



SUSTAINABLE BUILDING TECHNOLOGY

INDOOR COMFORT SOLUTIONS FOR HIGH-EFFICIENCY BUILDINGS



“EVERY DAY, WE REDEFINE THE
BOUNDARIES OF WHAT IS POSSIBLE
WITH POLYMER-BASED SOLUTIONS.”

JOBST WAGNER, PRESIDENT, REHAU GROUP

Whether it is an energy-efficient building, a safer driving experience or an exclusive furniture design, time and again, polymer solutions offer companies, designers, architects and consumers increasingly valuable options.



© MAM

Sustainable Comfort

Whether touring a fine art exhibit at a world-famous museum or watching a favorite television program at home, a comfortable indoor environment can make a significant difference in how we enjoy these experiences. Buildings that surround us with consistent warmth, refreshing coolness, low humidity and filtered air offer an ideal setting for year-round indoor comfort.

Few of us would demand comfort at any cost. We want sustainable comfort – comfort that's affordable, easy to maintain and good for the environment. Not only do we expect our buildings to make efficient use of energy; we also are beginning to require our buildings to sustain themselves with energy from the earth, wind and sun. Whether the goal is to lower a building's carbon footprint or achieve complete independence from the power grid, sustainable building technology from REHAU can make a substantial contribution.

REHAU innovations have helped define the world of construction for more than 60 years. From geothermal heat exchange to radiant heating and cooling to residential fire protection, our systems are working to provide sustainable comfort in thousands of residential and commercial buildings around the world.

REHAU radiant heating adds to the enjoyment of Milwaukee Art Museum visitors.

REHAU POLYMER PIPES

A RICH HISTORY OF SUSTAINABLE INNOVATIONS

RAUPEX® and RAUGEO™ PEXa are REHAU trade names for our specially formulated crosslinked polyethylene (PEXa) pipe.

- RAUPEX is used in radiant heating and cooling, snow and ice melting, fire protection, plumbing and water service applications.
- RAUGEO PEXa pipe is used in geothermal applications.

REHAU EVERLOC® compression-sleeve fittings take advantage of the unique properties of PEXa pipe to make secure connections.





Using modern polymer solutions, we aim to perfect the application of first century discoveries to twenty-first century buildings. The ancient Romans used radiant heating and some of the earliest water vessels were made of silver. Centuries later, we are still discovering the best way to apply these concepts to modern buildings.

From pioneering PEXa heating pipe...

Since pioneering PEXa crosslinked polyethylene technology in 1968, we have accumulated more than 1 billion feet (300 million meters) of worldwide installation experience. PEXa pipes, coupled with our compression-sleeve fitting system introduced in 1988, are the central components in our ever-expanding range of sustainable building technologies.

to applying silver's antimicrobial protection to ventilation pipe...

With our latest renewable energy innovation, the REHAU ECOAIR™ ground-air heat exchange system, we are defining the market for controlled ventilation using underground silver-enhanced PVC pipes.

rest assured that REHAU is a leader in polymer pipe technology.

Working quietly and efficiently from their position in the concrete slab underneath Pier 1 in Port of San Francisco, RAUPEX pipe and EVERLOC compression-sleeve fittings do impressive work to comfortably heat and cool this massive space.

REHAU ECOAIR

GROUND-AIR HEAT EXCHANGER

THE ENERGY EFFICIENT FRESH AIR SOLUTION





With today's tight building envelopes, it is often necessary to bring in outdoor air to ensure good indoor air quality. A gentle breeze wafting through an open window first comes to mind. It's the symbol of health and comfort, until you realize that fresh air brings with it heat, cold and humidity, which detract from a building's efficiency and introduce allergens into the living environment.

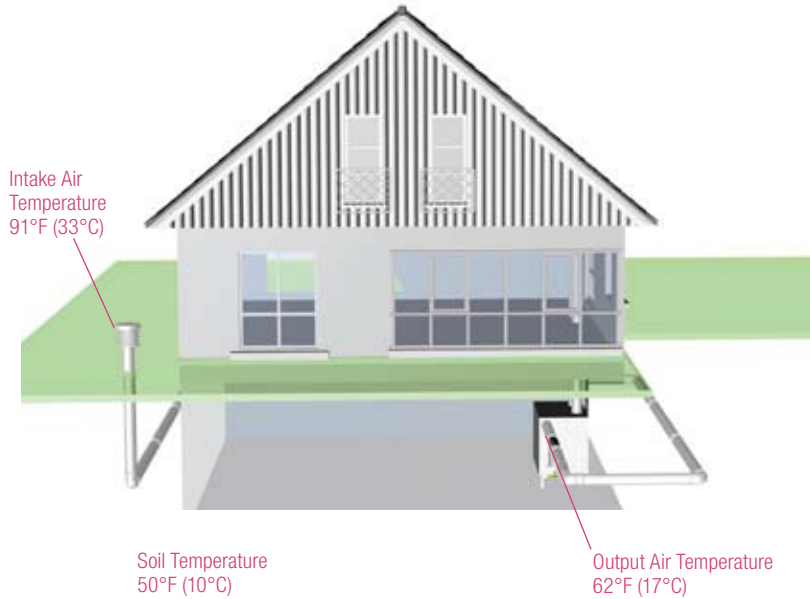
The REHAU ECOAIR ground-air heat exchange system supplies filtered, fresh air without these drawbacks. The system takes advantage of the relatively constant ground temperatures to precondition incoming fresh air, reducing heating and cooling costs. It also filters the air and can lower the relative humidity. So, build your energy-efficient, airtight building, and take a breath of fresh air – renewable, preconditioned fresh air from REHAU ECOAIR.

By taking advantage of the earth's energy, a ground-air heat exchange system enhances the efficiency of a building's HVAC and fresh air ventilation systems.

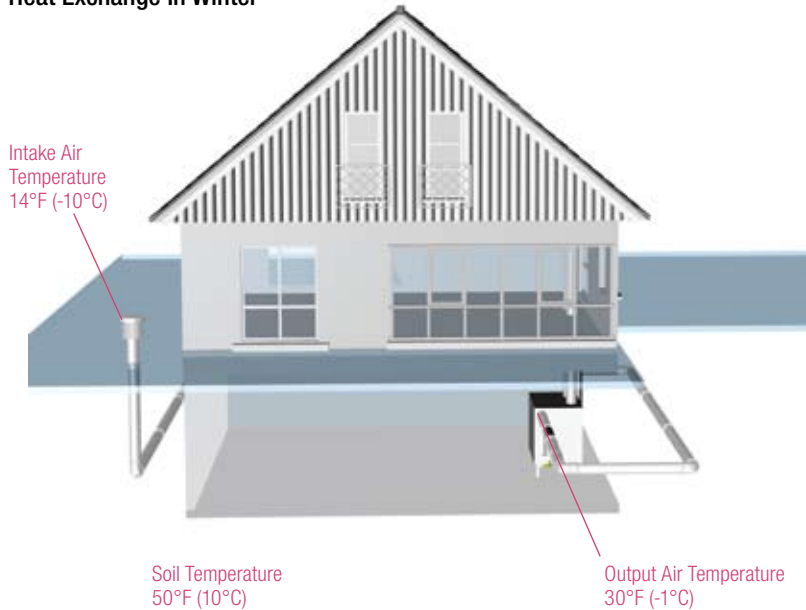
REHAU ECOAIR

BENEFITS

Heat Exchange In Summer



Heat Exchange In Winter



These examples demonstrate how heat exchange occurs in summer and winter.

Supplies Pre-Conditioned Fresh Air

At 5 to 7 ft (1.5 to 2 m) below the earth's surface, ground temperatures remain relatively constant throughout the year. As incoming air passes through REHAU ECOAIR underground pipes, it is pre-warmed with ground heat in winter and pre-cooled with cooler ground temperatures in summer. For example, in mid-latitude where ground temperatures range from 45°F-54°F (7°C-12°C), it is possible to reduce the intake air temperature by up to 29°F (16°C) in summer and to raise the intake air temperature by up to 16°F (9°C) in winter.

Reduces Heating and Cooling Costs

By narrowing the gap between outdoor temperatures and comfortable indoor temperatures, a ground-air heat exchange system can significantly reduce the amount of additional energy required to heat or cool a building. The system requires only a small amount of electrical power to operate an air intake fan and provides significant energy cost savings, especially when used in conjunction with heat or energy recovery ventilators (HRV or ERV). It can also allow downsizing of heating and cooling equipment particularly in larger buildings, and may replace the need for an air conditioning unit in residential buildings in some climates.

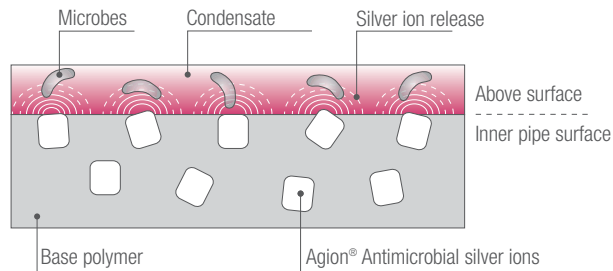
Manages Condensation and Inhibits Microbial Growth in System

During the cooling season, condensation can occur in the ground-air heat exchange pipes in regions with high humidity. This moist environment can be conducive to microbial growth. To grow, microbes require moisture and a food source. The first defense against microbial growth is removing the moisture through proper condensation management. Effectively removing particles from the incoming air – the food source – is the next most important safeguard. The complete REHAU ECOAIR system provides for both condensate drainage and inlet-air filtration.

In addition, the unique design of REHAU ECOAIR pipes provides yet another layer of protection against microbial growth. Smooth-walled PVC pipes do not harbor particles. To further inhibit microbial growth, Agion Antimicrobial silver ions are embedded in the inner, exposed layer of REHAU ECOAIR pipes. The antimicrobial property of this silver-enabled lining was tested and verified by SGS Institut Fresenius in Taunusstein, Germany to ASTM Standard E2180. The silver material is also registered by Agion Technologies with the EPA for use as an antimicrobial in HVAC applications.

