Unit 319PH: Understand sanitation system installation, commissioning, service and maintenance techniques

# Delivery guide

Unit information

The purpose of this unit is for learners to obtain trade experience in plumbing and heating installations.

The purpose of this unit is for learners to explore sanitation systems within a domestic property and industrial and commercial building and the competences that underpin work on the different systems. Learners will have the opportunity to:

* inspect and pre-commission sanitation systems
* decommission sanitation systems
* install and test sanitation systems
* commission sanitation systems
* service and maintain sanitation systems.

This work will be in accordance with the current versions of the appropriate industry standards and regulations; the specification; industry recognised working practices; the working environment and the natural environment.

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

* What are complex sanitation systems?
* What steps must you take to design a sanitation system including sanitary appliances and pipework systems and components?
* What steps are part of commissioning sanitary appliances and pipework systems and components?
* How do you service and maintain sanitary appliances and pipework systems and components?

Learning outcomes

1. Understand the applications, advantages and limitations of appliances, components, and accessories
2. Understand the appropriate industry standards and regulations
3. Understand the organisational procedures for confirming with the relevant people the appropriate actions to be taken to ensure that any variations to the planned programme of work will not introduce a hazard and have minimum negative impact on the installation work to be undertaken
4. Understand the appropriate testing procedures for confirming the systems’ integrity
5. Understand how to complete relevant documentation in accordance with organisational procedures
6. Understand the methods for determining the type of size of appliances, components, and accessories
7. Understand how to interpret diagrams and drawings for the system to identify the planned location of the appliances, components, and accessories
8. Understand how to interpret diagrams and drawings for the sanitation system to identify the planned location of the appliances, components and accessories
9. Understand the visual and manual checks required to confirm that the appliances, components, and accessories have been fixed, fitted and connected
10. Understand the methods and techniques for commissioning the sanitation system
11. Understand the methods for determining the type of size of replacement appliances, components, and accessories
12. Understand the methods and techniques for servicing and maintaining appliances, components, and accessories
13. Understand the methods and techniques for replacing/repairing the appliances, components, and accessories
14. Understand basic fault-finding techniques

Suggested resources

Textbooks

* Maskrey, M. (2019) *The City & Guilds Textbook: Plumbing Book 1 for the Level 3 Apprenticeship (9189), Level 2 Technical Certificate (8202) & Level 2 Diploma (6035) (City & Guilds Textbooks)*. London: Hodder Education.

ISBN 978-1-5104-1648-2

* Tanner, P. and Stephen, L. (2019) *The City & Guilds Textbook: Plumbing Book 2 for the Level 3 Apprenticeship (9189), Level 3 Advanced Technical Certificate (8202) & Level 3 Diploma (6035) (City & Guilds Textbooks).* London: Hodder Education.

ISBN 978-1-5104-1646-8

Websites

* [Armitage Shanks | Bathrooms](https://www.armitageshanks-mena.com/homepage.html)
* [Floplast | Homepage](https://www.floplast.co.uk/)
* [Ideal Standard | Homepage](https://www.idealspec.co.uk/)
* [McAlpine Plumbing | Homepage](https://mcalpineplumbing.com/)
* [Planning Portal | Homepage](https://www.planningportal.co.uk/)
* [Polypipe | Homepage](https://www.polypipe.com/)
* [Saniflo | Homepage](https://www.saniflo.co.uk/)

British Standards

* BS EN 12056-2:2002. *Gravity Drainage Systems Inside Buildings. Sanitary Pipework, Layout and Calculation.*

Legislation

* *Building Regulations 2010 Approved Document A: Structure*. Newcastle upon Tyne: NBS.

ISBN 978-1-8594-6508-0

* *Building Regulations 2010 Approved Document F: Ventilation (2010 edition incorporating 2010 and 2013 amendments)*. Newcastle upon Tyne: NBS.

ISBN 978-1-8594-6679-7

* *Building Regulations 2010 Approved Document G: Sanitation, Hot Water Safety and Water Efficiency*. Newcastle upon Tyne: NBS.

ISBN 978-1-8594-6600-1

* *Building Regulations 2010 Approved Document H: Drainage and Waste Disposal*. Newcastle upon Tyne: NBS.

ISBN 978-1-8594-6599-8

* *Building Regulations 2010 Approved Document M: Access to and use of Buildings*. Newcastle upon Tyne: NBS.

