

Installation Manual: ROUGH IN

Winter 2026



Rheia, LLC

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Phoenix, AZ

rheiacomfort.com

Rheia has made all reasonable efforts to ensure this manual contains the most up-to-date, accurate information. Enhancements to the Rheia system may result in modification of features and or specifications without notice.

Rheia is not liable for installation practices that deviate from this manual or are not acceptable practices within the industry. Prior to installing the Rheia Air Distribution System, Rheia recommends a thorough review of the Rheia training documentation and to contact their local Rheia representative.

Please direct any inquiries to your builder, contractor, or HVAC designer. Rheia can be contacted via the Contact Us link at rheiacomfort.com/contact

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About this manual

This manual is published for HVAC professionals, contractors, building officials, HVAC designers and homebuilders. It provides general guidelines on the preparation and installation of the Rheia Air Distribution System.

- Check the Rheia website to make sure you are referencing the most current version of this manual which can be found at: <https://rheiacomfort.com/contractor-resources/>
- Review the Table of Contents to familiarize yourself with the layout of the manual.
- If you need to find specific information quickly, use the index at the back of the manual to direct you to the appropriate pages.
- Before diving into the instructions, understand any symbols or naming conventions used in the manual.
- Follow the step-by-step procedures.
- Use the diagrams and illustrations as visual aids to understand the installation steps, components, and system configurations.
- QR codes are used throughout the document. Scan these codes with your smartphone camera to access more detailed information on a topic.

Introduction

This Installation guide is published for HVAC technicians and installers, building officials, and construction professionals interested in the Rheia Air Distribution System. It describes general installation recommendations of the Rheia components, duct, and accessories. Always follow local code requirements.

To ensure you are referring to the latest version of this manual, please visit rheiacomfort.com/resources.

Prior to installing the Rheia system, Rheia recommends all installers review the Pro series

training videos and support information provided on rheiacomfort.com.

Rheia's compact duct and components are designed to be installed in the conditioned space of the home. When required, insulated ducts can be used as recommended by the HVAC designer.

The Rheia system comprises:

- UL 181-listed, 3' and 4' diameter duct
- UL 181C / UL 2043 listed Connector Components (Ferrule, Coupler, and Elbow)
- UL 94 V-0 rated Distribution Components (take-offs, wall, ceiling, and floor boots)
- UV stabilized ceiling and wall diffusers
- Metal accessories and floor diffusers

When storing and handling

- Do not store outdoors
- Do not weld, glue, or apply tapes or adhesives, unless UL 181-listed
- Do not store below -40 deg. F or above 160 deg. F ambient temperature
- Do not install underground

Before starting an installation, review Rheia's library of training resources, carefully read these guidelines, and assemble all the required tools

Access Rheia's Library of free installation training videos:

<https://bit.ly/rheia-training>



Rheia components

Part No.	Name/ Specification	Description	Image
10-01-010	3" Ferrule PC/ABS UL94 V-0	3" connector component threads into the end of a 3" diameter duct using a patented design to ensure a near air-tight seal. Use only with Rheia-approved ducts. Meets Standard UL2043 and is identified as Classified with the ETL listed mark, control number 5016806. Complies with Standard UL181C and is identified with the UL listing mark, file number MH64419	
20-01-010	4" Ferrule PC/ABS UL94 V-0	4" connector component threads into the end of a 4" diameter duct, using a patented design to ensure a near air-tight seal. Use only with Rheia-approved ducts. Complies with Standard UL2043 and is identified as Classified with the ETL listed mark, control number 5016806.	
10-01-020	45-Degree Elbow PC/ABS UL94 V-0	45-degree connector component that can be doubled-up to form a 90-degree elbow where required. Used for tight radius duct transitions to ensure optimum airflow. Complies with Standard UL2043 and is identified as Classified with the ETL listed mark, control number 5016806. Complies with Standard UL181C and is identified as Certified with the UL listing mark, file number MH64419	
10-01-030	Coupler PC/ABS UL94 V-0	3" connector component connects two ducts or connector components together. Used to extend a duct run. Complies with Standard UL2043 and is identified as Classified with the ETL listed mark, control number 5016806. Complies with Standard UL181C and is identified with the UL listing mark, file number MH64419	
10-01-041	Duct board Take Off Inside Extended PC/ABS UL94 V-0	Interior component to a two-part assembly, for use with 1" or 1 1/2" duct board. Only use with #10-01-051. No additional sealing required.	
10-01-051	Duct board Take Off Outside Extended PC/ABS UL94 V-0	Exterior component to a two-part assembly, for use with 1" duct board only. Only use with #10-01-040. No additional sealing required.	
10-01-200	High-Sidewall Boot Assembly PC/ABS and PP 2-part shell: UL 94 V-0 Damper: UL 94 V-0	Typical application is installed in 2x4 walls. Mounted to framing using Rheia Hanger Bar Assembly #00-00-240, or fastened directly to wood blocking. Includes a manually-adjustable damper blade for airflow balancing. Not for use in ceiling applications.	
10-01-210	Pass-Through Boot Assembly PC/ABS 2-part shell: UL 94 V-0 Damper: UL 94 V-0	Typical application is installed in chases. Mounted to framing using Rheia Hanger Bar Assembly #00-00-240, or fastened directly to wood blocking. Includes a manually-adjustable damper blade for airflow balancing.	
10-01-220	Ceiling Boot Assembly PC/ABS UL 94 V-0 Damper: UL 94 V-0	Typical application in ceiling installations. Mounted to framing using two Rheia Hanger Bar Assemblies #00-00 240 or is screwed to wood blocking. Includes a manually adjustable damper blade.	

Part No.	Name/ Specification	Description	Image
10-01-280	Floor Boot Assembly PC/ABS UL 94 V-0 Damper: UL 94 V-0	For floor installations. Attaches directly to the sub-floor. Includes two manually-adjustable damper blades for airflow balancing. Use only with Rheia Metal Floor Diffuser 4x10 #'s 00-04-300, 00-05-300, 00-06-300.	
10-01-300	Dual Duct Floor Boot Assembly PC/ABS UL94 V-0	For floor installations. Attaches directly to the sub-floor. Includes two manually-adjustable damper blades for airflow balancing. Use only with Rheia Metal Floor Diffuser 4x10 #'s 00-04-300, 00-05-300, 00-06-300.	
10-04-230	Ceiling Diffuser Assembly ABS UV stabilized UL94 HB	Diffuser assembly distributes air 360 degrees. Throw is approximately 12 feet @ 40 CFM. Compatible with 5/8" or 1/2" drywall.	
10-04-260	Ceiling Diffuser Small Assembly ABS UV stabilized UL94 HB	Diffuser assembly distributes air 360 degrees. Air throw pattern is designed specifically for heating dominated markets. Compatible with 5/8" or 1/2" drywall.	
10-04-091	Slotted Diffuser ABS UV stabilized UL94 HB	One-piece diffuser. Distributes air omni-directionally. Throw is approximately 17 feet @ 40 CFM. Compatible with 5/8" or 1/2" drywall. Use with High Sidewall Boot Assembly #10-01-200, or Pass Through Boot Assembly #10-01-210.	
00-04-300 00-05-300 00-06-300	Metal Floor Diffuser White: 04: RAL 9016 Beige: 05: PANTONE 7531C Grey: 06: PANTONE COOLGREY 6C	Painted steel diffuser for use only with Floor Boot 4x10 Assembly #10-01-280. Do not substitute with diffusers incorporating a built-in adjustable damper.	
00-00-240	Hanger Bar Assembly 23 ga. Galvanized sheet metal	Galvanized steel adjustable hanger bar. Used for all wall and ceiling boot installations where specified. Adjustable design allows installation within wall cavities, ceiling cavities, and bulkheads with spacing between 12" and 24" o.c.	
3" dia. 10-00-190 4" dia. 20-00-190	Uninsulated Duct UL 181 certified Class I Air duct	Listed under UL Standard 181 and CULS110 as a Class 1 flexible air duct. Thermaflex S-TL air duct is a coated spring steel wire helix permanently bonded to a coated, woven fiberglass cover. Supplied in 50 foot lengths only.	
3" dia. 10-00-190 4" dia. 20-00-190	Uninsulated Duct UL 181 certified Class I Air duct	Listed under UL Standard 181 and CULS110 as a Class 1 flexible air duct. Thermaflex M-KC air duct is a coated spring steel wire helix permanently bonded to a coated, woven fiberglass cover, 1" insulation jacket. Supplied in 25 foot lengths only.	

Refer to Rheia's component spec sheets:
<https://bit.ly/rheia-training>



Rheia design coordination process

The Rheia air distribution system works with any size and type of standard residential air handling unit (AHU) from any manufacturer and easily accommodates up-flow, down-flow, and horizontal units.

Rheia systems are designed using the Right-Rheia Duct Module, a plugin built into Right-Suite® Universal (RSU) for experienced HVAC designers who are familiar with the RSU environment, Manual J®, and Manual S®. While Manual D and Manual T contain valuable information, they do not specifically apply when designing a Rheia system because Rheia uses custom component sizing. The Rheia RSU plugin supersedes Manual D® and Manual T®.

When designing a Rheia system, the AHU and ducts must be located entirely within the building's air barrier and thermal envelope. This allows the Rheia system to use uninsulated ducts while meeting residential building code requirements. Insulated ducts are available for use in specific circumstances as specified by the HVAC designer.

Kick-off meeting overview

MEETING GOAL

Describe how Rheia will support all stakeholders through the pilot to production implementation of Rheia.

RHEIA ROLE

Rheia will walk-through the Rheia approach to HVAC design, architectural integration, and the design-to-pilot-to-production process.

PARTICIPANTS

- Architecture Team.
- Structural Engineer.
- HVAC Designer.

OUTCOMES

Define the target house plans.

Deliver the plan package to Rheia.

Establish the pilot home/ community production schedule.

Kick-off meeting required documentation

Rheia Specification Sheet – completed to perform Manual J and Manual S.

A full set of Architectural Plans.

A full set of Structural Plans.

Ceiling Lighting Layout.

Sprinkler Layout if applicable.

Kick-off meeting contractor-specific reviewed items

Zoning

- Zone damper make and model.
- Bypass make and model.

Filter information

- Filter manufacturer.
- Filter thickness (inch).
- Filter minimum merv rating.

Central return grille specifications

- Make and model.
- Filter grille (yes/no).
- Preferred sizes.

Transfer grille/jumper duct preferences

- Make and model (size for 2.5 Pascal pressure difference).
- Preferred sizes.

Conventional duct information

- Supply trunk type (flex duct, sheet metal, duct board, etc.)
- Return trunk type (flex duct, sheet metal, duct board, etc.)
- Duct insulation R-value.

Kick-off meeting review items

Rooms with low or no cfm

- Identify small rooms that require a supply register despite low or no cfm demand. (Bathrooms, powders, WICs, etc). Rheia suggests removing supply ducts from any room(s) with less than 10 cfm if allowed by the building code.

Load calc info notes zoning

- Include zoning for multi-story (yes/no/designer's discretion).

Return strategy (select all that apply)

- Single central return.
- One return per floor.
- Ducted return in primary.
- Jump duct in primary.
- Jump ducts in all bedrooms.
- Transfer grilles in all bedrooms.
- Transfer grilles in secondary bedrooms.
- Other - please describe .

Register preference (rank 1-3, 1 most preferred)

- Ceiling.
- Sidewall.
- Floor.

Architectural change preference (rank 1-3, 1 most preferred)

- Dropped ceilings.
- Thickened walls.
- Inverted soffit.

Architectural/structural coordination

- Contact information to coordinate architectural changes.
- Contact information to coordinate joist hole cuts.

General

- Municipality / climate zone.
- Above code programs (i.e. Energy star, ZERH).
- Any specific submittal requirements.

Foundation (all that apply)

- Slab.
- Crawlspace.
- Unfinished basement.
- Finished basement.

Floors

- Floor over garage r-value.
- Floor over crawlspace r-value.
- Floor over unconditioned basement.
- Slab on grade edge insulation r-value and depth.
- Slab on grade perimeter insulation r-value and width.
- Cantilever over ambient air r-value.

Walls

- Above grade frame r-value (2x4 or 2x6).
- Below grade finished basement frame r-value (2x4 or 2x6).
- Below grade unfinished basement frame r-value (2x4 or 2x6).
- Attic knee wall r-value (2x4 or 2x6).
- Garage partition r-value (2x4 or 2x6).
- Crawlspace foundation wall r-value.
- Rim board (aka band joist) r-value.

Ceilings

- Attic type (vented, conditioned, etc.).
- Ceiling insulation r-value.
- Vaulted ceiling r-value radiant barrier (if applicable).

Window

- Properties fixed u-value/shgc operable u-value/shgc.
- Sliding glass door (u-value/shgc).
- Insect screen (yes/no).
- Design for internal shading (yes/no).

Doors

- U-value or r-value.

Temperatures

- Indoor heating & cooling setpoints.
- Outdoor heating & cooling design conditions.

Infiltration setting

- Blower door test results (air changes/ hour) @ 50 pa.

Ventilation info (check all that apply)

- Outside air (supply).
- Outside air (exhaust).
- Outside air (balanced).
- ERV.
- HRV other.
- Ventilator model number.

Orientation

- Worst case or lot specific.

Manual S data

Outdoor equipment (condenser)

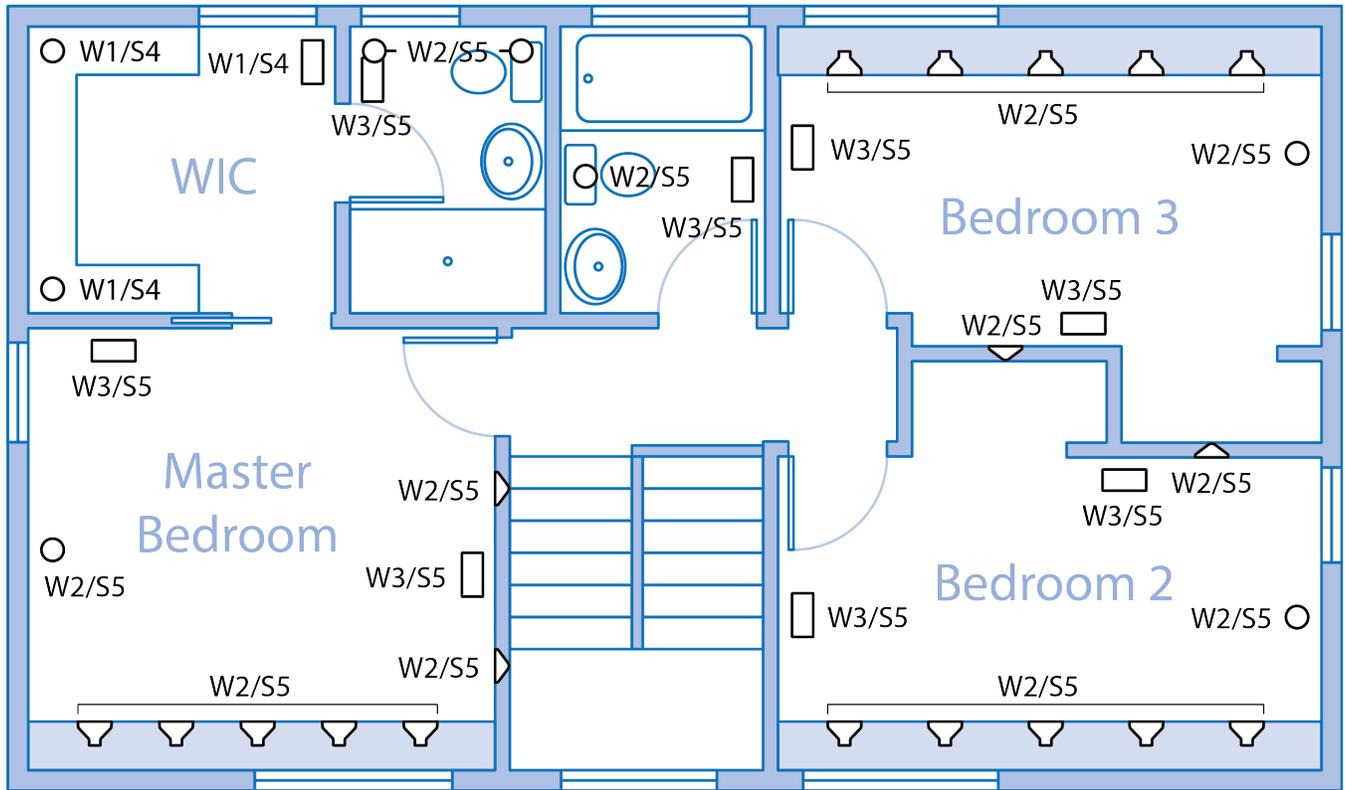
- Manufacturer.
- Model prefix.

Indoor equipment

- Manufacturer.
- Furnace/air handler model prefix.
- Evap coil model prefix.

Rheia draw report

Rheia draw report shows the locations of the ceiling, wall, and floor boots, the duct sizes, and risers to other floors. Details such as hole cut sizes in the framing, transfer duct locations, return duct sizing, and notes of air sealing may be found on a draw report. Not following the details and layout shown in the draw report may result in higher static pressure and a system that might not perform as designed.

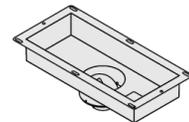


Duct layout drawing legend

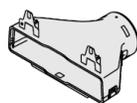
HIGH SIDEWALL BOOT



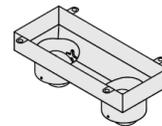
FLOOR BOOT



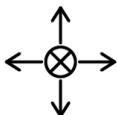
PASS-THROUGH BOOT



DUAL DUCT FLOOR BOOT



CEILING BOOT



Manual S equipment report

A Rheia design will include a Manual S®, specifying the equipment to be installed that matches the Manual J and meets the Rheia duct system design. Equipment used that does not match the design may not be used without updating the Manual S to meet the manufacturer's guidelines.