Optimizes Air Quality and Increases Ventilation System Efficiency

REHAU ECOAIR not only directly reduces the energy required to heat or cool incoming fresh air, but also contributes to overall ventilation system optimization. Preconditioning the intake air can eliminate the need for an HRV defrost cycle in the winter and it can lower humidity in the summer, further reducing energy consumption. Lower humidity has the added benefit of improving comfort.



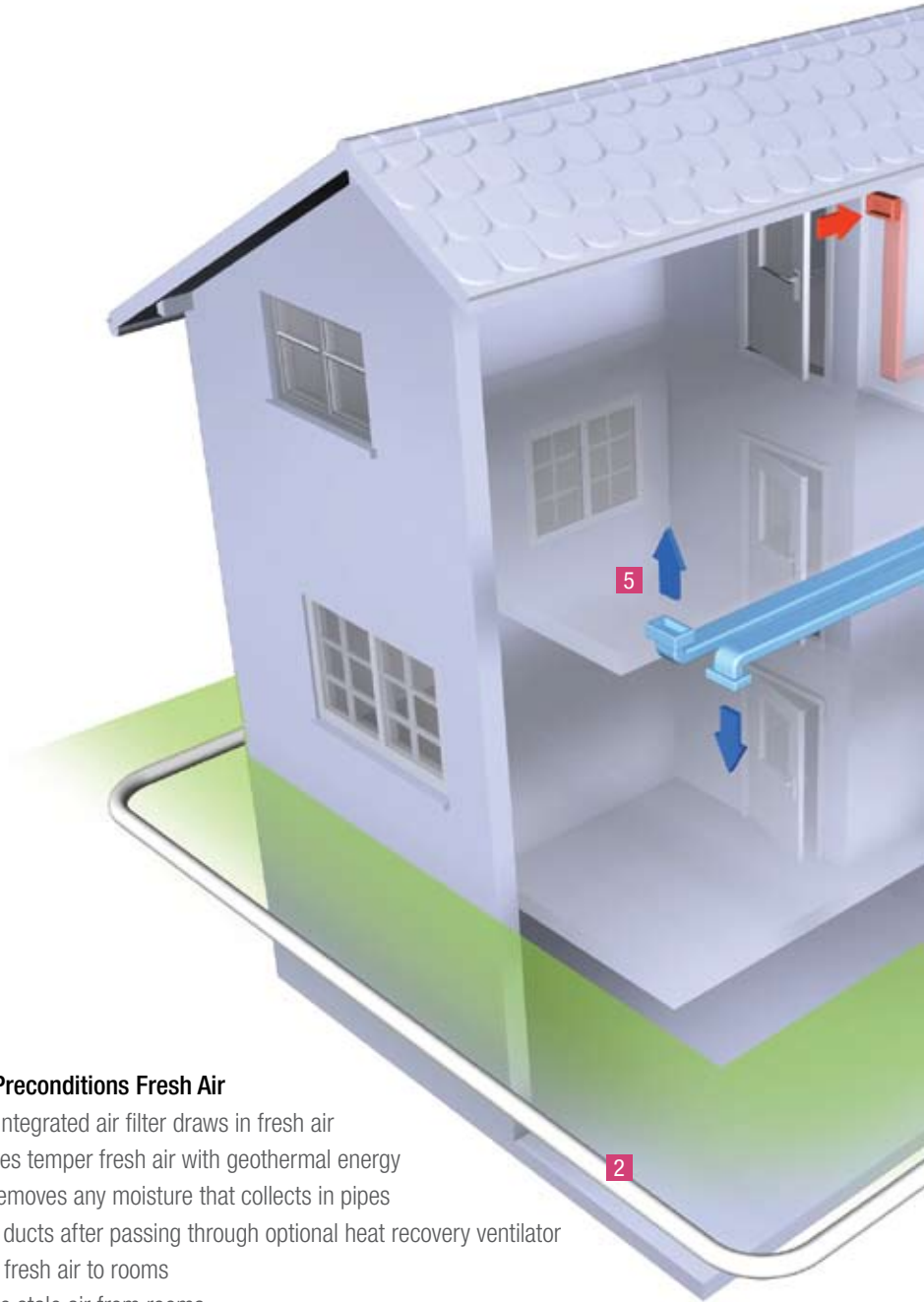
Embedded silver particles create an antimicrobial inner pipe surface that inhibits microbial growth. Silver ions are released when moisture is present, at the very moment when antimicrobial protection is most needed.



Nature's antimicrobial

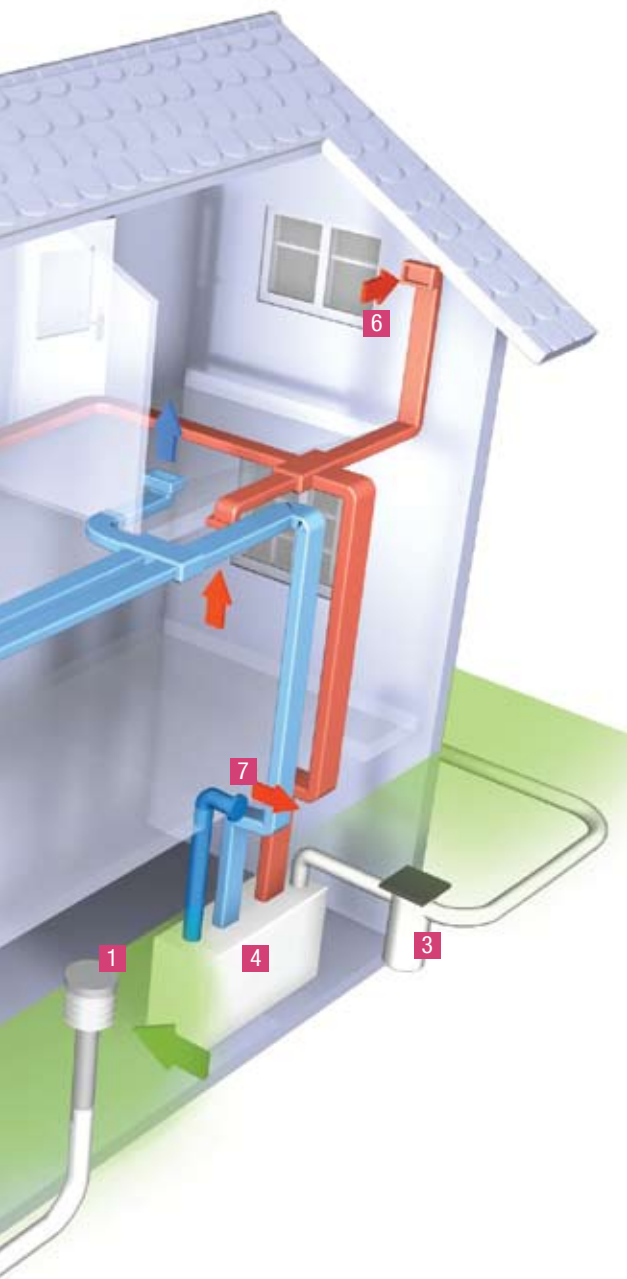
REHAU ECOAIR

HOW IT WORKS



Geothermal Energy Preconditions Fresh Air

1. Air inlet tower with integrated air filter draws in fresh air
2. REHAU ECOAIR pipes temper fresh air with geothermal energy
3. Condensate drain removes any moisture that collects in pipes
4. Fan propels air into ducts after passing through optional heat recovery ventilator
5. Registers distribute fresh air to rooms
6. Return vents remove stale air from rooms
7. Exhaust fans expel air from the building after passing through optional heat recovery ventilator



Air Inlet Tower

Made of stainless steel, the tower captures incoming fresh air through the louvered hood where a filter removes dust and pollen. It is tall enough to clear low-lying obstacles such as vegetation and typical snow banks, yet it is still easy to reach during filter changes.



REHAU ECOAIR Pipes

Solid-walled PVC pipes and fittings can be configured in various patterns to achieve the required ground-to-air heat exchange. A unique silver-enabled lining inhibits microbial growth.



Two options for condensation management protect pipe hygiene:

Integrated Condensate Drain Adapter

This integrated drain adapter discharges condensate into the building's existing drainage system and prevents odors from entering the ventilation supply air.



Condensate Collection Shaft

This stand-alone drainage solution uses an exterior shaft and pump to expel water into a water reclamation or storm drainage system or directly into the ground.



REHAU ECOAIR

SIGNATURE COMPONENTS



REHAU ECOAIR Pipe

REHAU ECOAIR pipes have been engineered to meet the requirements of a ground-air heat exchange system. They inhibit ground-water intrusion, provide good thermal conductivity with the soil and have sufficient strength to resist sagging or crushing when buried under normal circumstances.

– Solid-Walled PVC Pipe

PVC pipe is a good heat conductor, providing efficient heat transfer from ground to air. Pipes have minimum stiffness of 46 psi (320 kPa) in accordance with ASTM D3034 and CSA 182.2, allowing it to be buried under load.

– Antimicrobial-Protected Inner Layer

REHAU ECOAIR pipes feature a unique antimicrobial-protected inner layer developed by REHAU for ground-air heat exchange systems. The antimicrobial properties are achieved by incorporating silver ions into the inner layer of the pipe.

– High Longitudinal Rigidity

The high longitudinal rigidity of REHAU ECOAIR pipe promotes effective condensate drainage. Pipes with inadequate longitudinal rigidity are not recommended for ground-air heat exchange systems because they may sag and allow puddles to form at low points.

– Resistant to Radon

Radon is a natural colorless, odorless radioactive inert gas encountered in rock and soil. It diffuses through the ground, dissolves in water and escapes into the atmosphere at the ground surface. REHAU ECOAIR pipes are equipped with locked-in gaskets that resist penetration by liquids and gases such as radon. The pipe joint design is tested to ASTM D3212 Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

– Wide Range of Fittings

A wide range of fittings provides flexibility in designing the ground-air heat exchange system. Elbows, wyes and couplings are available to allow for the installation of grid, serpentine and ring pipe configurations.

