



APPLICATION MANUAL

for Architects and Engineers

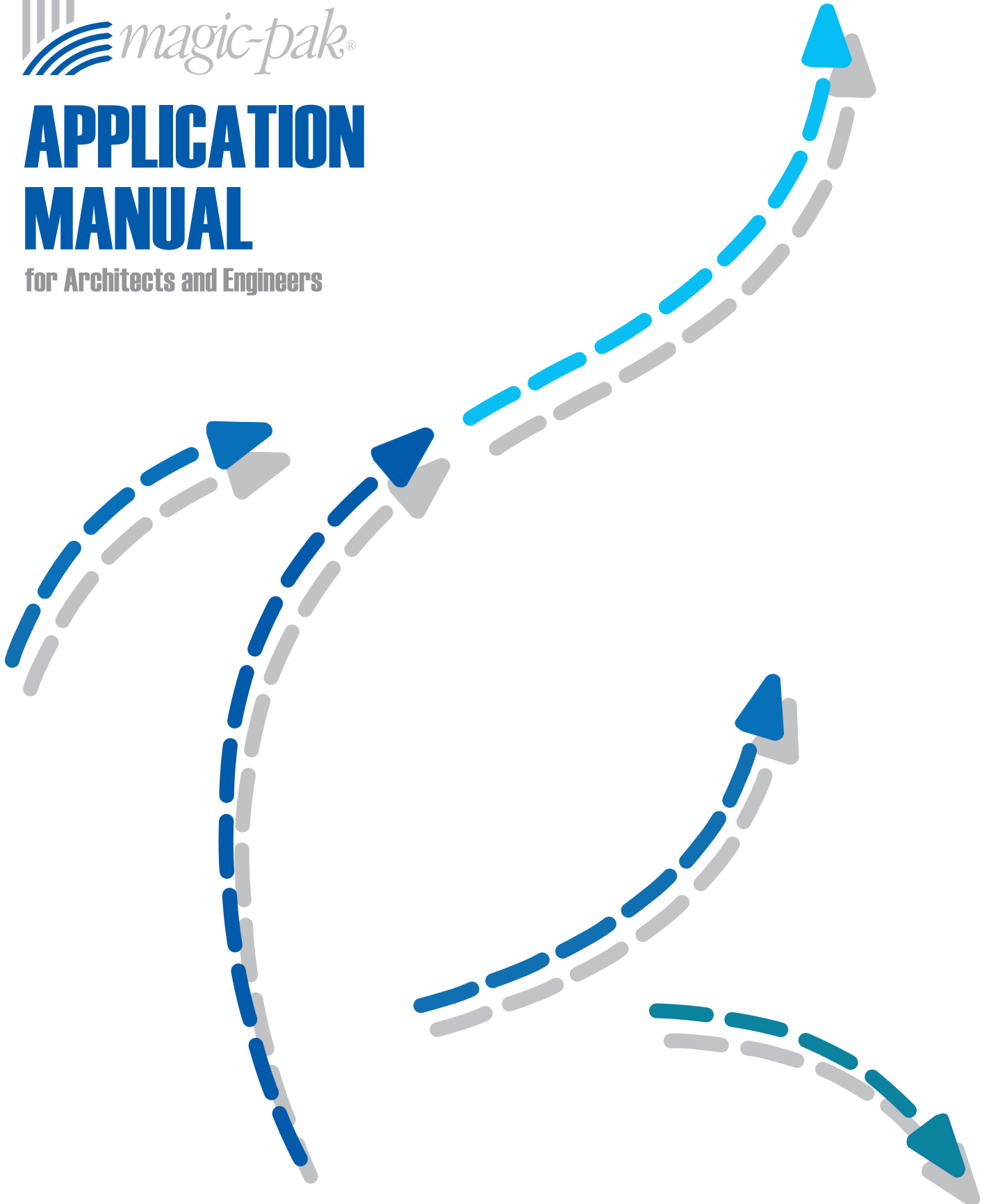


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1. Purpose of this Manual

This manual provides assistance to architects and design engineers who are considering the use of Magic-Pak heating and cooling equipment in multi-dwelling buildings or shopping centers.

It conveys some of the experience gained over many decades, and includes some of the most successful and economical installation practices for Magic-Pak units.

Building structure heat loss and heat gain, duct sizing, gas supply mains and riser sizing, and electrical-supply wiring should be determined for the building by a qualified Professional Engineer familiar with the applicable local building code requirements for the type of occupancy.

2. Magic-Pak: Designed and Built for Designers and Builders

For over 30 years, the Magic-Pak concept of providing quality heating and cooling in high-rise condominiums and apartment buildings has proven increasingly popular among building designers and mechanical contractors.

Over these years with literally hundreds of thousands of units installed throughout the United States and Canada, Armstrong has compiled comprehensive practical experience for varying types of building construction and operating conditions.



2.1 Totally Packaged HVAC System Provides Individual Comfort Control

The Magic-Pak concept provides all the practical benefits of a split system, plus a heating system, without the expense and complications of split-system units. Magic-Pak provides a ducted, single-package, combination heating-and-cooling unit for each individual suite that is reliable, easy to install and inexpensive to maintain. Just as important, it allows individual metering and comfort control for each unit.

Occupants can have heating or air conditioning any time of the year according to the outdoor temperature. A cold day in June, heating; a hot day in January, cooling. No central system has this flexibility.

2.2 Hermetically Sealed Refrigeration System

The hermetically sealed refrigeration system is another feature of the Magic-Pak's refrigeration system. The system is completely factory-built, checked for leaks with sensitive electronic equipment, and thoroughly performance tested before placement in any unit. This comprehensive testing eliminates the need for highly trained personnel at the time of installation or start up.

2.3 Interchangeable with Earlier Models

Another advantage of the single package combination is the one that eliminates concerns of obsolescence. Replacement units are available for units installed in the very first Magic-Pak buildings over 30 years ago. The equipment built today includes modern technology in heat transfer surface and compressor design for higher efficiencies, but the equipment will still fit the older Magic-Pak installations. For more information, see **Retrofit Applications** on page 40.

Dedication to this interchangeability with earlier models is basic to the Magic-Pak concept of today and insures that these units will never become "orphans" in the future.

2.4 Gas and Electric Alternatives

Magic-Pak offers a variety of heat sources to best suit the geographic area or local utility energy costs. All are ducted, through-the-wall units which have no need for chimneys.

2. Magic-Pak: Designed and Built ... (cont.)

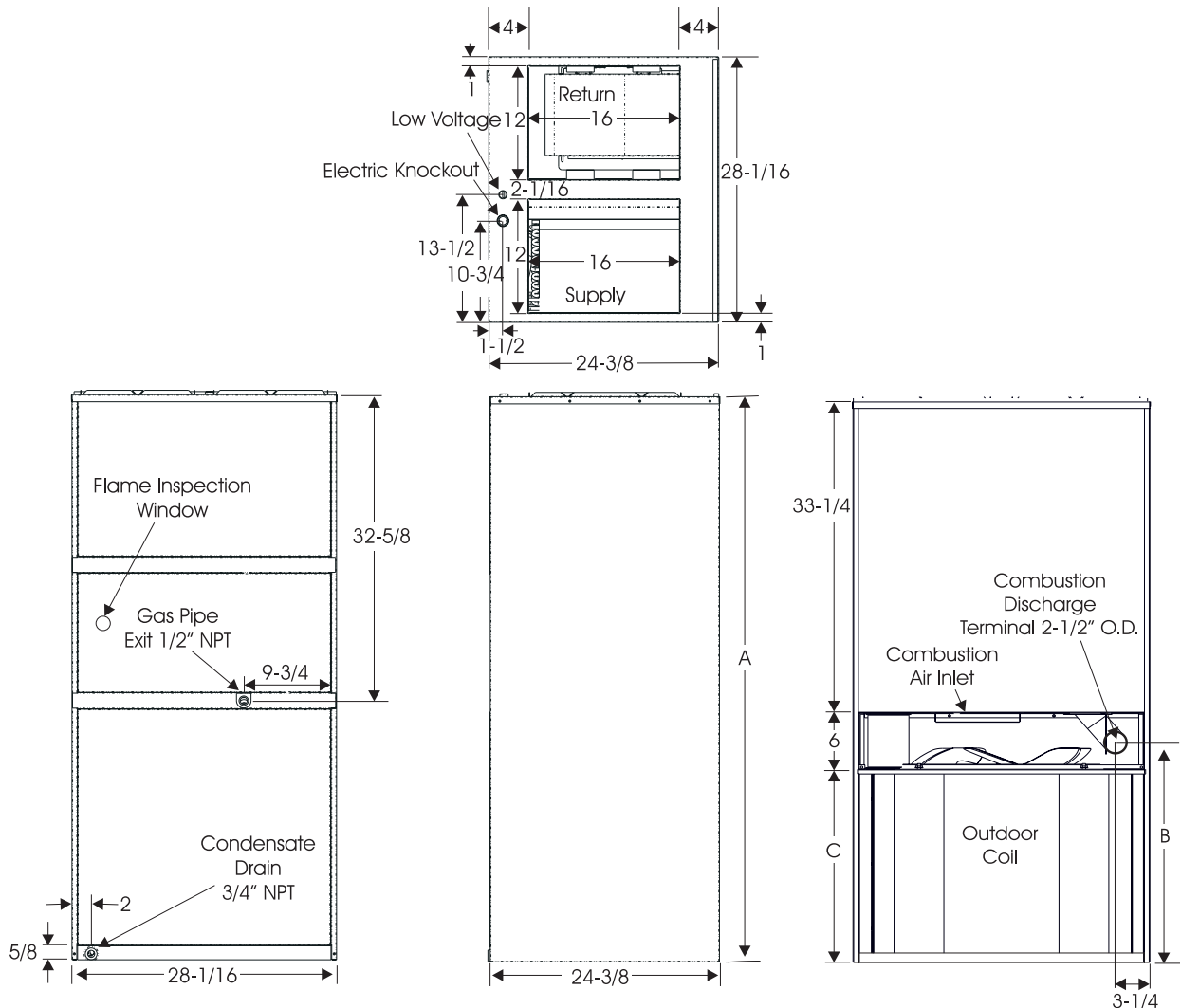
MGE

Gas Heating, Electric Cooling

Maximizes energy-cost efficiency in applications where gas is available. Uses only outside air for combustion. Built-in power vent eliminates need for chimney.

Dimensions (in.)

Model	A	B	C
MGE10-12	58-7/8	20-1/5	18-5/8
MGE10-18			
MGE10-24	59-7/8	22-1/2	20-5/8
MGE10-30			
MGE12-18			
MGE12-24			
MGE12-30	64	26-1/2	24-3/4



2. Magic-Pak: Designed and Built ... (cont.)

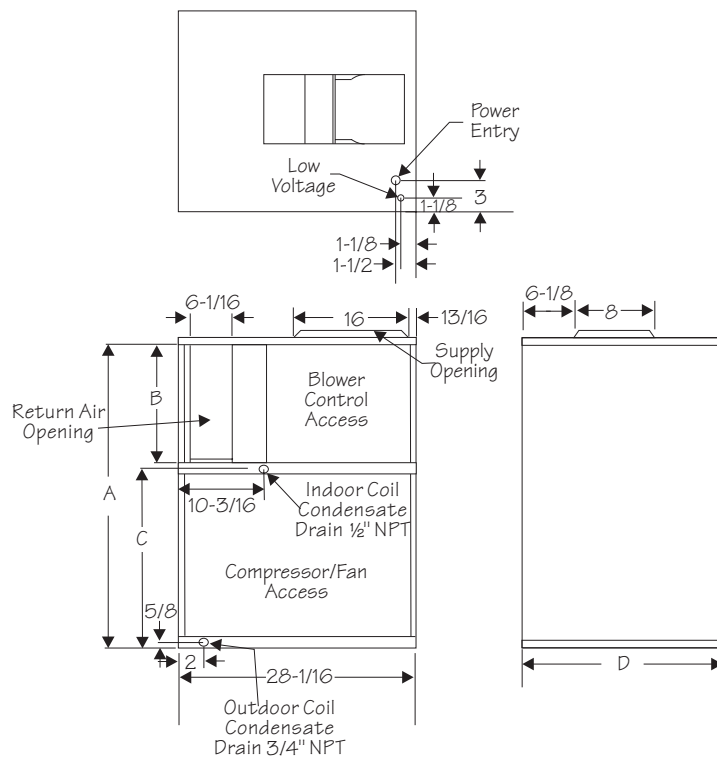
MHP

Electric Heat Pump

The energy-efficient option for heating and cooling where gas is not available or preferred.

