C&G 2394/2395 Past Exam Paper

Section A

1. Provide one example where each of the following may be required.
a) Periodic Inspection Report. (1 mark)
b) Minor Electrical Installation Works Certificate. (1 mark)
c) Electrical Installation Certificate. (1 mark)
(Total marks 3)

2. List one statutory and two non statutory documents that an inspector may refer to during an inspection and test. (3 marks)

3. List any three of the four areas of responsibility that are attributed to an inspector as stated in BS7671 and GN3. (3 marks)

4. State the main reason BS7671 gives why periodic inspection and testing is required. (3 marks)

5. Prior to commencing a periodic inspection and test, state
a) what must be agreed with the client (1 mark)
b) who needs to agree this with the client (1 mark)
c) where this agreement should be recorded. (1 mark)
(Total marks 3)

6. State 3 possible dangers resulting from the use of leads which do not comply with GS 38, when carrying out live testing. (3 marks)

7. State three common faults or defects that need to be checked before using test equipment. (3 marks)

8. List two operational characteristics of a low reading ohm meter. (3 marks)

9. List the first three tests required following the installation of a lighting circuit in a domestic environment. (3 marks)

10. List, using the correct terminology, three types of protective conductors that may be found in an installation. (3 marks)

11. State, under which circumstances, when testing for continuity of protective conductors, methods 1 and 2 can not simply be applied to a completed installation. (3 marks)

12. When testing for continuity of ring final circuits GN3 recommends a 3 step approach. List 3 of the possible outcomes that would be expected if the 3 steps proved that the circuit was satisfactory. (3 marks)

13. State both the appropriate dc test voltage and minimum acceptable test result value, when testing insulation resistance, for each of the following circuits.
a) SELV or PELV. (1 mark)
b) Up to and including 500 V but excluding SELV & PELV. (1 mark)
c) Above 500 V. (1 mark)
(Total marks 3)

14. List the two tests recommended by BS7671 and GN3 when carrying out an insulation resistance test. (3 marks)

15. Protection against direct contact is provided by supplementary insulation applied to equipment during erection on site. State the,
a) degree of protection required for the enclosure (2 marks)
b) electrical test the insulating enclosure must be capable of withstanding. (1 mark)
(Total marks 3)

16. BS7671 requires that insulation resistance tests are made between SELV circuits and other circuits, to satisfy the requirements for separation of circuits. State,
a) where the test is to be conducted. (1 mark)
b) the test voltage that should be applied. (1 mark)
c) the minimum value that, in practice, if not met would require further investigation. (1 mark)
(Total marks 3)

17. a) State under what circumstances testing for protection by barriers or enclosures is not likely to be required (2 marks)
b) State, when testing must take place for protection by barriers or enclosures, what degree of protection would be required. (1 mark)
(Total marks 3)

18. State three purposes of a dead polarity test. (3 marks)

19. State,
a) two methods of determining the value of earth fault loop impedance for a circuit (2 marks)
b) why the rule of thumb method would be used. (1 mark)
(Total marks 3)

20. State,
a) two reasons for confirming the value of Ze for a new installation. (2 marks)
b) the instrument required for the test in (a). (1 mark)
(Total marks 3)

Section B Questions 21-26 refer to the following scenario and Figure 1 below. Answer all six questions. All questions carry equal marks. Please show all calculations.

