

BTEC

HIGHER NATIONALS

Construction



**Higher National
Certificate Lvl 4**

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, a student 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

Learning Outcomes and Assessment Criteria

Pass	Merit	Distinction
LO1 Identify pre-design information required for a non-domestic heating system		LO1 and 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
<p>LO3 Design a non-domestic heating system for a given building type</p>		<p>LO3 and LO4</p> <p>D2 Analyse a range of sustainable options suitable for the heating system in a given building</p>
<p>P7 Discuss suitable alternative heating strategies for a given building</p> <p>P8 Explore the design criteria for the selection of heat emitters and heat source, and the criteria for their selection</p> <p>P9 Produce a design proposal for a non-domestic heating system</p>	<p>M4 Select a suitable heating strategy for a given building and analyse the reasons behind their selection</p> <p>M5 Justify the selection of suitable heat emitters and heat source for a given building and analyse their selection</p>	
<p>LO4 Justify the selection of non-domestic heating system components and installation strategy.</p>		
<p>P10 Calculate sizes of pipework for a given building</p> <p>P11 Identify the index circuit and calculate the pipework resistance</p> <p>P12 Justify the selection of a range of non-domestic heating system components</p>	<p>M6 Discuss how the selection of different components impacts on an installation strategy</p>	

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 & Air Conditioning Design & Installation

Unit 17: Principles of Public Health Engineering

Unit 31: Advanced Heating, Ventilation & Air Conditioning Design & Installation

Unit 43: Hydraulics