

City&Guilds 2394 Past Exam Paper

1. An inspection and test is to be conducted on a new installation. State the
 - a) type of verification to be carried out (1 Mark)
 - b) documentation that will need to be completed. (2 Marks)

2. State the legal status of EACH of the following
 - a) British Standard 7671 (1 Mark)
 - b) the IEE Guidance Note 3 inspection and testing (1 Mark)
 - c) the Electricity at Work Regulations 1989. (1 Mark)

3. State THREE methods of protection to prevent contact with live parts. (3 Marks)

4. State THREE human senses that may be used during the inspection of an installation. (3 Marks)

5. State
 - a) With whom the extent and limitations of an inspection and test should be agreed (2 Marks)
 - b) the documentation on which this information should be recorded. (1 Mark)

6. State the instruments that measure EACH of the following units
 - a) $M\Omega$ (1 Mark)
 - b) kA (1 Mark)
 - c) ms (1 Mark)

7. Identify the conductors that connect together the following
 - a) main earthing to the means of earthing (1 Mark)
 - b) gas and water services to the main earthing terminal (1 Mark)
 - c) exposed conductive parts to extraneous conductive parts in a bathroom. (1 Mark)

8. A test is to be conducted on a cooker circuit to establish the value of $(R_1 + R_2)$. State the
 - a) instrument to be used (1 Mark)
 - b) meaning of $(R_1 + R_2)$. (2 Marks)

9. For a continuity test on a ring final circuit state the
 - a) other test that is automatically performed (1 Mark)
 - b) effect on the resistance reading between L and N taken at a spurred socket outlet compared with that taken at a socket outlet on the ring (1 Mark)
 - c) significance of the reading taken between L and c.p.c. at each socket outlet on the ring. (1 Mark)

10. The insulation resistance of a three-phase installation is to be tested. State the
 - a) conductors between which the test should be carried out (2 Marks)
 - b) units in which the test is measured. (1 Mark)

11. For EACH of the following circuits, state the insulation resistance test voltages which should be applied
 - a) SELV or PELV (1 Mark)
 - b) circuits up to 500V (1 Mark)
 - c) circuits over 500V (1 Mark)

12. State
 - a) TWO circumstances which would cause the resistance of an installed circuit conductor to increase (2 Marks)
 - b) ONE reason, apart from a fault, why overall insulation resistance of an installation would decrease (1 Mark)

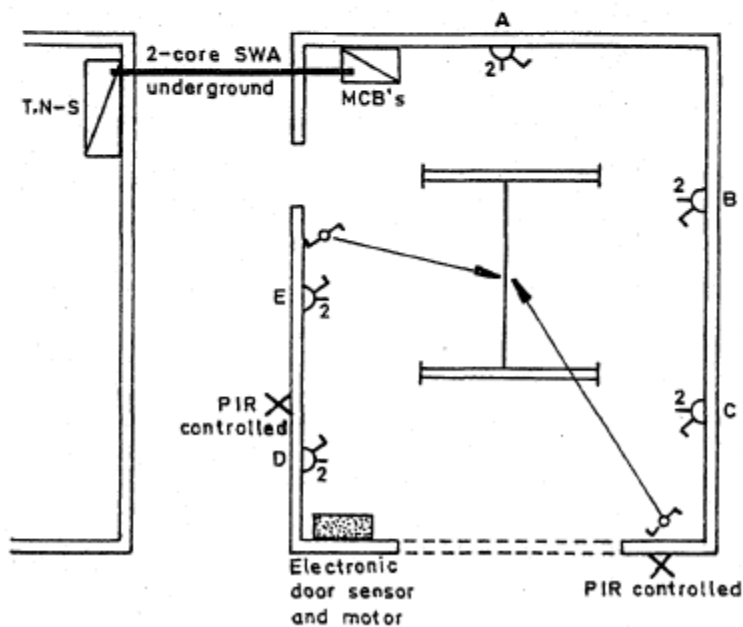
13. State the
 - a) TWO IP codes that provide protection against finger contact (2 Marks)
 - b) TWO IP code that provides protection against the entry of a 1 mm diameter wire. (1 Mark)

