

WIRSBO™

Installation Handbook

Radiant Floor Radiant Ceiling RADIPEX™ Baseboard and Radiator Supply Systems

6th Edition

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Read the entire contents of this handbook before installing a Wirsbo Radiant Floor/Ceiling Heating System or RADIPEX™ Baseboard Supply System. Refer to this handbook, as necessary, during all phases of installation.

Radiant Floor Installation Handbook

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SECTION 1: BEFORE YOU BEGIN

The purpose of this handbook is to familiarize contractors, architects, engineers and HVAC officials with Wirsbo Company's recommended methods of constructing and installing Wirsbo Radiant Floor/Ceiling Heating Systems and RADIPEX™ Systems.

Codes

Wirsbo systems should be installed by a hydronic heating installation technician after carefully reviewing all applicable building, heating and mechanical codes. Any conflicts with the codes must be resolved before installation.

Wirsbo PEX tubing products are manufactured to ASTM F876 - Standard Specification for Cross-Linked Polyethylene (PEX) Tubing. The tubing is listed to ASTM F876 and the tubing and fitting system is listed to ASTM F877 and ASTM F1960 by a third party independent testing laboratory.

BOCA - The use of ASTM F876 and ASTM F877 PEX tubing is listed for use in the BOCA NATIONAL MECHANICAL CODE under Hydronic Pipe - Section M-703.0 (93).

ICBO - Wirsbo PEX tubing products and radiant panel heating products are approved for use by ICBO. See ICBO Report No. 4407 for allowable values and/or conditions of use concerning material presented in this document. ICBO reports are subject to re-examination, revision and possible cancellation.

IMC - The use of ASTM F876 and ASTM F877 PEX tubing is approved for use in the International Mechanical Code under Hydronic Piping - Section 1202.

New York State - Wirsbo PEX tubing products meet the requirements for the New York State Uniform Fire Prevention and Building Code, and are approved for use in the State of New York for sealed central heating systems including radiant floor.

Economic Design Information

In the residential market there is a common misconception that radiant floor heating is only for high-end, custom homes. This simply is not true. Like any heating system, radiant floor systems can be designed to fit a wide array of applications and budgets. Wirsbo systems can be designed to be competitive with any heating alternative. Wirsbo systems can be ultra-basic or ultra-sophisticated, depending on the specific requirements of an application and the budget of a project.

There are many ways to achieve economic design. Here are some options:

Use The Correct PEX Product: If ferrous components (e.g., cast iron boiler and/or circulators) are used in the system, then Wirsbo hePEX™plus with an oxygen diffusion barrier must be used. However, if there are no ferrous components in the system, the Wirsbo AQUAPEX® non-barrier tubing may be used. AQUAPEX® is the same quality tubing, but because it has no barrier, it costs less.

Use The Proper Size Tubing: In nearly all residential applications, 1/2" hePEX™plus or AQUAPEX® tubing is perfectly adequate. The 5/8" tubing may also be used, but it is more costly. There are lots of advantages to 1/2" tubing besides cost. It is more flexible and easier to work with, making it easier and faster to install. The only advantage to using 5/8" tubing over 1/2" tubing is a lower pressure loss over the same loop length. Larger diameter PEX WILL NOT deliver more heat per square foot of radiant panel.

Use 3/8" PEX Tubing For Joist Heating: In joist applications, 3/8" tubing may be used. It is even more flexible and easier to work with than 1/2" tubing. However, because of the smaller diameter the pressure drop is significantly higher with 3/8" tubing than with 1/2" tubing, so maximum loop lengths will be shorter. Even so, 250 to 300 foot loop lengths can be done with 3/8" PEX.



Use Common Sense Control Strategies: There are many levels of control strategies that can be used with radiant floor heating systems, ranging from simple on/off control to weather responsive reset packages. The higher the level of control sophistication, the higher the upfront cost. Keep in mind, however, that these costs are often offset by greater comfort and fuel economy.

A designer should carefully weigh the design options available, and choose the option that best fits an individual application. For instance, a small one or two room job will perform just fine with a simple tempering valve (if necessary) and an on/off control. In fact, a tempering valve and intermittent control will be satisfactory in many larger applications as well. More elaborate reset controls are becoming affordable and may be used in appropriate jobs without busting the budget.

Use Common Sense Zoning Strategies: One of the great benefits of radiant floor heating is to provide complete room-by-room zoning with thermostats in every room. While this adds a high level of control, it can also add extra cost. Often, several rooms of similar design, use patterns, and proximity may be zoned together into a single zone without sacrificing comfort or efficiency. Zone valves or circulators used to zone a single manifold, rather than multiple thermostats on a single manifold, can be used to help reduce cost.

Do Not Install Any Tubing In Zero Heat Loss Areas: If the heat loss of a given area is zero, do not install tubing. An example of this is a small room that is surrounded by heated space. It may very well have a zero heat loss and therefore would not need additional tubing installed. The exception to this would be any slab on or below grade application where downward heat loss exists.

Use Radiant Ceiling: Radiant ceiling can be used cost effectively in many situations. Radiant ceiling applications typically use less tubing and fewer components than radiant floor

applications. In addition, the cost of underlayment is saved. Radiant ceiling is perfect for retrofit and remodeling applications, supplemental heat situations, and it can be used cost effectively in the specified housing market.

Install Tubing Between The Joists Without Plates:

This application is used both in retrofit/remodel and new construction. Simply install the tubing in between the floor joists, either clipped or stapled to the subfloor, without aluminum heat emission plates. This is much less expensive than installations using plates. The only sacrifices are a higher required water temperature and a slightly slower response time. This method can also be more cost effective than a poured floor underlayment application. More tubing is used but the cost of the underlayment is saved.

Use the Most Cost Effective Heat Plant: Because of its low water temperature requirements, radiant floor and radiant ceiling systems can often use water heaters as heat sources. There are limitations in terms of output and water temperature, of course, but water heaters are less expensive than boilers and do not require a tempering device to achieve proper supply water temperature. *Consult your local codes before installing a water heater as a heat source.*

Use A Wirsbo Stapler: Wirsbo staplers greatly reduce installation time for suspended floor applications, both above and below the subfloor, as well as for radiant ceiling installations. The investment in the tool can be recovered after just a few jobs.

Parts Inspection: Before beginning the installation, check to be sure that you have received all of the necessary components required to complete the project. Verify that all components are in good working order and were not damaged during shipping. Report damaged or missing goods to your distributor or dealer as soon as possible to avoid unnecessary delays.



NOTE: The installation of a radiant floor heating system is a permanent fixture of the structure. Improper installation, exceeding limitations and practical expectations of the radiant floor will be difficult, if not impossible, to correct once the installation is complete. Therefore, it is strongly recommended that a room-by-room heat loss of the structure is completed prior to installation. Wirsbo offers Radiant Express, a PC compatible program designed specifically for radiant floor/ceiling heating applications. In addition, Wirsbo offers the Complete Design Assistance Manual (CDAM) which provides detailed information about products, design, applications and controls. Contact your local sales representative for availability.

SECTION 2: WIRSBO PEX PRODUCTS

The term PEX refers to cross-linked polyethylene. Wirsbo offers two PEX products for radiant floor heating systems: AQUAPEX® and Wirsbo hePEX™plus. They are similar in that they are both cross-linked polyethylene produced by the Engel method but each has special features that make it more suitable for specific installations. In this handbook the term PEX or Wirsbo PEX is generic and refers to both tubing products.

AQUAPEX®

AQUAPEX® is cross-linked polyethylene (PEX) heat transfer tubing without an oxygen diffusion barrier. AQUAPEX® should only be used in systems that isolate ferrous components from the floor circulating loop or in systems where all ferrous components have been eliminated.



AQUAPEX® is rated at 160 psi @ 73.4°F, 100 psi @ 180°F and 80 psi @ 200°F. These pressure and temperature ratings are issued by the Hydrostatic Design Stress Board of the Plastic Pipe Institute (PPI). PPI is a division of the Society of Plastics Industry (SPI).

AQUAPEX® is available in:

3/8" nominal inside diameter (1/2" O.D.)
Contains 0.491 gallons/100'
Standard coil lengths are: 400', 1000'

1/2" nominal inside diameter (5/8" O.D.)
Contains 0.920 gallons/100'
Standard coil lengths are: 300', 1000'

WIRSBO™



5/8" nominal inside diameter (3/4" O.D.)
Contains 1.387 gallons/100'
Standard coil lengths are: 300', 1000'

3/4" nominal inside diameter (7/8" O.D.)
Contains 1.89 gallons/100'
Standard coil lengths are: 300', 500'

1" nominal inside diameter (1 1/8" O.D.)
Contains 3.01 gallons/100'
Standard coil lengths are: 300', 500'

1 1/4" nominal inside diameter (1 3/8" O.D.)
Contains 4.65 gallons/100'
Standard coil lengths are: 100'

1 1/2" nominal inside diameter (1 5/8" O.D.)
Contains 6.49 gallons/100'
Standard coil lengths are: 100'

hePEX™plus

Wirsbo hePEX™plus is cross-linked polyethylene (PEX) heat transfer tubing with an oxygen diffusion barrier. A slight modification to the oxygen diffusion barrier resulted in a more flexible tubing. The increased flexibility makes it possible to use Wirsbo's ProPEX® fittings system with hePEX™plus tubing in addition to the proven QS20 compression fittings. (More information on Wirsbo fittings can be found in Section 4 on Page 18).

Corrodible or ferrous components may be used in a re-circulating hot water system with Wirsbo hePEX™plus tubing.

Wirsbo hePEX™plus is rated at 200° F at 80 psi, 180° F at 100 psi, and 73.4° F at 160 psi. These temperature and pressure ratings are issued by the Hydrostatic Design Stress Board of the Plastic Pipe Institute (PPI). PPI is a division of the Society of Plastics Industry (SPI).



Wirsbo hePEX™plus is available in:

3/8" nominal inside diameter (1/2" O.D.)
Contains 0.491 gallons/100'
Standard coil lengths are: 400', 1000'

1/2" nominal inside diameter (5/8" O.D.)
Contains 0.920 gallons/100'
Standard coil lengths are: 300', 1000'

5/8" nominal inside diameter (3/4" O.D.)
Contains 1.387 gallons/100'
Standard coil lengths are: 300', 1000'

3/4" nominal inside diameter (7/8" O.D.)
Contains 1.89 gallons/100'
Standard coil lengths are 300', 500'

1" nominal inside diameter (1 1/8" O.D.)
Contains 3.01 gallons/100'
Standard coil lengths are 300', 500'



SECTION 3: WORKING WITH PEX

PEX tubing is engineered as a very workable and forgiving construction material. The following procedures and methods are recommended to simplify installation and help the installer avoid mistakes that could damage the product or otherwise complicate the project.

Storing Wirsbo PEX Tubing

PEX tubing must be stored under cover to avoid extended exposure to direct sunlight (diffused light does not pose a concern). Ultraviolet light can cause accelerated aging. Never install tubing that is suspect of being exposed to direct sunlight for more than 30 days. Exposure to sunlight during normal installation is not harmful. Care should always be taken to ensure that abuse or mishandling is avoided. Wirsbo PEX tubing is shipped in individual boxes. Please save boxes for storage of unused lengths.

Temperature

Wirsbo PEX tubing is very flexible, however, it is more rigid to work with at temperatures below 40° F. Installation is simplified when the PEX tubing coils are warmed to a temperature above 60° F.

Uncoiling

A Wirsbo Tube Uncoiler (*Part No. E6061000*) can be purchased to facilitate convenient uncoiling. If one is not available, a suitable uncoiler should be constructed.



Cutting Wirsbo PEX Tubing

Wirsbo PEX tubing is manufactured to close dimensional tolerances and fittings are provided that meet these tolerances. It is important that when the tubing is cut, damage does not occur that adversely affects the fitting connection. A Wirsbo tubing cutter should be purchased for this purpose. If one is not available, use an appropriate substitute that will not damage the tubing. Tubing should be square cut perpendicular to the length of the tube. No excess material should remain that might affect the fitting connection.



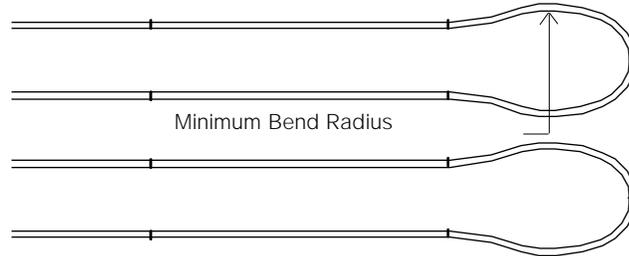
Bending Wirsbo PEX Tubing

Wirsbo PEX tubing is very flexible (see table below for minimum bend radius). Bends less than 12" in diameter should be made slowly and carefully to avoid over-bending and possibly kinking the tube (see page 14 for instructions on how to re-form kinks). Bend supports are available and should be used to make 90° right angle bends that are otherwise not supported (e.g., when the tubing makes a 90° bend from the floor to the manifold).

Tubing can be installed at lesser on center distances, by making the width of the turns larger than the on center distance of the tubing runs (see page 14).

Minimum Bend Radius
For Wirsbo PEX Tubing

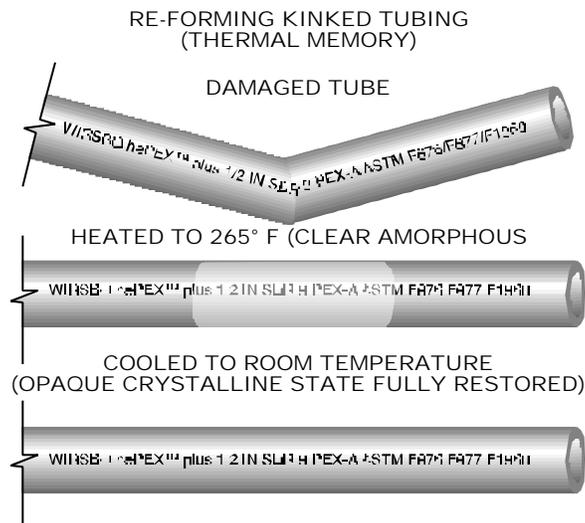
3/8" nominal tube size	3.0"
1/2" nominal tube size	3.75"
5/8" nominal tube size	4.5"
3/4" nominal tube size	5.25"
1" nominal tube size	6.75"



Re-forming Kinked Wirsbo PEX Tubing

Wirsbo PEX tubing is a cross-linked polyethylene product. As such, it can be described as “plastic with memory.” In the event the PEX tubing is kinked in a way that results in an obstruction to flow, repairs can be made in the following manner:

1. Straighten the kinked portion of the PEX tube.
2. Heat the kinked area to approximately 265° F (to the point where the PEX tubing turns clear) with an electric heat gun. The temperature of the air must not exceed 338° F. Apply the heat evenly until the PEX tubing turns clear around its circumference. **DO NOT USE AN OPEN FLAME.**
3. Let the re-formed tube cool undisturbed to room temperature. It will soon return to its original opaque white appearance.



Fastening Wirsbo PEX Tubing - The Wirsbo Stapler System

Wirsbo Pneumatic Staplers



Wood Only (E6021638)



Wood & Foam (E6021638)



Foam Staple
(for use with Manual Stapler)



Manual Stapler - Foam
(E6025075)

The Wirsbo tubing stapler system is designed to fasten Wirsbo PEX tubing products to wood or foam surfaces. The pneumatic stapler kit includes a pneumatic stapler, a walking stick (which allows you to operate the stapler from a standing position) and one stapler head for use over wood.

