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## Snow Melting Systems

**Richard E. White, P.E.**

*This article is the concluding segment in a series dealing with the theory and practice of snow melting utilizing hydronic heat transfer. As always, we invite your comments.*

## General Comments on Coil Sizing

Much can be written about calculating the heat load of a snow-melting system, but two facts usually take precedence over everything else. The first is that if coil spacing is greater than 12", there will probably be strips of unmelted snow on the paved surface through most or all of the "melting" on-time. Therefore, approximately 12" maximum spacing for the heat-source-to-the-pavement is a necessary concept for most systems.

The second fact is that the thermal mass of the system will present a load of significantly more than 100 BTU/sq ft/hr on the heating source, at least during the warm-up period. Therefore, there is little point in selecting components or arrangements that will produce less than 100

BTU/sq ft/hr or heat to the pavement on a steady-state basis.

## Details of Snow-Melting Coils – Hydraulic Systems

After the entire snow melt area and heat rate are determined, several choices must be made by the designer before the

**Discover Radiant `97**

The Radiant Panel Association's 3rd annual North American Conference & Trade Show is coming to the Rhode Island convention Center in Providence, April 17-19, 1997.

A variety of conference sessions are planned to explore applications, installation and marketing strategies of radiant technology. Products and services of over one hundred manufacturers will be on display the final two days in Exhibit Hall C including Radiant panel Seminars with Technical and marketing presentations by industry experts. *Intro to Radiant, Selling Radiant, Electrical Connection, Primary/Secondary Pumping, Integrated Controls, Wood floors, Water Heaters and Radiant, Floor Cooling,Technology in Sales and much more.*

We extend an invitation to all attendees to visit us at Booth 329. We've chosen this premier event to feature a wide variety of our snow/ice melting and floor warming sensor and control products. Personnel will be available to demonstrate their specific capabilities and to assist your

sizing of the snow-melting coils can be completed. Typical considerations are discussed below:

1. Type of coil to be used. Two general types are serpentine and grid. The type selected is based to some extent on the designer's experience and preference, but mostly on the geometry of the pavement area.

A serpentine coil is formed by connecting together adjacent segments with 180 bends at alternate ends to form a series circuit of whatever length is desired. The advantage of this type is that the length of the coil can be selected to suit the available pressure pattern and thus assure design flow performance. *Figure 1* shows a typical serpentine coil.

applications requirements.

*For further information contact the Radiant Panel Association, (800) 660-7187*

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**Recommended Reading... "Antifreeze in Hydronic Systems"**

by Larry Ashton, P.E. and Lance Westerlund *Engineered Systems*, p.82, January, 1997 (Vol. 14, No.1).

Everything you need to know about the selection, care, and feeding of glycol-based antifreeze solutions.

"Winterizing Chilled Water Coils," by Joanne M. Payton; *Air Conditioning, Heating & Refrigeration News*, p. 75, January 27, 1997 (Vol. 200, No. 4). Characterizes corrosion problems associated with uninhibited glycol solutions; also explains the chemical

