DESIGN AND CONSTRUCTION SUGGESTIONS

Designing a system is easier than you might think. Radiantec will help. Call us for assistance with your design.

1-800-451-7593

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Additional Information is Available

Look on our website, use the live chat feature (www.Radiantec.com), email us at info@radiantec.com, or call (800) 451-7593 for the following subjects:

Install radiant heat within a slab
Install radiant heat within floor joists
Install radiant heat in a ceiling
Installation supplements
Wiring and controls
Snowmelting
Tubing layout
Tool lists

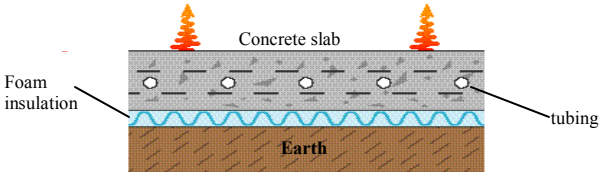
RADIANT HEATING METHODS

There are many ways to use radiant heating.
Here are some of the more common methods.

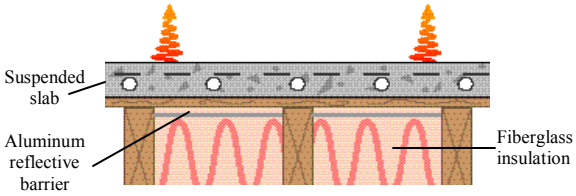
PLEASE NOTE THAT SOME OF THESE METHODS ARE ABLE TO PUT OUT MORE HEAT THAN OTHERS.

R = a retrofit possibility

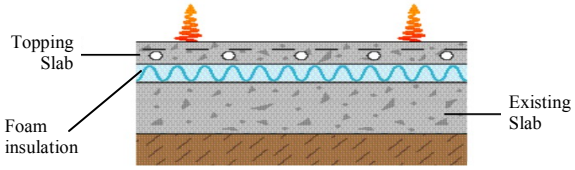
SLABS ON GRADE – A high efficiency method with very high heat output.
(Up to 45 BTU per hour per square ft)



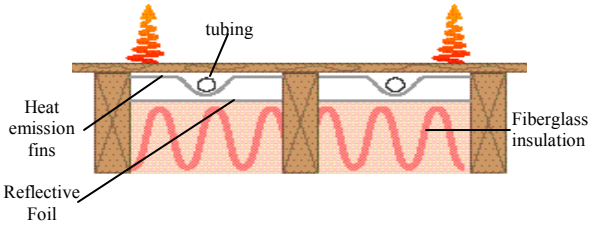
SUSPENDED SLABS – A slab is cast over floor joists. This is a way to gain high performance with a joisted floor. **R**
(Up to 40 BTU per hour per square ft)



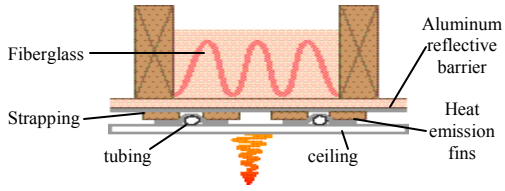
TOPPING SLABS – A slab containing heating tubes is cast over an existing slab. **R**
(Up to 40 BTU per hour per square ft)



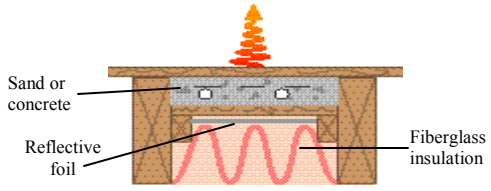
WITHIN JOISTED FLOORS – Tubing is stapled to the underside of the floor from beneath and an aluminum heat emission fin conducts the heat through the subfloor into the room above. **R**
(up to 35 BTU per hour per square ft)



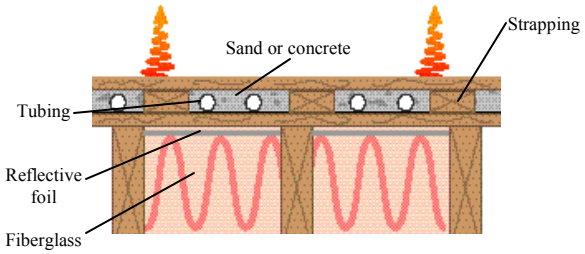
CEILING – Tubing is placed between strapping underneath the ceilings.
(Up to 35 BTU per hour per square ft)



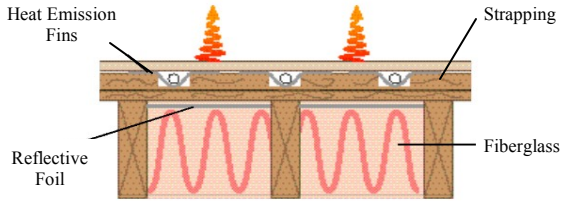
LEDGER – Tubing is placed upon a ledge within the joist space. This is a common retrofit solution when building up the floor is not practical. **R**
(up to 35 BTU per hour per square ft)



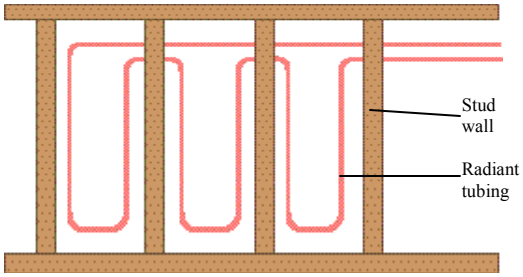
BETWEEN STRAPPING – Tubing is placed in the space between wooden strapping members. If the space is filled with concrete or dry mix, the method offers most of the performance of slabs, and yet allows wooden flooring to be placed on top. A good way to heat a "great room" with high heat requirements.
(Up to 35 BTU per hour per square ft)