Using the wood stapler head, staple Wirsbo 1/2" and 5/8" PEX tubing directly to wood underlayments using Wirsbo 1 1/4" staples.

Used without a stapler head, the stapler can fasten polystyrene insulation to wood subfloors (using Wirsbo 1 1/4" staples) or aluminum plates to furring strips (using Wirsbo 5/8" staples).

Using the Manual Foam Stapler (E6025075), staple Wirsbo 3/8", 1/2" and 5/8" PEX tubing directly to high density foam insulation using the plastic foam staples (A7015050) or (A7015075).

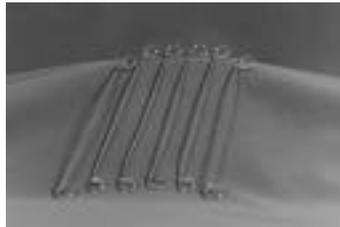


U-Shaped Tube Fastener and Fixing Wire

For attaching Wirsbo PEX to wood subfloors when a stapler is not available, Wirsbo offers the U-shaped Tube Fastener (A7040250). The Tube Fastener should be driven in over the tube to hold the tube securely in place. The tube should not be compressed by the Tube Fastener. Use caution when using U-shaped tube fasteners. Always wear safety glasses.



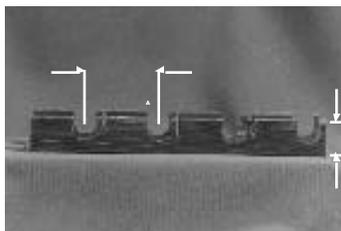
Use Wirsbo galvanized fixing wire (A7031000) to secure Wirsbo PEX to wire mesh or rebar.



See the floor construction methods (page 48) for fastener spacing.

Wirsbo PEX Rails

PEX rails can be used as an alternative to attach Wirsbo PEX to wood subfloors. Rails are secured to wood subfloor with 1" screws. Tubing then can be snapped into rails on recommended spacing. See the floor construction methods (page 56) for rail spacing.



Part No.	A	B
A5700500	2.0"	1"
A5700625	2.0"	1"

Protect PEX Tubing from Freezing

PEX tubing not buried in concrete is highly tolerant to freeze conditions and normally will not burst. Precautions must be taken to avoid freezing when PEX tubing is embedded in concrete. When pressure testing with water, **DO NOT** allow the water to freeze. If the area experiences frequent power outages or if the structure is used intermittently, a suitable mixture of water and propylene glycol should be used in the system.

Other Handling Precautions

- **DO NOT** use PEX tubing where temperatures and pressures exceed product ratings.
- **DO NOT** apply an open flame to PEX tubing.
- **DO NOT** solder within 18" of PEX tubing in the same water line.
- **DO NOT** install PEX tubing where it will come in direct contact with high concentrations of low molecular weight petroleum products, such as fuels or solvents.
- **DO NOT** install PEX tubing in direct contact with sharp fill.
- **DO NOT** weld or glue Wirsbo PEX.
- **DO NOT** install Wirsbo PEX within 6" of any gas appliance vents or within 12" of any un insulated recessed light fixtures.
- **DO NOT** use Wirsbo PEX to convey natural gas.
- **DO NOT** use Wirsbo PEX tubing for an electrical ground.



SECTION 4: FITTINGS

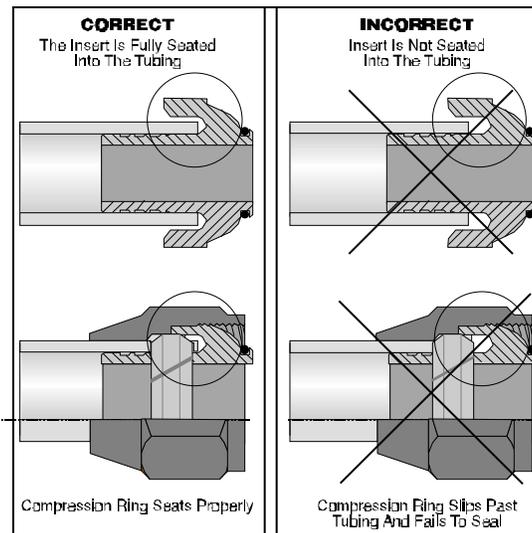
Wirsbo QS20 Compression Fittings

Wirsbo compression fittings and all components are made of brass. The QS20 fitting is designed and tested for use with Wirsbo hePEX™plus and AQUAPEX® tubing.

Using Wirsbo QS20 Fittings:

1. Square cut the end of the tubing using a Wirsbo tubing cutter or other suitable plastic tubing cutter. Tubing should be square cut perpendicular to the length of the tube.
2. Slide the brass compression nut and compression ring over the tubing.
3. Slide the barbed insert head into the end of the tubing. Make sure the head is fully seated against the end of the tubing (see diagram).
4. Tighten the compression nut to the manifold or fitting.

NOTE: All compression fittings must be retightened after initial installation. Wait 30 minutes to allow the tube to fully relax, then retighten each fitting.



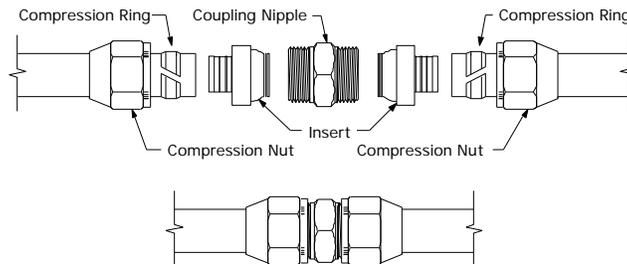
Connecting QS20 Fittings to the Wirsbo Manifold

1. Cut tubing even with the bottom thread on the manifold nipple as shown in the diagram below.
2. Slide compression nut, compression ring and QS20 barbed insert onto tubing as described above.
3. Tighten compression nut securely onto the manifold nipple.

NOTE: When installing a fitting onto the manifold or a repair coupling, leave a little slack in the tubing. This will allow the end of the tubing to move inward toward the manifold or coupling when the fitting is tightened. If the tubing is taut and can't move, the barbed insert head could pull out of the tubing while the nut is being tightened and result in a leak.

Repair Couplings

If during installation, the Wirsbo tubing is damaged or punctured, a Wirsbo repair coupling must be installed. A Wirsbo repair coupling consists of one R20 x R20 (A4322020) or one R25 x R25 (A4322525) coupling nipple and two appropriately sized brass compression fittings. For $\frac{3}{8}$ ", $\frac{1}{2}$ " and $\frac{5}{8}$ " tubing, use an R20 x R20 coupling nipple and an R25 x R25 coupling nipple for $\frac{3}{4}$ " tubing.



1. Cut the damaged section of tubing from the loop.
2. Slide the compression nuts and compression rings over the end of the tubing.
3. Slide the QS20 barbed insert heads into each end of the tubing.
4. Push O-ring inserts into the coupling nipple.
5. Tighten compression nut onto the coupling nipple. Use a wrench on both the compression nut and coupling nipple to avoid damage to fittings or tubing.



NOTE: Wirsbo repair couplings will replace about 1" of tubing. If the damaged section of tubing is longer than 1", and you have no excess tubing in the line, you will need to use two repair couplings and a length of PEX tubing to replace the damaged section of pipe.

Caution: When tightening the compression nut onto the brass coupling nipple, always use two wrenches: one on the compression nut and one on the hex nut on the coupling nipple. Never tighten one compression nut against the other without securely holding the hex nut. This could damage both the fitting and the tubing.

Important: All compression fittings must be retightened after initial installation. Wait at least 30 minutes to allow the tubing to fully relax, and then retighten each fitting.

NOTE: All reasonable measures should be taken to avoid couplings in a concrete slab. If it is necessary, the repair coupling should be wrapped with insulation to prevent direct contact with the concrete.

Wirsbo ProPEX® Fittings and Tools

Wirsbo ProPEX® fittings rely on the shape memory of Wirsbo AQUAPEX® and Wirsbo hePEX™plus tubing. The ProPEX® Hand Tool (Q6305075) and the ProPEX® Air Expander Tool (Q6301000) expand the tubing enough to insert the ProPEX® fitting. The tubing then squeezes around the fitting as it returns to its original shape.

The ProPEX® Hand Expander Tool

The complete kit consists of:

- 1 two-handled expander tool
- 3 expander heads: one each for 1/2", 3/4", and 1" PEX tubing. (3/8" and 5/8" expander heads are sold separately.)
- 1 tube of tool lubricant
- 1 ProPEX® tool case

Proper Maintenance for the ProPEX® Hand Expander Tool

1. Store the tool and expander heads in the case. Store the tool with an expansion head in place to protect the internal driver. Unscrew the head slightly so the handles come together. Be sure to retighten the expander head before use.
2. Periodically remove the head and clean the cone of the ProPEX® Hand Expander Tool using a dry, lint-free cloth.
3. Periodically clean the inside of the expander heads using a dry, lint-free cloth. This will remove any debris that may be trapped between the head and cone.
4. To keep internal parts working smoothly, apply a thin coat of lubricant to the internal cone. Lubricant should be applied daily with regular use. Keep all other parts of the tool free from grease.

Caution: Excessive lubrication may result in improper connections. Only a small amount of lubricant is necessary to keep the tool working properly.

The ProPEX® Air Expander Tool

Wirsbo ProPEX® Air Expander Tool (Q6301000) uses air pressure to make fast, easy connections to 3/8", 1/2", 5/8" and 3/4" hePEX™ plus and AQUAPEX® tubing.

NOTE: The ProPEX® Air Expander Tool is NOT designed for use with 1" tubing and fittings.

The complete kit consists of:

- 1 ProPEX® Air Expander Tool
- 1/2" expander head (3/8", 5/8" and 3/4" expander heads are sold separately.)
- 1 tube of tool lubricant
- 1 instruction manual
- 1 carrying case



Tool Specifications

The Wirsbo ProPEX[®] Air Expander Tool is rated for use at 80-90 psi. Do not operate the tool above 100 psi as high pressures can be dangerous.

Pressure:	80-90 psi working pressure
Consumption:	4 CFM
Capacity:	3/8" to 3/4" tubing
Connection Size:	1/4" male quick connect fitting
Weight:	5.5 lbs./ProPEX [®] Air Expander Tool 7.0 lbs./ProPEX [®] Air Expander Tool, expander head, lubricant, instructional manual and carrying case

Operating Instructions

1. Attach the correct sized expander head to the ProPEX[®] Air Expander Tool. Be sure the head is screwed on tightly.
2. Make sure the air compressor regulator is set between 80 to 90 psi. (Do not exceed 100 psi.)
3. Attach air supply to the tool.

NOTE: Prior to each use, check the cone for dirt and clean as listed below. Add one to two drops of oil to the inlet of the ProPEX[®] Air Expander Tool to lubricate the tool.

Proper Tool Maintenance

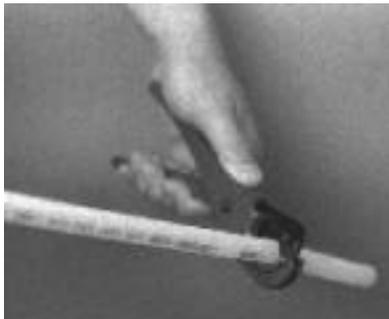
1. Store the ProPEX[®] Air Expander Tool in a dry location to prevent rust. The ProPEX[®] Air Expander Tool is shipped with one 1/2" expander head attached to it. Store the ProPEX[®] Air Expander Tool with the expander head in place to prevent damage to the expander cone.
2. Periodically remove the head and clean the cone of the ProPEX[®] Air Expander Tool using a dry, lint-free cloth.
3. Periodically clean the inside of the expander heads using a dry cloth. This will remove any debris that may be trapped between the head and cone.
4. To keep internal parts working smoothly, apply a thin coat of lubricant to the internal cone. Apply the lubricant with a lint-free cloth.

Caution: Excessive lubrication may result in improper connections. Only a small amount of lubricant is necessary to keep the tool working properly.

NOTE: Review of the Safety and Operational Guidelines in the ProPEX® Air Expander Tool Manual is strongly recommended before using the tool.

Using ProPEX® Fittings

1. Screw the proper expander head size completely onto the ProPEX® Air Expander Tool. Be sure the expander head corresponds with the tubing size.
2. Square cut PEX tubing perpendicular to the length of the tubing using a cutter designed for plastic tubing.
3. Remove all excess material or burrs that may compromise the fitting connection.

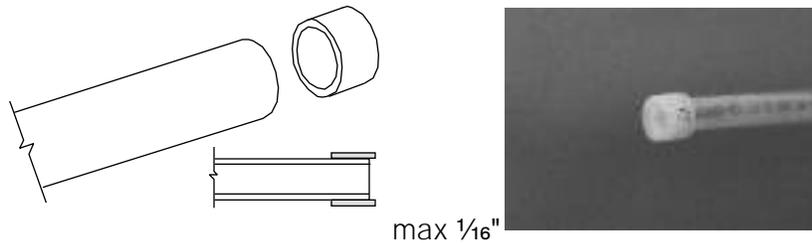


Proper PEX Cutting Procedures

NOTE: hePEX™plus and AQUAPEX® are manufactured to close dimensional tolerances and fittings are provided to meet those tolerances. Cut the tubing as described in Step 2 to avoid damage. A Wirsbo tubing cutter may be purchased for this purpose. If one is not available, use an appropriate substitute.



4. Slide the ProPEX® ring over the end of the tube. Extend the ProPEX® ring over the end of the tubing no more than 1/16". The end of the tubing and inside of the ProPEX® ring must be dry and free of grease to prevent the ring from sliding out of place during expansion



If Using The ProPEX® Hand Expander Tool:

5. Separate the ProPEX® tool handles and insert the expander head into the head of the tubing until it stops. Place the free handle of the tool against your hip or in the holder of the ProPEX® Expander Belt (Q6505075). Fully separate the handles and bring them together. Repeat this process until the tubing and ring are snug against the shoulder on the expansion head. See Chart A below for the recommended number of expansions.



Tube Size	Ring Marking	Head Marking	Number of Expansions
3/8"	3/8"	3/8"	4
1/2"	1/2"	1/2"	4
5/8"	5/8"	5/8"	7
3/4"	3/4"	3/4"	9
1"	1"	1"	14

Chart A

- 6. Before the final expansion, withdraw the tubing from the ProPEX® Hand Tool and rotate the tool 1/8 of a turn. If the number of expansions exceeds the recommended number in Chart A or if the tubing is held in the expanded position, the tubing requires additional time to fully shrink over the fitting.

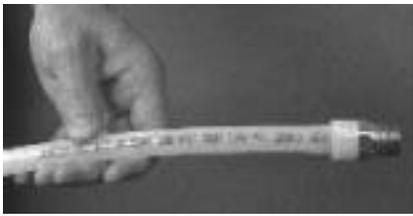


(Rotate the tool 1/8 of a turn)

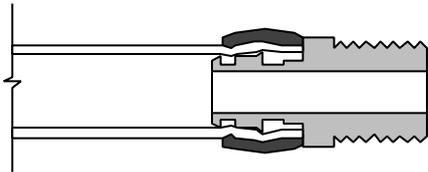
- 7. Immediately remove the tool and slide the tubing over the fitting until the tubing reaches the stop on the fitting. Hold the fitting in place for two or three seconds until the tubing shrinks onto the fitting and it holds the fitting firmly. **The tubing and ProPEX® ring must be seated against the shoulder of the fitting for a proper connection.**



Slide the tubing over the fitting.



