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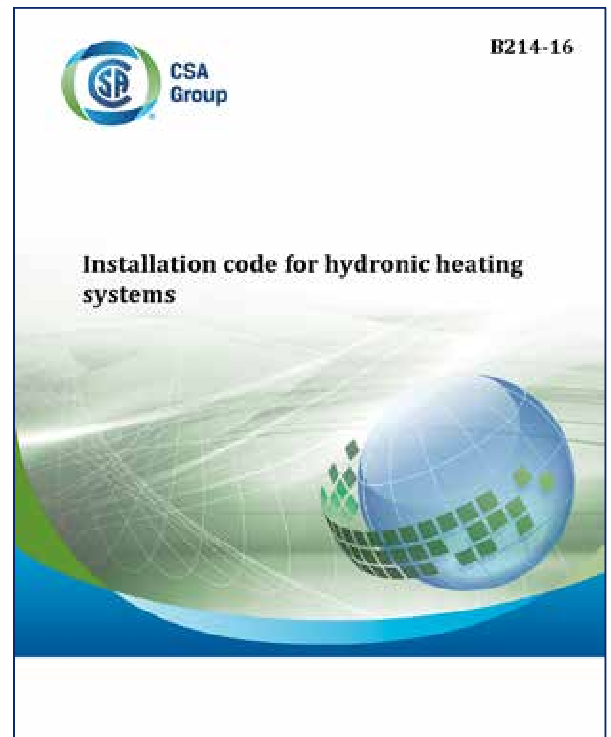
Important Updates to CSA B214-16

Installation Code for Hydronic Heating Systems

What you should know about
CSA B214-16 before 2020
(and hopefully do already)



Speaker Introduction

Lance MacNevin, P.Eng.

- *PPI Director of Engineering, PPI Building & Construction Division*
- University of New Brunswick (Mech. Eng.)
- Active in the piping industry since 1993
- Member of technical committees within ASTM, ASPE, AWWA, CSA, IAPMO, IGSHPA, NSF
- Member of ASHRAE TC 6.5 and TC 6.8, HIA-C, RPA
- ASSE Series 19210 Certified Hydronics Installer
- Tel (469) 499-1057 lmacnevin@plasticpipe.org

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The Plastics Pipe Institute

PPI is a non-profit trade association representing the plastic pipe industry

- PPI's five divisions focus on solutions for multiple applications:
  - **Building & Construction Division (BCD)**
  - Drainage Division (DD)
  - Energy Piping Systems Division (EPSD)
  - Municipal & Industrial Division (MID)
  - Power & Communications Division (PCD)

HDPE Conduit for fiber optic

Gas distribution piping

HDPE water mains

Disclaimer

- Speaker is not officially representing CSA Group or an employee of CSA
- Nor is he representing the CSA B214 Technical Committee or any other committee other than his direct employer

Hydronics is Natural

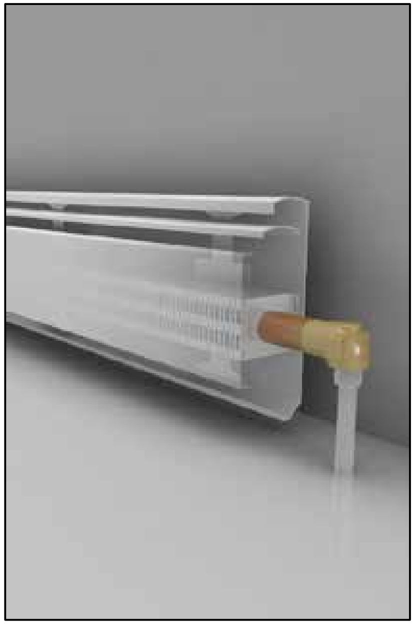
Hydronic Heating Systems

- Water (**R718**) is the optimal heat transfer fluid
- Typical hydronic systems actually outperform VRF (variable refrigerant flow) systems by 30 to 40 percent in overall systems efficiency, due mainly to lower pumping costs
- Hydronic distribution systems do not distribute refrigerants throughout buildings

Hydronics is Comfortable

Hydronic Heating Systems

- Many different types, very adaptable



Hydronics is Comfortable

Hydronic Heating Systems - Radiant

- Tubing is embedded in floors, walls or ceilings
- Heated water is circulated through the tubing for energy transfer
- The most comfortable and efficient method to heat or cool any space

System Benefits:

- Improved thermal comfort, silent
- Architectural freedom, invisible
- Energy flexibility, controllability
- Reduced temperature stratification
- Higher overall system efficiency
- Compliance with ASHRAE Standard 55
  "Thermal Conditions for Human Occupancy"

Courtesy REHAU

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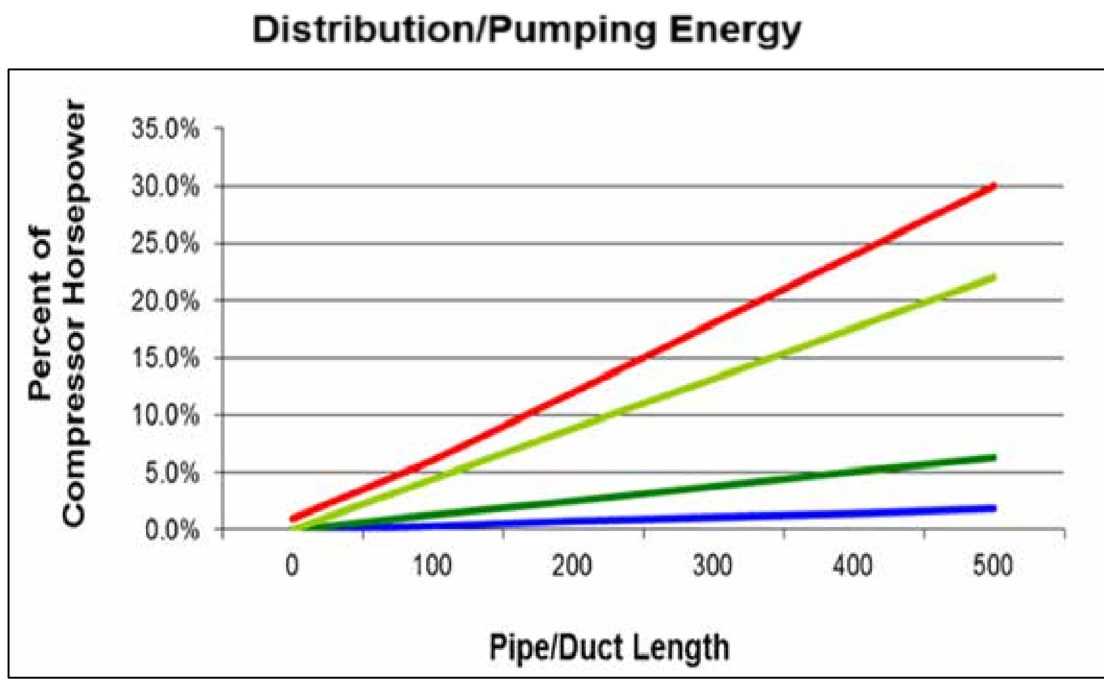
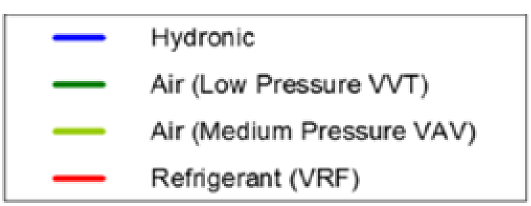
Hydronics is Efficient