Dimensions (in.)

Model	A	B	C	D
MHP10-12	43-7/8	16-7/8	25-5/16	21-1/2
MHP10-18				
MHP10-24	47-13/16	18-15/16	27-1/8	24-3/8
MHP10-30				
MHP12-18				
MHP12-24	55-13/16	22-13/16	31-1/8	24-3/8
MHP12-30				



2. Magic-Pak: Designed and Built ... (cont.)

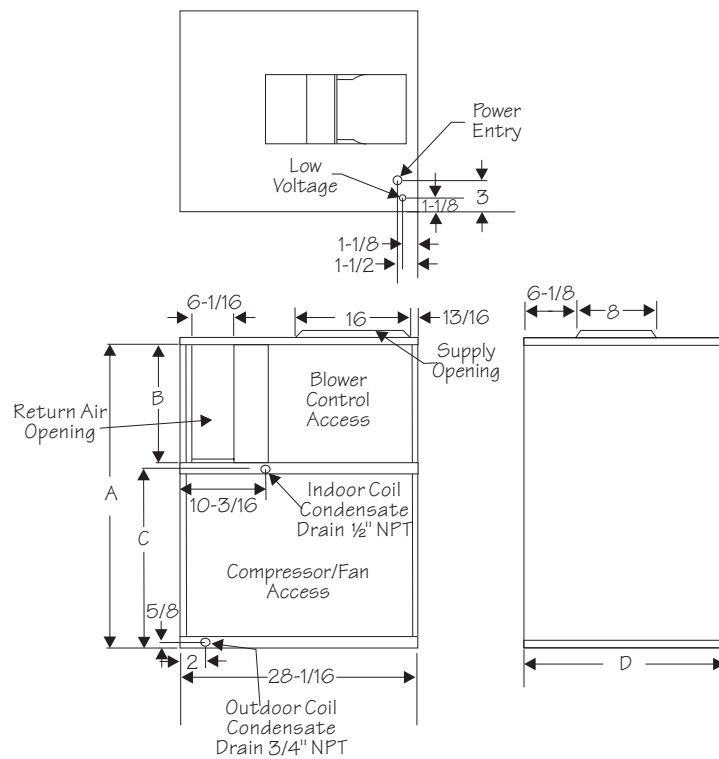
MCE

Electric Heating, Electric Cooling

Provides the best alternative to a heat pump in all-electric applications.2

Dimensions (in.)

Model	A	B	C	D
MCE10-12	43-7/8	16-7/8	25-5/16	21-1/2
MCE10-18				
MCE10-24	47-13/16	18-15/16	27-1/8	24-3/8
MCE10-30				
MCE12-18				
MCE12-24	55-13/16	22-13/16	31-1/8	24-3/8
MCE12-30				



3. Unit Location

Magic-Pak units should be installed in an outside building wall that is clear of obstructions which might impede the free intake and discharge of condenser air.



Figure 1 Condominium with Magic-Paks on outside walls

3.1 General Considerations

A building wall should be no closer to an opposite building wall than two feet for every floor or Magic-Pak unit in a vertical array facing the wall.

For example, a one-story building with a Magic-Pak unit should be a minimum of 2 ft. from the wall facing the unit, and if the facing wall also has a Magic-Pak unit, the two walls should be at least 4 ft. apart.

A six-story building with six Magic-Pak units in a vertical array should be at least 12 ft. from the opposite building wall, and if that building wall also contains Magic-Pak units, the buildings should be at least 24 ft. apart.

Buildings taller than six stories need not exceed the separation needed for six-story buildings.

If three or more adjacent walls form an air shaft with Magic-Pak units facing each other in each wall, the separation between opposite walls should be increased by 20%.

These “rule-of-thumb” dimensions are intended to minimize possibilities for recirculation of condenser air, or interaction between units. However, these numbers are not exact for every application, and other considerations might suggest that the designer consult the factory about desired alternatives.

3.2 Sound Considerations

It should be mentioned that any time a hard surface or wall faces a unit, the sound emanating from that unit can be reflected by the opposite wall. If the two walls are not parallel, the sound may be somewhat dispersed, but in general it is preferable to locate Magic-Pak units in a wall with as much clear distance to the nearest wall or reflecting surface as is practical.

3. Unit Location (cont.)

Units located in walls forming an air shaft or confined courtyard are not as desirable (from a sound standpoint) as units located in the outer perimeter walls of a building.

Similarly, if the unit is to be installed in a wall at right angles to a wall containing a window, at least 6 ft. of separation between the closest point of glass to the unit should be maintained in order to minimize sound transmission through the window.

3.3 Accessibility

An important consideration when selecting a suitable location is accessibility for equipment removal.

A 30 in. wide minimum clear opening is needed in front of the unit in order to remove it.

A 30 in. wide door or access covering to the enclosure is preferred as a minimum to allow for some tolerance in locating the access door frame exactly centered on the unit.

If the unit is located in the end of a clothes closet, and it is accepted that the clothes must be removed first to remove the unit, be sure that the closet door is large enough to get the unit out of the closet.

Also, if the Magic-Pak is installed through the side of a closet, be sure the closet is wide enough to permit sliding the unit all the way out before running into the opposite closet wall.

The minimum distance to allow for equipment removal from the front of the unit cabinet to the opposite wall is 36 in.

Units in a relatively inaccessible location for easy removal should be avoided if at all possible; if for no other reason than to keep the air filter accessible for easy and timely cleaning by the occupants or by maintenance personnel.

3.4 Vent Location for Gas Models

Consideration for location must be given to the power vent of gas-fired Magic-Pak models such that they will not be installed at variance with the latest edition of the National Fuel Gas Code (NFPA 54/ANSI Z223.1).

3. Unit Location (cont.)

Clearance to combustibles is 0" at the side, top, and front of plenum. If accessibility clearances are greater than clearances to combustibles, accessibility clearances take precedence.

The front of the unit must be accessible for service. If the unit is enclosed, providing a door or access panel opposite the front of the unit is the preferred method of providing access. The door or access panel must be at least 30" wide (centered on the unit) and as tall as the unit.

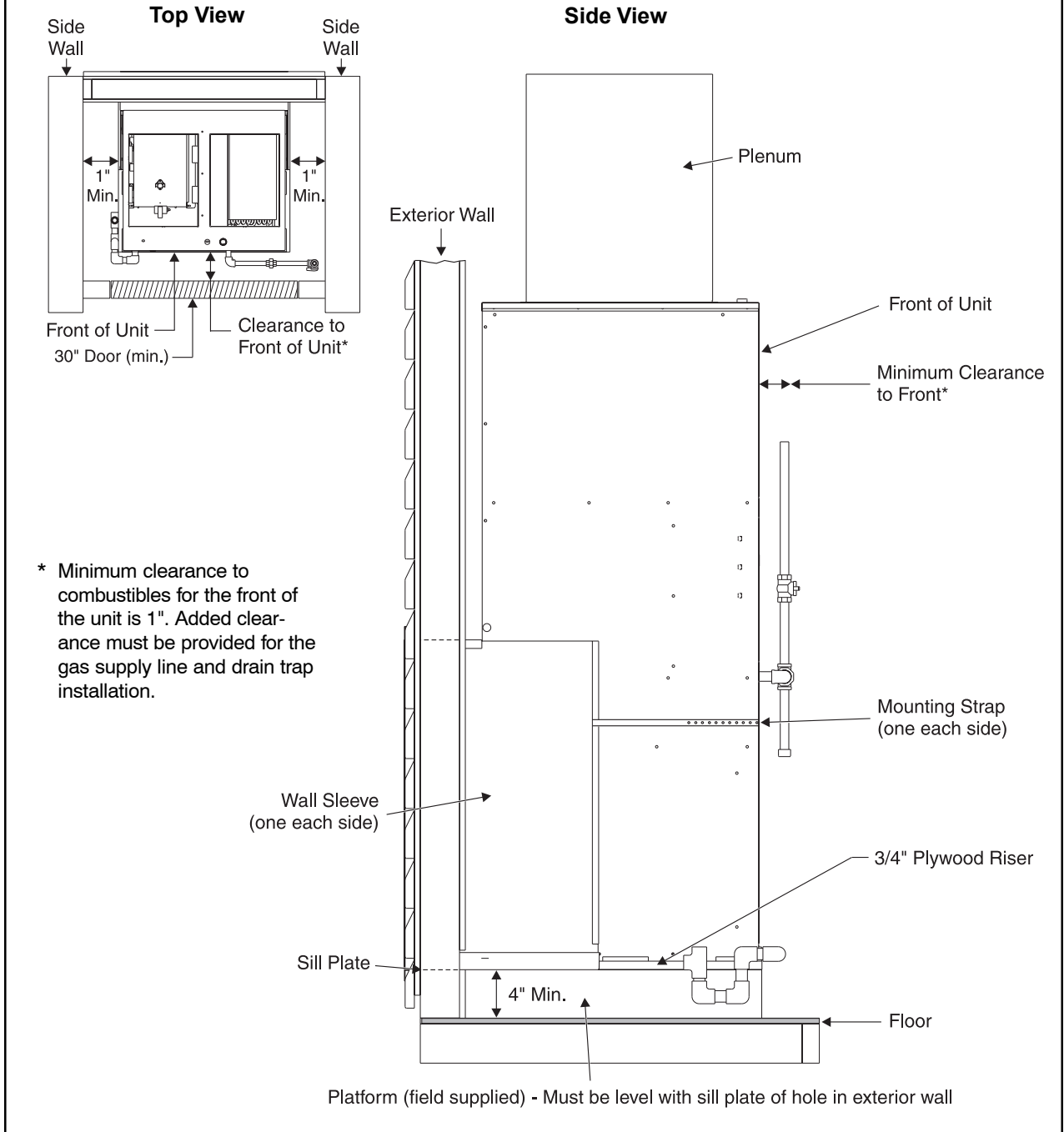
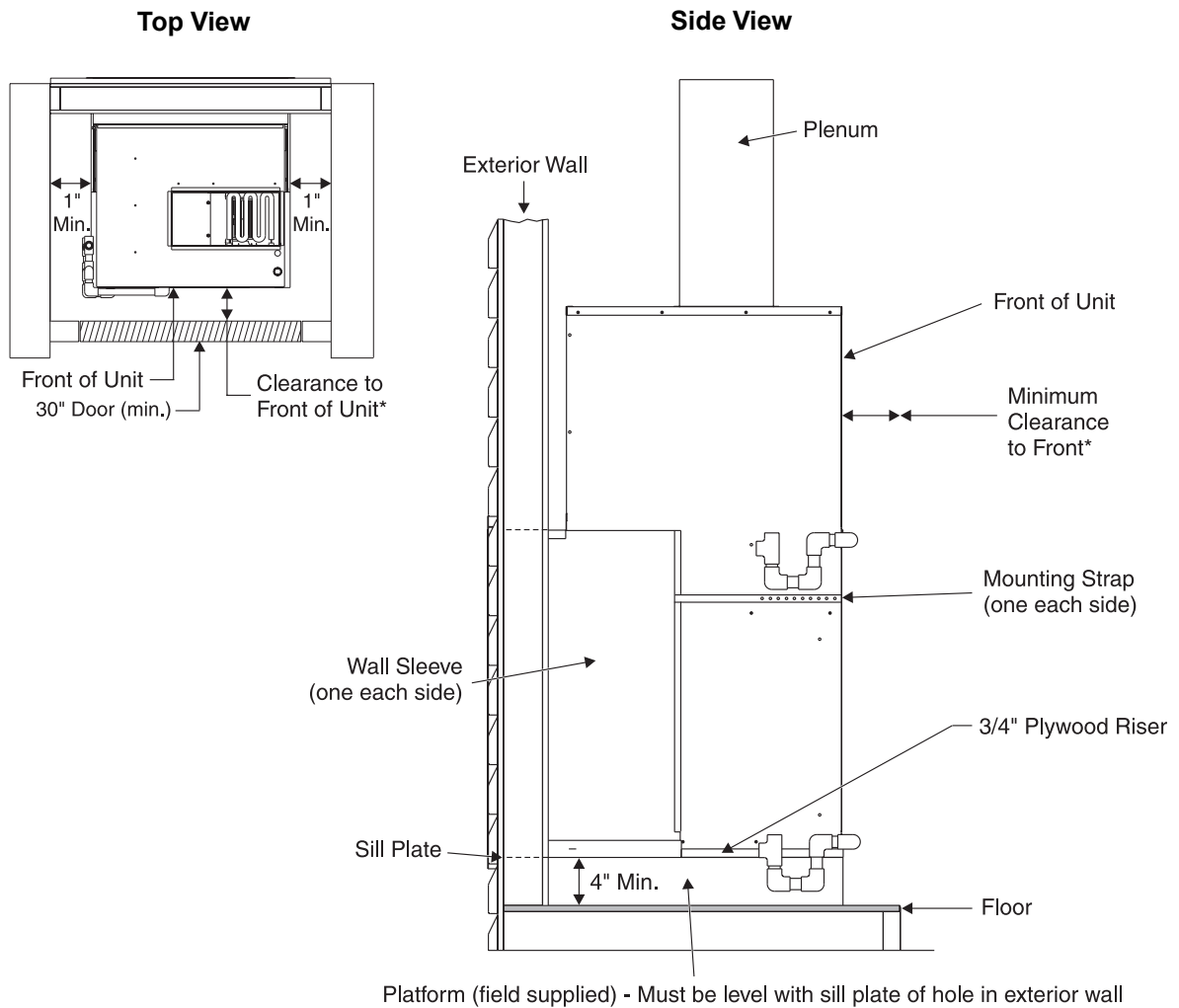