The tubing should hold the fitting firmly after a few seconds.





NOTE: Chart A is the *recommended* number of expansions. The *correct* number of expansions is the number it takes for the tubing and the shoulder of the expander head to fit snugly against each other. The goal in achieving a proper connection is to shrink the tubing and ProPEX® Ring immediately around the fitting.

NOTE: Full expansions are necessary for a proper connection. Making half expansions or deviating from the recommended expansion method may result in improper connections. If the fitting does not slide into the tubing all the way to the stop, immediately remove it from the tubing and expand the tubing one final time. To avoid over-expanding the tubing, do not hold the tubing in the expanded position.

If Using The ProPEX® Air Expander Tool:

5. Insert the expander head onto the end of the tubing until it stops. Expand the tubing until it is flush with the stop on the expander head. See Chart B for the recommended number of expansions for each tubing size.

Tubing Size	Ring Marking	Head Marking	Number of Expansions
3/8"	3/8"	3/8"	4-5
1/2"	1/2"	1/2"	4
5/8"	5/8"	5/8"	6-7
3/4"	3/4"	3/4"	7-9

Chart B

6. Before the final expansion, withdraw the tubing from the ProPEX® Air Expander Tool and rotate the tool 1/8 of a turn. Expand the tubing one final time. If the number of expansions exceeds the recommended number in Chart B or if the tubing is held in the expanded position, the tubing requires additional time to fully shrink over the fitting.

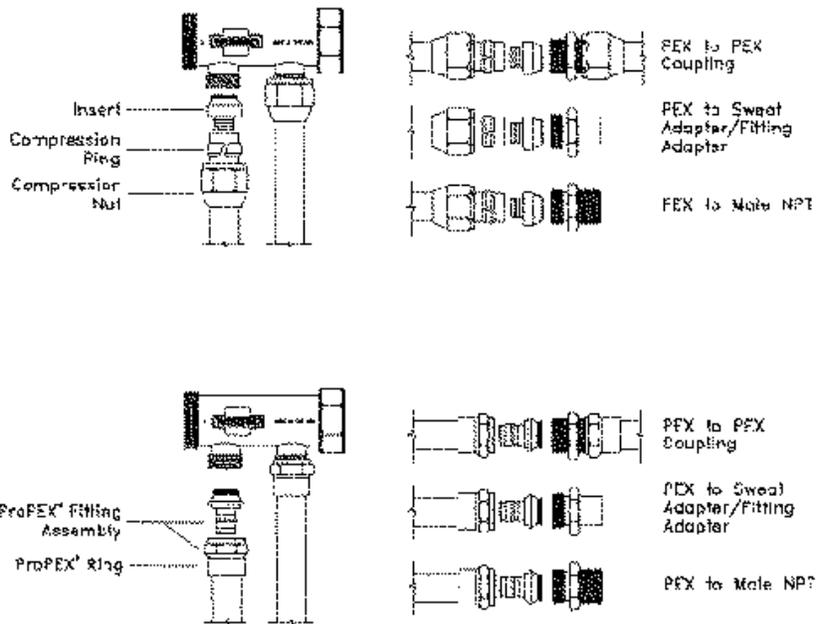
7. Immediately remove the ProPEX® Air Expander Tool and slide the tubing over the fitting until the tubing reaches the top of the fitting. Hold the fitting in place for two or three seconds until the tubing shrinks onto the fitting so that it holds the fitting firmly. The tubing and ProPEX® ring must be seated against the shoulder of the fitting for a proper connection.
8. Pressure test ProPEX® connections to the system's working pressure. Refer to your local code for additional requirements.





SECTION 5: WIRSBO BRASS MANIFOLD

Wirsbo 1¼" manifolds are constructed of dezincification resistant brass. Wirsbo manifolds are available in two, three and four loop configurations. The return manifold combines the telestat and flow balancing valves on this valved manifold. The supply manifold is valveless. Valveless manifolds for both supply and return are cost-effective for loop length balanced systems. The Wirsbo manifolds have a ¾" NPT outlet for the fitting assembly connection.



NOTE: The ¾" connection will accommodate any QS20 style compression nut used for ⅜", ½" and ⅝" Wirsbo PEX tubing. The QS20 compression nut used for ¾" PEX tubing will not connect directly onto the ¾" outlet.

Plan Manifold Locations and Rough In Requirements

1. Manifolds should be located on an interior wall whenever possible. Manifolds mounted on exterior walls may experience significant heat loss. Installing a manifold on an interior wall makes it more accessible to the floor area. On an interior wall, tubing can be routed to the floor in front of or behind the manifold.
2. Select a location that allows the use of hallways or large rooms as avenues for the leaders to run to and from distant rooms. The inside of a closet is an ideal manifold location.
3. The location should permit easy connection to supply and return lines from the heat source.
4. The location should permit easy access for maintenance.

WIRSBO BRASS MANIFOLD OPENING REQUIREMENTS

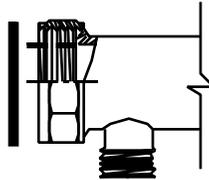
NUMBER OF LOOPS	HORIZONTAL INSTALLATION	
	HEIGHT	WIDTH
2	30"	10"*
3	30"	11.5"*
4	30"	13.5"*
5	30"	15.5"
6	30"	17.5"
7	30"	19.5"
8	30"	21.5"
9	30"	23.5"
10**	30"	25.5"

* Fits within a standard stud wall at 16" on center
** Maximum recommended number of loops in one manifold.



Assembling Manifolds

1. When assembling Wirsbo Brass Manifolds, install the supplied gaskets between all unions. The gasket should be fully seated before manifold assembly. Use Wirsbo's 1 $\frac{7}{8}$ " service wrench (A6111875) for tightening manifold unions.

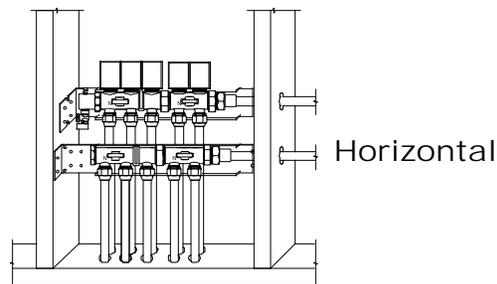


2. When using combinations of two, three and four loop manifolds, it is helpful to place each manifold in the mounting bracket opposite the corresponding manifold of the same loop configuration.

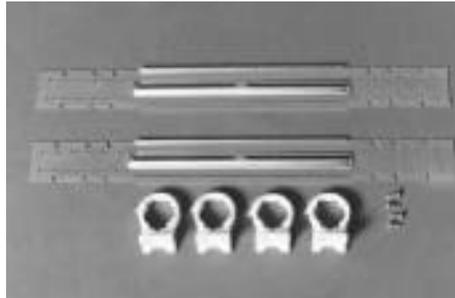
Manifold Installation

Manifolds may be installed in either a horizontal or vertical position. The horizontal configuration may limit the length of a manifold to that of the space between the studs or require that the cavity be boxed off to accommodate the full width of the manifold. The vertical installation will require two additional bend supports per loop, but it facilitates the installation of a radiant floor/ceiling combination.

NOTE: Manifold(s) should be located at least 16" above the floor.

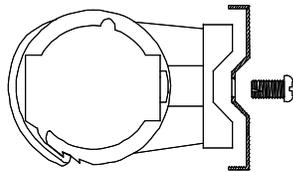


Wirsbo Manifold Mounting Bracket

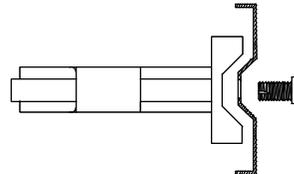


Parts List:
Bracket (2)
Manifold Clip (4)
Self Threading Screws (4)

The Wirsbo Brass Manifold Mounting Bracket (A2071500) is designed to simplify the installation of the Wirsbo manifold. The bracket can be used to secure the manifolds to any type of wall.



Horizontal



Vertical

Instructions for Manifold Mounting:

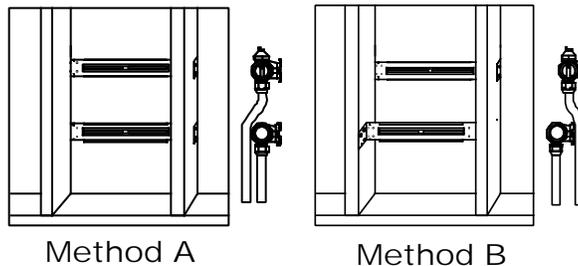
1. Attach the clip to the bracket. Place clip horizontally or vertically onto slotted alignment boss.
2. Screw self tapping screws (provided) into manifold clip. Do not tighten the clip down completely. Leave the clip loose enough so it can slide along the slot. This will help you align the manifolds properly. When proper spacing is determined, tighten clip completely and install manifold.

NOTE: Install the clip so that the teeth are on the lower part of the clip.



Wood Frame Construction

The manifold bracket is equipped with bending guides to allow the bracket to bend around the outsides of 16" center stud walls (Method A). The installer can offset the manifolds to allow tubing destined for the return manifold to run behind the supply manifold.



Method A

1. Using suitable hardware, secure both brackets around the outside of the wall stud. Be sure there are at least 8" between manifold brackets to allow the tubing to reach the upper manifold and connect squarely.

Method B

1. Install the return manifold bracket (upper) by bending at the two outside bending guides and attaching to the outside of the 16" on center stud wall using suitable hardware.
2. Install the supply manifold bracket (lower) by bending at the two middle bending guides and attaching to the inside of the 16" on center stud wall using suitable hardware. Allow enough space behind the bracket for the tubing to fit (at least the O.D. of the tubing). Make sure there are at least 10" in between the two brackets.
3. The tubing for the return manifold will run behind the supply manifold.

NOTE: Do not tighten compression fittings on the manifold solely against manifold support bracket. Hold the manifold while tightening fittings.

Mounting Manifolds to Block Walls

- 1. Using suitable hardware, anchor the return manifold to the bracket and secure the bracket to the wall (Figure A).

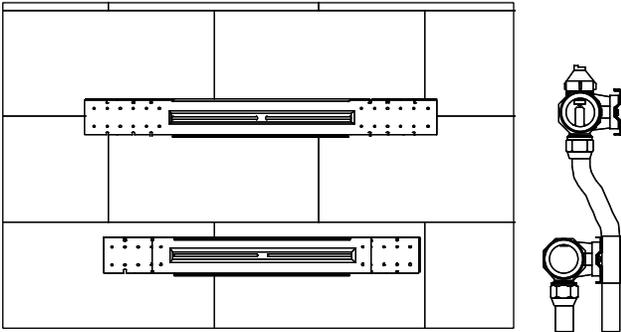


Figure A

- 2. Bend the bracket for the supply manifold (Figure B) so that tubing running to the return manifold is fed behind the supply manifold.



Figure B

NOTE: For walls with greater than 16" on center stud spacing, two brackets can be connected to increase the bracket to 38" (Figure C). Use sheet metal screws to connect brackets.

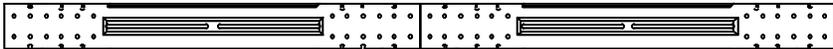
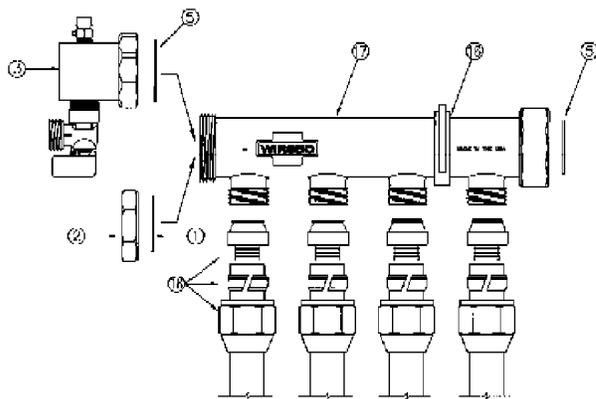
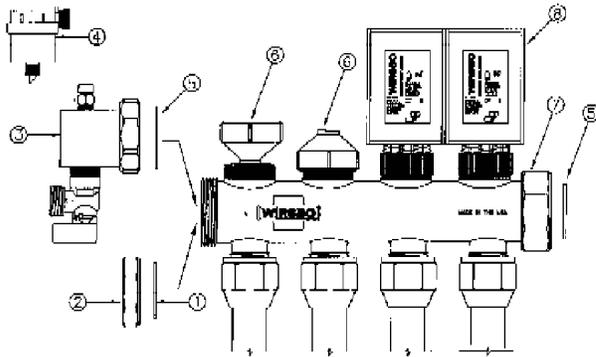


Figure C

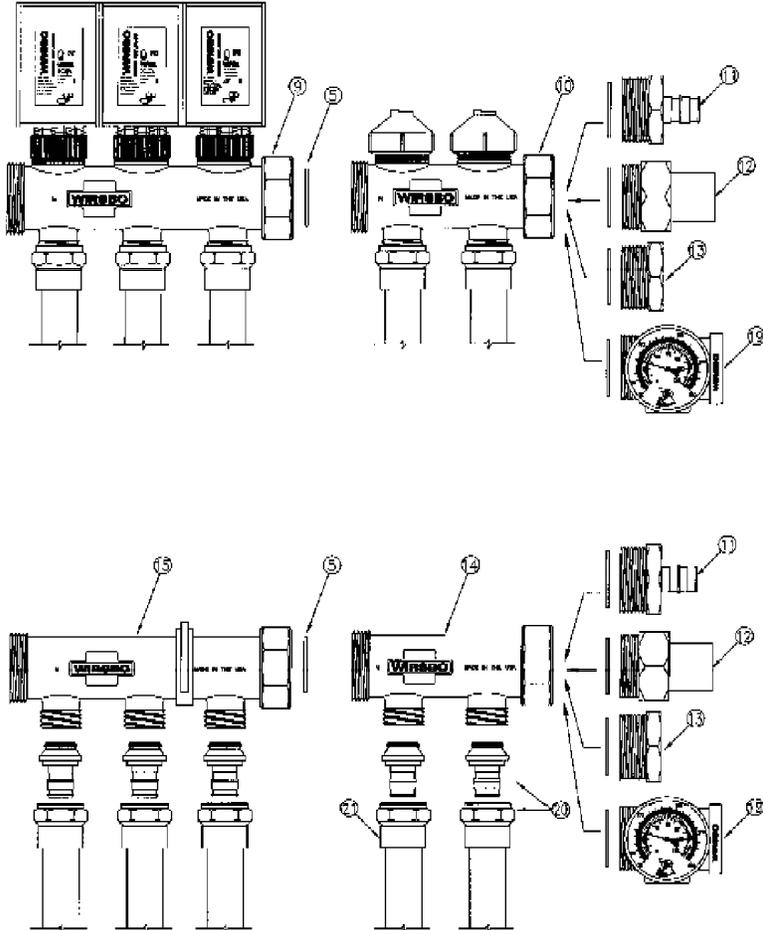


Wirsbo Components

1. Basic End Cap Gasket (A2400032)
2. Basic End Cap (A2080032)
3. End Cap w/Vent (A2803250)
4. Automatic Air Vent (A2130417)
5. End Cap w/Vent Gasket (A2403232)
6. Flow Balancing Cap
7. 4 Loop Valved Manifold (A2553220)
8. MVA Telestat II (4 wire) (A3020522)
9. 3 Loop Valved Manifold (A2533220)



