Unit 301: Understanding Building Services Engineering practice in Wales

# Delivery guide

Unit information

The purpose of this unit is for learners to explore and understand the wide and changing scope of the construction sector in Wales from pre-1919 practices to future development. It will provide an overview and set the scene for working in the building services engineering sector in Wales.

Learners may be introduced to this unit by asking themselves questions such as:

* Why do tradespeople require cards for access to commercial sites?
* What impact does my trade have on other trades?
* Why does the construction and built environment sector change over time?
* What influences the changes to materials, tools, and techniques used in the trade?
* What impact may my trade have on the environment?
* What impact does my trade have on other trades?

It is recommended this unit is delivered prior to Unit 302.

Learning outcomes

1. Know the relevant trade bodies and organisations within the building services engineering sector
2. Understand connected practice in construction and building services engineering
3. Know the changing construction and built environment sector
4. Know the changes in building services engineering materials, tools and techniques over time
5. Understand the relationship between trades and the environment

Suggested resources

Textbooks

* Gashe, M., Byrne, K. (2020) *The City & Guilds Textbook: Plastering for Levels 1 and 2*. London: Hodder Education.

ISBN 978-1-3983-0647-9

* Tanner, P. (2019) *Electrical Installations Book 1 for the Level 3 Apprenticeship (5357), Level 2 Technical Certificate (8202) & Level 2 Diploma (2365).* London: Hodder Education.

ISBN 978-1-5104-3224-6

Websites

* [BREEAM | Homepage](https://www.breeam.com/)
* [CBE | Sustainability Framework](https://www.cbe.ab.ca/about-us/sustainability/Documents/CBE-Sustainability-Framework.pdf)
* [Designing Buildings | Computer Aided Design](https://www.designingbuildings.co.uk/wiki/Computer_aided_design_CAD)
* [Designing Buildings | Protected species](https://www.designingbuildings.co.uk/wiki/Protected_species)
* [Edraw | Construction Gantt Chart](https://www.edrawsoft.com/project/construction-gantt-chart.html#:~:text=Construction%20Gantt%20charts%20show%20a,tasks%20need%20to%20be%20completed)
* [Electrotechnical Certification Scheme | ECS Card Types](https://www.ecscard.org.uk/card-types)
* [Elemental Green | 10 Eco Building Materials Revolutionizing Home Construction](https://elemental.green/10-eco-building-materials-revolutionizing-home-construction/)
* [Engineering Council | Homepage](https://www.engc.org.uk/)
* [Engine Shed | Traditional Mortars: Going Full Circle](https://blog.engineshed.scot/2018/08/24/traditional-mortars-going-full-circle/)
* [Gas Safe Register | Understand the Gas Safe ID Card?](https://www.gassaferegister.co.uk/help-and-advice/understand-the-gas-safe-id-card)
* [HSE: Information about Health and Safety at Work](https://www.hse.gov.uk/)
* [LJMU | Sustainable Construction in the 21st Century](http://researchonline.ljmu.ac.uk/id/eprint/4532/)
* [Natural Resources Wales | Scrap metal dealers public register](https://naturalresources.wales/permits-and-permissions/scrap-metal-dealers-public-register/?lang=en)
* [Passive House Institute | Passive house requirements](https://passiv.de/en/02_informations/02_passive-house-requirements/02_passive-house-requirements.htm)
* [PBC today | Construction Directory](https://www.pbctoday.co.uk/construction-directory/directory/listing/cabe-chartered-association-of-building-engineers)
* [Standard Heritage | All about lime mortars](https://www.standardheritage.uk/uncategorised/all-about-lime-mortars/)
* [WRAP | Waste management and reprocessors](https://wrap.org.uk/sectors/waste-management-reprocessors)
* [Future Generations | Well-being of Future Generations (Wales) Act 2015](https://www.futuregenerations.wales/about-us/future-generations-act/)
* [GOV.UK | Changes to PAS 2030:2017](https://www.gov.uk/government/publications/changes-to-pas-20302017)
* [LEGISLATION.GOV.UK | Control of Pollution Act 1974](https://www.legislation.gov.uk/ukpga/1974/40/contents)
* [LEGISLATION.GOV.UK | Control of Substances Hazardous to Health (COSHH) Regulations 2002](https://www.legislation.gov.uk/uksi/2002/2677/made)
* [GOV.UK | Domestic Building Services Compliance Guide](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/697525/DBSCG_secure.pdf)
* [LEGISLATION.GOV.UK | Environment (Wales) Act 2016](https://www.legislation.gov.uk/anaw/2016/3/contents/enacted)
* [LEGISLATION.GOV.UK | Environment Protection Act 1990](https://www.legislation.gov.uk/ukpga/1990/43/contents)
* [LEGISLATION.GOV.UK | The Hazardous Waste (England and Wales) Regulations 2005](https://www.legislation.gov.uk/uksi/2005/894/contents/made)