ISBN 978-1-8594-6747-3

| **Learning outcomes** | **Criteria** | **Delivery guidance** |
| --- | --- | --- |
| 1. Understand the applications, advantages and limitations of appliances, components, and accessories in relation to the working environment | * 1. The types and layout features of sanitary appliances pipework systems | * Learners to be able to state the advantages and disadvantages and to be able to identify types and layout features of sanitary appliances pipework systems including: * primary ventilated stack system * secondary ventilated stack system * ventilated branch discharge system * stub stack system. * Learners to be able to explain the system layout features for discharge stacks (wetted portion) at the foot of the stack in buildings up to five storeys in height including: * use and type of bend * proximity of low-level connections. * Learners to be able to explain the system layout features for: * discharge stacks (wetted portion) * soil stack sizes based on WC outlet size * waste stack sizes serving waste appliances only * use of bends in the wetted portion of the stack. * Learners to be able to explain the system layout features for branch discharge pipework. * Learners to know the layout of unventilated and ventilated branch discharge pipework including: * maximum length of pipework and pipework gradient * sizes of branch discharge pipework for soil and waste appliances * use of traps and self-sealing valves in preventing noxious smells in buildings. * Learners to know methods of: * ventilating branch discharge pipework * connecting multiple waste appliances to branch discharge pipework * connecting branch discharge pipework into the main stack. * Learners to be able to explain the system layout features for stack ventilation (dry portion of the stack). * Learners to know the proximity of vent outlet to openable windows. * Learners to be familiar with the use of air admittance valves. * Learners to be able to explain the system layout features for systems and appliances located on the ground floor including: * stub stack systems * waste appliance connections to gullies * waste appliance connections direct to drain * WC connection direct to drain. |
| * 1. The working principles of sanitary appliances pipework systems, positioning fixing, connection and operation of components | * Learners to know maximum distances permitted in sanitary appliances pipework systems within dwellings. * Learners to be able to describe the working principles of sanitary appliances pipework systems, positioning fixing, connection and operation of the following components: * bend 92.5 degree * bend 135 degree * bend (male–female) * access bend * offset bend * branch tee * boss * boss socket * vent terminal * waste manifold * pan connectors * traps * waterless trap * air admittance valve * clips/brackets * coupler * socket plug * socket rodding access * floor gullies. |
| * 1. The expansion and contraction in sanitary appliances and pipework systems and negative effects | * Learners to develop their understanding of expansion and contraction of sanitary appliances pipework and to know the measures to take when installing pipework in different situations including expansion fittings. |
| * 1. The different types of sanitary appliances and components used in dwellings | * Learners to be able to explain the purpose of sanitary appliances used in dwellings and to be able to identify the different types. * Learners to be able to explain the working principles of the following sanitary appliances and components: * conventional WC * flushing cisterns (automatic and manual) * waste disposal units * baths * bidets * wash hand basins * shower tray * bath/shower screens and cubicles * sinks * urinals * WC macerators * wastewater lifters used in domestic dwellings * sink waste disposals. |
| * 1. The factors that lead to trap seal loss in sanitary pipework systems | * Learners to be able to state the factors that lead to trap seal loss in sanitary pipework systems including: * self-siphonage * induced siphonage * wavering out * evaporation * leaks * momentum * capillary action. * Learners to know how to combat trap seal loss and the negative effects of trap seal loss. |
| * 1. The working principles of greywater recycling systems | * Learners to be able to describe the basic operating principles of greywater reuse/recycling systems. * Learners to be able to identify the permitted uses of greywater in properties such as flushing toilets, washing cars etc. * Learners to be able to describe the purpose of components used within greywater reuse systems. |
| * 1. The suitability of below ground drainage systems to receive wastewater | * Learners to know the suitability of below ground drainage systems to receive wastewater including: * combined drainage systems * separate drainage systems * partially separate drainage systems * soakaway * cesspit and * septic tanks. * Learners to understand types of wastewater, including foul, soil, waste and condensate water. * Learners to be able to state where these devices are sited in relation to industry standards and how faults affect the safety of these systems. |
| 1. Understand the appropriate industry standards and regulations relevant to  * decommissioning * installing and testing * commissioning * service and maintenance   of sanitary appliances and pipework systems | * 1. The information sources required to complete testing and commissioning | * Learners to be able to identify the information sources available to them while working on sanitary appliances and pipework systems. * Learners to know the information required to complete testing and commissioning of hot water systems in accordance with: * Building Regulations 2010 Approved Document G: Sanitation, hot water safety and water efficiency * BS EN 12056-2:2000. Gravity drainage systems inside buildings * Manufacturers’ technical instructions. |