Manual S Compliance Report Entire House Rheia, LLC © 2023

Web: rheiacomfort.com

Project Information

For: DR Horton
Ft. Wayne, IN

Cooling Equipment

Design Conditions

Outdoor design DB:	88.1 °F	Sensible gain:	13823	Btuh	Entering coil DB:	75.7°F
Outdoor design WB:	73.0 °F	Latent gain:	2355	Btuh	Entering coil WB:	62.7°F
Indoor design DB:	75.0 °F	Total gain:	16178	Btuh		
Indoor RH:	50%	Estimated airflow:	640	cfm		

Manufacturer's Performance Data at Actual Design Conditions

Equipment type:	SplitAC	Model:	GA4SAN41800NA0+CVPVA2417XMC+59SC5B040E17-12			
Manufacturer:	Carrier					
Actual airflow:	640	cfm				
Sensible capacity:	15996	Btuh	116%	of load		
Latent capacity:	2762	Btuh	117%	of load		
Total capacity:	18758	Btuh	116%	of load	SHR:	85%

Equipment required to be installed

Heating Equipment

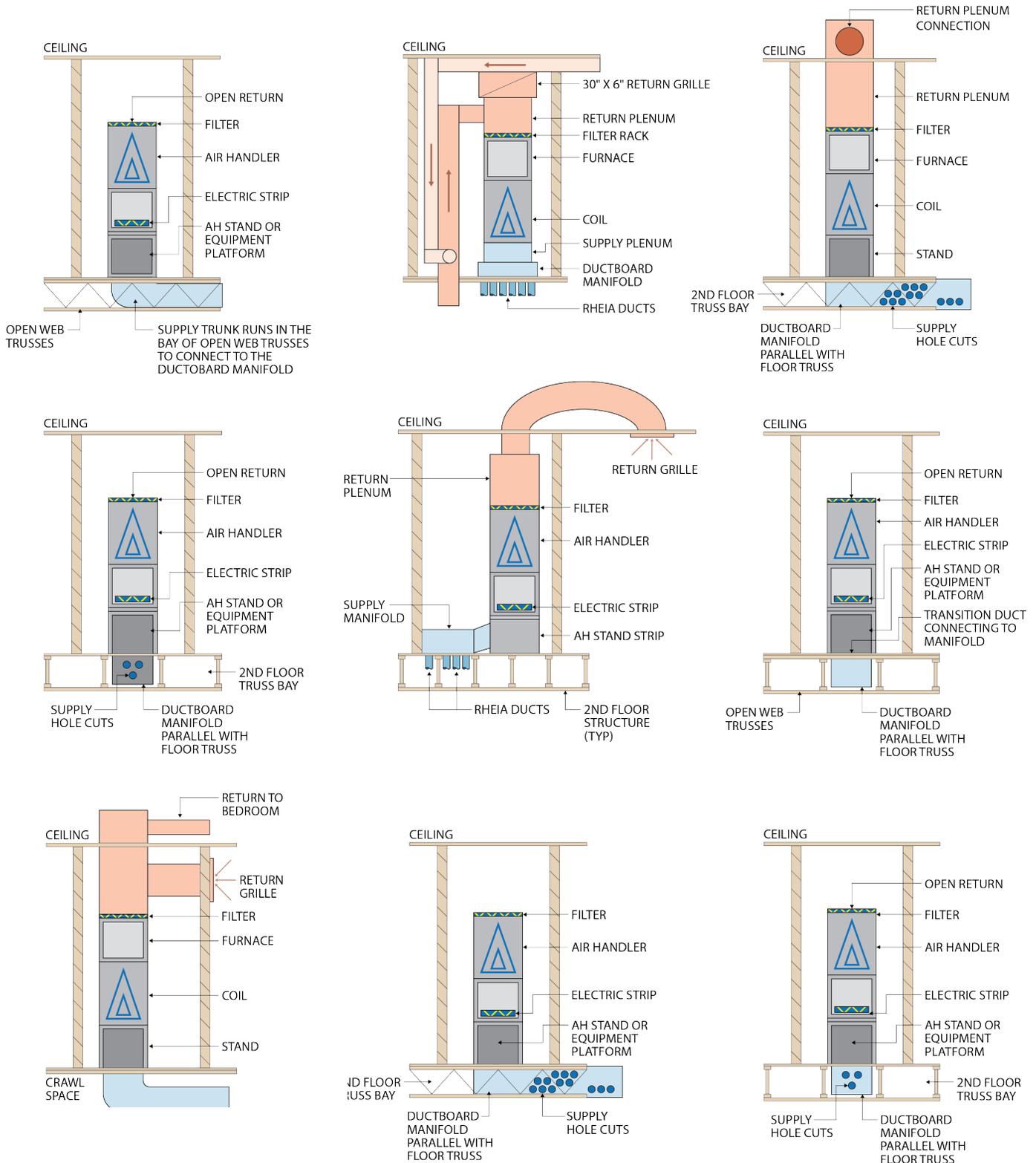
Design Conditions

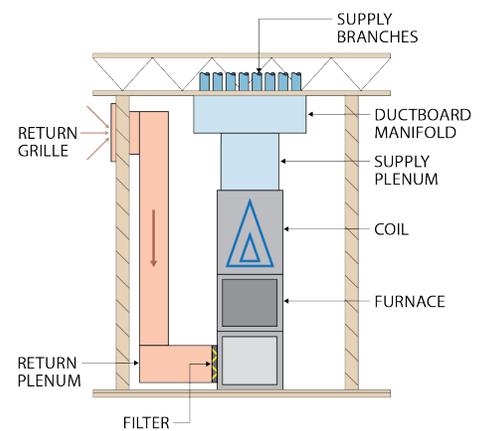
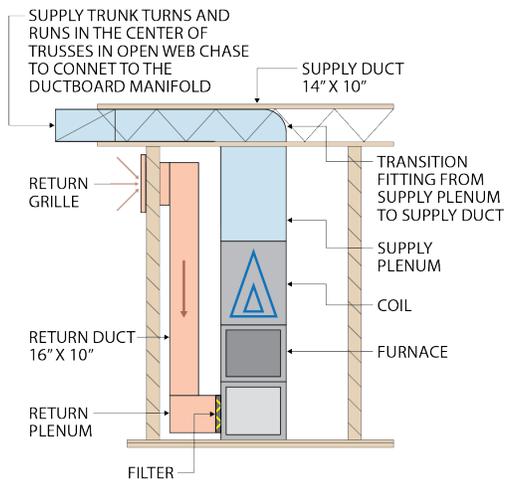
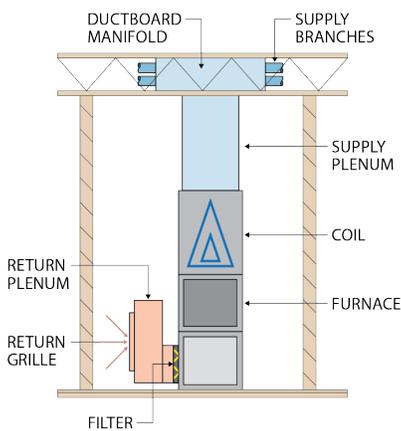
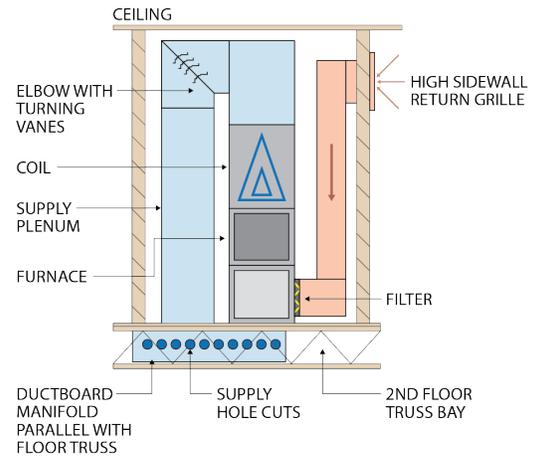
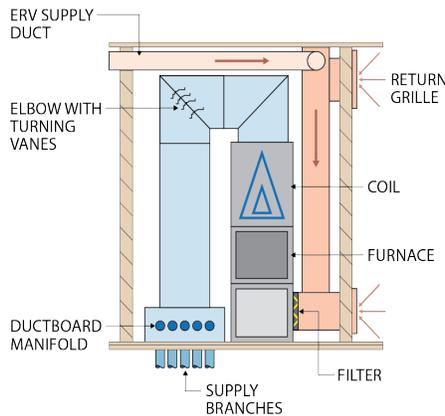
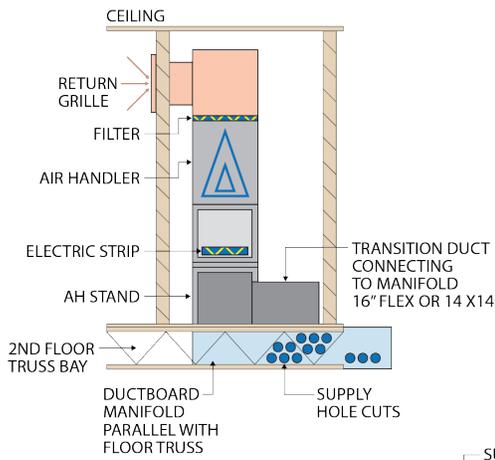
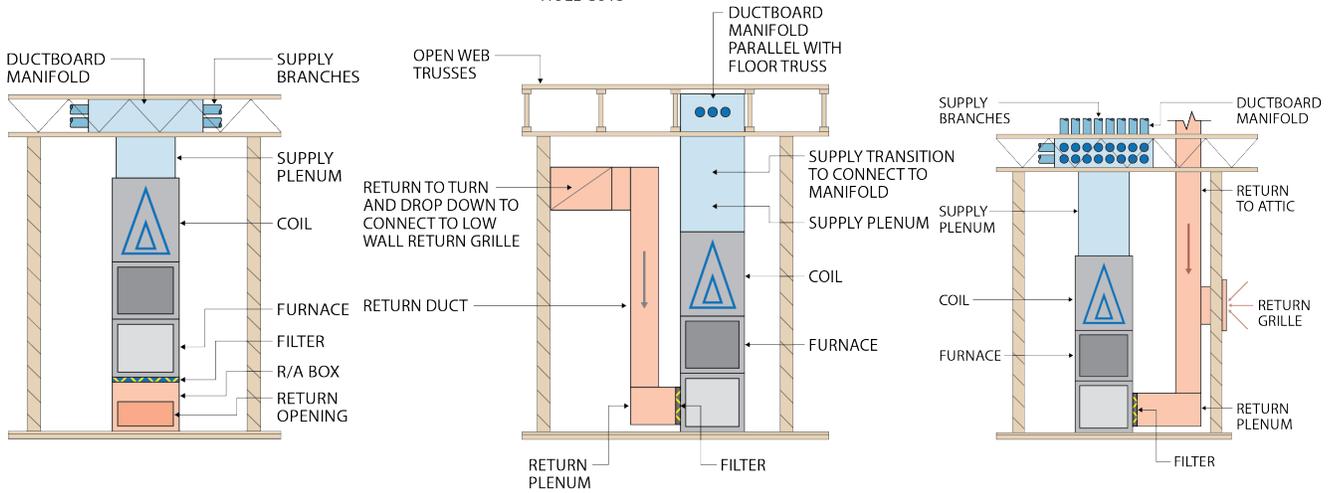
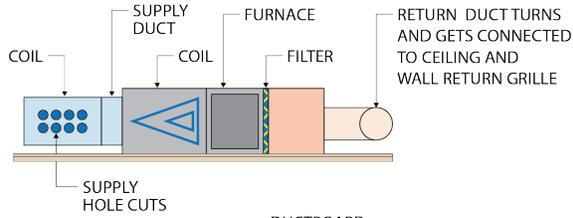
Outdoor design DB:	5.4 °F	Heat loss:	22873	Btuh	Entering coil DB:	69.3°F
Indoor design DB:	70.0 °F					

Manufacturer's Performance Data at Actual Design Conditions

Equipment type:	Gas furnace	Model:	59SC5B040E17-12			
Manufacturer:	Carrier					
Actual airflow:	675	cfm				
Output capacity:	39000	Btuh	171%	of load	Temp. rise:	54 °F

Mechanical closet layout options

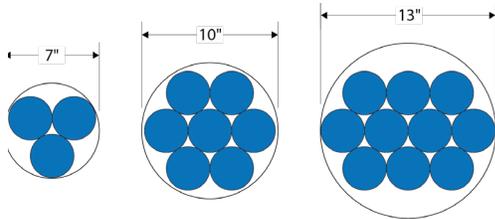




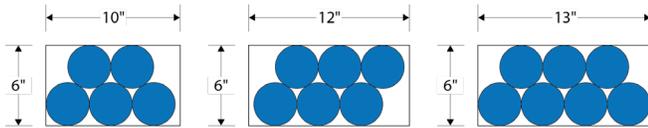
I-Joist hole cutting layouts

The Rheaia home-run air distribution system can be designed to route through I-joists, and must follow the guidelines of the I-joist manufacturer for hole sizing and spanning. Below are the number of ducts that can be designed and installed into an I-joist floor system. When designing a system, the designer will confirm and route the ducts accordingly, but the layout must be confirmed with the structural engineer.

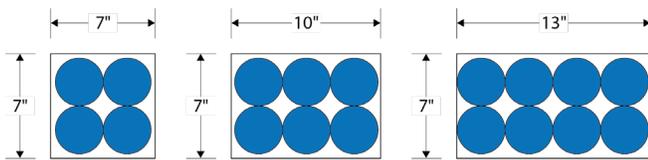
Number of 3" ducts in I-Joists



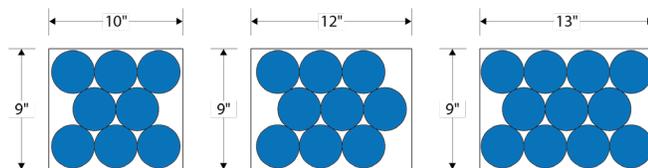
ROUND HOLES CUT IN JOISTS



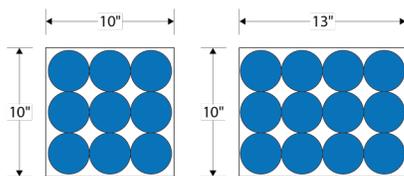
6" TALL RECTANGULAR HOLES CUT IN JOISTS



7" TALL RECTANGULAR HOLES CUT IN JOISTS

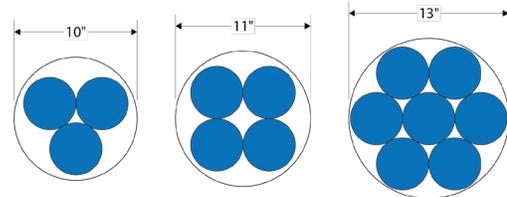


9" TALL RECTANGULAR HOLES CUT IN JOISTS

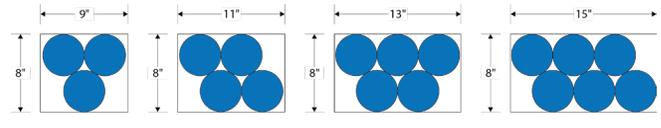


10" TALL RECTANGULAR HOLES CUT IN JOISTS

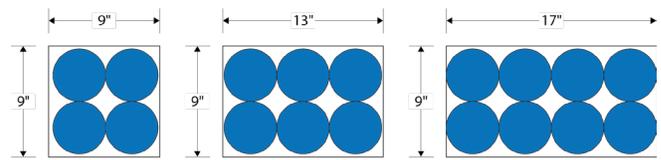
Number of 4" ducts in I-Joists



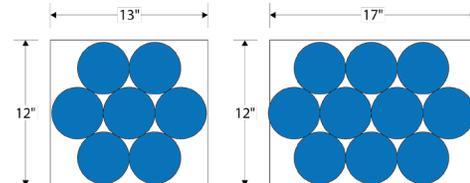
ROUND HOLES CUT IN JOISTS



8" TALL RECTANGULAR HOLES CUT IN JOISTS



9" TALL RECTANGULAR HOLES CUT IN JOISTS

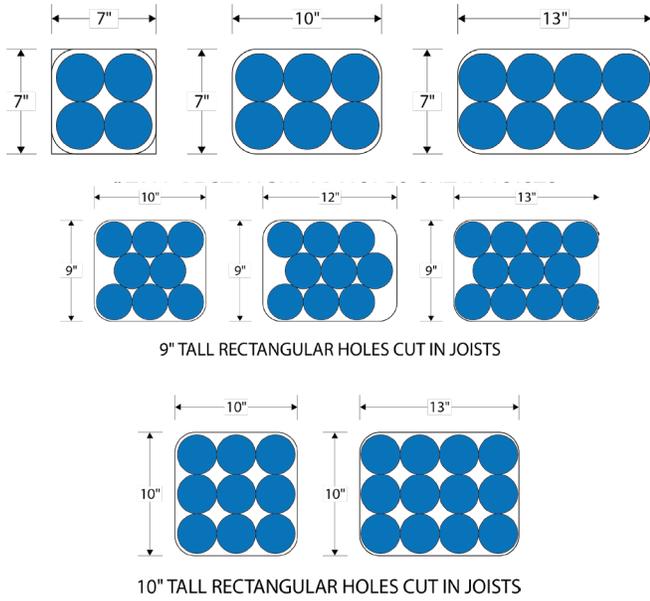


12" TALL RECTANGULAR HOLES CUT IN JOISTS

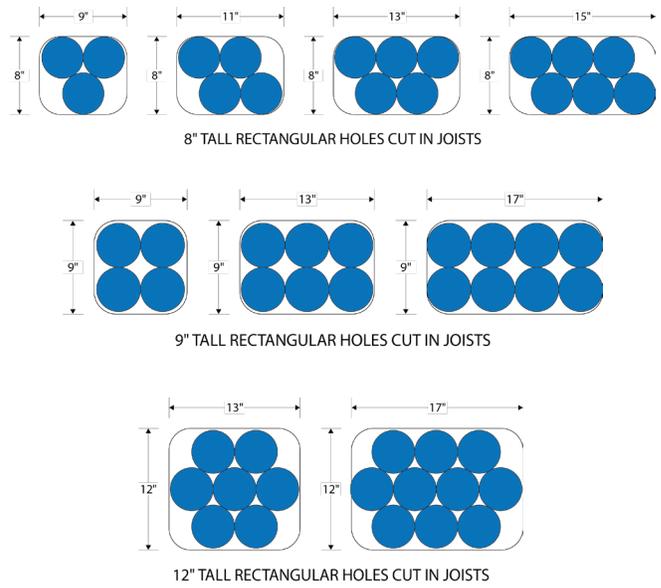


ALERT: The actual outside diameter of 3" Rheaia ducts is 3.20", and 4" ducts is 4.25". The examples shown are examples only. Check the joist manufacturer's specifications to determine the acceptable size and locations of holes cut in joists. Additional sized holes not shown on this sheet are also acceptable as long as the joist manufacturers specifications are followed.

Number of 3" ducts in holes in I-joists
BCI rounded corners



Number of 4" ducts in holes in I-joists
BCI rounded corners



ALERT: These diagrams only apply to Boise Cascade new rectangular hole cuts with rounded corners. The rounded corners have a 2" radius.



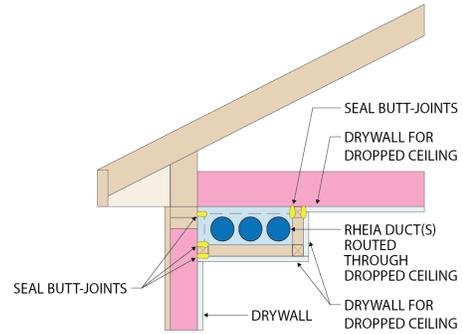
ALERT: Do not cut holes in I-joists or other structural components without consulting the manufacturer or building inspector. Always follow the joist manufacturer's guidelines when cutting penetrations in a joist.

Air sealing construction details

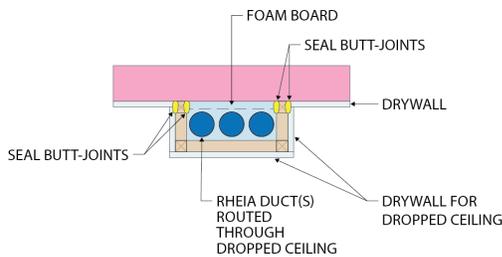
Dropped Ceiling And Soffit Details

1. For dropped ceilings and soffits on single-story homes.

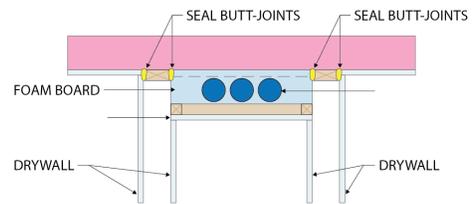
- a. Prior to Rheia installation, inspect all dropped ceiling or soffit framing, and confirm that:
 - i. All framing is installed at the correct locations and dimensions per the plans.
 - ii. The air barrier is installed as specified per the plans, using the approved material
 - iii. All seams are air sealed per the plans and scope of work requirements.



DROPPED CEILING DETAIL - EXTERIOR WALL



DROPPED CEILING DETAIL - CENTER OF ROOM

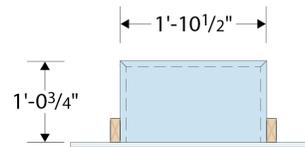


DROPPED CEILING DETAIL - INTERIOR WALL

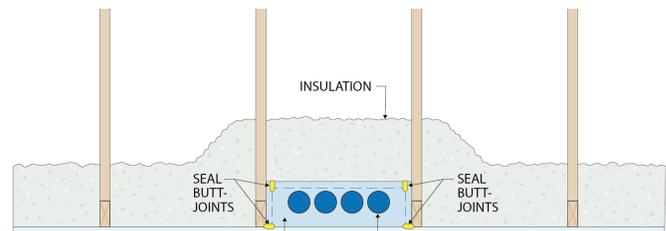
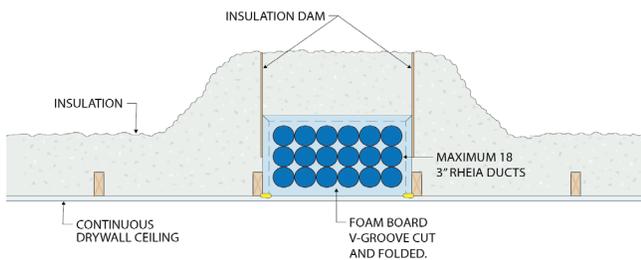
Inverted Soffit Details

1. For inverted soffits on single-story homes.

- a. Prior to the Rheia installation, inspect all inverted soffit framing, and confirm that:
 - i. All framing is installed at the correct locations and dimensions per the plans.
 - ii. The air barrier is installed as specified per the plans, using the approved material
 - iii. All seams are air sealed per the plans and scope of work requirements.



