

HNC Electrical and Electrical Engineering

Module: Design of Electrical Installations

Module Code: PCEE4007

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Introduction Page

This assignment has been split into three sections; all three sections are based on the attached drawing that shows the top of an office block. The suite of offices has been completely refurbished and interior walls are of 100mm solid partition sections. The office floors have been screened and are to be covered with carpet tiles. External walls are of 225mm fair-faced brickwork, internally plastered.

The electrical supply to the building is TNC-S-400V, 3-phase and neutral. The installation within the building is fed by a variety of final circuits plus a sub-main SWA cable to the office suite. There is an existing single phase, 10way, metal clad distribution board with BS3036 protective devices installed by the entrance to the office suite. The supply is TN-S, 230V, 50Hz, single-phase. The quick start modular fluorescent luminaires are rated at 58w. The tungsten Filament lamps are rated at 100w.

The mounting heights to the top of the accessories above f.f.l, are as follows:

- Light switches, 1350mm
- Switched socket outlets, 400mm
- Distribution board, 2100mm

All work is to be carried out during normal working hours and while the rest of the building is occupied.

This assignment includes an explanation of necessary considerations and factors that are involved when upgrading an office. This assignment goes into detail on the safety requirements, electrical testing and how to cooperate with an operating building.

Section A

- 1)** There are various possible effects when upgrading the level of illumination within the office.
The effects for example, by upgrading from a single to twin lamp fitting there will be a risk of overloading the circuit. If an overload to the circuit occurs, it will have an affect on the circuit wiring. To prevent this from happening, replace the fuses therefore the rating will suit the circuit.
- 2)**
 - A.** The existing wiring could either be re-wired or relocated this all depends on the condition.
For example, if the cores had been exposed then new wiring would be necessary, however if in usable condition then can be relocated and continued to be wired suitably for the new office partition.
 - B.** As the contractors will be working in a small area that is still running, communication is necessary between all the building to allow for continued efficiency. By having communication and relationships between the various trades and contractors will lead to less arguments and quicker progress to finish the project.
 - C.** A rota would ensure efficient work and good communication, as it would include the times when there would be disruption allowing everyone to work around these times.
- 3)** There are various factors to be considered when calculating the cost of:
 - a. Upgrading of fluorescent luminaires - considering it will take 3x longer with the building still operated, the cost will include manufacturing, time for delivery, installation and equipment.
 - b. Removal and replacement of outlets within the partition – the cost will be for the time, the number of contractors, the equipment needed, waste and the new outlets.

Section B

- 4) A CT (current transformer) is a device that is used for the transformation of current from a higher value into a proportionate current to a lower value. In this scenario a CT is used as there is electrical loading in the building, the CTs are fitted as part of a metering arrangement. The sketch drawn on Auto Cad Below shown as Figure A shows an example of how CTs would be fitted and connected as part of a 3-phase power meter.