Figure 2 Minimum Clearances – MGE Units

3. Unit Location (cont.)

Clearance to combustible materials is 0" at the side, top, and front of plenum. If accessibility clearances are greater than clearances to combustibles, accessibility clearances take precedence.

The front of the unit must be accessible for service. If the unit is enclosed, providing a door or access panel opposite the front of the unit is the preferred method of providing access. The door or access panel must be at least 30" wide (centered on the unit) and as tall as the unit. If a return duct is not installed, in order to provide adequate return air the minimum clearance required between the front of the unit and the door or access panel is 4" for 43" tall cabinets and 5" for 48" and 56" tall cabinets.



* With no return duct installed, minimum clearances to the front of the unit are 4" for 43" tall cabinets and 5" for 48" and 56" cabinets. If a return duct is installed, enough clearance must be provided for the drain trap installation.

Figure 3 Minimum Clearances – MHP/MCE Units

4. Wall Sleeves

“Wall sleeve” is the term used to describe an accessory for the Magic-Pak units. The wall sleeve is designed to facilitate the installation of Magic-Pak units by providing an accurate opening during building construction. Units can then remain off-site until building construction approaches completion.

The wall sleeve is comprised of four assemblies (top, bottom, and right and left sides) which easily slip together on the job to form a rectangular box correctly sized to receive a Magic-Pak unit (see Figure 4).

When in place and securely fastened, the wall sleeve opening provides easy access to the finished wall perimeter for caulk sealing.

Magic-Pak units must be installed with wall sleeves. Various wall sleeve kits are available to fit a multitude of wall applications. See **Chapter 5 – Types of Wall Construction** for proper wall sleeve selection.

Letter	Quantity	Description
A	1	Top Panel Assembly
B	1	Base
C	1	Left Side Panel Assembly
D	1	Right Side Panel Assembly
E	1	3/4" Plywood Riser
F	1	Divider Panel Assembly
G	1	Template
--	2	Lag Screws and Washers
--	8	Sheet Metal Screws
--	1	Installation Instructions

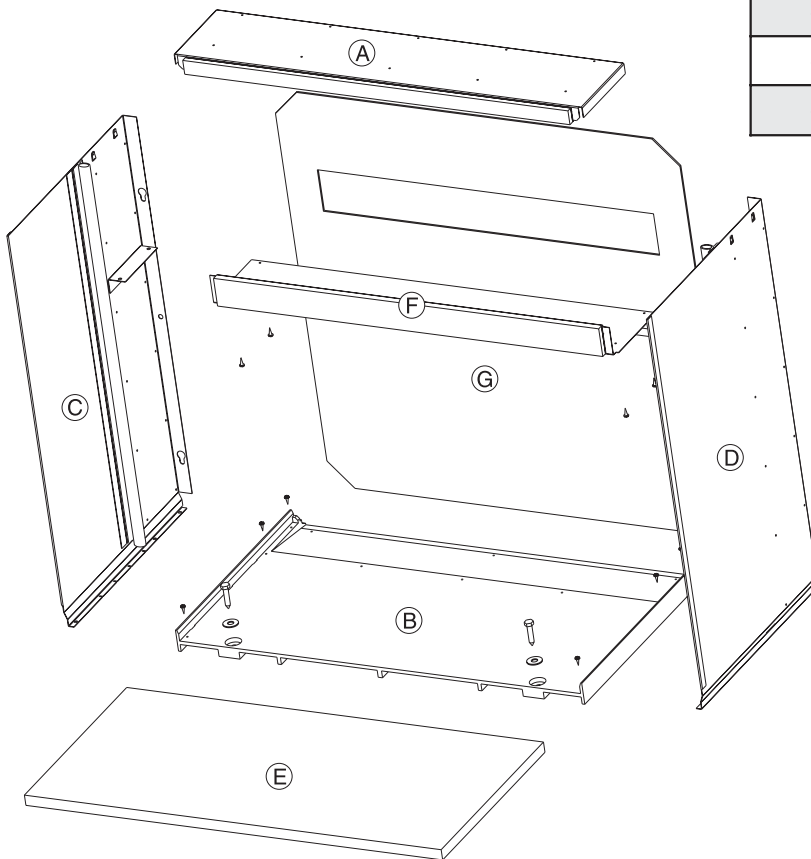


Figure 4 Wall Sleeve Assembly

4. Wall Sleeves (cont.)

4.1 Installation

The sleeve may not extend beyond the finished wall. This is due to the fit-up of the outdoor grille which is designed to be flush with the finished wall.

Reaching the perimeter through the opening from inside for sealing can become difficult and dangerous. Adequate safety precautions should be taken to protect personnel.

In many high-rise construction applications, contractors insert the wall sleeves from the outside while the wall is being constructed (see Figure 5). Three flashing angles are included with the wall sleeve kits to provide the installer a means to mount the wall sleeve to the exterior surface of the rough wall. The flashing angles mount to the top and side panels of the wall sleeve (see Figure 6 on page 14). Each of these panels has two sets of holes in them for mounting the angles: one set of holes which will extend the wall sleeve 1/2 in. beyond the outside rough wall and another set of holes which will extend it 4-1/2 in. beyond the rough wall. If the application requires that the wall sleeve fit flush with the “rough wall”, reverse the angles and use the holes closest to the front of the wall sleeve.

It is recommended that the flashing angles be caulk sealed to the sleeve during installation. This will provide proper weather seal.

The wall sleeve can now be installed from the outside into a wall under construction.

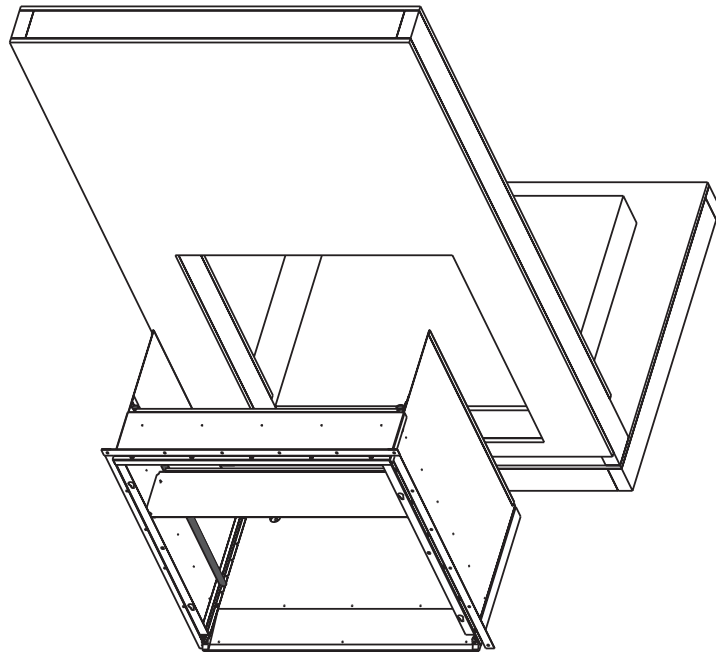


Figure 5 Installing Wall Sleeve from Outside of Building

4. Wall Sleeves (cont.)

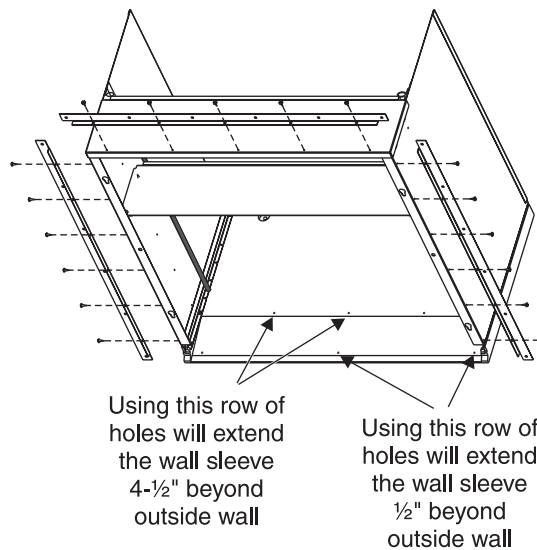


Figure 6 Flashing Angles

The wall sleeve may also be installed from the inside of the building without using the flashing angles. This type of installation is necessary with wall construction that may incorporate various finished wall designs. The wall sleeve can be fastened directly through the sides allowing enough clearance for the exterior grille to fit flush to the finished wall (approximately 1 in. for poly grilles and 1-1/4 in. for aluminum grilles).

For example, if the supporting wall (rough wall) is concrete block with a brick facing, there is usually a space between the block and the brick. This space dimension must be added to the width of the brick and block when choosing the correct wall sleeve (see **Chapter 5 – Types of Wall Construction**). When the wall sleeve is inserted into the opening and fastened to the block wall, it will recess into the finished wall by 1 in or 1-1/4 in. depending on the type of grille being used (see Figure 7).

The same applies if the supporting wall (rough wall) is wood framed. The sleeve must be inserted, whether from inside or outside, allowing for the thickness of the finish siding, trim, and caulk sealing.

Position wall sleeve in base as shown in Figure 8 on page 16. **IMPORTANT:** The notched edge of both front corners of the base must be positioned correctly. If an aluminum louver will be used in the installation, the notches must line up 1-1/4" back from the face of the outside wall. If a polypropylene louver will be used, the notched must line up 1" from the face of the outside wall.

After inserting the sleeve into the wall, it is very important to ensure that the sleeve is level and plumb. Use of shims between the wall and the wall sleeve may be necessary.