Hydronic Efficiency

- The chart below compares the energy used by various systems to distribute heating or cooling capacity throughout a building
- Source: **HIA-C**
- www.iapmo.org/hiac





Hydronics is Awesome… when done right

Bad Radiant

- Informed code inspectors caught these messes before the pour

Course Outline

1. Introduction to CSA B214-16

2. New piping materials and requirements

3. Lists of approved radiant tubing fasteners and spacing

4. Revised maximum floor temperatures (radiant heating)

5. Clarifications on snow & ice melting loop lengths and installation

6. Notes about Legionella and combined systems

7. Annex C on radiant cooling

8. Annex D on minimum flow rates through heat transfer tubing

9. Obtaining CSA B214-16

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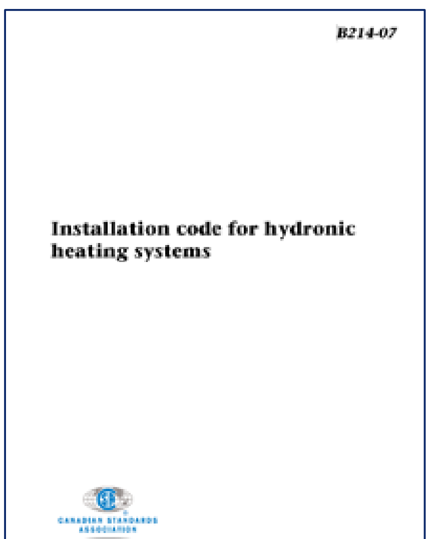
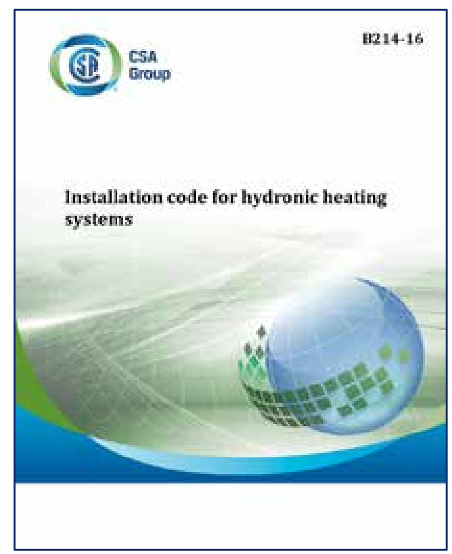
1. Introduction to CSA B214

CSA B214 *Installation Code for Hydronic Heating Systems*

- CSA B214 first published in 2001, and has been revised in 2007, 2012, & 2016
- CSA B214 has been part of the National Building Code since 2010
- The current 2015 NBC requires compliance to **CSA B214-12**
- **CSA B214-16** published in October 2016, and will be referenced in the 2020 NBC

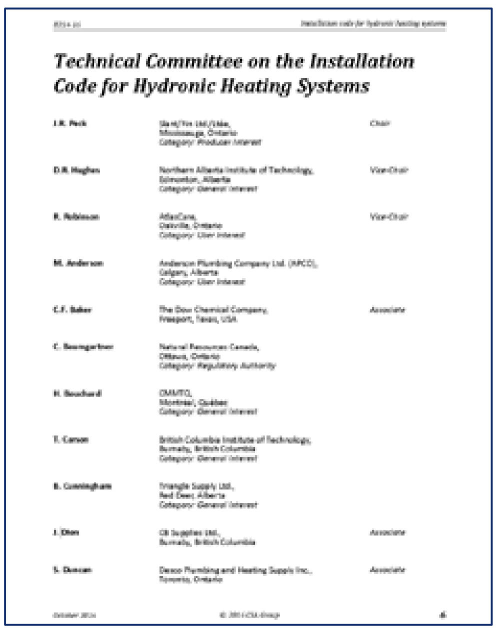




Introduction to CSA B214

CSA B214 *Installation Code for Hydronic Heating Systems*

- The CSA B214 Technical Committee (TC) is responsible for contents
- 18 Voting Members, 9 Associates (in 2016)



B214-16 — *Installation code for hydronic heating systems*

Technical Committee on the Installation Code for Hydronic Heating Systems

J.R. Peck	Slant/Fin Ltd./Ltée, Mississauga, Ontario *Category: Producer Interest*	*Chair*
D.R. Hughes	Northern Alberta Institute of Technology, Edmonton, Alberta *Category: General Interest*	*Vice-Chair*
R. Robinson	AtlasCare, Oakville, Ontario *Category: User Interest*	*Vice-Chair*
M. Anderson	Anderson Plumbing Company Ltd. (APCO), Calgary, Alberta *Category: User Interest*	
C.F. Baker	The Dow Chemical Company, Freeport, Texas, USA	*Associate*
C. Baumgartner	Natural Resources Canada, Ottawa, Ontario *Category: Regulatory Authority*	
H. Bouchard	CMMTQ, Montréal, Québec *Category: General Interest*	
T. Carson	British Columbia Institute of Technology, Burnaby, British Columbia *Category: General Interest*	
B. Cunningham	Triangle Supply Ltd., Red Deer, Alberta *Category: General Interest*	
J. Dion	CB Supplies Ltd., Burnaby, British Columbia	*Associate*
S. Duncan	Desco Plumbing and Heating Supply Inc., Toronto, Ontario	*Associate*

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B214-16 — *Installation code for hydronic heating systems*

F.E. Dalton	Government of Newfoundland, Department of Environment and Conservation, St. John's, Newfoundland and Labrador *Category: General Interest*	
M.A. Gordon	UA Local 46, Bowmanville, Ontario	*Associate*
I. Grebulak	Weil-McLain Canada Sales Inc., Burlington, Ontario *Category: Producer Interest*	
C.B. Haldiman	Watts Water Technologies, Springfield, Missouri, USA *Category: User Interest*	
C. Kahramanoglu	Ontario Ministry of Municipal Affairs and Housing, Toronto, Ontario *Category: Regulatory Authority*	
A. Knapp	A. Knapp & Associates, Toronto, Ontario *Category: User Interest*	
C.K. Lee	Heating, Refrigeration and Air Conditioning Institute of Canada, Mississauga, Ontario	*Associate*
L.D. MacNevin	The Plastics Pipe Institute, Irving, Texas, USA *Category: User Interest*	
C. McLellan	Canadian Home Builders' Association, Ottawa, Ontario	*Associate*
M. Miller	Taco Canada Ltd., Milton, Ontario *Category: Producer Interest*	
G. Morgan	Viega LLC, Shawnee, Kansas, USA	*Associate*
D. Nickelson	Rehau Incorporated, Leesburg, Virginia, USA *Category: Producer Interest*	

