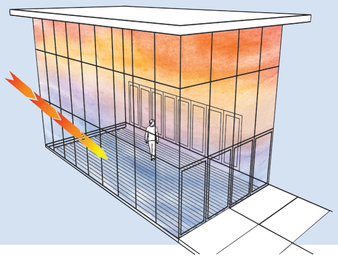

Basic Design Parameters

- 12 to 14 Btu/h/ft² of sensible cooling
- Up to 18 additional Btu/h/ft² of direct solar absorption for a total of 32 Btu/h/ft²
- 66°F minimum floor surface temperature
- 76°F to 78°F room set point temperature
- 55°F to 58°F average fluid temperature

For specific project design information, contact Uponor Design Services at 888.594.7726 or design.services@uponor.com.

Radiant Heating and Cooling Design Criteria

	Total Heat Exchange Coefficient Btu/h/ft²	Acceptable Surface Temperature (°F)	Maximum Capacity Btu/h/ft²
	Heating/Cooling	Maximum/Minimum Heating/Cooling	Heating/Cooling
Floor Perimeter Area	1.94/1.23	95/66	52/14
Floor Occupied Area	1.94/1.23	84/66	31/14
Wall	1.40/1.40	104/63	50/21
Ceiling	1.06/1.94	80/63	13/32

Based on REHVA Low-temperature Heating and High-temperature Cooling Guidebook and ASHRAE Standard 55 Thermal Comfort

Uponor's Experienced Team of Commercial Radiant Cooling Specialists

Uponor has an experienced team of dedicated professionals to assist the engineering and architecture community from concept to commissioning.

- Commercial sales representatives provide onsite training and education
- Design engineers provide concept and design support
- Project managers provide project coordination from concept to commissioning
- Engineering resource portal for specs, submittals, CAD details and other technical documentation
- BIM support — Uponor products in Autodesk® Seek, Building-Data/TSI
- Uponor specifications in SpecAgent®

To learn more, visit www.uponorengineering.com.

LEED Rating: Gold
Project: Pier 15 Exploratorium
Location: San Francisco, Calif.
System: Uponor Radiant Heating and Cooling
Product: Radiant Rollout™ Mats with Wirsbo hePEX™
Radiant Square Feet: 330,000
Engineer: Integral Group
Planned Completion: 2013

LEED Rating: Platinum
Project: National Renewable Energy Lab (NREL)
Location: Golden, Colo.
System: Uponor Radiant Heating and Cooling
Product: Wirsbo hePEX
Square Feet: 220,000
Engineer: Stantec
Design/Build Firms: RNL & Haselden Construction
Contractor: Trautman & Shreve
Completed: 2010

LEED Rating: Gold
Project: MGM City Center – Crystals
Location: Las Vegas, Nev.
System: Uponor Radiant Heating and Cooling
Radiant Square Feet: 60,000
Tubing: Wirsbo hePEX
Architect: Studio Daniel Libeskind
MEP Engineer: Flack + Kurtz
Contractor: Perini Building Company
Outside Design Dewpoint: 60°F
Completed: 2009

LEED Rating: Platinum
Project: Manitoba Hydro Place
Location: Winnipeg, Man., Canada
System: Uponor Radiant Heating and Cooling
Product: Wirsbo hePEX
Square Feet: 695,742
Executive Architect: Smith Carter Architects & Engineers
Design Architect: Kuwabara Payne McKenna Blumberg Architects
Structural Engineer: Halcrow Yolles, Crosier Kilgour & Partners
MEP Engineer: AECOM
Contractor: PCL Constructors Canada
Completed: 2009

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RADIANT COOLING

BROCHURE

Radiant Cooling — The Ultimate Comfort and Efficiency for Commercial Applications

We are the Radiant Cooling Experts

Since the 1990s, Uponor has provided more hydronic radiant cooling systems in more structures around the globe than all other hydronic radiant providers combined. With hundreds of systems in service worldwide, we are the experts at designing an effective, energy-efficient solution for any application.

Radiant Cooling Fundamentals

Hydronic radiant cooling uses active surfaces to absorb and remove heat. The system takes advantage of the considerably higher heat capacity of water over air. In a hydronic radiant cooling system, chilled water circulates through embedded PEX-a tubing to control the slab temperature and manage a portion of the sensible load, thereby reducing the air-system load. In addition, the same tubing used for radiant cooling can also be used for radiant heating.

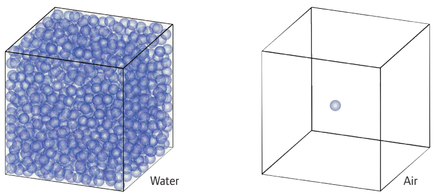
Benefits and Advantages — Reducing Energy Use While Improving IEQ

- Radiant cooling is especially effective in high-glazing areas where solar gain can be up to 80% of the load.
- Radiant systems reduce problems with mold and allergens (which are easily spread by forced-air systems), making it an ideal choice for hospital and healthcare environments.
- System designers can achieve LEED® credits in energy efficiency, renewable energy, indoor air quality (IAQ) and indoor environmental quality (IEQ) through radiant cooling applications and integration with related design strategies.
- Effective space conditioning with moderate cooling water temperatures enables optimization of mechanical equipment.
- Operative temperature control provides improved thermal comfort and allows designers to more readily comply with ASHRAE 55 standards.
- Radiant cooling can be used in passive systems enabling the use of reduced-cost, off-peak energy and thermal-storage strategies.
- Radiant cooling can be effective in meeting 50% energy savings over the baseline ASHRAE 90.1-2004 Standard.*

* *Pacific Northwest National Laboratory, Technical Support Document: 50% Energy Savings Design Technology Packages for Medium Office Buildings, Sept. 2009*

Water is 832 times denser than air.

