



Candidate Handbook answers

Progress check 8.1, p. 397

1. What do the Electricity at Work Regulations say about the live parts of an electrical system?
Live conductors and live parts to be insulated
2. Which part of the Building Regulations deals with the electrical installation in a domestic property?
Part P
3. Which set of guidelines could be described as the electrician's handbook?
IET On-Site Guide

Working practice 8.1, pp. 399–400

A periodic inspection was arranged for one of the office areas in a large UK research laboratory. The inspection was planned for the following weekend. A memo was sent out by email from the department manager to her staff to inform them that there would be a power shutdown for four hours on that date.

One member of her staff, however, an engineer named Dave, was off sick. When he came back to work he was inundated with emails and only read those he thought relevant to his job. Because of this, he did not read the shutdown memo. Neither did he read the shutdown notice that was pinned to the office notice board. Dave was very good at his job, but *his* job was his main focus and he paid little attention to the other activities going on in the department.

Inspection day arrived and the electrician, Nathan, went straight to the service cupboard, unlocked the door, located the relevant distribution board, and, using the board's circuit schedule, found the 100 A fuse that protected the sub-main supply to the office area. He pulled it out and laid it on top of the distribution board, then went into the office area to start the inspection. His first job was to remove the front cover of the office distribution board to confirm cable identification and connections.

Meanwhile Dave, who had come in to the office to catch up, was outraged to see his desktop computer suddenly shut down and most of the morning's work vanish. He was on his feet in a moment, angry and determined to rectify the problem. Thinking of himself as something of an electrician he went off to find out what was happening. On his way out, he saw that the service cupboard door was open. When he went inside he noticed the exposed distribution board and the fuse. He opened the board, retrieved the fuse and pushed it back into its carrier.

Fortunately Nathan noticed the office lights flicker back into life and jumped back from the distribution board he was working on without receiving a shock. But how could the near-accident have been avoided?

List the precautions that should have been put into place to prevent this type of scenario occurring.

The office...

- **More than one memo should have been sent out, on paper as well as by email, because Dave was inundated with emails and only read those he felt to be urgent or important.**
- **Get the staff together to remind them about, and plan for, the shutdown.**

- Inform Dave personally about the shutdown when he returned to work – especially knowing how impatient and oblivious to anything outside his own work he was.

The electrician...

- Visit the office on the day before inspection to make sure it is OK to shut down the power. Talk to everyone if possible and certainly meet with the client.
- Use the safe isolation procedure – place notices on the board, erect barriers – to make people like Dave think twice before attempting to restore power.
- Take the fuse away from its distribution board so that it cannot be replaced.
- Lock the service cupboard door.

Progress check 8.2, p. 400

1. Apart from shock, what is another risk for an electrician working on a live circuit?
Burns from the flash of a short circuit
2. Why is a photovoltaic supply a hazard for an electrician carrying out an inspection and test?
It produces electricity whenever there is light.
3. What are safe systems of work for inspection and testing?
Risk assessment and permit to work

Progress check 8.3, p. 402

1. Give two inspections that can be carried out using touch.
Choose from tug-test to check security of terminations, security of fixings and fittings; tracing individual cables; soundness of fixings, lids and covers; using hands to see if anything feels hot or if there is excessive vibration
2. Give two inspection checks that can be carried out using the sense of hearing.
Listening for chattering, vibration or crackling sounds; listening to the customer or electrician who installed the system
3. Why would an inspector not complete all the inspections listed on the Schedule of Inspections?
Some of the inspections may not be relevant to the particular installation to be inspected.