STANDARD INVERTED SOFFIT DIMENSIONS. SIZED TO FIT BETWEEN 24" O.C. TRUSSES

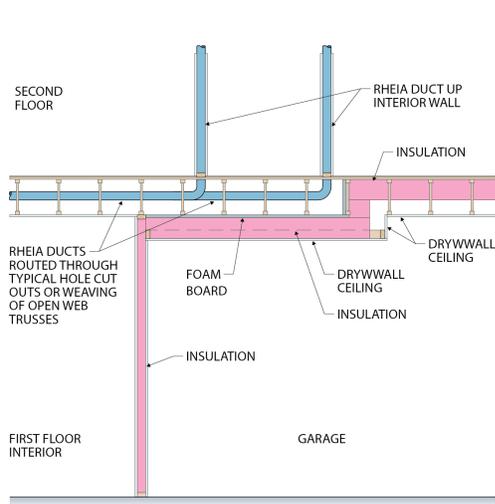


INVERTED SOFFIT DETAIL - DOWN ROOF TRUSS BAY

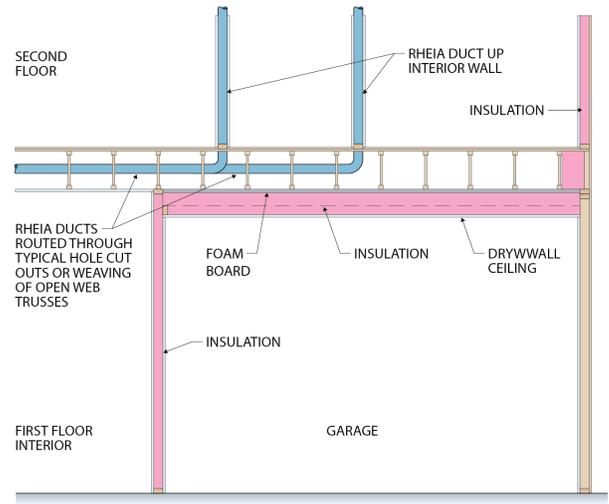
 **PRO TIP:** The minimum dropped ceiling depth that can accommodate Rheia ducts is 7". This includes the framing and drywall. This allows for routing through non load-bearing walls with a single top plate. For load bearing walls with a double plate an additional 1.5" is required. If there is no wall in the path of the duct, then a 6" drop is acceptable.

 **ALERT:** Properly air sealing and insulating the dropped ceiling or soffit from the unconditioned attic is essential. Before installing the duct system, ensure there is a complete and continuous air barrier between the dropped ceiling or soffit and the unconditioned attic.

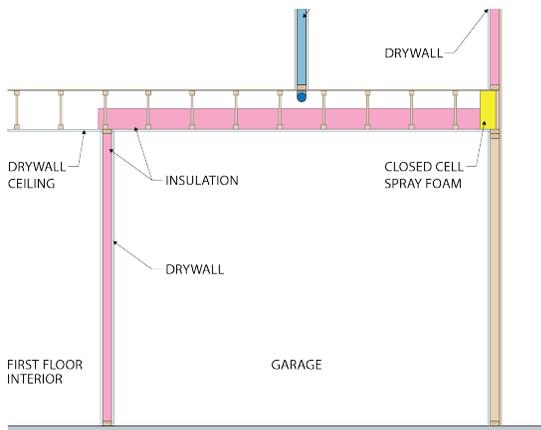
Dropped Ceilings And Soffit Details



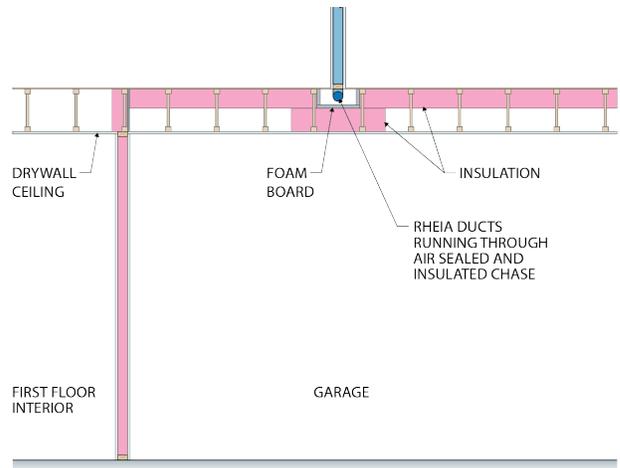
DUCT RUNNING THROUGH GARAGE WITH PARTIAL DROPPED CEILING DETAIL



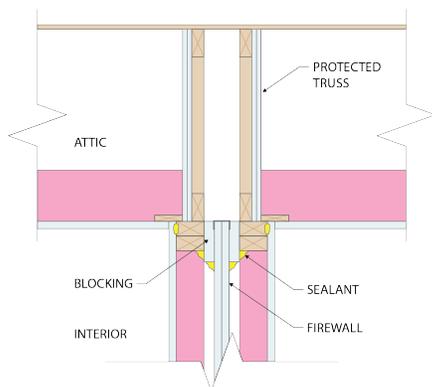
DUCT RUNNING THROUGH GARAGE WITH FULL DROPPED CEILING DETAIL



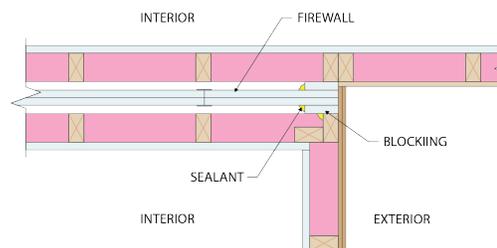
DUCT RUNNING THROUGH AN AIR SEALED GARAGE FLOOR DETAIL - FOR LOW HUMIDITY CLIMATES ONLY



DUCT RUNNING THROUGH GARAGE JOIST BAY CHASE DETAIL



PARTY WALL ASSEMBLY AIR SEALING AREAS AT ATTIC TRANSITION



PARTY WALL ASSEMBLY AIR SEALING AREAS AT VERTICAL EXTERIOR TRANSITION - PLAN VIEW

 A PDF version of the Air Sealing Details CAD file is available for download here:



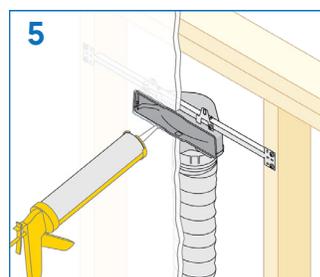
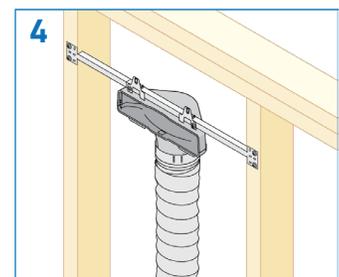
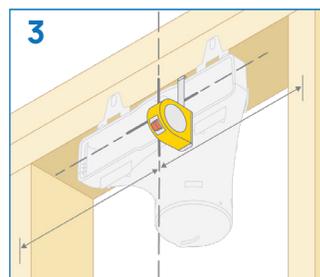
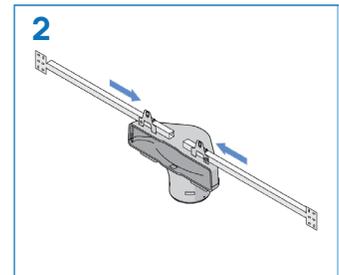
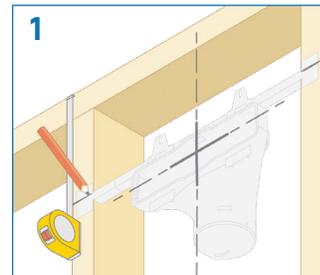
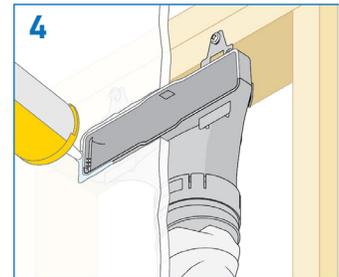
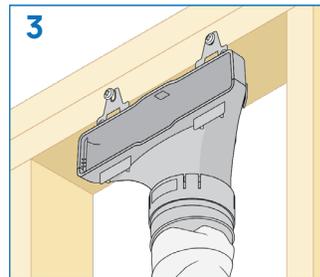
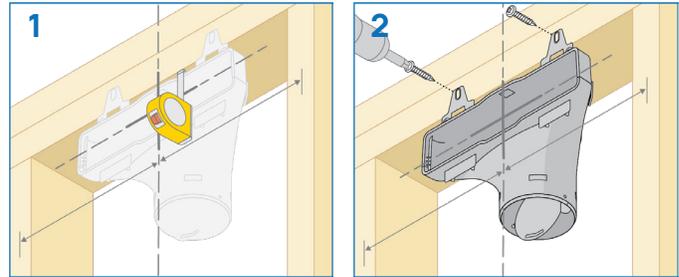
Recommended tools & materials

Name Description		Name Description	
Side Cutting Pliers Used to cut the duct wire helix.		Hole Saw or Sheet Metal Hole Cutter Used to cut holes in the manifold to install take-offs.	
Utility Knife Duct Knife Duct Cutter Used to cut the duct to length.			
Cordless Drill or Impact Driver Used to install hanger bars, boots, and fasten boot to hanger bars.			
1/2" min Sheet Metal Screws 3/4" min General Purpose Screws Self-drilling, used to lock the ceiling, pass-through, or high-sidewall boot to the hanger bar. Used to attach the boots and brackets to framing.			
Cordless Right Angle Drill & Hole Augers (3-1/2" & 4-1/2") Carbide Used to cut the bottom or top plate of walls for duct routing.			
Tape Measure Marker or Pencil Used to locate the boot location in the ceiling, walls, and floors.			
Level Used to check the level of the High-Sidewall and Pass-Through boots.			
Fabric Duct Strap Used to secure ducts with spacing as required by code.			

Installation guidelines

Installing High Sidewall Boots

1. Review the plans to identify if boots are to be attached directly to the framing structure or use the adjustable Hanger Bars.
2. For attachment of the boot directly to framing:
 - a. Confirm the distance from the wall top plate to the boot is per the construction drawings, and mark the distance from the top of the top plate down to the top of the Hanger Bar mounting tab.
 - b. Confirm the position of the center of the boot horizontally, and make sure the boot is level and on the measurement marks.
 - c. Use two general purpose screws in the mounting holes provided to attach the boot to the framing.
 - d. After drywall installation, apply a bead of caulk into the gap between the boot and drywall cut out.
3. For attachment of the boot using Hanger Bars:
 - a. Confirm the distance from the wall top plate to the boot is per the construction drawings.
 - b. Mark the distance from the top of the top plate down to the top of the Hanger Bar mounting tab.
 - c. Separate the Hanger Bar parts insert through each opening on the left and right side of the boot.
 - d. Slide the Hanger Bar halves back into each other.
 - e. Set the Hanger Bar in position to span across the stud bay.
 - f. The Hanger Bar mounting tabs can be attached to the front face of the framing or can be folded back for mounting on the inside face of the framing.
 - g. Position the Hanger Bar on the mark and secure with drive one or two general purpose screws.
 - h. Make sure the boot is level and on the measurement marks.
 - i. Drive one or two general purpose screws through the remaining Hanger Bar tab into the framing.
 - j. Slide the boot along the hanger bar to its final position and secure the boot in position to the Hanger Bar using a sheet metal screw.
 - k. After drywall installation, apply a bead of caulk into the gap between the boot and drywall cut out.



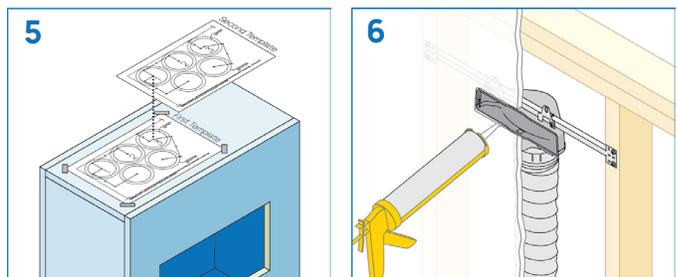
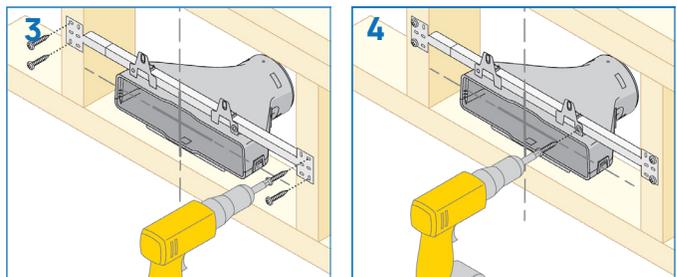
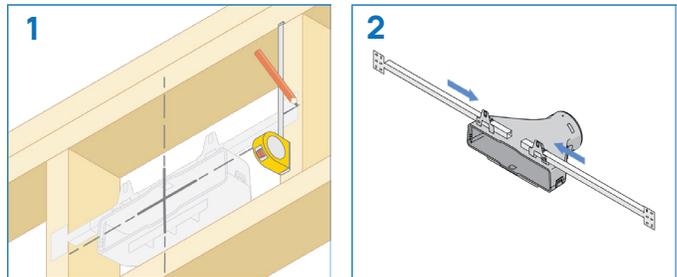
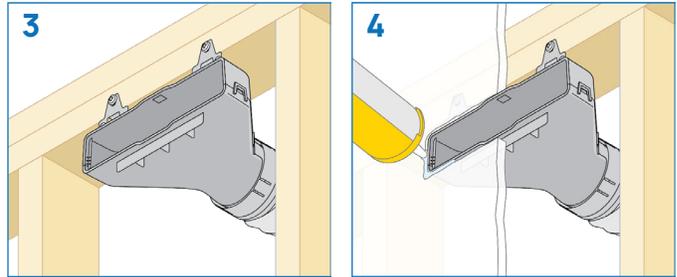
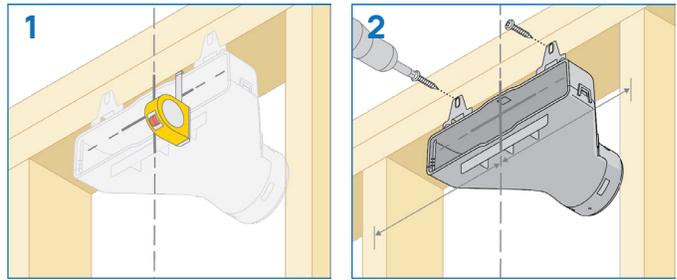
PRO TIP: Be consistent with the distance from the top plate to the Hanger Bar when installing all wall boots. This will ensure all boots are set the same distance from the top plate, and all diffusers will visually align when installed later.



ALERT: To get the best possible look in a room, make sure all the wall boots are level, located at the same height, and when grouped together on a wall that their spacing relative to each other is equal.

Installing Pass-Through Boots

1. Review the plans to identify if boots are to be attached directly to the framing structure to the framing structure or using the adjustable Hanger Bars.
2. For attachment of the boot directly to framing:
 - a. Confirm the distance from the wall top plate to the boot is per the construction drawings and confirm the position of the center of the boot horizontally.
 - b. Mark the distance from the top of the top plate down to the top of the Hanger Bar mounting tab.
 - c. Ensure the boot is level and on the measurement marks.
 - d. Use two general purpose screws in the mounting holes provided to attach the boot to the framing.
 - e. After drywall installation, apply a bead of caulk into the gap between the boot and drywall cut out.
3. For attachment of the boot using Hanger Bars:
 - a. Confirm the distance from the wall top plate to the boot is per the construction drawings.
 - b. Mark the distance from the top of the top plate down to the top of the Hanger Bar mounting tab.
 - c. Separate the Hanger Bar parts insert through each opening on the left and right side of the boot.
 - d. Slide the Hanger Bar halves back into each other.
 - e. Set the Hanger Bar to span across the stud bay.
 - f. The Hanger Bar mounting tabs can be attached to the front face of the framing or can be folded back for mounting on the inside face of the framing.
 - g. Position the Hanger Bar on the mark and secure with drive one or two general purpose screws.
 - h. Make sure the boot is level and on the measurement marks.
 - i. Drive one or two general purpose screws through the remaining Hanger Bar tab into the framing.
 - j. Slide the boot along the hanger bar to its final position.
 - k. Secure the boot in position to the Hanger Bar using a sheet metal screw.
 - l. After drywall installation, apply a bead of caulk into the gap between the boot and drywall cut out.



PRO TIP: Be consistent with the distance from the top plate to the Hanger Bar when installing all wall boots. This will ensure all boots are set the same distance from the top plate, and all diffusers will visually align when installed later.



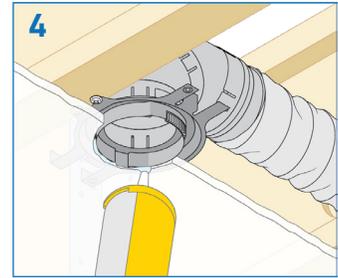
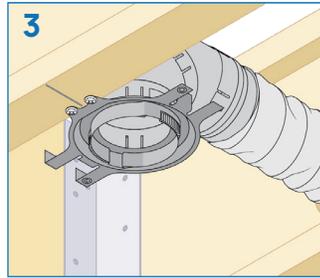
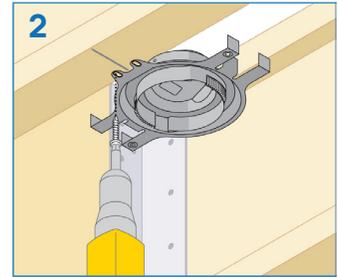
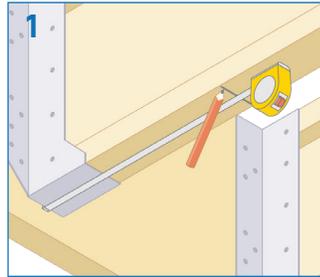
ALERT: To get the best possible look in a room, make sure all the wall boots are level, located at the same height, and when grouped together on a wall that their spacing relative to each other is equal.

Installing Ceiling Boots

1. Review the plans to identify if boots are to be attached directly to the framing structure directly to the framing structure or using the adjustable Hanger Bars.

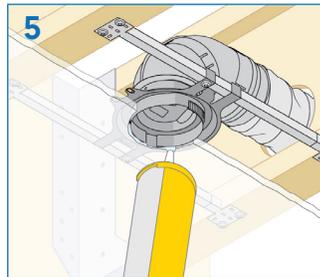
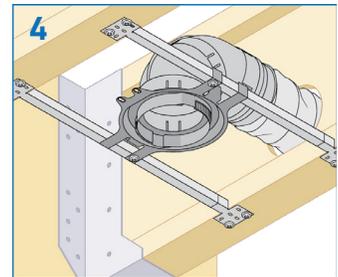
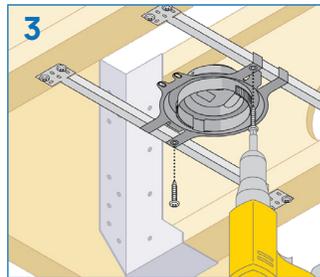
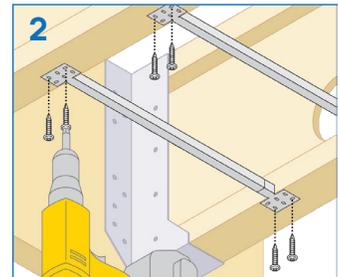
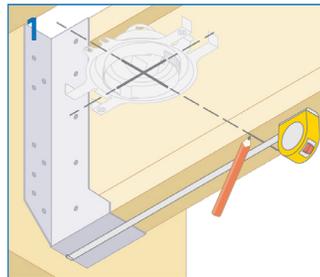
2. For attachment of the boot directly to framing:

- Review the construction drawings to locate the position of the center of the Ceiling Boot.
- If the Ceiling Boot locations are not indicated on the plans, discuss the layout with a builder representative to establish a pattern that works with the lighting layout per the plans.
- Mark the center of the boot on the adjacent framing.
- Use two general purpose screws in the mounting holes provided to attach the boot to the framing.
- After drywall installation, apply a bead of caulk into the gap between the boot and drywall cut out.



