Unit 321HV: Understand the techniques for decommissioning, testing, flushing and charging of industrial and commercial pipework systems

# Delivery guide

Unit information

This unit covers the knowledge and understanding of the procedures used to make a system and its components safe through decommissioning. It will cover the procedures for flushing the system, for testing its integrity and for charging and filling with water. Learners are not expected to be able to commission a system at this stage but will know the procedures for filling and venting a system. The procedures for testing using gas or a liquid will be covered, as will the types of additives that should be included to each specific system.

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

* What is the sequence of activities required to install typical heating and ventilation systems?
* What are the safe procedures for testing, commissioning and decommissioning heating and ventilation systems?

Learning outcomes

1. Understand the decommissioning of heating and ventilation equipment
2. Understand the appropriate testing procedures for confirming the system’s integrity
3. Understand the methods and techniques for cleaning and flushing the system
4. Understand the charging of industrial and commercial pipework systems

Suggested resources

Textbooks

* BESA TR/20 (2003) *Technical Specification for Pipework Installation.* London: The Building Engineering Services Association.
* Bleicher, D. (2017) *BSRIA Illustrated Guide to Mechanical Building Services (BG/31/2017)*. Berkshire: BSRIA.

ISBN 978-0-8602-2758-8

* Brown, R. (2015) *BSRIA Heat Interface Units (BG 62/2015)*. Berkshire: BSRIA.

ISBN 978-0-8602-2747-2

* Chadderton, D. (2012) *Building Services Engineering*. London: Taylor & Francis.

ISBN 978-0-4156-9932-7

* HSE *Legionnaires’ disease. The control of legionella bacteria in water systems. Approved Code of Practice and Guidance 2013* (L8).

IBSN: 978-0-7176-6615-7

* Oughton, D., Hodkinson, S. and Brailsford, R. M. (2015) *Faber and Kell’s Heating and Air-Conditioning of Buildings.* London: Routledge.

ISBN 987-0-4155-2265-6

* Ronceray, M. and Parsloe, C. (2021) *Pre-Commission Cleaning of Pipework Systems*. Berkshire: BSRIA.

ISBN 978-0-8602-2784-7

* Young, L. and Graham, M. (2000) *Water Regulations Guide*. *Water Regulations Advisory Scheme*. Stockport: WRAS.

ISBN: 978-0-9539-7080-3

Websites

* [Fernox | Homepage](http://www.fernox.com/)
* [Sentinel Protects | Homepage](http://www.sentinelprotects.co.uk/)
* [VEXO | Homepage](http://www.vexoint.com/)

Legislation

* *Building Regulations 2010 Approved Document L2A: Conservation of fuel and power in new buildings other than dwellings. 2013 edition with 2016 amendments.* Newcastle upon Tyne: NBS.

