Unit 317E: Inspect, test and commission electrical systems and equipment

# Delivery guide

Unit information

This unit covers the understanding and performance requirements for the commissioning of electrical systems and equipment. Learners must be able to comply with the processes and procedures for the commissioning and handing over of an electrical system and equipment 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 must work safely in accordance with the Health and Safety at Work etc. Act and the Electricity at Work Regulations.

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

* What are the safe working procedures to be followed when inspecting and testing?
* What inspections are carried out?
* What is the sequence of tests to be undertaken?
* What documentation is required?

Guidance: Within this unit, learners will follow the requirements of BS 7671, and *IET Guidance Note 3* and will be able to carry out the inspection, testing and commissioning. Learners will be able to complete relevant documentation (e.g. an Electrical Installation Certificate and relating schedules, up to a 100 A supply).

This unit builds upon learners’ knowledge of the fundamental inspections and de-energised testing methods and requirements for single-phase circuits.

This Delivery guide only covers the knowledge and understanding elements within this unit, not the performance criteria which are specific to each learner’s workplace.

Learning outcomes

1. Understand the requirements for inspection and testing
2. Understand the methods and procedures for conducting an inspection of electrical installations prior to their being placed into service
3. Understand the methods and processes to carry out correctly the tests that ensure safe and efficient operation of the electrical system
4. Understand the requirements for the completion of electrical installation certificates, associated documentation and handover

Suggested resources

Textbooks

* *BS 7671 Requirements for Electrical Installations*, 18th edition. London: Institute of Engineering and Technology.

ISBN 978-1-7856-1170-4

* *IET Guidance Note 3 Inspection and Testing*. London: Institution of Engineering and Technology.

ISBN 978-1-7856-1452-1

* *IET On-Site Guide (BS 7671:2018) (Electrical Regulations)*, 7th edition. London: Institution of Engineering and Technology.

ISBN 978-1-7856-1442-2

* Tanner, P. (2018) *The City & Guilds Textbook: Book 2 Electrical Installations for the Level 3 Apprenticeship (5357), Level 3 Advanced Technical Diploma (8202) & Level 3 Diploma (2365).* London: Hodder Education.

ISBN 978-1-5104-3225-3

Websites

* [Electrical Apprentice | Home](https://www.electricalapprentice.co.uk/)
* [GOV.UK | The Electricity at Work Regulations 1989](https://www.legislation.gov.uk/uksi/1989/635/contents/made)
* [SmartScreen | Homepage](https://www.smartscreen.co.uk/)
* [YouTube | Chris Kitcher](https://www.youtube.com/user/chriskitcher)
* [YouTube | GSH Electrical](https://www.youtube.com/channel/UCgtbE9w_d-u2AvPp3WBlPfQ)

British Standards

* BS 7671:2018+A1:2020. *Requirements for Electrical Installations. IET Writing Regulations*.
* BS EN 61010-1:2010+A1:2019. *Safety requirements for electrical equipment for measurement, control and laboratory use. General requirements*.
* BS EN 61557-2:2007. *Electrical safety in low-voltage distribution systems up to 1000 V a.c. and 1500 V d.c. Equipment for testing, measuring or monitoring of protective measures. Insulin resistance.*

Legislation

* [GOV.UK | The Electricity at Work Regulations 1989](https://www.legislation.gov.uk/uksi/1989/635/contents/made)

