Information Kit

Table Of Contents

Tubing Quality Comparison

Feature	Henco Pex-Al-Pex From Radiant Outfitters	Competitors Pex-Al-Pex	Regular Pex
Does it Have an Oxygen Barrier?	YES	YES	sometimes
Is the Oxygen Barrier 100%	YES	YES	no
Is the Oxygen Barrier Layer Protected	YES	YES	sometimes
Highest Temp. & Pressure Ratings	YES 203°F @ 145 PSI	no 180°F @ 125 PSI	no 180°F @ 100 PSI
Easy to Layout	YES	YES	no
Works well with Heat Transfer Pans	YES	YES	no
Approved for Warmboard®	YES	sometimes	almost never
Butt Welded Aluminum Sleeve	YES	no	N/A
Uniform Pex Thickness	YES	no	YES
Less Fasteners Needed	YES	YES	no
Coefficient of Linear Thermal Expansion Similar to Copper	YES	YES	no
Best Heat Transfer	YES	YES	no
Stays Where you Bent it	YES	YES	no
NOT Sold by Chain Stores	YES	YES	no
NOT Sold on Internet	YES	no	no
MANUFACTURES Name on Tubing	YES	no	sometimes
Made on Latest Technology Equipment	YES	no	almost never
Utilizes C-Method of Crosslinking Which is the Strongest Method	YES	almost never	almost never
Country of Origin Printed on Tubing	YES	almost never	sometimes

Clear Winner is Henco Pex-Al-Pex From Radiant Outfitters

MADE IN BELGIUM

BUTT WELD VERSES OVERLAP WELD

(Related to the aluminum sleeve)

There are two options for welding the aluminum sleeve found in Pex-Al-Pex. This weld is very important, as the seam and the weld runs the entire legnth of the tubing.

Butt weld (method Henco chooses) -

- Does not have aluminum fighting itself through expansion and contraction during the heating process.
- Stronger weld
- Extruded on the latest technology equipment
- Does NOT affect the thickness (or the uniformity) of the inner or outer layer of Pex.

Henco's butt welded Pex –Al – Pex

Overlap weld -

- Has aluminum fighting against aluminum at the overlap weld as it expands and contracts with temperature changes.
- Overlap welds have less strength.
- Extruded on old technology extruders.
- Creates thinner Pex layers at the weld area, usually on both the inside and outer layers.

Currently, Henco is the only Pex-Al-Pex tubing available in America with the butt weld!

INSULATION AND VAPOR BARRIER INFORMATION

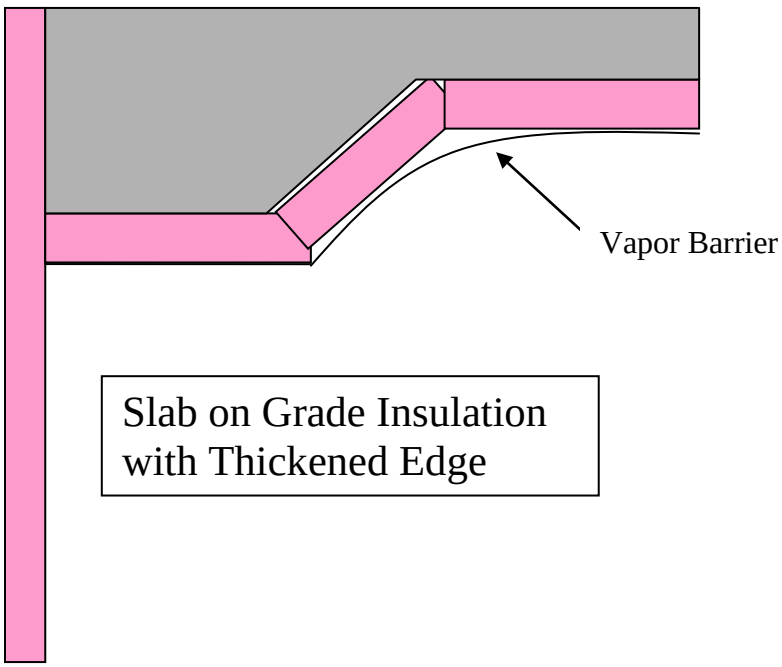
Please keep a few laws of physics in mind when using radiant floor heat.

