

(online course offered through HeatSpring, BNP Media, John Siegenthaler)
<http://bnp.cammpus.com/courses/hydronic-system-design-training--online>

Title: Mastering Hydronic System Design

Course Description: This course provides a detailed discussion of the design elements underlying modern hydronic heating systems. It presents both design concepts and design tools for optimizing hydronic heating systems in a variety of contemporary applications. It is not meant as an introduction course. Rather, it is structured to combine a student's existing knowledge, with new approaches and analytical methods that are specifically focussed on the cutting-edge of hydronic heating. The goal is to equip students to design state-of-the-art systems for residential and light commercial buildings that deliver unsurpassed comfort, efficiency, and reliability.

Preliminary outline:

Module #1: Welcome & Fundamentals

- Course overview
- Reviewing the benefits of hydronic heating
 - Superior comfort
 - Ability to zone
 - Low distribution energy use
 - Minimally invasive installation
- Why water versus air?
- Where is there room for improvement? (several common mistakes)

Module #2: Heat source application:

- Conventional boilers, (efficiency and boiler protection)
- Mod/con boilers
- Electric boilers - when are they applicable?
- Hydronic heat pump characteristics
 - Capacity & COP versus operating temperatures
- Solar thermal collectors (design considerations, practical combisystems)
- General heat source design considerations (head loss, buffering, protection against temperature extremes, safety)

Module #3: Fluid flow through piping

- Static pressure
- Flow velocity and flow rate
- Head energy (head gain and head loss calculations)
- System head loss curve
- Series piping circuits

Parallel piping circuits

Module #4: Circulators: Performance, application, selection

Common types of circulators (PSC, ECM)

Review of circulation performance (pump curve)

Design techniques to avoid circulation cavitation

Hydraulic separation

Applying variable speed circulators (constant and proportional ΔP control)

Circulator selection

Module #5: Control concepts & hardware

Control terminology

Temperature setpoint control

Differential temperature control

Outdoor reset control

Mixing strategies (3-way and 4-way motorized valves, injection)

Using relays and switches to create logic

Module #6: Heat emitters and distribution systems

Low temperature heat emitter options

Panel radiators

Radiant floors

Radiant ceilings and walls

Homerun distribution systems

2-pipe distribution systems

Module #7: Element of contemporary system design

Importance of low temperature distribution systems

Ensuring low distribution energy use

Concept of single thermal mass accumulator

Low approach heat exchangers

Storage assisted on-demand domestic water heating

Zoning with valves and circulators

Module #8: Design tools

Using the Hydronics Design Studio

Creating system schematics using CAD

Module #9: Example system #1

Design and component selection for a basic residential system using panel radiators, indirect water heater, mod/con boiler, buffer tank. Schematics, calculations, layout, controls

Module #10: Example system #2

Design and component selection for a residential system with radiant ceilings supplied from a geothermal heat pump, inputs for solar thermal collectors, auxiliary boiler. Schematics, calculations, layout, controls.

Reference materials:

1. Modern Hydronics Heating, 3rd Ed.
2. Caleffi hydronics journals - free downloadable PDFs
3. Free download demo version of Hydronics Design Studio software
4. References to archived columns at www.PmMag.com

Anticipated assignments:

1. Reading in references
2. Exercise in MHH 3E text
3. Using online software to select a heat exchanger
4. Finding sources of supply online
5. Design of their own system

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