REHAU ECOAIR AT WORK

BIOHAUS ENVIRONMENTAL LIVING CENTER

BEMIDJI, MINNESOTA



Many REHAU systems contribute to the outstanding energy performance of the BioHaus: ground-air heat exchange, solar thermal hot water, geothermal ground loop heat exchange as the energy source for radiant heating, and high performance vinyl tilt-turn windows.

The BioHaus Environmental Living Center at Concordia Language Villages in Bemidji, Minnesota is the first-ever certified German Passivhaus in North America. Opened in June 2007, this innovative living and learning center uses 85 percent less energy than comparable U.S. structures.¹ The BioHaus laid claim to being the nation's tightest building when it passed the stringent Passivhaus airtightness test – a notable achievement in light of the structure's location in an extreme climate zone.

The REHAU ground-air heat exchange system is essential to a building as airtight as the BioHaus. The system not only supplies fresh air ventilation, but also significantly reduces energy consumption for space heating and eliminated the need to install a central air conditioner. On a sub-zero winter day, air taken into the system at 20°F below zero (-29°C), after traveling through a grid with a total of 328 ft (100 m) of 8 in (200 mm) underground pipes, entered the building at 25°F (-4°C). Heat gain increases further as the outdoor temperature drops and decreases as the temperature differential between the ground and the outdoor air diminishes. In the summer, the ground-air heat exchanger turns into an “air-conditioner,” providing fresh, cool air throughout the day by cooling 85°F (29°C) outside air down to a comfortable 67°F (19°C).

¹Source: <http://waldseebiohaus.typepad.com>

RAUGEO

GEOHERMAL GROUND LOOP HEAT EXCHANGER
RENEWABLE ENERGY FOR HEATING AND COOLING





These days, we're all searching for ways to conserve energy and reduce our environmental impact. Solar, wind and natural gas are increasing in popularity. You may be surprised to hear that there's an even more efficient alternative energy source – geothermal – which has been fine-tuned during more than three decades of installations.

Geothermal systems are “the most energy-efficient, environmentally clean and cost-effective space conditioning systems available today,” according to the U.S. Department of Energy.²

Heat from the sun warms the earth and keeps the underground temperature relatively constant throughout the year. Geothermal heat pump systems use this renewable energy from the earth and a small amount of electricity to provide an extremely energy-efficient heating and cooling solution.

Our RAUGEO ground loop heat exchanger, with its unique design and materials, is one of the best ways to collect energy for geothermal heat pump systems.

² *Space Conditioning: The Next Frontier*, U.S. Environmental Protection Agency, EPA430-R-93-004, Washington, D.C., 1993.

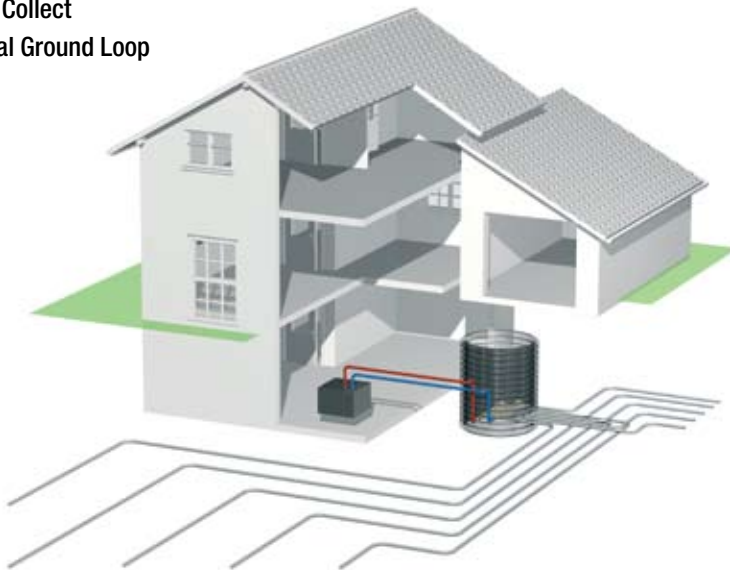
RAUGEO

BENEFITS

RAUGEO U-bend Vertical Ground Loop



RAUGEO Collect Horizontal Ground Loop



Minimizes Environmental Impact

A ground source heat pump system can reduce energy costs by up to 70 percent in the heating mode and up to 50 percent in the cooling mode, according to the EPA.³ In addition, a typical residential system reduces carbon dioxide emissions by more than 200 tons over a 20-year period, which is equivalent to removing two cars from the road.

Reduces Operating and Maintenance Costs

In residential applications, the initial investment in a geothermal heat pump system is higher, while in commercial applications, the costs are more comparable. Once the initial investment is recouped, which typically occurs in five to ten years, you'll enjoy many years of stable, low-cost energy. With few moving parts, geothermal heat pumps are durable and highly reliable, lowering your maintenance costs.

Fits Most Building Sites

The geothermal ground loop is custom-designed to fit your space and meet your heating and cooling requirements. Where there is plenty of open space and suitable soil conditions, a horizontal ground loop located about 5 to 7 ft (1.5 to 2 m) below ground, is the most economical option. Where space is limited, vertical ground loops are inserted in boreholes which are several hundred feet deep using a well-drilling rig.

³ *Geothermal Heat Pumps*, ToolBase Services, NAHB Research Center, <http://www.toolbase.org>, 15 Jan. 2010.

RAUGEO

HOW IT WORKS



RAUGEO Collect horizontal ground loops connect to geothermal manifold in vault.

Geothermal heat pump systems take advantage of the moderate and relatively constant ground temperatures to provide free, renewable energy for heating, cooling and domestic hot water. Because they use electricity only to move energy, rather than to generate it, geothermal heat pumps are significantly more efficient than conventional systems. They typically use only one unit of electricity to move three to four units of energy to and from the earth.

The ground loop heat exchanger is a sealed, pressurized closed loop pipe system that circulates a heat transfer fluid below the earth's surface. The same ground loops are used for both heating and cooling. When heating, the system collects and

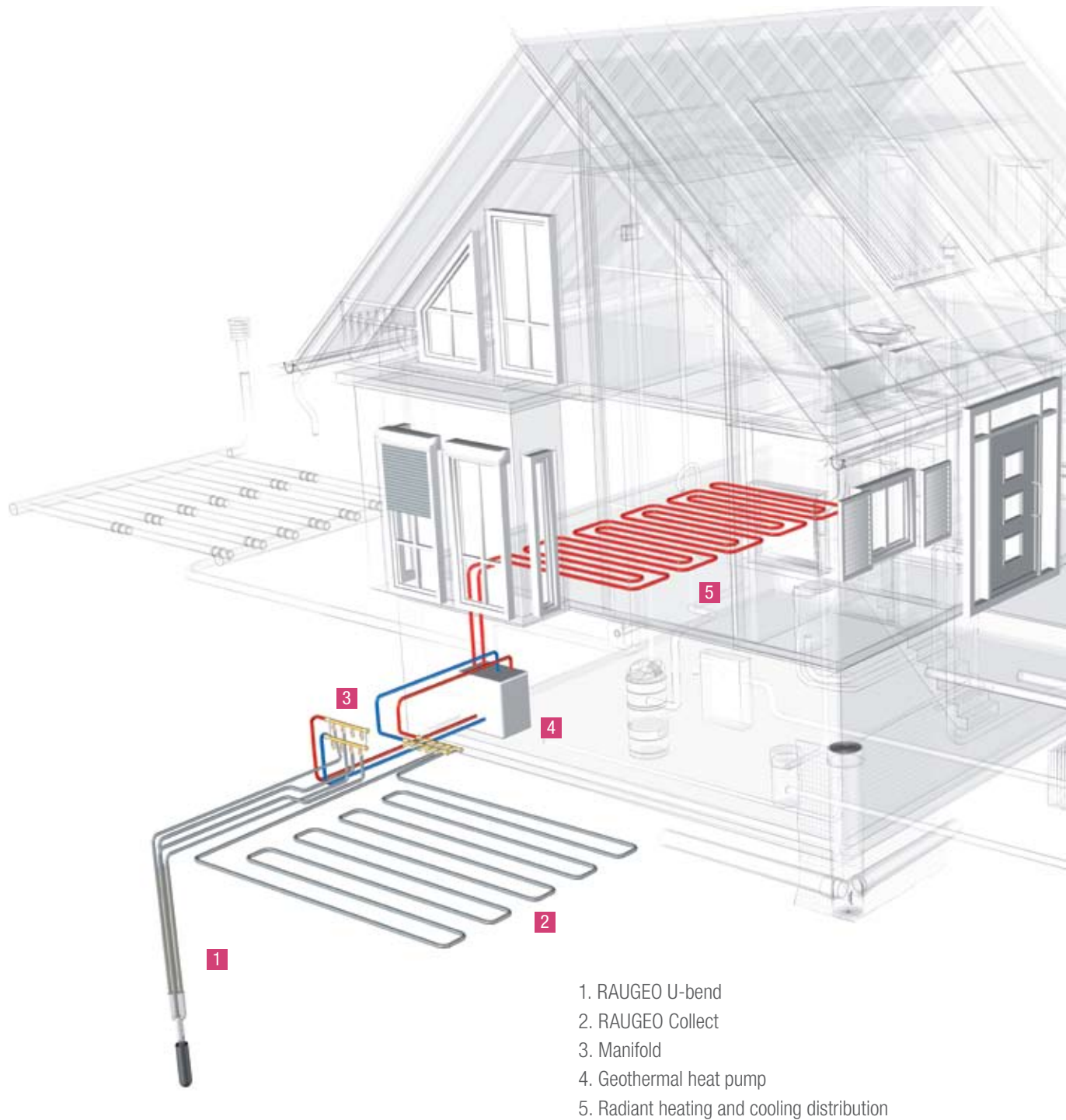
concentrates heat from the ground and delivers it to the building. When cooling, excess heat is removed from the building and dispersed into the ground. By simply turning a switch on your indoor thermostat, the flow of energy is reversed inside the heat pump.