1. Heat DOES NOT rise! Hot air rises, radiant heat travels in *all* directions.
2. Heat seeks cold and tries to neutralize it.

When dealing with concrete slabs you need to consider perimeter insulation vertically installed and horizontal insulation under the slab. This is done to stop the heat from going directions that are not of value and therefore creating a less efficient heating system.

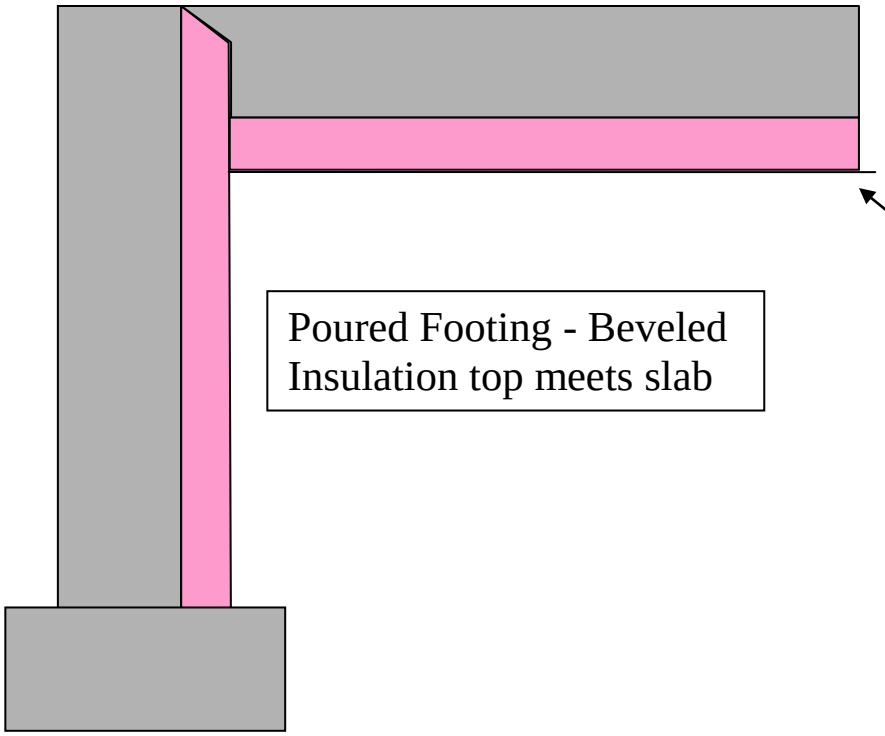
PERIMETER INSULATION – This needs to be 2'' thick with a minimum R-value of 10. The insulation needs to be installed along the edge of the concrete and is usually put in as part of the forms before the concrete is poured. In northern climates it should go down a minimum of 3 feet from the top of slab. Some local codes may require it to go deeper.

The diagrams below are NOT to scale.

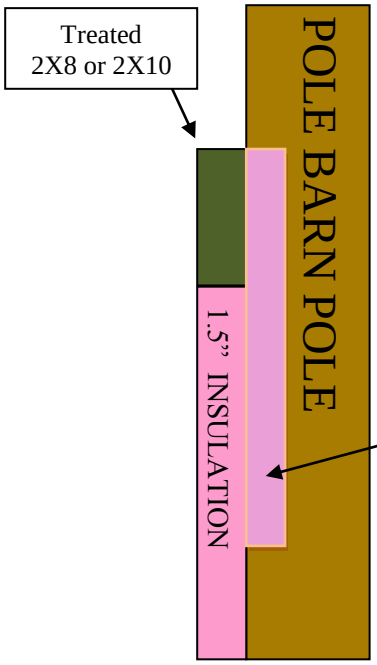


Slab on Grade Insulation with Thickened Edge

Perimeter Diagrams Continued



Poured Footing - Beveled
Insulation top meets slab



POLE BARNS

Insulation is between the poles.(Do not cut poles)