4. Wall Sleeves (cont.)

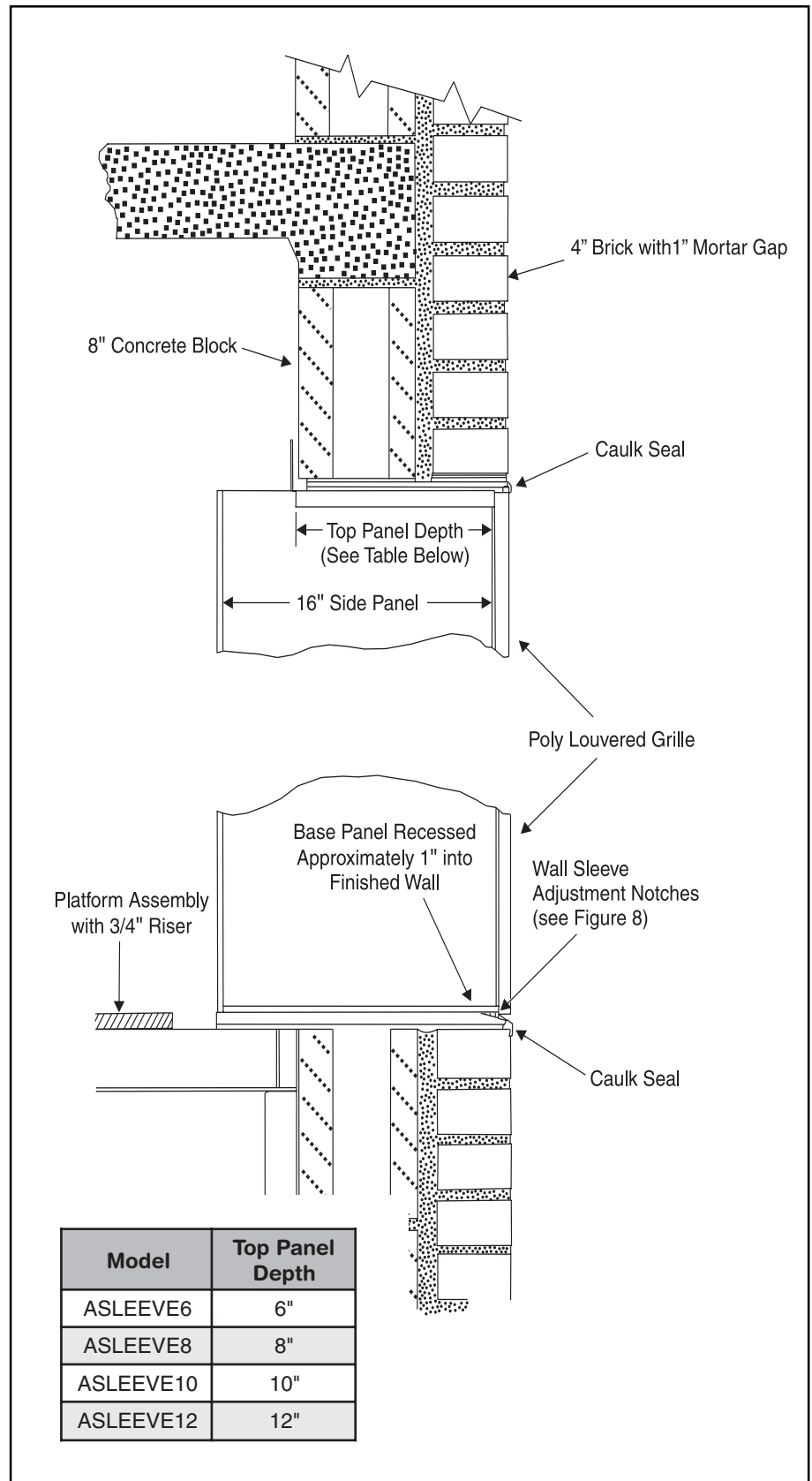


Figure 7 Installing Wall Sleeve in Concrete Block with Brick Facing

4. Wall Sleeves (cont.)

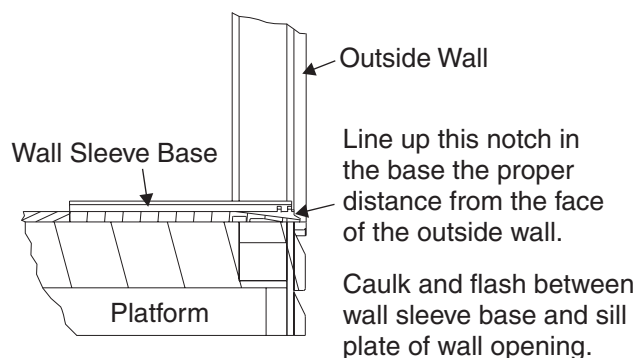


Figure 8 Positioning Wall Sleeve Base

4.2 Recessed Sleeves

In some applications, where building walls are either very thick (over 12 in.) or architectural design dictates, units can be recessed. The finished wall should not protrude beyond the exterior grille by more than 1 in. However, if the wall opening can be larger in vertical dimension than the wall sleeve, so that the bottom can rest on a sill that is at least 2 in. higher than the bottom of the wall opening, some further recessing is permitted.

The top of the wall opening should be above the top of the wall sleeve by a dimension equal to or greater than the amount of the recess to avoid restriction of the condenser discharge air.

4.3 Weatherproofing Wall Sleeves

Wall sleeves are packaged in a carton and are shipped flat to save space and shipping costs. They snap and screw together easily at the job site and are held square by the center divider panel. Instructions for caulk sealing the slip joints and spot-welded joints have been added to minimize problems with water infiltration during episodes of high wind-driven rain.

This sealing must be done while the sleeve is assembled, but before the Magic-Pak unit is installed in the sleeve. Caulk sealing of the bottom is best accomplished while the wall sleeve sides are being attached to the base before it is placed in the wall opening (see Figure 9). The top panel must be sealed to the side panels while they are being attached. It is also recommended that the base be caulk sealed to the bottom of the opening during wall sleeve installation. Remaining final sealing can be done just after the sleeve is secured into the wall opening, if desired, to avoid breaking the seal during handling.

Further sealing against air infiltration is done while the Magic-Pak unit is installed in the wall sleeve and utility connections are completed. Rubber gasket seals are included with each wall sleeve kit to provide all necessary unit-to-wall sleeve sealing.

4. Wall Sleeves (cont.)

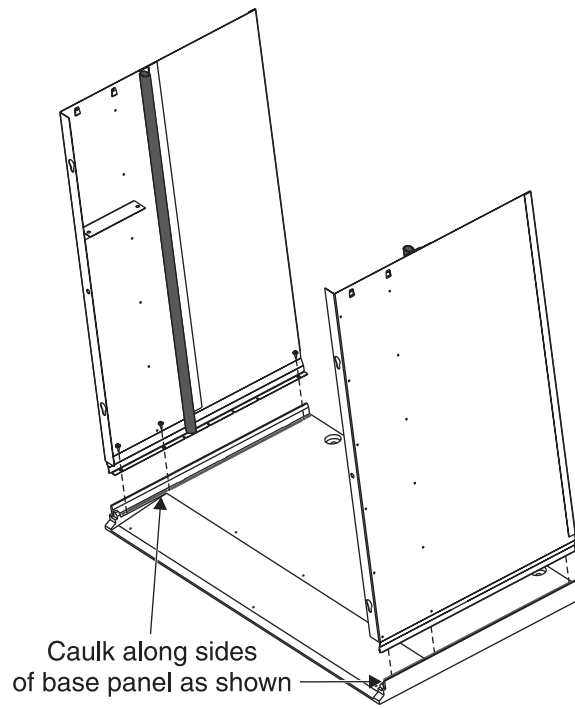


Figure 9 Caulk Sealing Wall Sleeve Bottom

5. Types of Wall Construction

5.1 Support

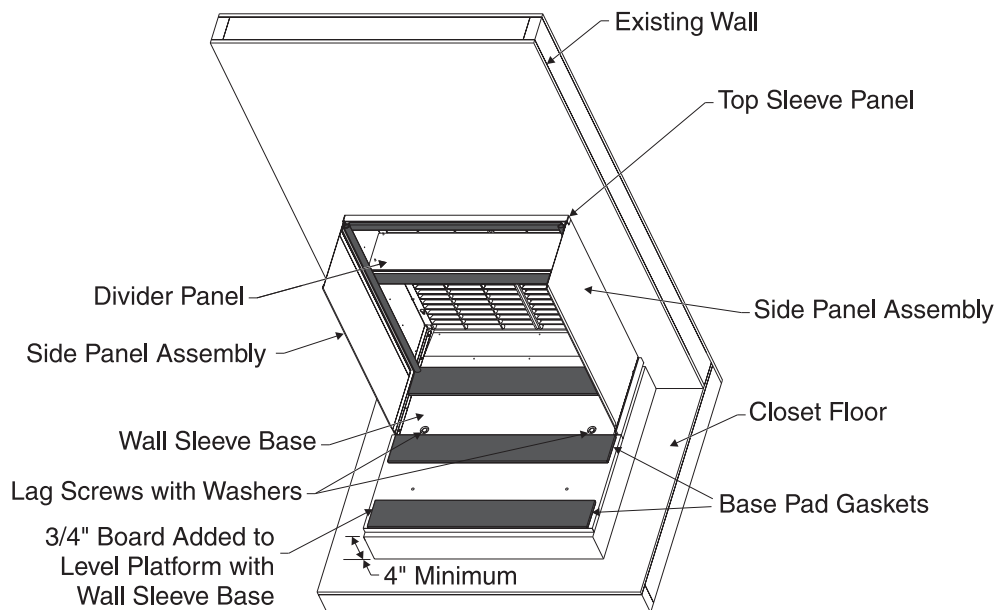
The wall sleeve is not designed to support the unit. It is designed to serve as an air and weather seal channel through the wall. A separate platform assembly is required to be constructed before wall sleeve or unit installation (see Figure 10).

The platform must be constructed to be level with the sill plate of the wall opening. The minimum height of the platform is 4 in. from the floor.

The platform assembly should be constructed of a minimum of 2 x 4 lumber and 3/4 in. plywood. The width of the platform must be at least 30 in. The depth of the platform must be consistent with the depth of the Magic-Pak unit and the distance between the unit and the wall. Example: Wall Sleeve Kit 8-1 is 8 in deep. If that wall sleeve kit is used on a 6 in. deep wall, there would be a 2 in. difference. That 2 in. difference must be added to the unit depth to determine the proper platform depth.

A 3/4 in. platform riser is included with each wall sleeve kit. The riser must be installed as it is used to level the platform with the plastic wall sleeve base. It will also serve as the bottom seal of the unit. Position riser so that the front edge of the riser is aligned with where the front edge of the unit will be when it is installed. The back edge of the riser does not need to be flush against the plastic base of wall sleeve.

Three base pads gaskets are supplied with the wall sleeve kits. They are adhesive-backed foam rubber pads designed to serve as the unit-to-wall sleeve seal and vibration isolators. The base pads must be installed prior to unit installation.



NOTE: The platform base must be sized to support the full length and width of the bottom of the unit and constructed so that it is level with the sill plate of the wall opening.

Figure 10 Typical Wall Sleeve Installation

5. Types of Wall Construction (cont.)

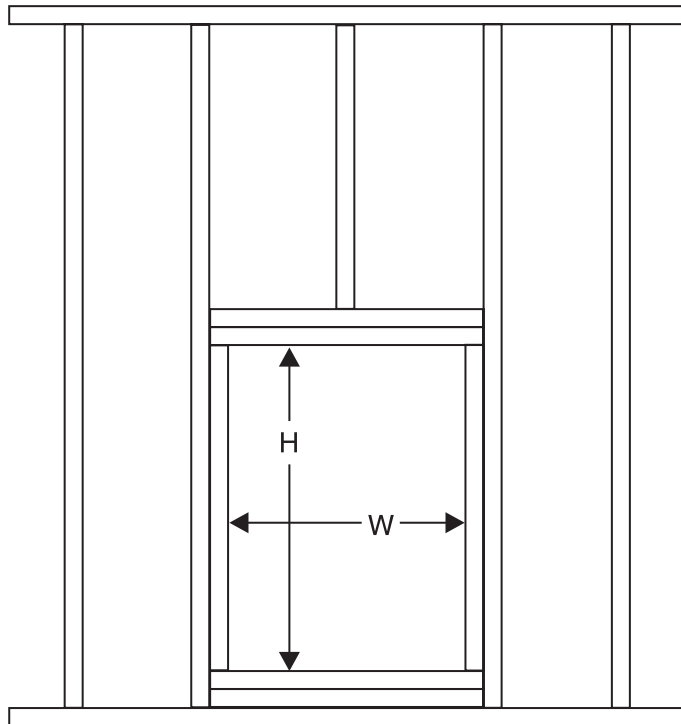
5.2 Wood Frame Walls

The framed opening should consist of double 2 x 4's or 2 x 6's on both sides and across the bottom of the opening (see Figure 11).