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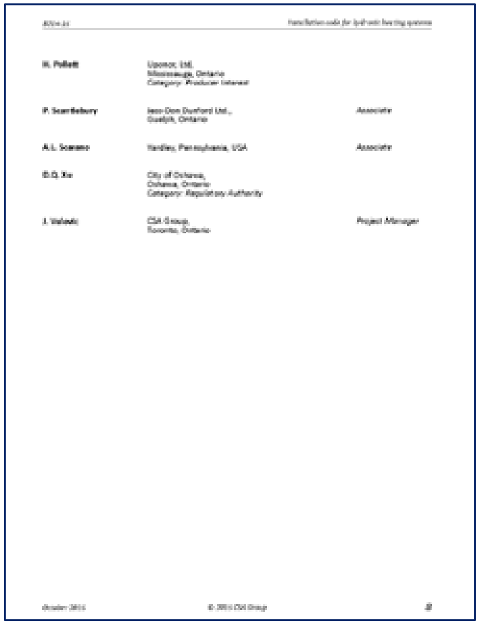

B214-16 — *Installation code for hydronic heating systems*

H. Pollett	Uponor Ltd., Mississauga, Ontario *Category: Producer Interest*	
P. Scantlebury	Jean-Don Dunford Ltd., Guelph, Ontario	*Associate*
A.L. Scarano	Yardley, Pennsylvania, USA	*Associate*
D.Q. Xu	City of Oshawa, Oshawa, Ontario *Category: Regulatory Authority*	
J. Valeski	CSA Group, Toronto, Ontario	*Project Manager*

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Introduction to CSA B214

CSA B214 *Installation Code for Hydronic Heating Systems*

- CSA B214-16 has dozens of updates:

This is the fourth edition of CSA B214, *Installation code for hydronic heating systems*. It supersedes the previous editions, published in 2012, 2007, and 2001.

The main changes from the previous edition are as follows:

a) clarification of the use of storage-type dual-purpose water heaters;
b) clarification of oxygen diffusion barriers;
c) clarification of requirements for hydronic fluid quality;
d) inclusion of polyethylene of raised temperature (PE-RT) tubing and tubing fittings;
e) clarification of requirements for return-water low-temperature protection;
f) clarification of insulation requirements;
g) clarification of requirements for tube fasteners;
h) inclusion of snow and ice melting systems as stand-alone systems;
i) clarifications of auxiliary systems;
j) clarification of radiant under-floor heating and floor surface temperatures;
k) revisions to nominal tube sizing in Table 1;
l) revisions to loop lengths for snow and ice melt systems in Table 3;
m) inclusion of Annex C with guidelines related to radiant surface cooling; and
n) inclusion of Annex D with guidelines related to minimum flow rates for heat distribution.

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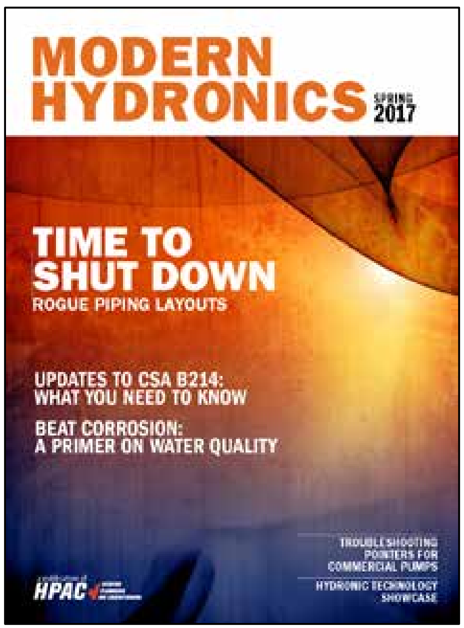
Important updates have been made to CSA B214 "Installation Code for Hydronic Heating Systems."
BY LANCE MACNEVIN

Introduction to CSA B214

See Article in Spring 2017 Modern Hydronics supplement

- Article touched on just five sets of updates



CODES AND STANDARDS

GOOD DESIGN AND INSTALLATION KEY TO GROWTH

Important updates have been made to CSA B214 "Installation Code for Hydronic Heating Systems."

BY LANCE MACNEVIN

CODES AND STANDARDS

"A well-written code can certainly lead to continued growth of the hydronics industry"

2. New Piping Materials & Requirements

CSA B214 allows a wide range of piping materials for hydronics

- Copper tube (ASTM B88)
- Steel pipe (multiple standards)
- PVC   (CSA B137.3)
- PEX   (CSA B137.5)
- CPVC (CSA B137.6)
- PEX-AL-PEX (CSA B137.10)
- PP-R   (CSA B137.11)
- PE-RT (CSA B137.18)

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New Piping Materials & Requirements

New: Polyethylene of Raised Temperature: PE-RT

- A high-temperature flexible pressure piping system; <u>operation up to 180°F (82°C)</u>
- First used for warm-water radiant heating in the 1990s in Europe
- Introduced to the US in 2007 with the publication of ASTM F2623
- **CSA B137.18** was published in 2013

Courtesy Dow

B137.18-17 — *Polyethylene of raised temperature resistance (PE-RT) tubing systems for pressure applications*

B137.18-17

Polyethylene of raised temperature resistance (PE-RT) tubing systems for pressure applications

1 Scope

1.1

This Standard specifies requirements for polyethylene of raised temperature (PE-RT) tubing systems that are comprised of tubing and fittings.

Tubing covered by this Standard is made in Standard Dimensional Ratio 9 (SDR 9).

Systems are pressure rated at two temperatures: 1105 kPa at 23 °C and 690 kPa at 82 °C. Systems are intended for use in potable water distribution systems or other applications, including municipal water service lines, reclaimed water distribution, radiant panel heating and cooling systems, hydronic baseboard heating systems, snow and ice melting heating systems, building services piping, compressed air distribution, and ground source geothermal systems, provided that the PE-RT tubing systems covered in this Standard comply with the applicable code requirements. Residential and commercial systems are included.