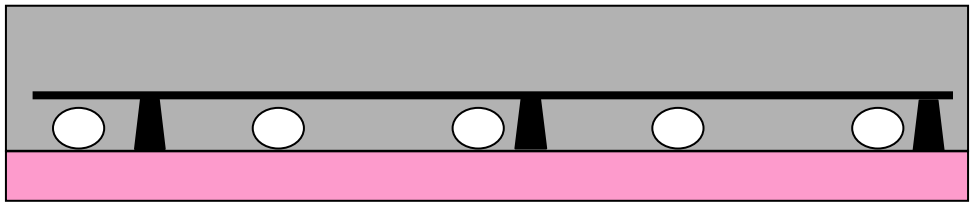
HORIZONTAL INSULATION – there are several things to consider:

- **Vapor barrier** is a must under all slabs and should be installed under all horizontal insulation.
- **When to insulate under slabs**:
  - When the project is 2,000 sq. ft. or smaller always insulate.
  - If the project is larger than 2,000 sq. ft. than insulate the whole area if ground water is a concern or if you want to maximize efficiency. If ground water levels and absolute maximum efficiency are not a concern, you can consider only putting horizontal insulation on the first 8-16 feet in from the outer walls.
- **What type of insulation** – a closed cell polystyrene with a thickness of 1" to 2". These are usually sold in 4x8 blue or pink or gold sheets.
- **Do I need to tape the insulation seams?** – Due to the vapor barrier below, taping in not needed.
- **Are most bubble foil bubble insulation products a good horizontal insulation?** – NO! This product has been proven to not give good r-values under slabs.
- **What about those insulated tarps and other products?** – We are somewhat leery of these products, but have not heard any reports of them not working.
- **Density of the insulation** – When buying insulation, ask the sales person to recommend a density for your particular application.

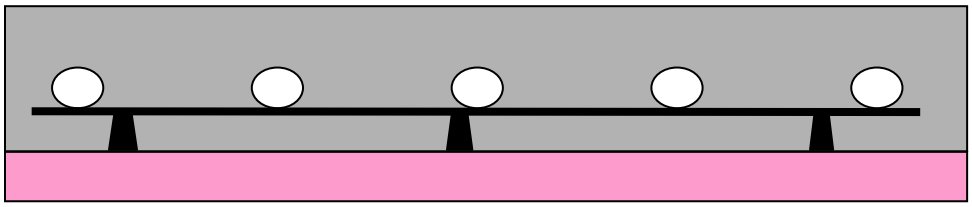
LOCATION OF TUBING IN CONCRETE

There are three locations to consider:

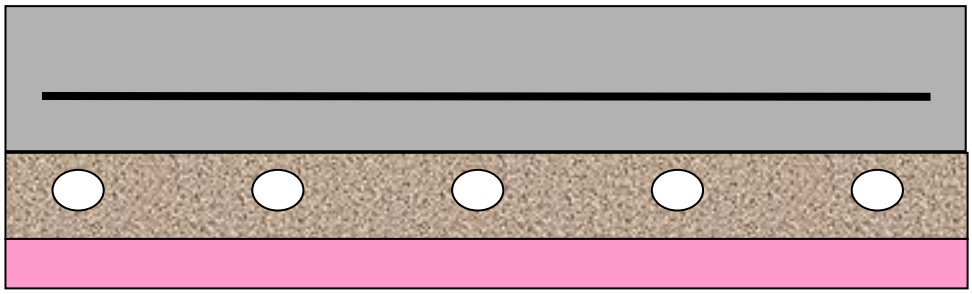
- At the ***bottom*** of the concrete with the re-rod above it. The tubing is attached to the insulation with plastic staples or screw clips. **This is our preferred location**. We feel the tubing is more protected from damage during the pour and it is farther away from future drills, nails and screws that may penetrate the slab. Yes it will take a little longer to feel heat at the surface when you first "fire" the floor up, but that is a minor point. Keep in mind, when tubing is located in the *middle* of slab it still heats downward anyway.