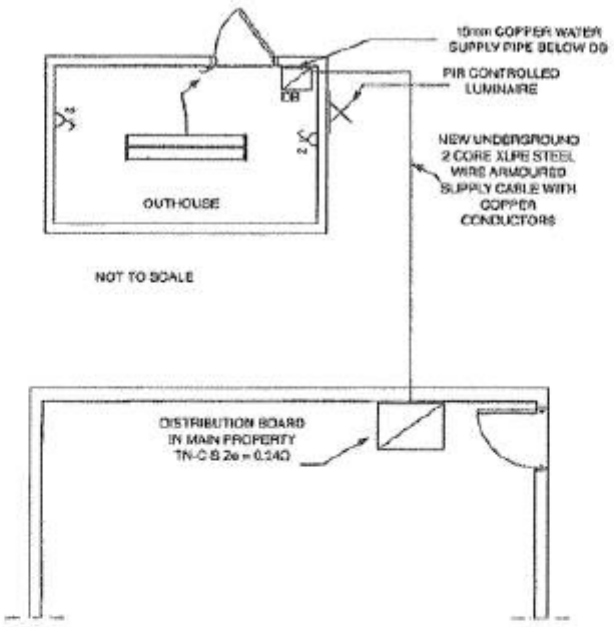


Figure 1

The owner of a domestic property has decided to have the supply to a steel framed outhouse re-instated, following a storm some 5 years ago, when the old overhead supply was blown down. The outhouse is to be used for simple DIY activity. The building has its own 15 mm copper water supply pipe situated just inside the outhouse directly below the all insulated consumer unit. The consumer unit has a 100mA RCD to BS EN 61008 as its main switch.

A new supply cable to the outhouse has been installed underground, the cable run is 12 metres longer than the original overhead supply cable. Following instructions from local electricity company you are ***not*** to utilise the suppliers earth as a means of earthing for the outhouse.

The 230 V 50 Hz supply to the distribution board within the main property forms part of a TN-C-S earthing system, with a measured Ze of 0.24Ω and a PFC of 1 kA.

The all-insulated consumer unit within the outhouse supplies three radial circuits as follows,

Circuit 1
13 A double socket outlet with neon indicator protected by a 16A type B, 30 mA RCBO to EN 61009. The circuit length is 8 metres and is likely to supply portable equipment used outside.

Circuit 2
13 A single socket outlet with neon indicator protected by a 16A type B, 30 mA RCBO to EN 61009.The circuit length is 4 metres and is likely to supply portable equipment used outside.

Circuit 3
58W fluorescent luminare, one way controlled and an external 250W halogen lamp operated by an integral PIR controller protected by a 6A type B circuit breaker. The circuit length is 12 metres.

21. State,
a) the types of verification/certification required for both the existing outhouse and the new supply, listing any supporting documentation required. (5 marks)
b) the legal status of the,
i) documentation required in (a) (2 marks)
ii) person carrying out the inspection and testing (2 marks)
c) the title given in the EAWR to the inspector (2 marks)
d) two relevant statutory documents that may be required for reference during this work (2 marks)
e) one non statutory document that would most likely be required for reference during this work. (2marks)
(Total marks 15)

22. List
a) five relevant tests, including the individual instruments, required on the outhouse supply cable following the test for continuity of protective conductors (10 marks)
b) five relevant inspections required, when inspecting the installation of the outhouse supply cable. (5 marks)
(Total marks 15)

23. Show, with the aid of a fully labelled diagram, the
a) earthing arrangements at the main earthing terminal for the outhouse (8 marks)
b) earth fault loop path for the lighting circuit in the outhouse. (7 marks)
(Total marks 15)

24. a) Explain why the earth fault loop impedance test result on the lighting circuit in the out house is likely to be significantly higher than a similar circuit in the main property. (6 marks)
b) Explain briefly,
i) why the main switch may operate when testing for earth fault loop impedance on the lighting circuit in the out building (4 marks)
ii) how you would overcome the problem encountered in b(i). (5 marks)
(Total marks 15)

25. a) Describe, in detail, the tests required on the RCDs in the outhouse. (7 marks)
b) Explain, with the aid of a fully labelled diagram, how the effectiveness of the means of earthing for the outhouse would be checked when using an earth fault impedance tester. (8 marks)
(Total marks 15)

26. When measuring the insulation resistance between live conductors on the circuits in the outhouse, the following results were obtained