Wall opening dimensions will vary based on the size of the equipment being used. Proportionally, the wall sleeve kit also will vary based on the size of the equipment and the depth of the wall.

Wall sleeve kits are designed to fit a multitude of wall construction types. To aid installation it is acceptable to use wall sleeves that are deeper than necessary. However, the greater the depth of the wall sleeve, the further the unit will sit away from the wall. This will also necessitate a deeper platform.

Consideration for vibration control should be made when constructing wall openings and platform assemblies. Walls of particularly light weight construction with little or no insulation and thin drywall and exterior sheathing can be excited by vibrating machinery. They will transmit the vibrations more easily to other areas. As a precaution, vibration isolating materials may be installed between the floor and the platform assembly. The wall sleeve assembly should be securely fastened to the wall opening to avoid vibration as well.



See specification sheets for wall sleeve dimensions.

Add 1/8" to "H" and "W" dimensions for clearance and later caulk seal weathertight.

Figure 11 Wall Opening in Frame Wall

5. Types of Wall Construction (cont.)

5.3 Cement Block Walls

Cement block or cinder block walls have proved to be the most forgiving for vibration and noise transmission in single or multistory buildings.

Wall sleeve openings must include a suitable lintel across the top as prescribed by local building codes.

The wall sleeves may be installed from inside or outside of the building and this choice will determine the location of the side angles.

Many contractors prefer to shoot fasteners through the sides of the sleeves into the block, using the side angles as position locators.

It is important that the angles be held tightly to the block along both sides while shooting the fasteners in order for the wall sleeve to finish vertical.

Wall sleeves are made to fit 6, 8, 10, or 12 in. deep walls. The depth of the wall, whether constructed of masonry materials or wood frame, should take into account any brick facia, stucco, or siding minus 1-1/4 in. for aluminum grilles and 1 in. for poly grilles.

Walls of depths greater than 12 in. will require recessing the wall sleeve into the wall opening. This may be accomplished by installing the wall sleeve from the inside without using the flashing (support) angles. The inside stop of the wall sleeve's top panel should be placed against the inside surface of the wall. Proper weathersealing of the wall sleeve exterior must be done once the wall sleeve is fastened to the wall.

When recessing the wall sleeve in this manner, the vertical dimension of the wall opening must be increased to an amount equal to the amount that the wall sleeve is recessed. Example: The wall is constructed of 10 in. masonry material with a 1 in. air space and 4 in. brick facade. The total wall thickness is equal to 15 in. The 12 in. wall sleeve will be recessed 3 in. In this case, the vertical dimension of the wall opening should be made larger by 3 in. to permit the use of a recessed sill on which the wall sleeve can rest and still provide a means to seal the outside edges of the wall sleeve. It is important that the entire wall sleeve base and Magic-Pak unit is supported as stated in Section 5.1 on page 18.

When the outside facing is brick, another approach has been to keep the block wall opening the same for the wall sleeve, but the direction of the brick placed along the bottom is changed. The long dimension is placed at an angle starting underneath the wall sleeve by 1/2 in or more, sloping downward to permit drainage, while still providing a suitable groove between the sleeve and brick in which to apply caulking material.

5. Types of Wall Construction (cont.)

5.4 Poured Concrete Walls

The use of “pre-cast” or poured concrete walls has increased considerably in high-rise or multistory building construction. These buildings require no special consideration to install Magic-Pak units. When used in conjunction with prestressed concrete floors, noise phenomena can occur several floors away or on an opposite side of the building. Curing these phenomena usually means isolating the unit from the wall, as well as the floor. The use of vibration isolation blocks is recommended between the platform and the floor.

5.5 Metal Studs

Some types of construction involve the use of steel 2 in. x 4 in. channel studs in exterior walls, covered with rigid sheathing and thick, rigid insulation panels with extensive use of adhesives. Magic-Pak wall sleeves are attached to the steel studding just as for wood, except that self-drilling screws are used with power drivers.

6. Noise Transmission

Noise perception by building occupants can be elusive, and early planning can address many adverse contributing factors.

For duct layout and air distribution, it is better to locate a unit centrally in the floor plan. If it can also be a utility room, kitchen, or balcony location, as opposed to a bedroom or living room location, then both ductwork and sound-transmission concerns can be better served.

In general, the perception of noise can be traced to:

- Vibration transmission
- Sound radiating from the source (compressor and motors) through the panels and enclosure walls
- Air noise
- Resonant surfaces and objects

6.1 Vibration Transmission

In spite of the efforts of rubber mounting, balancing, flexible loops of tubing, and mufflers, there is always some vibration created by moving machinery, and a Magic-Pak unit is no exception. If the remaining vibration can be absorbed by the wall surrounding the unit without transmitting the energy further or exciting an adjacent structural member, there is no problem.

Concrete block walls have proved to absorb vibration better than poured concrete walls.

Wooden stud wall construction can be more easily excited to re-radiate vibration unless adequately dampened by other materials.

Wooden stud walls which are heavily packed with fiberglass batt insulation or rock wool are less likely to re-radiate vibration than are sparsely insulated (or uninsulated walls).

Flexible duct collars must be used between the Magic-Pak plenum duct flanges and any sheet metal ducts. Also, the ducts must not be supported by, or otherwise touch, the unit.

6.2 Radiated Sound and Resonant Surfaces or Objects

In general, the sources of sound are the compressor and the rotating motors incorporating air moving blades. A 60 Hz AC power hum can sometimes be heard from these sources or the control transformer, but generally this is imperceptible in a normal operating unit and does not contribute to any sound problem. The sound frequencies generated by the motor/compressor acting upon the refrigerant gas are a substantial contributor to the total sound radiated by the unit.

Sound frequencies generated by the action of the blades of the circulating air blower and the condenser fan blade upon air are additional sources of radiated sound.

Frequently these sources of sound can transfer certain frequencies to other objects or surfaces which might in turn be resonant with some of the frequencies from these sources of sound. If this is the case,

6. Noise Transmission (cont.)

these objects or surfaces can be excited to vibrate and further impose the sound on another area.

These sound sources then radiate to enclosing panels, which are made of materials that either reflect, absorb, or transmit (usually a combination of all three) certain frequencies.

Some types of materials are more “transparent” to some frequencies than others. Factors that affect this property include thickness, density, and distance from the source. A closet enclosure for the Magic-Pak unit can reduce the sound level in the adjoining space if constructed with this purpose in mind.

6.3 Clearances

The Magic-Pak cabinet is approved for “zero” clearances, as far as safety codes are concerned. However, if sound transmission through a wall is of major concern, a minimum dimension of 4 in. to the inside wall surface is preferred. This applies also to the front access door of the closet. Additional sound attenuation can be achieved by using two layers of gypsum dry wall (5/8 in. or 1/2 in. minimum) on the inside (Magic-Pak unit side) of the walls and the front access door of the closet (see Figure 12 on page 24).

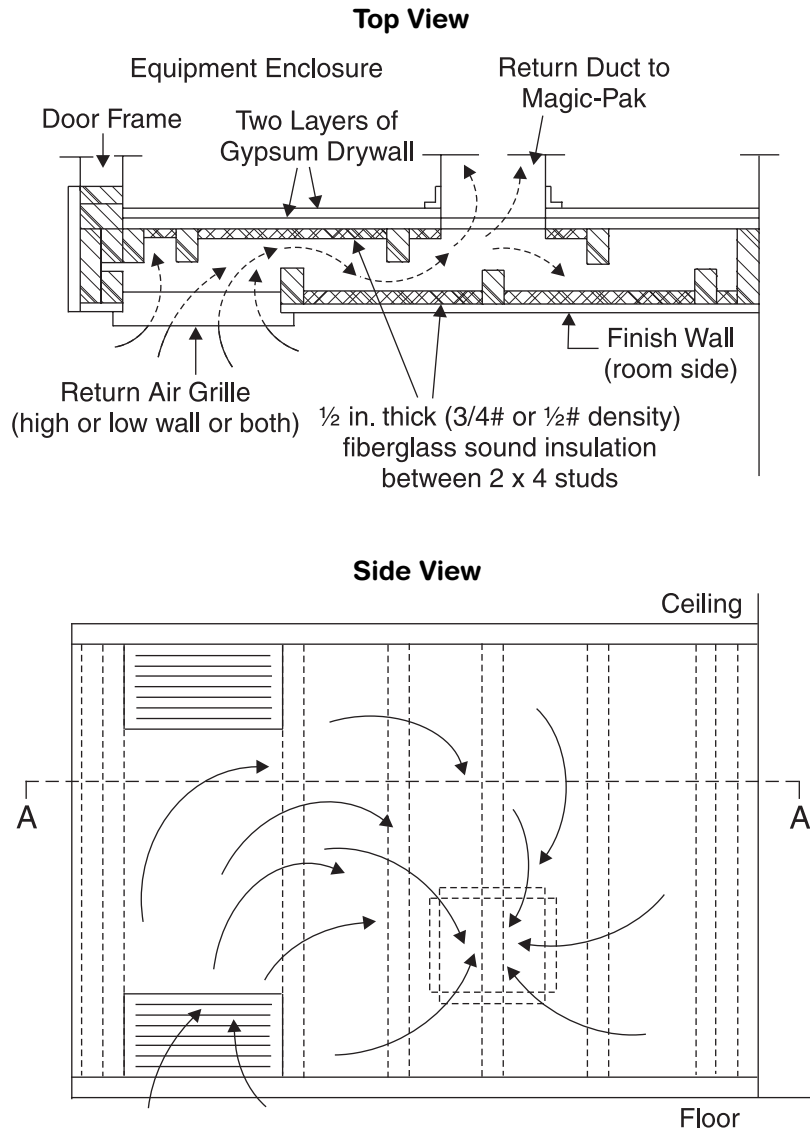
The side walls can further be improved for sound transmission if the 2 in. x 4 in. studs are fastened to 2 in. x 6 in. top and bottom plates and staggered to opposite edges of the plates on 16 in. centers. This forms a nominal 6 in. partition wall instead of the usual 4 in. wall, and permits the inside wall board and outside wall board to be fastened to studs without being tied together to the same stud. The space between the two wall surfaces may then be filled with 2-1/2 in. minimum, 1-1/2 pound density fiberglass.

This same type of staggered stud wall construction may effectively be used as return air space, where local building codes permit.

Cement block construction for the side walls of the closet enclosure has been employed successfully using a minimum thickness of 4 in. block to attenuate radiated sound. The effectiveness is further improved by adding two layers of gypsum wall board fastened to the inside wall surface by means of furring strips and structural adhesive (and/or nails).

Fiberglass or rigid polystyrene insulation may be applied between the furring strips if thermal insulation and a vapor barrier is appropriate in the building design. However, the fiberglass or polystyrene alone will not prove effective at these frequencies without two thicknesses of gypsum wall board, unless the fiberglass thickness is increased to more than 3 in.

6. Noise Transmission (cont.)



If wall space is not to be used for return air passage, full 2-1/2 or 3 in. thickness fiberglass insulation should be used.

Figure 12 Cross section of walls with 2 x 4 studs staggered on wide top and bottom plate for lateral air passage.