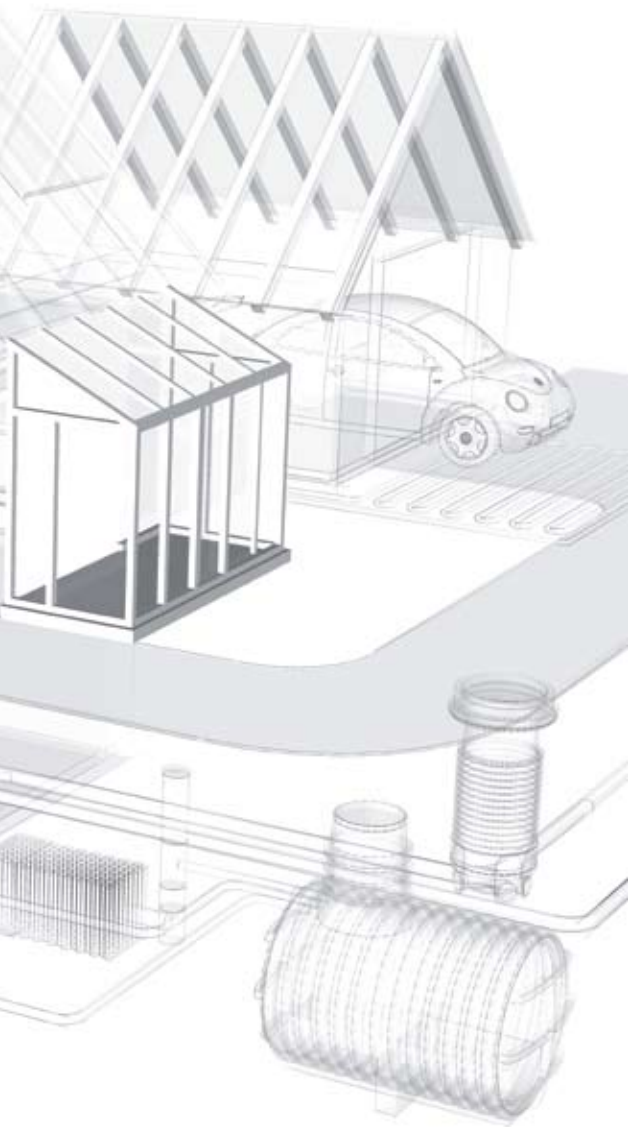
A typical geothermal system uses a water-to-air heat pump to transfer the energy from the ground loop fluid to a forced-air distribution system. A water-to-water heat pump transfers energy directly to a hydronic energy distribution system inside your building. When this distribution system is radiant heating and cooling, your heat pump will operate at its highest efficiency levels, delivering the highest coefficient of performance (COP) for heating and energy efficiency ratio (EER) for cooling.

Among the many government incentives for geothermal heat pump systems, our RAUGEO ground loop system qualifies for a 30-percent residential tax credit under the American Recovery and Reinvestment Act of 2009.

RAUGEO

HOW IT WORKS





RAUGEO PEXa Pipe

RAUGEO PEXa pipe provides superior resistance to impact, rock impingement and the stresses of earth movement. Unlike HDPE pipes which require sand bedding, PEXa pipes can use natural backfill which is lower in cost and achieves greater thermal conductivity.



EVERLOC Fittings

Engineered for use with PEXa pipe, the REHAU EVERLOC brass fitting system connects your ground loop system components with a high level of security. Making compression-sleeve joints is a quick, reliable process that is not dependent on installer skill or weather conditions.



Polymer Manifold

The REHAU polymer manifold provides greater control compared to typical reverse-return headers. The robust polypropylene design is offered in a range of sizes suitable for most geothermal projects.



RAUGEO U-bend

The superior flexibility of RAUGEO PEXa pipe allows a continuous length of pipe to be bent in a tight 180-degree radius and cast in a fiberglass-reinforced polyester tip mold. This eliminates the need for connections and the potential for leaks in the borehole.



RAUGEO

SIGNATURE COMPONENTS



A double U-bend is made up of two single U-bends with independent pipe circuits. The double U-bends extract more energy and protect against loss of the borehole in case of damage to one pipe circuit.

RAUGEO Double U-bend

The unique RAUGEO Double U-bend design extracts more energy, while offering a higher degree of security against loop failure.

In North American thermal performance testing,⁴ RAUGEO Double U-bends installed alongside single HDPE U-bends experienced significantly lower borehole thermal resistivity. Test results demonstrated that the RAUGEO Double U-bend with pipe spacer requires 20 percent less borehole footage to extract the same energy as a single HDPE U-bend, allowing drilling costs to be reduced.

Unlike HDPE U-bends that incorporate welded joints, RAUGEO U-bends are formed from one continuous length of pipe. The strong, yet flexible PEXa pipe is bent to a 180-degree angle and cast in a fiberglass-reinforced polyester tip mold. This results in a rugged U-bend that resists damage during borehole insertion and eliminates risks associated with underground joints.

Polymer Manifold

Integrating a manifold into a geothermal system design gives you much more control over your ground loops. By simply reading the manifold flow gauges, you'll know that all your ground loops are functioning properly. If a circuit becomes damaged or unusable for any reason, the manifold allows it to be shut off. So, instead of losing the entire loop field, only one U-bend is lost, keeping your heating and cooling system operating until repairs are possible.

The manifold also allows the system to be more easily optimized. Balancing numerous ground loop circuits can be challenging, especially if the length of one or two of the loops is different from the rest. Incorrect circuit balance can reduce system efficiency. The manifold allows you to balance each circuit individually with the built-in circuit adjusting valves, providing more freedom to design the most cost-effective well field.

⁴ Results based on findings from: Crecraft, Harrison, and Justin Mahlmann. *REHAU in-situ Borehole Thermal Performance Testing*, Chantilly: Bowman Geothermal, 8 Oct. 2009

RAUGEO AT WORK

MINNIE HOWARD HIGH SCHOOL
ALEXANDRIA, VIRGINIA



RAUGEO provides renewable energy and an authentic lesson in sustainability for D.C. metro-area high school students.

The REHAU RAUGEO ground loop heat exchange system played an integral role in the Alexandria City Public Schools (ACPS) "TC9" initiative to transform the T.C. Williams High School Minnie Howard Campus into a state-of-the-art working Green School Laboratory. This 65 borehole installation of 300-ft (90-m) REHAU PEXa double U-bends is anticipated to contribute to a more than \$400,000 life cycle cost savings over the next 20 years, as well as reduce greenhouse gases by 110,000 lbs (50,000 kg) of CO₂ per year. In addition, 10 polymer modular manifolds were installed in a unique system of five buried vaults that provides complete access for easy individual circuit balancing, purging and maintenance.



Well driller inserts one of 65 vertical ground loops.

RAUGEO AND RADIANT SYSTEMS

UNMATCHED EFFICIENCY FOR HEATING AND COOLING





There's a natural synergy between geothermal heat pump and radiant systems. So, if you're considering using our RAUGEO ground loop system, you'll also want to look at radiant heating and cooling, and vice versa.

To provide comfortable room temperatures, radiant heating works well with relatively low water temperatures and radiant cooling works with moderate water temperatures. It's precisely in these temperature ranges that your water-to-water geothermal heat pump operates most efficiently.

By combining RAUGEO with REHAU radiant heating and cooling, you'll enjoy the greatest comfort at the lowest operating cost. You'll also appreciate the reliability of REHAU quality components – durable PEXa pipes, secure EVERLOC joints and manifolds with individually controlled circuits – from the geothermal probe to your thermostat.

In many cases, a properly designed geothermal-radiant system can provide enough energy to heat and cool your entire space even in extreme temperatures.

RADIANT HEATING

OUTSTANDING COMFORT AND ENERGY EFFICIENCY
SIGHT UNSEEN





If you are searching for a more comfortable and more efficient way to heat your space, radiant heating may be the answer. Anyone who suffers with uneven heat or drafts in their home or building knows that the winter months can be just as difficult indoors as they are outdoors. When properly installed, radiant heating provides even, comfortable heat at every level and in every corner of your space.

Because of its exceptional comfort at relatively low operating temperatures, radiant heating is very energy efficient. Optimizing the radiant panel design using strategies such as room-by-room zoning can add to your energy savings.

Radiant heating can be the primary heat source or serve in combination with auxiliary heating systems. It can be installed almost anywhere heat is needed – residential homes, apartment buildings, office buildings, schools, assisted living centers, auditoriums, barns and warehouses. In all of these spaces, radiant heating provides warm, gentle heat unmatched in comfort, efficiency and flexibility.

Gentle heat radiating from pipes in the floor adds to your comfort.

RADIANT HEATING

BENEFITS



Increases Comfort

Step onto a floor with REHAU radiant heating and experience comfort at its best. Heat is gently radiated throughout the space, virtually eliminating cold spots and temperature fluctuations. A radiant heating system also keeps floors warm and dry, making hard surface flooring more comfortable.

Enhances Control

It's easy to zone a radiant heating system using multiple thermostats. This allows you to adjust temperatures in a single room or a group of rooms, based on activity and usage levels. For example, a guest room can be kept at a lower temperature when not in use.

Offers Flexibility

Radiant heating can be used in floors, walls and ceilings and can be installed in a single room or throughout your home or building. There are no heaters, radiators or vents, so you'll have more design freedom and open space. Radiant heating is a great choice for today's open floor plans, especially in areas with high ceilings.

Improves Energy Efficiency

Radiant heating allows a thermostat to be set as much as 4°F (2°C) degrees lower than it would be with traditional hot air systems without sacrificing comfort. These lower operating temperatures can reduce fuel consumption, potentially saving up to 30 percent per year in heating expenses. And since radiant heating can be used with a variety of heat sources including geothermal heat pumps, solar collection systems and condensing boiler technology, you can achieve even further savings.

RADIANT HEATING

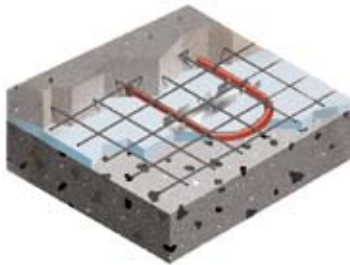
HOW IT WORKS

REHAU's radiant heating system works by circulating warm water through a network of pipes placed in the floor, wall or ceiling. Heat is gently radiated from the panel, warming the surfaces, objects and air in the room to create a comfortable environment.