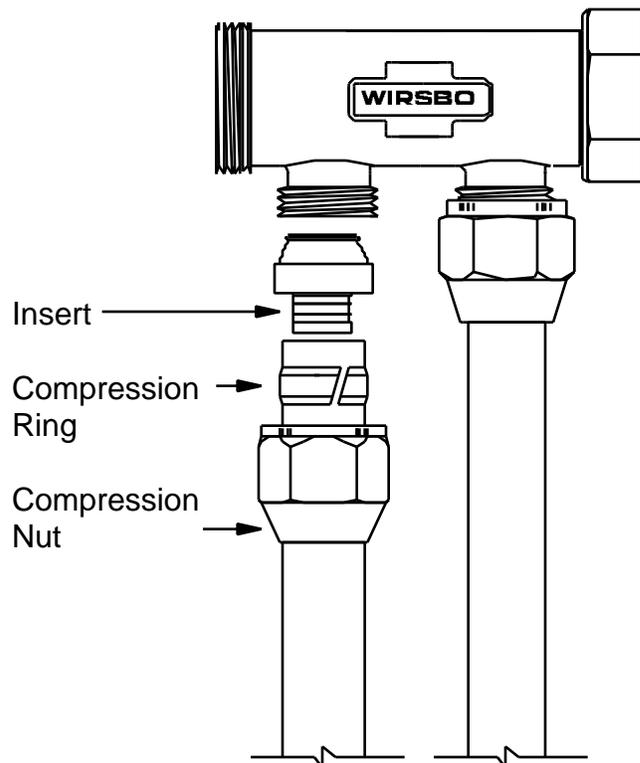
- 10. 2 Loop Valved Manifold (A2513220)
- 11. R32 x 3/4" Adapter/1" Fitting Adapter (A4143210)
- 12. R32 x 1" Bushing (A2123210)
- 13. R32 x 1" Adapter/1 1/4" Fitting Adapter (A4133210)
- 14. 2 Loop Valveless Manifold (A2503220)
- 15. 3 Loop Valveless Manifold (A2523220)
- 16. Manifold Mounting Bracket (A2071500)
- 17. 4 Loop Valveless Manifold (A2543220)
- 18. OS20 Fitting Assembly (3/8"-A4020375, 1/2"-A4020500, 5/8"-A4020625)
- 19. Adapter Assembly with Thermometer (A2913210)





Connecting Wirsbo PEX to the Manifold

1. Follow the directions on page 18 for the use of Wirsbo QS20 compression fittings and Wirsbo ProPEX® fittings on page 23.
2. To attach the tube to the manifold properly, cut the tube even with the bottom thread on the manifold nipple.



SECTION 6: WIRSBO COPPER MANIFOLDS

Wirsbo copper manifolds are constructed of 1" type "L" copper. Branches are ½" nominal type "L" that are brazed to the manifold trunk. They are available in three and four outlet configurations and can be sweat together to provide the correct number of outlets. For two loop manifold configuration, use a ½" copper end cap on the spare port of a 3 loop manifold. Use ½" copper QS20 conversion nipples (A4332050) to make connections to ¾", ½" and ⅝" PEX. Requires 1" copper end cap.

Plan Manifold Locations and Rough-In Requirements

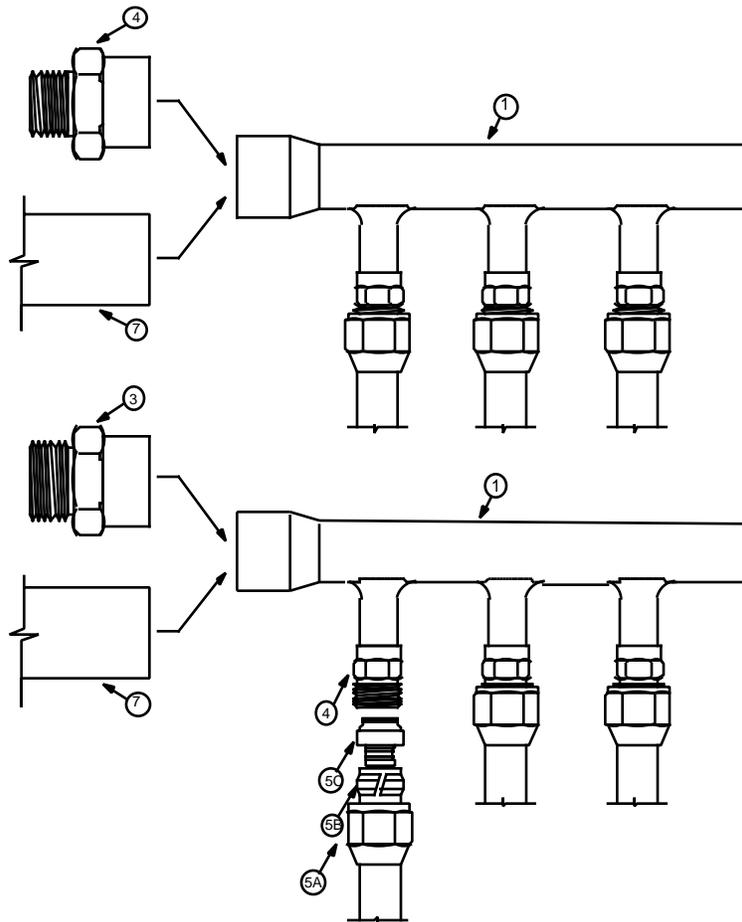
1. Manifolds should be located on an interior wall whenever possible. Manifolds mounted on exterior walls may experience significant heat loss. Installing a manifold on an interior wall makes it more accessible to the floor area. On an interior wall, tubing can be routed to the floor in front of or behind the manifold.
2. Select a location that allows the use of hallways or large rooms as avenues for the leaders to run to and from distant rooms. The inside of a closet is an ideal manifold location.
3. The location should permit easy connection to supply and return lines from the heat source.
4. The location should permit easy access for maintenance.

MANIFOLD SIZE	WIDTH
3 Outlets	8"
4 Outlets	10"
5 Outlets	13"
6 Outlets	15"
7 Outlets	17"
8 Outlets	19"

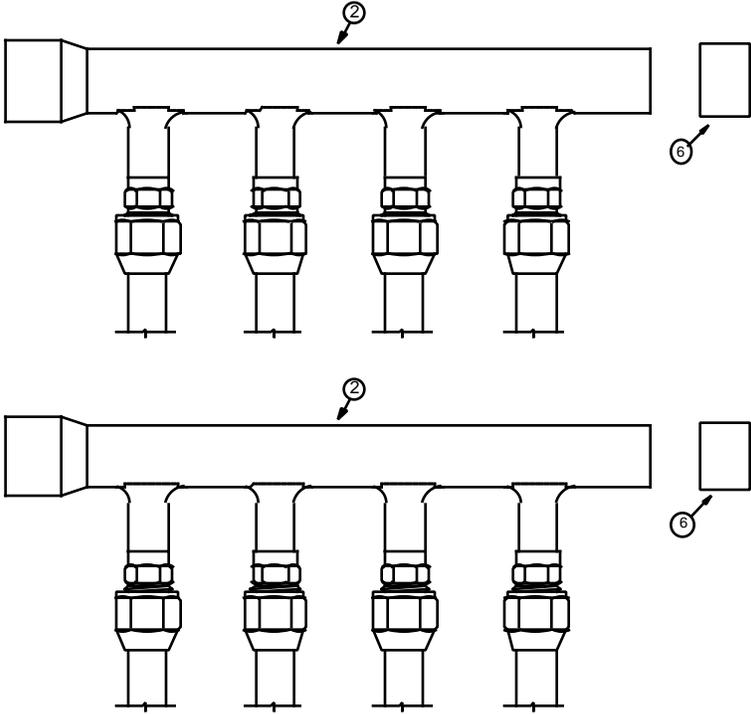


Wirsbo Components

1. 1" Copper, 3 outlet copper manifold (F2781050)
2. 1" Copper, 4 outlet copper manifold (F2791050)
3. R25 to 3/4" copper/1" copper fitting adapter (A4332575)
4. R20 x 1/2" copper pipe adapter (A4332050)



- 5. Fitting Assembly (A4020500)
 - A. Compression nut
 - B. Compression ring
 - C. QS20 Insert
- 6. 1" Copper cap
- 7. 1" Copper pipe





Assembling Copper Manifolds with QS20 Fittings

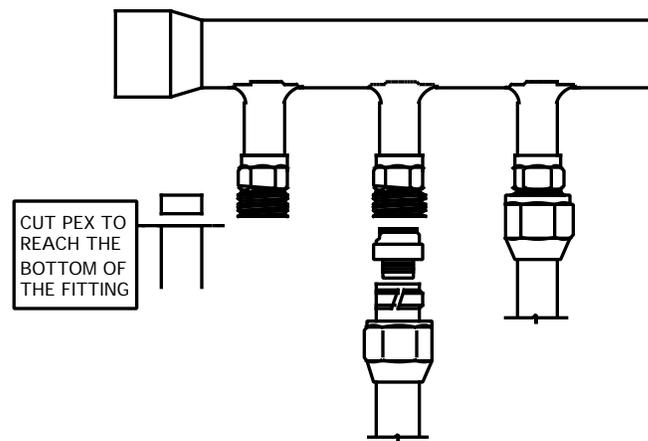
1. Sweat copper manifold sections together to provide the correct number of outlets if necessary.
2. If 3/4" PEX is used to supply the manifold, use a QS20 Adapter R25 x 3/4" CU (A4332575) to sweat to the flared side. A 3/4" QS20 Fitting Assembly (A4020750) will transition to PEX. Use a 1" copper cap on the straight pipe side.
3. Sweat a QS20 Adapter R20 x 1/2" CU (A4332050) onto each branch outlet on the manifold. Use the appropriate QS20 fitting assembly to complete connection of PEX to manifold.

Copper Manifold Installation

Wirsbo copper manifolds should be mounted horizontally with the outlets up or down. Any support designed for 1" nominal copper pipe may be used as a mounting bracket.

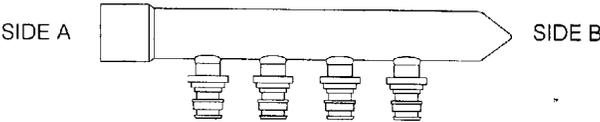
Connect PEX to the Manifold

Wirsbo PEX must be used with compression fittings provided by or approved in writing by Wirsbo Company. Incompatible fittings may cause damage to the PEX tubing.



ProPEX® Copper Manifolds

Preassembled ProPEX® manifolds are constructed of 1" type "L" copper with 3/8" and 1/2" ProPEX® outlets. They are available in 4, 6, 8, 10 or 12 outlet configurations. Use a short piece of AQUAPEX® with a plug to cap unused outlets.



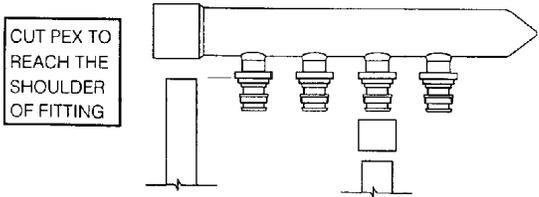
The manifold ends are adaptable to 1" copper pipe and fittings. Supply side A of the manifold with

- 3/4" PEX, using ProPEX® 3/4" PEX to copper adapter (Q4517510)
- 1" PEX, using ProPEX® to copper adapter (Q4511010)

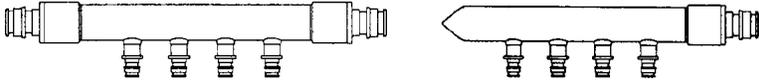
Side B of the manifold is spun closed. Adequate space is available if the end needs to be removed.

Connecting AQUAPEX® To The ProPEX® Manifold Using ProPEX® Fittings

1. Square cut the tubing at a length even with the shoulder of the fitting.
2. Connect the tubing to the manifold using ProPEX® instructions in section xxxxxxxxxxxxxx

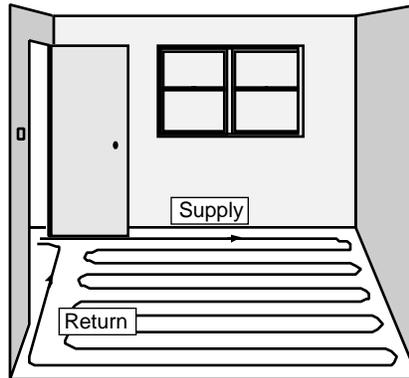


ProPEX® manifolds with one or two 3/4" ProPEX® ends are also available.

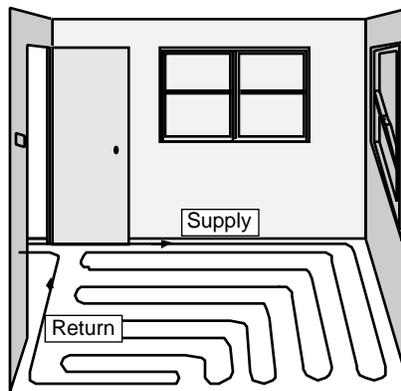




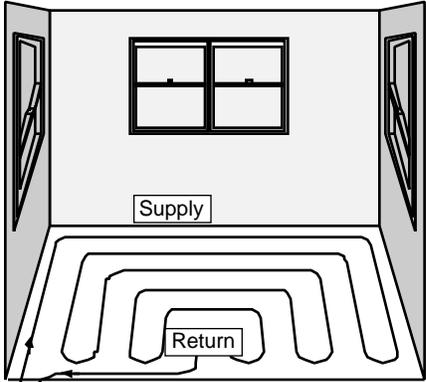
SECTION 7: APPROPRIATE TUBING LAYOUT PATTERN



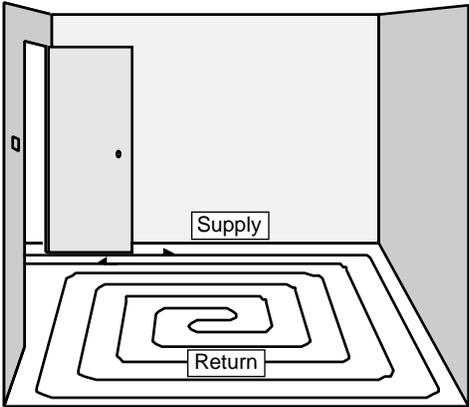
Single Wall Serpentine — Use when a single wall represents the major heat loss of the zone. The supply is fed directly to the high heat loss wall and then serpentine toward the lower heat loss area. Start tubing runs 6" from walls or nailing surfaces. A 6" on center tubing run is often installed along outside walls to improve response time.



Double Wall Serpentine — Use when there are two adjacent walls representing the major heat loss of the room. The supply is fed directly to either of the heat loss walls and then serpentine toward the lower heat loss area in an alternating pattern against the two heat loss walls. Start tubing runs 6" from walls or nailing surfaces. A 6" on center tubing run is often installed along outside walls to improve response time.



Triple Wall Serpentine — Use when there are three walls representing the major heat loss of the room. The supply is fed along the heat loss walls in an alternating pattern and serpented toward the lower heat loss area of the room. Start tubing runs 6" from walls or nailing surfaces. A 6" on center tubing run is often installed along outside walls to improve response time.