| 1. Understand the organisational procedures for confirming with the relevant people the appropriate actions to be taken to ensure that any variations to the planned programme of work will not introduce a hazard and have minimum negative impact on the installation work to be undertaken | * 1. What may be communicated to the client through the progress of a job | * Learners to be aware of the information that may be communicated to the client throughout the progress of a job including: * start and finish times * changes to specifications * alternative sources whilst systems are being decommissioned * confirming the location of components * requesting valuable items are removed whilst installation work is undertaken * information regarding delivery orders/deliveries * delays to progress. * Learners to be able to explain suitable communication methods including: * verbal communication * written communication * emails * text messages. |
| * 1. The types of communication that may be required with the site management team | * Learners to be aware of the types of communication that may be required with the site management team including: * architect * quantity surveyor (QS) * buyer/estimator * surveyor * project manager/clerk of works * structural engineer * building services engineer * contracts manager * construction manager. * Learners to be able to explain suitable communication methods such as communicating with the clerk of works to confirm sanitary appliance positioning, including by: * verbal communication * written communication * emails * text messages. |
| * 1. The importance of complying with company policies and procedures | * Learners to be able to discuss the importance of complying with company policies and procedures and the consequences of not adhering to them, for example, not complying with company health and safety policies could result in disciplinary action. |
| * 1. The impact when materials are not delivered on time against the work programme | * Learners to be able to explain the impact when materials are not delivered on time such as: * delays in completion * effect on the work programme on other trades * delays affecting other deliveries. * Learners to identify any changes to the work programme and to know how to respond to these changes. |
| * 1. The factors which affect working time allocation to work activities | * Learners to be aware of the factors that affect working time allocation to work activities including: * material availability * labour requirements * staff experience * delivery requirements * labour availability * weather * environmental * client deadlines. |
| 1. Understand the appropriate testing procedures for confirming the systems’ integrity | * 1. A soundness test to industry requirements on sanitary appliances and pipework systems pipework and components | * Learners to be able to describe a soundness test to industry requirements on central heating systems pipework and components as follows: * visual inspection * notify * air test * initial fill * wet test * check for leaks * complete documentation and notify as required. * Learners to be made aware of the equipment used (manometer, hand pump, seal, cap) including test pressure and test durations. * Learners to know the method of applying an air test using test equipment. Air test specification: 38mm water gauge, 3-minute test, no pressure loss. * Learners to understand that leaks must be rectified and re-tested before a test certificate is issued. |
| 1. Understand how to complete relevant documentation in accordance with organisational procedures | * 1. The information sources required to complete commissioning installation and maintenance records | * Learners to be aware of the information contained on commissioning, installation and maintenance records for example, installation date, type of system installed, name of engineer, parts maintained, pressures, flow rates, temperatures, materials used, test information. * Learners to be provided with examples of commissioning, installation and maintenance records. * Learners to be made aware of the appropriate advice on serviceable components, to highlight specific instructions and to understand that relevant component manufacturer’s instructions are to be left and explained to the customer on handover. * Learners to understand that, to comply with the Building Regulations, notification has to be given when work is carried out. |
| 1. Understand the methods for determining the type of size of appliances, components, and accessories in accordance with industry recognised organisational procedures | * 1. The factors that affect the selection of sanitary appliances and pipework systems for dwellings | * Learners to be aware of the factors that affect the selection of sanitary appliances and pipework systems for dwellings including: * customer needs * size of household * type of property * building layout and features * energy efficiency * environmental impact * cost/affordability * current legislation * appliance type * drainage system type * pipework routes * access requirements. * Learners to know the requirement for design temperatures and how these impact on selection and positioning. |
| * 1. The information sources required to size and select sanitary appliances and pipework systems and components | * Learners to know that the following information sources are required to size and select sanitary appliances and pipework systems components: * Building Regulations 2010 Approved Document F: Ventilation * Building Regulations 2010 Approved Document G: Sanitation, hot water safety and water efficiency * Building Regulations 2010 Approved Document H: Drainage and Waste Disposal * Building Regulations 2010 Approved Document M: Access to and use of buildings * BS EN 12056-2:2000. Gravity drainage systems inside buildings. Sanitary pipework, layout, and calculation * BS 6465-2 Sanitary installations. Space recommendations. Code of practice * manufacturers’ technical instructions * plans and drawings * pre-determined data * specifications * industry standards. * Learners to know that verbal and written feedback is also required from the customer in relation to appliance type and proposed locations. |
| * 1. How to calculate sanitation system requirements used in dwellings | * Learners to be provided with system requirements and different sources of information to calculate system components including: * gradient * diameter * length * material * system type. * For: * the main stack sizes * branch pipework size * stack vent size. |