3. For attachment of the boot using Hanger Bars:

- Review the construction drawings to locate the position of the center of the Ceiling Boot.
- If the Ceiling Boot locations are not indicated on the plans, discuss the layout with a builder representative to establish a pattern that works with the lighting layout per the plans.
- Mark the center of the boot on the adjacent framing.
- Snap the Hanger Bars to the Ceiling Boot. An audible click indicates the Hanger Bars are in place.
- The Hanger Bar mounting tabs can be attached to the front face of the framing or can be folded back for mounting on the inside face of the framing.
- To mount the Ceiling Boot assembly to the framing, hold it in place, drive one or two general purpose screws through the Hanger Bar tabs into the framing, then attach the opposing side.
- Slide the boot along the hanger bar to its final position, and confirm the center of the boot is per the construction drawings.
- Secure the boot in position to the Hanger Bar using a sheet metal screw.
- After drywall installation, apply a bead of caulk into the gap between the boot and drywall cut out.



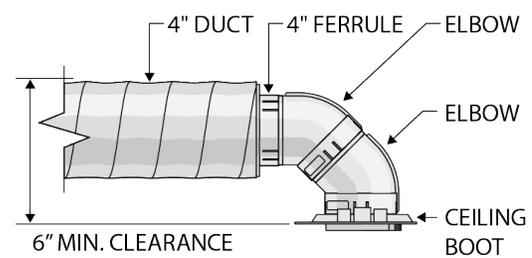
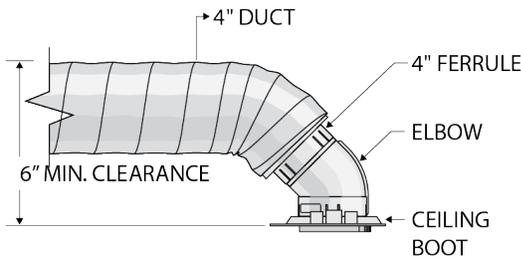
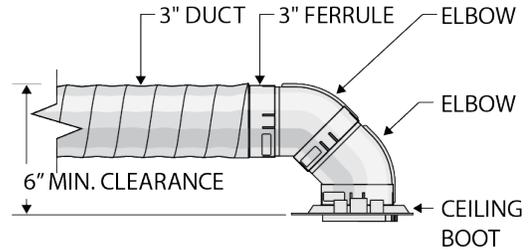
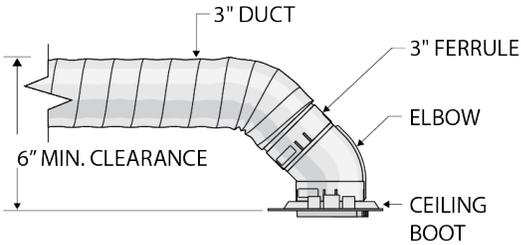
ALERT: Pay close attention to the lighting layout of the room and follow any guidelines for aligning Ceiling Boots with the ceiling lighting pattern and layout.



ALERT: The maximum drywall thickness for Ceiling Boot installations is 5/8". Applying too much drywall mud or other materials that increase ceiling thickness can make it difficult to properly install the Ceiling Diffuser.

4. Elbow use with Ceiling Boots in floor cavities.

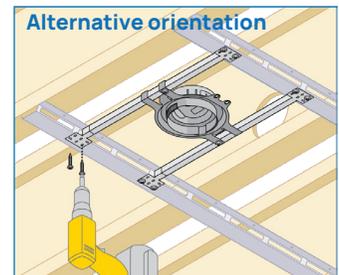
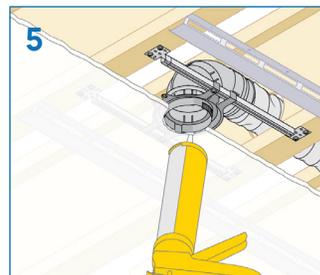
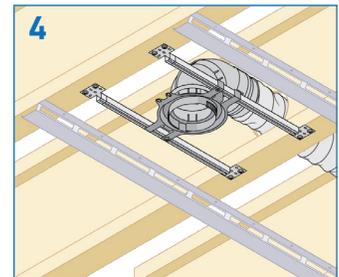
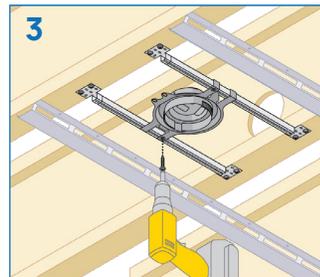
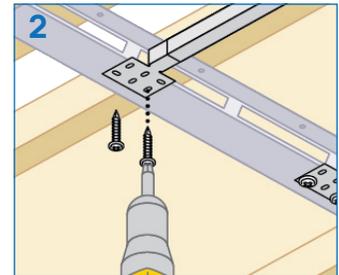
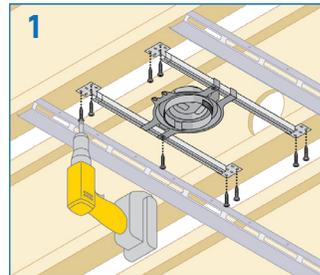
- a. In all Ceiling Boot installations the minimum floor cavity height is 6 inches. Use at least one 45-Degree Elbow to transition the Ceiling Boot to the duct.



Installing Ceiling Boots With Resilient Channel Ceilings

1. For ceiling installations using a 1/2" resilient channel

- Confirm that the resilient channels are installed per the plans.
- Review the construction drawings to locate the position of the center of the Ceiling Boot.
- When attaching the Hanger Bars to the framing, orient them so that they are proud of the framing. This will position the boot to be 1/2" lower, correctly aligned with the resilient channel and drywall.
- When attaching the Hanger Bars to the resilient channel, attach them in the typical orientation.
- After drywall installation, apply a bead of caulk into the gap between the boot and drywall cut out.
- Alternative orientation:** When attaching the Ceiling Boot to the resilient channel using Hanger Bars, flip the Hanger Bars 180 degrees from the typical orientation.

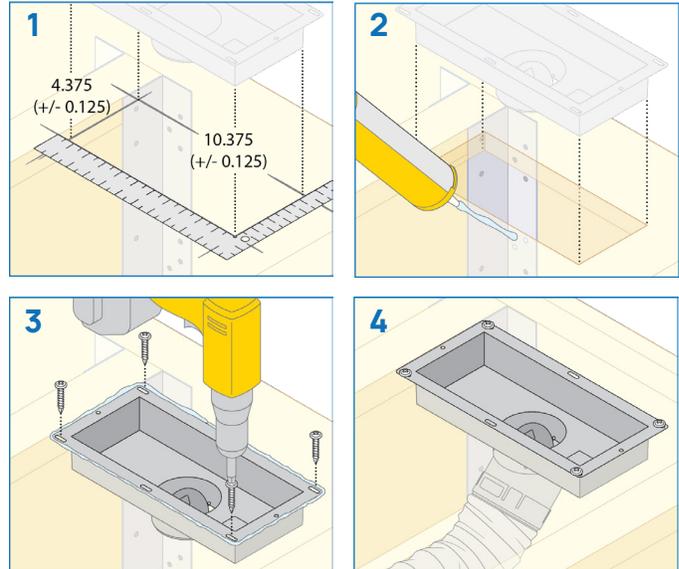


ALERT: For resilient channel installations, reverse the Hanger Bar orientation to ensure Ceiling Boot alignment with the drywall. Incorrect Hanger Bar orientation will result in misalignment of the Ceiling Boot and drywall, preventing Ceiling Diffuser installation.

Installing Floor Boots

Single Duct Floor Boot

1. Identify what floor covering will be installed. This determines if the floor boots need to be flush with the sub-flooring
2. For attachment of the boot to the floor deck:
 - a. Review the construction drawings to locate the position of the Floor Boot.
 - b. Mark the location of the Floor Boot cut out on the floor deck. The cut out dimensions are 10.375" (+/- 0.125") x 4.375" (+/- 0.125"). 10 ³/₈" x 4 ³/₈".
 - c. Caulk the perimeter of the cut out if required. Set the Floor Boot into the opening
 - d. Use a minimum of four general purpose screws in the mounting holes provided to attach the boot to the floor deck.
 - e. Use at least one 45-Degree Elbow to transition the Floor Boot to the duct.



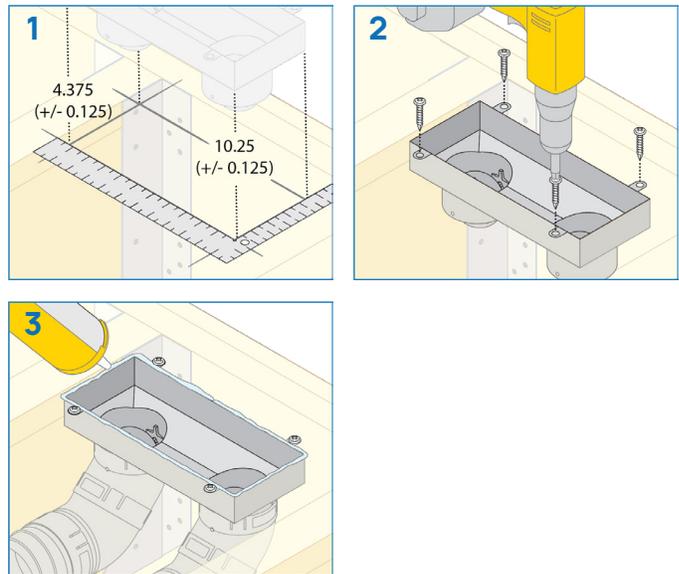
3. For attachment of the boot flush with the floor deck:
 - a. Cut off the flange around the perimeter of the boot, and set the boot top edge flush with the sub-floor.
 - b. Drive four flat head screws through the side wall of the boot into the sub-floor.
 - c. Caulk the perimeter of the cut out if required.

PRO TIP: A good practice is to locate the edge of the Floor Boot 3" away from interior walls, and 6" away from exterior walls.

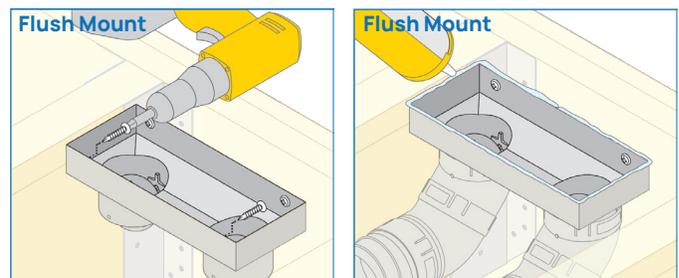
PRO TIP: A good practice is to locate the edge of the Floor Boot 3" away from interior walls, and 6" away from exterior walls.

Dual Duct Floor Boot

1. For attachment of the boot to the floor deck:
 - a. Review the construction drawings to locate the position of the Floor Boot.
 - b. Mark the location of the Floor Boot cut out on the floor deck. The cut out dimensions are 10.25" (+/- 0.125") x 4.375" (+/- 0.125"). 10 ³/₄" x 4 ³/₈".
 - c. Set the Floor Boot into the opening.
 - d. Use a minimum of four general purpose screws in the mounting holes provided to attach the boot to the floor deck.
 - e. Use at least one 45-Degree Elbow to transition the Floor Boot to the duct.

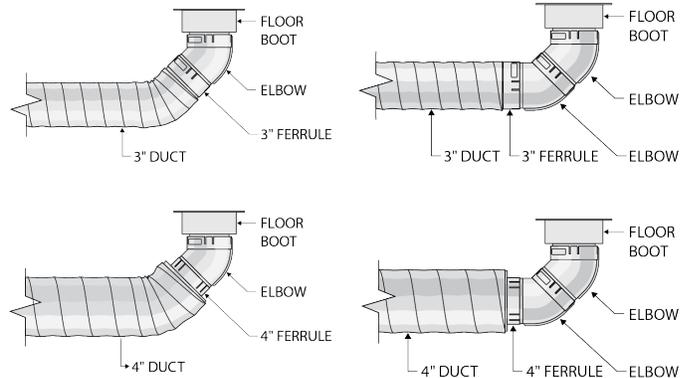


2. For attachment of the boot flush with the floor deck:
 - a. Break off the four mounting tabs around the perimeter of the boot by bending them back and forth a few times, or using side cutters.
 - b. Set the boot top edge flush with the sub-floor.
 - c. Drive four flat head screws through the side wall of the boot between the vertical ribs into the edge of the sub-floor.



3. Elbow application with Floor Boots in floor cavities.

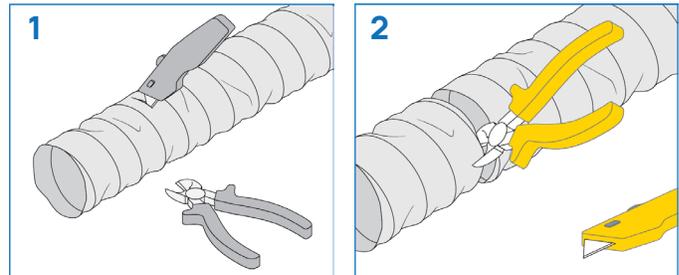
- Use one or two 45-Degree Elbows to connect Floor Boots to ducts running in the floor system.
- Ensure that the transition from the Floor Boot to the duct is smooth and does not adversely affect the airflow.



Duct-To-Ferrule Connections

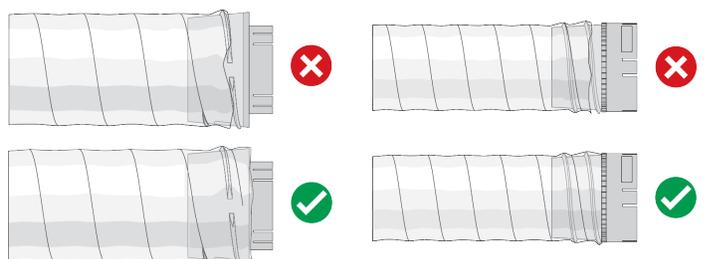
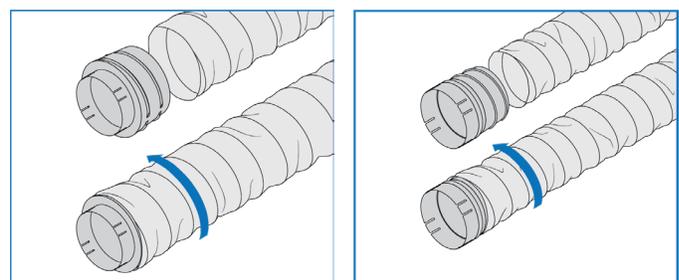
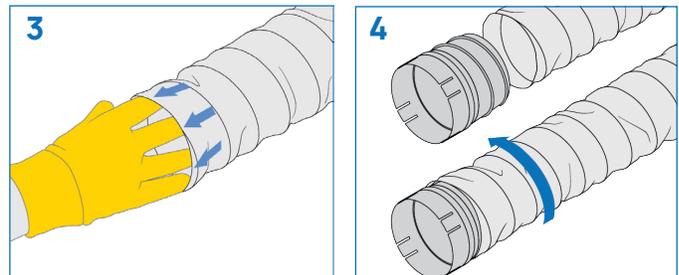
1. To trim a length of duct:

- Inspect the duct for tears or holes and discard any damaged duct.
- Make sure the wire helix is attached to the fabric on the inside of the duct.
- Use a utility knife to cut through the fabric of the duct, stopping at the wire helix.
- Use side cutters to snip through the wire.



2. To install a Ferrule:

- Check the end of the duct and trim off any excess fabric.
- With the duct in one hand, use the other hand to spread the duct fabric with fingers.
- Insert the Ferrule into the duct and twist clockwise until the Ferrule catches the duct's wire helix.
- For 3" ducts, twist the Ferrule until the duct fabric reaches the ribbed exterior surface of the Ferrule at the end of the threaded section.
- For 4" ducts, twist the Ferrule until the duct fabric passes the exterior edge of the threaded area.
- Pull the Ferrule away from the duct to check for a tight connection. The Ferrule to duct connection is tight enough when it will not easily twist apart by hand.
- Overlapping of the duct fabric as it screws onto the Ferrule is an acceptable practice.



PRO TIP: Repair small holes in the duct ONLY with UL181- listed duct tape.

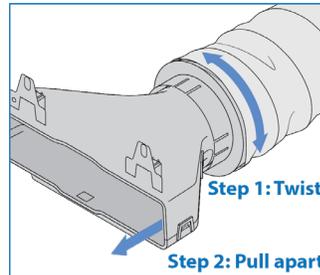
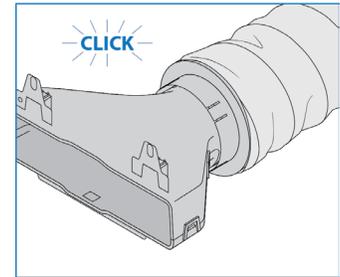
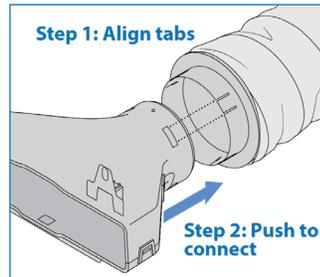


PRO TIP: Cut end of the duct as cleanly as possible to ensure a quicker installation of the Ferrule.

Ferrule Connections To Other Components

1. To connect any two components of the system:

- Align the Ferrule's snap-fit fingers with receiving slots and push the components together.
- An audible "click" will be heard when the two components are properly connected. If the snap fit is not aligned, slightly twist one of the parts to lock them together, listen for an audible click.
- Pull the two components in opposite directions to confirm they are connected.
- To separate the components, twist one component less than a quarter turn and pull apart.
- If the duct is not long enough to reach the intended location, a Coupler with two Ferrules should be used to attach a new length of duct (shown below) and extend the duct run.
- 90-degree transitions in a duct run to other components that have an inside radius of less than the duct diameter must use at least one 45 Degree Elbow.
- Sweeping 90-degree transitions in a duct run that have an inside radius of more than the duct diameter do not need an elbow.



Duct Transitions

1. For transitioning 4" duct to the Sidewall Boot in a wall:

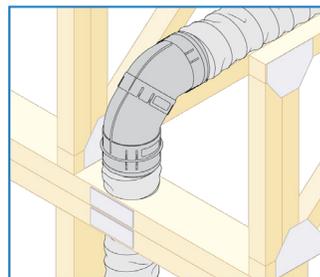
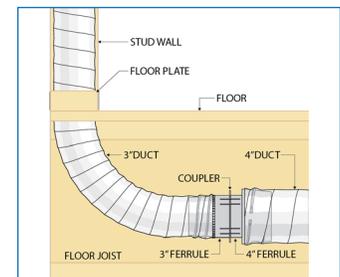
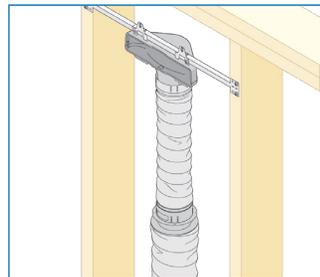
- Connect a short, minimum 1' long section of 3" duct to the High Sidewall Boot.
- Connect the 4" duct run in the wall to the 3" duct using a 3" Ferrule, Coupler, and 4" Ferrule.

2. For transitioning 4" duct to the High Sidewall Boot in a floor system:

- Run the 3" duct from the wall through the bottom plate in a sweeping transition to the floor cavity.
- Connect the 4" duct run in the wall to the 3" duct using a 3" Ferrule, Coupler and 4" Ferrule.