REHAU radiant heating is compatible with a variety of floor coverings, including hardwood, carpet, vinyl, ceramic, tile and natural stone.

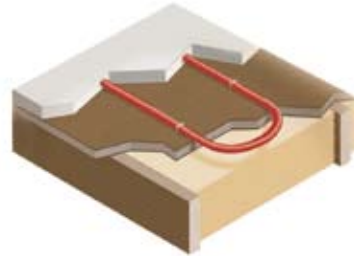
There are several methods for installation of a radiant heating system each with its own advantages.

Slab



Pipes can be installed within a normal concrete slab either on or below grade, usually with no design changes to the slab. It is very important to use the right amount of insulation under a heated slab for optimal efficiency and response time.

Overpour



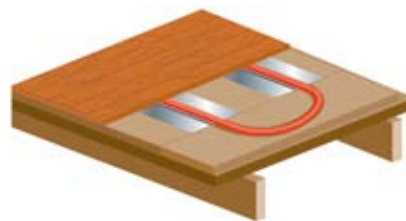
Pipes can also be installed above suspended wood floors and encased in a thin slab overpour, usually 1.5 in. (38 mm) thick.

Joist Space



Aluminum heat transfer plates are installed directly under the subfloor to conduct heat from the pipes. Joist space installation is sometimes ideal for retrofit construction, since you don't have to alter your flooring.

Dry Panel



Pipes are snapped into aluminum heat transfer panels on top of a suspended wood floor or existing slab. This system delivers the best efficiency and response time.

REHAU's dry panel system is a great option for both retrofit and new construction because it has a low profile and is easy to install.

RADIANT HEATING

HOW IT WORKS



RAUPEX O₂ Barrier Pipe

RAUPEX O₂ Barrier pipe is the main component in the REHAU radiant heating system. This durable, yet flexible PEXa pipe offers enhanced temperature/pressure capabilities and long-term strength. The oxygen diffusion barrier protects iron and steel system components against corrosion.



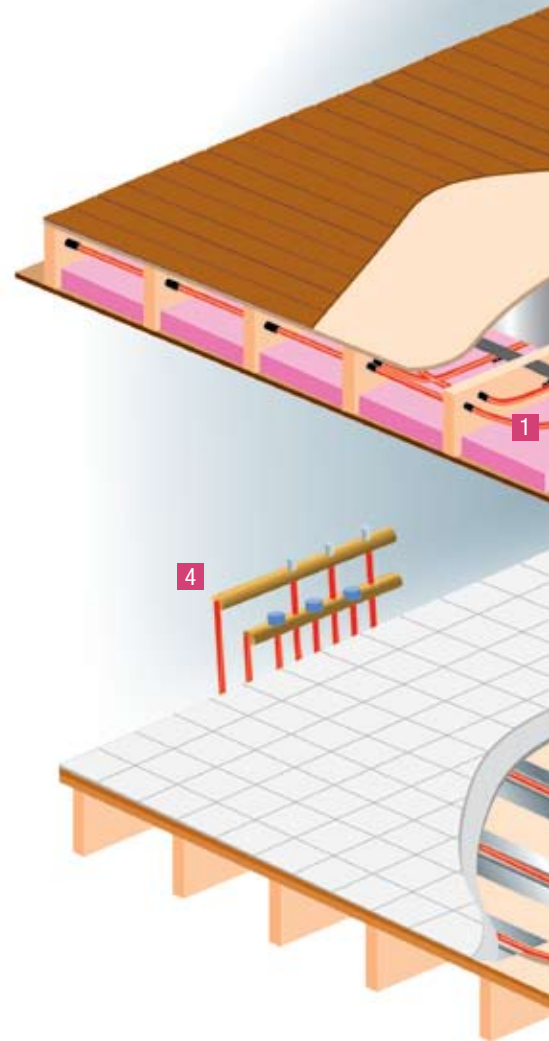
PRO-BALANCE® Manifolds

PRO-BALANCE manifolds bring ease of installation, controllable flow rates and a professional look to hydronic applications. PRO-BALANCE manifolds come preassembled and are available in a wide range of outlets. They make zoning easy to achieve without additional piping.



EVERLOC Fittings

Designed for use with RAUPEX pipes, EVERLOC compression-sleeve fittings have a larger inside diameter than typical PEX crimp ring fittings, resulting in superior flow characteristics and reduced pressure loss. Secure connections can easily be made using special tools even in tough weather conditions, providing you with reliability and proven performance. REHAU is the only PEX manufacturer who warrants radiant heating fittings when encased in concrete.



1. RAUPEX pipe
2. RAUPLATE joist space heating
3. RAUPANEL dry panel heating
4. PRO-BALANCE manifold



REHAU Controls

REHAU offers a wide variety of electronic components for your radiant heating application. They combine accurate and steady temperature with the flexibility of room-to-room control.



RAUPLATE™ Joist Space Heating

RAUPLATE's two-channel heat transfer plates are installed in the joist space below your floor. RAUPEX pipes are easily clipped into the channels in the aluminum plates to provide even distribution of warmth.



RAUPANEL™ Dry Panel Heating

REHAU's low temperature RAUPANEL heating system is ideal for retrofit and new construction. Installed above the subfloor and just beneath the finished floor, extruded aluminum panels conduct heat from 3/8 in. RAUPEX pipe to provide even floor surface temperatures with lower water temperatures.



RADIANT HEATING

SIGNATURE COMPONENTS



RAUPLATE Joist Space Heating

Experience the warm comfort of radiant heating without altering your existing flooring. RAUPLATE allows you to place radiant heating in the joist space, so there is no need to change or add height to the existing floor above. You can experience warm, even heat without disrupting your space or your life.

RAUPLATE double-channel heat transfer plates screw to the underside of the subfloor. The RAUPEX pipes then clip easily and firmly into place, providing heat to the space above. RAUPLATE is more efficient than using tubing alone, and is easier to install than other plate systems.

System Components

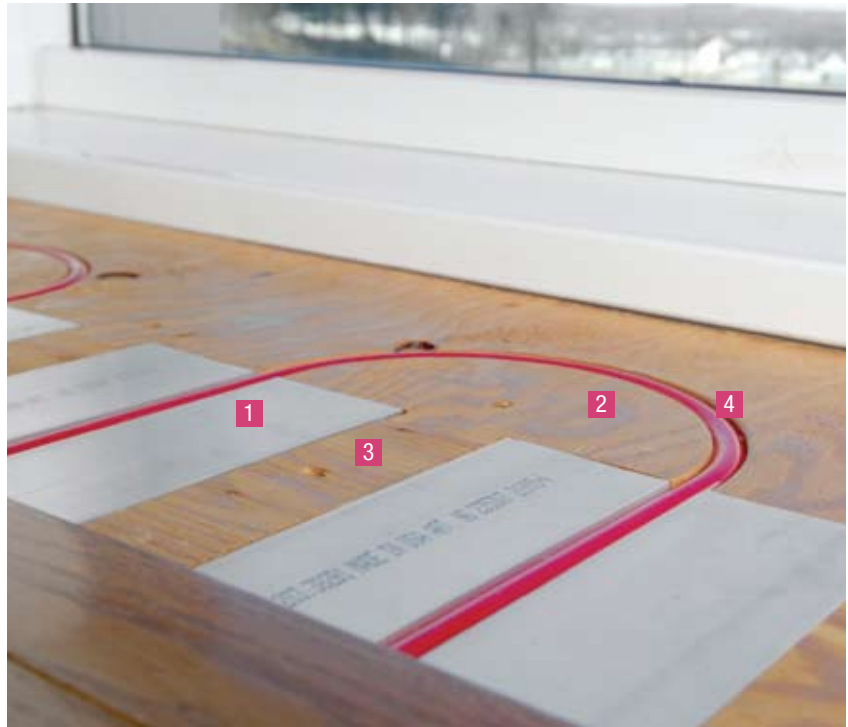
1. RAUPLATE joist space heat transfer plate
2. RAUPEX O₂ Barrier pipe
3. Pipe fastening rail
4. Protection sleeve

RAUPANEL Dry Panel Heating

Whether you're renovating a single room or building a new home, REHAU's innovative RAUPANEL system is ideal because it is installed without a concrete overpour. The system is placed directly on top of the subfloor and the pipes snap into grooves in the panels. Flooring can be installed directly over RAUPANEL components.

There are several advantages to using RAUPANEL:

- The low thermal mass of the extruded aluminum components promotes high heat conductivity, resulting in a fast response time for maximum comfort and efficiency. It also more easily addresses rapid temperature fluctuations during the spring and fall seasons.
- With only a 5/8 in (1.6 cm) height, RAUPANEL is a low profile system that offers installation flexibility in transition areas, such as between rooms or with different kinds of floor coverings.
- Unlike poured installations, no moisture is added to the building during placement of the thermal mass, minimizing the impact on your construction schedule.
- At about one-tenth the weight of a 1.5 in (3.8 cm) overpour, RAUPANEL does not require structural changes or reinforcement, making it an economical and easy choice.
- Dry panel systems allow for 100 percent installation by the heating contractor, reducing construction time and increasing quality control.
- In a recent study by Virginia Tech, RAUPANEL (with 6-in. and 8-in. spacing between pipes) provided the best overall output (50 to 60 percent more) when tested against competitors' dry and wet systems at the same water temperature and flow rate.⁵



System Components

1. Aluminum panels
2. Plywood return bends
3. Furring strips
4. RAUPEX O₂ Barrier pipe

⁵Results based on findings from: Khanna, Amit. *Development and Demonstration of a Performance Test Protocol for Radiant Floor Heating Systems*, MS Thesis, Virginia Polytechnic Institute and State University, January 2006.

RADIANT HEATING AT WORK

SPRING CREEK RESIDENTIAL COMMUNITY
CANMORE, ALBERTA





This innovative 70-acre residential community, designed to highlight the natural environment of the Canadian Rockies, also promotes a high level of environmental responsibility, including alternative energy sourcing that will provide power to all of its commercial and residential structures. The 12-year project currently features three live-work buildings designed with integrated low-temperature radiant heating and geothermal systems as the main source of heat. Approximately 550,000 ft (167,640 m) of RAUPEX pipe was used for the radiant heating systems in these initial three structures, with a total of several million feet expected to be installed by completion of the project.