Legislation

* *Building Regulations 2010 Approved Document L1A: Conservation of fuel and power in new dwellings. 2013 edition with 2016 amendments.*   
  Newcastle upon Tyne: NBS. ISBN 978-1-8594-6743-5
* *Building Regulations 2010 Approved Document L1B: Conservation of fuel and power in existing dwellings. 2010 edition (incorporating 2010, 2011, 2013 and 2016 amendments).*   
  Newcastle upon Tyne: NBS. ISBN 97801-8594-6744-2

| **Learning outcomes** | **Criteria** | **Delivery guidance** |
| --- | --- | --- |
| 1. Know the relevant trade bodies and organisations within the building services engineering sector | * 1. The trade bodies and organisations relevant to the trade | * Learners to research the trade bodies and organisations relevant to their trade and their roles depending on their chosen pathway: * Electrical: Electrical Contractors Association (ECA), Joint Industry Board (JIB), Certsure, the National Inspection Council for Electrical Installation Contracting (NICEIC), ELECSA, National Association of Professional Inspectors and Testers (NAPIT), The Institution of Engineering and Technology (IET) and Chartered Institution of Building Services Engineers (CIBSE). * Plumbing and heating: Association of Plumbing and Heating Contractors (APHC), Heating Equipment Testing and Approval Scheme (HETAS), Oil Firing Technical Association (OFTEC), Gas Safe, Institution of Gas Engineers and Managers (IGEM), the Chartered Institute of Plumbing and Heating Engineering (CIPHE) and the Chartered Institution of Building Services Engineers (CIBSE). * Learners to research, collaborate and understand the role that The Health and Safety Executive (HSE) have in the Building Services Industry. |
| * 1. The role of the relevant trade bodies and organisations | * Learners to undertake theory training on the training bodies listed in 1.1 to have a better understanding of the roles and services these organisations offer. * Learners to research and discuss the advantages and disadvantages of being engaged with union representation such as Unite Construction, Allied Trades and Technicians (UNITE)) and Building Engineering Services Association (BESA). * Learners to be aware of the membership requirements for each trade body/organisation. * Learners to understand the qualifications required to obtain membership. |
| * 1. The competence card schemes within the building services engineering sector and the types of cards available | * Learners to engage in tutor-led sessions to enable knowledge of card recognition schemes, card issuers and qualifications required for their BSE trade depending on their chosen pathway: * Electrical: Electrotechnical Certification Scheme (ECS) and the types of cards available. * Plumbing and heating: JIB UK-PHMES CSCS, and Gas Safe/Gas Service Engineer Gold Registration Card and the types of cards available. * Learners to research, discuss and know the role of card issuers, their registration requirements and the need for industry-recognised qualifications. * Learners to research and undertake training in readiness for application for the card/recognition scheme, to know what type of cards are available and to know what they should apply for depending on their chosen pathway. |
| * 1. Professional registration as an Engineering Technician | * Learners to engage in tutor and peer sessions to gain knowledge of professional bodies and any membership requirements. * Learners to find out the benefits of engaging with these such as: * higher earning potential * improved career prospects and employability * enhanced status leading to higher self-esteem * international recognition of competence and commitment * evidence of expertise * greater influence within own organisation and industry * recognition as a counter signatory. * Learners to be aware of the membership requirements to join the Engineering Council. |
| 1. Understand connected practice in construction and building services engineering | * 1. Interdependencies between trades | * Learners to engage in a project scenario of their chosen pathway task of their choice and to link this to how to communicate with all other trades within the process regarding timings of first and second fix and how to work together collaboratively to complete a successful project. * Learners to understand the roles and responsibilities of different trades within on-site construction and building services including: * bricklayer * joiner * plasterer * tiler * electrician * Heating & Ventilation (H&V) fitter * gas fitter * decorator * groundworkers * plumber * roofer. * Learners to draw up a Gantt chart to track how the trades will link up in their chosen project scenario. |
| 1. Know the changing construction and built environment sector | * 1. The factors influencing pre-1919 construction | * Learners to research and understand how pre-1919 construction and engineering resources were sourced locally and how, due to transport constraints, this dominated the type and look of buildings in certain areas e.g., local quarries would produce different looking types of aggregate from region to region. * Learners to research and understand binders and mortars used pre-1919 such as different types of lime used and how it was produced and slaked. * Learners to understand the basic qualities and uses of mortars, aggregates, binders, internal and external functional and decorative finishes such as stone, slate, timber and earth. * Learners to have a knowledge of lime used pre-1919 such as quick lime and hot lime. * Learners to engage in tutor-led sessions in the workshop to gain an understanding of qualities and uses of mortars used pre-1919. |