3. For transitions of a 3" vertical duct to a horizontal cavity requiring a tight sweep radius.

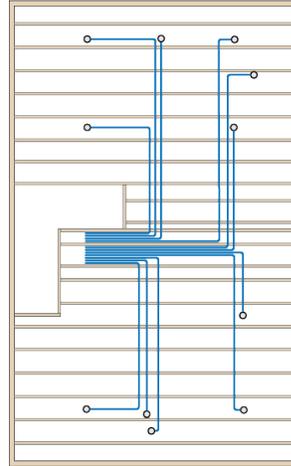
- Run the 3" duct through the top plate(s).
- Connect the 3" vertical duct run to a 3" or 4" horizontal duct run using a 3" Ferrule, Coupler and 3" or 4" Ferrule.



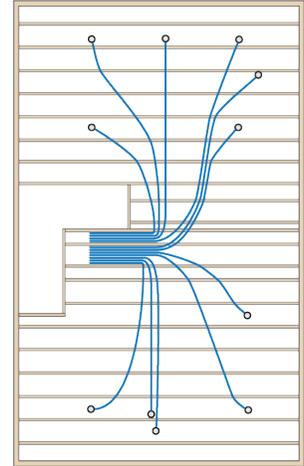
Duct Routing

Rheia's duct can be routed within 2" x 4," or greater walls, floor joists and other cavities. I-joists and other non-open web framing can be pre-cut or field cut to accommodate the routing of ducts. Follow all manufacturer's and building code requirements when cutting structural framing components. The Rheia design process accommodates variability in duct tightness, corner transitions and minor routing changes based on job site conditions.

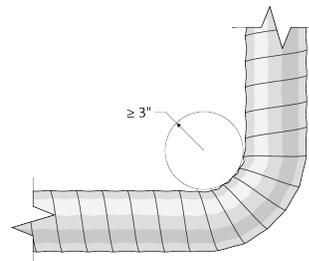
1. Uninsulated 3" and 4" duct must be installed inside the building's thermal envelope.
2. Follow the duct routing plan and boot locations per the construction drawings.
3. I-joist (and other non-open web framing) dictates a linear duct routing method, grouping ducts together and running them through pre-cut or field cut openings in the joists.
4. Open web trusses allows for flexibility in the direction of the duct runs, resulting in less total duct length.
5. Route ducts so that the total length, number of bends, and severity of bends are minimized.
6. Check duct bends. If the inside bend radius is less than the diameter of the duct, insert a minimum of one Elbow to replace the compressed duct with a smoother transition.
7. Duct bends that have an inside bend radius no less than the diameter of the duct are acceptable.
8. Use one or two 45-Degree Elbows at any 90-degree transition between a wall top plate and floor structure where the inside radius of the curve is less than the diameter of the duct.
9. Avoid over-crowding ducts through the same gaps or holes causing them to be compressed or deformed, especially if they are pinching the ducts.
10. To minimize duct length, take direct routes through trusses rather than adding turns. Try to maintain straight duct runs where possible.
11. Run ducts side-by-side where possible.
12. Inspect the duct stretch visually, or by measuring the pitch of the wire helix. As a general guide:
 - a. 3" ducts should have approximately a minimum 1.25 in. spacing between the wire coils.
 - b. 4" ducts should have approximately a minimum 1.75 in. spacing between the wire coils.



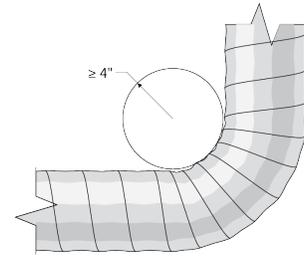
Routing of ducts in I-joists follow a linear path using pre-cut holes at allowed locations in the I-joists



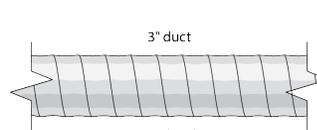
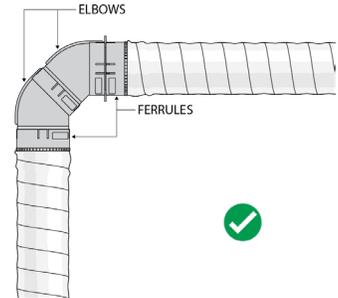
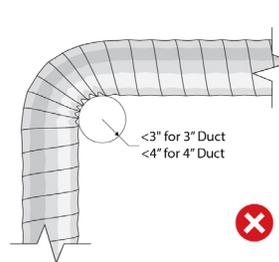
Routing of ducts in open web trusses follow direct paths using the openings in the truss webbing



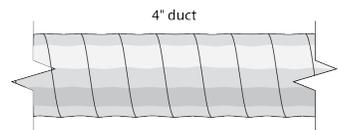
Minimum 3" radius curve in a 3" diameter duct



Minimum 4" radius curve in a 4" diameter duct



Approximate 1.25" minimum stretch between wire coils



Approximate 1.75" minimum stretch between wire coils



PRO TIP: There is no maximum allowed duct length in a Rheia system. If an installed duct run required more than 10% duct length than the design, contact the HVAC Designer to assess the situation.



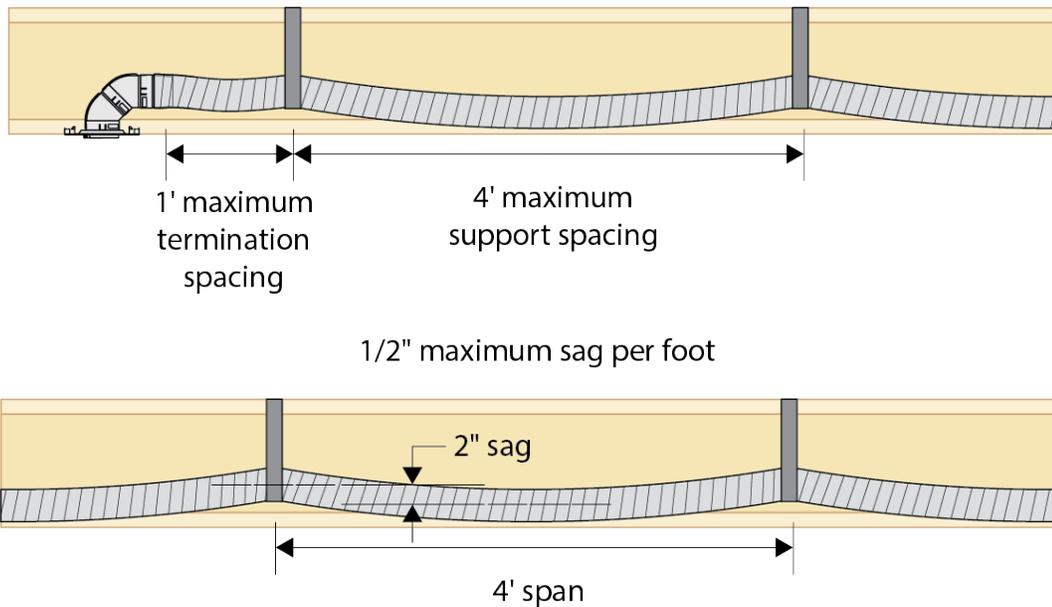
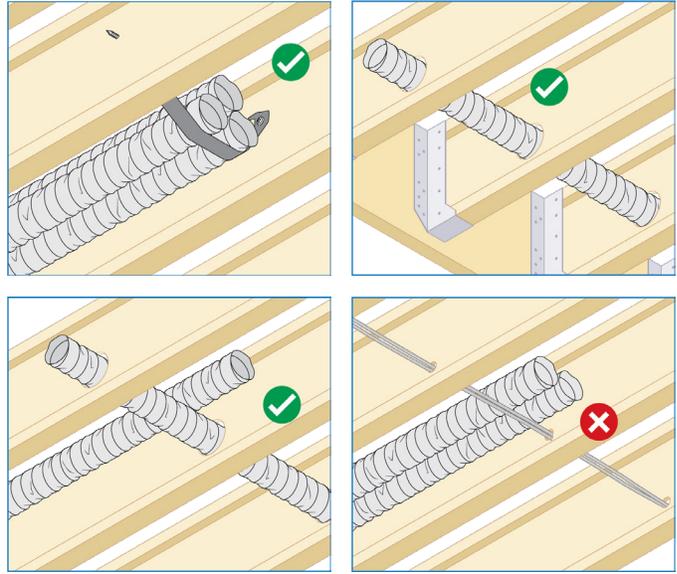
PRO TIP: The wire helix pitch of the duct varies in manufacturing so the recommended duct pitch is an approximate measurement intended as a guide.

Duct Support

Requirements for supporting Rheia ducts are based on the relevant sections from: Air Duct Council: Flexible Duct Performance & Installation Standards, 6th Edition; and Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA): HVAC Duct Construction Standards Metal and Flexible, 4th Edition.

Rheia does not specify the products or materials required to support Rheia ducts within walls, floors, and interstitial spaces. Follow these requirements when installing Rheia flexible duct:

1. Individual ducts or duct bundles installed in horizontal applications shall be supported using flexible strapping or rigid supports.
2. Rheia requires horizontal duct to be supported at least every 4 ft (1.5 m) or per the local building code. A connection to another duct, a manifold, or a boot termination point is considered a support point.
3. Locate the first strap 1 foot from a duct termination point if possible.
4. The maximum permissible sag between supports is 1/2" in. per foot.
5. A connection to another duct or equipment is considered a support point.
6. Framing or other structural components are permissible as duct supports.
7. Electrical wiring or supply plumbing must not be used as a support for ducts.
8. Bundles of ducts can be secured using a single strap.
9. The width of a flexible strap or rigid support retaining a duct or bundle of ducts should be no less than 1/2".
10. Ducts can be supported by other ducts within any floor, wall cavity, or interstitial space where duct installation is permitted.
11. Flexible duct straps and rigid supports shall be attached to the building structure to support the weight of the duct

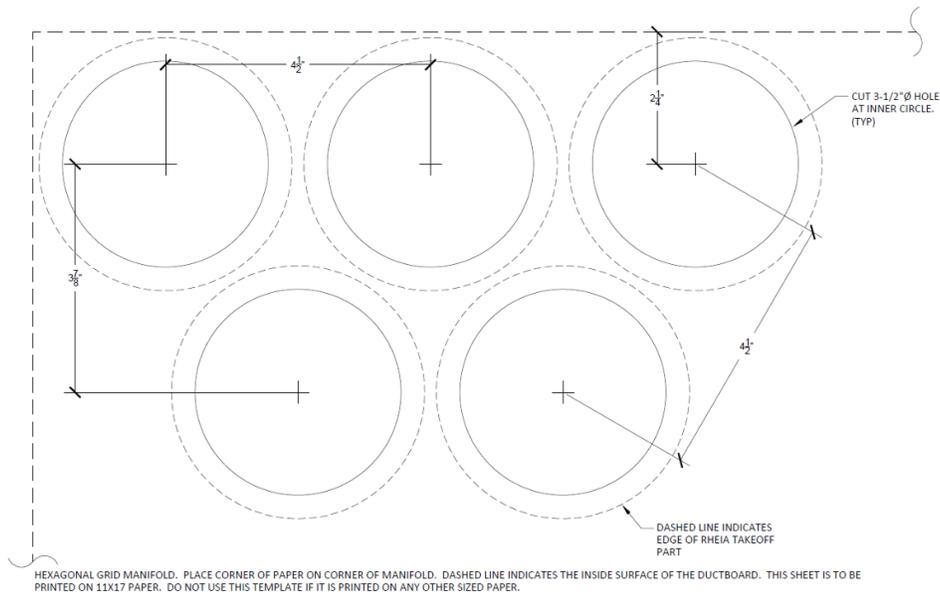


Manifold construction

A Rheia manifold is fabricated from 1" duct board, 1-1/2" duct board, or sheet metal. These materials are readily available and provide designers and contractors the ability to custom size the manifold for each floor plan. They are also easily field-modified for situations where, for example, structure interferes with its original design.

- Multiple 3-1/2" holes are cut into the duct board or sheet metal, in a layout defined by the HVAC Designer.
- The holes are 3-1/2" for 3" and 4" diameter ducts.
- The hole size is not impacted by the diameter of the duct.
- For duct board manifolds, take-off components clamp on either side of the holes, creating a seal and providing the connection points for all supply ducts.
- No tape, mastic, or mechanical fasteners are required.

Manifold take off hole spacing dimensions



PRO TIP: In some regions the use of a sheet metal manifold is acceptable. Consult with an HVAC Design Engineer to confirm if a sheet metal manifold is acceptable in your region. For this application a Manifold Take Off Outer is installed to the sheet metal Manifold with an approved sealed to ensure an airtight connection.



The manifold hole cutting template can be downloaded here:

Print at full scale on 11x17 paper.

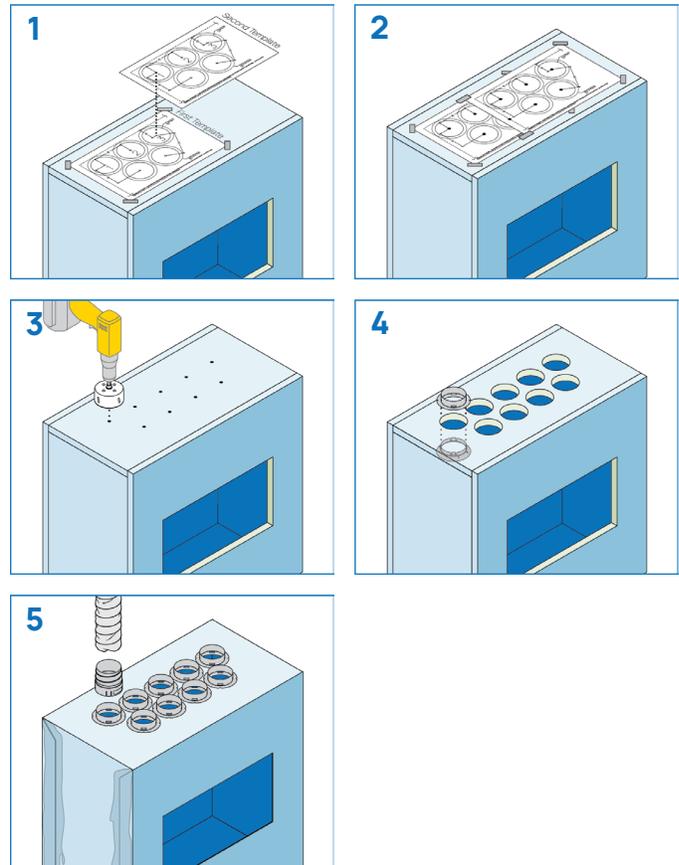


Duct board manifold assembly

Manifolds can be pre-built, or built on site following NAIMA's (North American Insulated Manufacturer's Association) Fibrous Glass Duct Construction Standards.

To start the process use "RHEIA-Manifold-Templates-Horizontal-Linear" or "RHEIA-Manifold-Templates-Hexagonal-Grid" to layout the take off assembly that is best for installation.

1. Templates can be downloaded at www.rheiacomfort.com/contractor-resources/ and must be printed at full scale on 11"x17" paper.
2. Use a 3-1/2" hole saw to drill out each hole per the template. Operate the drill in reverse to cut a smooth hole in the duct board preventing tear outs.
3. Take the duct board take off inside and place it inside the duct board with one hand. Take the duct board take off outside with the other hand and align with the inside and press together until all four tabs have secured the two pieces as one making a "Click" sound.
4. The take off assembly creates a seal to the duct board. Additional sealing with tape or mastic is not required.
5. To attach the duct to the manifold, pull the duct tight and mark the coil that reaches the selected Take Off on the Manifold. Use a utility knife or duct knife and wire cutters to cut the duct at the mark.
6. Screw a Ferrule into the end of the duct using the method explained in the 'Duct-to-Ferrule connections' section of this document.
7. Attach the ducts in an organized manner.
8. Begin with the locations that are harder to access and work outwards.
9. Route ducts in layers so that those connecting at the center of the manifold lay above those at the edges. Make use of vertical space as much as possible.
10. Connect ducts on the same side of the manifold as the most direct route from the boot to the air handler.
11. Use Elbows where needed, and when the duct bend radius is less than the diameter of the duct.
12. The final arrangement should allow each duct its own clear route from the manifold with minimal turns.



The Duct Board Manifold construction step-by-step is available for download here:

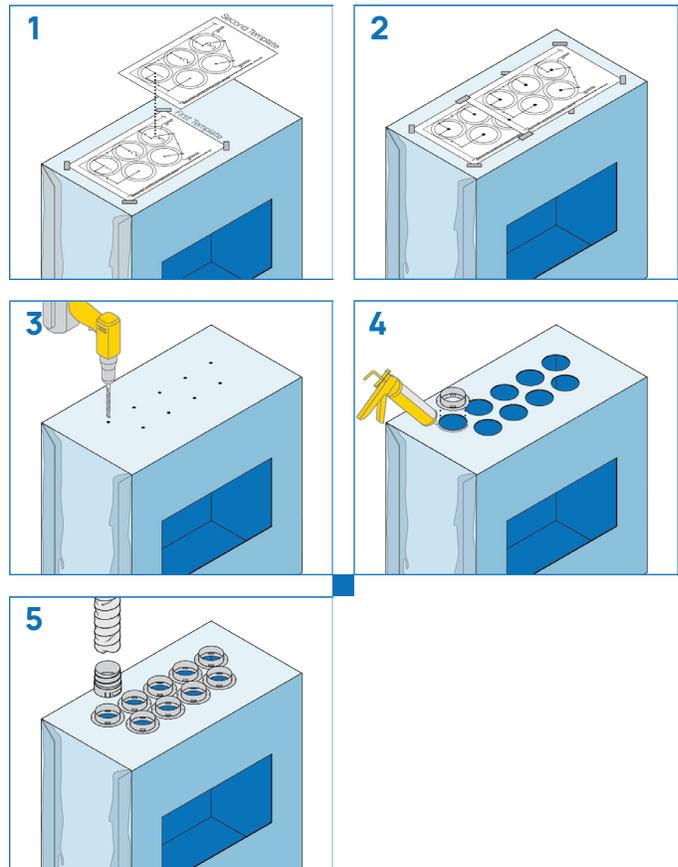


Sheet metal manifold assembly

Sheet metal manifolds, either pre-built, or pre-cut panels, are delivered on site for final assembly as preferred by the installing contractor.

To start the process use "RHEIA-Manifold-Templates-Horizontal-Linear" or "RHEIA-Manifold-Templates-Hexagonal-Grid" to layout the take off assembly that is best for installation. Use a sheet metal adjustable hole cutter set at 3-3/8" to cut out the hole in the manifold for each take off. Alternatively, use a hole saw specified for sheet metal cutting.

1. Using only the Outside Take Off, place a bead of high quality silicone sealant approved for sheet metal and plastic on the inside flange of the Take Off. Place a Take Off on the outside of the manifold in each pre-cut hole.
2. Secure the Outside Take Off with four (4) screws at each of the flange notches of the Take Off.
3. To attach the duct to the manifold, pull the duct tight and mark the coil that reaches the selected Take Off on the Manifold. Use a utility knife or duct knife and wire cutters to cut the duct at the mark.
4. Screw a Ferrule into the end of the duct using the method explained in the 'Duct-to-Ferrule connections' section of this document.
5. Attach the ducts in an organized manner.
6. Begin with the locations that are harder to access and work outwards.
7. Route ducts in layers so that those connecting at the center of the manifold lay above those at the edges. Make use of vertical space as much as possible.
8. Connect ducts on the same side of the manifold as the most direct route away from the air handler.
9. Use Elbows where needed, and when the duct bend radius is less than the diameter of the duct.
10. The final arrangement should allow each duct its own clear route from the manifold with minimal turns.



ALERT: DO NOT rely solely on mastic to seal the take off to the sheet metal manifold. Use a high-quality silicone-based sealant to seal the connection.