Progress check 8.4, p. 405

1. Why test for continuity of protective conductor?
To confirm that the protective conductor for each circuit is not broken and provides a low resistance path for an earth fault to flow down
2. Why carry out an insulation resistance test?
To check for damaged insulation and the possibility of short circuits
3. Why test for polarity?
To make sure that all single-pole switches and protective devices are in the line conductor and that all connections are the right way round, i.e. line to the L terminal, neutral to the N terminal and earth to the E terminal

Progress check 8.5, p. 408

1. What can limit the extent of testing you can carry out in premises?
The presence of sensitive equipment, hazardous areas, equipment that cannot be shut down
2. What are the first three tests to be carried out?
 - **Continuity of protective conductors, main and supplementary bonding conductors**
 - **Continuity of ring final circuits**
 - **Insulation resistance**
3. List three ways in which electrical wiring or equipment can pose a fire risk.
 - **High resistance and arcing due to loose connections**
 - **Overloaded cables**
 - **Incorrectly placed hot-running equipment**

Progress check 8.6, p. 409

1. Which test instrument is used to confirm continuity of a conductor?
Low reading ohmmeter
2. Which test instrument is used to confirm the soundness of cable insulation?
Insulation resistance tester
3. Which test instrument measures the impedance of the fault path from point of fault to star-point, then back to the point of fault?
Earth fault loop impedance tester

Progress check 8.7, p. 413

1. On an Electrical Installation Test Certificate, what is meant by 'supply characteristics'?
The details of the installation supply are split into the following five headings.
 - **Earthing arrangements**
 - **Number and type of live conductors**
 - **Nature of supply parameters, e.g. supply voltage and frequency**
 - **Supply protective device characteristics**
 - **Other sources of supply, e.g. PV or generator**
2. What is maximum demand?
It is the calculated demand for the installation. Diversity must be taken into account when calculating maximum demand.
3. What is an Electrical Installation Condition Report?
It is the report derived from a periodic inspection and test.

Progress check 8.8, p. 414

1. What does GN3 mean by a design 'specification'?
Prepared before the installation work starts, it contains detailed design and other related information.

2. What are Form 1 and Form 2 Electrical Installation Certificates?

Form 1 – a single-signature form used for a smaller installation which was designed, installed and tested by the same person.

Form 2 – a multi-signature form for larger works where the roles were carried out by different people

3. A standard inspection schedule for a periodic test can be used for an installation with a current demand of up to how many amps?

100 A

Activity 8.1, p. 417

In the course of making additions to an existing light circuit, an electrician opened up a two-way switch at the bottom of a staircase. The lighting was wired using the loop-in method. The cable that runs between the two switches in this type of system is normally a three-core and earth (see Chapter 3), which gives the facility for two strappers and a common, needed to make the arrangement work. In this case a twin-and-earth had been run between the switches: brown as common, blue as one strapper, the CPC – identified and insulated using brown sleeving – as the other. Why is this wrong?

The CPC should never be used as a conductor because:

- **it is not insulated**
- **in some twin-and-earth cables it has a smaller cross-sectional area than the live conductors so it will not carry as much current**
- **there is no earth to the second switch.**

Progress check 8.9, p. 421

1. List two things that should be inspected for routing of cables.

Choose from presence of water or high humidity, presence of foreign bodies such as dust, presence of corrosive substances, vibration

2. Which conductor should single-pole devices be connected to?

Line only

3. What is AB6 the code for?

Equipment that will withstand extremes of temperature

Activity 8.2, p. 428

1. While carrying out a $r_1 + r_n$ test on a ring final circuit, an electrician notices that the reading at one 13 A socket is much higher than the others. What could cause this?

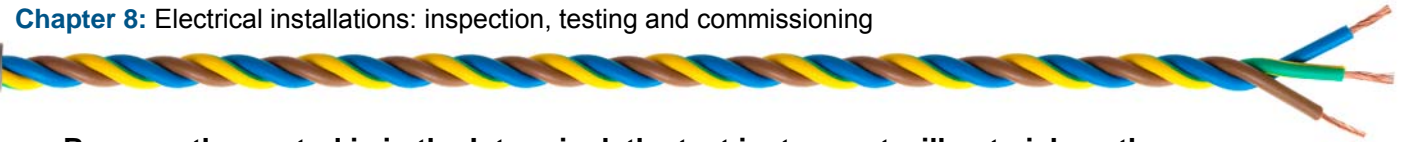
- **The 13 A socket might be spurred off the ring.**
- **Either the line or the neutral connection to the 13 A socket is poor.**

2. The $r_1 + r_n$ test on another socket in this ring is fine. However, the resistance reading for the $r_1 + r_2$ test is so high it is off the scale. What is the probable cause for this?

