

## City & Guilds 2365 Level 3 Diploma in Electrical Installation (2018)

### Unit 304 – Inspection and Testing: 614 Task B Written Paper

**Time allocated: 2 hours**

You **must** use a pen with black or blue ink to complete your answers.

Write your name and candidate details at the top of your answer sheet.

Any calculations or rough working can be done on your answer paper.

Use of a non-programmable scientific calculator is allowed.

Use of writing/drawing instruments is allowed.

Attempt all questions. If you find a question difficult, leave it and return to it later.

This is a **closed book** assessment.

There are 6 questions worth 90 marks (15 marks per question).

In terms of the expected level of detail: for **each single mark**, your answer should be **no longer than 1-2 lines**, and **may** be a single word or a very short statement. So a question worth **3 marks** might be **up to 3-6 lines**, but **may** be as short as 3 words or bullet points.

#### **SECTION A**

1. (a) State the purpose of initial verification. (4 marks)

To verify (1) that an installation is safe (1) and suitable (1) to be put into service (1). (Other similar wording acceptable.)

- (b) State what the inspection verifies during a periodic inspection. (4 marks)

Safety of persons and livestock against the effects of electric shock and burns (1).

Protection against damage to property by fire and heat arising from an installation defect (1).

Confirmation that the installation is not damaged or deteriorated so as to impair safety (1).

The identification of installation defects and departures from the requirements of these Regulations that may give rise to danger (1).

- (c) During initial verification, explain why it is necessary to carry out testing even though we have conducted a thorough inspection. (3 marks)

Testing is carried out to confirm (1) the observations made during the inspection process (1) and forms part of the initial verification process (1).

- (d) i) State what "IP" stands for, in the context of IP codes (1 mark)

Ingress protection (1).

- ii) State what the first number of an IP code relates to (1 mark)

Level of protection against objects (1).

iii) State what the second number of an IP code relates to (1 mark)

Level of protection against water (1).

iv) State what an “X” relates to in an IP code (1 mark)

This degree of protection is not a requirement (1).

2. A new galvanised steel conduit system has been installed on an external wall to supply some outside lights. It is to be inspected prior to cables being installed. Complete the table below, stating five items that should be checked before the cables are installed. (15 marks)

Answers may include the ones listed below; other suitable answers accepted but must be related to the conduit system. 1 mark for each correct item 15 marks in total.

Item number	Item is to be checked before cables are installed	What the item is being checked for	Human sense used
1	Conduit system	Fully completed	Sight
2	Conduit system	Complies with relevant British Standard (BS EN 61386-21)	Sight
3	Conduit system	Securely fixed	Touch
4	Conduit edges/joints	No sharp edges	Touch
5	Ends of conduit and scratches	Protected by galvanised paint	Sight

3. (a) i) Other than by measurement using “a dedicated stakeless or clamp-based earth electrode tester,” state **two** possible instruments that could be used to perform an earth electrode test. (2 marks)

Earth electrode resistance tester (1).

Earth fault loop impedance tester (1).

ii) For both the methods above, state what must be done in relation to the installation supply before the test is undertaken. (1 mark)

Isolated (1).

iii) State what must be done with the earthing conductor, with respect to the Main Earthing Terminal, during the test. (1 mark)

Disconnected (1).

(b) The earth electrode resistance is to be determined using the method using two temporary test spikes. The electrode under test is approximately 2.5m long. State the name of the two test spikes, and the approximate distance from the electrode under test for each of them. (4 marks)

Potential (or “P”) spike (1), 12.5m (1) from the earth electrode.

Current (or “C”) spike (1), 25m (1) from the earth electrode.

(c) State **three** reasons for carrying out a polarity test. (3 marks)

Every fuse, single pole control and protective device is connected in the line conductor only (1).

Except for E14 and E27 lampholders to BS EN 60238; in circuits having an earthed neutral conductor, centre

contact bayonet and Edison screw lampholders have the outer or screwed contacts connected to the neutral conductor (1).

Wiring has been correctly connected to socket outlets and similar accessories (1).

- (d) On an installation with no faults, state **two** causes of reduced insulation resistance. (2 marks)

Longer circuits (1) and more circuits in parallel (1).

- (e) State why tests are carried out in a specific sequence. (2 marks)

For reasons of safety (1).

Each tests rely of previous tests to give valid/accurate results (1).

## **SECTION B**

**Questions 4-6 all refer to the scenario below.**

A new workshop on a farm is being built. The electrical installation forms part of a 400/230V TT system. The main distribution board at the origin of the installation is in a separate dedicated outbuilding. The main protective devices are BS 88-3 rated at 100A per phase. The external impedance and Prospective Fault Current (I<sub>pf</sub>) were measured at 29.0Ω and 5.2kA respectively.