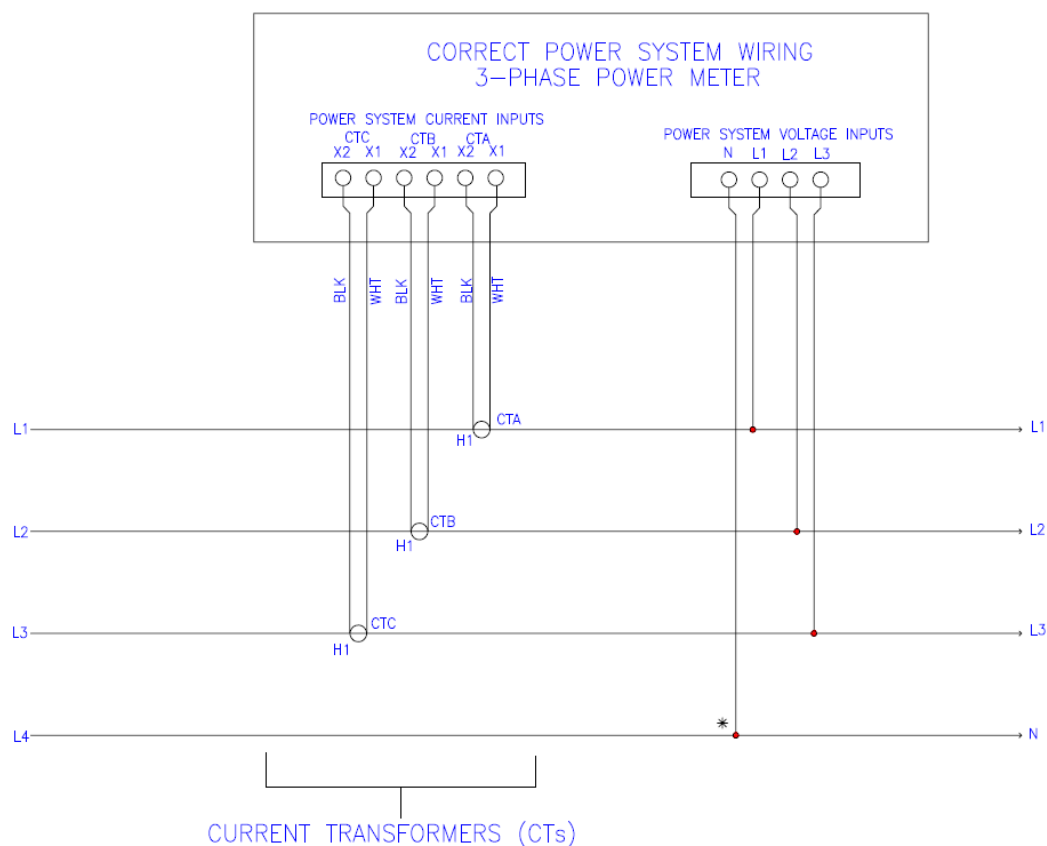


Figure A

5) Upon completion of the alterations and additions to the electrical installation, the work will have to be inspected and tested following certification.

A. There are 5 tests that will need to be carried out:

- Polarity testing – This test is used to confirm the correct connection of the line and neutral conductors.
- Earth fault loop impedance testing – A test used to verify if a fault occurs in an electrical installation, the higher the impedance, the lower the fault current is, meaning that the circuit protection will take longer to operate. If the resistance in the earth return circuit is too high, the fault current may be too low to be detected, and the fault current will continue to travel around the main circuit – causing a short circuit.
- Insulation resistance testing – This test measures the insulation resistance in ohms. The resistance measured indicates the condition of the insulation between two conductive parts. The higher the reading the better the result. The table below shows the required test voltage and minimum required resistance in accordance with BS7671.

Nominal Circuit Voltage (v a.c)	Test Voltage (v d.c)	Minimum Resistance (Mohm)
Between 0 and 50	250	0.5
Between 50 and 500	500	1
Between 500 and 1000	1000	1

- Continuity of final ring circuit conductors – By checking the continuity of a ring final circuit it ensures the installation and that the appropriate parts are isolated. More information on how to carry out this test is explained by <https://electricalapprentice.co.uk/checking-continuity-of-ring-final-circuit/> (10/05/20) 'Cross-connect the incoming neutral conductor with the outgoing phase of the circuit, and vice versa. Measure the resistance phase to neutral and note the result which should be approximately half the measured value of the phase or neutral conductor measured separately (as in Step 1). Alternatively, the measured value at each socket-outlet should be substantially the same. This measurement would be $(r1+r_n)$ or $(1 + r_n)/4$.'

- Continuity of protective conductors – This test is carried out to verify that the CPC forms a continuous path around the circuit under test. To carry out this test a low-reading ohmmeter is used.

B. Equipment used to carry out electrical testing must comply with the standard HSEGS38. The standard provides advice on the selection and use of test probes, leads, lamps, voltage detecting equipment and measuring equipment, this is equipment used for circuits which the rated voltage is no higher than 1000 V ac. HSE GS38 is a non-statutory document, the objective is to give electrical safety guidance to inspectors and other electrically competent individuals that are involved in testing of electrical circuits.

C. The electrical installation certificate needs to be completed when the testing is completed. This certificate is kept as proof, to assure that the testing was completed and that the installation was carried out by the certified electricians.

D. The completed forms/certificates will go to the client.

6) There are various types and ranges of test instruments which will be used to test electrical installation.

- Low resistance Ohm Meter 0-20 Ω - measuring low resistance helps identify resistance elements that have increased above acceptable values. Low resistance is required to prevent long term damage to existing equipment and minimize energy wasted as heat.
- Insulation resistance tester 0-200/300/500 Ω 0 – A test to measure resistance in ohms, greater detail on how this test works can be seen on page 6.
- Earth Fault loop impedance tester 0-2000 Ω - an explanation on this test can also be found on page 6.