In addition, 170 manifolds capable of controlling up to 16 individual zones per residence offer added comfort for those living at Spring Creek, as well as an enhanced level of system efficiency and overall energy conservation.

The radiant heating systems have also contributed to securing Silver, Gold and Platinum Built Green™ ratings for the three buildings constructed to date.



RADIANT COOLING

CREATING COMFORTABLY COOL SPACES





How refreshing it is to step inside a comfortably cool space on a sweltering hot day. Achieving this ideal indoor environment without wasting a lot of energy is much more complex than you might imagine. Comfortable cool is often elusive, despite the high dollars we spend on cooling our residential and commercial spaces.

Most traditional forced-air cooling systems produce uneven room temperatures. They can also contribute to poor air quality by distributing airborne contaminants, making a space unhealthy and uncomfortable.

By circulating cooled water through pipes embedded in your building's structure, radiant cooling evenly absorbs heat energy from a room, eliminating drafts and hot spots. A radiant cooling system is typically designed in conjunction with radiant heating, and achieves best results when combined with other energy-efficient systems in tight building structures.

Radiant cooling may handle the entire cooling load or be used to cover the base loads in traditional cooling applications. Since radiant cooling solutions can improve air quality, they are ideal in buildings such as hospitals and nursing homes where air quality is critical.

Water is superior to air as a cooling transport agent, so it cools a space much more efficiently and effectively.

RADIANT COOLING

BENEFITS

Just as ground temperatures keep the walls of your basement slightly cooler and therefore absorb heat from the rooms, a radiant system embedded in your building structure can have a similar effect, providing even, comfortable cooling to your space.

Reduces Life Cycle Costs

Compared to a traditional forced-air system, radiant cooling has a lower operating cost, due to the superior heat transfer properties of water. The installation of a radiant cooling system may also lead to a significant reduction in forced-air system components and ductwork costs.

Improves Energy Efficiency

Compared to traditional systems, radiant cooling operates with moderate water temperatures, allowing you to raise your thermostat a few degrees while still maintaining the same level of cooling. This can lead to a significant reduction of energy consumption and carbon footprint. The efficiency of a radiant cooling system can be even further enhanced with the integration of a water-to-water geothermal heat pump system.

Increases Thermal Comfort

The human body feels at its best when it can regulate at least 50 percent of its heat emission via radiation. Radiant cooling optimizes the surface temperature of the occupants' surroundings, providing a comfortable environment while minimizing drafts and ventilation noise.

The Earth Rangers Centre, a wildlife refuge, hospital and education center, relies on REHAU radiant heating and cooling to keep their space comfortable year round. A ground-air heat exchanger allows them to meet their healthy air requirement of 100 percent outdoor air ventilation.





RADIANT COOLING

HOW IT WORKS

In radiant cooling systems, RAUPEX pipe is either integrated into a floor structure with insulation to condition the space above or without insulation to condition the space above and below.

Designing and installing a radiant cooling system can be straight forward, especially when integrating it with a radiant heating system. A focus on controlling humidity levels and water temperatures is essential to reduce the risk of condensation associated with radiant cooling.

Radiant cooling works best in a tightly sealed building, so you will typically need supplemental ventilation, either to meet the building's fresh air requirements or to meet peak cooling loads. A controlled ventilation system, such as the REHAU ECOAIR ground-air heat exchanger, is ideally compatible with radiant cooling because it preconditions fresh air with geothermal energy, reducing demand on the cooling system.

The capacity of a radiant cooling system depends on factors such as insulation, pipe spacing, floor construction and floor covering. Under optimal design conditions, capacities of up to 16 Btu/h ft² can be achieved,⁶ with more typical capacities in the 8-12 Btu/h ft² range.

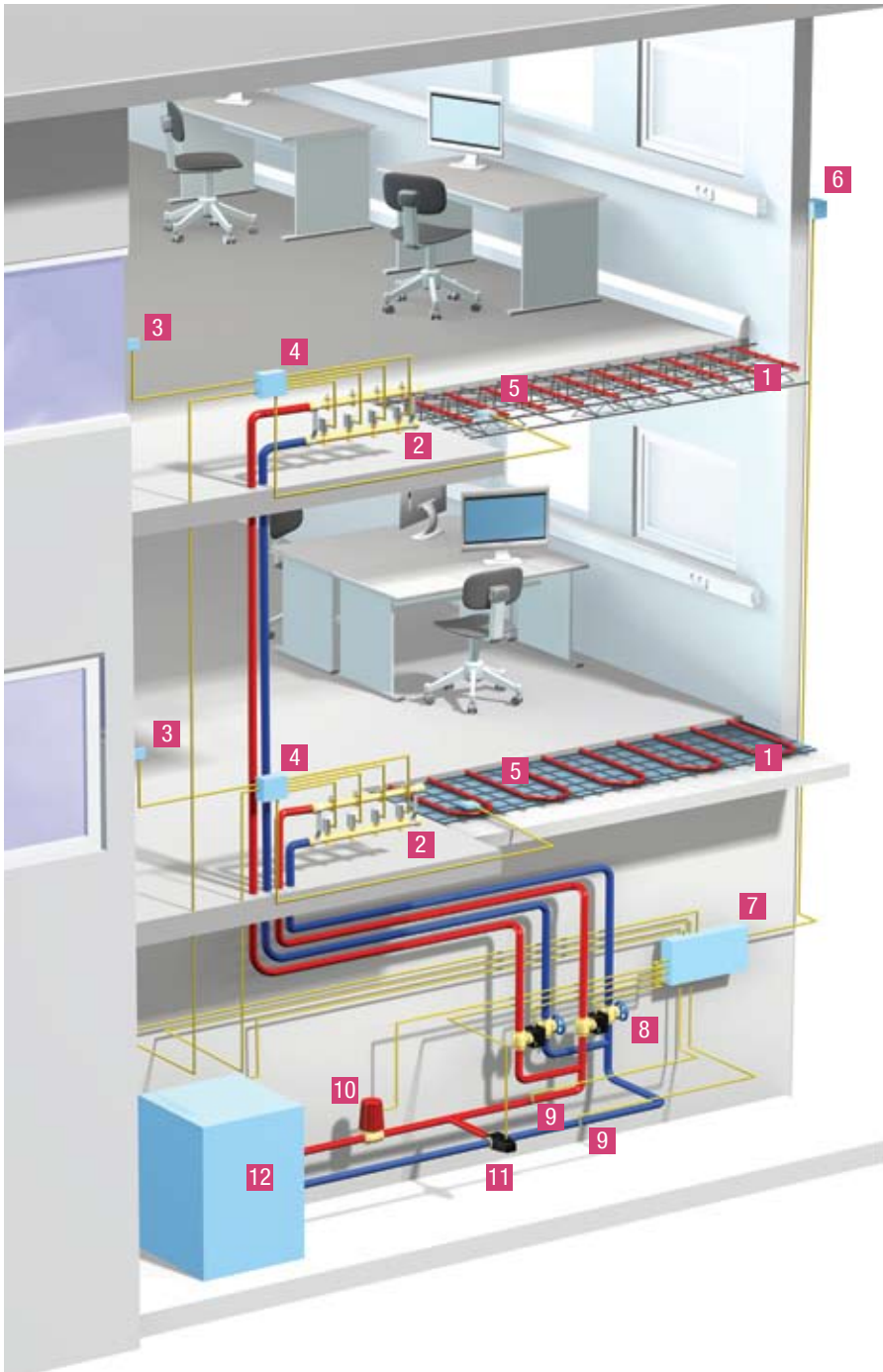
⁶ Olesen, Bjarne. *Radiant Floor Cooling Systems*, ASHRAE Journal, September 2008.



REHAU radiant cooling system provides a welcome relief for motorcycle techs at Harley-Davidson in Liberal, Kansas.

To help make working conditions as optimal as possible for its service technicians, especially during hot summer months, Liberal Harley-Davidson (in Liberal, Kansas) embraced the installation of a combined radiant heating and cooling system. Approximately 5,000 ft. (1,542 m) of 3/4 in. RAUPEX pipe was used throughout the 4,500 sq. ft. (418 sq m) concrete slab-on-grade installation.

Consistent and even temperatures throughout the service bays, compared with the showroom which is conditioned by a traditional forced air system, are noticed and enjoyed by the technicians and customers. The technicians particularly appreciate the relief during the hot summer season, provided by a cool, comfortable working environment.

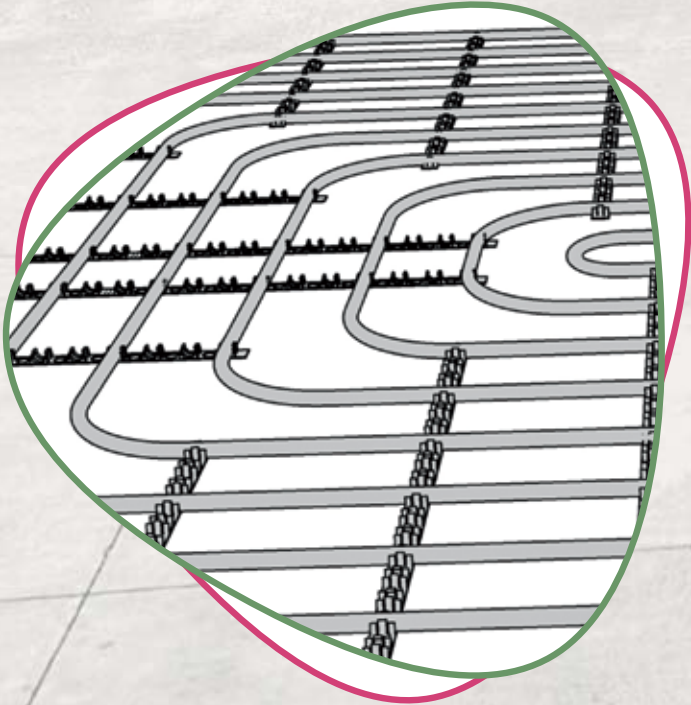


1. RAUPEX pipe
2. PRO-BALANCE manifold
3. Room thermostat / humidity sensor
4. System controller
5. Surface sensor
6. Outdoor air sensor
7. Main control
8. Valve
9. Temperature sensor
10. Circulator pump
11. Mixing valve
12. Energy supply (e.g., geothermal heat pump)

This diagram of a typical commercial radiant cooling system illustrates two installation configurations: REHAU CCTC (Concrete Core Temperature Control) in the upper floor and a standard in-slab construction with an insulation barrier in the lower floor. Supply lines from the energy source are colored red; return lines are colored blue.