| **Learning outcomes** | **Criteria** | **Delivery guidance** |
| --- | --- | --- |
| 1. Understand the requirements for inspection and testing | * 1. The requirements of the Electricity at Work Regulations for the safe inspection of electrical systems and equipment | * Learners to refer to the Electricity at Work Regulations (EAWR) 1989 with respect to the safe inspection of electrical systems. * Learners to understand that the main purpose of EAWR is to: * prevent danger (risk of injury) * prevent injury (where danger exists) * not to give rise to danger. * Learners to understand the term ‘absolute’. * Learners to understand the terminology ‘reasonably practicable’. * Learners to understand that the regulations apply to both employer and employee. |
| * 1. The health and safety requirements which apply when inspecting, testing and commissioning electrical installations and circuits | * Learners to understand the term ‘duty holder’ and the responsibilities of such a position. * Learners to be familiar with EAWR, particularly Regulations 4 and 13–16 which have particular implications for inspecting, testing and commissioning of electrical installations and circuits. |
| * 1. The safe isolation procedure | * Learners to know the equipment required to conduct a safe isolation of an electrical system or circuit. * Learners to understand that a risk assessment should be made before a safe isolation procedure is carried out. * Learners to understand the steps to be followed to conduct a safe isolation on an electrical system or circuit. * Learners to be shown the procedure being carried out either on a live rig (demonstration only) or from a video of the procedure. * Learners to undertake the procedure in controlled conditions so that they become familiar with it and to know how items such as miniature circuit breaker (MCB) locks are fitted. |
| * 1. The industry practices and organisational procedures to ensure the coordination of site services and the activities of others who may be affected by the inspection and testing | * Learners to understand that a coordination of site services is essential when conducting inspections and testing. * Learners to understand the implications on the activity of others whilst inspection and testing activities are carried out, such as: * colleagues * other trades personnel * members of the public * lift services becoming inoperative * lighting services becoming inoperative * sudden power removal for a building * computing systems without UPS. * Learners to be given a scenario of the trades needed to complete a construction project (electricians, plasterers, carpenters, floor fitters, plumbers etc.) and to discuss the order that tasks must be completed in as the project progresses to ensure a timely and efficient completion, and how each trade is affected by others. |
| * 1. The purpose and requirements of the initial verification of electrical installations | * Learners to understand that initial verification relates to new installations or circuits only. * Learners to understand the purpose and requirements of initial verification, as described in Tanner, *Book 2*, Ch 6 and the *IET Guidance Note 3*, Ch 2. |
| * 1. The relevant documents associated with the inspection, testing and commissioning of an electrical installation | * Learners to refer to BS 7671:2018:2018+A1:2020. * Learners to understand the documentation relevant to inspection, testing and commissioning of an electrical installation: * Electrical Installation Certificate * Schedule of Inspections * Schedule of Test Results * Minor Electrical Installation Works Certificate. * Learners to know that model forms are shown in BS 7671:2018+A1:2020, the *IET On-Site Guide*, *IET Guidance Note 3* and Tanner, *Book 2*. |
| * 1. The information that is required by the inspector to conduct the initial verification of an electrical installation | * Learners to understand that required information should be available to the inspector before carrying out an initial verification. * Learners to understand that the information required prior to initial verification is made up of: * assessment of general characteristics * diagrams, charts and tables. * Learners to be aware that, for new work which has never been energised, certain information must be made available to the inspector before commencing the inspection. * Learners to know that the Electricity Safety, Quality and Continuity Regulations (ESQCR) state that the electrical supplier or distribution network operator (DNO) must make the required information available to those that need it. There are examples of these obligations in *IET Guidance Note 3*, Section 2. * Learners to discuss the potential consequences of not obtaining this information prior to initial verification. |
| 1. Understand the methods and procedures for conducting an inspection of electrical installations prior to their being placed into service | * 1. The appropriate items to be checked during the inspection process | * Learners to refer to BS 7671:2018+A1:2020. * Learners to interpret and apply information given in the *IET Guidance Note 3*, Section 2.5.3, as an inspection checklist for initial verification or to interpret and apply information given in BS 7671:2018+A1:2020, Appendix 6, as examples of items requiring inspection during initial verification. * Learners to be familiar with the inspection list given in the *IET On-Site Guide*, Ch 9. |
| * 1. The application of the human senses for initial verification | * Learners to understand that the human senses of sight, hearing, smell and touch can be used as an aid during initial verification. * Learners to identify where the human senses can best be used to aid initial verification. * Learners to learn to use their human senses on an isolated system from an electrical circuit constructed in a practical workshop session, including: * sight for incorrect installation or wiring * touch for identifying loose connections. |
| * 1. The requirements for the inspection of electrical installations | * Learners to understand that, during initial verification, inspection precedes testing. * Learners to understand that, during initial verification, inspection is carried out during and on completion of the electrical installation. * Learners to understand that, during initial verification, percentage sampling of circuits is not allowed. * Learners to understand that, during initial verification, any non- compliances must be corrected before any documentation can be issued. |
| * 1. The requirements for the inspection, to include: * special installations and locations as identified in Part 7 of BS 7671 * IP classification of equipment | * Learners to understand that special locations are defined in BS 7671:2018+A1:2020, Part 7. * Learners to understand that the requirements for inspection extend to special locations. * Learners to understand that the requirements for barriers and enclosures in special locations must meet the IP classification requirement as determined in BS 7671:2018+A1:2020, Part 7. |