Counter Flow — Use when the heat loss for the room is evenly distributed throughout the entire room or the major heat loss is to the floor. The supply is fed along the exterior of the room spiraling inward with the return paralleling it from the center of the room. Start tubing runs 6" from walls or nailing surfaces. A 6" on center tubing run is often installed along outside walls to improve response time.



SECTION 8: FLOOR/CEILING CONSTRUCTION METHODS

Wirsbo radiant floor tubing may be installed in virtually any type of floor construction. The method of installation varies with the basic structure of the floor. For the two basic types of floor construction, slab on grade and suspended, there are several different variations of installation. The following pages contain detailed examples of different construction techniques. It is the responsibility of the contractor to assure compliance with local building codes.

(A) Wirsbo PEX in a Slab or Overpour

Structural Factors - Minimum cover for tubing is detailed in the local building codes. Generally, a minimum of 1½" of concrete must be poured over the tubing when the slab is exposed to the earth or weather (UBC). When the slab is not exposed to the earth or weather, a ¾" concrete pour over the tubing is generally acceptable (UBC). Other types of slab constructions (e.g., pre-stressed concrete planking or posttensioned concrete slabs) may have different requirements.

See Chapter 9 of the Wirsbo Complete Design Assistance Manual (CDAM) and check local building codes for additional information.

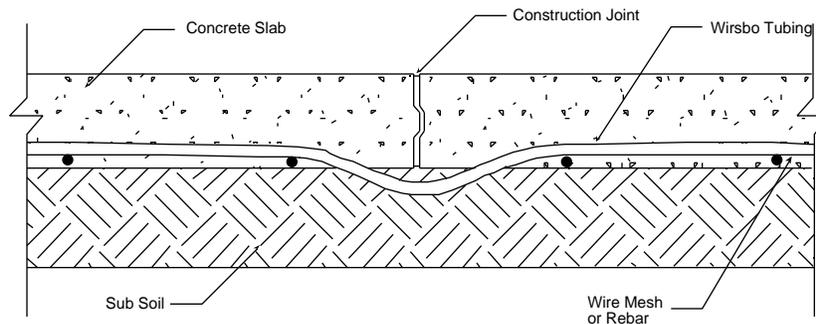
Joints in Concrete - Concrete slabs often require construction joints, control joints or expansion joints. Details for these joints must be specified on the plan. Provisions must be made to control shear forces at the joints and eliminate damage to the tubing.

Construction Joints - Construction joints separate two pours of a slab completed at different times. Because it is difficult to construct a large slab in one pour, a bulkhead is installed to contain sections of the slab until the next phase is poured. It may be convenient to install the tubing in an area just before the slab is poured. That makes it easier to move concrete equipment from

place to place and reduces the chances that the tubing will be damaged during installation. Typically, the tubing is dropped below the control joint. See Figure 1.

Control joints, sometimes called contraction joints, are places where the concrete surface is scored to control cracking and relieve the stress created when concrete shrinks during the curing process. These joints eliminate the random cracks that would otherwise occur. Because control joints are often cut into the slab after it has set, the tubing must be placed deep enough in the slab to avoid the blade used to score the concrete.

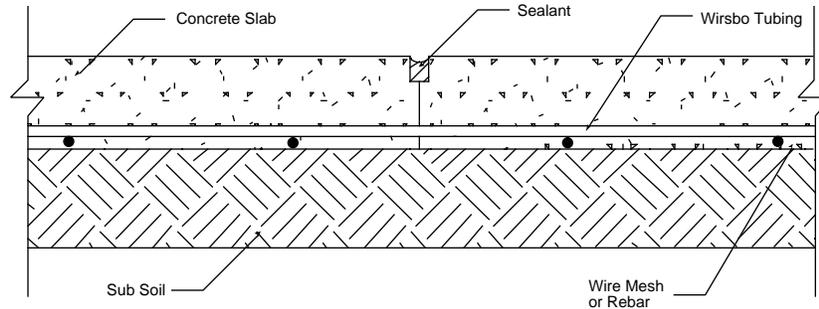
Figure 1: Construction Joint - Two pours completed at different times.



1. Dip tubing under joint below the slab.



Figure 2: Control Joint - Sawed or formed. Allows concrete to crack in a predictable pattern.



1. Tubing must be placed deep enough in the slab to be safe from the control joint (saw blade).
2. Tubing must be secured tightly to prevent it from floating up into the slab.
3. Tubing may be wrapped with insulation or pipe sleeve for 3" on both sides of the control joint.

Expansion Joints – Sometimes called isolation joints, these joints are intended to absorb horizontal movement caused by drying shrinkage and the thermal expansion and contraction of the slab. Radiant heating systems generally reduce the severity of expansion and contraction because they limit the temperature range the slab experiences.

The coefficient of linear expansion for concrete is approximately 0.000055 inch per inch per degree Fahrenheit. This means, roughly, that for every 10°F temperature rise, a 100 foot span of concrete is expected to expand about $\frac{1}{16}$ ".

When foam insulation is used to accommodate minor shear action, care must be taken to prevent floating during the pour. Also, minimum cover must be computed on the basis of the outside surface of the foam.

There are two ways to install PEX tubing in an expansion joint. See Figures 3 and 4.

Figure 3

- 1. Dip tubing below slab into subsoil.

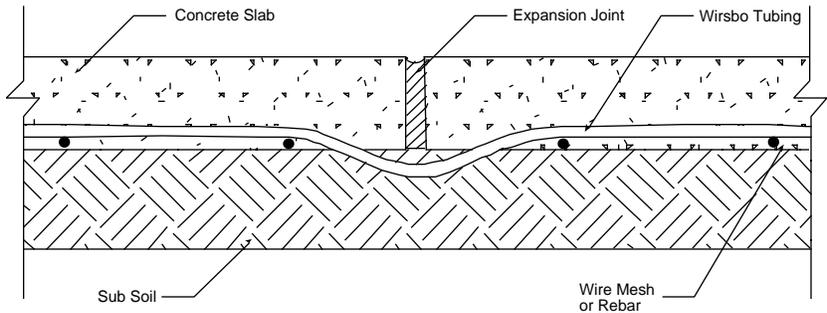
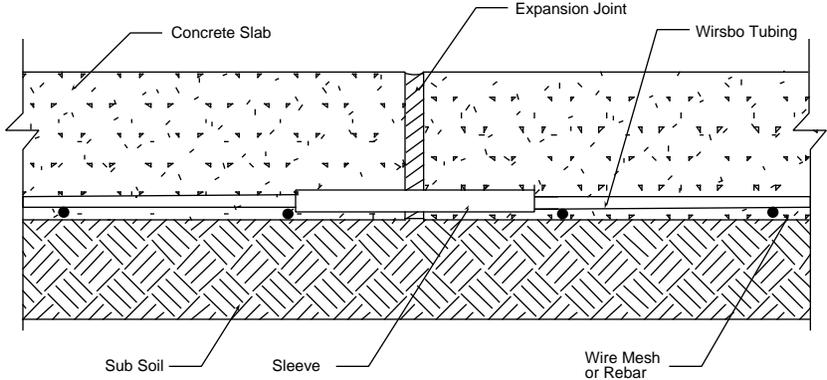


Figure 4



- 1. If the tubing must remain in the slab, wrap the tubing with a pipe sleeve or a larger diameter tubing for 6" on both sides of the expansion joint.

The drawings on pages 48 through pages 57 illustrate five methods of installing Wirsbo PEX in a slab or overpour.

WIRSBO™



METHOD A-1
SLAB ON OR BELOW GRADE - EDGE INSULATION ONLY

7. Apply a suitable concrete mixture over the tubing.

CAUTION: Under slab heat loss may be critical to the performance of this radiant slab. Complete under slab insulation is highly recommended and is essential where high water tables are present, when heat demand is high, when restrictive floor coverings are used, or when the linear feet of perimeter is high in relationship to gross floor area.

1. Lay out the wire mesh or rebar over the base material.

2. Connect one end of the loop to the supply manifold (see page 36).

3. Secure the tubing to the wire mesh or rebar.

4. Tie the tubing to the wire mesh or rebar using Wirsbo wire ties every four feet along straight runs. At the 180° turns, tie the tubing at the top of the arc and once on each side, 12" from the top of the arc (see Figure 1). This will prevent the tubing from dislodging or floating into the pour.

5. Once the complete loop has been installed, connect the end of the loop to the return manifold. Complete the tubing installation.

6. Pressure test the system in accordance with local building codes (see page 74).

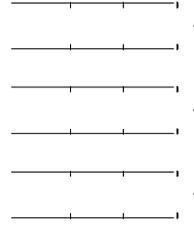


Figure 1



METHOD A-2
SLAB ON OR BELOW GRADE - SINGLE POUR WITH UNDER SLAB AND EDGE INSULATION

1. Lay out the recommended type high density insulation over the base material.
2. Lay out the wire mesh or rebar.
3. Connect one end of the loop to the supply manifold (see page 36).
4. Secure the tubing to the wire mesh or rebar.

NOTE: To speed up installation when using rebar, mark the insulation at the appropriate on center distances or make a space bar using a piece of tube cut to the correct length. When using wire mesh, follow the spacing of the mesh.

5. Tie the tubing to the wire mesh or rebar using Wirsbo wire ties and wire twister. Secure the tubing to the wire mesh or rebar every four feet along straight runs. At the 180° turns, tie the tubing at the top of the arc and once on each side, 12" from the top of the arc (see Figure 2), to prevent it from dislodging or floating into the pour.

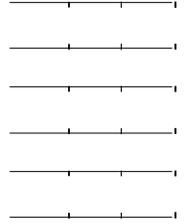


Figure 2



METHOD A-3
SLAB ON OR BELOW GRADE - SINGLE POUR OVER TUBING IN A SANDBED

- 1.** Lay out the wire mesh or rebar over the base material.
- 2.** Connect one end of the loop to the supply manifold (see page 36).
- 3.** Secure the tubing to the wire mesh or rebar.
- 4.** Tie the tubing to the wire mesh or rebar using Wirsbo wire ties and wire twister. Secure the tubing to the wire mesh or rebar every four feet along straight runs. At the 180° turns, tie the tubing at the top of the arc and once on each side, 12" from the top of the arc (see Figure 3), to prevent it from dislodging or floating into the pour.
- 5.** Once the complete loop has been laid out, connect the end of the loop to the return manifold. Complete the tubing installation.
- 6.** Pressure test the system (see page 74) in accordance with local building codes.
- 7.** Apply sand over the tubing.
- 8.** Apply a suitable concrete mixture over the sand.

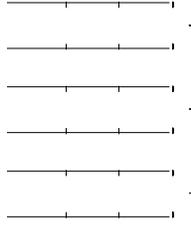


Figure 3



METHOD A-4
POURED FLOOR UNDERLAYMENT ON A SUSPENDED WOOD FLOOR
(REFER TO WIRSBO'S PNEUMATIC STAPLER OPERATION MANUAL)

1. Connect one end of the loop to the supply manifold (see page 36).
2. Make sure the wood stapler head is securely fastened to the stapler and the stapler is loaded with 1 1/4" staples. Staple the tubing to the wood subfloor.

NOTE: To simplify the installation in new construction, frame the wall with double base plates. Then apply concrete mixture up to the top of the lower plate. This allows the upper plate to be used as a nailer.

3. Staple the tubing as necessary along the straight runs to ensure that it will stay in place (additional staples will be added later). At the 180° turns, secure one staple at the top of the arc and two staples, one on each side, 12" below the top of the arc (see Figure 5).

4. Once the complete loop has been laid out, connect the end of the tubing to the return manifold.

5. Attach the walking stick to the stapler and fasten the tubing to the subfloor every two feet or as necessary to prevent it from dislodging or floating into the pour. Complete the tubing installation.
6. Pressure test the system (see page 74) in accordance with local building codes.
7. Apply a suitable concrete mixture over the tubing.

NOTE: The minimum thickness of most poured floor underlayment above the Wirsbo tubing is 3/4". Consult the poured floor underlayment applicator.

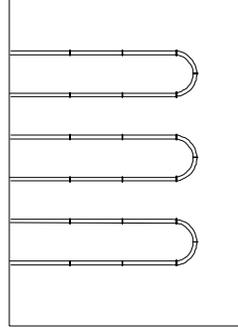


Figure 5

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METHOD A-5
POURED FLOOR UNDERLAYMENT ON A SUSPENDED WOOD FLOOR USING WIRSBO PEX RAILS

- 1.** Lay out Wirsbo rails parallel with floor joists (perpendicular to tubing layout direction). Space the rails 12" from the edge of each wall, and 3' on center thereafter. (See figure 6).
- 2.** Fasten rails to subfloor using 1" wood screws.
- 3.** Connect one end of the loop to the supply manifold (see page 36).
- 4.** Snap the tubing into each rail at the recommended spacing. The tubing will be installed in a single wall serpentine layout pattern (see Figure 6).
- 5.** Once the complete loop has been laid out, connect the end of the tubing to the return manifold.
- 6.** Pressure test the system (see page 74) in accordance with local building codes.
- 7.** Apply a suitable concrete mixture over the tubing.

NOTE: To simplify the installation in new construction, frame the wall with double base plates. Then apply concrete mixture up to the top of the lower plate. This allows the upper plate to be used as a nailer.

NOTE: The minimum thickness of the poured floor underlayment is 1½" when using the rail system. Consult the poured floor underlayment applicator.

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Figure 6

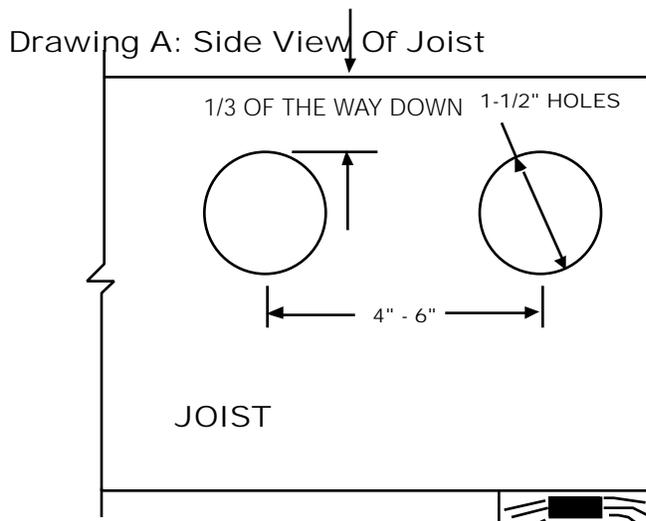


(B) Installing Wirsbo PEX in Suspended Wood Floors
 When installing tubing below the subfloor between floor joists, it will become necessary to loop the tubing from one joist cavity to the other. Loop the tubing below the joist or drill a hole through the floor joist.

