Unit 5: Building Services Design

Unit code:	F/504/4342
QCF level:	6
Credit value:	15

Aim

This unit gives learners an understanding of the role of the building services engineer in the design and development of a project. Learners will also develop skills and abilities for the creation of successful design solutions, including considering design solutions that are integrated post construction and fall into the remit of ongoing facilities management.

Unit abstract

This unit explores building services design, including client requirements, design technology, legal, health and safety and environmental issues, within a theoretical and practical framework.

In this unit learners will develop the ability to turn ideas from client needs into a design brief, identifying goals and analysing these goals for sound building services design solutions. Learners should consider sustainability of resources and the identification of risks and constraints within the execution of the project. They will then undertake a full design activity to provide a solution which seeks to satisfy design objectives whilst being economically viable.

Learners will be expected to determine, and work within, acceptable standards and tolerances whilst developing innovative, sustainable and creative building services engineering solutions for a construction project. Learners will also apply solutions to an existing building.

Learning outcomes

On successful completion of this unit a learner will:

1 Understand the function of building services design

2 Be able to produce sustainable building services design solutions

3 Be able to integrate building services design solutions throughout the lifetime of a building.

Unit content

1 Understand the function of building services design

Client needs: client, e.g. end-user client, private finance initiative (PFI) project company, design and build contractor client, developer client; needs, e.g. budgets, time constraints, use of space, lighting services, fabric structure, heating, ventilation, air conditioning (HVAC), lifts, IT and communications, electrical services, internal finishes, fire protection, security, public health

Using principles of building services design: whole-project view; sustainable conscience; consistent process; related work stages, e.g. preparation, design pre-construction, construction, commissioning of engineering services, pre-handover, initial occupation, post-occupancy aftercare; progressive fixing of information; integrated working practices; stakeholder involvement; risk management

Role of the building services consultant: services consultants, e.g. advisory and consultative role up to handover to specialist designer; specialist services designers, definition services at preparation/concept/design development stages, review services at production information, post-practical completion stages; strategic guidance on energy/water/new technologies

Work stages: plans of work, Royal Institute of British Architects (RIBA), Construction Industry Council (CIC), Association for Consultancy and Engineering (ACE), Office of Government Commerce (OGC) Gateways, Building Services Research and Information Association (BSRIA); construction phase; work stage activity checklists; inputs/outputs; procurement process, e.g. traditional, design and build, developer client; checking as-built decisions, e.g. against client brief and stakeholder expectations; project documentation

Buildability of design solutions: briefing, e.g. the client brief, the project brief, the project definition, strategic brief approval, concept report approval, design development report approval; benchmarking for sustainability potential; embodied energy; architectural, e.g. space allocation, space availability, gross internal floor area (GIA), net internal floor areas (NIA), flexibility, value for money, location, layout, access and circulation, aesthetics; structural, e.g. structural elements, permissible loadings; Construction Industry Council (CIC) Scope of Services; Schedule of Services for the Appointment of Consultants and Specialists; Construction Contract Requirements (CCRs); business case; acceptance criteria; identification of management procedures; control systems

Specialist product information: new technology; innovation; creating healthier internal environments; develop renewable energy sources

Whole-life design strategy: environmental performance requirements; cost effectiveness; low environmental impact; low energy; zero carbon solutions, e.g. solar, wind, biomass, hydroelectric, geothermal energy; fitness for purpose

2 Be able to produce sustainable building services design solutions

Deliverables: specialist investigations; test reports; technical studies; survey report; design options; associated cost estimates; selection criteria; input into concept report; specialist deliverables, e.g. component definition, outline and detailed specifications, integrated input into design development report, production information, fabrication details, installation details

Developing design proposals: stages of development, definition stage, e.g. cost, programme, health and safety, performance, integration, coordination; review stage activities, e.g. consultant input, coordinated definition outputs, general compliance with design intent; regulatory compliance relevant to the home country, e.g. BSRIA Legislation and Compliance resource, industry regulators; legislation relevant to the home country, e.g. Health and Safety at Work etc Act (1974), the Electricity Act (1989), the Gas Act (1995), the Water Act (1989), the New Roads and Streetworks Act (1991), all as amended; regulations relevant to the home country, e.g. Building Regulations (2010), the Construction (Design and Management) Regulations (2007), Management of Health and Safety at Work Regulations (1999); approved codes of practice, guidance and standards relevant to the home country, for the UK (Health and Safety Executive (HSE) Approved Codes of Practice, HSE Guidance, British Standards); client or industry standards; using different design criteria, e.g. performance, prescriptive, internal and external environmental design; consumption and connectivity of utility services; whole-life consequences of technical options; production information; guides and guidelines, e.g. CIBSE Guides*;* BSRIA Guidelines, e.g. Blue Book, Services Job Book, Mechanical Building Services, Electrical Building Services, Renewable Technologies, Mechanical Cooling; CIC Scope of Services Handbook; Building Information Modelling (BIM)