The line and neutral are in the wrong terminal, i.e. line is in the neutral terminal and neutral is in the line terminal.

The first test would show a good reading because it is taken between line and neutral and would only show their connection to the L and N terminals. It does not prove their polarity.

The second test is taken between the line terminal and the CPC terminal.



Because the neutral is in the L terminal, the test instrument will not pick up the short circuit between line and CPC made by the cross-connect at the supply end.

Activity 8.3, p. 431

BS 7671:2008 states in Table 41.2 that the maximum earth fault loop impedance (Z_s) for a 16 A Type B circuit breaker to BS EN 61009-1 is 2.87Ω . However, if the earth fault loop impedance test returns a reading of 8.3Ω , what action should be taken? Note: the Z_e is within acceptable limits.

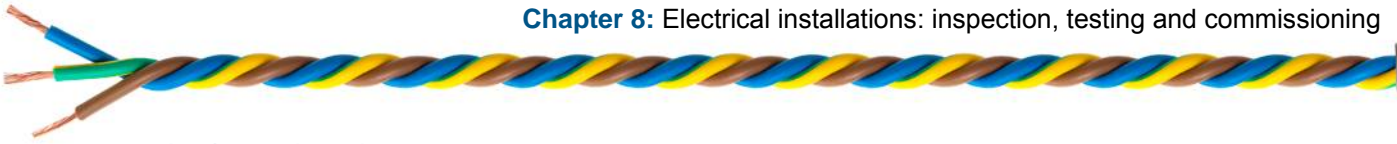
1. **Repeat continuity test for the CPC.**
2. **If the continuity is acceptable, then replace the CPC with a larger protective conductor and re-test earth fault loop impedance.**

Progress check 8.10, p. 433

1. What is the Method 1 continuity test usually used for?
Bonding conductors and for confirming continuity of trunking or conduit if it is used as the CPC
2. How do you carry out an insulation resistance test on a circuit feeding fluorescent luminaires?
Test line and neutral to earth only with line and neutral twisted together
3. What is Z_e ?
The part of the earth fault loop which is outside the consumer's installation

Progress check 8.11, p. 437

1. What are two extra tests that may have to be carried out when commissioning an item of electrical equipment?
Touch current and flash test
2. List three functionality checks carried out as part of commissioning equipment or a system.
Choose from the following.
 - **Switchgear**
 - **Controls**
 - **Stop buttons**
 - **Interlocks – e.g. panel doors cannot be opened until the power is switched off**
 - **No-volt cut out – built into motor controls so that if there is a power failure the motor will not restart until the start button is pressed**
 - **Correct sequence or start-up and operation**
 - **Programming works correctly**
 - **All warning lights, on/off lamps, etc. work correctly**
3. What type of documentation is required for commissioning electrical equipment and systems?
Checklists and schedules of settings



Knowledge check, p. 438

1. The M6 designation on a circuit breaker means that it:
b can withstand a fault current of 6 kA
2. If the Z_e of an installation is 4Ω and $R_1 + R_2$ is 0.6Ω , what is Z_s ?
b 4.6Ω
3. An end-to-continuity test is carried out on a ring final circuit wired in 2.5 mm twin-and-earth. r_1 and r_n are both 0.08Ω . What would you expect the r_2 resistance to be?
b 0.134Ω
4. If r_1 is 0.07Ω and r_n is 0.08Ω , the result of the $r_1 + r_n$ test should equal:
d 0.0375Ω
5. What is the test voltage and acceptable reading for an insulation resistance test on a SELV circuit?
b 250 V d.c., $0.5 M\Omega$
6. An E1-type earth electrode resistance test requires:
a a four-terminal earth electrode tester and two test stakes
7. When should verification take place for a new electrical installation?
c At all stages of the installation process
8. A Minor Works Certificate is needed for:
c a modification to an existing circuit
9. Which of the following would be carried out as part of an inspection?
c Check that fittings and accessories are securely fixed, check if circuits are live, check for presence of notices warning that pre-harmonisation colours are present in the installation
10. RCDs should be tested at:
b half x operating current, at operating current, 5 x operating current