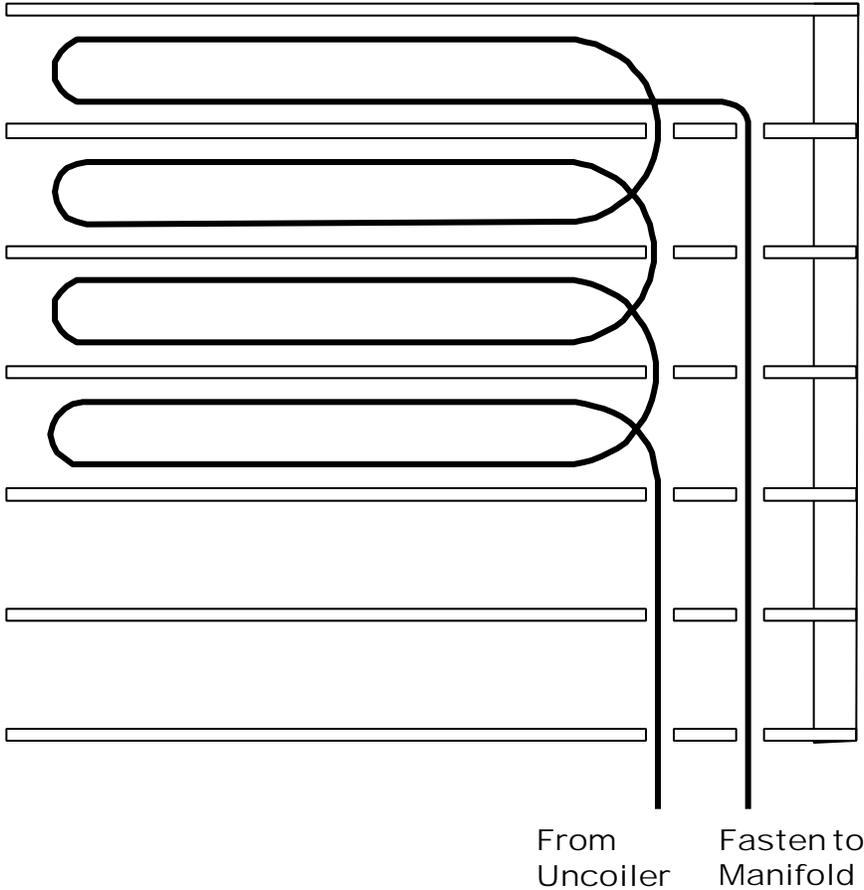
NOTE: Check local codes before drilling through floor joists.

Feeding Tubing Through Floor Joists

1. Drill two 1½" holes in each joist as shown in Drawing A.
2. Feed tubing off the uncoiler through holes farthest from the sill until the last joist bay to be done with that loop is reached.
3. Loop tubing around and back through holes closest to the sill plate. Fasten loose end to the manifold. (see page 36)
4. Starting with the joist bay farthest from the manifold, grab the loop and twist 180°. Then pull the loop the length of the joist bay. Fasten the end of the loop in place or let it hang. Continue to work back toward the manifold. (see Drawing B)
5. Follow the specific instructions for the method of fastening used.



Drawing B: Top View of Joist Installation



The drawings on pages 60 through 67 illustrate four methods of installing Wirsbo PEX in suspended wood floors.

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METHOD B-1
JOIST HEATING WITH WIRSBO ALUMINUM HEAT EMISSION PLATES

- 1.** Follow the instructions for feeding the tubing through the floor joists (See page 58).
- 2.** Snap the hanging loops of tubing into the heat emission plates and staple the plates to the underside of the subfloor. Leave a 1" gap between each plate. Place two staples on each end between the tubing, and two in the center between the tubing.
- 3.** Connect the end of the loop to the return manifold. Complete the tubing installation.
- 4.** Pressure test the system (see page 74) in accordance with local building codes.
- 5.** Install suitable insulation below the plates to limit downward loss.

NOTE: Be sure to use only $\frac{5}{8}$ " staples. Longer staples may pass through the subfloor and floor covering above.

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METHOD B-2
JOIST HEATING USING WIRSBO PEX JOIST HANGERS

1. Follow instructions for feeding the tubing through the floor joists (see page 58).
2. Support the tubing by fastening joist heating hangars below the tubing at 36" intervals. The tubing should be approximately 1" to 2" below the bottom of the subfloor.

NOTE: Fasten the hangars to the joist using a hammer to drive in the sharp ends. If this method does not hold well, use regular framing nails to fasten each end.

3. Affix tubing to the joist heating hangars at the recommended spacing using Wirsbo wire ties.

NOTE: Tubing should be supported high enough in the joist cavity to allow for adequate insulation below.

4. Connect the end of the loop to the return manifold. Complete the tubing installation.
5. Pressure test the system (see page 74) in accordance with local building codes.
6. Install suitable insulation below the plates to limit downward loss.

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METHOD B-3
JOIST HEATING USING WIRSBO PEX CLIP

1. Follow instructions for feeding the tubing through the floor joists (see page 58).
 2. Wirsbo PEX clips are fastened to the bottom of the subfloor in each joist bay. The clips must be 8" on center in 16" joist bays (6" on center in 12" joist bays) and 3' apart.
- NOTE:** The clips should be attached with screws no longer than 3/4".
3. Snap the tubing into the PEX clips. The tubing will hang suspended approximately 1" below the subfloor.
 4. Suitable insulation is then installed in the joist bay about an inch below the tubing leaving roughly a 2" air gap under the subfloor.
 5. Connect the end of the loop to the return manifold. Complete the tubing installation.
 6. Pressure test the system (see page 74) in accordance with local building codes.

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METHOD B-4
JOIST HEATING USING THE WIRSBO STAPLE GUN KIT

1. Follow instructions for feeding the tubing through the floor joists (see page 58).
2. Using the Wirsbo pneumatic staple gun kit for wood or foam installations and two 1/2" staples, staple the tubing to the plywood subfloor approximately every 3'. Be sure that the tubing hangs, resting on the bottom of the staple.
3. Suitable insulation is then installed in the bay, approximately 1" below the tubing, leaving roughly a 2" air gap under the subfloor.
4. Connect the end of the loop to the return manifold. Complete the tubing installation.
5. Pressure test the system (see page 74) in accordance with local building codes.

NOTE: The tubing should not come in contact with the subfloor.

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FIGURE 7

SANDWICH METHOD

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Radiant Floor Installation Handbook

- 1.** Mark the approximate location of the tubing on the subfloor.
- 2.** Starting at the area farthest from the manifold, glue and nail a 1" x 6" furring strip to the subfloor along the exterior wall.
- 3.** Using a heat emission plate as a guide, nail and glue another 1" x 6" furring strip parallel to the first. Be sure to leave a 1" space between furring strips for the groove of the heat emission plate.
- 4.** Staple the heat emission plates to the furring strips on one side of the tubing only (see Figure 7). This will allow the plates to expand as the subfloor or finish flooring is nailed down. Leave a small gap between plates.
- 5.** Connect one end of the loop to the supply manifold (see page 36).
- 6.** Following the tubing layout pattern, snap the tubing into the heat emission plate.
- 7.** Connect the other end of the loop to the return manifold. Complete the tubing installation.
- 8.** Pressure test the system (see page 74) in accordance with local building codes.
- 9.** Apply a suitable construction adhesive to the furring strips where exposed between the heat emission plates.
- 10.** Apply a suitable subfloor or finish flooring over the tubing.
- 11.** Install suitable insulation below the floor to limit downward loss.

NOTE: The Wirsbo stapler system may be used to staple the heat emission plates to the furring strips using $\frac{5}{8}$ " staples.

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RADIANT CEILING
RADIANT CEILING USING WIRSBO ALUMINUM HEAT EMISSION PLATES

1. Install suitable insulation in the ceiling joist cavity to limit heat transfer to floors above.
2. Starting with the area along the highest heat loss wall, secure 1" x 6" wooden furring strips to the ceiling. If the furring strips run parallel to the ceiling joists, backing must be installed.
3. Using a single groove heat emission plate as a guide, secure additional 1" x 6" furring strips parallel to the first strip.
4. Staple the heat emission plates to one side of the furring strips only. This allows the plates to expand as the sheetrock is fastened. Leave a 1" gap between each plate to allow expansion and contraction. Be sure to leave a space where the ceiling and the wall meet for the 180° turns. (See page 72 for information on reducing noise).

5. Following the tubing layout pattern, snap the tubing into the heat emission plates.
6. Connect the end of the loop to the return manifold. Complete the tubing installation.
7. Pressure test the system (see page 74) in accordance with local building codes.
8. Install sheetrock.

NOTE: Care must be taken to avoid puncturing the tubing while installing the sheetrock. Mark safe areas for nailing or screwing on the walls or adjacent sheetrock panels prior to installing the sheetrock.

NOTE: The system should not be used to accelerate the drying time of the joint compound or sprayed ceilings. Allow adequate drying time prior to system operation.

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Avoiding Noise in Aluminum Heat Emission Plate Installations

When aluminum plates are used in radiant floor/ceiling heating systems, conditions can exist that cause a ticking sound during operation. The sound is a result of the thermal expansion of PEX tubing and the stresses placed on the aluminum plates from thermal expansion.

Wirsbo PEX tubing products expand at a rate of 1.1" per 100' of tubing per 10°F temperature rise. Aluminum plate radiant floor systems often operate around 160°F; the total temperature rise from the time of installation is around 100°F. Expansion occurs because of the significant temperature rise. If the expansion is not accommodated, some noise in the system is possible. This noise is caused when the tubing expands at the 90° bends and expansion continues until the tubing meets the far side of the hole drilled in the joist. Once the tubing has hit the far end of the hole, the added stress transmits back into the plate.

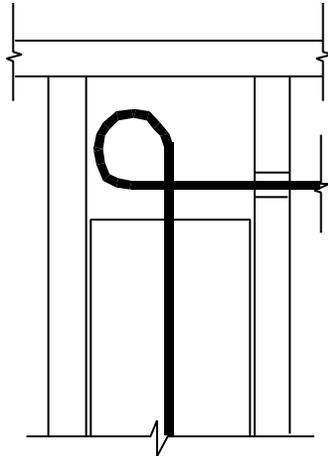
There are several easy ways to reduce or eliminate noise.

1. Drill the holes through the joists large enough so the tubing does not hit the back side of the hole when it expands. Check local building codes for information on drilling through floor joists.
2. Use open truss span joists so that drilling holes in the joists is unnecessary.

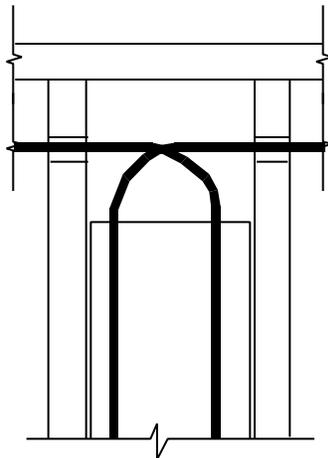
NOTE: Wirsbo does not recommend installing radiant floor/ceiling heat in composite joists that have an unconditioned space on one side. Under certain conditions this may cause excessive movement of the floor/ceiling.

3. Install shorter runs so more loops are available to accommodate expansion.
4. The higher the water temperature the more the tubing expands, so always use the lowest water temperature required to provide adequate heat.
5. Install expansion loops for longer runs.

Single Plate Expansion Loop



Double Plate Expansion Loop





SECTION 9: SYSTEM START-UP

Pressure Testing the System

Before the tubing is covered, the system must be pressure tested. Air or water may be used as a test medium. Each manifold may be tested separately or, depending upon the construction schedule, the entire system may be tested at one time. The following is a recommended procedure for pressure testing.

1. Be sure all connections are properly sealed using the supplied gaskets.
2. On end cap with vent, remove air vent and drain cock and replace with proper sized plugs.
3. Install the Wirsbo Pressure Test Kit (*E6122000*) or suitable pressure test kit onto the system.
4. Pressurize the system with water or air to 60 psi. The system should maintain the 60 psi for a minimum of 24 hours.
5. Depending on the circumstances of the installation, the PEX tubing may expand under pressure and require a one time addition of water or air to offset the tubing expansion.

Maintain pressure on the system during the slab pour or when finished flooring is being installed. This simplifies leak detection if the tubing is damaged during the pour or installation.

NOTE: The manifold internal valving is made up of flow valves that are not designed to hold high pressure. Pressure testing against these valves may result in some leakage and may compromise the test. Use appropriate end caps or plugs to further seal the system, as necessary.

The testing procedure detailed above is a recommendation from the Wirsbo Company. Check local building codes for compliance or additional test requirements.

Filling the System with Water

Once the entire system has been properly pressure tested, use

the following procedure to fill it with water:

1. Connect the system (at a fill point) to a water source.
2. Open all valves in the system. Be sure that all manual valves on the return manifolds are fully open by turning them counter-clockwise.
3. Open the in-line fill valve to begin filling the system with water. As the system fills and pressure builds, open the vent at the highest point available.

Purging Air from the System

In order for the system to operate properly, all the air must be purged from the system. There are several methods to purge air from the system. One manifold at a time simplifies the process.

For Valved Manifold Assemblies

1. Close all the isolation valves for each supply and return manifold.
2. One manifold at a time, attach one end of a service hose (female garden hose connector) directly to the boiler drain on the end cap and place the other end into a pail of water. Make sure the boiler drain is completely open and the hose is completely submerged in the bucket.
3. Close each manifold balancing valve (turn clockwise).
4. Start the circulator that services that manifold.

NOTE: Domestic water pressure or other means may be necessary to purge trapped air from the system.

5. Open the isolation valve to the supply manifold.
6. Open one manifold balancing valve. Allow water to circulate until no air is discharged into the bucket. Close all balancing valves.
7. Repeat this procedure for each balancing valve (each loop).
8. When all the loops on the manifold are completely purged, close the isolation valve to the supply manifold.
9. Repeat the process for each manifold.



For Valveless Manifold Assemblies

1. Close all the isolation valves for each supply and return manifold.
2. One manifold at a time, attach one end of a service hose (female garden hose connector) directly to the boiler drain and place the other end into a pail of water. Make sure the boiler drain is completely open and the hose is completely submerged in the bucket.
3. Start the circulator that services that manifold.

NOTE: Domestic water pressure or other means may be necessary to purge entrained air from system.

4. Open the isolation valve to the supply manifold. Allow water to circulate until no air is discharged into the bucket.
5. Close the isolation valve to the supply manifold.
6. Repeat the process for each manifold.

Initial Balancing of Manifold Loops

When it is not possible to design your system using equal loop lengths (loop lengths within three percent of each other), then the system must be balanced in order to ensure adequate flow to each loop on a manifold. Wirsbo recommends that the systems be designed with telestats controlling the on/off flow for each loop, in response to the appropriate zone thermostat's call for heat. In addition, zone valves can be effectively used to control the flow to an entire manifold in response to a call for heat from the zone thermostat.

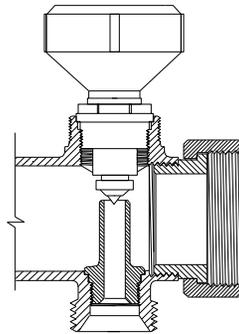
NOTE: The balance setting is the number of half turns from closed.

Initial Flow Balancing Calculations for Wirsbo Manifolds (A2513220), (A2533220) and (A2553220).

$$\frac{\text{Length of tubing in loop to be balanced} \times 4}{\text{Length of the longest loop on the manifold}} = \text{Balance Setting}$$

The balance valve on a Wirsbo manifold is located on the return manifold under the plastic protective cap. To turn the valve:

1. Remove the protective plastic cap and turn it upside down. Place the cap over the operating pin and put the protruding tip into the slot.
2. Close the valve by turning it clockwise until it stops, then turn the cap counter-clockwise the calculated number of turns.



Fine Balancing of the Manifold Loops

After initial balancing, and after the system has been stabilized under a heat load, it may still be necessary to correct the output of an erratic loop.

Check the differential temperature between the supply and return of the loop to be adjusted.

A large temperature differential indicates a large heat loss and/or insufficient flow rate. To correct this situation, to the extent possible through balancing, open the balance valve an additional 50 percent of its present setting.