ON TOP OF THE SUBFLOOR – Plywood is ripped into strips and placed on top of the floor leaving a groove wide enough for an aluminum heat emission fin and the tubing. **R**
(Up to 35 BTU per hour per square ft)



WITHIN THE WALLS – Tubing is placed within the cavity of a partition wall. Exceptional comfort results if the floor and walls are heated in a bathroom. Combine wall heating with towel warmers.
(Up to 35 BTU per hour per square foot)



ESTIMATE YOUR HEATING REQUIREMENTS

Underfloor radiant heat uses the floor to heat the area above by raising the floor in temperature until the heating output of the floor matches the amount of heat that the building is losing. We need to estimate the heat loss of the building so that we can estimate the floor temperature that will be needed to do the job. Then we can go about the task of deciding which radiant method to use and what the tube spacing and fluid temperatures should be in order to do the job in the most efficient manner.

DETERMINE THE HEATING REQUIREMENT PER SQUARE FOOT

The chart on the right is a rough "rule of thumb" guide for assessing a building's heat loss. It does not take the place of a heat loss analysis but can be useful in making preliminary decisions. Your Radiantec Co. representative will provide design assistance as part of his or her services.

DEFINITION: BTU stands for British Thermal Unit and is the amount of heat needed to raise one pound of water one degree Fahrenheit.

INSULATING VALUE OF THE BUILDING	HEAT LOSS in BTU'S per HOUR PER SQUARE FOOT
SUPER INSULATED (very high R-values; R30 walls, R50 ceilings, high performance windows, .25 air changes per hour or better, exceeds modern energy codes)	**.1 BTU's per hour per square foot of floor area per degree F.**
GOOD (high R-values; R19 walls, R38 ceilings, high performance windows, tight construction, typical of new buildings meeting modern energy codes)	**.3 BTU's per hour per square foot of floor area per degree F.**
FAIR (typical of well maintained existing structures)	**.6 BTU's per hour per square foot of floor area per degree F.**
POOR (poorly insulated, leaky construction)	**2 BTU'S per hour per square foot of floor area per degree F.**

EXAMPLE: What is the heat loss (per square foot) of a building with "good" insulating characteristics when it is 65 degrees F. inside and –10 degrees F. outside?

ANSWER: 22.5 BTU's /hr/sq. ft (heat loss x temperature difference) (.30 btu's/hr/ft sq/degree f x 75 degrees f.

MULTIPLY HEAT LOSS BY TEMPERATURE DIFFERENCE

The chart below shows that a floor temperature of 80^0 F. will be adequate to put out 27 BTU's per hour. This will be enough to heat a building with "good" insulation when it is well below zero. Nearly all residential buildings and most commercial buildings are built to this standard today.

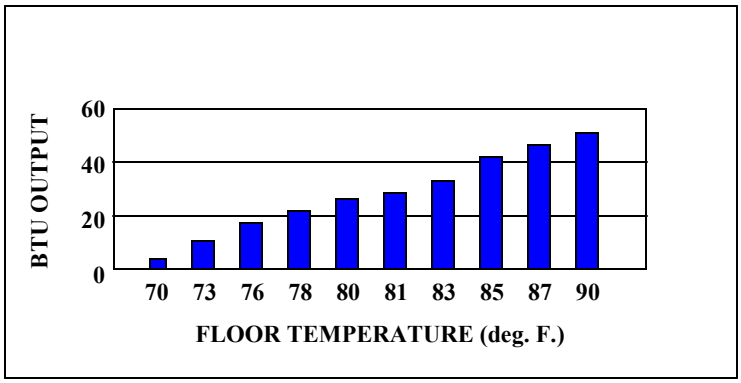
To size the heating source, simply multiply your heat loss per square foot by the area (in sq. feet). You will need a heater or boiler with this rated output. Your contractor should confirm this calculation.

DETERMINE YOUR HEAT OUTPUT

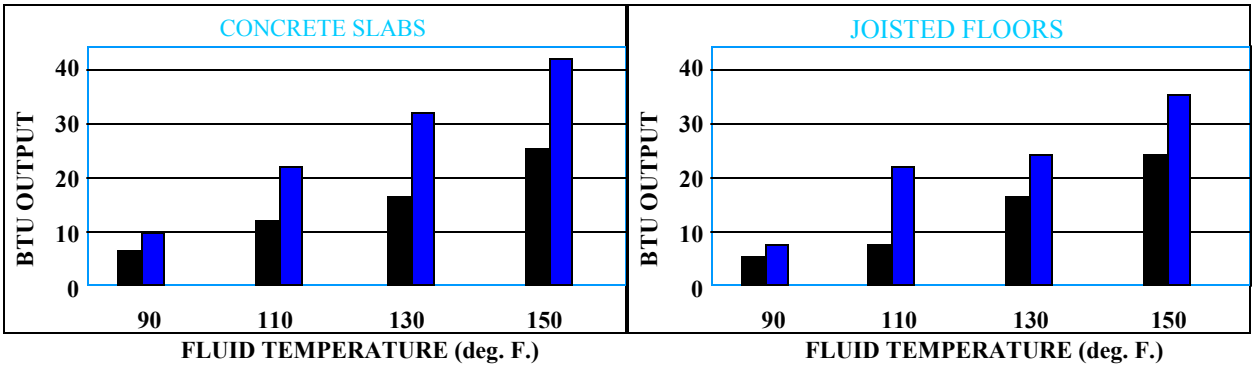
Use the graphs below to predict the amount of heat that you will get from the floor. Heating outputs greater than 45 BTU's per hour cannot be achieved without floor temperatures greater than 90 degrees F. Use supplementary heat in those rare cases where more than 45 BTU's/square ft are required or better still, invest in energy conservation measures. Radiant ceiling or wall heat, when used as a supplement, will provide exceptional comfort.

