HRAI SkillTech ACADEMY
Setting the Standard for Performance

RESIDENTIAL RADIANT HYDRONICS DESIGN MANUAL

Student Reference Guide

2004 Edition

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FORWARD

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PREFACE

The evolutionary growth of radiant heating systems began in North America in the mid 1940's. Canada saw significant growth beginning in the late 1970's. Between 1980 and 2003, several industry associations, committees, and councils were established to govern the quality of designs and installations. Several municipalities and provincial code bodies provided recommendations, guidelines, and 'STANDATA's' to support efforts lead by industry. It was the collaboration between the various groups which resulted in the *Canadian Standards Association B214, Installation Code for Hydronic Heating Systems* and the need to develop training programs for designers and installers.

In response to membership demands for a residential radiant hydronics design certification course, the Heating, Refrigeration and Air Conditioning Institute of Canada developed the following materials to support the design of systems governed by the R-2000 Standard and CSA B214.

The following is by no means an exhaustive presentation of the various methods of designing residential radiant hydronic systems. The objective of the course is to augment the knowledge already possessed by HVAC practioners with tools and skills to successfully navigate through and meet the radiant requirements and relevant codes and standards.

The three-day course discusses, in Chapters 1 through 6, the fundamentals of thermal comfort, heat transfer, fluid flow, types of equipment and their assembly into modules, sub systems, and full systems. Chapter 7 discusses the design process followed by a design project in Chapter 8.

INSTRUCTIONS

This manual was developed to serve as both a training manual and reference book for continuing education in Hydronic Heating Systems.

Specific information which students must know for this course is indicated by a solid vertical line next to the text or graphic. →

The manual breaks down the theory and application of radiant systems into small components.

These components are then merged into modules, modules into sub systems and sub systems into complete residential radiant hydronic packages.

Students will be encouraged to use their imagination to understand hydronic and radiant principals, and several demonstrations will be used to engage students in this activity.

Just knowing what questions to ask can lead students to a better understanding of how components, theory, and system work. The manual is filled with **practical questions experienced designers frequently ask themselves when involved in the design process**.

The sequence of information is presented by:

- Discussing the benefits of heating surfaces to control comfort.
- Exploring the process of using heated water to achieve warm surface.
- Looking at individual components that make it all happen.
- Assembling components into modules, then into sub systems and then into whole systems.
- Discovering the design process.
- Completing an actual design.

Instructors will present core materials while students complete homework assignments for more detailed learning. This will be followed by an exam. Students will benefit from completing the HRAI Residential Heat Loss and Heat Gain Calculation Course, HRAI Residential Mechanical Ventilation Course and HRAI Residential Integrated Combo Systems Course before participating in this course.

OBJECTIVES

Designer Note:

Heat Loss Calculations and Ventilation Design are not included in this manual; however, they are necessary in providing a complete system design.

For this reason, students are strongly encouraged to complete these courses and have demonstrated work experience in calculating heat loss and designing ventilation systems.

The objective of this course is to have students successfully understand how to determine the following items:

1. Specify boiler input from a heat loss.
2. Pipe sizing, velocity, and head losses in the boiler piping.
3. Pipe sizing, velocity, and head losses in the primary piping system.
4. Optimum performance of the primary system circulator.
5. Pipe sizing, velocity, and head losses in the secondary injection piping.
6. Cv selection and head loss through the injection control valve.
7. Pipe sizing, velocity, and head losses in the lines connected to the radiant circulator piping.
8. Optimum performance selection of a radiant circulator
9. Selection of a zone valve.
10. Pipe sizing, velocity, and head losses, spacing, loop lengths and fluid temperatures in a radiant floor heating system.
11. Sizing of expansion tanks.