A small differential temperature indicates relatively low heat loss and/or higher than necessary flow rate. This could decrease the flow rate to a longer loop on the manifold. To correct this situation, to the extent possible through balancing, close the balancing valve to 50 percent of its present setting.



SECTION 10: ELECTRICAL CONTROLS

Mounting the Thermostats

Each zone is controlled by a thermostat. The thermostat should be located:

1. In an area that experiences an average ambient temperature of the zone. Never locate a thermostat on an exterior wall or in close proximity to an exterior door or window. Avoid locations that are exposed to direct sunlight, abnormal drafts or other factors that could result in erroneous temperature readings.
2. The thermostat should be mounted 60" above the finished floor.

The Wirsbo Zone Control Module

The Wirsbo Zone Control Module (A2553220) is a printed circuit control and diagnostic device that is designed to be used with Wirsbo thermostats and four wire telestats or zone valves. The module provides: connection to the power supply transformer, the interconnections between the individual thermostats and their respective telestats or zone valves, and the buss connection between all end switches. The control module is available in both three and four zone configurations and may be ganged together with other modules to provide connections for up to 10 zones at any one location. The modules are internally fused for protection from overcurrent or direct shorts at the telestats and thermostats.

The end switch circuit is not protected from overcurrent or direct shorts and should have a 2 amp (maximum) fuse installed.

Diagnostic Features

The Wirsbo Control Modules are equipped with light emitting diodes (LEDs) to indicate various functions of control. A green LED indicates that power is supplied to the module. Yellow LEDs indicate which zone(s) are calling for heat. Red LEDs indicate which end switches are closed and signalling the boiler or circulator pump to engage.

Compatible Components

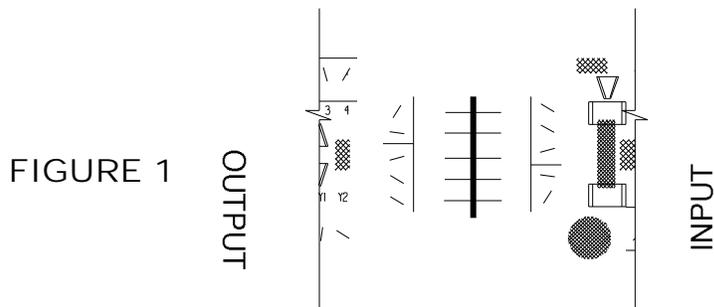
The Control Modules are designed to be used with DT10 thermostats (A3030011), DT20 thermostat (A3030021), T86H thermostats (A3010086), 4 wire motorized valve actuators (A3020522) and 4 wire zone valves (A3070526). The control module is also designed to be wired with Wirsbo's weather responsive reset controls, the ProMix™ 101 (A3091000 & A3091250) and the DuoMix™ 201 (A3030005).

Mounting Instructions

For best results, mount the control module in a convenient location above the telestats using either the double stick tape (provided) or the mounting holes and suitable hardware. Ensure that the module will not be exposed to moisture or physical damage.

Connecting Modules Together

The modules can be connected together in series by use of a module jumper (provided). This jumper must be fastened securely within the input and output blocks of the corresponding modules (see Figure 1).



Wiring Instructions

Strip wire of insulation to a length of not more than ¼". Ensure that the wire is fully seated in the terminal and that it does not short to adjacent wires. Twist loose stranded wire tightly and ensure that no loose strands are present. Tighten the terminal nut securely. Each terminal is equipped with a jamb plate for accommodating stranded wire. If the terminal must be reconnected, it may be necessary to push the jamb plate back into place with a suitable round punch prior to reinserting the wires.



Combining Multiple Telestats or Zone Valves

Multiple telestats or zone valves may be ganged together in the same telestat block to be controlled by one thermostat. If wires from telestat or zone valves become too bulky to fit in the wiring block when ganged together, junction the wires prior to connecting them to the block.

Fuse Replacement

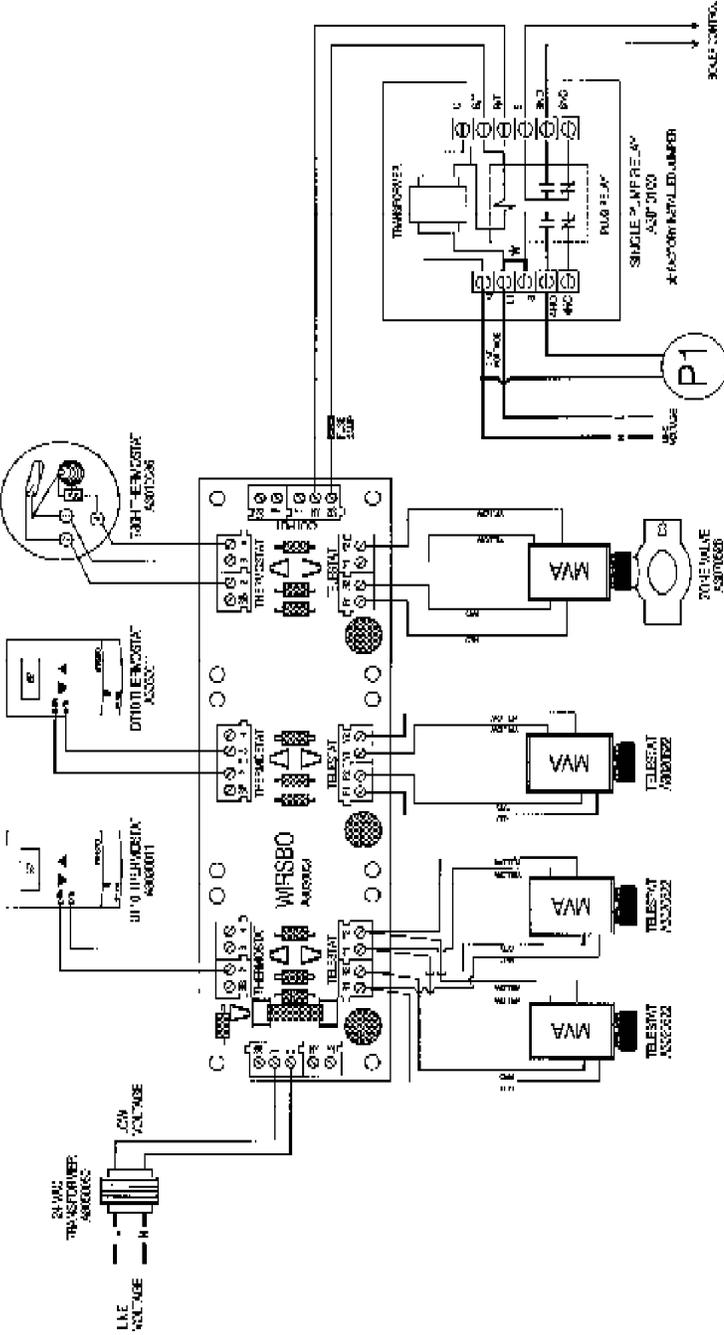
Replace the fuse as necessary with one of the following:

- 2 amp fuse for 50VA transformer
- 3 amp fuse for 75VA transformer
- 4 amp fuse for 100VA transformer (maximum)

Wiring Schematic

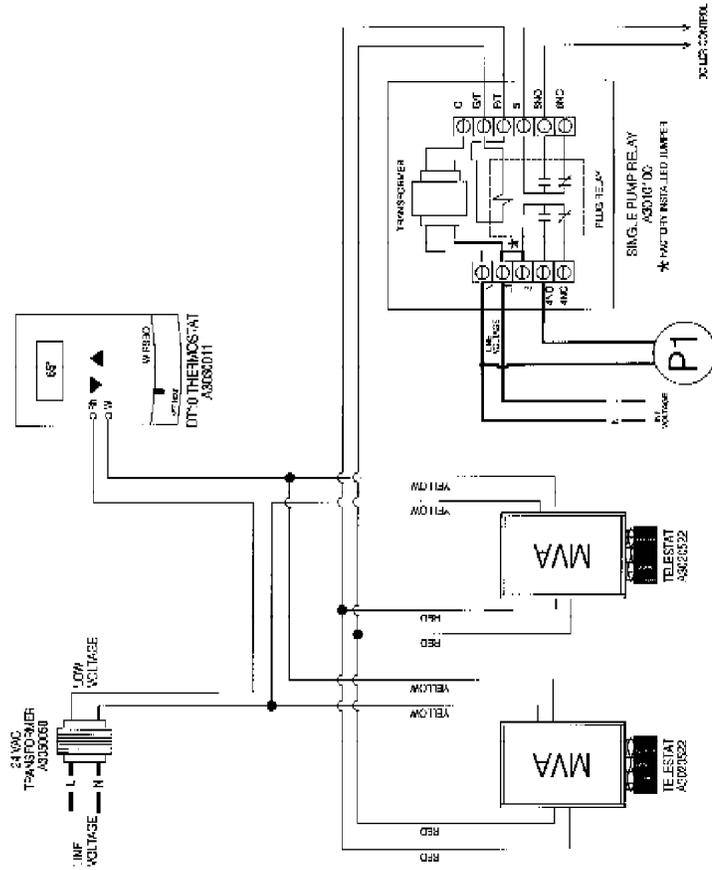
The following schematics provide detailed wiring instructions for common control strategies. Refer to the Complete Design Assistance Manual (CDAM), Chapter 12, for more wiring schematics and information.