ISBN 978-1-8594-6745-9

| **Learning outcomes** | **Criteria** | **Delivery guidance** |
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| 1. Understand the decommissioning of heating and ventilation equipment | * 1. The purpose and types of decommissioning within the installation project | * Learners to know the range of decommissioning within a project such as: * permanent * temporary * sectional and zoned isolation. * Learners to be able to describe the difference between these types and to be able to give examples of each. * Learners to know the stages of an installation project and using role play/given scenarios and to be able to identify when decommissioning may take place within that project. * Learners to be able to explain the purpose of decommissioning from a safety aspect and to be able to list the types of systems for which decommissioning may be necessary within a Building Services Engineering (BSE) project. |
| * 1. Ensuring the system is safe and ready to be decommissioned | * Learners to know and describe the impacts of decommissioning. * Learners to know the risk of removing water from an active system, which may lead to damage. * Learners to be able to suggest checks which may need to be carried out before decommissioning is carried out. * Learners to know the impact of decommissioning high pressure systems incorrectly and the potential for steam explosions if incorrect valves and controls are operated. * Learners to be able to explain the purpose of method statements and risk assessments along with pre-decommissioning checklists for systems including: * cold water supplies * cold water systems * hot water systems * hydronic heating systems * chilled water systems * steam and high temperature systems. |
| * 1. Ensuring the components are safe and ready to be decommissioned | * Learners to describe/explain the impact of system and component decommissioning on the building and its occupants. * Learners to know that the decommissioning of heating systems and components within high need establishments, such as hospitals needs to be considered and potential temporary supplies established beforehand. * Learners to be able to demonstrate how to check that components have been safely isolated before they are removed such as: * pumps * pressurisation units * boilers * vessels * heat exchangers * terminal units * motorised valves * safety devices. * Learners to be able to safely isolate, shut down and drain pipework systems including the safe and proper disposal of the system contents. |
| * 1. The procedures for safe decommissioning of pipework systems and components | * Learners to be familiar with a range of decommissioning method statements. * Learners to be shown presentations and videos to explain the procedure for the double block and bleed process on steam and High Pressure Hot Water (HPHW) including: * identifying valves * labelling * preventing vacuums * locking off * double block and bleed * isolation procedure * method statement * risk assessments * permits to work * draining at low level. * Learners to be shown how draining of systems is carried out after isolation using live systems where practicable to demonstrate which valves need to be used and how to remove water at low level. * Learners to know how to prevent air locks and vacuums in a range of systems including: * cold water supplies * cold water systems * hot water systems * hydronic heating systems * chilled water systems * steam and high temperature systems. * Learners to know how to produce basic method statements based on the safe decommissioning and draining of systems and to role play scenarios in small groups. * Learners to know how to carry out simple decommissioning within practical environments within the centre. |
| * 1. The procedures to follow when shutting off devices and components used to decommission and empty the system malfunction | * Learners to know the potential for devices and component failure during decommissioning. * Learners to know examples of what can happen when valves fail, which are essential to draining or isolating. * Learners to be familiar with examples of alternative actions such as full drain downs and to know about the use of freezing kits to rectify the issue and carry out the planned work. |
| * 1. Handling and disposing of system water | * Learners to know how to distribute Control of Substances Hazardous to Health (COSHH) safety sheets for chemicals such as: * inhibitor * glycol * chlorine. * Learners to know how these chemicals may need to be disposed of during decommissioning and the methods required to reclaim the system water safely. * Learners to be shown personal protective equipment (PPE) and know how to obtain potential authorisation from the Local Authority. |
| * 1. The electrical safe isolation procedure relevant to industrial and commercial building engineering systems | * Learners to be shown presentations and practical demonstrations to explain the step-by-step process for safe electrical isolation of single and three-phase electrical supplies. * Learners to be shown the correct equipment and how to use HSG38: Lighting at work approved voltage indicators and proving units. * Learners to understand the need for safe isolation and understand the consequences of not following the procedure given in Electrical Safety First’s Best Practice Guide No.2 for safe isolation or using equipment non-compliant with HGS38. * Learners to be able to give examples of the types of components that may need to be electrically isolated to allow for mechanical disconnection such as: * single-phase isolation * three-phase isolation * pumps * actuators * boilers * pressurisation units. * Learners to be able to produce bullet point explanations of the process and to be able to carry out the procedure under competent supervision. |
| 1. Understand the appropriate testing procedures for confirming the system’s integrity | * 1. Confirming that pipework systems are ready to receive soundness tests | * Learners to be able to offer examples of visual checks on systems, which should be conducted before testing of systems including: * hot * cold * heating * chilled. * Learners to examine method statements from site and to be able to identify the steps to be taken before systems are pressurised, such as permit to work systems required for pneumatic testing and ensuring that components, which could be damaged by testing, are removed or isolated. * Learners to be given set tasks to check installed systems within the centre are ready to be tested. |
| * 1. Soundness testing procedures | * Learners to be shown presentations and practical demonstrations to explain the process of soundness testing a range of systems and pipework materials. * Learners to know both hydraulic and pneumatic test procedures including duration, pressure and the need for client witness and certification. * Learners to know the differences between the two, including the potential energy within pneumatic testing. * Learners to be given the opportunity to carry out the process in small teams within the centre under supervision. |
