

Unit 10: Building Services Design, Installation and Maintenance in Construction

Unit code: R/601/1260

QCF level: 4

Credit value: 15

- **Aim**

This unit provides learners with the opportunity to develop an understanding of the principles that underpin the design, installation and maintenance of building services in domestic, industrial and commercial buildings.

- **Unit abstract**

This unit provides learners with an understanding of the principal applications of building services to domestic, industrial and commercial buildings. Learners will also gain an understanding of issues related to the maintenance of building services. This unit should reinforce the need to coordinate building services installations within the overall construction process.

- **Learning outcomes**

On successful completion of this unit a learner will:

- 1 Understand the principles that underpin the design and installation of space heating, ventilation and air conditioning systems
- 2 Understand the principles that underpin the design and installation of building services distribution systems
- 3 Understand the principles that underpin the design and installation of building services disposal systems
- 4 Understand the principles that underpin the design and installation of lifts and escalators
- 5 Understand the issues associated with the maintenance of building services.

Unit content

1 Understand the principles that underpin the design and installation of space heating, ventilation and air conditioning systems

Space heating systems: space heating in buildings; type of systems available; criteria for the specification of systems (comfort needs, storage needs, availability of plant space, relationship to structure and finishes)

Design and installation principles for space heating: systems (low, medium and high pressure hot water systems; steam, warm air and radiant tube systems; gas and electric local appliances); issues associated with choice of fuel; energy sources and controls; types of boiler and ancillary plant; space requirements; issues associated with noise, loading and heat gains

Ventilation and air conditioning systems: need for ventilation and air conditioning in buildings; statutory and legal requirements; ventilation and air conditioning systems for industrial, commercial and public buildings; criteria for specification of systems (comfort needs; health, safety and welfare; user requirements; relationship to building design)

Design and installation principles for ventilation and air conditioning: natural and mechanical systems of ventilation; application to a range of building types and situations; natural ventilation; action of wind and thermal forces; use and interrelationship of air conditioning control systems (temperature, humidity, air cleanliness); types of system and their application; plant and space relationships; distribution and re-circulation systems; control mechanisms; fire dampers

2 Understand the principles that underpin the design and installation of building services distribution systems

Building services distribution systems: cold water, hot water, electricity, gas, telecommunications, fire alarm and detection; integration of distribution services

Cold water distribution systems: quality and characteristics of cold water supplies; by-law requirements; materials and components; special requirements for high-rise buildings; storage; related loadings on structure

Hot water distribution systems: hot water generators; direct and indirect systems; pressurised systems; safety requirements

Electrical distribution systems: power and lighting circuits; controls and cable systems; IEE Regulations for safe operation of installations; testing and inspection; temporary supplies on construction sites

Gas distribution systems: pipework; meters and associated controls; flues; ventilation requirements (balanced and fan-diluted flues)

Telecommunication distribution systems: data handling; control systems; ICT systems (including networking between buildings)

Fire alarm and detection distribution systems: alarm and detection systems; emergency lighting; relationship of systems to other services and escape routes; components and equipment; selection according to nature of hazard

Integration of distribution services: planning, design and installation of integrated services; effect on design of building structure; access issues; safety issues eg incompatibility of water and electricity

3 Understand the principles that underpin the design and installation of building services disposal systems

Building services disposal systems: foul water; surface water; domestic and commercial refuse

Foul water disposal: selection of sanitary appliances; layouts compatible with type of building; associated services; special provision for people with disabilities; criteria for the selection and installation of above-ground and below-ground drainage for domestic, industrial and commercial buildings; principles, applications and installation requirements for sewage disposal systems

Surface water disposal: domestic and small commercial buildings; flat and pitched roofs; criteria for the selection and installation of above-ground and below-ground drainage systems

Domestic and commercial refuse disposal: refuse handling; on-site storage and chute systems; mechanical handling; maceration; land fill; incineration; problems related to material separation and storage provision when recycling

4 Understand the principles that underpin the design and installation of lifts and escalators

Design and installation of lifts and escalators: operation; space for construction of shafts; structural and builders' work requirements; pits; motor rooms for electrical and hydraulic lifts; floor openings for escalators

Health and safety risks: special requirements for safe working (during construction, operation and maintenance)