Use this chart to see what the temperature of the floor must be in order to heat the building when the outside air is at the coldest expected (design temperature).

HEATING OUTPUT IN 65 DEGREE ROOM PER SQ. FT. FLOOR AREA



HEAT OUTPUT PER SQUARE FT. OF FLOOR AREA



Carpet **Non-Carpet**

3/4" carpet, 1/4" pad

Assume the following spacing:
7/8" Pex - 16" on center
5/8" Pex - 12" - 14" on center
1/2" Pex - 10" - 12" on center
3/8" Pex - 8" on center

Carpet **Non-Carpet**

Assume the following spacing:
7/8" Pex - 16" on center
5/8" Pex - 12" - 14" on center
1/2" Pex - 10" - 12" on center
3/8" Pex - 8" on center

WHAT SHOULD YOU DO IF YOU ARE NOT SURE THAT YOU WILL GET ENOUGH HEAT FROM THE RADIANT FLOOR?

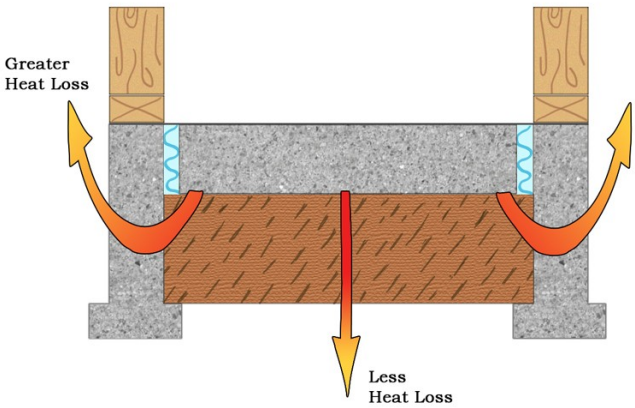
This happens occasionally and there are several solutions.

1. Lower the heat loss with energy efficiency measures (this is the best solution).
2. Look at another radiant heating method that puts out more heat than what you were thinking about first. A slab or suspended slab will put out more heat than joisted floors.

3. Use supplemental radiant wall heat or radiant ceiling heat (very comfortable).
4. Use a supplemental heating source for very cold days, like a woodstove, gas fireplace, or supplemental baseboard heat.

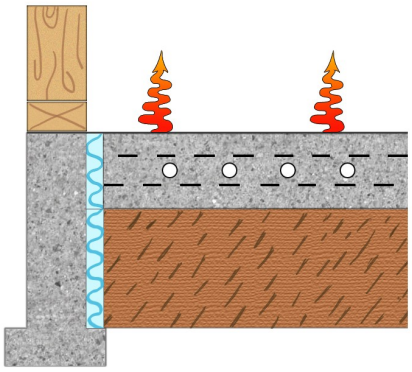
INSULATION METHODS

SLAB ON GRADE - It is helpful to understand the nature of heat loss to the ground so that we can plan good strategies to reduce it. Very little heat is lost straight down with a slab on grade structure. Earth is not a very good insulator, but there is a great thickness of it so that heat does not penetrate much more than 4 feet. Of greater concern is heat loss off to the sides, and for that reason, we concentrate the insulation efforts there.

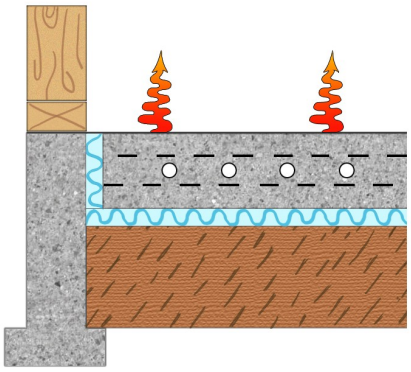


The proper material for below grade insulation is extruded polystyrene. Other materials are prone to absorb moisture or do not have enough compressive strength or stability over time. Some promote a very thin sheet of air-bubbles with foil. This **is not** an acceptable substitute for extruded polystyrene. There is no substitute at present in our opinion.

You can insulate either vertically down the side of the building or you can insulate horizontally under the slab. The methods are about the same as far as reducing heat loss is concerned.



But the choice of insulation method can make a big difference in the ability of the building to store heating or cooling energy. If the insulation is placed vertically, the heat storage ability of the earth is incorporated into the building down to an effective depth of about 3 feet.

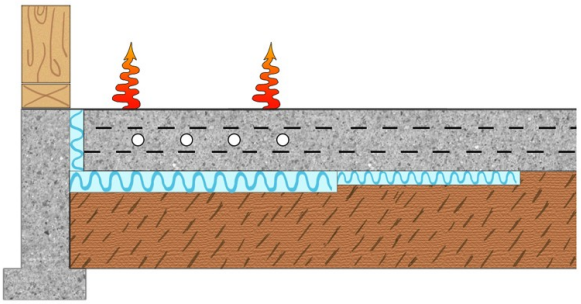


This results in a building that can store large quantities of heating or cooling energy. Such a building can "coast" through the Spring and Fall seasons without large amounts of heating or cooling energy inputs. Such a building can also be designed to store alternative energies such as solar in an efficient and cost effective way.