| * 1. How to select sanitation components in accordance with calculations from predetermined data | * Learners to be provided with system requirements and different sources of information to select system components using pre-determined data including: * the main stack size * branch pipework size * stack vent size. * Learners to determine how to make the required selection of components. |
| 1. Understand how to interpret diagrams and drawings for the sanitation system to locate site services and system supply | | * Learners to be shown how to interpret diagrams and drawings for the sanitation system to locate site services and system supply. * Learners to be introduced to the use of scale drawings, to understand the formula to determine full scale measurements from the drawings and to look at the contents of drawings, plans and specifications. * Learners to be given examples of diagrams and drawings. * Learners to be able to look at diagrams and drawings and develop a comprehensive materials list. * Learners to know the process of using specifications when carrying out design calculations. * Learners to know: * how to prepare line drawings to present design calculations * how to prepare a quotation from design information and * calculations for the method of presenting and producing a tender. |
| 1. Understand how to interpret diagrams and drawings for the sanitation system to identify the planned location of the appliances, components and accessories | * 1. Interpret information to complete a detailed materials list | * Learners to know the requirements and methods to fit the selected components, appliances and accessories and what documentation and procedures to follow. * Learners to be aware of how to interpret information from a range of sources to complete a detailed material list. * Learners to know that material lists should include quantities, colours/grades/sizes of: * pipework * consumables * fittings * components * fixings * appliances. * Learners to know that, when ordering from a plumber’s merchant, product codes should also be included. * Learners to be shown how to prepare a quotation from design information and calculations and to understand the method of presenting and producing a tender. |
| * 1. Present calculations and information in a suitable format for quotation and tender | * Learners to be aware of the methods to present calculations and information in various formats. * Learners to know that scale drawings are produced to show the customer the proposed final installation. * Learners to know that technology and bespoke computer programmes, 3D drawings and artist impressions can be produced showing what the installation will look like when completed. * Learners to know that spreadsheets can be used to present design calculations. Functions can also be added to automatically calculate data. * Learners to know that Word documents and spreadsheets can be used to produce quotes, material lists and to write job specifications to supplement drawings. * Learners to be given the opportunity to present calculations using a range of formats and to prepare line drawings to present design calculations. |
| 1. Understand the visual and manual checks required to confirm that the appliances, components and accessories have been fixed, fitted and connected in accordance with:  * the plumbing and heating system’s design * the working environment * organisational procedures | * 1. A visual inspection of sanitary appliances, pipework systems to confirm that it is ready to be soundness tested | * Learners to know the reasons for a visual inspection prior to completing an air test. * Learners to be able to explain the steps taken during a visual inspection to confirm the sanitation system is ready to be soundness tested including: * appliance checks * checking that all joints have been made correctly and there is no leakage * checking that all pipework is secure and adequately supported * checking the installation conforms to the Regulations * checking for damage * checking for signs of damp on the building surface. * Learners to be aware that any problems, such as insufficient clipping of pipes or inadequate gradients, should be rectified before testing begins. * Learners to be able to list the visual checks required on sanitary pipework systems and components before an air test is completed. * Learners to understand the procedure to follow if installations faults on sanitary pipework systems and components are identified during a visual inspection. |
| 1. Understand the methods and techniques for commissioning the sanitation system in accordance with:  * the plumbing and heating system’s design * the working environment * organisational procedures | * 1. The flushing requirements including the use of system additives for new and existing sanitary appliances, pipework systems | * Learners to know the flushing requirements, including the use of system additives for new and existing sanitary appliances and pipework systems. |
| * 1. The operational checks required during commissioning | * Learners to be able to describe operational checks and how to carry out a performance test during commissioning including: * correct fall * no trap seal loss * no leaks * adequate support * waste removed satisfactory. * Learners to be provided with the opportunity to undertake the commissioning procedure and to carry out operational checks. |
| * 1. The commissioning procedures for sanitary appliances, pipework systems and components | * Learners to be aware of the commissioning procedure for sanitary appliances, pipework systems and components including: * visual inspection * soundness test * operational checks * commissioning documentation * handover. * Learners to know the commissioning procedure that must be followed in line with Building Regulations 2010 Approved Document H and manufacturer instructions. * Learners to know, as part of the commissioning procedure, that they will carry out operational and performance checks, including: * the recommended depth of seal on the traps of common appliances * the method of carrying out a performance test * how to ensure the seal on traps meets the recommended depth after a performance test * the correct commissioning procedures for a macerator WC and the reasons that such components need to be correctly commissioned. |