That means water can capture and channel more energy per unit volume than air.



Source: Thermally Active Surfaces in Architecture, K.Moe, Princeton Architectural Press © 2010

"PEX-based radiant heating and cooling slabs are one of the keys to the energy performance at the Research Support Facility and in other TABS-style buildings yet to come. Water is a much better conductor of energy than air, and employing hydronic systems as a pathway for energy will be one of the strongest tools in rewriting our energy profile."

— Paul Torcellini, Senior Engineer, National Renewable Energy Laboratory (NREL), Golden, Colo.

Radiant Cooling Applications

- Compatible with renewable energy sources, including geothermal, solar and biomass
- Architecturally and visually appealing solution, since pipes are embedded in structural elements of the building (walls, floors and ceilings)

Uponor Radiant Floor Heating and Cooling

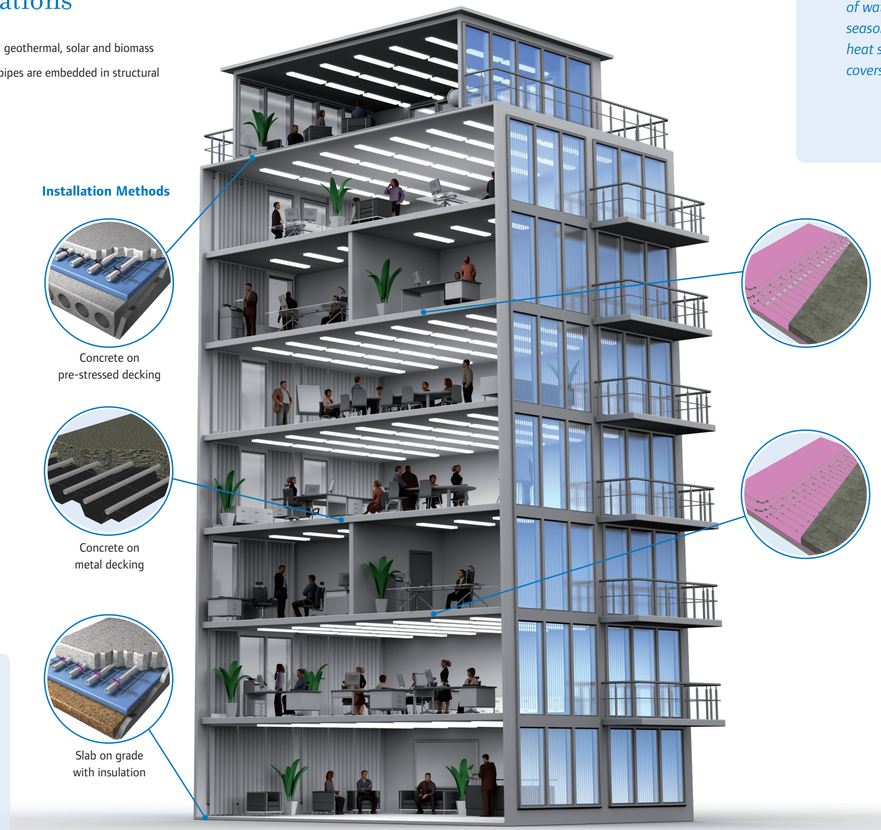
- Comfortable heating and cooling solution for both residential and commercial buildings, with a cooling capacity of up to 12-14 Btu/h/ft² (32 Btu/h/ft² in areas with high solar gain)
- Suitable for buildings requiring individual room temperature control
- Suitable for various floor constructions

Uponor Radiant Ceilings

- An energy-efficient heating and cooling solution with increased cooling capacity up to 32 Btu/h/ft²
- Capacity is not limited by carpet or fixed furniture

Uponor Thermo Active Building Systems (TABS)

Cost-efficient cooling for office and public buildings, with a cooling capacity of up to 32 Btu/h/ft²



"The renovated facility is projected to be 57 percent more efficient than the ASHRAE 90.1 baseline standard for a typical U.S. museum, thanks in part to its innovative use of water from the San Francisco Bay. Depending on the season, the latter will function as either a heat sink or a heat source for a radiant heating and cooling system that covers approximately 90 percent of the floor space."

– Joe Wenisch, Project Manager, Integral Group
Pier 15 Exploratorium, San Francisco, Calif.

Radiant Rollout™ Mat

Custom-designed mats provide a fast, efficient and consistent method for installing radiant heating and cooling systems in large commercial applications.

- 85% reduction in installation time
- Minimizes potential installation errors
- Enables fast commissioning and easy start-up
- Helps projects meet schedules
- Promotes worker safety

Tichelmann Design Method

Large-diameter, in-slab distribution piping for radiant loops prevents crowded manifold-approach zones and helps simplify the design process.

- Uses in-slab, reverse-return header for radiant distribution piping
- Distribution headers feed radiant loop modules
- Reduces or eliminates required wall manifolds
- Minimizes leaders to prevent crowded manifold-approach zones
- Simplifies design process for hard-to-reach radiant zones