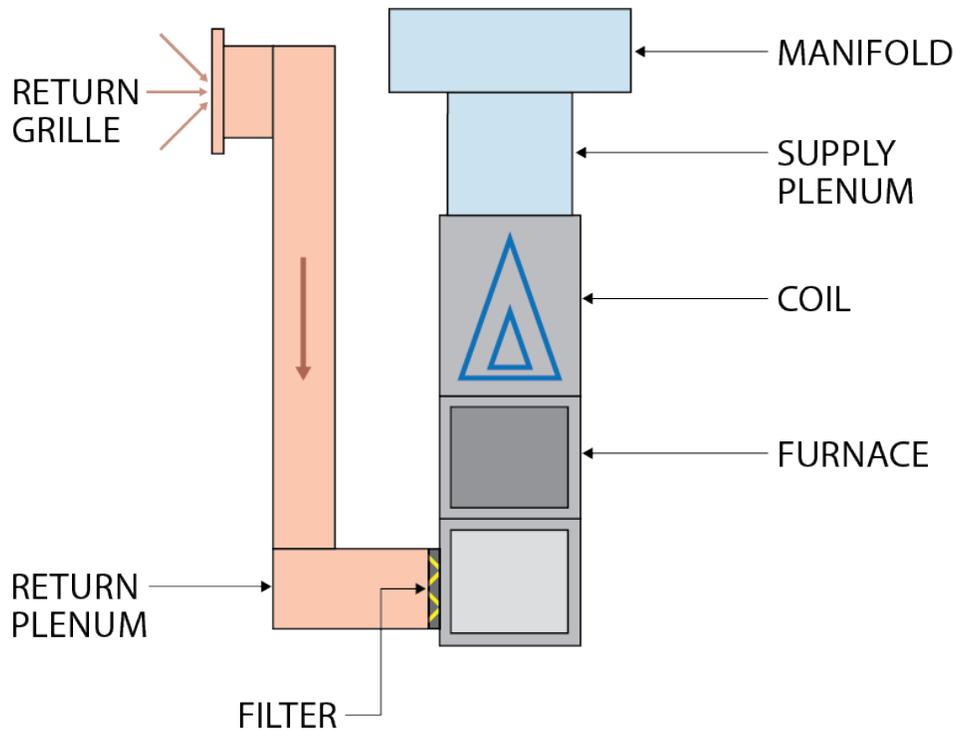
The Sheet Metal Manifold construction step-by-step is available for download here:

Manifold design

Rheia is a home run air distribution system that works with any size of standard residential air handling unit (AHU) from any manufacturer, accommodating up-flow and down-flow configurations. In a Rheia system, the AHU connects to a riser and an engineered manifold. All duct runs take off from the manifold and route directly to boot and diffuser assemblies in the rooms of the home as designed.

Manifold best practices

- ✦ Keep the manifold as compact as possible to minimize material used and optimize installation.
- ✦ Locate holes for each duct on the face of the manifold in the direction the duct will be routed.
- ✦ Maintain a minimum of 18" between the AHU or DX coil outlet and the nearest hole on the manifold to allow the air stream to reach uniform temperature and flow pattern.
- ✦ Locate the manifold to limit the number of individual duct penetrations through a ceiling or floor. Penetrations through ceilings and floors must be fire caulked. It is much quicker and easier to fire caulk a single manifold versus many individual small diameter ducts.



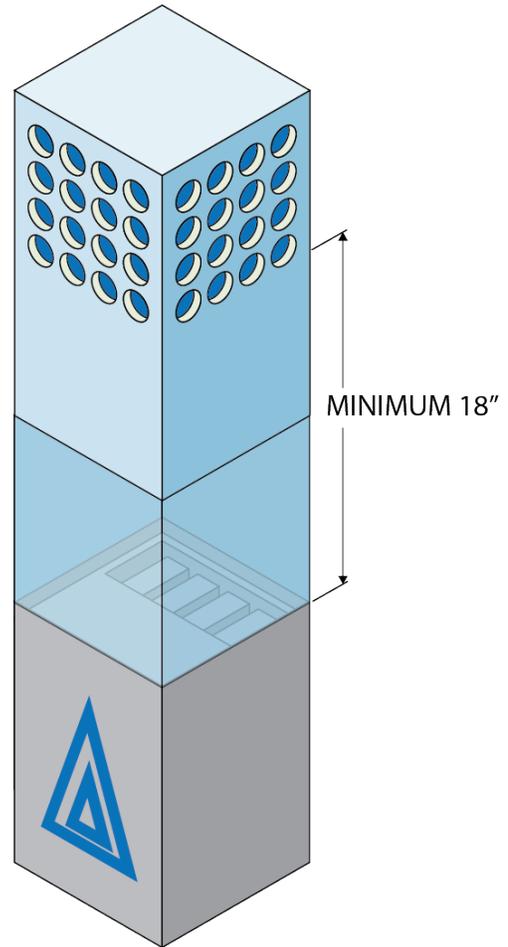
Elevation view of AHU, riser, and manifold

to reduce material cost and ease installation.

Riser design best practices

The riser is the section of duct that connects the AHU or DX coil to the manifold. Risers can be constructed of duct board or any other approved duct material. When specifying a riser, follow these best practices:

- ✦ Size risers to match the outlet dimensions of the AHU or DX coil to ensure minimal pressure loss and ease of installation.
- ✦ Maintain a minimum of 18" vertical distance between the AHU or DX coil outlet and the nearest drilled hole in the manifold to provide the air stream enough distance to reach uniform temperature and flow pattern. (This can be slightly less than 18" if needed to fit within the architecture of the home.)
- ✦ Design the riser to be as simple as possible, which will minimize pressure loss and maximize pressure available to the supply ducts. If architecture prohibits a simple riser design, you must ensure that any static pressure specific to the riser is accounted for in the total static pressure estimate by drawing it accurately within the Right-Suite® Universal (RSU) software.
- ✦ Risers can be constructed of duct board or any other UL-approved material.



AC coil to manifold outlets dimensional requirements



For more information about designing manifolds, download the Rheia Manifold Design Manual.



Plenum manifold

The plenum manifold essentially extends the height of the manifold to function as both manifold and riser. A plenum manifold will typically be used only with up-flow AHUs and furnaces.

Advantages:

- Extremely compact; it fits the greatest number of outlets in the least amount of space.
- Low vertical profile is easy to fit under low ceiling heights.
- Usually fits within any mechanical closet.
- Ducts can route in multiple directions.

Disadvantages:

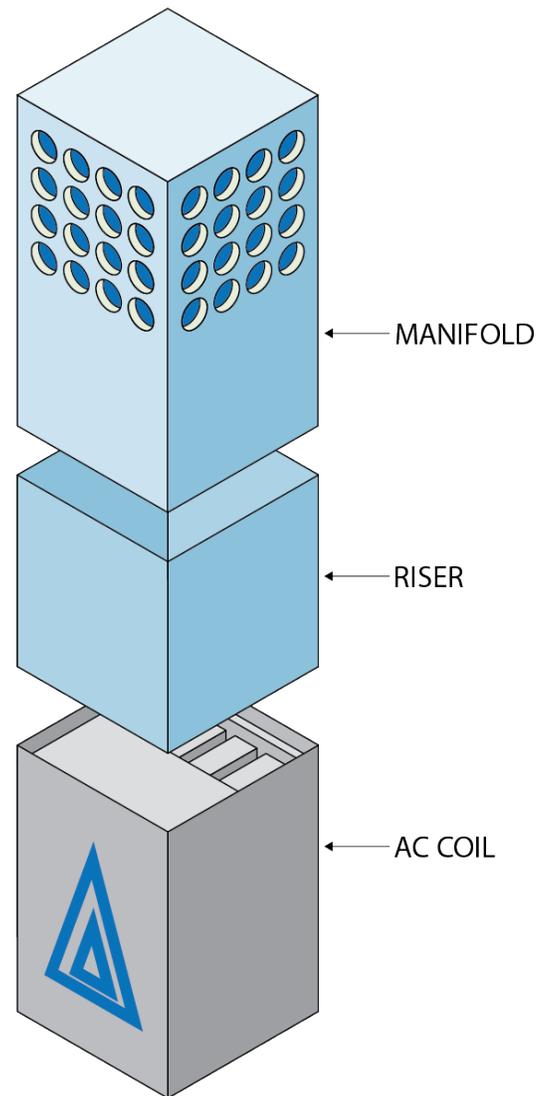
- The end face of the manifold can accommodate a limited number of holes governed by end face dimensions which are constrained by AHU or DX coil outlet dimensions.

Plenum manifold design rules:

- ☑ Do not locate any holes on the top face. If this face will be close to the sub-floor above.
- ☑ The width of the manifold must be no greater than the width between the floor trusses. Allow 1-1/2" between the manifold and truss for installation of the take-off components. The center of each hole must be no closer than 3-1/2" from an edge.

Plenum manifold best practices:

- ✦ The length and width of the manifold should match the outlet dimensions of the AHU or DX coil for easy connection during installation. It is acceptable to increase or decrease these dimensions slightly to fit within the architecture of the floor plan.
- ✦ Holes can be located on all sides and the end face of a plenum manifold.



End outlet manifold

The end outlet manifold is used with a riser to connect to up-flow or down-flow AHUs and furnaces. For an up-flow unit, the manifold sits on top of the riser; for a down-flow unit the manifold sits directly below the riser.

Advantages:

- Holes can be located on the entire end face.
- The manifold feeds easily into the floor system from above or below.
- A single penetration into the floor system makes the required fire caulking much faster and easier to do.

Disadvantages:

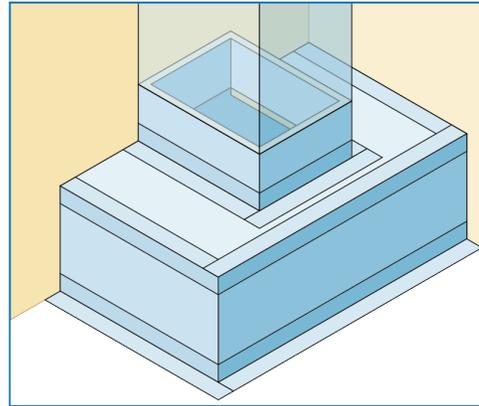
- Ducts can be located only on one end face, so it is typically used to feed ducts into a floor cavity.

End outlet manifold design rules:

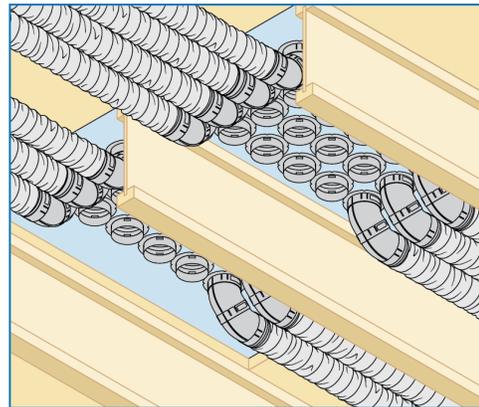
- ☑ The center of each hole shall be no closer than 3-1/2" from any edge.
- ☑ The manifold height shall be at minimum 10". This minimum distance will ensure all holes on the end face receive adequate airflow.

End outlet manifold best practices:

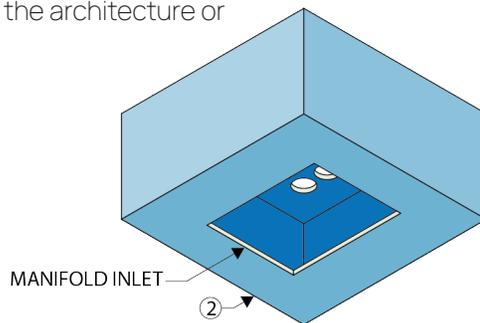
- ★ The manifold inlet dimensions should match the riser dimensions; the riser dimensions should match the AHU or DX coil outlet dimensions.
- ★ Size the length and width of the manifold as big as necessary to fit the required number of holes. Keeping the manifold as compact as possible will reduce material cost and make installation easier.
- ★ Holes can be placed anywhere on the end face if there is no conflict with the architecture or



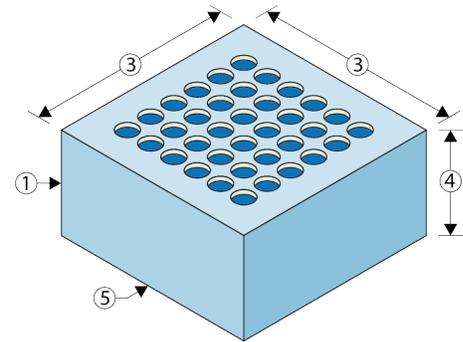
A second floor down-flow furnace feeds into this riser and end outlet manifold.



The same end outlet manifold is pictured from the level below, feeding the supply ducts directly into the floor system for routing to specified rooms.



INLET SIDE VIEW.
BOTTOM FACE FOR UPFLOW, TOP FACE FOR DOWNFLOW.



ADJACENT SIDE VIEW.
TOP FACE FOR UPFLOW, BOTTOM FACE FOR DOWNFLOW.



PRO TIP: To optimize the access and routing of ducts out of a manifold into the floor system, use one or two elbows for the tighter duct transitions around the perimeter take offs, and sweep the duct turns without elbows on the inner take offs.

Manifold within a floor system

structure of the home.

Some floorplans require the manifold to sit within a floor system. I joists do not provide adequate openings in the webs to route ducts away from the manifold.

Advantages:

- Used when there is not adequate space within the mechanical closet to fit a manifold.
- Can be located away from the mechanical closet in a more central location, shortening the individual duct runs. A supply trunk is routed from the closet, connecting to the manifold.

Disadvantages

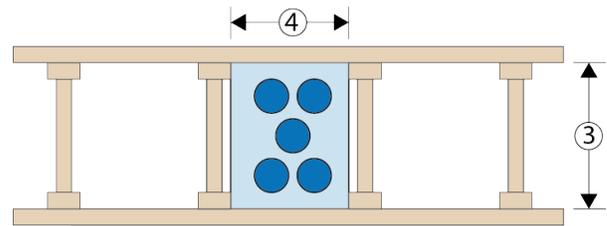
- The designer must coordinate with the structural engineer to determine location of holes/take offs to avoid conflict with the floor trusses.
- This manifold type does not work with I joist floor systems.

Manifold within a floor system design rules:

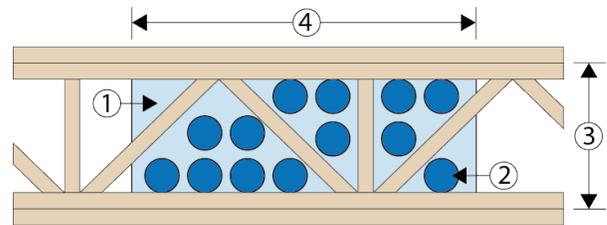
- ☑ The center of each hole shall be no closer than 3-1/2" from any edge.
- ☑ Locate the holes strategically to avoid conflict with the floor trusses. Coordination with the structural engineer is required.
- ☑ The height of the manifold must be no greater than the height of the floor trusses.

Manifold within a floor system best practices:

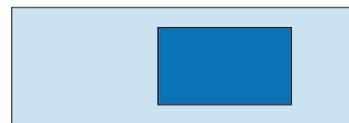
- ★ Size the manifold length to fit the required number of holes. Keep the manifold as compact as possible



SIDE FACE



SIDE FACE

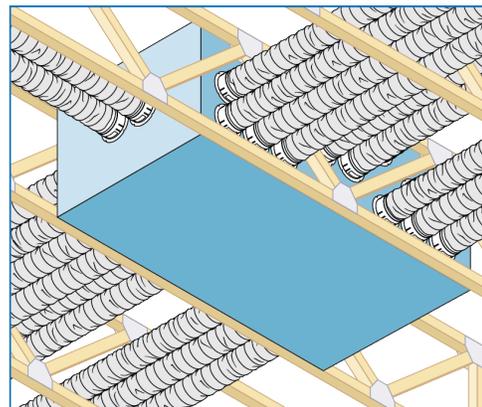


BOTTOM FACE



TOP FACE

A within floor system manifold sits between two open web floor trusses and has holes located on all side faces. Holes are located on the side faces to not create conflict with the webbing of the trusses.



This within floor system manifold sits between two open web floor trusses and has holes located on all side faces. Holes are located on the side faces to not create conflict with the webbing of the trusses.



PRO TIP: This type of manifold only works in an open web truss floor system.

Zoning with Rheia

Rheia does not manufacture any zoning components. Rheia recommends one of three design solutions using market-available components, including the zone dampers and controls:

- Bypass-free system, single speed
- Bypass-free system, two speed
- Bypass system

Bypass-free system, single speed

Jackson Systems' ESP product line is the basis for this option, although equivalent systems by other manufacturers are approved.

Components

The bypass-free system consists of motorized zone dampers, a static pressure sensor in the supply plenum upstream of the dampers, and a zone control panel (Jackson Systems' MD dampers and ESP control panel with static pressure sensor).

- Each zone also has its own thermostat wired to the zone control panel.
- These components integrate with most residential AHUs.
- Designers must specify the correct panel model to match the AHU type (e.g. gas/heat pump, single stage/two stage).

How it works

1. Each thermostat communicates with the zone panel.
2. When any zone calls for air, the AHU turns on. The motorized dampers of the zones calling for air open, and the dampers of the zones not calling for air remain closed.
3. The static pressure sensor in the supply plenum monitors the supply static pressure and communicates with the zone panel.
4. If one or more dampers remain closed while the AHU is running, the system static pressure will increase.
5. When the system static pressure reaches a preset maximum (usually ~0.35-0.40 IWC), it triggers the zone panel to open the closed dampers to relieve the excess pressure.
6. Tests indicate that bleeding a small amount of conditioned air for a short time into non-calling zones has little to no impact on the zone temperature. This allows the system to operate below the preset maximum static pressure without using a bypass).

Design considerations

1. When specifying a bypass-free, single speed system, the designer will calculate the preset maximum for static pressure within the Rheia Design plugin in RightSuite® Universal (RSU).
2. During installation, the contractor will set the equipment per the designer's calculation.
3. To accommodate increased airflow, the designer will also need to add a few supply ducts downstream of each manifold enough to relieve the excess pressure.

Bypass-free system, two speed

Jackson Systems' ESP product line is the basis of design for this option, although equivalent systems by other manufacturers are approved.

Components

The bypass-free system comprises motorized zone dampers, a supply plenum static pressure sensor upstream of the dampers, and a zone control panel (Jackson Systems' MD dampers and ESP control panel with static pressure sensor).

- Each zone also has its own thermostat wired to the zone control panel.
- These components integrate with most residential AHUs.
- Designers must specify the correct panel model to match the AHU (gas/heat pump, single stage/two stage, etc.).

How it works

1. Each thermostat communicates with the zone panel.
2. When all zones are calling for air, the AHU turns on at high speed and the motorized dampers open for all zones.
3. When one or more but not all zones are calling for air, the AHU turns on at low speed, the dampers of the zones calling for air will open, and the dampers of the zones not calling for air remain closed.
4. The static pressure sensor in the supply plenum monitors the supply static pressure and communicates with the zone panel. The zone panel has internal logic to tell the AHU when to run at high speed or low speed, and also to monitor but not exceed the maximum static pressure.
5. If the static pressure reaches the maximum, it triggers the zone panel to open all closed dampers just enough to relieve the pressure.
6. Tests indicate that bleeding a small amount of conditioned air for a short time into non-calling zones has little to no impact on the zone temperature. This allows the system to operate below the preset maximum static pressure without using a bypass).

Vertical alignment of AHU, supply plenum, zone dampers, and manifolds. Use this configuration whenever possible because the vertical alignment results in a lower pressure drop and is thus more efficient. When the ceiling height in the mechanical closet is sufficient, align the supply plenum, zone dampers, and manifolds vertically.

Bypass system

Honeywell TrueZONE product line is the basis of design for this option, although equivalent systems by other manufacturers are approved.