Note: *The requirements and test methods specified in this Standard can involve hazardous materials, operations, and equipment. This Standard does not purport to address all potential safety problems associated with its use. Before using this Standard, users are responsible for establishing appropriate health and safety practices and determining the applicability of any regulatory limitations.*

New Piping Materials & Requirements

PE-RT: Configurations

- PE-RT tubing is available in coils or straight lengths
- PE-RT tubing is Copper Tube Size (CTS); same dimensions as PEX
- PE-RT can be compatible with most of the same fittings as PEX
- PE-RT is available with or without an oxygen diffusion barrier layer

New Piping Materials & Requirements

Updated Language: Oxygen Diffusion Barrier

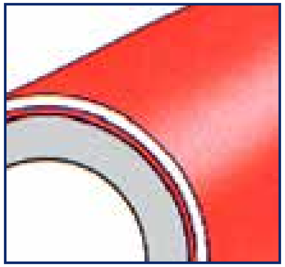
- Oxygen (O_2) from the atmosphere can permeate or diffuse (pass through) the wall of plastic pipes (e.g. PEX, PE-RT) and be absorbed into the heating system water
- This may cause corrosion of iron or steel components or certain aluminum heat exchangers (causes no harm to the tubing itself)

Solution:

- Some PEX and PE-RT tubing has an oxygen diffusion barrier (layer) to resist permeation
- This oxygen diffusion barrier is required when pipes are used in most closed-loop hydronic systems with ferrous components

Performance:

- German standard DIN 4726 is recognized worldwide as the basis of O_2 barrier performance



New Piping Materials & Requirements

Updated Language: Oxygen Diffusion Barrier

4.2.3 Oxygen permeation

The materials and equipment used in a closed hydronic heating system shall be selected to reduce the effects of oxygen permeation by one of the following means:

(a) a non-metallic tubing system that incorporates an oxygen barrier, with a maximum rate of oxygen permeation of less than 0.32 mg/m^2/day @ 40°C (4.588x10^{-4} grains/ft^2 /day @ 104°F) ~~0.1 g/m3/d (0.04 grains/ft3/d) at 40 °C (104°F)~~

(b) a non-ferrous heat exchanger that isolates a non-ferrous metallic radiant panel heating system from a ferrous boiler system. All components on the non-ferrous metallic radiant heating panel side in contact with the hydronic fluid shall be non-ferrous; or

(c) non-ferrous components throughout the heating system that are in contact with the hydronic fluid ~~in the hydronic system~~.

New Piping Materials & Requirements

Updated Language: Oxygen Diffusion Barrier

- Supporting language is also found in Clause 9.2.7:

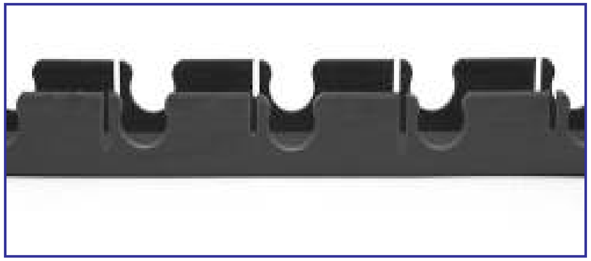
9.2.7 Oxygen corrosion

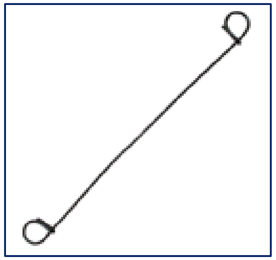
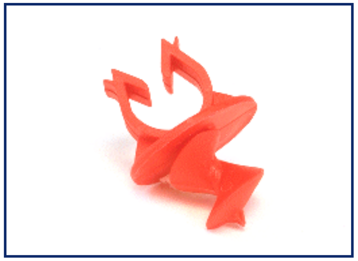
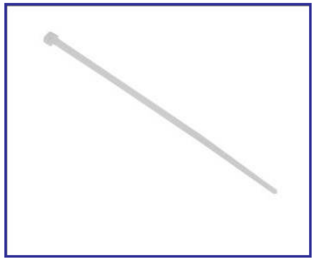
For a closed heating system, steps shall be taken to prevent the effects of oxygen corrosion resulting from oxygen entering the system. See Clause 4.2.3.

3. Radiant Tubing Fasteners

New Language: Allowable fasteners

- According to anecdotes, certain inspectors question various fasteners for radiant tubing
- The TC wanted to create generic language that would list the types of fasteners that are typically approved by tubing manufacturers
- New language should prevent those disputes with contractors




Radiant Tubing Fasteners

14.4.4 Tube Fasteners

Clause 14.4.4.1 Types of tube fasteners

Tube that is embedded within Portland cement or gypsum cement concrete shall be fastened according to manufacturer's instructions. Unless prohibited by manufacturer's instructions, approved tube fasteners include the following:

(a) **ties made of wire**, typically fastened to anchors such as rebar or wire mesh;

(b) plastic **tube/cable ties**, typically nylon, fastened to anchors such as rebar or wire mesh;

(c) **staples** made of metal or plastic or combination thereof, without sharp edges that would harm tube, fastened to insulation or subfloor;

(d) **plastic rails** with integrated tube holders intended for the specific type of tube;

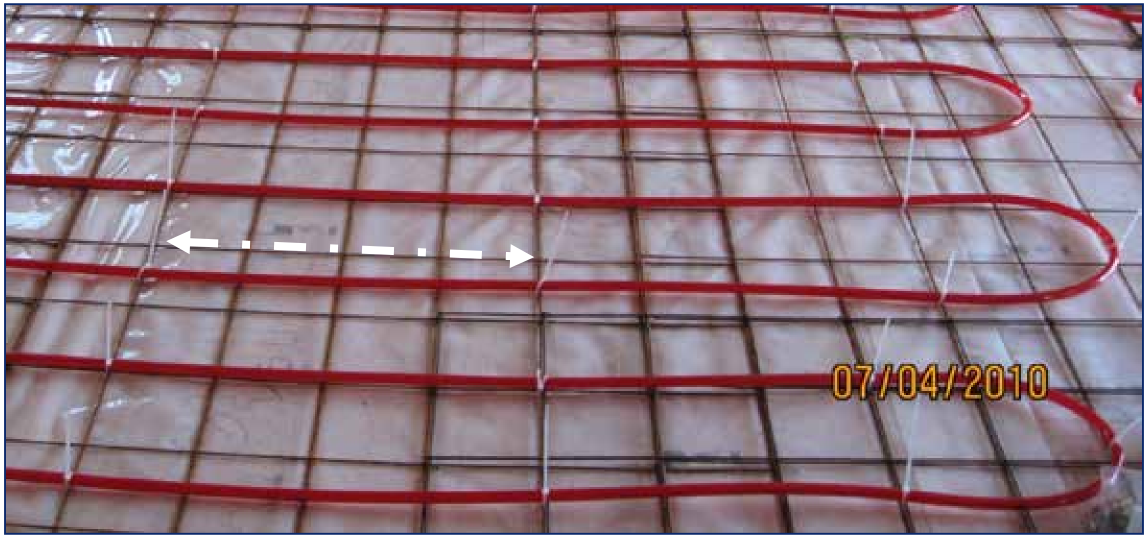
(e) **insulation sheets** with integrated knobs for holding the specific type of tube and intended for this application.

