

Unit 65: Building Services Control Systems

Unit code: J/600/0319

QCF Level: 3

Credit value: 10

Guided learning hours: 60

Unit aim

This unit will enable learners to develop knowledge of the purpose and functions of building services control systems, an understanding of the operational characteristics of control components and devices, and the skills to develop control strategies, schemes and schematic drawings for building services systems.

Learning outcomes and assessment criteria

In order to pass this unit, the evidence that the learner presents for assessment needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit.

Learning outcomes	Assessment criteria
1 Know the purpose of building services control systems and the functions they perform	1.1 Identify the purpose of controls and control systems for building services
	1.2 Describe the functions control systems perform
2 Understand the principles associated with building services control systems	2.1 Explain the fundamental principles of control loops
	2.2 Explain the operational features, properties and characteristics of control loops
3 Know the operational characteristics of control components and devices	3.1 Describe how the features, characteristics and operating principles of control components and devices affect their specification
	3.2 Outline the operating characteristics of direct acting controls
4 Be able to develop appropriate control strategies, schemes and schematic	4.1 Identify control functions for specific applications

drawings for building services systems	4.2	Produce functional design and control strategies for given building services installations
	4.3	Produce detailed drawings to support control strategies

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Unit content

1 Know the purpose of building services control systems and the functions they perform

Purpose of controls and control systems: what building services controls do; consequences of poor control for owner and environment; legislative requirements

Functions: generic functions eg temperature, humidity, air quality, level, flow, lighting level, time, contamination/pollution, pressure, fire and smoke; specific adaptations of the generic function eg weather compensation, night set-back, zone control, optimum start/stop, system frost protection, fabric protection, pump exercising, plant sequencing; safety controls (functions performed by safety controls and control systems eg flame failure, combustion, pressure relief, leak detection, high and low level warning)

2 Understand the principles associated with building services control systems

Principles: terminology; control loops; modes of control; operational features

Terminology: controlled condition; set point; controlled process; controlled variable; manipulated variable; deviation; disturbances; offset; controller; sensor; actuator; controlled device; lag; hunting; dead-band

Control loops: components eg open loop, closed loop, single loop, multi-loop

Modes of control: eg two position, proportional, integral, derivative, proportional-integral (PI), proportional-integral-derivative (PID)

Operational features: lag; transport and transfer lag (causes, effects, methods of reduction); stability and accuracy; definition; causes and effects

3 Understand the operational characteristics of control components and devices

Control components: sensors; actuators; controlled devices; controllers: direct acting controls

Sensors: eg temperature, humidity, flow, velocity, pressure, level, air quality, rotational speed, gas detection, flame, smoke, light, presence, thermal radiation

Actuators: linear actuators; rotary actuators; types of power; drive and positional feedback

Controlled devices: control valves (types, operation, associated problems); control valve characteristics; valve authority; applications; control dampers (types, blade action, construction, operation); inherent and installed characteristics; applications; damper authority; mixing; other controlled devices (types, operating principles, features, characteristics); examples such as light dimmers, variable speed fans, pumps and compressors

Controllers: purpose; control signal media (mechanical; pneumatic; electrical; electronic); control data (examples of analogue and digital); conversion from analogue

to digital; the role of microprocessors and software in control systems; types eg manual, simple automatic, direct digital control, building management system and integrated control systems

Direct acting controls: eg thermostatic radiator valves, float valves, thermostatic expansion valves, pressure relief valves, flame failure valves, thermostatic shower mixing valves, thermostatic hot water valves

4 Be able to develop appropriate control strategies, schemes and schematic drawings for building services systems

Control functions: desirable and essential; for installations, systems and items of plant

Functional design strategies: key features to be identified before control strategy; key factors to be considered when selecting appropriate control strategies

Control strategies: automatic or direct digital control strategies for various specific building services installations and plant eg low pressure hot water heating systems and boiler plant, central ventilation/warm air heating/air conditioning systems and air handling units, domestic hot water installations, calorifiers and hot water generators, chilled water installations and refrigeration plant, packaged air conditioning systems, refrigeration plant for commercial applications; location of sensors to achieve required control functions; sequence of events and scenarios; functions of various sensors; selection of appropriate sensor set points, dead bands (differential)

Drawings: production of appropriate schematic control drawings and sketches; requirement to communicate control system detailed designs; use of drawing symbols and annotation

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