14. State THREE reasons given in BS 7671 why it is necessary to conduct a 'dead'

- polarity test on an installation. (3 Marks)
- 15 A test is to be conducted on an existing installation to establish the value of Z_e .
State the
a) instrument to be used (1 Mark)
b) action to be taken with regards to the installation earthing (1 Mark)
c) action to be taken with regards to the supply. (1 Mark)
- 16 The maximum tabulated values of Z_s for three circuits are
- 2.62 ohms
- 1.5 ohms
- 0.6 ohms.
The test values are
- 2.25 ohms
- 1.0 ohms
- 0.5 ohms.
Show if the measured values are acceptable. (3 Marks)
- 17 State
a) TWO instruments that may be used to conduct an earth electrode resistance test (2 Marks)
b) What action should be taken regarding the earthing conductor during such a test. (1 Mark)
- 18 State THREE locations on a construction site where special regulations DO NOT apply. (3 Marks)
- 19 State
a) TWO reasons for using a 300 mA r.c.d. in an installation (2 Marks)
b) the reason for regular operation of an r.c.d. using the integral test button. (1 Mark)
- 20 State THREE functional tests that may be carried out on a domestic installation. (3 Marks)

Section B -Answer ALL SIX questions.

All questions in Section B refer to Fig. 1 below, which shows the layout of the electrical installation in a new-detached garage. An initial verification of the installation is to be carried out.



- 21 State
- a) the documentation/information required to carry out the verification (5 marks)
 - b) where the documentation/information in a) should be located (3 marks)
 - c) what particular items of equipment should be detailed on such documentation (3 marks)
 - d) the consideration that should be given to the existing installation from which this new installation is supplied. (4 marks)

- 22 From the BS 7671 checklist, state FIVE areas of inspection for this installation that should be carried out prior to testing. (15 marks)

- 23 The test results shown in Fig. 2 below were obtained from a ring final circuit continuity test. State whether the readings for EACH socket are satisfactory or unsatisfactory. Give reasons for those readings that are unsatisfactory. (15 marks)
- Note: line, neutral and c.p.c. loops = 0.8Ω .

SOCKET	L - N	L - c.p.c.
A	0.4	0.41
B	no reading	0.39
C	0.5	0.4
D	0.4	no reading
E	0.41	0.41

Fig. 2

- 24 a) Describe in detail, the test procedure for the insulation resistance on this installation. (8 marks)
- b) The test result indicates an overall value of $1.75\text{ M}\Omega$. State with reasons what actions, if any, should be taken. (7 marks)

- 25 A loop impedance test on the lighting circuit is conducted and the 6A type B m.c.b. trips repeatedly.
- a) Explain why this is the case (8 marks)
 - b) Explain how the problem may be overcome in order to conduct the test. (7 marks)

- 26 The electronic door sensor/motor is wired on its own radial circuit.
- a) List ALL the component parts of the earth fault loop path associated with this circuit in the event of a fault to earth. (8 marks)
 - b) If the maximum value of loop impedance for this circuit is 2.4 ohms and an earth fault causes a current of 120 A , show by calculation if this value will disconnect the circuit in the required time. (7 marks)

Answers

- 1 a) Initial inspection and test
b) Electrical installation certificate
Schedule of inspections
Schedule of test results
- 2 a) Non statutory
b) Non statutory
c) Statutory
- 3 Any three of...
 - Insulation of live parts
 - Barriers/enclosures
 - Placing out of reach
 - Obstacles
- 4 Any three of...
 - Smell
 - Touch
 - Hearing
 - Sight
- 5 a) The client/person ordering the work
b) Periodic inspection report
- 6 a) Insulation resistance tester
b) Prospective fault current tester
c) Residual current device tester
- 7 a) Earthing conductor
b) Main protective bonding conductor
c) Supplementary protective bonding conductor
- 8 a) Low resistance ohm meter
b) The resistance of the circuit line and protective conductors from the distribution board to the remote end of the circuit
- 9 a) Polarity
b) The reading at a spurred outlet will be higher than that of an outlet connected within the ring
c) The $R_1 + R_2$ value for the circuit (highest value)
- 10 a) - All live conductors
L1-L2, L2-L3, L1-L3, L1-N, L2-N, L3-N
- All live conductors and earth
L1-cpc, L2-cpc, L3-cpc, N-cpc
b) Megohms $M\Omega$
- 11 a) 250 V dc
b) 500 V dc
c) 1000 V dc
- 12 a) Any two of...
 - Loose connection
 - Increase in ambient temperature
 - Increase in load current leading to an increase in conductor temperatureb) Addition of another circuit
Extension of a circuit
- 13 a) i) IP2X ii) IPXXB
b) i) IP4X ii) IPXXD