Radiant Tubing Fasteners

14.4.4 Tube Fasteners

Clause 14.4.4.2 Spacing of tube fasteners

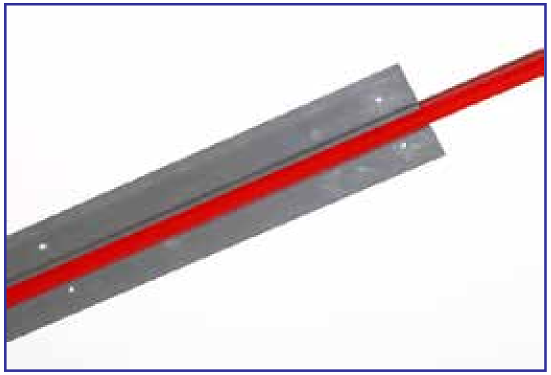
The maximum spacing between tube fasteners within a poured floor thermal mass shall not exceed the spacing specified by the manufacturer or, in the absence of manufacturer's specifications, 0.75 m (2.5 ft).

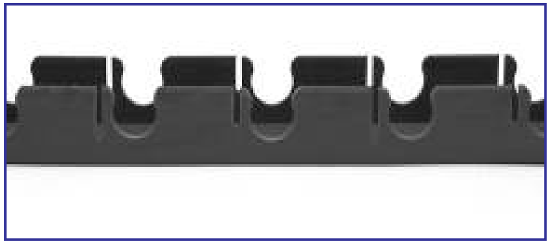


Radiant Tubing Fasteners

14.5 Joist Systems and Subfloors

- New language added to clarify approved installation techniques in joist spaces





Radiant Tubing Fasteners

14.5 Joist Systems and Subfloors

Clause 14.5.2 Types of tube fasteners

Tube that is installed within joist spaces and subfloor panel systems shall be fastened in accordance with the manufacturer's instructions. Unless prohibited by the manufacturer's instructions, approved tube fasteners shall include the following:

a) **heat transfer panel** systems made of wood, aluminum, or other thermally conductive materials intended for this application and the specific type of tube

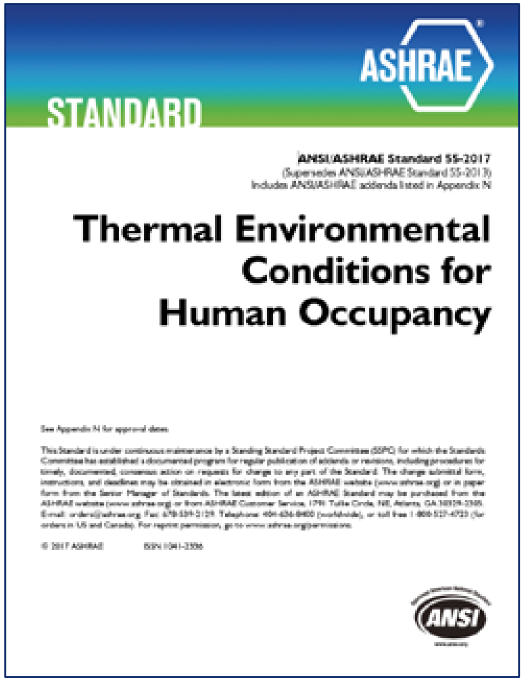
b) **staples** made of metal or plastic or combination thereof, without sharp edges that would harm tube, intended for this application and the specific type of tube fastened to subfloor; and

c) **plastic rails** with integrated tube holders intended for the specific type of tube

4. Radiant Floor Temperatures

Maximum Floor Temperatures

- Previous language and floor temperatures did not match any other code or guideline
- Descriptions of floor types were a bit “mysterious”
- New language complies with **ASHRAE Standard 55**
Thermal Environmental Conditions for Human Occupancy



Radiant Floor Temperatures

14.2 Radiant under-floor heating

Clause 14.2.1

Floor surface temperatures shall not exceed ~~25°C (77°F) in areas where prolonged foot contact with the floor is likely;~~ 29°C (84°F) in occupied areas, with the following exceptions:

a) 31°C (88°F) in industrial spaces;

~~a) 25°C (77°F) in areas where prolonged foot contact with the floor is likely;~~

~~b) 31°C (88°F) in dwellings or commercial space;~~

b) 33°C (91°F) in bathrooms, indoor swimming pools, and foyers; and

c) 35°C (95°F) in radiant panel perimeter areas, i.e., up to 0.8 m (2.5 ft) from outside walls.

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Radiant Floor Temperatures

14.2 Radiant under-floor heating

Clause 14.2.1

Floor surface temperatures shall not exceed 29°C (84°F) in occupied areas, with the following exceptions:

a) 31°C (88°F) in industrial spaces;

b) 33°C (91°F) in bathrooms, indoor swimming pools, and foyers; and

c) 35°C (95°F) in radiant panel perimeter areas, i.e., up to 0.8 m (2.5 ft) from outside walls.

The **29°C** (84°F) temperature for occupied areas is based on **ASHRAE Standard 55** *Thermal Environmental Conditions for Human Occupancy*

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5. Snow & Ice Melting

Snow and ice melt

- In CSA B214-12, Snow Melt systems were part of section 17 “Auxiliary Systems”
- In CSA B214-16, Snow and Ice Melt is its own section 17
- Several improvements were made for SIM systems
- “Auxiliary Systems” is now section 18

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Snow & Ice Melting

17. Snow and ice melt

Clause 17.5 Insulation

When a poured concrete snow melt system is installed in contact with the soil, insulation that complies with Clause 14.4.5.3 and has a minimum RSI value of 0.9 m^2•K/W (R-value of 5 h•ft^2•°F/Btu) shall:

a) be placed between the concrete and the compacted grade; and

b) extend as close as practical to the outside edges of the concrete;

~~c) be placed on all vertical slab edges that are in contact with plants or landscaping.~~

- The requirement for insulation on slab edges is removed because this insulation is often not beneficial, gets exposed and damaged, and is unsightly

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Snow & Ice Melting

SIM Tubing Loop Lengths

- **Table 3** is revised
- Now includes option for nominal size ½ PEX or PE-RT tubing; often beneficial for stairs and steps

Courtesy Ridgeway Home Services

Table 3
Loop lengths for snow and ice melt systems

Nominal Size ~~mm (in)~~	~~Average~~ Maximum active loop length, m (ft)	Total loop length, m (ft)
PEX or PE-RT tubing		
1/2	**40 (130)**	**45 (150)**
~~16~~ 5/8	~~68.6~~ 70 (225)	~~76.2~~ 75 (250)
~~19~~ 3/4	~~91.4~~ 90 (300)	~~99.1~~ 100 (325)
~~25~~ 1	~~137.2~~ 135 (450)	~~144.8~~ 145 (475)
Copper tube*		
~~13~~ 1/2	—	~~42.7~~ 43 (140)
~~19~~ 3/4	—	85.~~3~~ (280)