On the other hand, the building with vertical insulation will not be as responsive to changes in energy inputs as compared to the building with a horizontal placement under the slab. There will be less benefit from nighttime or weekend temperature setbacks.

Larger sized slab on grade buildings can benefit from a special detail with the benefits of both insulation methods.

Larger sized slab on grade buildings should use this detail.



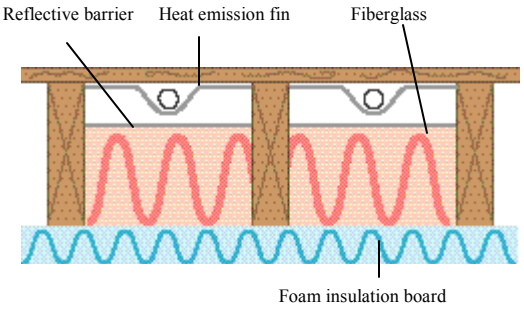
Insulation of decreasing thickness is placed from the perimeter of the slab in towards the middle of the building. It is common to use 2" thick extruded polystyrene for 4 ft and then 1" thick for another 4 ft and then no insulation at all under the center of the slab.

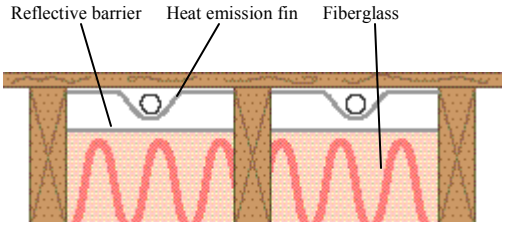
This method reduces heat loss and also creates a heat storage mass. The building will be responsive to thermostat changes and will require less insulation material.

JOISTED STRUCTURES - The extent of the insulation measures depends upon what the consequences of the heat losses are. For example, if heat loss downward is entirely wasted, such as to a crawl space, then insulation should be extensive. If heat loss downward will go to another area that also needs heat, the insulation effort can be less extensive. Be careful not to permit so much heat loss downward that the area where the heat is wanted does not get enough. If there is extensive carpeting above, there needs to be more insulation beneath the heated floor.

Within joisted structures, there are three approaches 1) fiberglass batt insulation, 2) an aluminum reflective foil surface and 3) a foam panel.

This detail is good for crawl spaces and other situations where no heat loss downward at all is wanted. The aluminum reflective barrier reflects radiant heat energy upwards. The fiberglass batt controls conducted energy downwards and the foam insulation board adds more R value, insulates the joist and keeps the wind out.





This detail ensures that most of the heat given off by the floor will go up. An aluminum reflective barrier reflects radiant heat that is headed downward back up to the floor. The effectiveness of the aluminum foil can be lowered by dust accumulation. Plastic sheeting or rosin paper can be applied under the finish floor to eliminate dusting.

SELECT THE RIGHT HEATING SYSTEM

A CLOSED SYSTEM - is one in which the heating fluid is self contained within the system and stays there unless removed for maintenance. A boiler or water heater warms the water or another fluid such as anti-freeze. When heat is called for by the thermostat, a pump comes on and circulates the warm water throughout the floor until the thermostat is satisfied. A Plumbing Mechanical Package (PMP) is needed for proper operation. This device includes fill and drain valves, shut-off valves, an air eliminator, pressure relief valve, and pressure gauge. An expansion tank will also be required. **Closed systems are familiar to code officials and contractors, and they encounter little resistance. Closed systems can be combined with baseboard radiators.**