| * 1. Equipment and plant for soundness testing | * Learners to be shown the equipment required to carry out soundness testing. * Learners to examine the equipment and to be able to explain how each piece should be connected to the system and how they are operated. * Learners to be able to give examples of when stool pieces may be required. * Learners to know the types and operating procedures of: * types of test pumps * electrical * manual * gauges * stool pieces * safety barriers * signage. |
| * 1. Quality assurance procedures to ensure that the test is successful | * Learners to know the purpose of the quality assurance process. * Learners to use role play scenarios to explain the roles of all parties within the testing process, including the client, the operative, witness, clerk of works etc. * Learners to be able to explain the certification and handover processes. * Learners to be shown examples of test certificates and allowed to complete test certificates after a testing process within the centre. |
| * 1. Actions that must be taken when inspection and testing reveal defects in pipework systems | * Learners to be able to generate potential faults and failures that may be revealed during testing. * Learners to be able to give examples from experience where defects have been found and how they can damage building fabric. * Learners to be able to create step-by-step action plans or method statements that could be followed in the event of a leak or defect. * Learners to know the actions to take when testing reveals defects in systems and components, to be aware of the specific items that may not withstand test pressures and the actions to take to ensure they are not damaged by testing. |
| 1. Understand the methods and techniques for cleaning and flushing the system | * 1. The purpose and advantages for flushing and cleaning the system | * Learners to know the purpose of flushing and cleaning system pipework. * Learners to know about the purpose of individual chemical cleaning agents from chemical treatment specialists and manufacturers where possible. * Learners to know how to use manufacturers’ literature to discuss the types of chemicals available and the advantages these have within system pipework. * Learners to know which systems need flushing and the purpose of each procedure. |
| * 1. The equipment for flushing pipework systems | * Learners to be able to demonstrate power flushing technology or show videos of the equipment in use. * Learners to be shown demonstrations of the following and to use manufacturers’ literature to understand: * power flushing equipment * hoses * chemical additives. * Learners to be able demonstrate how flushing equipment is connected to a real system. |
| * 1. The procedures for flushing and cleaning the system | * Learners to be able to demonstrate the procedure for power flushing with flushing equipment connected within a real system. * Learners to be able to demonstrate this procedure using heating or chilled water pipework. * Learners to know the process for chemical disinfecting of potable water systems. * Learners to be shown how systems are flushed through and tested for PH levels using chlorination kits and how to use neutralising agents. * Learners to know how to examine the COSHH certificates for chemical cleaning agents and discuss the disposal of this. * Learners to be able to produce step-by-step method statements describing the procedures. |
| 1. Understand the charging of industrial and commercial pipework systems | * 1. The differences in charging procedures between sealed and open systems | * Learners to be shown presentations and system diagrams to explain how differing systems are charged. * Learners to know the purpose of quick-fill loops and the use of clean potable water when charging chilled water or heating systems. * Learners to be aware that pressurisation units are not for filling systems, but are instead used for maintaining pressure and that filling loops should be left disconnected unless Reduced Pressure Zone (RPZ) valves are in place. |
| * 1. The pre-fill checks to be carried out before charging the systems | * Learners to know what should be checked before putting water into the system. * Learners to be able to use pre-commissioning checklist sheets and conduct a visual inspection on systems within the centre to identify: * check for open ends * valve positions * components that may be need specific fill procedures * visual inspection * customer liaison. |
| * 1. Identifying supply sources and relevant valves before charging commences | * Learners to be able use system drawings to explain where individual isolation points may be relative to a range of systems. * Learners to be set tasks to identify valves on drawings or in physical systems that would need to be isolated or opened before filling and charging. * Learners to be able to explain the different valve operation relative to sealed and open vented systems, cold water systems and hot water systems using drawings, presentations and physical systems. |
| * 1. The filling and charging procedures for pipework systems | * Learners to be shown a practical demonstration of the physical charging procedures for a range of system types. * Learners to be able to follow set tasks to produce simple method statements for system charging. |
| * 1. The methods of air removal from charged systems | * Learners to understand what an air lock is and what problems it can create within a system. * Learners to be able to explain how air locks affect different system types in different ways and where they may form within a system. * Learners to be able to identify system pipework arrangements, which would create issues with trapped air. * Learners to be shown the venting procedures for Low Temperature Hot Water (LTHW) systems and to be able to identify where automatic air vents may be required in examples of systems. |
| * 1. The types and properties of chemicals for use within pipework systems | * Learners to be able to use manufacturers’ literature to discuss the properties of a range of chemicals for use within the system. * Learners to have this explained by chemical treatment specialists and manufacturers where possible. * Learners to be able to explain the properties, differences and uses of: * glycol * inhibitor * chlorine solutions * cleaners. |
| * 1. The methods for chemical treatment of pipework systems including the handling and disposal of water and chemicals for treatment of pipework systems | * Learners to be able demonstrate the use of chemical dosing pots, to know how to add chemicals within a dosing pot and to know which valves to operate throughout the process. * Learners to be informed about individual technologies by manufacturers where possible. * Learners to examine COSHH data sheets for a range of chemicals and to be able to create basic method statements in small groups to cover the disposal of chemicals. |