6.4 Air Noise

6.4.1 Supply-Air Duct System

Duct air velocity, air turning corners, changes in duct size, etc., can all create sound of a much different character than the vibration and radiated sounds of moving machinery. Since Magic-Pak units are usually connected to ducts for air distribution, any air noise will usually be heard at the supply registers or return-air grille in the room.

6. Noise Transmission (cont.)

Supply ducts and the plenum on the Magic-Pak unit should be insulated to prevent condensation formation on the outside of the duct during summer operation. If the insulation is applied to the inside of the ductwork when it is made, the dual purpose of insulation and sound reduction will have been achieved.

The use of 1 in. thick fiberglass duct board will accomplish the same where local codes will permit.

A supply register cut into the side of the supply plenum or at the end of a very short duct is not recommended. At least 4 ft. of inside insulated duct and/or at least one turn of direction is needed to attenuate the noise in the duct or plenum.

The face velocity of air out of the supply register will ultimately determine the perception of sound from air noise.

The selection tables furnished by the register manufacturer usually include values for noise along with face velocity, throw, and air friction at the required air flow for each supply register.

6.4.2 Return-Air Duct System

Duct air velocity, air turning corners, changes in duct size, etc., can all create sound of a much different character than the vibration and radiated sounds of moving machinery. Since Magic-Pak units are usually connected to ducts for air distribution, any air noise will usually be heard at the supply registers or return-air grille in the room.

More frequently, air noise involves the return-air system (or lack of it) when a return grille is simply cut into the side or the door of the closet enclosing the Magic-Pak unit. This is not recommended, since any equipment operating noise or air velocity noise in the closet can escape through the return grille unimpeded.

This practice also frequently utilizes the closet space as a return plenum for air returning to the Magic-Pak unit and presents additional disadvantages discussed later.

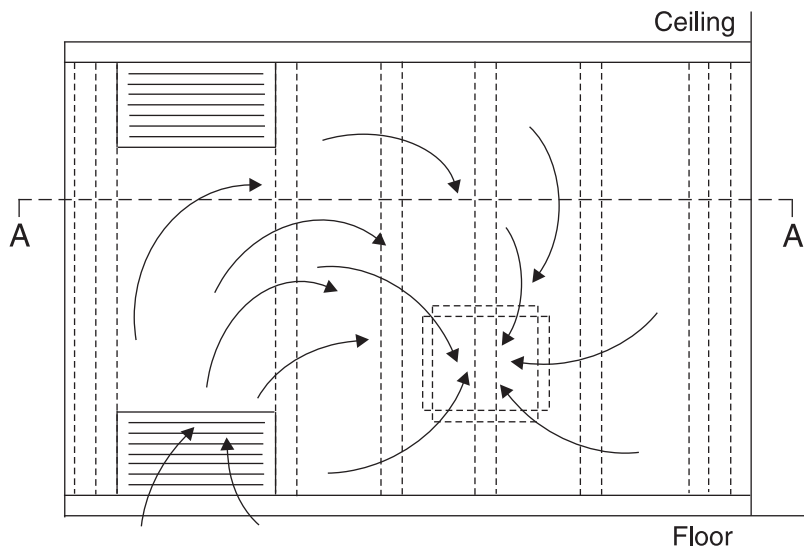
If only one return-air grille is used, it should not be in line of sight to the closet enclosure or the return duct opening in the bottom of the Magic-Pak unit.

Offsetting the grille location up or sideways in a 6 in. closet side wall is one method used successfully (see Figure 13 on page 26).

Additional air noise attenuation can be accomplished by adding 1/2 in. thick duct liner to the air passages thus created, and to the inside surface of the opposite wall facing the return grille.

If the closet enclosing the Magic-Pak is used as a return-air plenum and the return-air grille is located in one of the enclosing walls directly adjacent to the unit, the grille should be located high on the wall, rather than at floor level. Then duct liner can be placed on the inside closet walls and door to effectively reduce the air noise from the

6. Noise Transmission (cont.)



If wall space is not to be used for return air passage, full 2-1/2 or 3 in. thickness fiberglass insulation should be used.

Figure 13 Return Air Duct System

bottom of the unit. This high wall location has the advantage of minimizing “roll out” of infiltration air during high-wind conditions.

If other considerations dictate that a low wall return grille should be used, the air passage should be “trapped” inside the closet with a vertical duct 4 ft. to 5 ft. high, open at the top, 4 in. deep and as wide as the grille, with duct liner (1/2 in. thick) applied to the inside duct surface. Rigid duct board may also be used where local codes permit. This will reduce the airborne sound at the return grille and is also effective against cold air “roll out” due to infiltration in high wind conditions.

Another treatment for air-noise reduction on the return-air side is to drop a short duct down through the return-air opening of the Magic-Pak to within 6 in. to 8 in. of the floor. The filter access door must first be removed in order to reach the opening. This short duct must also be lined inside with 1/2 in. duct liner.

A second piece of sheet metal (about 30 in. x 30 in.) with duct liner on one side should be placed on the floor directly under the return-air duct with the insulated side up. A piece of thick pile carpet directly beneath this short duct will serve the same purpose.

If the return grille is low in the sidewall or closet door, the effect of infiltration in high-wind conditions may still be noticeable due to “roll out” if the circulating blower is off and the room thermostat is satisfied.

Since most of the infiltration comes through the wall sleeve and not through the Magic-Pak unit, it is recommended that the closet enclosure not be used as a return-air plenum. Instead, connect the return grille (or

6. Noise Transmission (cont.)

duct) directly to the return duct flanges on the Magic-Pak unit using sheet metal ducts lined with fiberglass insulation or duct liner and a flexible collar connector between the unit and the metal ductwork.

The practices just described are intended to deal primarily with air noise and airborne sound, as well as vibration and radiated sound.

Infiltration will be discussed in the following section.

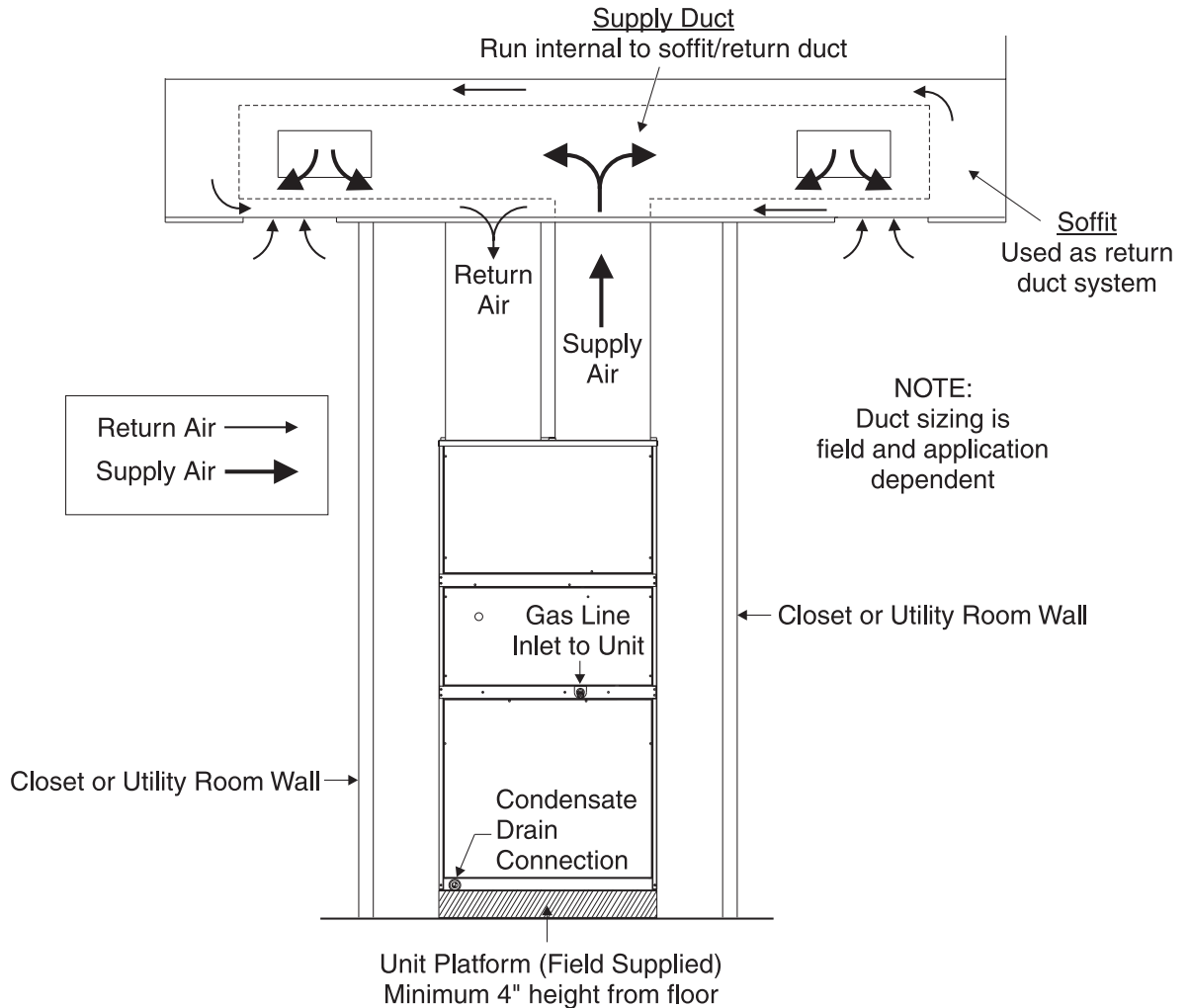


Figure 14 Concentric Supply and Return Duct System for MGE Magic-Pak Unit

7. Infiltration

Water infiltration and air infiltration are most effectively addressed in different ways.

7.1 Water Infiltration

Instead of relying heavily on seals and gaskets to keep the water outside, the design contains, and channels off, the water to the outside.

During periods of rain, an air conditioner must adequately channel large amounts of water through the appropriate drainage paths. The length of time and the amount of water received during that time determines whether or not the base pans will fill faster than they can drain. The unit base takes the first water entering through the condenser coil face and the upper discharge condenser air opening. The Magic-Pak unit uses a molded composite base with a built-in drain pan. The base of the wall sleeve is also molded composite and sloped outward to allow sufficient drainage of rainwater to the outside.

If the Magic-Pak wall sleeve is recessed into the wall opening, it will also likely receive the water running down the building wall above it plus the water draining out of any units in the same wall directly above. The cabinet base takes the overflow from the wall sleeve base and can take about another 1 in. of water depth along the sides of the condenser compartment. The design is such that all of the rainwater drains to the outside by gravity. Wind pressure is generally the same over the entire outside face and should not affect the ability of the water to run out the drain opening.

If the quantity of water is excessive for a short period of time, the drain pans can be filled with water faster than it can run out the drain openings, it can find its way inside the building. During high wind conditions, the outside pressure is greater than the indoor pressure and more water can be forced through the wall sleeve. Even then, the inside cabinet condenser compartment bottom frame is designed to further retain this leakage if it should occur. The condenser base pan has a 3/4 in. N.P.T. drain opening which must be connected to the building drain system. Should infiltration make its way into the condenser compartment, a properly installed drain line will not allow infiltration into the building.

There have been few instances of water infiltration over the past 30 years, and the problems which have arisen have been traced to leaky flashing or sealing to the wall sleeve, or to cases where sealant was omitted or improperly installed.

7.2 Air Infiltration

The wall sleeve design allows little air infiltration into the building. Proper sealing of the exterior portion of the wall sleeve and proper installation of the unit to the sleeve will enhance the resistance to air infiltration. The unit is installed on three foam rubber base gaskets, two foam rubber side gaskets, and one foam rubber top gasket. The unit is held in place by two mounting straps which maintain constant pressure between the unit and the gaskets.

7. Infiltration (cont.)

The load added to the Magic-Pak units for both sensible and latent heat of the outside air entering the conditioned space must be included in the heat loss/gain calculations in accordance with standard practice.