A new distribution circuit is to be added to the electrical installation to supply the new workshop and the associated single- and three-phase circuits. The distribution circuit terminates at a metal-clad TP+N distribution board within the workshop, and the distribution circuit is protected by a TP+N BS EN 61008 100mA S-type (time delayed) RCD. All single phase power and lighting circuits are protected by RCBOs to BS EN 61009, and all three phase circuits are protected by circuit breakers to BS EN 60898. All final circuits are radials, with the exception of socket circuits which are ring final circuits. All circuits are wired using copper single core 70°C insulated thermoplastic cables in surface mounted metal conduit and trunking.

All testing is to be carried out at an ambient temperature of 20°C.

4. (a) List all the tests to be completed on the new distribution circuit to the workshop, including the instrument used for each test. (12 marks)

Continuity of protective conductors (1): low resistance ohmmeter (1).

Insulation resistance (2): insulation resistance tester (1).

Polarity (1): low resistance ohmmeter (1).

Earth fault loop impedance (1): earth loop impedance tester (1).

RCD functionality (1): RCD tester (1).

Phase sequence (1): phase sequence tester (1).

- (b) State **three** checks that would be made on the instruments prior to carrying out the tests. (3 marks)

Any three from:

Check the instrument is not visibly damaged.

Check the status of the batteries.

Check the instrument is calibrated.

Check the leads are not damaged.

Check this instrument is functioning correctly.

5. (a) State the three parts of the BS7671 initial verification documentation that should be given to the client. (3 marks)

Electrical Installation Certificate (1).

Schedule of inspections (1).

Schedule of test results (1).

- (b) An insulation resistance test is carried out on a circuit to a 3-phase motor. The following results are measured:

L1 to L2:  $>999\text{M}\Omega$

L1 to L3:  $890\text{M}\Omega$

L2 to L3:  $>999\text{M}\Omega$

(L1+L2+L3) to N:  $870\text{M}\Omega$

(L1+L2+L3) to E:  $640\text{M}\Omega$

N to E:  $>999\text{M}\Omega$

- i) State the results to be recorded, and the headings in the table where they would appear. (4 marks)

Live – live (1):  $870\text{M}\Omega$  (1).

Live – earth (1):  $640\text{M}\Omega$  (1).

- ii) State the test voltage used. (1 mark)

500V (1).

- iii) State the minimum acceptable value. (1 mark)

$1\text{M}\Omega$  (1).

- iv) State the test instrument to be used. (1 mark)

Insulation resistance tester (1).

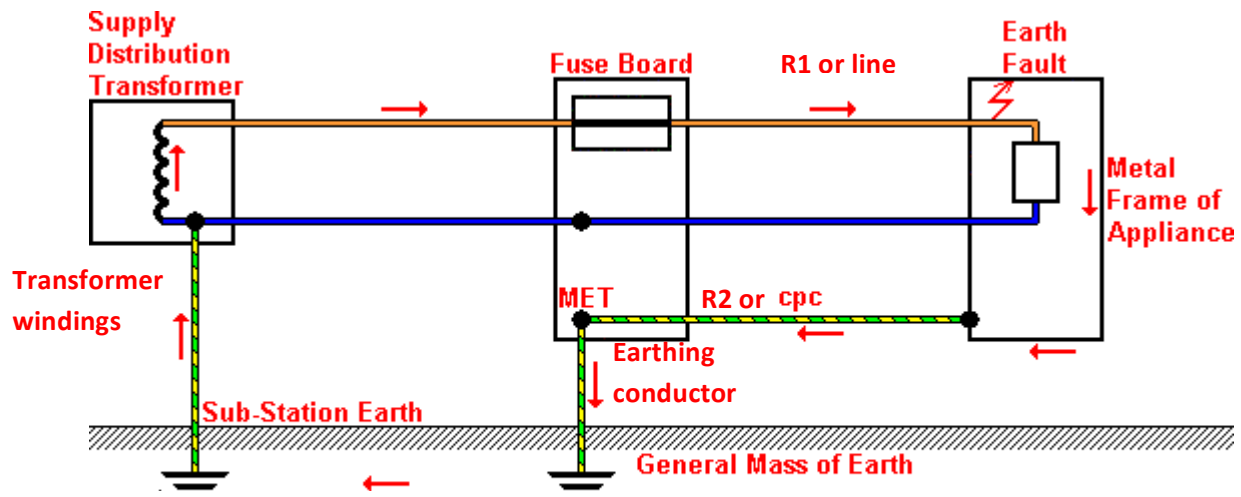
- (c) Explain the consequences of having a measured earth fault loop impedance value higher than that permitted by BS7671. (3 marks)

Fault current will be lower (1), meaning disconnection times will be longer (1) than those specified in BS7671, leading to increased shock risk (1).

- (d) Explain the consequences of incorrect phase sequence on this installation. (2 marks)

Rotation of machines could be reversed (1) leading to risk of damage/danger (1).

6. Describe, with the aid of a fully labelled diagram, the earth fault loop for the lighting circuit in the workshop. (15 marks)



System = 4 marks

Path = 4 marks

Labels = 7 marks