| * 1. The range of information that would be detailed on commissioning documentation | * Learners to be aware of the information contained on a commissioning record, for example: * installation date * type of system installed * name of engineer * serial numbers * appliances * test pressures and durations * details of performance checks. * Learners to be provided with examples of commissioning records. |
| * 1. The actions that must be taken when commissioning reveals defects | * Learners to be able to identify the actions that must be taken when inspection and testing reveals defects in sanitary appliances, pipework systems and components. * Learners to know how to deal with systems that do not meet correct installation requirements, including insulation requirements such as remedial work associated with: * defective pipe work bracketing * leakage from pipe work systems * operation of appliance traps/self-sealing valves * the operation of flushing cisterns/mechanisms. * Learners to be provided with practical examples and asked to come up with solutions to rectify the defects. |
| * 1. The procedure for handing over to the end-user | * Learners to be aware that, once the system has been tested and commissioned, it can be handed over to the customer. * Learners to know that this process involves: * a full demonstration of any system controls * an overview of system maintenance requirements, including durations and * an explanation of what to do in the event of an emergency, including isolation points and procedures where applicable. |
| 1. Understand the methods for determining the type of size of replacement appliances, components and accessories in accordance with industry recognised organisational procedures | | * Learners to understand the methods for determining the type of size of replacement appliances, components and accessories using design data, pre-installed systems and manufacturer information. * Learners to be provided with examples and asked to determine the type of size of replacement appliances, components and accessories. |
| 1. Understand the methods and techniques for servicing and maintaining appliances, components and accessories in accordance with:  * the plumbing and heating system’s design * the working environment * manufacturers’ instructions | * 1. How to use manufacturer instructions and job maintenance schedules to establish the periodic servicing requirements of system components | * Learners to be able to explain the use manufacturer instructions and job maintenance schedules to establish the periodic servicing requirements of sanitary appliances, pipework systems and components. |
| * 1. The routine checks required on sanitation system components and pipework as part of a periodic maintenance programme | * Learners to be able to explain how to how to carry out routine checks on sanitary appliances, pipework systems and components as part of a periodic maintenance programme including: * visual inspection of pipework for leakage * adequate support * effective operation of terminal fittings * effective operation of float operated valves * effective operation of valves * condition of cisterns * operation of flushing cisterns/mechanisms * fitting of effective waste outlet plugs * effective operation of appliance traps/ self-sealing valves * performance checks * appliance support. * Learners to be given the opportunity to carry out routine maintenance procedures. * Learners to know the routine checks required to confirm the effective operation of the components identified including: * WC macerators * wastewater lifters * sink waste disposal units * air admittance valves. |
| * 1. The types of information to be provided on a maintenance record for sanitary appliances and pipework systems | * Learners to be aware of the range of information that would be detailed on maintenance records such as: * test pressures * durations * test dates * replacement parts * condition reports. * Learners to be provided with examples of maintenance records for them to complete. |
| 1. Understand the methods and techniques for replacing/repairing the appliances, components and accessories in accordance with:  * the plumbing and heating system’s design * the working environment * manufacturers’ instructions | | * Learners to understand the methods and techniques for replacing/repairing sanitary appliances, pipework systems and components. * Learners to be given the opportunity to replace/replace sanitary appliances, pipework systems and components. |
| 1. Understand basic fault-finding techniques | * 1. The repair and rectification procedures to deal with a range of faults | * Learners to know the fault diagnosis and rectification procedure, including: * diagnose * notify client * decommission * rectify * re-commission * handover. * Learners to know the types of instruments and measuring devices used in fault diagnosis techniques, the method of checking system components for correct operation and the methods of repairing faults in sanitation system components. |
| * 1. The methods of obtaining information on system faults | * Learners to be aware of how information on system faults can be obtained in the following ways: * the customer (end-user) – they will be able to give you an overview of the fault, what is happening, when it happens * carrying out a visual inspection to identify faults on the system * service history – information relating to the system/component faults may be detailed on a maintenance record with remedial actions to be completed * manufacturer instructions contain a maintenance section which will detail common system/component faults. Included in this section may be a flow chart detailing symptoms and checks/repairs * manufacturer technical instructions will detail replacement part numbers. * Learners to be familiar with system faults and to be able to rectify: * leaks * blockages * inadequate or broken support * trap seal loss * debris * expansion and contraction * cistern fault * appliance faults * WC macerators faults * wastewater lifters and sink waste disposal unit faults * air admittance valves * pipework faults * condensing boiler condensate faults. |