Components

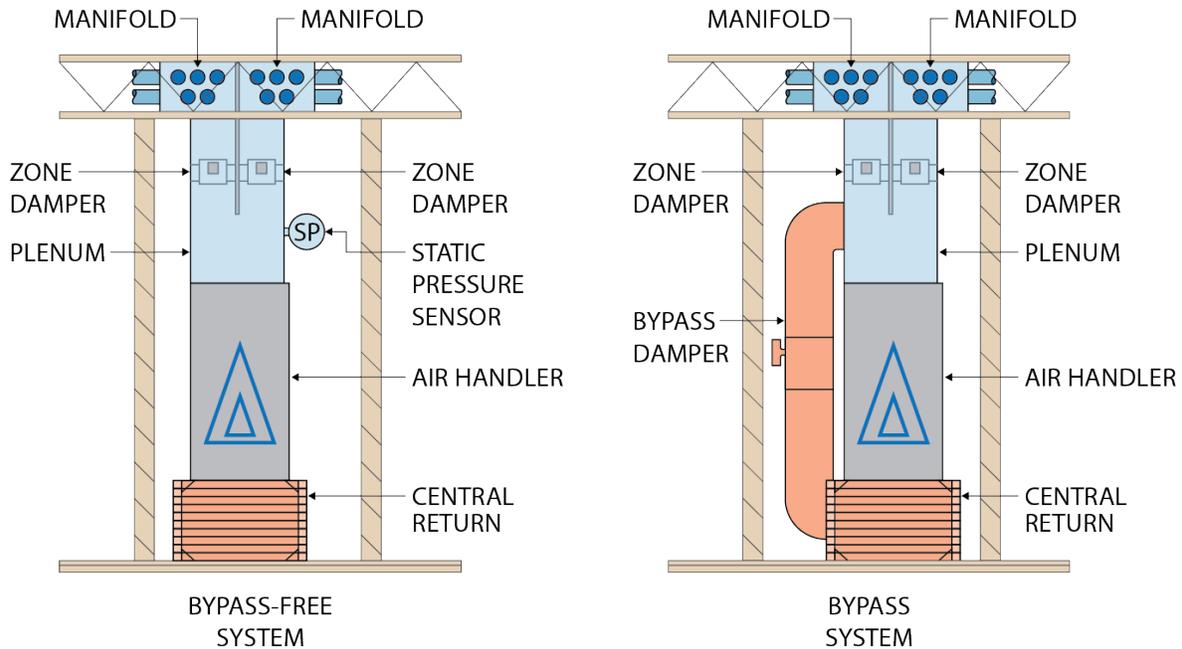
- The bypass system uses motorized zone dampers, a barometric bypass damper, and a zone control panel (Honeywell ZD zone damper, CPRD bypass damper, and HZ control panel).
- Each zone also has its own thermostat wired to the zone control panel.

How it works

1. Each thermostat communicates with the zone panel. When any zone calls for air, the AHU turns on.
2. The motorized dampers of the zones calling for air open, and the dampers of the zones not calling for air remain closed.
3. When one or more zone dampers remain closed, the supply air that is intended to flow through the closed dampers circulates from the supply plenum, through the bypass duct/bypass damper, and directly to the central return.
4. The bypass duct and damper keep static pressure below the maximum when one or more zone dampers remain closed.

Design considerations

1. When specifying a bypass system, the designer must size the bypass duct using conventional sizing methods to relieve all but the smallest zone's airflow at the supply static pressure.
2. During installation, the bypass damper is set to a specific static pressure. Also, the designer will size the Rheia duct. Rheia provides two options for configuring the AHU, zone dampers, and manifolds to ensure equal static pressure



Bypass-free systems (single and two speeds) maintain static pressure by slightly opening non-calling zone dampers to bleed off air. A bypass system maintains static pressure by directing air through the bypass duct/damper and into the central return when one or more zone dampers remain closed.

Zoning advantages and disadvantages

Cost, equipment size, energy efficiency, and maintaining temperature across multiple set points all factor into a zoned system design. Zone systems aim to maintain uniform temperature in each zone. Specification of a Rheia no-zone option can achieve uniform temperature goals and reduce costs versus a zone system.

It's the designer's role to understand the zoning options approved for use with Rheia and to work with the builder to specify a system that best meets their goals per each floor plan.

Once the zone equipment has been selected, the designer must take some additional steps before beginning a duct layout within the Rheia Design plugin for RightSuite® Universal. Specifically, the designer must locate the zone dampers and manifold in relation to the AHU as well as size the zone dampers and supply plenum correctly.

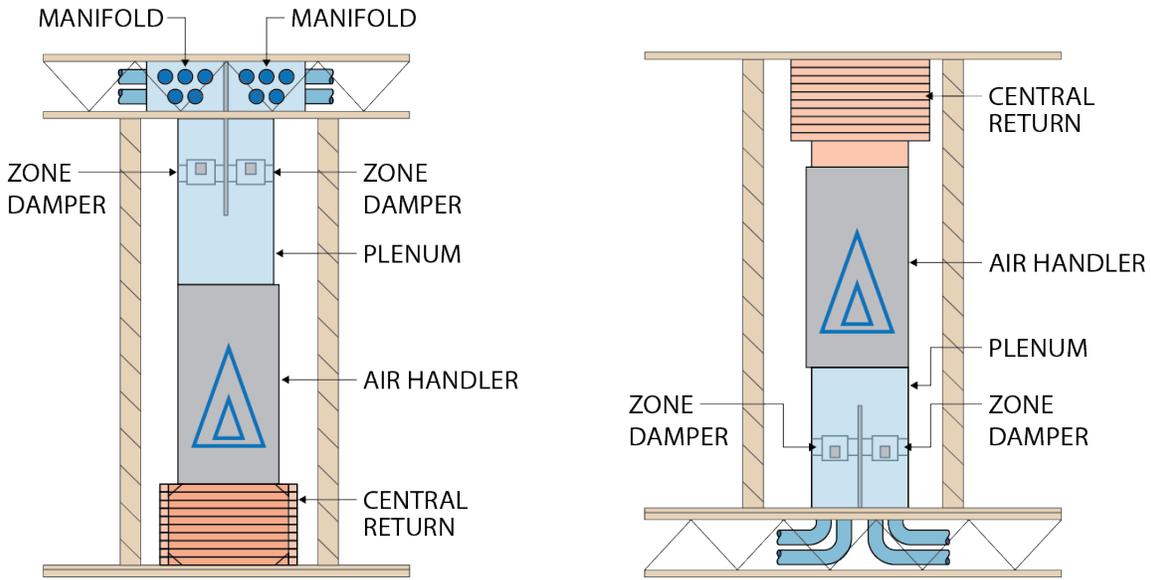


PRO TIP: All Rheia systems, including zone systems, must be configured to allow equal static pressure for every manifold and for all duct take-offs from the manifold(s). The Right-Rheia Duct Module plugin in RSU makes calculations based on this assumption. The system will not balance properly if there are extra components or other causes for pressure drop upstream of the damper.

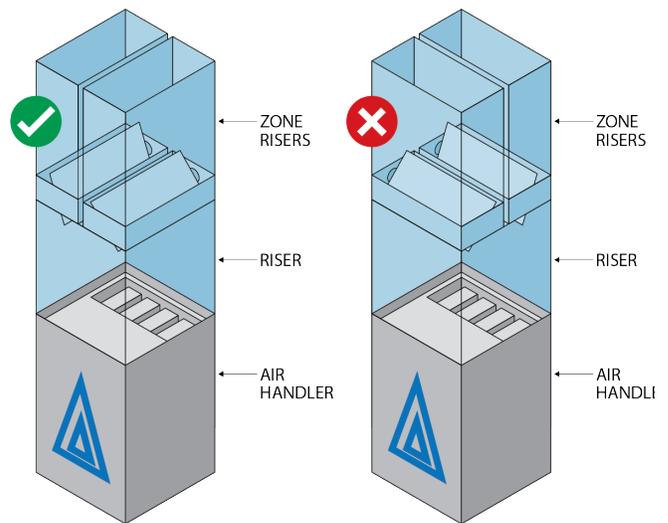
Rheia provides two options for configuring the AHU, zone dampers, and manifolds to ensure equal static pressure to all zones. Both options work with up-flow and down-flow AHUs and with two-zone and three-zone systems are driven by the ceiling height of the mechanical closet.

Tall closet configuration

Vertical alignment of AHU, supply plenum, zone dampers, and manifolds. Use this configuration whenever possible because the vertical alignment results in a lower pressure drop and is thus more efficient. When the ceiling height in the mechanical closet is sufficient, align the supply plenum, zone dampers, and manifolds vertically.



Use the tall closet configuration for lower pressure drop and better efficiency with both up-flow and down-flow AHUs.

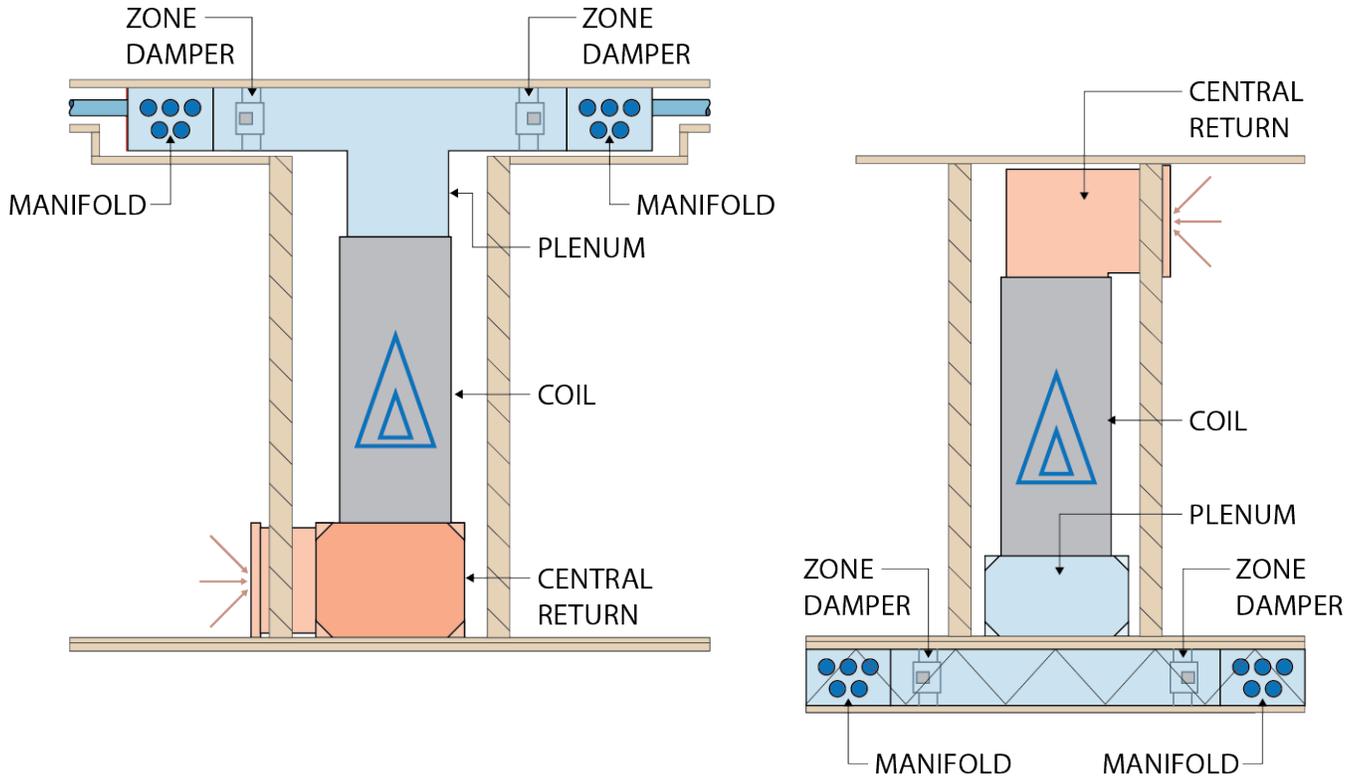


For an AHU with supply air outlet that's not centered, be sure to orient the zone dampers perpendicular to the AHU outlet as shown on the left. Avoid the positioning shown on the right, so as not to favor one manifold over the other.

ALERT: In a Tall Closet configuration, it is critical to note the location of the supply air outlet from the AHU. If the AHU has a supply air outlet that is not centrally located, orient the dampers perpendicular to the outlet opening. Orienting them parallel will favor one manifold, resulting in unequal static pressure.

Short closet configuration

When the mechanical closet height cannot accommodate the Tall Closet orientation, specify a "T" supply plenum and locate the zone dampers and manifolds horizontally from the AHU. This configuration requires a wider mechanical closet and additional dropped ceilings, or it can be located in a large closet or basement.



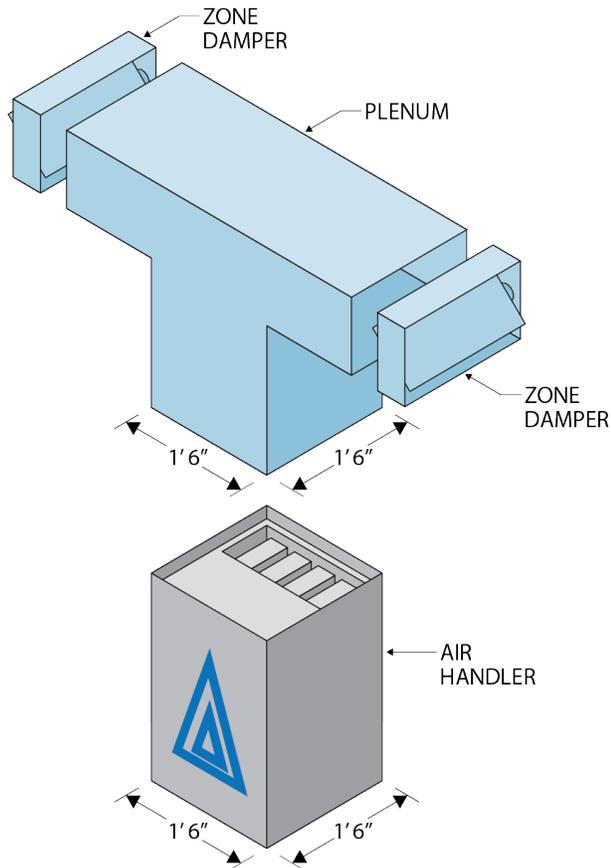
Use the short closet configurations as an alternative solution with both up-flow and down-flow AHUs.

Supply plenum and zone damper sizing

Rheia has developed the following best practices for sizing the supply plenum and selecting and sizing the zone dampers. Use these best practices with all zoning equipment options (bypass free, single-speed; bypass-free, two speed; and bypass) as well as both configurations (Tall Closet and Short Closet).

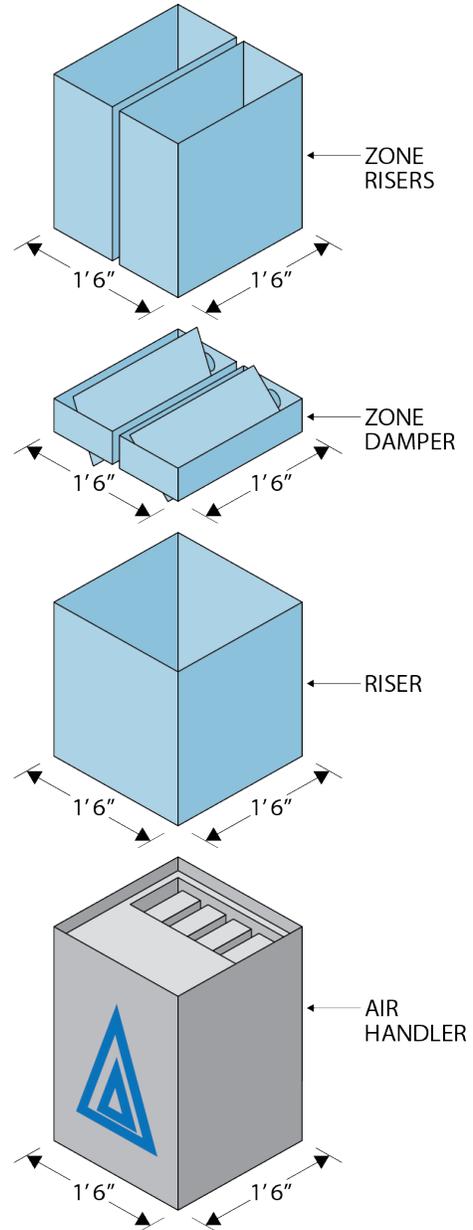
1. Size the supply plenum to match the size of the AHU outlet. This will minimize system pressure drop and will be easier to install.
2. Specify rectangular zone dampers (not round) for better flexibility and fit. Rectangular dampers can be made shorter and wider to fit the configuration you've specified. Rectangular dampers also have a shallower airflow dimension compared to round dampers, so they take up less space.
3. Using conventional methodology, size the zone dampers primarily to minimize static pressure drop at full airflow and secondarily to fit the physical space available.
4. Rheia recommends sizing the zone dampers for a maximum friction loss of 0.05" per 100 ft. of duct. Testing shows that dampers sized this way result in a negligible pressure drop for the system static pressure and do not affect system performance.

In a Short Closet configuration, the mechanical closet dimensions and/or dropped ceiling dimensions will affect the zone damper size. When dampers and manifolds will be in a dropped ceiling, first consider the framing of the drop. Specify the height of the damper to be short enough to fit within the drop and then wide enough to handle the airflow per the 0.05" per 100 ft. of duct sizing criteria.



In a Short Closet configuration, the AC coil outlet and riser inlet should match up dimensionally for ease of installation and reduced pressure drop.

In a Tall Closet configuration, the ideal zone damper size will match the dimensions of the supply plenum; however, if this requires the dampers to be undersized per the 0.05" per 100 ft. of duct sizing criteria, do not match the plenum size.



In a Tall Closet configuration, all components should match up dimensionally for ease of installation and reduced pressure drop.