*(Continued From page 1)*

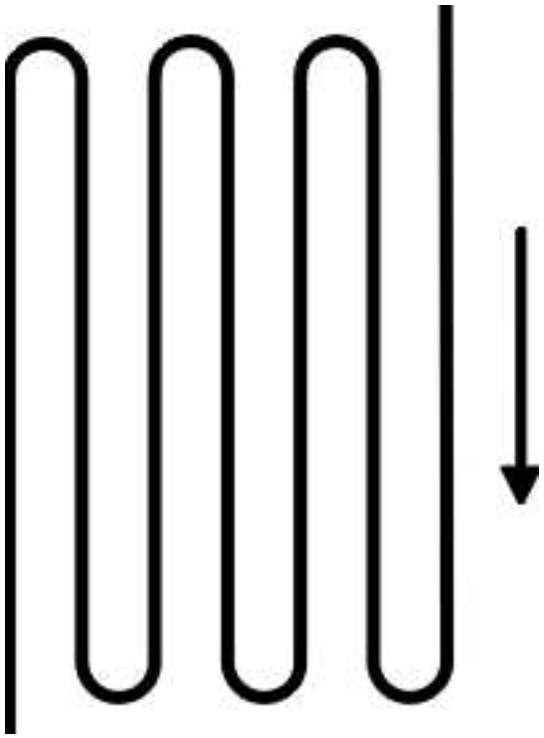

Figure 1

**Typical Serpentine Coil**

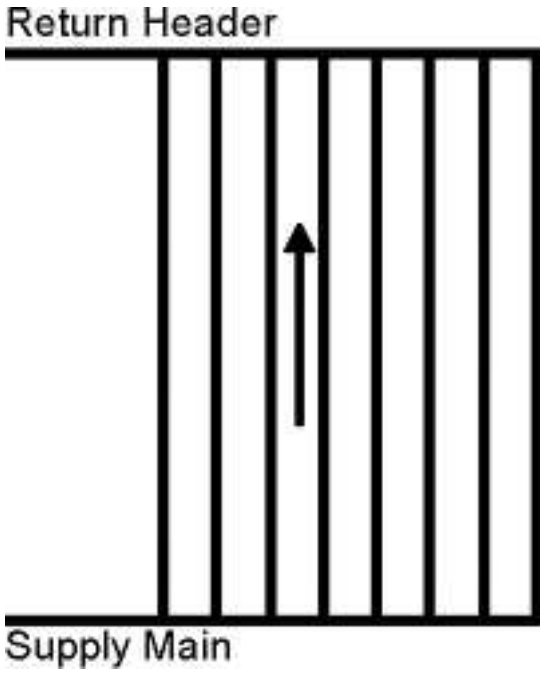


Figure 2

**Typical Grid Panel**

A grid coil consists of straight segments only that are connected to a supply header on one side and a return header on the other side. This coil type is more difficult to design because all details must be carefully selected if satisfactory performance is to be achieved. *Figure 2* shows a typical grid coil.

Serpentine coils usually have moderate pressure drop over the length of the coil, and grid systems have low pressure drop over the elements in the grid.

2. Variations in Serpentine coils. Serpentine coils are most often installed with a common supply header buried in the pavement, and the individual coil returns brought to a convenient place and connected to a return header that is outside the pavement. *Figure 3* shows an example. Each coil end is valved, so the flow through

degradation process in low concentration glycol solutions.

" Hydronic Sales Pro Puts Know-how to Work for his Own Vacation Haven," *Air Conditioning, Heating & Refrigeration News*, p. 81, January 27, 1997 (Vol. 200, No. 4). For his own comfort and to promote the benefits of radiant heating to family, friends, business associates and renters, John Carpenter, D & C Plumbing & Heating Supply Company of Ann Arbor, MI, integrated a variety of applications in the construction of his new 2600 sq ft. Northern Michigan "lodge." Photo coverage of the installation, which includes geothermal heat pump, hydronic radiant floor, hydronic fintube and panel radiation, electric radiant floor warming and split system air conditioning.

each coil can be adjusted by partially closing these valves. Note, however, that because all coils are common via their connections to the supply header, it is impossible to isolate ( or even identify ) a leaking coil should a failure occurs. A popular variation is to use a supply header and a return header that is accessible, and with valves that permit isolation of each coil. *Figure 4* shows an example of this arrangement.

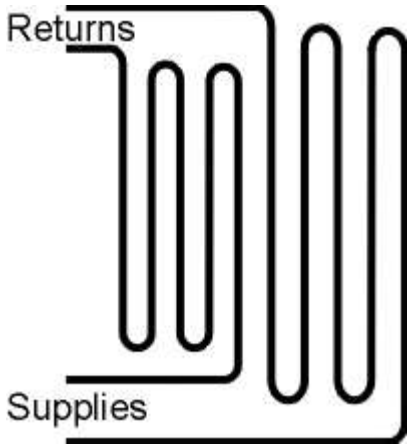


Figure 3

**Typical Piping Panel**

With Individual Supplies & Returns

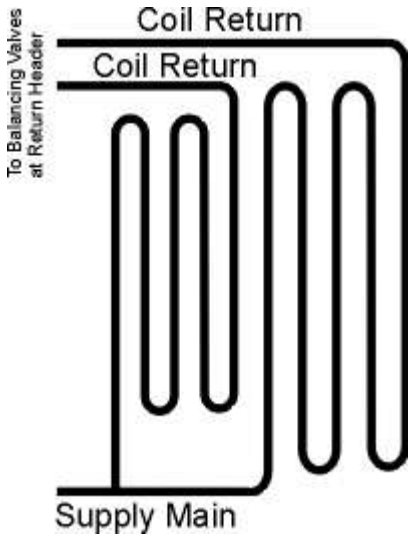


Figure 4

**Typical Piping Panel**

With Supply Main and Individual Returns



*(Continued From page 2)*

3. Tubing (or pipe) size to be used in the coil. For any

*(Continued from page 2)*

"Feeling Radiant," by Joanna R.

tubing or pipe size, there is a fluid flow rate that is a practical upper limit on what can be passed through the tubing. This limit is set by pressure drop performance, total heat to be delivered per coil, available pump pressure, and/ or ability (or lack of ability) of the tubing material to tolerate high flow rates. Thus, with smaller tubing sizes, less paving material is needed to cover the tubing, but the practical total length of an individual coil is limited.

The most important reason for desiring to use smaller tubing in a serpentine coil is that minimum bending radius is a function of tubing material and tubing diameter. Thus, if close spacing is required to deliver the necessary heat flux, small diameter tubing or pipe may be the only option available.

4. Number of coils required. The tentative choice made for tubing size in Item 3 above must be examined to be sure that a workable design will be achieved. For a given paved area to be provided with snow melting and a maximum heat output per coil ( determined by allowable flow rate), the necessary number of coils for the total area is determined by simple division.

5. The tubing or piping material. Until recent years, Type L copper tubing was used for small systems and 1/2" or 3/4" Sch 40 steel pipe was used for larger systems. For very large systems 1" Sch 40 steel pipe was used in grid arrangements.

