

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.

L04 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.

Learning Outcomes and Assessment Criteria

Pass	Merit	Distinction
LO1 Identify pre-design information required for a non-domestic heating system		LO1 LO2 D1 Analyse the health & safety and environmental legislation relevant to the design, installation and operation of a non-domestic heating system.
P1 Explain the design process stages and tasks that must be considered for the design of a non-domestic heating system. P2 Discuss the information that should be included in a design brief for a non-domestic heating system design. P3 Produce design data for a heating system in a given building.	M1 Evaluate the design considerations and possible constraints for a given building type provided, with reference to legislation and possible health & safety considerations. M2 Analyse human comfort requirements.	
LO2 Analyse heating loads for non-domestic buildings		
P4 Calculate U-values for a given structure. P5 Calculate heat loss for spaces within a given building. P6 Calculate the total heating load for a given building.	M3 Analyse the current requirements for minimum U-values in domestic and non-domestic buildings, including infiltration rates.	

Pass	Merit	Distinction
L03 Design a non-domestic heating system for a given building type		L03 L04 D2 Analyse a range of sustainable options suitable for the heating system in a given building.
P7 Discuss suitable alternative heating strategies for a given building. P8 Explore the design criteria for the selection of heat emitters and heat source, and the criteria for their selection. P9 Produce a design proposal for a non-domestic heating system.	M4 Select a suitable heating strategy for a given building and analyse the reasons behind their selection. M5 Justify the selection of suitable heat emitters and heat source for a given building and analyse their selection.	
L04 Justify the selection of non-domestic heating system components and installation strategy		
P10 Calculate sizes of pipework for a given building. P11 Identify the index circuit and calculate the pipework resistance. P12 Justify the selection of a range of non-domestic heating system components.	M6 Discuss how the selection of different components impacts on an installation strategy.	

Recommended Resources

Textbooks

CHADDERTON, D. (2013) *Building Services Engineering*. 6th Ed. Abingdon: Routledge.

CIBSE (2015) *CIBSE Guide A: Environmental design*. 8th Ed. London: CIBSE.

CIBSE (2005) *CIBSE Guide B: Heating, ventilating, air conditioning and refrigeration*. London: CIBSE.

RACE, G. L. (2006) *CIBSE Knowledge Series: KS8: How to design a heating system*. London: CIBSE.

TEEKARAM, A. (2006) *CIBSE AM14: Non-domestic hot water heating systems*. London: CIBSE.

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