- 14 To prove
- All single pole devices break the line conductor only
 - The centre contact of Edison screw lamp holders is connected to the line conductor
 - The correct connection of all circuit conductors line, neutral and cpc
- 15 a) Earth loop impedance tester
 b) All installation earthing to be disconnected to remove any parallel paths
 c) Installation to be disconnected from the supply whilst the earthing is disconnected

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	Max. Value	Max. Value Adjusted × 0.8	Reading	Acceptable Y/N
a)	2.6	2.08	2.25	N
b)	1.5	1.2	1.0	Y
c)	0.60	0.48	0.5	N

- 17 a) i) Earth electrode resistance tester
 ii) Earth loop impedance
 b) It should be removed from the earth electrode or from the installation so as to eliminate possible parallel paths to earth.
- 18 Any three of...
- Site offices
 - Cloakrooms
 - Meeting rooms
 - Canteens
 - Restaurants
 - Dormitories
 - Toilets
- 19 a) i) To protect against fire
 ii) Where disconnection cannot be achieved by EEBADS
 b) To prove that the mechanical and electrical components are operating within their sensitivity
- 20 Operation of and RCD
 Operation of circuit breakers
 Operation of switches
- 21 a) - Maximum demand
 - Arrangement of live conductors & type of earthing
 - Nature of supply
 - Distribution schedule
 - Charts/diagrams/working instructions
 - Equipment vulnerable to tests
 b) At the distribution board, or with the client
 c) Electronic door sensor and the PIR detectors
 d) Whether the existing supply is capable of supplying the existing and the new load.
- 22 Any five
- Connection of conductors
 - Polarity
 - Method of installation
 - Method of protection against electric shock
 - Presence of earthing and circuit protective conductors
 - Identification of conductors

- 23 As the line, neutral and C.P.C. loops are 0.8Ω , the outlet readings should be in the order of $0.4\Omega \pm 0.05\Omega$.
- Socket A L-N reading is acceptable
L- CPC reading is acceptable
Conclusion Polarity is correct
- Socket B L-N reading is unacceptable - no continuity
L- CPC reading is acceptable
Conclusion Reverse polarity on P/CPC conductors,
or
Neutral is not connected to the terminal
- Socket C L-N reading is unacceptable - Too high (greater than $\pm 0.05\Omega$)
L- CPC reading is acceptable
Conclusion May indicate a loose connection on the neutral conductor
- Socket D L-N reading is acceptable
L- CPC reading is unacceptable - no continuity
Conclusion Reverse polarity on P/N conductors,
or
CPC is not connected to the terminal
- Socket E L-N reading is acceptable
L- CPC reading is acceptable
Conclusion Polarity is correct
- 24 a) – Isolate the supply and lock OFF
– All switches closed
– All current using equipment removed
– All fuses/M.C.B.'s in place/on
– All equipment vulnerable to test should be removed
– Test performed at meter tails if possible.
Test Between Live conductors (L & N)
Live conductors and earth
- b) This could indicate a latent defect. Each circuit should be tested individually and its insulation resistance should be greater than $2\text{ M}\Omega$.
- 25 a) As loop impedance tester delivers high current for a short time, it is not
b) The loop impedance in such cases will have to be determined by a
– Measure Z_e , (incoming side of device)
– Measure $R_1 + R_2$ for the circuit
– Then $Z_s = Z_e + (R_1 + R_2)$
- 26 a) The fault current path starts at the point of fault and includes
– Circuit C.P.C from the point of fault back to the M.E.T.
– Suppliers service cable metallic sheath
– Sub-station transformer secondary winding
– Suppliers Line conductor
– Consumers Line conductor to point of fault.
- b) Using the formula in appendix 3 of BS 7671 we can use the fault current to find the actual impedance value

$$Z_s = \frac{U_0}{I_s} = \frac{230}{120} = 1.92\Omega$$

The maximum impedance is higher than the calculated value therefore, based on the information provided, the circuit complies.