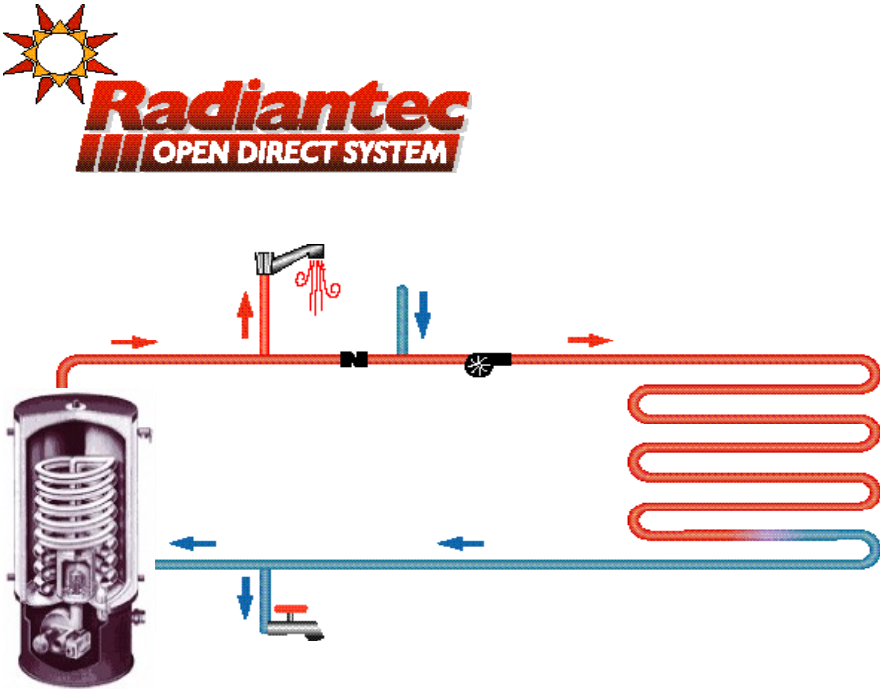
USE THE SAME HEATING UNIT FOR BOTH HEATING AND DOMESTIC HOT WATER

There are many reasons to do this in residential construction, and few reasons not to. The energy efficiency and cost efficiency are both excellent. Most domestic hot water heaters do nothing at all for 22 hours per day and many easily have capacity to do both. Most heating units waste energy when they are just “standing by”. When you use one unit to do two jobs, the standby losses of one unit are eliminated and the one combined unit stands by less often. When you buy one good, highly energy efficient unit to do the work of two lesser units, your energy bill can drop by 40% or more.

Radiantec has two options for you that use a water heater for both heating and domestic hot water. One is called the Radiantec Open Direct system and the other, the Radiantec Indirect System. The features and benefits of both are explained in the following pages.

THE RADIANTEC OPEN DIRECT SYSTEM

The Radiantec Open Direct System uses the domestic water heater to provide both underfloor heating and domestic hot water from the same unit. In the heating mode, hot water flows directly from the water heater, through the heating tubes, and back to the heater. This is a highly efficient system with many significant advantages.



Polaris High-Efficiency
Water Heater

The Radiantec Open Direct System provides space heating and domestic hot water from a single heating appliance.

FLOW

- When heat is called for, the pump comes on and water flows out of the top of the tank, through the heating zone and back to the bottom of the tank.

- When domestic hot water is consumed, water flows out of the top of the tank to the point of use. Cold water replaces the hot water by flowing in at the top of the system, through the heating system, and then into the bottom of the tank.

- Visit our website at www.radiantec.com/systems-sources/open-system.php to view animations of the Open Direct System in operation.

REASONS

The cold water feeds into the supply side of the heating system rather than directly into the tank for the following reasons:

1. The possibility of stagnation (particularly in the summer when the heat is not used) is absolutely eliminated.
2. In the winter, this flow pattern gives priority to the domestic hot water use if both heat and hot water are called for at the same time (so the person in the shower doesn't run out). There is no efficiency loss in the winter; any heat taken out of the floor is put in the tank so there is no net energy loss to the system.

3. Incredible efficiency. During the summer, limited free cooling is enjoyed. Heat is taken out of the building (saving on the air conditioning bill). The heat is put in the domestic hot water tank (saving again on the gas bill!)

The Radiantec Company has played a leading role in the development of these systems. These systems have been evaluated by the ICC (International Code Council) and are approved by many of the major code bodies.

ADVANTAGES

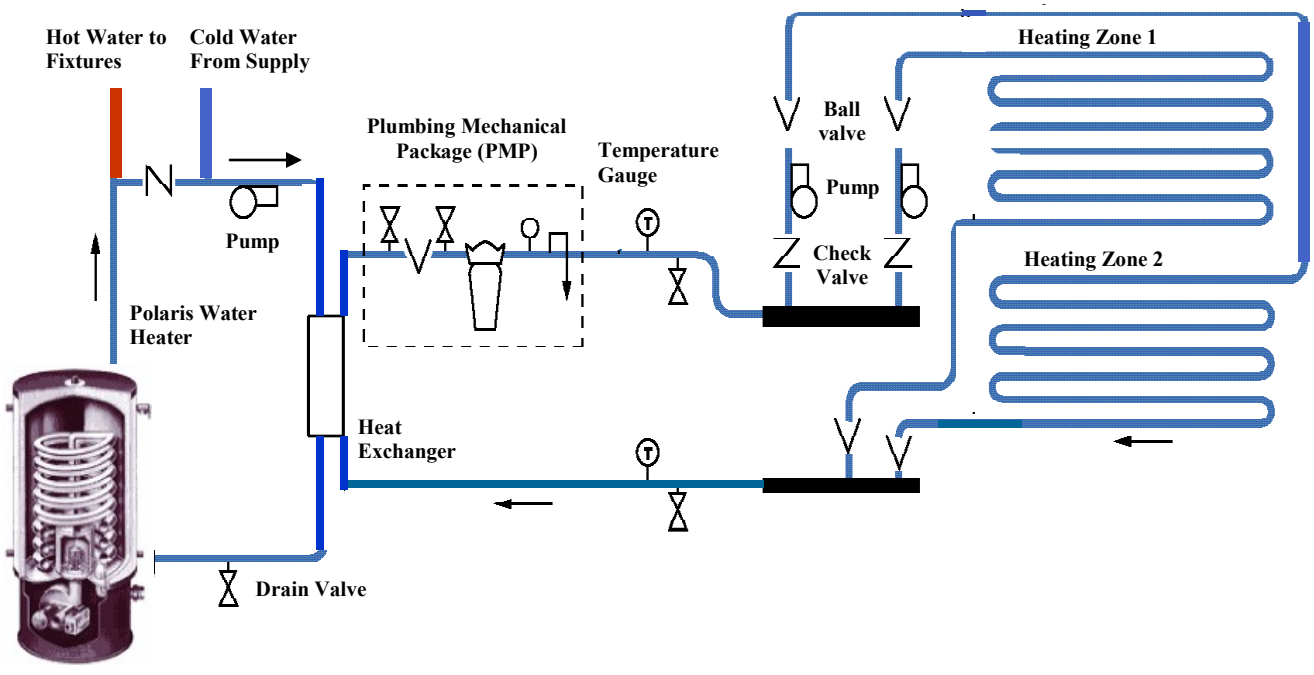
1. Very low cost.
2. Mechanically very simple, elegant and reliable.
3. Outstanding energy efficiency, particularly if the Polaris water heater is used.
4. Oxygen diffusion issues are not relevant because all of the materials are potable rated.
5. Use of the outside faucet for watering lawns, etc. will further enhance cooling.