| * 1. The factors influencing post 1919 to modern construction | * Learners to research and know how transport systems were developed from pre-1919 to post-1919, helping to revolutionise the building services engineering industry and make more varied construction materials available from around the country. * Learners to research and to understand the cost implications, both good and bad, when more materials become available for purchase to construct buildings and to supply building services engineering. * Learners to engage in tutor- and peer-led sessions to gain knowledge of post-1919 to modern construction methods. * Learners to know that more prestigious buildings, such as churches and government buildings, would generally use more expensive materials to complete external and internal architectural finishes which would mean more expensive build costs. * Learners to know that more modern buildings post-1919 would incorporate a Damp Proof Membrane (DPM), a Damp Proof Course (DPC) and steel and glass into building projects and what affect this had on the types and speed of construction. * Learners to understand modern building services engineering materials and their uses, such as plastic and copper. |
| * 1. The factors influencing twenty-first century construction | * Learners to research and to have a good understanding of what is meant by sustainable construction for modern twenty-first century building projects. * Learners to research and collaborate to gain an understanding of the importance of the Well-being of Future Generations (Wales) Act 2015 for the construction industry. * Learners to research and know the quality and uses of building materials used for twenty-first century building projects particular to achieving a zero-carbon footprint. * Learners to be aware of traditional methods of building surveying and design such as Computer Aided Design (CAD) and Building Information Modelling (BIM). * Learners to undergo a small CAD design of their choice. * Learners to understand the difference and benefits of using modern software for use of 2D and 3D design tools compared to traditional methods. * Learners to have some knowledge of limitations to planning and design in construction when using 2D and 3D software technologies. * Learners to undertake research on types of modular buildings and off-site construction methods for twenty-first century builds. |
| 1. Know the changes in building services engineering materials, tools and techniques over time | * 1. The considerations required when performing building services engineering work on pre-1919 buildings and structures | * Learners to work in group sessions and collaborate to identify the changes in building services engineering materials, tools and techniques over time. * Learners to have a knowledge of methods, applications and techniques used to fit out buildings and structures pre-1919. * Learners to have an understanding and to be able to list the types of tools used to fit out buildings and structures pre-1919. * Learners to research methods and resources used pre-1919 in the application of building services engineering for buildings and structures. * Learners to research traditional finishes (renders, plasters, paints) pre-1919 and to understand the implications of repairs when installing them in historical buildings which may have protection orders on them. * Learners to research methods, materials and resources on their chosen pathway that were used in the installation of plumbing and electrical systems pre-1919. * Learners to have an understanding of traditional building services engineering materials and their uses, such as lead and cast iron. * Learners to know the actions to be taken where unsafe building services are discovered and to know the lifespan of a building service due to: * overload * corrosion * electrolysis * age * wear and tear * environmental conditions * verdigris/oxidation of copper * usage * changes to regulations * materials * safety requirements. |
| * 1. Post-1919 and modern construction techniques and building services | * Learners to work in group sessions and collaborate to identify post-1919 and modern construction techniques and building services. * Learners to have a knowledge of methods, applications and techniques used to fit out buildings and structures post-1919. * Learners to have an understanding and to be able to list the types of tools used to fit out buildings and structures post-1919. * Learners to research and to be able to list the types of materials used in the application of building services engineering for buildings and structures post-1919. * Learners to have an understanding of modern building services engineering materials and their uses, such as plastic and copper. * Learners to research the development of brick cavity methods of construction and later variations of cavity-wall design which enables the safe and effective planning, installation and commissioning of the building services post-1919. * Learners to be made aware of the evolution of solid to cavity wall (brick, block and modern timber framing), prefabricated floor, wall, roof and joinery components, modern heating and ventilation systems, electrical installations, water and waste management systems. * Learners to be aware of the Building Regulations applicable to installation of the service (key requirements only). |