**In concrete use Type L copper water tube. In bituminous pavement (blacktop) use Type K copper water tube.*

Notes:

(1) *~~13 mm (1/2 in) tube should not be used.~~ The total PEX or PE-RT loop lengths consist of two separate sections, the active loop and the leader length. The active loop is installed within the heated slab. The leader length is the total distance to and from the manifold and heated slab, including any vertical distances.*

(2) *The manifolds should be installed as close to the snow and ice melt area as possible.*

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Snow & Ice Melting

SIM Tubing Loop Lengths

- See **Clause 17.3.1** about loop lengths: ± 10% is about “the design”, not about **Table 3**
- Table 3 provides **default** maximum loop lengths in case there is no design

17.3 Tube placement

17.3.1 General

Snow and ice melt tubing shall be installed in accordance with the manufacturer’s instructions, with the tube layout and spacing as specified in the system design. Except for distribution mains, tube spacing that is shown in the design as centre-to-centre and the individual loop lengths shall be installed with a variance of not more than ±10% from the design. The tube spacing may be varied by not more than ±20% where on-site conditions conflict with the design.

Note: *The recommended pattern for snow and ice melting is the counter-flow pattern or reverse-return. The serpentine pattern should be avoided.*

6. Legionella and Combined Systems

Notes about combined systems

- See excerpt from Modern Hydronics Spring 2016

"The bacterium legionella pneumophila is found in both potable and non-potable water systems, especially with stagnant water between 95°F (35°C) and 122°F (50°C).

"Legionella can cause ***Legionnaires' disease*** *or Legionellosis, a severe, often lethal, form of pneumonia that occurs primarily when steam or vapour containing legionella is inhaled."*

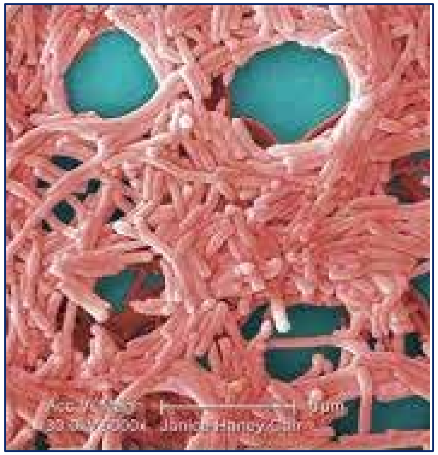
Legionella and Combined Systems

Notes about combined systems

- See excerpt from Modern Hydronics Spring 2016

"*In a potable-hydronic system with a shared water heater, the water from the heating distribution system will inevitably mix with domestic hot water whenever the heating system is activated.*

"After longer periods of inactivity, such as after the summer, the heating water has been stagnant for weeks or months, allowing more time for legionella to multiply. This situation has the potential to expose users of the domestic hot water to legionella bacterium through showers and other hot-water uses."



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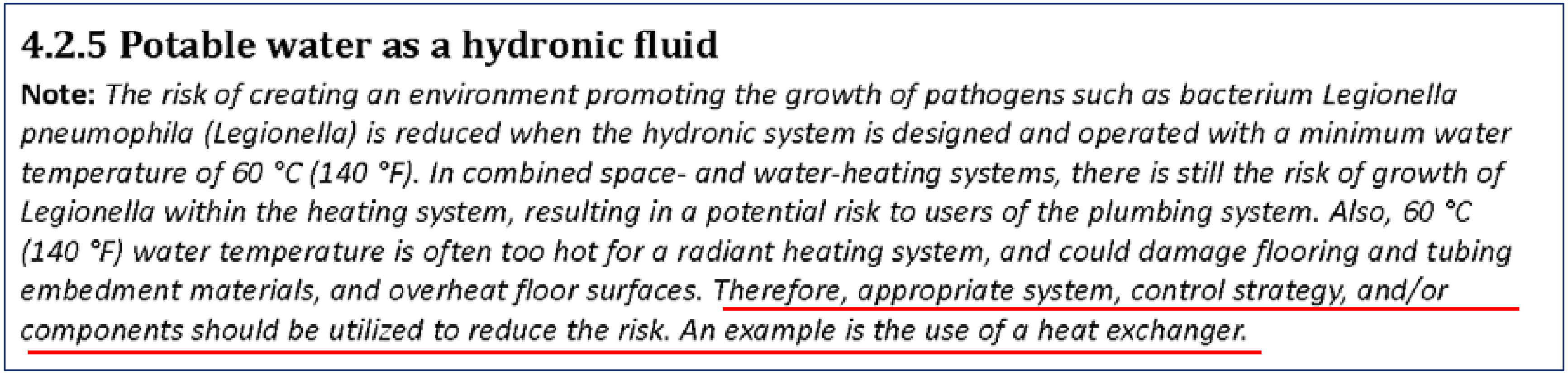
Legionella and Combined Systems

Notes about combined systems

- See new Note in Clause 4.2.5 Potable water as hydronic fluid



4.2.5 Potable water as a hydronic fluid

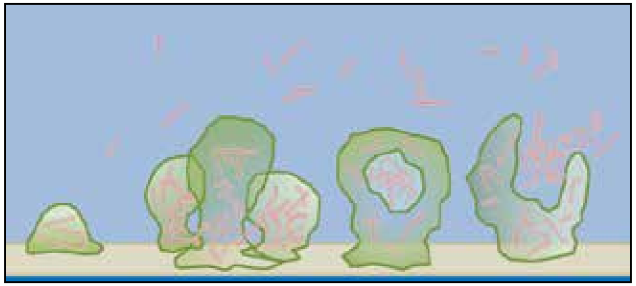
Note: *The risk of creating an environment promoting the growth of pathogens such as bacterium Legionella pneumophila (Legionella) is reduced when the hydronic system is designed and operated with a minimum water temperature of 60 °C (140 °F). In combined space- and water-heating systems, there is still the risk of growth of Legionella within the heating system, resulting in a potential risk to users of the plumbing system. Also, 60 °C (140 °F) water temperature is often too hot for a radiant heating system, and could damage flooring and tubing embedment materials, and overheat floor surfaces. Therefore, appropriate system, control strategy, and/or components should be utilized to reduce the risk. An example is the use of a heat exchanger.*

Legionella and Combined Systems

Notes about combined systems

- Combined systems may have issues with regards to compatibility with potable water
- For example, are all components that touch the water certified for potable water safety?
- And, are all components that touch the water compatible with fresh, oxygenated water?