- Another common tubing location is in the ***middle*** of the concrete attached to the re-rod. This is a matter of preference and the tools you own for fastening. This is our second choice for location. Please keep in mind that in shops there needs to be a minimum of 1.5" of concrete above the tubing and for homes a minimum of ¾".



- Another option for tubing placement is ***below*** the concrete in a bed of sand. Some people choose this method for fear of the tubing breaking with the concrete, or for load management applications (storage heating). When tubing is placed in the sand, the tubing is not directly in the concrete so cracks and shifts of concrete give no threats. Normally, cracks in concrete are not a threat to tubing regardless of placement. We feel *CAUTION* should be used when using sand. Sand has been known to cause a lack of heat transfer to the slab above. The thicker the sand bed used, the more likely this problem is. Another potential threat when using sand is that the construction crew forgets there is tubing (because it is buried in sand) and they damage the tubing (drive a stake through, etc). An *advantage* of adding a little sand above the vapor barrier and insulation is that it DOES make the troweling of the concrete more normal (it is similar to not having a vapor barrier).



LIGHTWEIGHT CONCRETE RECIPE

(Your ready-mix plant may already have a recipe)

An alternative to gypsum based underlayment is lightweight concrete. Lightweight concrete can be mixed by local concrete suppliers and is poured, leveled, and troweled in the same manner as standard concrete.

Gypsom-Based Underlayments	Lightweight Concrete
Weight 14.4 lbs per square foot at 1.5 inches thickness.	Weight 12.5 – 14 lbs per square foot at 1.5 inches thickness.
Must be installed by a certified professional.	Can be installed by any concrete professional.
Compression strength 1500-2500 psi.	Compression strength 3000 psi.
Not designed to be used as a wear surface. It must be covered.	Can be used as a wear surface. Does not need to be covered.
Can be seriously damaged by prolonged exposure to water.	Very resistant to moisture damage.
Self-leveling – can be installed very quickly.	Needs to be screeded and troweled.
Thermal conductivity is less than standard concrete.	Has a higher conductivity than gypsum but less than standard concrete.

Recipe for lightweight concrete[1]

Portland cement (94 lb. Bags)	5.5 Bags
Sand	1160 pounds
Water	37 gallons
Norlite lightweight aggregate (3/8”)	900 pounds
Hycol (water reducing agent)	15.5 ounces
Daravair (air entraining agent)	4.0 ounces
WRDA-19 (superplasticizer)	51.7 ounces
Fiber mesh	1.5 pounds

This will make 1 cubic yard, which will cover 210 square feet of floor when poured 1.5” thick.

[1] *Modern Hydronic Heating* by John Siegenthaler, PE; Delmar Publications, 1995

WHY DOES TUBING NEED AN OXYGEN BARRIER?

- In short, oxygen in the boiler fluid is an enemy to the boiler and pumps. Oxygen + Metal + Fluid = Rust
- It is a fact that Pex that *does not* have an oxygen barrier layer added to it allows oxygen to permeate into the system. One theory on how this happens is that as hot water runs through plastic tubing the tubing expands and contracts, and this process creates minute cracks in the surface of the plastic wall. Oxygen lays in these small cracks and over time the oxygen works its way into the boiler fluid. This process happens WITHOUT the tubing leaking externally.
- The aluminum sleeve in Pex-Al-Pex is 100% oxygen proof, which is the original reason it was placed in-between the two layers of Pex, creating Pex-Aluminum-Pex.
- Regular Pex (without aluminum layer) has an oxygen barrier that is only approximately 98% effective at blocking oxygen even when brand new. Some regular Pex has no oxygen barrier at all (okay for plumbing, but not recommended for most heating systems). Most Pex that has an oxygen barrier has it located on the outside of the pipe. This is the easiest location for manufactures to put an oxygen barrier. However, the oxygen barrier on the outer wall is easily damaged as you install it by scraping it along the ground, etc.