ISSUES

1. The water must be kept potable and fit to drink. The flow detail described on page 8 must be executed and all materials used in the system must be potable rated.
2. Check with your local codes. Ask Radiantec Co. for assistance. Have your code official call us with questions.
3. An expansion tank may be needed if check valves or backflow preventers prevent expansion water from backing up to the rest of the water system.
4. Be sure the system pressure is compatible with tubing pressure limits.

THE RADIANTEC INDIRECT SYSTEM

The indirect system uses a heat exchanger to separate the heating fluid from the domestic hot water. An advantage is that an antifreeze solution may be added to the heating fluid, and snow melting can be added to the system. Some code administrators may require the heat exchanger. A disadvantage is that the cooling benefit is eliminated. Also, cost and complexity are increased with the addition of the heat exchanger.



OPERATION: When heat is called for by a thermostat, the heater pump comes on and water flows from the water heater through 1 side of the heat exchanger, heating it up in the process. At the same time, the zone pump comes on and causes water (or anti-freeze) to flow through the other side of the heat exchanger to pick up the heat and then travels through the heating zone. When the thermostat in the zone is satisfied, it shuts the pumps off.

APPLICATIONS

1. Allows for the use of a domestic water heater as the source for heating and domestic hot water in locations where separation of the two is required.
2. Allows for the use of two different types of fluids in each part of the system (anti-freeze for snowmelt and water in the heater, for example).
3. Provides absolute protection from oxygen diffusion in boiler applications.

SELECT THE RIGHT HEATING UNIT

Get the highest possible efficiency at a reasonable price.

Radiantec recommends that most people should use a water heater for radiant heating instead of a boiler. Radiant heat only requires water temperatures between 110° F and 150° F, and water heaters are designed to operate in these ranges. On the other hand, boilers are made to operate at very high temperatures and often will not work well at lower temperatures. Boilers often require expensive controls, complicated plumbing arrangements and mixing valves in order to provide lower temperature water.

There are significant efficiency advantages to low temperature operation. Your heater should be 95% efficient or better. The exhaust gas should be so cool that the unit can vent with plastic pipe instead of into an expensive chimney.

Domestic water heaters are designed to resist corrosion and attack by oxygen so oxygen barrier tubing is not required. Water heaters can provide quite high initial heating outputs because of the combination of the burner output and the heat stored within the tank.

Also, a high quality hot water heater should cost thousands less than the equivalent boiler and controls.

The Polaris water heater is all stainless steel, 95+ efficient and vents with plastic pipe. Its high efficiency and high output make it the ideal choice for either the Open Direct or Indirect systems.

SELECT THE RIGHT TUBING

Because there are many different ways to use radiant heat, there are different types of heat exchanger tubing available. They all have slightly different properties and features. Here are some of the important considerations.

- The tubing should last a long time.
- The tubing should be strong enough and durable.
- The tubing must have adequate heat output.

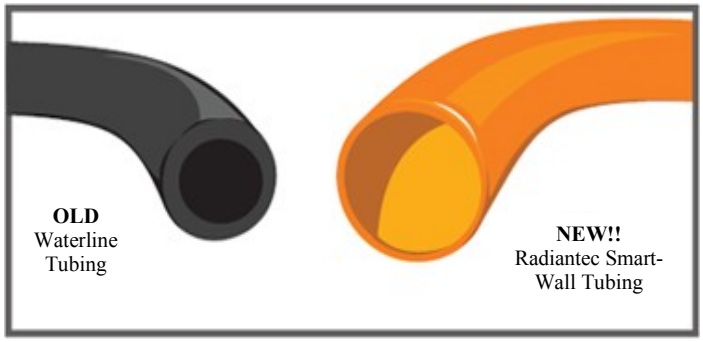
- The tubing must be easy enough to work with.
- The tubing may need to be acceptable by your local code official.
- The tubing may need to be potable rated.
- The tubing may need an oxygen barrier.

ENGINEERED HEAT EXCHANGER TUBING

Many of the products that are used in radiant heating applications were originally designed only for the purpose of carrying water from one place to another (waterline) without considering that we may want to lose some heat along the way. However, waterline may not be an ideal material for use as a radiant heat exchanger because the tubing typically has thick walls to allow for high pressure and temperature which is not normally required in a radiant system.

THERE ARE MANY ADVANTAGES to Radiantec's SmartWall tubing that is designed specifically for radiant heat and some of them are as follows:

- ***Higher heat output:*** Because of the thinner wall, Radiantec SmartWall tubing can increase heat transfer in the range of 18%-28%. The amount will vary according to temperature and flow.
- ***Lower, safer operating temperatures:*** SmartWall tubing will do the same work at a lower temperature than traditional tubing while reducing the possibility of burn from contact with hot pipes.