7) If an earth impedance test failed and didn't meet the requirements of BS7671 then the fuse would need to be replaced with a miniature circuit breaker. According to <https://www.consumerunitworld.co.uk/what-is-an-mcb-and-how-does-it-work-328-c.asp> (10/05/20) 'A Miniature Circuit Breaker is an electromechanical device designed to protect an electric circuit from over-current - A term to describe an electrical fault caused by either overload or short circuit'. An RCD would need to be installed as part of the circuit to provide additional protection.

Once this has been done another earth fault loop impedance test would be required to ensure that the fault is eliminated.

Section C

8)

A one key switch is used where access needs to be restricted to the switch's functions. Key switches can commonly be found where a key is needed to control electrical power. An example of basic wiring of a key switch is shown with Figure B (right). Image found on <http://www.lightwiring.co.uk/tag/2-way-lighting-circuit-diagram/> (10/05/20)

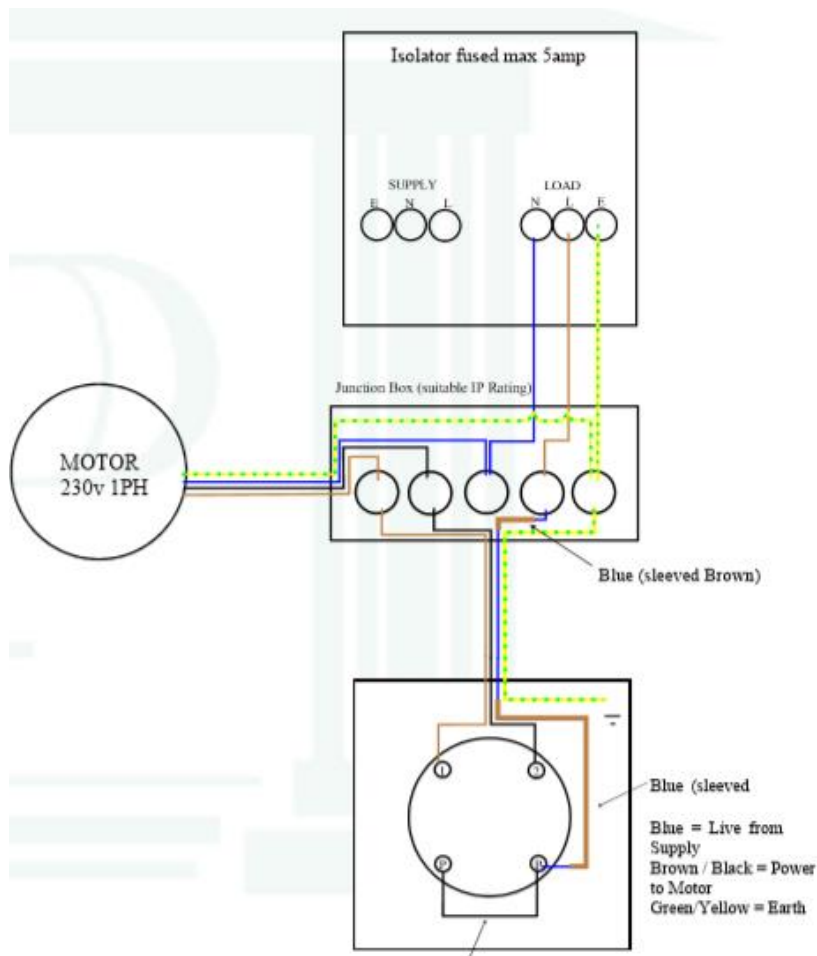


Figure B

According to

https://www.flameport.com/electric/lighting_circuits/lighting_multiple_lights_one_switch.ch.cs4 (10/05/20) 'To add a second light which is switched with the first one, the

switched line, neutral and earth need to be extended to the second light.' This can be seen with Figure C as 'light 2'. The end of 'light 2' (new cable) is taken to the position of the new light. The loop is not required at the new light, because this is only used to join incoming power and switch cable.