| 1. Understand the methods and processes to carry out correctly the tests that ensure safe and efficient operation of the electrical system | * 1. The tests to be carried out on an electrical installation in accordance with the BS 7671 and *IET Guidance Note 3* | * Learners to refer to BS 7671:2018+A1:2020. * Learners to understand the tests to be carried out on electrical installations, such as: * earth electrodes * earth fault loop impedance (Ze and Zs) * prospective fault current (PFC) * phase sequence * functional testing including residual current device (RCD) tests for faults and additional protection. * Learners to carry out the industry-recognised dead tests on electrical circuits. These are listed and explained in *IET Guidance Note 3* and include: * continuity of protective conductors including main and supplementary bonding * continuity of ring final circuits * insulation resistance including electrically separated circuits * dead polarity. * Learners to understand verification of volt drop (rarely undertaken in initial verification). * Learners to be familiar with the complete list of tests which could be carried out, as detailed in *IET Guidance Note 3*, Ch 2, which includes specialist tests not usually carried out for general electrical installations. |
| * 1. The appropriate instrument for each test to be carried out in terms of whether the instrument is fit for purpose and identifying the correct scale or setting | * Learners to understand appropriate test instruments and their scales when used on electrical installations. * Learners to know that instruments are deemed fit for purpose if they meet the requirements of BS EN 61010-1:2010+A1:2019 and refer to BS EN 61557-2:2007 and BS EN 61557-6:2007. * Learners to understand that a low-resistance ohmmeter covering the span of 0.2 ohms and 2 ohms and a resolution of 0.1 ohms is suitable for all continuity tests and polarity tests and has an output of 2–24vdc at 200mA. * Learners to understand that an insulation resistance tester capable of delivering 250V, 500V and 1000V DC with a reading range of 0.00 Meg ohms to 200 Meg ohms or higher should have a maximum output of 1mA. * Learners to understand that a dedicated earth electrode tester used with temporary spikes is a resistance meter capable of measuring up to 2 kilo ohms. * Learners to understand that an earth fault loop impedance meter with a scale of 0–20 ohms for TN systems is suitable for circuits up to 50A, and up to 2000 ohms if used for TT systems. * Learners to understand that most earth fault loop impedance meters can also be used for prospective fault current tests, with a reading in amperes. * Learners to understand that an RCD tester is switchable between 0.5, 1 and 5 x rated residual current and capable of measuring tripping times. * Learners to know that newer versions can test different types of RCD (AC and DC). * Learners to understand that all the instruments mentioned can be incorporated into a single multi-function instrument. |
| * 1. The requirements for the safe use of instruments to be used for testing and commissioning | * Learners to understand that a basic safety inspection of instruments is conducted before and after each use. * Learners to understand that a basic safety check includes ensuring: * there is no damage to the outer case to cause danger * that the instrument has no signs of overheating * probes and leads are not damaged nor have copper showing and conform to HSE Guidance GS 38 * the exposed probe tips are not longer than 4mm (and 2mm is preferred) * batteries are not drained of energy * the safety strap is secure. * Learners to understand that training and familiarisation with instruments is essential for safety. |
| * 1. The necessity for test results to comply with standard values and the actions to be taken in the event of unsatisfactory results being obtained | * Learners to refer to BS 7671:2018+A1:2020. * Learners to understand that the results of tests taken must be verified against standard values for compliance and safety. * Learners to understand that any test results that do not comply with standard values during an initial verification must be corrected before certification can be issued. * Learners to understand that after a non-compliance is corrected, other tests which were completed but are affected must be re-tested, as well as the original non-compliant test. |
| * 1. The reason why testing is carried out in the sequence specified in BS 7671 and *IET Guidance Note 3* | * Learners to refer to BS 7671:2018+A1:2020. * Learners to understand the reasons why tests are carried out in a set sequence as specified in *IET Guidance Note 3* and BS 7671:2018+A1:2020, as follows: * the safety of the inspector (non-energised tests first) * the result of one test may rely on the satisfactory completion of a previous test. |
| * 1. The requirements for testing before circuits are energised | * Learners to understand the requirements for testing before circuits are energised, as defined in *IET Guidance Note 3*, Ch 2. * Learners to understand the reason for carrying out dead tests. * Learners to understand how the dead tests are carried out. * Learners to understand how to interpret the results of the dead tests. |
| * 1. The requirements for testing energised installations | * Learners to understand the requirements for testing energised circuits as defined in *IET Guidance Note 3*, Ch 2. * Learners to understand the reason for carrying out the energised tests. * Learners to understand how the energised tests are carried out. * Learners to understand how to interpret the results of the tests. |
| 1. Understand the requirements for the completion of electrical installation certificates, associated documentation and handover | * 1. The procedures for: * completion of the relevant documentation * recording relevant data and information * informing relevant people * addressing issues and problems identified * ensuring information is passed to the relevant people | * Learners to refer to BS 7671:2018+A1:2020. * Learners to understand the form-filling requirements of carrying out inspection and testing of an electrical installation and to follow the guidance given in BS 7671:2018+A1:2020, Appendix 6 and *IET Guidance Note 3*, Ch 5. * Learners to understand the signatories required on all the forms. * Learners to understand that relevant data must be recorded on the forms. * Learners to understand the importance of ensuring the safety of others during the work activities. * Learners to understand that if problems are identified and issues addressed, then relevant people must be informed so that information is passed on. |
| * 1. How to ensure that the electrical system and equipment is ready for handover to the customer/client | * Learners to refer to BS 7671:2018+A1:2020. * Learners to understand the commissioning procedure prior to the handover of the electrical installation to the customer/client. * Learners to understand that a Guidance to Recipients document is appended to the certification, as described in BS 7671:2018+A1:2020, Appendix 6. * Learners to know who receives the original documentation and who receives copies. * Learners to understand that manufacturers’ literature is to be handed to the customer/client as part of the documentation of the electrical installation. |
| * 1. The organisational procedures for: * notifying relevant people of any variations * obtaining customer/client acceptance of the electrical system and equipment * the completion of all relevant documentation * recording of information and/or data in the appropriate information systems | * Learners to understand the organisational procedures should any variation to the original works be necessary. * Learners to understand that any variations must be agreed with the customer/client, preferably in writing. * Learners to understand the need to verify that all documentation has been completed and recorded in the appropriate information systems. |