- ***More energy efficient:*** This is simple. Lower operating temperatures will typically result in lower operating costs.
- ***Less pumping cost:*** The electricity savings that can be realized from reduced pumping work can be substantial. Savings of 40% or more are typical.
- ***Quieter operation:*** Expansion and contraction in higher temperature systems result in annoying creaking, squeaking, popping noises, particularly at night.

Radiantec's SmartWall tubing was developed with grant support from the United States Department of Energy. Considerable effort went into the design of a radiant heat exchanger tubing that had optimal characteristics of service life, energy efficient heat transfer and minimal electrical requirements for pumping. Flow through the tubing was optimized to be "slightly turbulent". Laminar flow (which is very smooth) and fully turbulent flow (which requires excessive pump work) are both to be avoided.

The technicians at Radiantec will help you select the best tubing for your project. If you need specialty tubing that Radiantec does not offer, our technicians will say so and tell you where you can obtain it.

TUBING SIZES AND TYPES

SMARTWALL PEX (For Closed and Indirect Systems)

7/8" PEX: All Pex tubing has very long service life and exceptional resistance to chemical attack. 7/8" SmartWall has the best overall heating performance and puts out twice as much heat as most other products. It has a pressure and temperature rating of 120° F. @ 100 psi. and 150° F. @ 80 psi. 7/8" SmartWall can be used in circuit lengths up to 400 ft.

The bending radius is 12" (i.e. it will take 24 inches to make a 180° turn). The larger bending radius will not pose difficulty in a slab of reasonable size. It will be more difficult to install in a joisted floor application and many people opt to use the smaller 5/8" Smartwall for that application. If you are subject to stringent building codes, you will want to get approval for this product prior to installation. 7/8" SmartWall is not certified under ASTM 877/876 but it is certified under ASTM F2929-13 for use in closed heating systems.

7/8" SmartWall is typically spaced at 16" on center in a joisted floor installation (1 line per bay) and 16" to 18" on center in a slab installation.

5/8" PEX: 5/8" SmartWall is easier to work with than the 7/8" in smaller slabs and in joisted floor installs. This tubing bends in a 8" radius and should be spaced 8" on center in a joisted installation (2 lines per bay assuming 16" on center joists) and 12"-14" in a slab. When compared to the "standard" 1/2" pex tubing, the 5/8" SmartWall puts out about 18% more heat.

It has a pressure and temperature rating of 120° F @ 100 psi. and 150° F. @ 80 psi. As with the 7/8" SmartWall, if you are subject to stringent building codes, you will want to get approval prior to installation. This tubing is not certified under ASTM 877/876 but it is certified under ASTM F2929-13 for use in closed heating systems.

CONVENTIONAL PEX

1/2" PEX: This product has thicker walls when compared to the SmartWall tubing and has higher temperature and pressure ratings (180° F. @ 100 psi). However, the smaller diameter and thicker walls mean that the product is much less effective as a heat exchanger. 1/2" PEX is certified under ASTM 877/876 (which makes it very code compliant) and is rated for potability with NSF. It can be used in circuit lengths up to 300 feet. 1/2" PEX is significantly more maneuverable than the other products and it is easier to install in tight areas so while the heat exchange properties may not be as good as other products, it still puts out enough heat to be effective and efficient.

5/8" PEX: This product has thicker walls when compared to the SmartWall tubing and has higher temperature and pressure ratings (180° F. @ 100 psi). However, the thicker walls mean that the product is much less effective as a heat exchanger. 5/8" PEX is certified under ASTM 877/876 (which makes it very code compliant) and is rated for potability with NSF. It can be used in circuit lengths up to 300 feet. 5/8" PEX is somewhat more maneuverable than the other products and it is a little easier to install in tight areas. This tubing puts out about 8% more heat than the industry standard 1/2" PEX.

3/4" PEX: We typically only recommend this tubing for supply and return lines. This product has thicker walls when compared to the SmartWall tubing and has higher temperature and pressure ratings (180° F. @ 100 psi). 3/4" PEX is certified under ASTM 877/876 (which makes it very code compliant) and is rated for potability with NSF.

OXYGEN BARRIER TUBING

This product can be used in heating systems with components that are not compatible with oxygen (steel and cast-iron are a couple of examples). Virtually all systems that use a boiler will require oxygen barrier tubing because most of them have either a steel or cast-iron tank. As mentioned previously, this is another advantage of using a water heater instead of a boiler.

TUBING TYPE	COST per sq. ft	HEATING OUTPUT	SERVICE LIFE	BENDING DIAMETER	T & P RATING
7/8" Smartwall	lowest	highest	100 + yrs.	24"	120° F. @100 psi. 150° F @ 80 psi
5/8" Smartwall	high	highest	100 + yrs.	16"	120° F. @100 psi. 150° F @ 80 psi
5/8" Con-ventional Pex	high	medium	100 + yrs.	16"	180° F. @ 100 psi
1/2" Con-ventional Pex	medium	low	100 + yrs.	12"	180° F. @ 100 psi

THE INFORMATION IN THE CHART ABOVE ALONG WITH OUR 35+ YEARS OF EXPERIENCE AND RESEARCH SUGGEST THE FOLLOWING USAGES:

LARGE SLABS

Any slab larger than 1500 square feet will lend itself to the use of 7/8" SmartWall. The 7/8" SmartWall is the most economical tubing and its lower pressure rating is irrelevant because the tube will be surrounded by reinforced concrete.