HYDRONIC FLOOR TUBING VERSES ELECTRIC MATS

	Tubing	Mats Or Cables
Gas boiler	*YES*	no
Electricity as heat source	*YES*	*YES*
Ground source heat pump	*YES*	no
Solar	*YES*	no
Wood boiler	*YES*	no
Corn boiler	*YES*	no
Bio-mass boiler	*YES*	no
Can you alter the temp delivered	*YES*	no
Can you alter the GPM	*YES*	no
Easy for bathroom remodel	no	*YES*

Long story short, if someone chooses electric mats or cables they are forever married to the electric company! They are also never able to upgrade to newer and higher efficiency heat sources as they become available in the future.

Hydronic Rules of Thumb

Tube Spacing Formula – Use to calculate on center spacing of tubing.
Take the **inside dimension** of the area to be heated in sq. ft., **divided** by available tubing, **multiplied** by 12 = **On Center Spacing.**

On Center Spacing Formula – Use to calculate how much tubing you need based on the on center spacing you want. Take the **area** in square feet and **multiply** it by the on center **multiplier** below.

Desired Tubing On Center Spacing	On Center Multipler
8”	1.5
9”	1.33
12”	1
15”	.8
18”	.667

Maximum Surface Temperature – For heated floor surfaces, it is recommended that temperatures do not exceed the mid 80s (for your feet’s sake).

Maximum Water Temperature – For tubing that is in contact with concrete, it is recommended for the concrete’s sake that the water temperature not exceed 140°F.

Maximum Loop Lengths – To deliver heat most efficiently with radiant floor tubing, you should not exceed the following loop lengths in most cases.
1/2” Tubing – 330 Feet
5/8” Tubing – 450 Feet

Approximate Volume of Water per 100’ of Tubing

1/2” Tubing	=	.91 Gallon
5/8” Tubing	=	1.62 Gallons
3/4” Tubing	=	2.53 Gallons
1’’ Tubing	=	4.27 Gallons

Approximate Building Heat Loss Per Square Foot

Basements	15 BTU's / sq. ft.
Main levels	20-25 BTU's / sq. ft.
Shops	25 BTU's / sq. ft.
Older homes	30-35 BTU's / sq. ft.
Greenhouses	100-125 BTU's / sq. ft.
Snowmelt	150-200 BTU's / sq. ft.
Car wash Bays	70-80 BTU's / sq. ft
Holding pens	45-50 BTU's / sq. ft.

WHAT IS A DELTA T? (ΔT)

The temperature difference between the water leaving the boiler and the water returning. Generally this should be 10 – 20 degrees.

DEFINING A BTU

The amount of energy to raise one pound of water 1 degree.
Example – 1 gallon of water weighs 8.33 pounds. To raise it one degree it would take 8.33 BTU's.

DELIVERING BTU'S WHEN USING HYDRONIC HEAT

500 x GPM x Delta tee = Delivered BTU's
EXAMPLE: 500 x 10 GPM x 20 Degrees = 100,000 BTU's

HOW MANY GALLONS PER MINUTE DO I NEED?

Each gallon per minute of water delivered equals 10,000 BTU's of heating (assumes a 20 degree Delta T). **EXAMPLE**: 125,000 BTU's needed divided by 10,000 = 12.50GPM

KW / BTU CONVERSION

1KW = 3,415 BTU's (Example: 12KW Boiler X 3,415 = 40,980 BTU's)

INSULATION VALUE CONVERSION

The number 1 divided by R-Value equals "U" factor
The number 1 divided by U-Factor equals "R" value