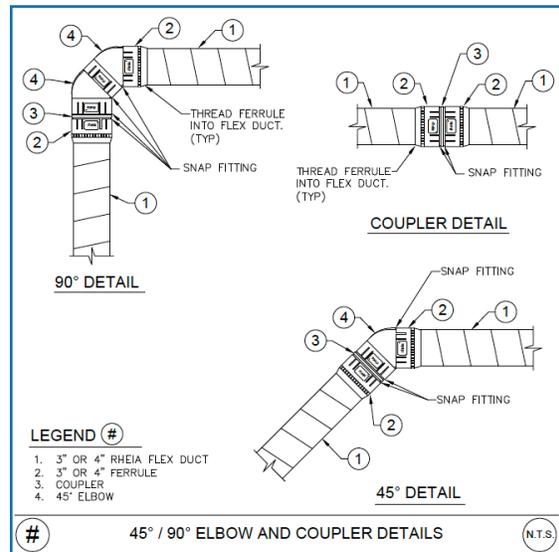
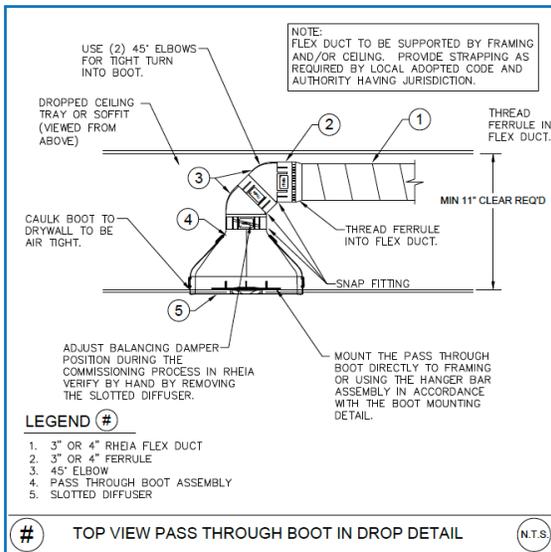
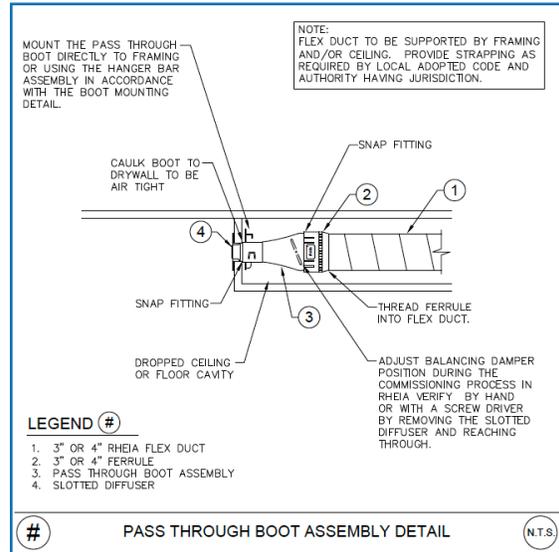
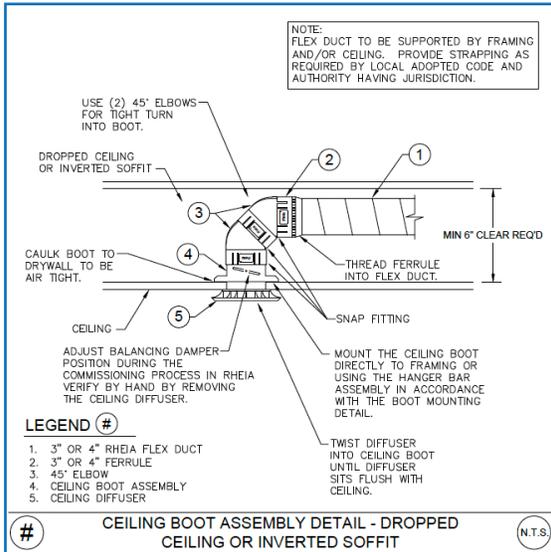
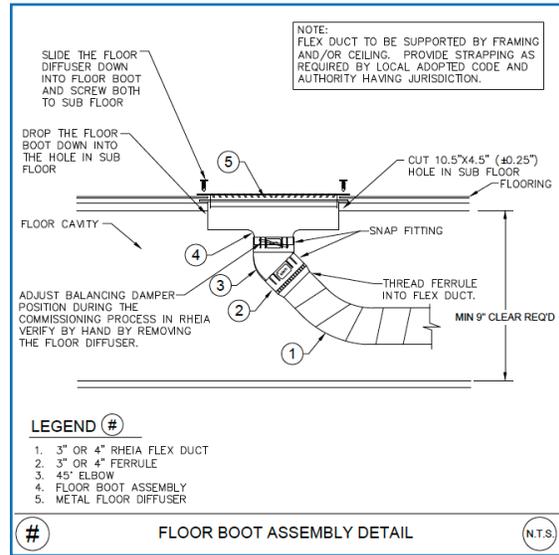
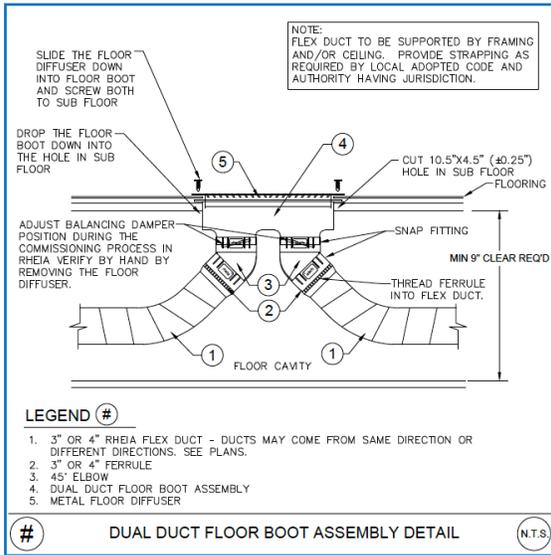
PRO TIP: Based on research and testing to evaluate the effects of oversized zone dampers, Rheia's results show that oversized dampers WILL NOT have a negative effect on system performance or balancing in either a Tall Closet or Short Closet configuration. Therefore, it is safe to increase zone damper sizes as necessary to make the connections to the supply plenum easier. Undersized dampers, however, WILL have a negative impact on the system performance. Undersizing one or more zone dampers can cause unequal static pressures in the manifolds and/or additional system static pressure that has not been accounted for in the calculation. Never undersize any zone damper.

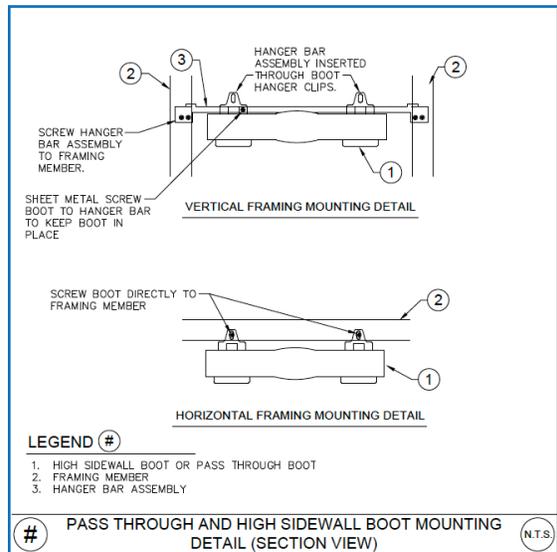
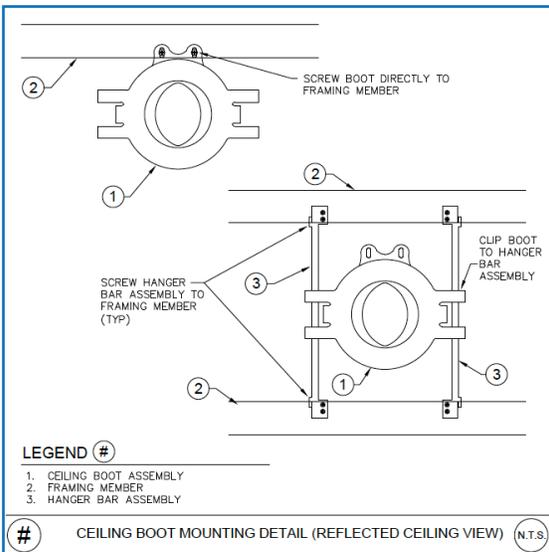
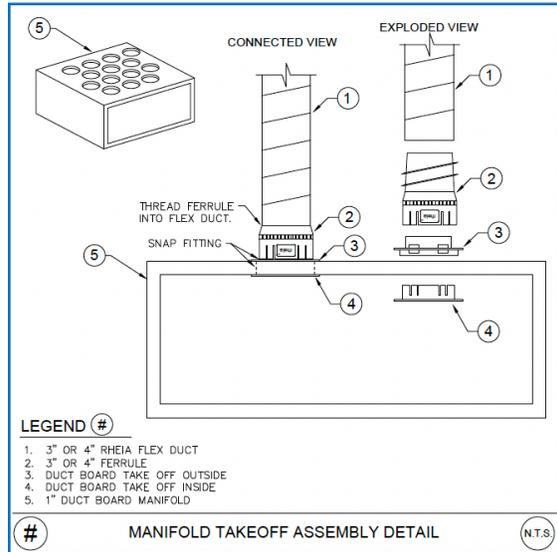
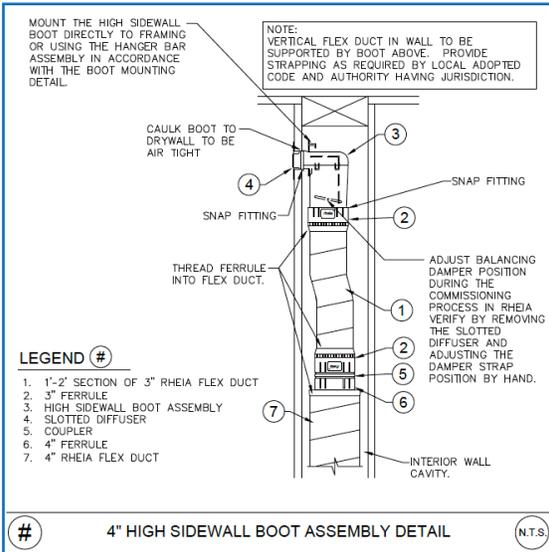
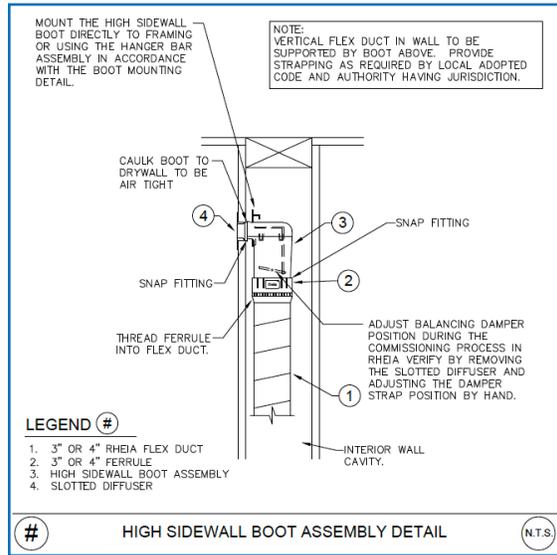
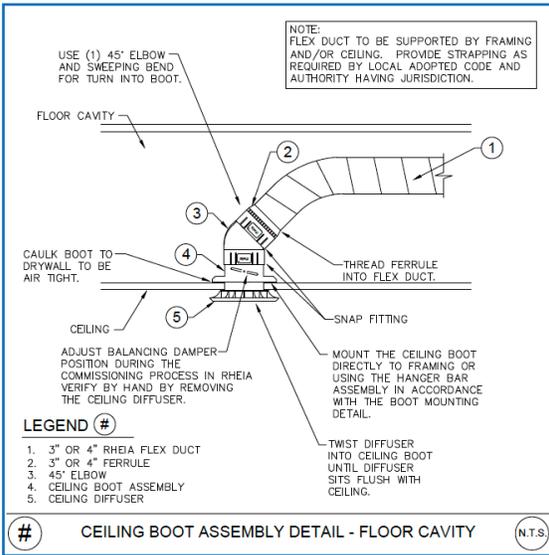


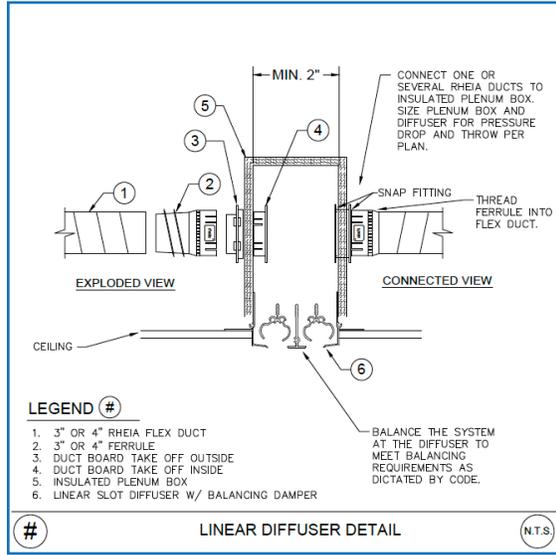
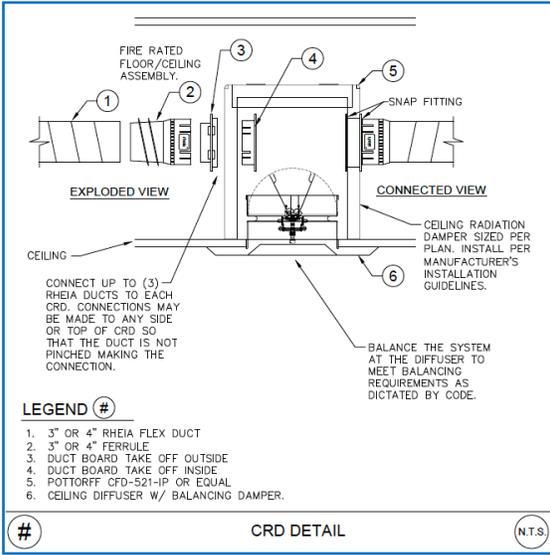
For more information about designing manifolds for zoning download the Rheia Zoning Design Manual.



Assembly CAD details







 A PDF version of the Assembly Details CAD file is available for download here:



Appendix

Component specifications

The following table lists the material specifications of the duct and components and their required UL-listings. Rheia is required to maintain its listing status through periodic factory inspections conducted by Intertek and UL. Rheia requires the manufacturers to maintain compliance with the relevant standards. Following each inspection visit, the manufacturer receives confirmation that they are in compliance.

Part No.	Part/ Assembly Name	Material Type	UL181/ CULS110	UL181C	UL2043	UL94	UL Listing File Number	ETL Control Number
Flexible Duct								
10-00-190	3" X 50' STL NON-INSULATED	PVC/Glass Mat	Yes				MH8698	
10-00-220	3" X 25' EVERCLEAN R8.0 INSULATED	PVC/Glass Mat	Yes				MH8698	
20-00-190	4" X 50' STL NON-INSULATED	PVC/Glass Mat	Yes				MH8698	
20-00-220	4" x 25' EVERCLEAN R8.0 INSULATED	PVC/Glass Mat	Yes				MH8698	
Injection Molded Components								
10-01-010	FERRULE 3"	PC/ ABS		Yes	Yes	V-0	MH64419	5016806
20-01-010	FERRULE 4"	PC/ ABS			Yes	V-0		5016806
10-01-020	45 DEGREE ELBOW EXTENSION	PC/ ABS		Yes	Yes	V-0	MH64419	5016806
10-01-030	COUPLER	PC/ ABS		Yes	Yes	V-0	MH64419	5016806
10-01-041	TAKE OFF - INSIDE EXTENDED	PC/ ABS				V-0		
10-01-051	TAKE OFF - OUTSIDE EXTENDED	PC/ ABS				V-0		
10-01-200	HIGH SIDEWALL ASSEMBLY	PC/ ABS				V-0		
10-01-210	PASS THROUGH BOOT ASSEMBLY	PC/ ABS				V-0		
10-01-220	CEILING BOOT ASSEMBLY	PC/ ABS				V-0		
10-01-280	FLOOR BOOT 4X10 ASSEMBLY	PC/ ABS				V-0		
10-04-091	SLOTTED DIFFUSER v2	ABS (UV STABLE)				HB		
10-04-230	CEILING DIFFUSER ASSEMBLY	ABS (UV STABLE)				HB		
10-04-260	CEILING DIFFUSER SMALL ASSY	ABS (UV STABLE)				HB		

The Rheia Air Distribution System components have been evaluated by IAPMO Uniform Evaluation Service (UES) and confirmed to be compliant with all of the International Residential and Energy Codes, Uniform Mechanical Code; the California Residential, Building, and Energy Codes; and the Florida Residential and Energy Conservation codes.



The IAPMO UES Evaluation Report is published here:
https://www.iapmoes.org/media/32888/er_0880.pdf



Glossary

Static Pressure Limit

The designer establishes the operating static pressure so that the home can be properly conditioned by the selected HVAC equipment. It is important not to exceed this limit so as to not compromise equipment performance. If the static pressure is too high, the airflow could be lowered to the point a coil could freeze or the blower will experience increased wear and tear. The balancing algorithm uses the measured static pressures and the designer specified limit to calculate the damper positions that will not result in high static. Consult the designer if the system is unable to close dampers because the pressure is too high. They may be able to increase that limit, but they have to check that the equipment will operate correctly at the higher static pressure.

(Energy Star Contractor Resources) [https://www.energystar.gov/partner_resources/residential_new/working/hvac/Requirements_%26_Resources] This page contains good training content for determining total system airflow.

Variable Speed Equipment

For variable speed equipment, the CFM is often determined by the control board via a simple tonnage input. The total CFM will be determined by the blower and typically this means you can max out your static pressure to the equipment limit while trusting the correct airflow will be delivered.

This step is about ensuring the AHU is programmed for the correct speed that will deliver the required airflow over the cooling coil or heat exchanger. The startup technician will have other tasks, such as confirming refrigerant charge. All equipment is furnished with controls to set the speed of the blower. With higher-end variable speed equipment, the airflow can be set directly and will modulate pressure to maintain proper airflow over the coil.

Types of speed setting interfaces

Speed Taps

Most equipment that is used in production home building will be single or two-speed equipment that uses speed taps to set the blower speed. These jumpers will plug into the control board and typically have 3-5 settings.

Dip Switches

With variable capacity equipment, dip switches are typically used to set the desired airflow for the unit.

Thermostat

This controller will maintain the correct airflow over the coil and will not modulate (as much) with changes in static pressure. This type of equipment can offer some diagnostics related to static pressure and will display pertinent warnings on the thermostat screen.

Fixed Airflow

Some newer units, such as the Daikin Fit system, will set a flat total airflow for its full range of static pressures. The outdoor unit controls the system airflow setting.

There are two primary ways to determine the total airflow is correct: a blower table lookup and direct measurement. If setting a Fixed Airflow system, this step is not required.

The static pressure and airflow values can be used to determine the speed setting by cross-referencing the blower table from the equipment manual, the speed tap setting and static pressure estimate. The goal is to set the speed that will achieve the desired airflow at the estimated design static pressure.

A blower data table, typically located at the back of the installer's manual, will list for each blower speed the static pressure and corresponding total airflow.

The combination of static pressure and speed will tell you what CFM will be delivered.

The Design provides the static pressure that was used to configure the duct system.

Total Airflow Measurements can confirm the equipment is in range of design.

More reliable because of variances in equipment and installation details. Some HVAC contractors have reported variances between manufacturer listed performance data and field-measured values.

An example device is a flow plate that can be used on the return system to directly measure the total airflow.

A duct blaster can be used to determine the airflow of the equipment. This is done by first pressurizing the system with the AHU, noting the pressure and then matching the pressure with the duct blaster which has a known airflow.

Balancing Pressure

The final static pressure should be higher, but not significantly higher than the initial. Ultimately, the total external static pressure limits based on the equipment manufacturers' recommended limits should be followed. Any questions about any particular system should be first consulted with the designer so they can rectify issues in the design files.

Balancing Mode

The balancing mode is the heating or cooling load profile that determines the balancing airflow targets per room.

System Maximum Airflow

Be sure to allow the system to cycle to the full speed before proceeding with measuring static pressure. We want the airflow to be at its peak value, otherwise the total airflow assumptions used for static pressure limiting will be in error.

Static Pressure

Static Pressure is akin to the blood pressure of the system and is the primary measure for overall system health. Poorly stretched duct work, major deviations from design duct layouts/ configurations (e.g. framing/plumbing interference) etc, lead to increased static pressure when they are unexpected by the designer. When there are major differences than what the designer specifies and what is installed, which is indicated by the measured static pressures, then the designer must be consulted to ensure an appropriate match-up.

The National Comfort Institute put together a great reference for measuring static pressure: [Measure and Interpret Static Pressures](#)

Using a Duct Blaster

Only use a duct blaster for pressurizing the duct system if it can supply the full design CFM. The CFM needs to be as close as possible to the selected design CFM for the balancing to be accurate.

Verifying Equipment

The duct system was designed for specific equipment, this step is intended to check whether the installed equipment matches the design.

The key number to watch out for is the tonnage, which roughly tracks with the maximum airflow through the unit. The optimal range is typically between 350-400 CFM per ton of cooling load. The design engineer will have selected the system that can deliver air within this range.

For example, if a unit is listed as a 3 ton but a 4 ton unit is installed, the technician can expect that at least 350 CFM additional air will move through the system. This increased airflow will also increase the static pressure outside of safe bounds.

Conversely, if a unit is listed at 4 ton and a 3 ton unit is installed, the system may fail to fully condition the home.

If the equipment does not match what the designer has selected, there could be an issue with the total airflow. Specific equipment will have its own pressure/airflow relationship for each speed setting. Different equipment will have different airflows for the same static pressure.

With some newer equipment, the airflow is more consistent with varying pressure. This means it will do a better job at hitting the correct total airflow even if the pressure is high. However, this creates a different issue—increased energy consumption and equipment wear-and-tear.

When the installed equipment does not match the equipment listed in the design, the technician must consult the design engineer to check the compatibility of the new equipment.

The design engineer will look at the duct system and whether the system can achieve the correct total airflow with the duct system that was designed for a different airflow.

Airflow Measurement Devices

The device used to take airflow measurements must be used in accordance with its manufacturer's instructions.

Damper Disclaimer

Dampers have 1-5 positions which for each boot is a similar step in pressure. There are a wide range of installation configurations and we use a single approximate average curve to represent the damper. That is to say take the accuracy of their effect with a grain of salt. That said, we think the model is a pretty good approximation of system performance. In the end the measured static pressure governs the predicted airflows (see note below).

Airflow Measurements Note

It is more important to be consistent with your airflow measurements making sure when it's wrong that it's wrong generally in the same way for all of them. Hopefully, when there are errors they are distributed normally from the good one. We use the measurements in the balancing process entirely as a proportion of air not as an absolute quantity. The total system airflow is governed by the technician who sets the equipment's blower configuration on site.

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