SMALLER SLABS AND THIN SLABS

Use 1/2" or 5/8" PEX or 5/8" SmartWall.

UNDERNEATH A JOISTED FLOOR

You can use 7/8" Smartwall if the joist bays are relatively uncluttered. If the bays are cluttered, vary in spacing, or you will be installing in a tight space, you should use 1/2" PEX. Other installations may be able to use 5/8" SmartWall or 5/8" PEX. Radiantec Technicians can help you decide what tubing is best for your project.

SNOWMELT

Use 1/2" or 5/8" PEX.

RETROFIT BATHROOMS

Use 1/2" PEX.

CIRCUITS LENGTHS AND FLOW RATES

It is desirable that circuit lengths be neither too long nor too short. The purpose of the tubing is to allow water (or another fluid) to pass through it and lose heat as it goes along. This heat is received by the floor which then heats the building. If the tube length is too long, there will be a tendency for the water to lose too much heat before it reaches the end of the run. The result is tubing at the end of the circuit is exposed to water that has already lost much of its heat and the tubing is then "loafing". You can make up for this by increasing the fluid velocity with a larger pump. At some point, the water becomes too turbulent and pump work and electricity consumption become unreasonable. In extreme cases, erosion corrosion can occur (the physical wearing away of system components) because of flow that is too turbulent.

Circuit lengths which are too short tend to run in laminar flow (smooth flow) which doesn't exchange heat quite as well as a slightly turbulent flow. One nuisance of slow flow is the possibility that air bubbles could collect in some tubes and reduce effectiveness or even block flow.

The goal is to have the fluid come out of the tube within 10-15 degrees of the temperature it went in at and move at a slightly turbulent flow as it passes through. The relationships below and on the next page work well although deviations can be acceptable if adjustments in pump sizing are made. Call the Radiantec Company for technical assistance if these recommended lengths cause inconvenience. Radiantec Company will specify a pump that will meet your pumping requirements in the most economical manner.

Radiantec will help you figure out circuit lengths and material choices. Just call 1-800-451-7593, fill out the "Next Step" form on our website, or send in the yellow proposal request form.

tube diameter	min length	max length	flow rate
1/2"	100 ft.	300 ft.	.25 gpm/100' of tube
5/8"	150 ft.	300 ft.	.33 gpm/100' of tube
7/8"	200 ft.	400 ft.	.5 gpm/100' of tube

MAXIMUM FLOOR TEMPERATURES

Floors should not exceed 80 degrees Fahrenheit on a routine basis and should never exceed 85 degrees Fahrenheit.

RECOMMENDED TUBE SPACING

These tube spacings will provide comfortable even heat within the limits of the fluid temperatures that are desirable.

tube diameter	recommended spacing
1/2"	8" - 12"
5/8"	8" - 14"
7/8"	12" - 16"

If the tubing will be spaced at 16" on center, multiply the floor area by .75

SPACING MULTIPLIER	
16" on center	.75
14" on center	.86
12" on center	1.00
10" on center	1.20
9" on center	1.33
8" on center	1.5
6" on center	2.0

EXAMPLE: A 1,000 sq. ft. area requires 750' of tubing if spaced 16" on center (1,000 x .75)

CALCULATE THE AMOUNT OF TUBING REQUIRED

Determine the total length of tubing needed by multiplying the floor area (in square feet) by the multiplier shown for your tube spacing.

If the tubing will be spaced at 16" on center, multiply the floor area by .75

WHAT ABOUT INSTALLATION?

INSTALLATION OF RADIANT HEAT DOES NOT HAVE TO BE HARD, AND IT DOES NOT HAVE TO BE EXPENSIVE

RADIANTEC WANTS TO SIMPLIFY, NOT COMPLICATE RADIANT HEAT.

Radiantec Company thinks that the task of installing underfloor radiant heat is the task of a reasonably competent handyperson. Radiantec Company thinks that the work can be done with common, readily available tools.

Naturally, a good manual would be helpful and the manual should be ***detailed.***

We want to get you the information that you need and not burden you with information that you don't. We do not want to burden the environment by sending everyone a pile of information that only a few will have interest in. And that is why we will let you decide.

Here is how you can get installation information that you want. JUST ASK! You can call 1-800-451-7593. Ask for what you want and we will send it to you.

Or, go to the internet and download it right now. www.radiantec.com/installation-manual

Here are some other installation manuals that you may find useful. You can access them at www.Radiantec.com/installation-manual

Design and Construction Manual: If you are new to radiant heat, this manual is a "Must Read!" This manual provides a wealth of general information about radiant heat. Slab insulation methods, calculating heat loss, tubing options, system options and much more, all written in easy to understand language for the homeowner with pictures and diagrams.

Instructions for installing tubing for a **concrete slab**. Installing tubing in concrete is one of the simplest and most cost-effective ways to install radiant heat. You will also want to refer to the Design and Construction Manual for slab insulation methods. Installation Supplement 250.

Instructions for installing tubing between the **floor joists**. If you have access to your floor joists from below then you can install radiant heat. This manual shows you how! Installation Supplement 260.

Instructions for installing Radiantec **Controls**. Wiring diagrams for all controls, thermostats and temperature sensing devices. Please note that this manual is usually a good guideline for your electrician to follow. Installation Supplement 410.

Instructions for installing tubing **in the walls**. Another good way to increase the comfort level of any space. This also works as a good supplement if the floor heat cannot entirely heat an area. Installation Supplement 280.

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