SCHEMATIC #1
WIRING DETAIL FOR WIRSBO ZONE CONTROL MODULE, DT10, T86H, 4 WIRE MVA AND
ZONE VALVES

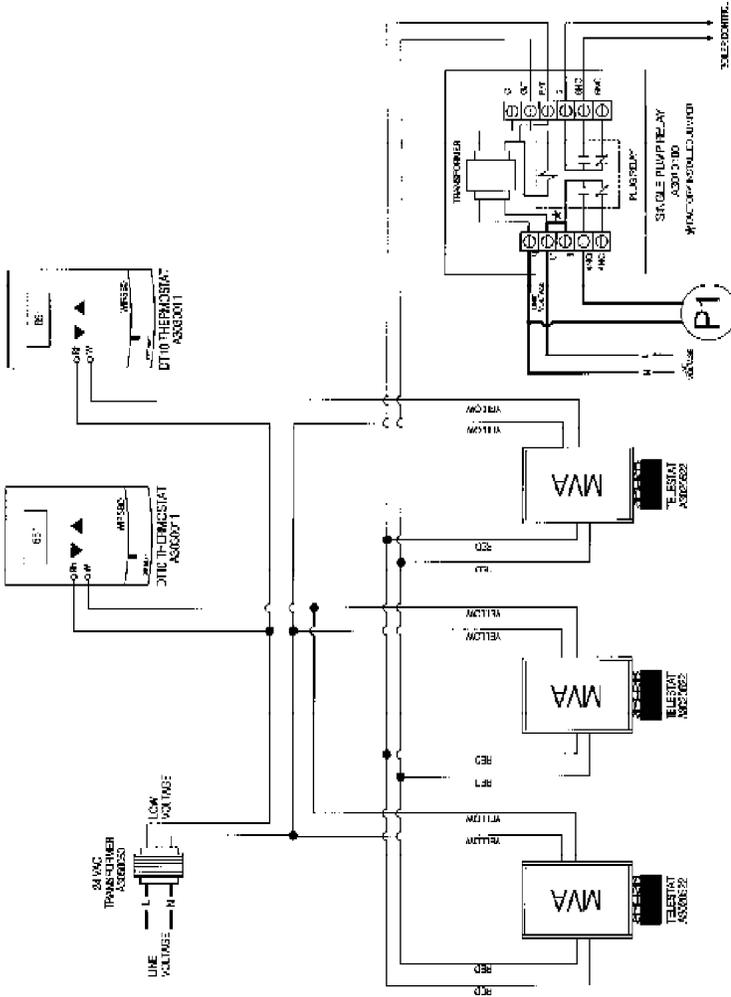




SCHEMATIC #2
WIRING DETAIL FOR WIRSBO DT10, 4 WIRE MVA AND EXTERNAL RELAY

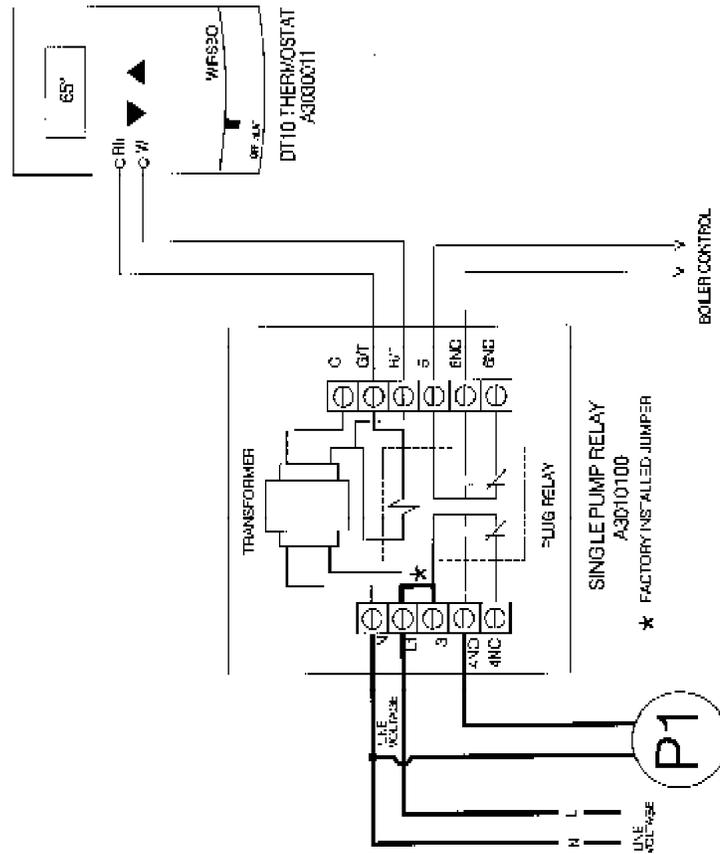


SCHEMATIC #3
WIRING DETAIL FOR MULTIPLE WIRSBO DT10'S, 4 WIRE MVA AND EXTERNAL RELAY

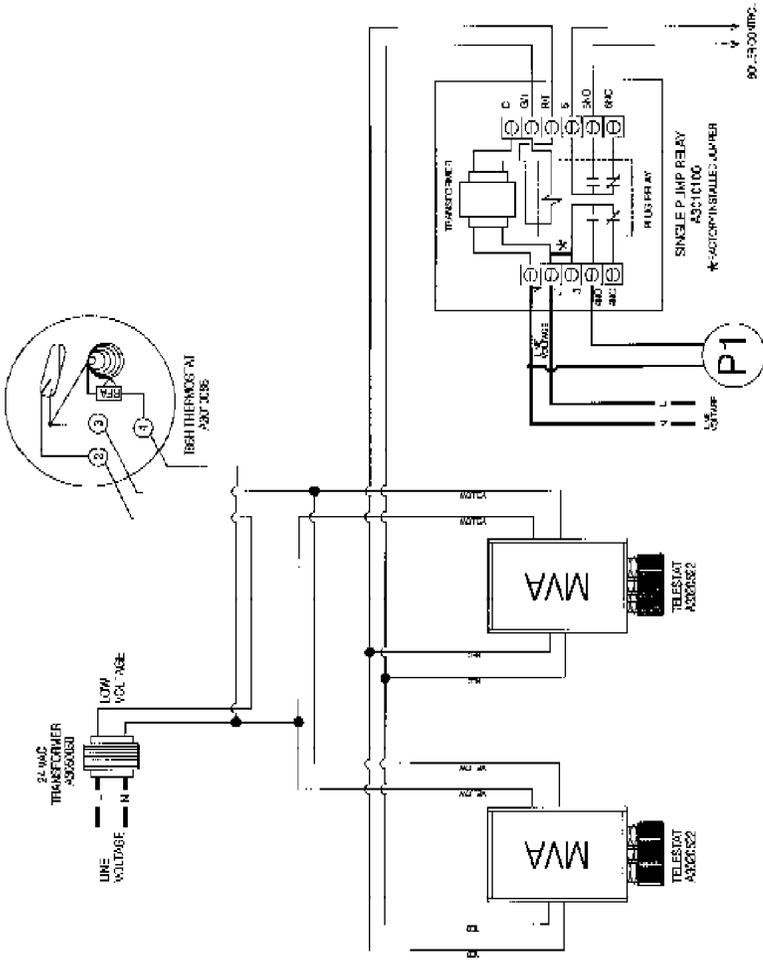




SCHEMATIC #4
WIRING DETAIL FOR WIRSBO DT10 AND EXTERNAL RELAY

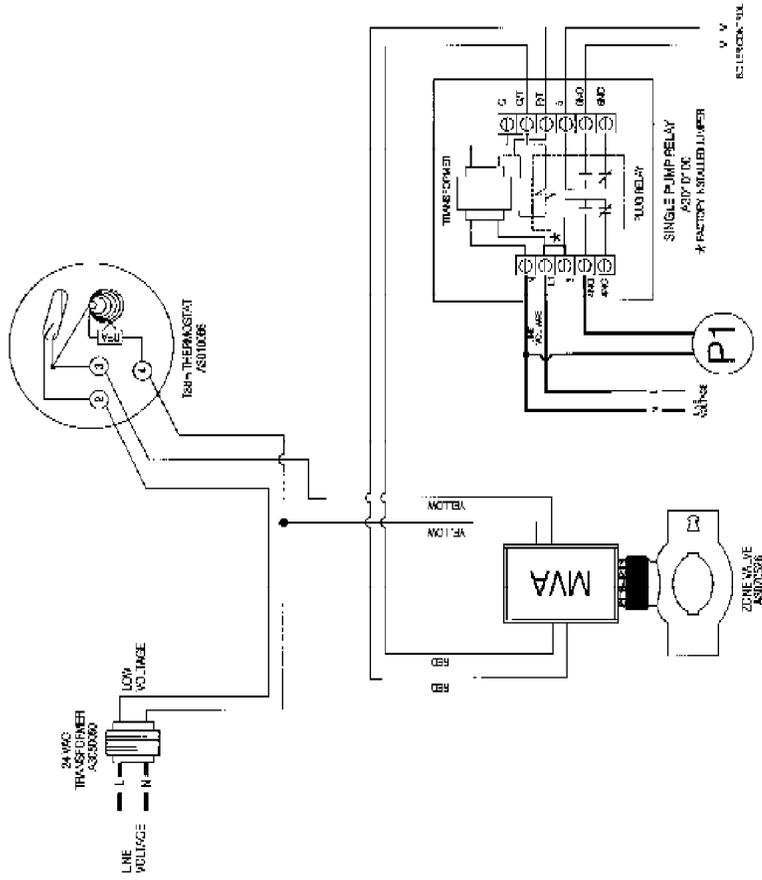


SCHEMATIC #5
WIRING DETAIL FOR WIRSBO T86H, 4 WIRE MVA AND EXTERNAL RELAY





SCHEMATIC #6
WIRING DETAIL FOR WIRSBO T86H, 4 WIRE ZONE VALVE AND EXTERNAL RELAY



**TYPICAL DATA FOR DIFFERENT KINDS OF PROJECTS
(not to be used for system design)**

Type of project	Industrial/ Commercial	Snow & Ice Melting	Warehouse	Car Wash	Residential
Tubing Size	1/2", 5/8", 3/4"	5/8", 3/4"	5/8", 3/4"	5/8"	3/8", 1/2"
Loop length, ft.		200 - 500	300-500	200-250	200-333
Temperature drop, °F	20	25	20	25	10-20
Heat Output BTU/h*sq. ft.	12-24	80-150	7-17	50-90	17-42
Control	Wirsbo	set point	Wirsbo	Wirsbo	Wirsbo
Center distance, in.	12-18	6-10	18-24	10	6-12
Room temp, °F	60-70	30	45-60	40-55	65-72
Water temp, °F	85-105	95-130	70-90	100-130	95-165
Surface temp, °F	~75	~38	~70	~65	75-87
Flow/loop, gpm	~1	~2	~0.7	~1.5	~0.7
Pressure head, ft.	15-30	15-40	10-30	15-40	5-20

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RADIPEX™ SYSTEMS

Wirsbo RADIPEX™ is a baseboard and radiator supply system that features Wirsbo hePEX™plus tubing. The RADIPEX™ system is less expensive and easier to install than copper piping. Some contractors report cutting labor in half by using RADIPEX™ instead of copper.

RADIPEX™ is ideal for use with fin tube baseboard, unit heaters, cast iron radiators and panel type radiators.

This section of the Radiant Heating Installation Handbook is intended to educate contractors, architects, engineers and HVAC officials with the products and techniques used to install a RADIPEX™ system.

Codes

Since Wirsbo hePEX™plus is used in the RADIPEX™ system, all Wirsbo product codes listed on page 4 apply. In addition, Wirsbo hePEX™plus and RADIPEX™ heating products are approved for use by ICBO. See ICBO Research Report No. 5143 for allowable values or conditions of use concerning material presented in this document.

Working with hePEX™plus

See Section 3: Working with PEX for detailed guidelines to be followed when using hePEX™plus tubing.

Joints and Connections

The RADIPEX™ system uses Wirsbo QS20 compression and ProPEX® fittings. See page 18 for instructions on how to properly use Wirsbo QS20 compression fittings and page 23 for installing ProPEX® Fittings. The fittings and components specific to the RADIPEX™ system are detailed on the following pages.

SIZING FOR RADPEX® SYSTEM

Maximum Length of hePEX™ plus Using Typical Small Residential Circulation (1/25 HP Circulator)		
180°F Supply Water 20°F Differential Temperature	With (see below) feet of basebd. installed	Max. length of hePEX tubing (feet)
10000	17	Use no more than (see below) feet 1/2" 391
20000	33	Use no more than (see below) feet 5/8" 271
30000	50	Use no more than (see below) feet 5/8" 106
40000	67	Use no more than (see below) feet 5/8" 42
50000	83	Use no more than (see below) feet 5/8" 12
60000	100	

Assumptions: 600
Btu/h per linear
foot at 180°F.
10% friction loss
for additional
components
included in chart
calculations

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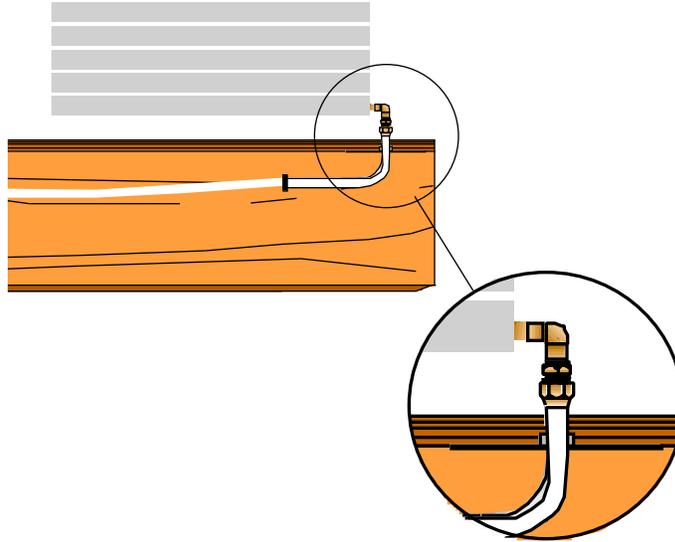
see below

see below

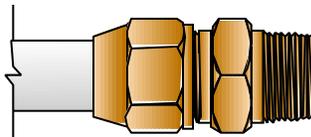


Using Drop Ear Bend Support

Drop ear bend supports are available for use with ½" Wirsbo hePEX™plus in order to make right angle exits from the floor.



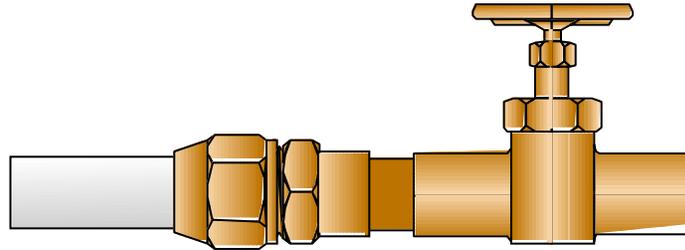
Wirsbo hePEX™plus should not be placed in direct contact with copper pipe or copper fittings. Use Wirsbo transition fittings to connect Wirsbo hePEX™plus to copper pipe, copper fittings, or to dry seal (NPT) pipe threads.



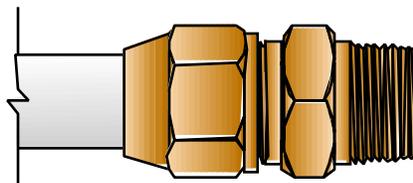
Use Wirsbo brass adapters to connect Wirsbo hePEX™plus to copper tubing.

DO NOT use copper adapters to connect Wirsbo hePEX™plus tubing to copper pipe.

Use Wirsbo fitting adapters to connect Wirsbo hePEX™plus to copper tubing.

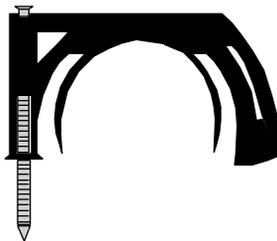


Use conversion nipples to connect Wirsbo hePEX™plus to NPT pipe or fittings



Tubing Supports

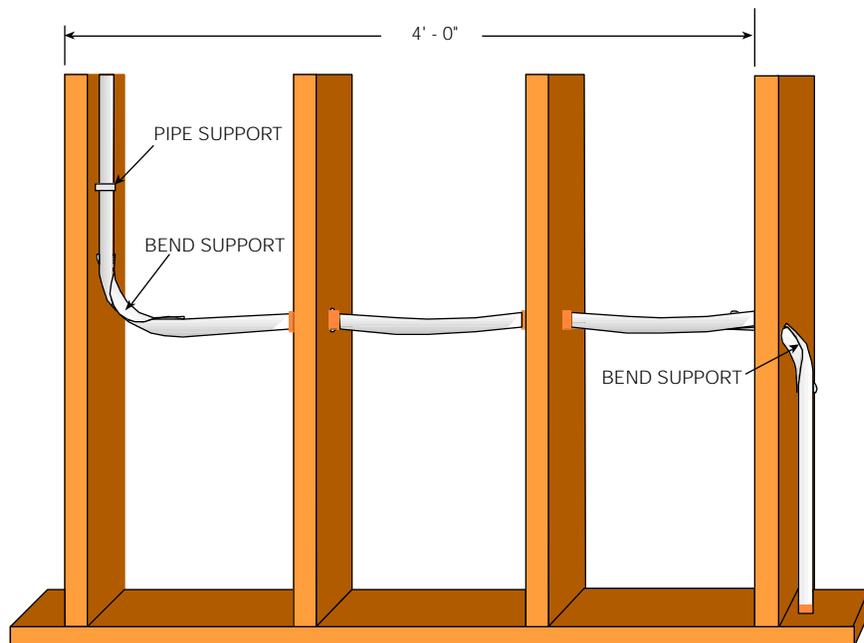
1. Plastic pipe supports are recommended, however, metal pipe supports designed for use with plastic tubing may be used.



2. Do not use supports that will damage the pipe. Inspect metal supports for sharp edges.
3. The linear expansion rate for hePEX™plus is approximately 1.1" per 10°F temperature change for each 100' of tubing.



4. When installing runs of tubing, allow $\frac{1}{8}$ " to $\frac{3}{16}$ " of slack per foot of run to accommodate thermal expansion. Tubing should be allowed to dip slightly between supports. Do not pull tubing tight during installation.
5. Do not rigidly anchor hePEX™plus tubing with pipe supports. Allow freedom of movement to expand and contract.
6. Allow adequate clearance between hePEX™plus tubing and the structure (bored holes or sleeves) to allow freedom of movement due to thermal expansion and contraction.



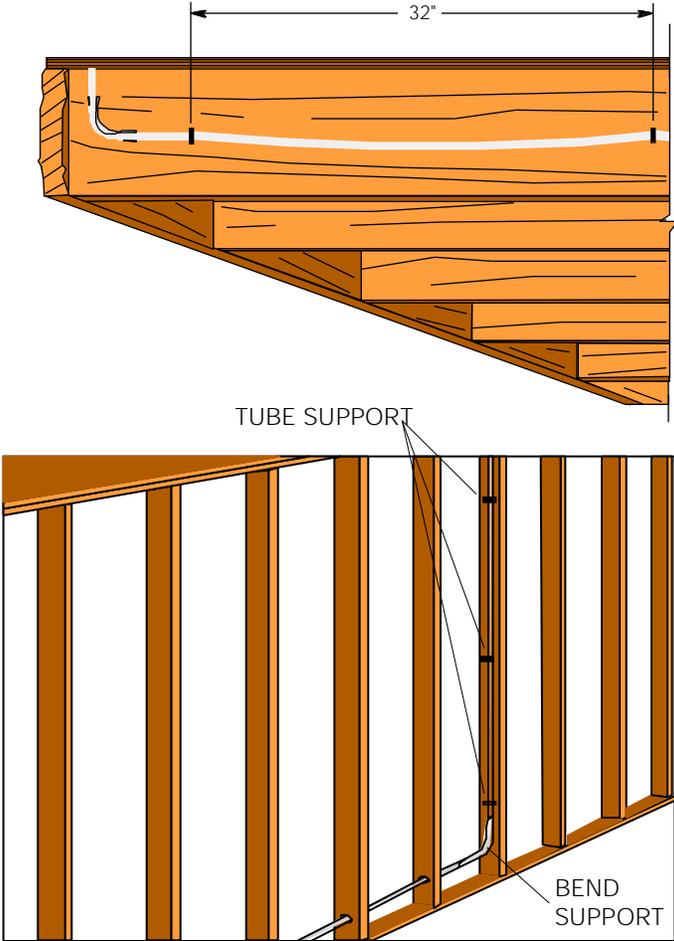
Allow $\frac{1}{8}$ " to $\frac{3}{16}$ " of slack per foot of hePEX pipe.
($4' \times \frac{3}{16}" = \frac{3}{4}"$ of slack.)

Tubing Support Spacing

Wirsbo hePEX™plus must be anchored securely enough to support the tubing, yet loose enough to allow the tube some play back and forth as it expands and contracts.

- 1. Along horizontal runs, install supports every 32". If horizontal runs are continuously supported, tube supports may be placed at 6' intervals.
- 2. Along vertical runs, install supports every 4' to 5'. At each floor and a mid-story guide.

DO NOT install Wirsbo hePEX™plus within 6" of any gas appliance vents or within 12" of any recessed light fixture.



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For more detailed information about radiant floor heating systems including installation methods, wiring diagrams, control strategies and product information, consult the Wirsbo Complete Design Assistance Manual (CDAM).

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