| * 1. The new and emerging technologies in the building services engineering trade and the impact they are having/may have on existing practice | * Learners to research modern-day application techniques of their chosen pathway: * Plumbing and heating: environmental technologies (heat pumps, solar thermal (hot water), ground source heat pump, air source heat pump, biomass etc.), hydrogen as a new mains gas. * Electrical installation: electric vehicle charging points, smart metering, battery technologies, photovoltaic (PV). * Learners to know how to access information on new developments in their trade, such as through professional engineering institutions, industry bodies and trade associations, articles, trade press, formal Continuing Professional Development (CPD), manufacturer’s information etc. * Learners to be able to recognise how keeping up to date with industry initiatives and developments can help BSE businesses, the sector and the environment. * Learners to research Chartered Association of Building Engineers (CABE). * Learners to have an awareness of Smart homes, controls, 3D modelling/printing and immersive technology. * Learners to engage in a tutor-led peer collaboration project around new and emerging technologies in the building services engineering trade. |
| 1. Understand the relationship between trades and the environment | * 1. Industry regulation and sustainability and the natural environment | * Learners to research government policy on sustainability e.g., Environment Wales Act 2016, Environment Protection Act 1990, Hazardous Waste (England and Wales) Regulations 2005, Control of Pollution Act 1974. * Learners to research Building Research Establishment Assessment Method (BREEAM) and how it fits into twenty-first century construction practice. * Learners to have knowledge of Passive House types of construction techniques to achieve the government initiative and policy on zero-carbon footprint. * Learners to know what should be done when there is a discovery of protected species during the construction process e.g., bats and newts. * Learners to research key aspects of PAS 2030 (and 2035) and the PAS 2030 installer scheme (a scheme that supports those installing energy efficiency measures). * Learners to know how the design of the building services can help with energy efficiency. * Learners to be familiar with the main aspects of Building Regulations 2010 Part L and Documents L1A and L1B and the Domestic Building Services Compliance Guide. * Learners to engage in tutor-led tasks to explore the relationships between trades and the environment. |
| * 1. Ecological considerations and principles | * Learners to research and to gain a knowledge of government policy and ecological considerations when undergoing any work which may affect protected wildlife and habitats e.g., nesting birds, rare plant species. * Learners to research and understand the implications for future development of flood plains and the effect this could have on the buildings and surrounding areas. |
| * 1. Sustainable approaches | * Learners to research and have a knowledge of sustainable considerations used in Construction and the Built Environment (CBE) and to recognise the scope of their use to maintain a healthy building which is user-friendly for twenty-first century applications under sustainable construction e.g., alarm and wi-fi installation. * Learners to list various ways a building can offset its carbon footprint to meet twenty-first century building targets and expectations such as heat recovery and ventilation, rainwater harvesting, fuel cells, solar panels, heat and cooling pumps, zero-carbon buildings. |
| * 1. Waste disposal in building services | * Learners to research and to have a knowledge of modern methods of waste disposal and recycling of construction materials. * Learners to research Waste Management and Reprocessors (WRAP) and link this to on-site construction waste disposal initiatives. * Learners to know about the disposal of hazardous waste and link this to the Control of Substances Hazardous to Health (COSHH) Regulations 2002. * Learners to know how different materials can reduce environmental impact in their trade area and the principles of the ‘3 Rs’ of waste management (reduce, reuse and recycle). * Learners to research and recognise how scrap materials can hold value (such as copper as it is a finite resource) and the public register of scrap metal dealers in Wales. * Learners to have an awareness of the content and production of a Site Waste Management Plan (SWMP). * Learners to engage in tutor-led and employer collaboration project highlighting and reporting on differing methods and ways of environmentally and safely disposing of waste. |