Polybutylene plastic tubing then displaced the metal piping for reasons of material cost, installation advantages, and inherent corrosion resistance. Since polybutylene, known by the acronym "PEX". PEX is available form several suppliers and is generally available in North

American and Europe.

6. Typical values of pipe sizes and available heat. *Table 1* shows maximum recommended flow and coil length for several pipe sizes through 3/4". Also shown is the maximum recommended flow through 1" pipe, but 1" pipe is best used in special situations in grid configuration.

| Pipe Size (Inch) | Flow (GPM) | Coil Length | Heat Output Per Coil |
|---|---|---|---|
| 3/8 OD | 0.5 | 50' | 5,000 |
| 1/2 OD | 0.7 | 75' | 7,500 |
| 1/2 | 1.5 | 150 | 15,000 |
| 3/4 | 3.5 | 300 | 35,000 |

Table 1. **Typical Coil Values**

*(Continued on page 4)*

Turpin; *Engineered Systems*, p. 68, January 1997

(Vol. 14, No. 1). General overview of infrared and hydronic radiant heating applications.

Publisher of the above four articles: Business News Publishing Co., P.O. Box 2600, Troy, MI 48007, (810) 362-3700.

"A Primer on Heating Systems," by Alex Wilson; *Fine Homebuilding*, p. 50 February/March, 1997. The Taunton Press, Inc., PO Box 5506, Newtown, CT 06470-5506, (800) 283-7252. A good overview of all common residential heating systems, including hydronic radiant and convection, with selection based upon three criteria: the climate, the house and the residents' needs.

"Consider Installation Options in Wood-fram Construction"

by Joe Friedrich; *Contractor*, p. 36 February, 1997. Cahners Publishing Co., 1350 Touhy Ave. DesPlaines, IL 60018-3358, (708) 390-2111. Guidance in choosing a method of installing radiant hydronic based upbon what works best for varying conditions encountered in both new existing construction.

*(Continued From page 4)*

**Details of Snow-Melting Coils –**

**Electrical systems**

The designer can select complete coil assemblies that are custom made for the shape and area to be served, or select form stock coils to serve the area. The alternate to these choices is to design the layout using heating cable of a given wattage per foot. In this case, the decisions are similar to those in the hydraulic design i.e., spacing in the pavement and routing of the heating cable to the source of supply.

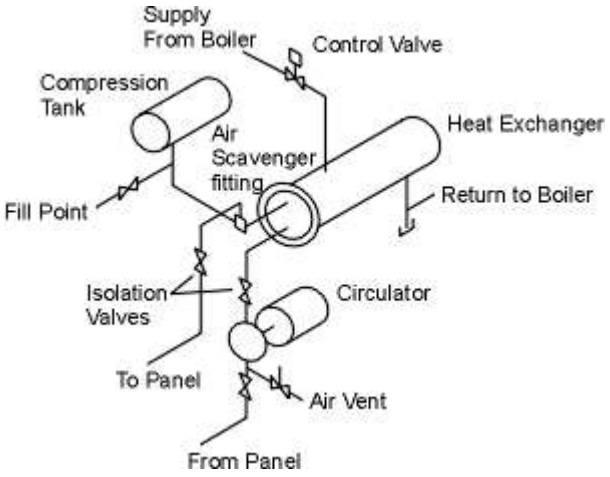


Figure 5. **Heat Exchanger Details**

**Heat Source Hydraulic Systems**

*Figure 5* shows a typical arrangement of steam- or water-to-water heat exchanger and necessary pumping and piping details. Note that a compression tank is required, along with air scavenging fittings and air vents. The system can be filled through the valve on the side of the pump suction. Note that this connection shall not be permanently connected to the potable water system.

## Watt is a Btuh?

One British thermal unit (Btu) is that quantity of heat (energy) required to raise the temperature of one pound of pure water by one degree Fahrenheit ( at standard sea level atmospheric pressure). The rate of transfer of this energy per hour, typically expressed Btu/hr. or Btuh, is equivalent to 3,413 watts (3.413KW). The following conversions are presented for your

## Following is a listing of application, installation and marketing reference resources available to both members and nonmembers of the Radiant Panel Association:

*Standard Guidelines* for the Design and Installation of Residential Radiant Panel Heating Systems-by RPA

List $12.00 l Member $6.00

*Consumer Pamphlet* (25 per pkg)

List $7.25 l Member $6.25

*Modern Hydronic Heating* by John Seigenthaler

List $55.95 l Member $45.95

*Hydronic Toolkit Software* (DOS)-18 Hydronic utility programs

List $69.95 l Member $59.95

*Hydronic Snow Melting Manual*

I=B=R Guide 400

List $11.50 l

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convenience.

Btuh x 0.2931 = Watts KW 3,413 W = Btuh

Member $9.50\

*Hydronic Radiant Floor Manual*

I=B=R Guide 400

List $27.00 l
Member $23.00

*How Come? - Hydronic heating*

questions and answers

by Don Holohan

List $25.00 l
Member $21.25

*Pumping Away- and other really cool piping options for hydronic systems.*

by Dan Holohan

List $20.00 l
Member $17.00

*The Golden Rules of Hydronic Heating* by Don Holohan

List $10.00 l
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