Legislation and approved codes of practice: current legislation relevant to the home country; UK legislation to include Health and Safety at Work etc Act (1974); UK regulations to include the Construction (Design and Management) Regulations (2007), Management of Health and Safety at Work Regulations (1999); UK codes of practice and guidance notes

3 **Be able to integrate building services design solutions throughout the lifetime of a building**

Post-practical completion activities: commissioning, e.g. coordination, planning and execution of testing of separate engineering services systems, integrating systems testing, operational outcomes, initial operating and fine-tuning procedure, statutory testing for building control; testing by specialist equipment manufacturers; application of 'soft-landings' strategy; coordinating involvement of client's engineering and maintenance personnel; demonstration of Building Management System (BMS) interface; checking commissioning records; operational and maintenance manuals, e.g. building logbook, building user's manual; production and delivery of training programmes; initiation of environmental and energy logging; migration planning for client stakeholders; resolution of defects after liability period; post-occupancy evaluation

Integrating services with facilities management: specialist designer's inputs, e.g. demonstrating operational techniques, control systems, reporting procedure, asset identification and registration, maintenance regimes, resource identification and allocation; aftercare services, e.g. initial aftercare period, extended aftercare, reference to procedural worksheets for each stage; operate technical review and performance monitoring procedures; user focus-group formation; advisory procedures for maintenance contracts

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 function of building services design	1.1 Appraise the services needs of a client 1.2 Evaluate the role of the building services consultant at design work stages 1.3 Critically analyse the buildability of design solutions which satisfy an agreed design concept 1.4 Critically evaluate specialist product information based on a sustainable whole-life design strategy
LO2 Be able to produce sustainable building services design solutions	2.1 Prepare the concept design deliverables from a client's brief 2.2 Devise design deliverables for the construction phase 2.3 Produce detailed design proposals for a specific building services function 2.4 Produce a Health and Safety plan for a specific building services design solution
LO3 Be able to integrate building services design solutions throughout the lifetime of a building	3.1 Critically evaluate the post-practical completion stage of a specific building project 3.2 Integrate building services design to the facilities management within an operational building

Guidance

Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 4	Level 5	Level 6
Unit 10: Building Services Design, Installation and Maintenance in Construction (R/601/1260)	Units 40-52 (BTEC HND in Construction and the Built Environment)	Unit 13: Installing and Commission Electrical and Electronic Services (L/504/4361)

Essential requirements

There are no special resources needed for this unit.

Delivery

It is essential that a culture of health and safety is embedded throughout building services design to ensure learners understand the importance and relevance of health and safety issues.

Assessment

Learning outcome 1 is most likely to be achieved through the analysis or evaluation of a case study taken from a completed project.

Learning outcomes 2 and 3 are most likely to be achieved through working on a project from conception through to a realistic design solution. A presentation to a group of building services engineers, as a peer review, is suggested as part of the overall assessment. This can be supported by relevant documentation which should include drawings, specifications and a workable programme to show the feasibility of the solution and/or the integration into existing buildings.

The scheme should highlight the learner's own input but might be considered as part of a small interdisciplinary team where the learner's work can be clearly identified and quantified.

This will most probably be achieved through workshop sessions and individual tutorials, perhaps accompanied by introductory lectures. Tutors should encourage learners to relate their investigations to the underpinning theories they have studied in other units.

The final report should reflect an appreciation of their responsibility to society for safe and sustainable solutions and of the effects such services, along with engineering works, have on communities and the environment.

Resources

Articles and guides

Parsloe C J – *A Design Framework for Building Services* 2nd Edition (BG 6/2009)

Allocation of design responsibilities for building engineering services – a code of conduct to avoid conflict (BSRIA, 1997) Technical Note TN 21/97

BSRIA Illustrated Guides set of 5 (ILL5) consists of:

AG15/2002 Illustrated Guide to Mechanical Building Services

BG5/2005 Illustrated Guide to Electrical Building Services

BG1/2008 Illustrated Guide to Renewable Technologies

BG2/2009 Illustrated Guide to Ventilation

BG1/2010 Illustrated Guide to Mechanical Cooling.

Websites

www.cibseknowledgeportal.co.uk/cibse-guides	*CIBSE Guides A–M*
www.modbs.co.uk	Modern Building Services