Unit 9: Principles of Heating Services Design & Installation

Unit code M/615/1395
Unit level 4
Credit value 15

Introduction

The buildings we use in everyday life – to work, study, socialise and live in – are increasingly complex in their design as well as being subject to more stringent environmental targets for emissions. Within these buildings, heating systems play a major part in maintaining the comfort of the occupants.

This unit will introduce students to the principles of the design and installation of heating systems for non-domestic buildings.

Subjects included in this unit are: the design process, pre-design/design brief, the production of design data, thermal comfort, calculation of U-values, heat loss calculation, total heating loads and heating plant capacity, heating media and distribution systems, system layouts, heat emitters, heat sources, heating system components, sizing and specification of heating system components, and commissioning, testing and handover procedures.

On successful completion of this unit students will understand the principles of the design, sizing and specification of non-domestic heating systems and components.

Learning Outcomes

By the end of this unit students will be able to:

1. Identify pre-design information required for a non-domestic heating system.
2. Analyse heating loads for non-domestic buildings.
3. Design a non-domestic heating system for a given building type.
4. Justify the selection of non-domestic heating system components and installation strategy.
Essential Content

LO1 Identify pre-design information required for a non-domestic heating system

The design process:
Design stages and tasks.
Legislation.
Health & safety.
Design constraints.
Sustainability.

Pre-design/design brief:
Building form.
Building orientation.
Air tightness.
Fabric insulation.
Glazing.
Thermal mass.
Occupancy, usage details.
Potential internal loads.
Cost plan.

Design data.
Thermal comfort.

LO2 Analyse heating loads for non-domestic buildings

U-values:
Calculation of U-values for composite structures.

Heat loss calculation:
Calculation of heat losses, ventilation heat losses.

Total heating loads and heating plant capacity:
Plant diversity.
Plant configuration.
Single and multiple boiler options.
Minimising heat loads.
LO3 **Design a non-domestic heating system for a given building type**

**Heating media and distribution systems:**
- Requirements of the heating system.
- Radiant and convective output.
- Distribution.
- Zoning options.
- Integration with domestic hot water (DHW) requirements, integration with low-carbon technology options.

**Heating media options:**
- Radiant, air, water.
- Low pressure hot water (lphw).
- Medium pressure hot water (mphw).
- High pressure hot water (hphw) and steam.

**System layouts:**
- Centralised or de-centralised.
- Distribution system layout options.
- Two-pipe.
- Reverse return.
- Constant flow and variable flow systems.

**Heat emitters:**
- Radiators.
- Natural convectors.
- Underfloor heating.
- Fan convectors.
- Radiant panels.

**Heat sources:**
- Direct and indirect options.
- Conventional boilers or other heat sources such as heat pumps or combined heat and power (CHP).
- Fuel options and possible storage requirements.
- Boiler and burner types.
- Plant room design requirements.
- Flue and chimney design.
Heating system components:
Pipework.
Pumps.
Pressurisation units.
Expansion vessels.
Low loss headers.
Air and dirt separators.
Pipework expansion devices.
Regulating valves.
Fire collars.

LO4 Justify the selection of non-domestic heating system components and installation strategy

Sizing and specification of heating system components:
Pipes.
Pumps.
Pressurisation units.
Expansion vessels.
Low loss header.
Air and dirt separators.
Pipework expansion devices.
Regulating valves.
Fire collars.

Commissioning, testing and handover procedures.
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<th>Learning Outcomes and Assessment Criteria</th>
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<td><strong>Pass</strong></td>
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<tr>
<td><strong>LO1</strong> Identify pre-design information required for a non-domestic heating system</td>
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<tr>
<td><strong>P2</strong> Discuss the information that should be included in a design brief for a non-domestic heating system.</td>
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<td><strong>P3</strong> Produce design data for a heating system in a given building.</td>
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<td><strong>LO2</strong> Analyse heating loads for non-domestic buildings</td>
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<td><strong>P4</strong> Calculate U-values for a given structure. <strong>P5</strong> Calculate heat loss for spaces within a given building. <strong>P6</strong> Calculate the total heating load for a given building.</td>
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<td><strong>LO3</strong> Design a non-domestic heating system for a given building type</td>
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<td><strong>LO4</strong> Justify the selection of non-domestic heating system components and installation strategy</td>
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Recommended Resources

Textbooks

Links
This unit links to the following related units:
Unit 2: Construction Technology
Unit 8: Mathematics for Construction
Unit 10: Principles of Ventilation and Air Conditioning Design & Installation
Unit 17: Principles of Public Health Engineering
Unit 31: Advanced Heating, Ventilation and Air Conditioning Design & Installation
Unit 43: Hydraulics