The amount of outside air that enters the space by infiltration through the Magic-Pak unit itself, and the wall sleeve, must also be included in this calculation. For applications in high wind areas, such as high-rise buildings, the amount of infiltration can be assumed to be minimal. An average of 15-30 CFM of infiltration can be used for calculation purposes. Wind conditions below 30 miles per hour can be considered as no (too low to measure) CFM air infiltration through the Magic-Pak unit and wall sleeve.

If the closet enclosure is on a balcony, it would not need to be sealed or gasketed around the access door as would an enclosure with an access door opening into the conditioned space.

7.3 Introduction of Ventilation Air

Some local building codes require that a specific amount of ventilation air be brought into the conditioned space, depending upon the occupancy and use of the building. In order to comply, some builders will install a short duct with a fixed damper to the outside wall from the return duct or plenum space.

A grille is placed over the opening in the outside wall. The grille should be backed up with a piece of screening to prevent insects from entering.

This method is particularly useful in keeping the space under a slight positive pressure; however, controlling the amount of air entering the duct under high wind conditions in high-rise buildings is very unpredictable. Therefore this practice should be limited to one, two, or three story buildings, or where adjacent walls form an air shaft offering some protection from high winds.

In any case, the amount of outside air brought directly into the inlet of the evaporator coil of the Magic-Pak unit **must not exceed 25%** of the **total rated cooling CFM** for the unit.

It is preferable to seal the exterior portions of the wall sleeve with silicone caulk and ensure the sleeve and platform are level and plumb. This allows for proper sealing of the Magic-Pak unit to the wall sleeve.

It is preferable to seal out any infiltration air that can enter the unit through the wall sleeve or building design and add a ventilation duct with a controlling damper to an air shaft constructed to meet local codes.

7. Infiltration (cont.)

7.4 Sealing Return-Air Ducts

Whenever return ducts are connected directly to the inlet of a Magic-Pak using flexible duct collars, care should be taken to seal all cracks, holes, and joints against air leaks, if the enclosing closet can be pressurized by high wind.

If the return-air grille is low in the sidewall or access door and connected by a duct coming down to the return location in the unit, the effect of leaky return ductwork and high wind pressure during an off cycle can be reduced, but not necessarily eliminated.

8. Louver Grilles

Water infiltration and air infiltration are most effectively addressed in different ways.

8.1 Louver Grille Furnished on Magic-Pak

Magic-Pak units eliminate the unsightly appearance of external condensers and cooling towers, and integrate unobtrusively into the building design. The polypropylene (available in white, beige, sandstone, taupestone, or custom color) or aluminum grille finish complements any exterior wall.

The appearance from outside is similar for all Magic-Pak models of any heating or cooling capacity. However, there are different cabinet sizes. See pages 5, 6, and 7 for illustrations showing the different heights, widths, and depths of the Magic-Pak units.

The louvers in the upper grille section are turned slightly upward to direct discharge air away from the intake of the condenser coil below it, to minimize recirculation of air, and to present a better appearance by avoiding line-of-sight observation of the space and action taking place behind the louvered grille (see Figure 15).

The lower grille section covering the condenser coil is on the intake side of the condenser coil, which can be more easily cleaned from the

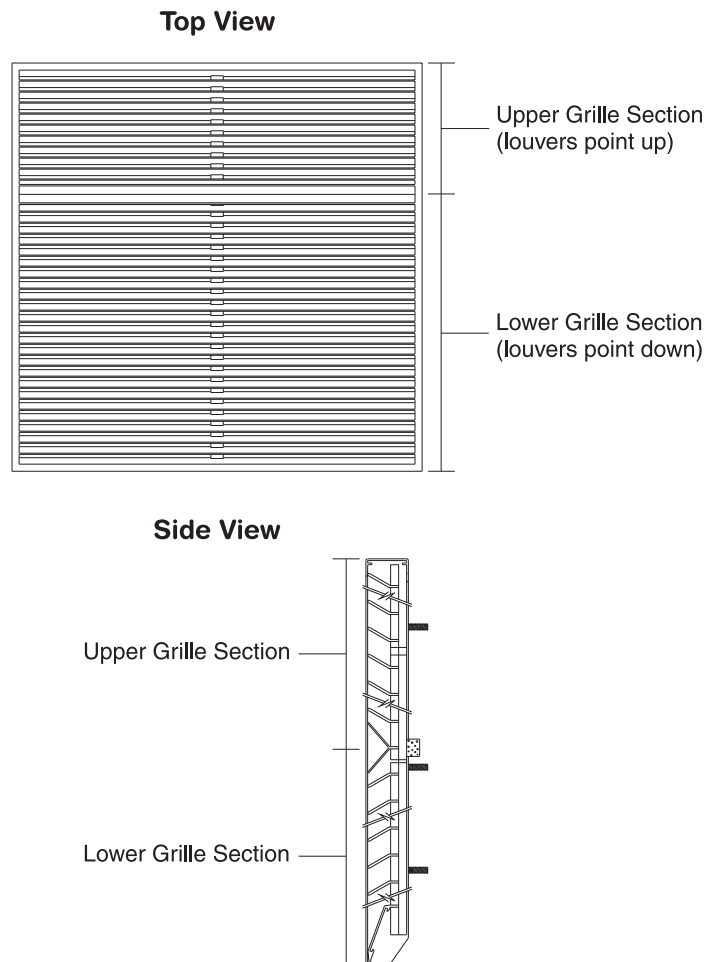


Figure 15 Magic-Pak Louver Grille

8. Louver Grilles (cont.)

outside where dirt, leaves, and other airborne debris can collect, as opposed to a “blow through” design which deposits this debris on the inaccessible side of the coil. In buildings over three stories tall, the likelihood of collecting such debris on the outside is very much reduced, and the action of rain and other elements ordinarily will clean away any accumulation.

If it becomes necessary to remove the louver grille for painting, cleaning, or repair, it can be removed from inside the building. To remove the grille, first remove the Magic-Pak unit, and reaching in, hold onto the grille. It may be necessary to attach a rope through the grille louvers to hold it in place while removing the six perimeter screws. This will help avoid dropping the grille while repositioning it to fit through the wall sleeve. The division panel must be removed prior to loosening the louver screws from the inside. Reverse the procedure to replace the grill and Magic-Pak unit.

Table 1 shows the different Magic-Pak louver grilles available.

8.2 Discharging Flue Gas Products from Gas-Fired MGE Models

The combustion products must be allowed to discharge freely and at sufficient velocity to project away from the outside surface minimizing condensation and corrosion. Inhibiting the free discharge of the combustion flue gases creates an undesirable back pressure within the heat exchanger this can contribute to poor combustion and a dirty flame. Also, the combustion products must not be allowed to recirculate back into the fresh air intake for the unit combustion air.

If it is necessary to locate an MGE (gas-fired) model in an inside corner of a wall, where the adjacent wall is at a right angle and is on the same side as the flue gas discharge tube, the adjacent wall must not have any obstruction or protrusion extending away from it that would interfere with the free discharge of the flue gases or would contribute toward recirculation of the flue gases.

Any protrusion on an adjacent wall must not extend into the path of the flue gases by an amount in excess of 1/2 the distance from the louvered grille to the protrusion.

Condensation of flue products, which emanate from the combustion blower discharge tube of MGE models, represent a possible cause of corrosion and ice build-up. A vent pipe extension is supplied with the unit (see *Section 8.2.1 Vent Pipe Installation* on page 34).

Due the high temperatures of the combustion products released from the gas vent, MGE gas package units require the use of either an aluminum louver kit or special MGE polypropylene louver kit (see Table 1).

8. Louver Grilles (cont.)

Kit No.	Description	Used With
ALVRPWHT	Polypropylene Louver Kit (White)	MCE/MHP 10 SEER - All Units MCE/MHP 12 SEER - 1.5 and 2 Ton Units
ALVRPWHT	Polypropylene Louver Kit (White)	MCE/MHP 12 SEER - 2.5 Ton Units
ALVRPSAN	Polypropylene Louver Kit (Sandstone)	MCE/MHP 10 SEER - All Units MCE/MHP 12 SEER - 1.5 and 2 Ton Units
ALVRPSAN	Polypropylene Louver Kit (Sandstone)	MCE/MHP 12 SEER - 2.5 Ton Units
ALVRPBGE	Polypropylene Louver Kit (Beige)	MCE/MHP 10 SEER - All Units MCE/MHP 12 SEER - 1.5 and 2 Ton Units
ALVRPBGE	Polypropylene Louver Kit (Beige)	MCE/MHP 12 SEER - 2.5 Ton Units
ALVRPTPST	Polypropylene Louver Kit (Taupestone)	MCE/MHP 10 SEER - All Units MCE/MHP 12 SEER - 1.5 and 2 Ton Units
ALVRPTPST	Polypropylene Louver Kit (Taupestone)	MCE/MHP 12 SEER - 2.5 Ton Units
ALVRPCSTM	Polypropylene Louver Kit (Custom Color*)	MCE/MHP 10 SEER - All Units MCE/MHP 12 SEER - 1.5 and 2 Ton Units
ALVRPCSTM	Polypropylene Louver Kit (Custom Color*)	MCE/MHP 12 SEER - 2.5 Ton Units
ALVRPWHTMGE	Polypropylene Louver Kit (White)	MGE 10 SEER - All Units MGE 12 SEER - 1.5 and 2 Ton Units
ALVRPWHTMGE	Polypropylene Louver Kit (White)	MGE 12 SEER - 2.5 Ton Units
ALVRPSANMGE	Polypropylene Louver Kit (Sandstone)	MGE 10 SEER - All Units MGE 12 SEER - 1.5 and 2 Ton Units
ALVRPSANMGE	Polypropylene Louver Kit (Sandstone)	MGE 12 SEER - 2.5 Ton Units
ALVRPBGEMGE	Polypropylene Louver Kit (Beige)	MGE 10 SEER - All Units MGE 12 SEER - 1.5 and 2 Ton Units
ALVRPBGEMGE	Polypropylene Louver Kit (Beige)	MGE 12 SEER - 2.5 Ton Units
ALVRPTPSTMGE	Polypropylene Louver Kit (Taupestone)	MGE 10 SEER - All Units MGE 12 SEER - 1.5 and 2 Ton Units
ALVRPTPSTMGE	Polypropylene Louver Kit (Taupestone)	MGE 12 SEER - 2.5 Ton Units
ALVRPCSTMGE	Polypropylene Louver Kit (Custom Color*)	MGE 10 SEER - All Units MGE 12 SEER - 1.5 and 2 Ton Units
ALVRPCSTMGE	Polypropylene Louver Kit (Custom Color*)	MGE 12 SEER - 2.5 Ton Units
ALVRAL-1	Extruded Aluminum Louver Kit	MCE/MGE/MHP 10 SEER - All Units MCE/MGE/MHP 12 SEER - 1.5 and 2 Ton Units
ALVRAL-2	Extruded Aluminum Louver Kit	MCE/MGE/MHP 12 SEER - 2.5 Ton Units
ALVRAL-3	Extruded Aluminum Louver Kit (45" Height)	MCE/MGE/MHP 10 SEER - All Units MCE/MGE/MHP 12 SEER - 1.5 and 2 Ton Units
ALVRAL-4	Extruded Aluminum Louver Kit (45" Height)	MCE/MGE/MHP 12 SEER - 2.5 Ton Units
ALVRAL-5	Extruded Aluminum Louver Kit (50" Height)	MCE/MGE/MHP 10 SEER - All Units MCE/MGE/MHP 12 SEER - 1.5 and 2 Ton Units
ALVRAL-6	Extruded Aluminum Louver Kit (50" Height)	MCE/MGE/MHP 12 SEER - 2.5 Ton Units

* Customer specified color

Table 1 Magic-Pak Louver Grilles Available

8. Louver Grilles (cont.)

8.2.1 Vent Pipe Installation

Determining the length of the vent pipe extension is dependent upon which wall sleeve accessory is installed at the job site for each particular installation.