SNOW AND ICE MELTING

CONVENIENCE AND SAFETY IN COLD WEATHER





Imagine never having to shovel or plow snow again. With snow and ice melting (SIM) systems, winter weather doesn't have to limit access to your home, building or facility.

By applying radiant heating technology to an outdoor application, SIM systems provide a safe and reliable way to keep surfaces clear of snow and ice. With proper design and installation, REHAU SIM systems provide long-term performance and reliability as well as saving the time and energy you spend on traditional snow and ice removal using mechanical equipment.

The flexibility of a SIM system allows for operation in a variety of outdoor areas such as sidewalks, steps, driveways, ramps for wheelchairs access and cars, parking lots, loading docks, carwashes, roadways, bridges and helicopter landing pads.

The REHAU snow and ice melting system takes the hassle out of winter weather and lets you enjoy the beauty of the season.

SNOW AND ICE MELTING

BENEFITS



Increases Safety

SIM systems eliminate snow and ice build-up, increasing the safety of surfaces where people walk and drive. By keeping your residence or place of business free of these dangerous elements that can cause accidents, SIM systems also reduce your liability exposure.

Provides Convenience

Snow and ice melting systems provide the ultimate in convenience, by eliminating time-consuming snow removal along with its associated health risks such as stretched muscles, aching backs and heart attacks.

Offers Cost Savings

A well-designed SIM system is often less expensive to operate than hiring motorized snow removal equipment, delivering significant cost savings during a typical season. It can also reduce indoor maintenance costs by eliminating the wear and tear from salt and water being tracked inside.

Minimizes Environmental Impact

By replacing motorized snow removal and deicing chemicals with a high-efficiency hydronic SIM system, you can actually reduce your environmental impact. In addition, the life of outdoor surfaces can be extended and damage to outdoor landscaping caused by the weight of snowbanks can be avoided.

SNOW AND ICE MELTING

HOW IT WORKS

SIM systems are hydronic systems intended to augment the removal of snow and ice by circulating a heat transfer liquid (usually a glycol and water mixture) through RAUPEX pipe which is installed within the SIM area.

An important feature of REHAU SIM systems is the electronic controls, which can provide fully automatic detection and sensing of snow and ice. By continually monitoring conditions at various outdoor sensors, the electronic control “knows” the outdoor weather, including when there is actually snow or ice on the outdoor surface. The system can turn itself on and off as needed. The control calculates how hot the fluid needs to be without overheating the area and wasting energy. The SIM system will run until the surface is dry.

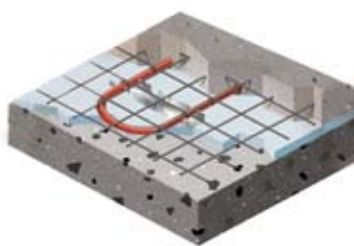
Users have the option to enable an idle function which keeps the system in operation when it is cold, but not actually snowing. By keeping the outdoor area warmer than ambient temperature, the system responds more quickly when precipitation begins, increasing safety. If the outdoor temperature becomes so cold that snowfall is unlikely, the system will also turn off, saving energy.

Weather and site conditions have significant impact on SIM system performance. REHAU has the engineering and weather data to help you design a system with output capacity geared to conditions in your geographic area. With proper design and installation techniques, our SIM systems will provide long-term performance and reliability in maintaining snow- and ice-free areas.

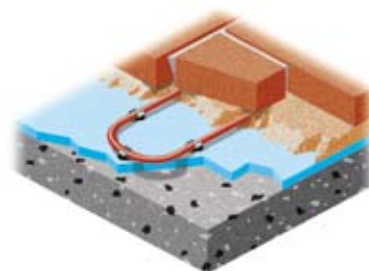


REHAU SIM system clears vehicle and pedestrian pathways around the Fallsview Casino Resort in Ontario.

RAUPEX pipe can be installed in substrates such as concrete, sandbeds and under asphalt using REHAU fastening systems that are designed to ensure fast, economical installations.



SIM installation in concrete overpour using wire mesh and ties to anchor the RAUPEX pipe.



SIM installation under brick pavers using screw clips to anchor the RAUPEX pipe inside the sand bed.

SNOW AND ICE MELTING

SIGNATURE COMPONENTS



INSULPEX® Energy Transfer Pipe

An ideal distribution pipe to snow and ice melting areas, INSULPEX consists of RAUPEX O₂ Barrier pipe surrounded by a solid layer of CFC-free polyurethane foam insulation. The smooth interior wall of RAUPEX provides superior flow and consistent water pressure, and resists mineral build-up. INSULPEX is available in one- and two-pipe configurations. The two-pipe configuration combines supply and return pipes, streamlining the installation process.



INSULPEX bends easily to avoid obstacles, simplifying installation.

A flexible alternative to rigid piping systems, INSULPEX offers ease of installation, combined with the long-term performance of PEXa pipe. INSULPEX is lighter than rigid piping systems and is available in continuous coils of various lengths that reduce the need for joints in the pipeline. These features greatly reduce the costs and time associated with installation. The continuous single layer of insulation minimizes heat loss and water permeability, while the outer LDPE casing offers protection from abrasion.

Connections are made with the REHAU EVERLOC fitting system, providing reliable joints that allow for immediate pressure testing.



In addition to snow and ice melting, INSULPEX is ideal for:

- District heating
- Chilled water
- Process piping
- Hydronic piping
- Potable water
- Geothermal (e.g., industrial and agricultural)
- Outdoor wood boiler

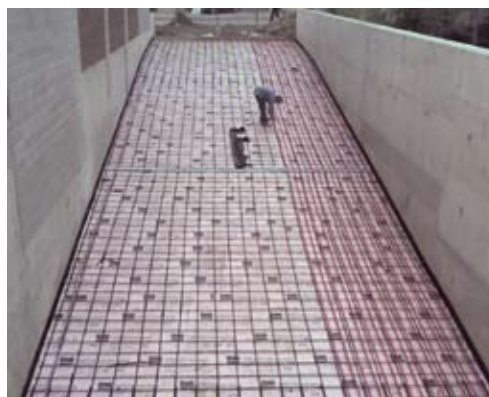
SNOW AND ICE MELTING AT WORK

LONDON POLICE STATION
LONDON, ONTARIO, CANADA



REHAU snow and ice melting system with PRO-BALANCE manifolds clears the path for London-area police.

A REHAU snow and ice melting system was installed under the new garage entry ramp at this London, Ontario police headquarters in Canada. With its steep incline, the ramp posed a potential hazard during the winter season, particularly for trucks and larger police vehicles entering the garage. The project included 8,000 ft (2,438 m) of RAUPEX pipe installed slab-on-grade, with three PRO-BALANCE XL manifolds to facilitate a high level of system control and monitoring, as well as enable individual loop isolation. London police vehicle operators can now access the parking garage without concern for the icy winter conditions typical to the central Ontario region.



RAUPEX pipe being installed under the garage entry ramp at the London, Ontario police station.

FIREPEX® RESIDENTIAL FIRE PROTECTION

INCREASED SAFETY OF FIRE SPRINKLERS FOR YOUR HOME





No one wants to think about the devastation a fire can cause. In no time, fire can not only claim your property and possessions, but also your life or the lives of your loved ones. Fire sprinklers can give you those precious seconds needed to evacuate you and your family. By combining fire sprinklers and smoke alarms, your chances of surviving a home fire increase by more than 97 percent.

Fire sprinklers can also reduce fire damage. On average, homes that are not equipped with sprinklers suffer 10-20 times more damage.

REHAU has engineered an innovative, yet proven residential fire sprinkler solution, based on more than four decades of installation experience with PEXa pipe. This unique system reduces installation costs while providing safety and reliability for you and your family.

*With a fire sprinkler system from REHAU,
your family can live with peace of mind.*

FIREPEX

BENEFITS



Enhances Safety

An American Fire Sprinkler Association study showed that only 28 percent of the smoke alarms in houses are working. Given that home fires become deadly in as few as three minutes, high risk groups such as the elderly and small children don't have sufficient time to escape. When homes are equipped with a fire sprinkler system, this time is greatly increased.

Lowers Investment Costs

Installation costs are comparable to the amount spent on common upgrades such as granite countertops or whirlpool bathtubs. In addition, a fire sprinkler system increases the value of your home and may also qualify your home for a 5 to 30 percent discount on the fire portion of your home insurance premium.

Reduces Damage

Fire sprinklers are activated by the heat generated by the fire. Only the sprinkler head within close proximity to the fire will be activated, thereby preventing the fire from spreading. Ninety percent of all home fires are contained with just a single sprinkler. Sprinkler systems typically release 85 percent less water than would be released by fire hoses.

Blends With Interior

The sprinklers themselves are the only visible components of the fire protection system. Concealed fire sprinklers have little impact on the interior look of the room.



Legislation Mandates Sprinklers in Many New Homes Beginning in 2011

In the United States, 78 percent of the 530,500 structure fires reported in 2007 occurred in residential properties, resulting in 14,000 injuries and 2,865 deaths. Fire sprinkler systems greatly reduce these risks.

In September 2008, the International Code Commission (ICC) approved a code mandating the installation of a fire sprinkler system in new one- and two-family homes and townhouses starting in 2011. These construction guidelines have been adopted by the majority of U.S. cities, counties and states and will go a long way toward making new homes more fire-safe.



FIREPEX

HOW IT WORKS

FIREPEX combines the convenience of lightweight, flexible PEXa pipe with the design and layout techniques of more traditional fire sprinkler systems. The flexibility of RAUPEX pipe ensures that no unnecessary joints are required between sprinklers.