Socket outlet 1	2.1 MΩ
Socket outlet 2	3 MΩ
Lighting circuit	10 MΩ

a) Describe briefly how an insulation resistance test would be carried out on the supply cable to the outhouse before the supply is connected. (7 marks)
b) State the value of insulation resistance if the installation was measured as a whole (show all calculations). (3 marks)
c) State whether the value obtained in (b) is acceptable. (2 marks)
d) State the precautions that would be required when undertaking the insulation resistance tests. (3 marks)
(Total marks 15)

Answers:

1. a. Change of use of premises etc. **GN3 p59, 60**
b. Addition of a socket or light which does not involve the installation of a new circuit. **GN3 p96**
c. Initial certification of a new installation or an alteration or addition to an existing installation. **GN3 p87**

2. EAWR 1989 BS7671, GN3.

3. Ensure no danger or damage to persons, livestock or property.
Compare results with design criteria.
Advise on any remedial works.
In the event of a dangerous situation make an immediate recommendation to isolate the defective part. **GN3 p14**

4. All electrical installations deteriorate due to a number of factors..... **GN3 p59**

5. a. Exactly what is covered by the report, extent and limitations.
b. The person carrying out the report.
c. In the extent and limitations on the report. **GN3 p99**

6. Shock risk if:
No finger guards are present.
The exposed tip is too much.
The leads are not fused, 500mA. This could also damage the instrument.

7. Test leads and probes are in good order.
Clean and no cracked or damaged insulation.
Fused leads. **GN3 p13**

8. A resolution of at least 0.01 ohm.
A power supply of between 4v and 24v. **GN3 p82**

9. Continuity of protective conductors.
Insulation Resistance.
Polarity. **GN3 p33**

10. Circuit Protective Conductor.
Main Protective Bonding Conductor.
Supplementary Bonding Conductor.

11. When the installation uses steel conduit or trunking etc which would provide parallel earth paths. **GN3 p34**

12. Continuity of the line, neutral and cpc.
Correct wiring of the sockets.
A value of R1+R2. **GN3 p36**

13. a. 250v 0.5M ohms
b. 500v 1 M ohms
c. 1000v 1 M ohm **GN3 p38**

14. Between live conductors and between live conductors and earth. **GN3 p39**

15. IP2X or IPXXB **GN3 p40**
An applied test voltage without breakdown or flashover.

16. a. Between the live conductors of the SELV circuit and the conductors of the higher voltage circuit.
b. 500v dc
c. 1M ohm. **GN3 p41**

17. a. When the barriers and enclosures are factory built. **GN3 p42**
b. IP2X or IPXXB. **GN3 p42**

18. All single pole devices are connected in the line conductor only.
All socket outlets and accessories are wired correctly. **GN3 p45, 46**
The centre pin of an Edison screw lamp holder is wired to the phase conductor.

19. a. Direct measurement with an earth loop impedance tester. Calculation with Zs = Ze + (R1 + R2) **GN3 p49**
b. To reduce max values in BS7671 by 80% which would put the value at a more realistic temperature for comparison with measured values. **GN3 p51**

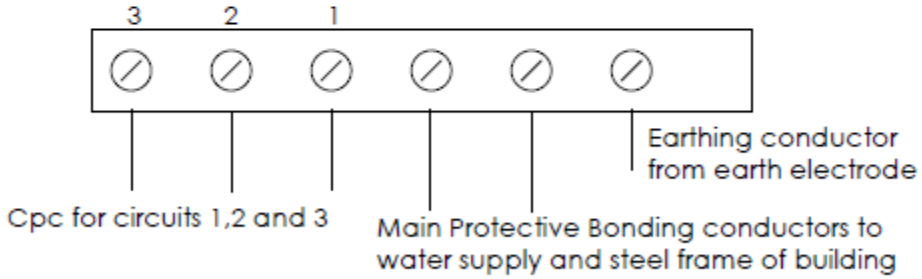
20. a. To verify the existence of a supply earth. To verify that the Ze is not greater than the value used in any design calculations, this value can be added to R1 + R2 values to give a Zs value for individual circuits. **GN3 p49**
b. Earth loop impedance tester. **GN3 p49**