CAUTION

For proper operation, the vent length must be correct for the installation. The unit may not operate correctly with inadequate vent length.

1. Access vent pipe at the side of the unit that will face the outdoors.
2. The vent pipe and vent pipe extension is located to the right of the outdoor fan (see Figure 16).

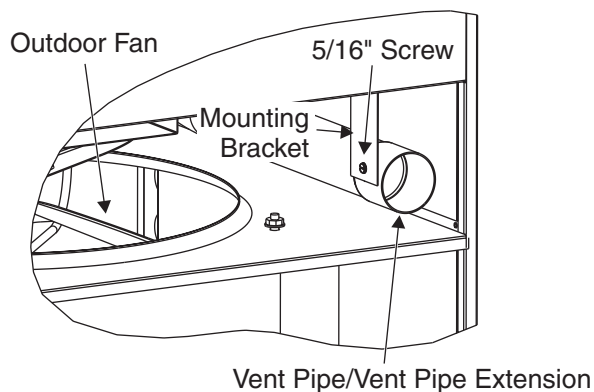


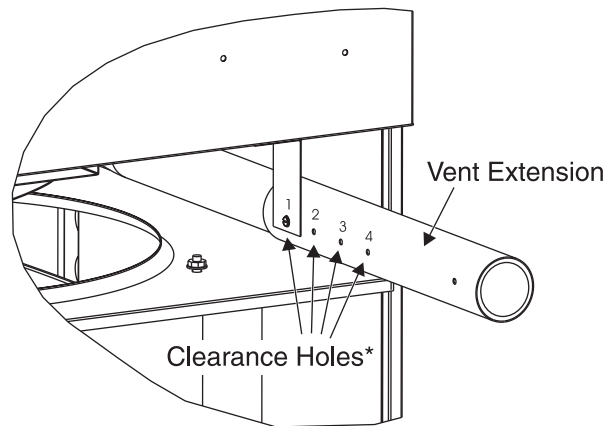
Figure 16 Locating Magic-Pak MGE Vent Pipe and Extension

3. Remove the 5/16" screw used to mount the vent pipe assembly to the mounting bracket. Keep this screw.
4. Five holes have been drilled into the vent extension (see Figure 17). Four of those holes are provided so that the vent can be extended the necessary length required for the installation. The wall sleeve that is installed determines which of these clearance holes should be used. Using Table 2 and Figure 17, determine which clearance hole should be used to position the vent extension properly. Slide the vent extension outward and line up the correct clearance hole on the vent extension with the hole in the vent pipe and the hole in the mounting bracket.
5. Re-install the 5/16" screw that was removed in Step 3. Thread the screw first through the clearance hole in the mounting bracket, the proper clearance hole in the vent extension, and into the engagement hole in the vent pipe. The length of the vent pipe extension that extends out of the cabinet should be as shown in Table 2.

8. Louver Grilles (cont.)

Wall Sleeve Used	Hole #	Approximate Length Vent Extends from Cabinet
ASLEEVE6-1, 2, 3, 4	4	5.5 inches
ASLEEVE8-1, 2, 3, 4	3	7.5 inches
ASLEEVE10-1, 2, 3, 4	2	9.5 inches
ASLEEVE12-1, 2, 3, 4	1	11.5 inches

Table 2 Determining Hole Setting on MGE Vent Pipe Extension



* The numbers are for identification purposes only. They are not marked on the actual vent extension.

Figure 17 Positioning Magic-Pak MGE Vent Pipe (Flue) Extension

In order to keep operating costs to a minimum, the **restriction** of condenser air flow must be minimized and the recirculation of condenser air at the outdoor face of the Magic-Pak must be prevented. These are prime considerations over which the building designer has control.

9. Condensate Drain

The Magic-Pak concept provides for the disposal of condensate water to a drain or wastewater line inside the building.

Provisions must be made to properly drain the indoor and outdoor drain pans of the Magic-Pak unit. (MGE Magic-Pak units have only one drain fitting as the indoor drain pan drains internally into the outdoor drain.) Piping the condensate to an inside drain is required.

The outdoor drain connection is located in the left end of the base of the Magic-Pak unit. The field-supplied outdoor drain connection is a 3/4 in. NPT to 3/4 in. PVC fitting (schedule 40). On MCE and MHP Magic-Pak units, the factory-supplied indoor drain connection is a 1/2 in. NPT to 3/4 in. PVC fitting (schedule 40). Both drains (if applicable) must be trapped as shown in Figures 18 and 19. The drain line(s) should pitch gradually downward at least 1 in. per 10 ft. of horizontal run to open drain.

Although the drain trap forms a trap when filled with condensate water during cooling operation, it is likely to be dry during prolonged periods of heating operation. The pan is always under negative air pressure when the condenser fan is in operation.

The building drain or waste line should be connected as local codes may prescribe for any other kind of air conditioning system, be it residential or commercial.

Use thread sealant on the threaded fittings. Install threaded fittings by hand only. **Do not overtorque the fittings.**

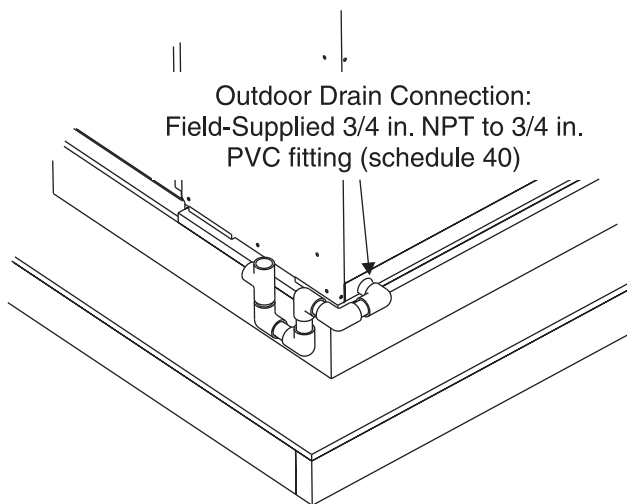


Figure 18 MGE Condensate Drain Connection

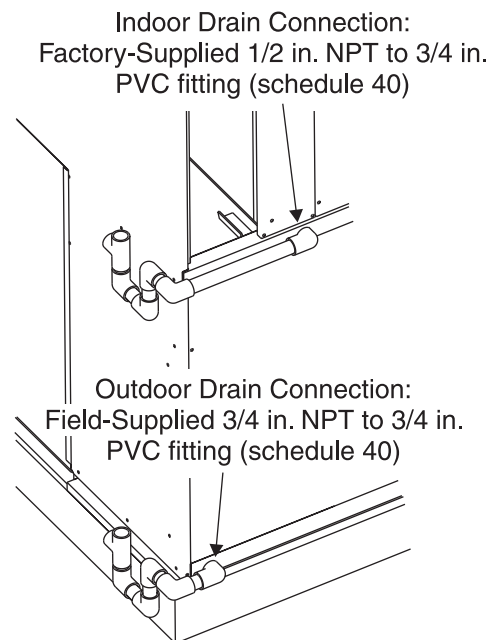


Figure 19 MCE/MHP Condensate Drain Connections

10. Electrical Service Wiring

Each Magic-Pak model is shipped with installation instructions which describe the options for electrical supply wiring connections to the specific unit model. All instructions defer to the code requirements of the agencies of local jurisdiction.

In most cases, the MGE gas-fired Magic-Pak units will be connected to nominal 230 volt, 60 Hz, single-phase power. The same units can be connected to 208 volt power if assurances can be given by the power supplier that a minimum of 197 volts will always be available. Cooling capacities will be reduced by about 1% for 208 volt operation. Gas heating ratings are not affected.

The MCE electric units and the MHP heat pump units are affected on the cooling cycle in a manner similar to the MGE models, as described above. However, since the MCE and MHP models both contain electric resistance strip heaters in the heating cycle, the supply line voltage has a bearing on the heating output of the strip heaters.

The specification sheet for each model contains a table which lists the BTUH output for each heater size at the voltages of 240, 230, 208, and 197 volts. The “rated” voltage of the heaters is 240 volts. The nominal KW is for a 240-volt rating.

The remainder of the Magic-Pak unit is rated at 230 volts, but has an operating voltage range from 253 to 197 volts, in accordance with the A.R.I. Standard 240.

The actual BTUH output of the electric strip heaters varies with the square of the voltage ratio; so if the expected operating voltage at a job location is known or can be determined, the actual heater output can be determined, or a heater optional size can be selected to meet a heating requirement at any chosen voltage.

Example:

- At 240 volts, 9.2 KW delivers 31,400 BTUH
- At 208 volts, the same heater delivers

$$\left(\frac{208}{240}\right)^2 \times 9.2 = 6.9 \text{ KW or } 23,550 \text{ BTUH}$$

The heat output for any other application voltage may be determined in the same way.

The specification sheets for each model also include the ampacity values required to determine wire sizes, in addition to the minimum fuse size requirements for both single-entry and multiple-entry connections to the units.

11. Air Filter

All indoor return air must be filtered. A washable filter is furnished with the Magic-Pak unit, located in the return air opening. If a return duct is installed, provisions must be to accommodate filter servicing.

The filter should be cleaned at least three times during the heating and cooling seasons, or more frequently if unusual conditions are encountered. To clean the washable filter, shake filter to remove excess dirt and/or use a vacuum cleaner. Wash filter in soap or detergent water and replace after filter is dry. It is not necessary to oil the filter after washing.

If an installation is made in which it is more desirable to mount the filter exterior to the unit, in the return duct work or elsewhere, the washable filter can be used or replaced with a disposable filter. If a disposable filter is used, use the information provided in Table 3 when sizing the disposable filter.

NOTE: When replacing filters, either the same filter must be used or an equivalent filter that achieves the same pressure drop and has the same filter area measurement (square inches).

Model Number	Filter Area
MCE/MHP/MGE*12	192 square inches
MCE/MHP/MGE*18	288 square inches
MCE/MHP/MGE*24	384 square inches
MCE/MHP/MGE*30	480 square inches

* 10 and 12 SEER models

Table 3 Minimum Required Surface Area for Disposable Filters

12. Special Considerations for Gas Units

One of the advantages of Magic-Pak units is that combustion air is not taken from the occupied space.

Gas-fired Magic-Paks take combustion air directly from the outside.

A centrifugal combustion air blower provides the displacement and pressure required to overcome the internal resistance of the heat exchanger passages, while drawing in the correct amount of air for efficient combustion.

The materials used in the construction of the heat exchanger, combustion blower, flue gas discharge tube, and outside louver grille are consistent with the requirements for corrosion resistance for the application, and consider the presence of moisture and the formation of acids through condensation internally and externally on the louvered grille.

The flue gas velocity and temperature are usually high enough to project the gases beyond the louvered grille before they condense, but in the event that erratic wind conditions could blow them back, the corrosion protection is provided.

12.1 Gas Distribution in Multi-Family Buildings

Use of "2 psi" gas distribution systems requires an additional regulator. It must be sized for the total BTUH load of only the appliances served in the apartment, such as a gas range, gas clothes dryer, gas water heater, etc., as well as the Magic-Pak gas unit.

If one of the appliances is located too far away from the others to permit use of small diameter tubing, it may be necessary to install a tee ahead of the regulator and run the 2 psi gas to it, locating a second pressure regulator at the distant appliance.

13. Retrofit Applications

MCE, MHP, and MGE Magic-Pak units can be retrofitted to replace any thru-the-wall product that utilizes a 45-1/8 in. tall by 29-1/8 in. wide wall opening.

Magic-Pak units can be used to replace the following thru-the-wall units:

- HWC Series Gas Heating with Electric Cooling Units
(Johnson Furnace, Magic Chef, Armstrong)
- EWC Series Electric Cooling Package Units
(Johnson Furnace, Magic Chef, Armstrong)
- PWC Series Self-Contained Heat Pump Units
(Johnson Furnace, Magic Chef, Armstrong)
- 50QT Series (Carrier Corp.)
- 50QP Series (Carrier Corp.)



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