Consisting of RAUPEX pipe and EVERLOC fittings, the FIREPEX system provides the same proven performance enjoyed by homeowners around the world. These components, combined with residential sprinkler heads, meet the requirements for fire protection systems as defined in the National Fire Protection Association Standard 13D Installation of Sprinkler Systems in One- and Two- Family Dwellings and Manufactured Homes. FIREPEX is also UL and C-UL listed for underground service applications.



1. RAUPEX pipe
2. REHAU sprinklers and cover plates



RAUPEX Pipe

RAUPEX is a durable yet flexible pipe. These features are derived from the PEXa production process pioneered by REHAU in 1968. A high degree of crosslinking results in a robust pipe with enhanced temperature capability, flexibility and long-term strength.



EVERLOC Fitting System

Manufactured from solid brass, the REHAU EVERLOC compression-sleeve fitting system is designed to withstand even the toughest conditions. Connections can be made quickly and easily without flame, heat or solvent, and are immediately ready for service. They have a larger inside diameter than typical PEX crimp ring fittings, resulting in superior flow characteristics and reduced pressure loss.



Sprinklers

REHAU also offers several UL-listed residential sprinkler heads to meet a wide variety of applications including concealed, recessed pendent and horizontal sidewall. Any listed residential sprinkler head will easily thread onto the specially designed EVERLOC fittings. Each fire protection fitting (tee, elbow or straight) has integrated mounting holes for easy installation.



FIREPEX AT WORK

RESIDENCE

ST. CHARLES, MISSOURI



Charring on this backsplash is the only hint of the fire that threatened this home before being extinguished by the FIREPEX sprinkler system.

FIREPEX system successfully extinguishes kitchen fire in St. Charles New Town Community.

First-time homeowners Erica and Jake Hamilton⁷ were happily settled for three years in their New Town community of St. Charles, Missouri when the highly unexpected occurred. While commencing a typical dinner routine, the couple watched in stunned awe as residual polishing solution on their granite countertops ignited in flames from the stove, and a full-blown fire overtook an adjoining wall.

“It was almost like it couldn’t be happening,” said homeowner Erica Hamilton. “The fire just seemed to ‘appear’ and spread in an instant.” Fortunately for the couple, the community’s developer, Whittaker Homes, had specified a FIREPEX residential fire sprinkler system from REHAU in the original building plans to meet local fire safety codes.

“A number of homes in the Hamilton’s area align the town’s waterfront, and the fire sprinklers were necessary to provide extra time for firefighters to navigate through and run hoses in the event of a fire,” explained Dale Andereck, Whittaker Homes plumbing supervisor. Approximately 45 seconds after the fire’s ignition, the system’s kitchen sprinkler head was activated and successfully extinguished the fire.

“We are educated people, and you think ‘I’m smart, I know what to do if a fire occurs,’” Hamilton shared. “It was shocking to realize in the midst of an actual fire, when the panic is at full strength, that you can’t even remember how to use a fire extinguisher.”

Andereck was notified of the sprinkler activation and sent to the Hamilton’s house for its repair.

“By the time I got to the house, the fire had been completely extinguished, and I couldn’t even tell there’d been one. It was absolutely amazing to me – you’d think there would be soot and residual smoke everywhere, but the only thing that even remotely indicated a fire was some slight charring on the countertop backsplash. The rest was just a normal-looking kitchen that had received a healthy sprinkle of water. To restore the FIREPEX system for future operation, Andereck needed only to replace the single activated sprinkler head and reestablish the water supply flow to the house.

“In reality, FIREPEX was an efficient, effective lifesaver that knew exactly what to do when we unfortunately didn’t.”

“Previous to the fire, it was kind of like a funny mystery when friends would come over and see the sprinkler heads,” said Hamilton. “We’d all wonder, ‘does the whole thing go off at once, like in the movies?’ In reality, FIREPEX was an efficient, effective lifesaver that knew exactly what to do when we unfortunately didn’t. I am so grateful for it and that no one got hurt – I know it could have been 100 times worse.”

“This was the first activation of a residential sprinkler system in any of our developments to date, and while we’d ideally prefer they all indefinitely remain on the ready, it’s wonderful to know REHAU FIREPEX was the reliable choice,” said Greg Whittaker, president of Whittaker Homes.



⁷ Names of homeowners have been changed to protect their privacy

REHAU SUPPORT

MAKING SUSTAINABILITY WORK FOR YOU

REHAU honors our promise of quality by continually providing architects, specifiers, builders, contractors, building owners and homeowners with answers to their questions about REHAU solutions.

You'll find an information request link on virtually every page of our website.

Quality is Our Core Value

By striving to consistently exceed industry standards with our materials and designs and showing genuine passion for our work, we achieve global success as a premium brand. Our PEXa pipe is manufactured in a state-of-the-art North American plant using a quality management system that is certified to ISO 9001.

Warranties Give Assurance

REHAU stands behind our products with a 25-year limited warranty on PEXa pipe and EVERLOC fittings and a 10-year limited warranty on REHAU ECOAIR pipe. For complete details, visit www.na.rehau.com/warranties

Education Spreads Best Practices

REHAU Academy is the central knowledge institute for REHAU solutions. First-class presenters provide product, design and technical information, installation techniques and industry trends. The REHAU Academy can present virtually anywhere – at our locations or yours, to a whole company or just a few employees. For our current course schedule, visit www.na.rehau.com/academy

Technical Information Provides Confidence

REHAU and our channel partners will provide the technical support you need to successfully integrate our systems into your building. Our engineering and design departments help you design the most efficient systems. In addition, our complete library of technical and installation information, suggested specifications and submittals is available from our website. Visit www.na.rehau.com/resourcecenter



Professional Installation Seals the Deal

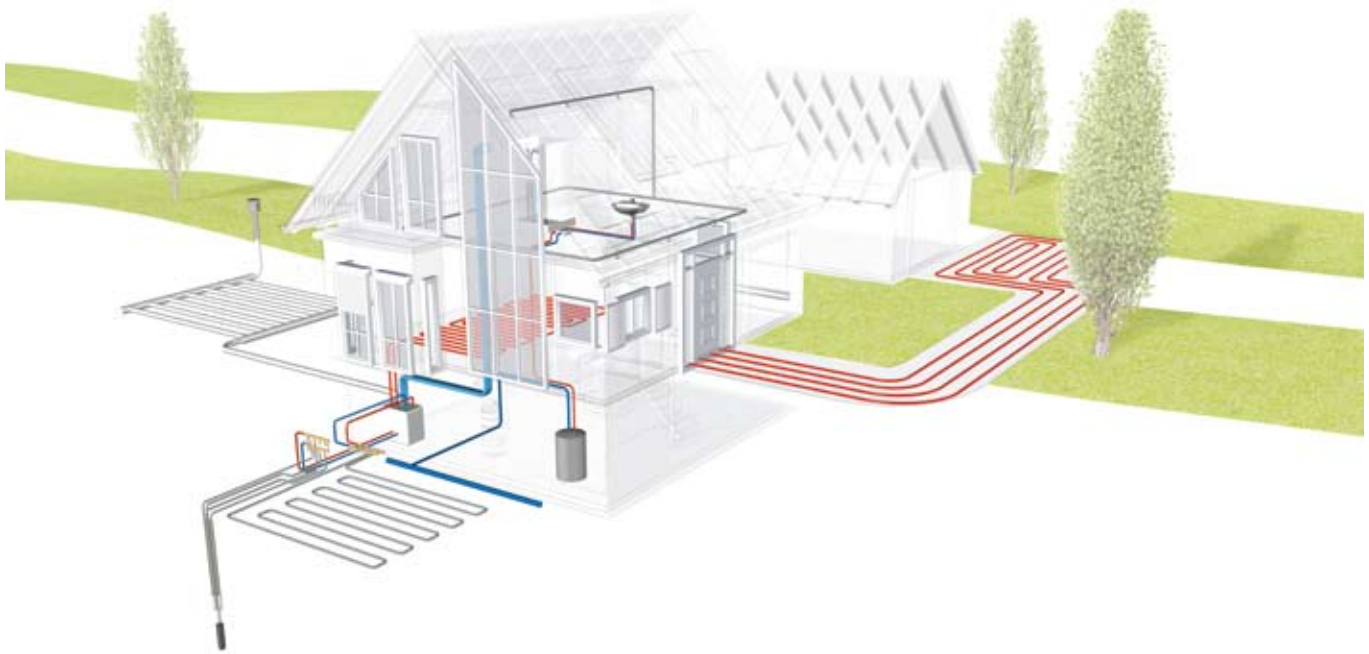
Installing one of our sustainable systems is definitely not a weekend “do-it-yourself” project. Proper installation of these systems requires the help of a professional installer. REHAU strongly recommends working with a trained contractor experienced in the design and installation of these systems.



Locating Your REHAU Product Supplier

REHAU has an extensive network of channel partners ready to help you achieve sustainable comfort on your next project.

Whether you are looking for the nearest supplier of quality REHAU products, an experienced REHAU contractor or one of our sales offices across North America, you'll find the appropriate contact information in our Dealer Locator database at www.na.rehau.com/dealers



REHAU's contribution to the construction and renovation of high-efficiency buildings is unmatched with regard to its quality and breadth.

Our polymer pipe systems work together seamlessly to capture energy from renewable sources and distribute energy efficiently. When combined with the outstanding insulating properties of our vinyl window, door and curtain wall systems, energy loss is significantly reduced.

With a product range that encompasses the building envelope and HVAC systems, we are uniquely qualified to help you and your design team optimize building performance. Invite us to the dialogue early in the planning phase, and we will help you to achieve sustainable comfort.

For updates to this publication, visit na.rehau.com/resourcecenter

The information contained herein is believed to be reliable, but no representations, guarantees or warranties of any kind are made as to its accuracy, suitability for particular applications or the results to be obtained therefrom. Before using, the user will determine suitability of the information for user's intended use and shall assume all risk and liability in connection therewith.

© 2010 REHAU Printed in USA