- Think of all the components touching the potable water… opportunities for biofilm growth



7. Annex C: Radiant Cooling

Non-mandatory information about Radiant Cooling

- Radiant Cooling systems must be carefully designed, constructed and controlled to prevent discomfort and condensation, while performing correctly
- Although most RC systems are in commercial or public spaces, the technology is available to contractors

- Radiant heating/cooling example: **JSF High School**

- CSA B214 is a "Heating" code, so new information on radiant cooling is informational guidance

- Excerpts follow…

Case Study

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ONTARIO SCHOOL RECEIVES "PROJECT OF THE YEAR" INDUSTRY HONOR

Radiant Slab Heating and Cooling System Also Assisted in School's LEED® Certification

LEESBURG, Va. – REHAU, Inc. was awarded with the Plastics Pipe Institute (PPI) Building & Construction Division's Project of the Year at the organization's annual meeting. The award recognizes the company's role in the École Secondaire Jeunes sans Frontiers (Secondary School for Youth Without Frontiers) project in Brampton, Ontario. The school, which has earned the Canadian Green Building Council's LEED® Silver certification, is the first secondary school building in Ontario to have achieved this status.

Designed by Robertson Simmons Architects, the French language high school, which encompasses approximately 91,000 ft², is dedicated to fostering an enriched, student-focused learning experience by providing a healthy and sustainably designed environment. To achieve this, the design includes indoor spaces integrated with outdoor landscapes, a green roof, expansive daylighting, water-conserving plumbing fixtures, lighting with occupancy sensors and displacement ventilation.

To achieve maximum HVAC efficiency, the design includes a REHAU radiant slab heating and cooling system, which circulates heated or chilled fluid through a network of PEX piping installed in the floors throughout the entire facility. The radiant system enables the school to meet indoor environmental criteria related to air quality, noise reduction and occupant comfort while also maximizing space efficiency by eliminating bulky convectors and ductwork.

"To help the school recognize the benefits of a combined radiant heating and cooling system, we supplied a finite element analysis to model the floor heating and cooling output," explained Mark Eutenier, president of Klimatrol Environmental Systems, the project's designer and supplier. "The results predicted a significant energy savings due to reduced heating and cooling loads and increased efficiencies of the heated and chilled water sources," he said. "Coupled with the comfortable, even method of heating and cooling, this analysis made the REHAU radiant system a must-have for the project."

JSF High School features a REHAU radiant slab heating and cooling system installed throughout the building. Photo © Patrick Kennedy

The system consists of 104,700 ft (32,000 m) of RAUPEX® 5/8-in. O₂ Barrier pipe and 42 PRO-BALANCE® manifolds pre-piped with 3-way valves into recessed manifold distribution cabinets. The PEX pipe was installed at the

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Annex C: Radiant Cooling

C.1 General

This Annex provides guidelines for radiant cooling systems.

Typically designed in conjunction with radiant heating, hydronic radiant surface cooling systems circulate cooled fluid through the same network of embedded tubes or pipes where warm fluid circulates during heating system operation.

This network of tubes or pipes can turn the radiant surface such as floors, walls, and ceilings of a conditioned space into cooled surfaces that evenly absorb sensible heat energy such as radiant energy from solar gain, people, lights and computers, in addition to convective heat transfer from the air.

Annex C: Radiant Cooling

C.2 Radiant cooling surface temperatures

For thermal comfort reasons, cooled floor surface average temperatures should not fall below guidelines set in **ASHRAE 55** and this Code.

Cooled floor surface average temperatures should not fall below **19°C (66°F)** in occupied areas. Cooled floor, wall, or ceiling surface temperatures should not fall below the anticipated dew point of the space.

To prevent condensation on any cooled radiant surface, the supply water temperature for a radiant cooling system should be a minimum of **2˚C (3˚F)** above the anticipated space dew point, or as per manufacturer's system design

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Annex C: Radiant Cooling

C.3 Controls

Radiant cooling control systems should have the ability to adjust the fluid and surface temperatures to **prevent condensation** on pipes, piping components, or exposed building surfaces.

C.4 Tube placement

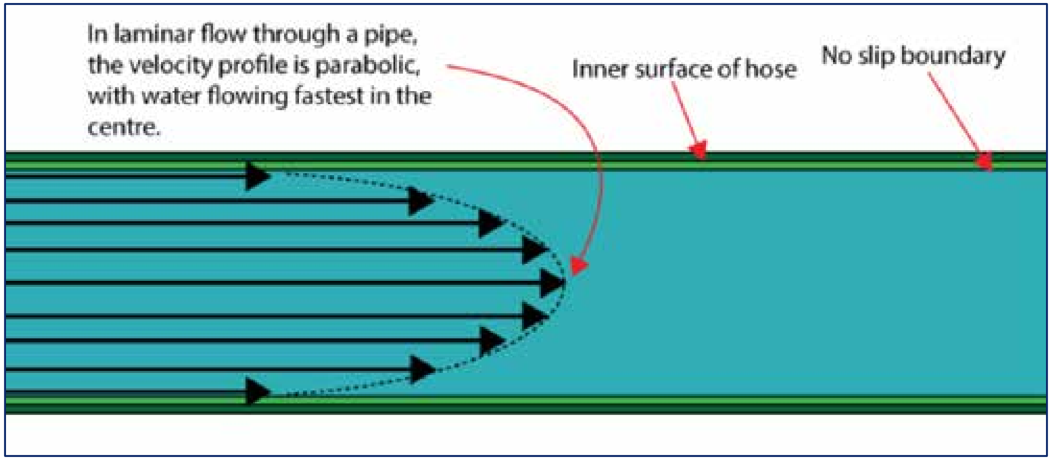
Radiant surface cooling installations should follow the same requirements for tubing installation as for radiant heating systems. Radiant cooling systems typically utilize **tighter spacing of the hydronic tubes** and **larger diameter tubes** than used in radiant heating systems for more effective heat transfer with the space.

C.5 Thermally activated building systems

8. Annex D: Minimum Flow Rates

Sizing pipes correctly

- Sizing pipe seems easy enough – make it large enough to carry the required fluid
  - #1: Keep friction low to reduce pumping costs
  - #2: Do not exceed allowable velocities (noise, vibration, erosion)
  - #3: Keep fluid moving fast enough to have turbulent flow for heat transfer
- Velocity is very important when heat transfer through the pipe wall is needed
  Ex: Radiant heating/cooling piping, geothermal ground loops



Laminar flow bad

Turbulent flow good

Annex D: Minimum Flow Rates

D.1 General

- To ensure good heat transfer through hydronic systems, designers should size heat distribution tubing to result in turbulent or transitional flow for the required flow and avoid oversizing the tubing, which could result in laminar flow. This consideration does not apply to piping or tubing intended to transfer heat from a heat source to a heat-distribution unit or manifold.

D.2 Reynolds number calculation

D.3 Avoiding laminar flow

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Annex D: Minimum Flow Rates

Table D.1

Table D.1
Minimum flow rates to avoid laminar flow in PEX and PE-RT tubing for water at 40 °C (104 °F)
(See Clause D.3.)