21. a. The new underground supply is a new circuit and requires an Electrical Installation Certificate with a schedule of inspections and schedule of test results. *Not sure what City and Guilds mean by* ***existing***. If its before the new sub main is installed then a Periodic Inspection Report with a schedule of inspections and schedule of test results. If its after the sub main is installed then this will change the characteristics for the existing out house circuits so they will also need an EIC with a schedule of inspections and schedule of test results.
b. i) Non- statutory.
ii) The Duty Holder who will be a competent person.
c. The Duty Holder who will be a competent person.
d. HASAWA 1974, EAWR 1989.
e. BS 7671.

22. a. i) R1 + R2, low reading ohm meter.
ii) Insulation Resistance. High reading ohmmeter or IR tester.
iii) Polarity, low reading ohm meter.
iv) Zs, Earth loop impedance tester.
v) Pfc, Prospective fault current tester.

b. Protection against mechanical damage..
Joints mechanically and electrically sound.
Correct current rating.
Metal sheaths and armours earthed.
Identified at terminations. **GN3 p30**

23. a.



Note, the supply authority has stated that their earthing arrangements are not to be used by the outhouse. The armours of the sub main must not connect the 2 Main Earthing Terminals together.

b. Fully labelled TT earth loop impedance drawing with load labelled as lighting circuit.

24. a. In the main property the return path to the earthed supply transformer is via the combined earth and neutral of the T-N-C-S supply, this should provide a low impedance path. The outhouse circuits will rely on the earth electrode and the general mass of earth for its path back to the supply transformer's earth. This will be a much higher impedance, that's why a 100mA rcd is required, max values of Zs will not be satisfied.

b. i) The current introduced to the circuit from the earth loop impedance tester can cause some protective devices to trip.
ii) Add the value for R1 + R2 for the lighting circuit to the earth loop impedance of the earth electrode.

25. a. Test the 100mA rcd (needed for the TT outhouse circuits):
At ½ the rated trip current (50mA) on both sides of the ac sine wave the rcd should not trip.
At x1 of rated trip current (100mA) on both sides of the ac sine wave the rcd should trip in less than 300ms, record the higher one of the 2.

Test the 30mA rcds at:
At ½ the rated trip current (15mA) on both sides of the ac sine wave the rcd should not trip.
At x1 of rated trip current (30mA) on both sides of the ac sine wave the rcd should trip in less than 300ms, record the higher one of the 2.
At x5 of rated trip current (150mA) on both sides of the ac sine wave the rcd should trip in less than 40ms, record the higher one of the 2.

b. Show diagram of earth electrode connected to ELIP tester via earthing conductor which is disconnected from main earthing terminal following isolation of supply. Test from live side of isolator as with Ze test.

26. a. Ensure that all loads and anything sensitive to the test voltage is disconnected. Test at the supply end of swa between live conductors. The isolator and protective devices in the outhouse c/u must be turned on. Any light switches must be tested in all combinations of switching to ensure all switch wires/strappers have been tested. The test voltage is 500v dc and when tested in parallel like this a reading of less than 2M ohm would require circuits to be tested individually. Test between Live conductors and earth, this will only test the swa and not the out house circuits as they are not connected to the earth at the house c/u. A further test between Live conductors and earth is required at the outhouse c/u to test the out house circuits.

b. $3 \times 10 / 3 + 10 = 2.3$

$2.3 \times 2.1 / 2.3 + 2.1 = 1.1$M ohm.

c. Not acceptable, when tested in parallel a reading of less than 2M ohm would require circuits to be tested individually and they must be not less than 1M ohm. Readings of this value would suggest latent faults and would require further investigation.

d. All electrical loads and any equipment sensitive to the test voltage disconnected, this would include the Passive Infra Red controller and fluorescent fitting on circuit 3. Once the sensitive equipment is disconnected it must be linked out for the duration of the test. All covers in place to avoid risk to persons or live stock whilst performing the test.