
1. Module details

Module name

HEATING SYSTEMS DESIGN

Nominal duration

One module

It is anticipated that students will achieve the competencies specified in 35 to 40 hours.

Module codes

EB144

Discipline code

2. Module purpose

To provide the student with the knowledge and skills necessary to effectively evaluate the suitability of various heating techniques select appropriate heating equipment to provide optimum performance. Students will also be able to identify and evaluate various hydronic piping configurations and describe the operating characteristics and advantages and disadvantages of each. Further, students will be able to correctly determine system pipe sizes taking into account thermal heat losses in the piping system.

3. Prerequisites

EB149 - Hydronic System Design

4. Relationship to competency standards

TBA

5. Content

1. Heating techniques:
 - electric resistance heaters
 - hot water boilers
 - steam boilers
 - refrigeration heat pump
 - heat reclaim
 - thermal storage systems
 - comparative heating costs
 - Australian Standards
2. Heating equipment selection
 - double bundle condensers
 - heat pumps
 - boilers
 - coils
 - expansion tanks
 - pumps, characteristics curves
 - control valves, types, flow diagrams,
 - air purge points
 - water treatment
 - pipe anchors and expansion joints
3. Hydronic system configuration
 - piping configurations

6. Learning outcome details

Learning outcome 1

Assessment criteria

Learning outcome 2

Assessment criteria

- single pipe closed circuit
- two pipe closed circuit
- direct return
- three pipe closed circuit with reversed return
- three way diverting valves
- risers and headers
- component location
- evaluation of piping configurations
 - capital cost
 - owning and operating costs
 - noise vibration
 - maintenance
 - future expansion
 - commissioning and balancing
- operating characteristics
 - cavitation

4. System pipe sizes

- pipe dynamic and friction losses for different materials
- fitting pressure losses for different materials
- thermal heat losses
- bare, insulated and underground pipes

On the completion of this module, the learner will be able to:

Evaluate the suitability of various heating techniques used in the HVAC industry.

Open book short answer test.
Project Assignments.

1.1 List and describe the various methods of heating used in the HVAC industry.

1.2 Establish an effective criteria for rating the relative merits of heating systems for given applications.

1.3 For specific given applications, contrast, rate and select the most appropriate method of heating.

Select appropriate heating equipment to provide optimum performance.

Projects/assignments.

2.1 Establish effective methods of matching heating capacity of equipment to the heating load.

2.2 Describe the method of capacity rating and sizing for each discrete component in a typical heating system.

2.3 For specific given applications, carry out selection of heating

	<p>system components.</p> <p>2.4 Provide an analysis of system performance for which components have been selected to ensure optimum performance.</p>
Learning outcome 3	Identify and evaluate various hydronic piping configurations and describe the operating characteristics and advantages and disadvantages of each.
Assessment criteria	<p>Projects/assignments.</p> <p>3.1 List the types and describe the relative advantages and disadvantages of hydronic piping systems used with HVAC heating systems.</p> <p>3.2 Evaluate the configurations of typical hydronic piping systems used with HVAC heating systems with respect to the relative location of system components such as pumps and make.</p>
Learning outcome 4	Correctly determine system pipe sizes taking into account thermal heat losses in the piping system.
Assessment criteria	<p>Project/assignments.</p> <p>4.1 Establish the range of operating temperatures and pressures encountered in hot water systems and the standard available sizes of pipe and tubing typically using in the HVAC industry.</p> <p>4.2 Use appropriate tables and charts to correctly determine system pipe sizes taking into account thermal heat losses and pressure drop in lines and fittings.</p>
7. Assessment Strategies	See Assessment Criteria.
8. Module Delivery Strategies	<p>This module contains learning outcomes that will require both theory and practical instruction. As such, it will require resources to facilitate both on and off-the-job delivery strategies.</p> <p>These strategies may involve:</p> <ul style="list-style-type: none"> - co-operative registered off-the-job provider/employer delivery sharing available resources. - delivery by an employer who is subregistered as an off-the-job provider, with qualified trainers in-house using resources to facilitate on and off-the-job delivery. - off-the-job objectives should focus on the industry context while on-the-job objectives should reflect application within enterprise operations. <p>Assessment instruments will need to be developed by the module</p>

9. Resource Requirements

provider. These instruments will need to reflect consistency with stated module learning outcomes and related assessment criteria.

Student records will be the responsibility of the off-the-job provider and where more than one off-the-job provider is involved, formal processes for transfer of student information must be established.

AIRAH 1989. AIRAH Handbook.

ASHRAE. Design Aids

ASHRAE. ASHRAE Handbook, HVAC Systems. Atlanta

ASHRAE ASHRAE Handbook, Refrigeration Systems and Applications SI Version. Atlanta

AUBRCC 1990. Building Code of Australia. CSIRO. North Ryde.

Australian Pump Manufacturer's Association. Australian Pump Technical Handbook.

Australian Pump Manufacturer's Association. Pipe Friction Handbook.

Boyle. Australian Refrigeration and Air Conditioning. Trust Publications.

Carrier Air Conditioning Company. Handbook of Air Conditioning Design, McGraw - hill.

Jones Air Conditioning Engineering.

Kinsky, R. 1982. Applied Fluid Mechanics. McGraw - Hill, Sydney.

Kinsky R. 1981 Applied Heat McGraw - hill Sydney

NATSPEC (latest edition) NATSPEC Volume 4 - Services Hydraulics.

NATSPEC (latest edition) NATSPEC Volume 6 - Services Control Monitoring Security Refrigeration, Heating, Air handling.

SMACNA 1987. HVAC Systems Applications.

Standards Australia - Latest Editions to be used:

ANSI/ARI410 Forced Circulation Air Cooling and Air Heating Coils.

AS1432 Copper Tube for Water Gas and Sanitation.

AS1571 Copper Seamless Tubes for Air Conditioning and Refrigeration.

AS1668 parts 1 & 2. The use of Mechanical Ventilation and Air Conditioning in Buildings.

AS1677 Refrigeration Systems.

AS1861 parts 1 & 2. Air Conditioning Units Methods of Assessing and Rating Performance.

AS3666. Air Handling and Water Systems of Buildings - Microbial Control.

Stoecker W.F., Jones J.W., 1982. Refrigeration and Air Conditioning McGraw - Hill.

The Trane Company 1986. Trance Air Conditioning Manual.

Additionally, further information may be sourced from:

- journal articles
- literature from water treatment companies
- literature form hydronic system specialist companies