Nominal tubing size	Minimum flow in l/min (USGPM) to avoid laminar flow	Fluid velocity in m/sec (f/sec) at minimum flow rates
5/16	0.5 (0.13)	0.2 (0.6)
3/8	0.6 (0.16)	0.2 (0.5)
1/2	0.8 (0.21)	0.1 (0.4)
5/8	1.0 (0.26)	0.1 (0.3)
3/4	1.1 (0.29)	0.1 (0.3)
1	1.4 (0.37)	0.1 (0.2)

- Calculations were performed using **Plastic Pressure Pipe Design Calculator**
- www.plasticpipecalculator.com

Annex D: Minimum Flow Rates

Table D.1

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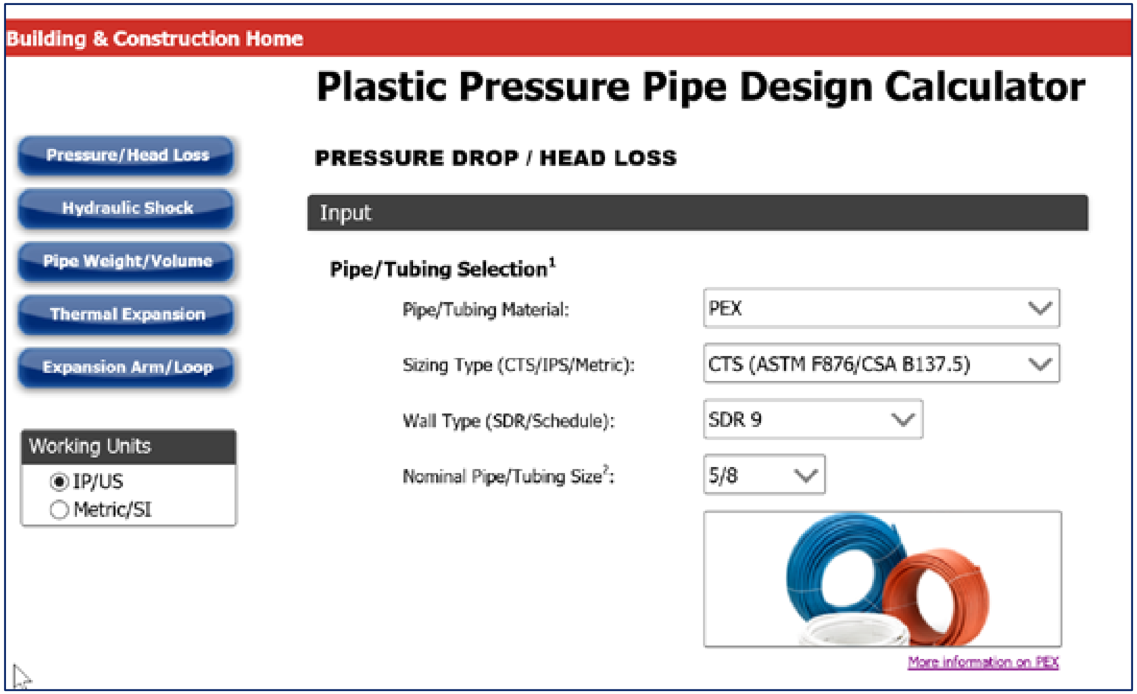


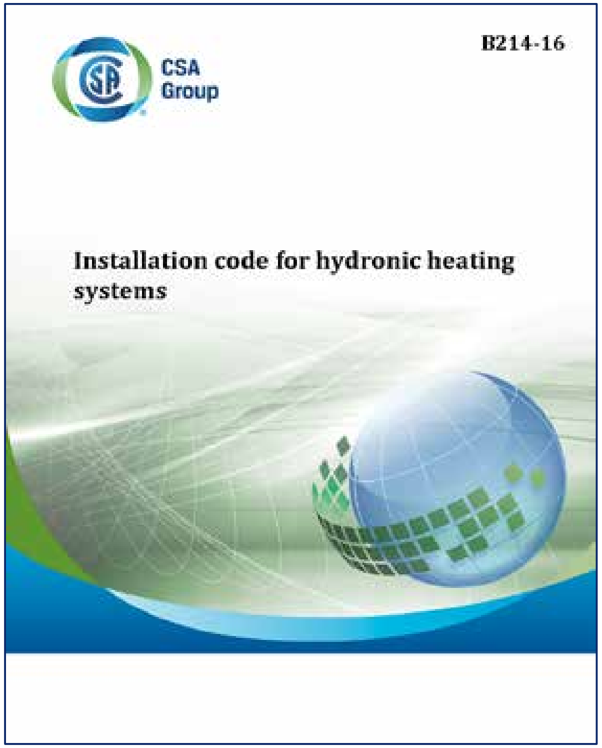
Obtaining CSA B214

Get yours at store.csagroup.org

- $173 CAD for pdf download
- $193 CAD for paper copy

Get involved!

- Join the Technical Committee or submit proposed revisions or suggestions to TC members



Summary

1. Introduction to CSA B214-16

2. New piping materials and requirements

3. Lists of approved radiant tubing fasteners and spacing

4. Revised maximum floor temperatures (radiant heating)

5. Clarifications on snow & ice melting loop lengths and installation

6. Notes about Legionella and combined systems

7. Annex C on radiant cooling

8. Annex D on minimum flow rates through heat transfer tubing

9. Obtaining CSA B214-16

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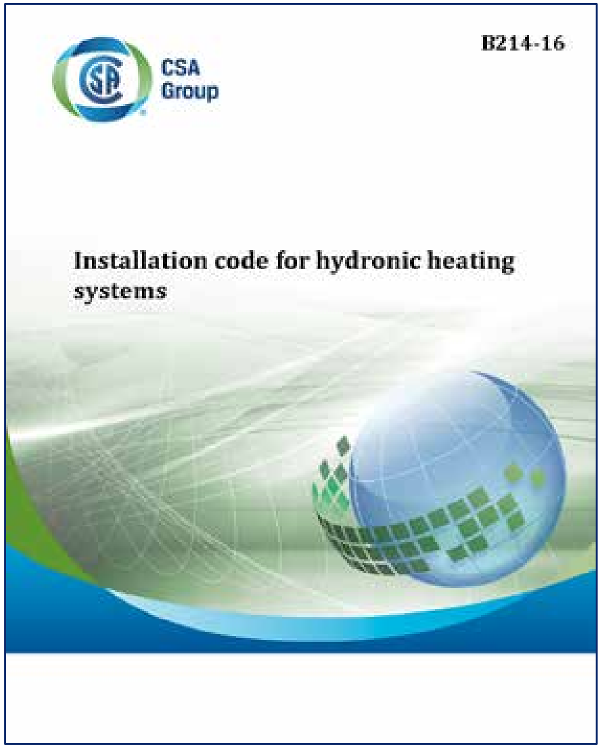
Important Updates to CSA B214-16

Installation Code for Hydronic Heating Systems

What you should know about
CSA B214-16 before 2020
(and hopefully do already)



Contact Info:
Lance MacNevin
lmacnevin@plasticpipe.org
469-499-1057