5 Understand the issues associated with the maintenance of building services

Building services maintenance issues: integration at design and installation stages; consideration of space requirements; sequencing of installation procedures; access to installations; commissioning and testing; processes of coordinating and commissioning building services (at design, project planning and handover stages); construction of ducts, holes and voids (for purposes of access, safety and fire resistance)

Learning outcomes and assessment criteria

Learning outcomes On successful completion of this unit a learner will:	Assessment criteria for pass The learner can:
LO1 Understand the principles that underpin the design and installation of space heating, ventilation and air conditioning systems	1.1 justify the criteria used to specify space heating systems for buildings 1.2 analyse the principles that underpin the design and installation of space heating systems 1.3 justify the criteria used to specify ventilation systems and air conditioning systems 1.4 analyse the principles that underpin the design and installation of ventilation systems and air conditioning systems
LO2 Understand the principles that underpin the design and installation of building services distribution systems	2.1 analyse the principles that underpin the design and installation of hot and cold water systems 2.2 analyse the principles that underpin the design and installation of electricity and gas distribution systems 2.3 analyse the principles that underpin the design and installation of telecommunication, fire alarm and detection systems 2.4 justify the methods used to integrate building services distribution services in a single building
LO3 Understand the principles that underpin the design and installation of building services disposal systems	3.1 justify the design criteria used to specify foul water and surface water disposal systems 3.2 evaluate the methods and techniques used in above-ground and below-ground disposal of foul water, including sewage treatment 3.3 evaluate the methods and techniques used in above-ground and below-ground disposal of surface water 3.4 compare the methods used to remove and dispose of domestic and commercial refuse from buildings
LO4 Understand the principles that underpin the design and installation of lifts and escalators	4.1 assess the need to provide mechanical circulation for people and goods around buildings 4.2 analyse design criteria and principles for lifts and escalators 4.3 evaluate the health and safety risks associated with lift and escalator installations and operations

Learning outcomes On successful completion of this unit a learner will:	Assessment criteria for pass The learner can:
LO5 Understand the issues associated with the maintenance of building services	5.1 discuss the importance of an integrated approach to building design and building services 5.2 assess the health, safety and welfare aspects in relation to the maintenance of building services 5.3 evaluate the need for formal commissioning of all building services installations 5.4 justify the need to maintain buildings throughout their life

Guidance

Links

This unit links with other Edexcel BTEC HN Construction and the Built Environment units, for example:

- Unit 2: Science and Materials for Construction and the Built Environment
- Unit 3: Applied Mathematics for Construction and the Built Environment
- Unit 6: Health, Safety and Welfare for Construction and the Built Environment
- Unit 42: Low Pressure Hot Water Heating for Non-domestic Buildings
- Unit 45: Heating Systems for Industrial and Specialist Applications
- Unit 46: Piped Distribution Services for Non-domestic Buildings
- Unit 53: Electrical Protection and Transportation Installations for Non-domestic Buildings
- Unit 54: Building Management Systems for Building Services Engineering.

The content of this unit has been designed and mapped against the current CIC National Occupational Standards and the current NVQs at levels 4 and 5. Completion of the learning outcomes will contribute knowledge, understanding and skills towards the evidence requirements of the NVQs.

- See *Annexe B* for summary of mapping information to NVQs.

This unit has also been mapped to illustrate the links to the NQF units.

- See *Annexe D* for summary of mapping information to NQF units.

Essential requirements

Risk assessments must be produced, and complied with, for all practical activities, including visits to building services installations, building services merchants and component manufacturer premises. Learners require access to design data, CIBSE guides, Building Regulations, IEE Regulations and BSI codes of practice.

It is essential that a culture of health and safety is embedded in all the units to ensure that the learners understand the importance and relevance of health and safety issues. Therefore there should be clearly signposted aspects of current legislation and health, safety and welfare implications throughout the delivery and assessment of this unit.

Employer engagement and vocational contexts

Tutors should organise site visits, for example to building services installations, building services merchants and/or component manufacturer premises. To ensure site visits are successful tutors should outline the aims and objectives of the visits, conduct preparatory briefings and encourage learners to review the site visits once completed. Tutors should organise presentations by visiting speakers, for example building services engineers, planning consultants and/or environmental consultants. Tutors should use real-life case studies, based on site visits, for part of the assessment for this unit.