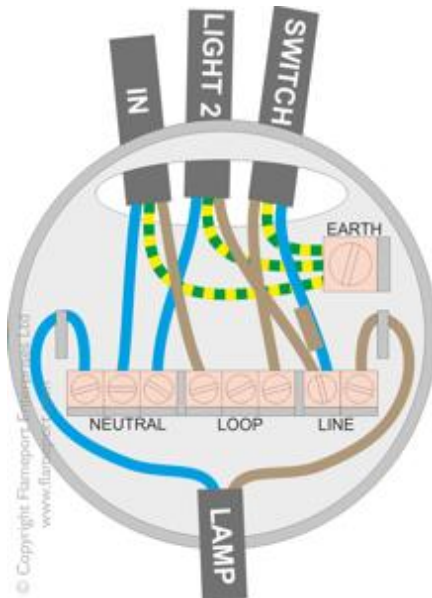
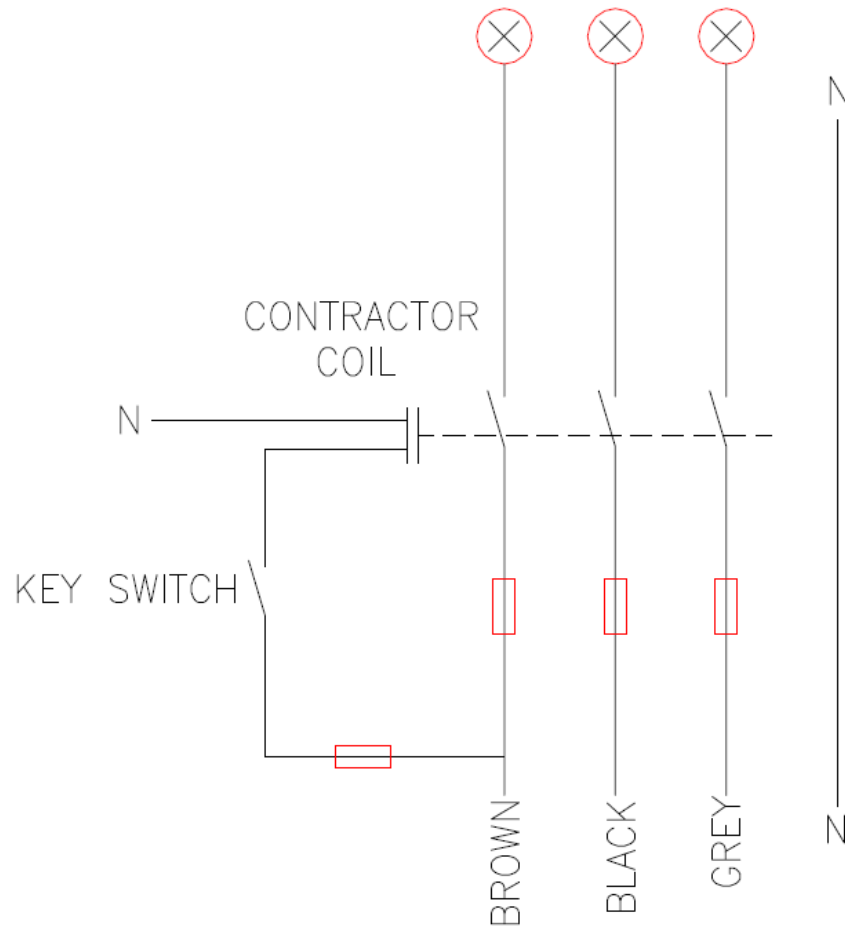


Figure C

An example of a simple wiring diagram illustrating a key switch energising a contactor coil which pulls in the contacts switching all the lights on is shown with Figure D (page 11). Figure D drawn using Auto CAD.



WIRING DIAGRAM TO ILLUSTRATE THE INTERCONNECTION
OF THE CONTROL COMPONENTS WITHIN THE CIRCUIT

Figure D

9) There are various reasons to why a fluorescent luminaire does not operate, sometimes it can be caused by the lack of electrical power. Another reason can be the starter and the bulbs. If the electrodes (filaments) fail in the lamp, it means that an electric current can't get into the lamp to stir up the necessary electrodes. Another reason according to <https://www.shineretrofits.com/knowledge-base/lighting-learning-center/why-do-fluorescent-lamps-and-ballasts-fail.html> (10/05/20) is the loss the phosphors 'Eventually as the lamp is used, the performance of the phosphor coating that lines the insides of the lamp's tube will start to dwindle.' It becomes clear when this happens as the light emitted from the lamp is not as bright as it once was.

10) By isolating the supply to the office, the implications for the client would be that they would lose money through not having business but having to pay employees. To prevent this implication would be to move individuals through different rooms, only having one room in the office isolated from the office workers and occupied by contractors.

Reference Page

<https://electricalapprentice.co.uk/checking-continuity-of-ring-final-circuit/> (10/05/20)

<https://www.consumerunitworld.co.uk/what-is-an-mcb-and-how-does-it-work-328-c.asp> (10/05/20)

<http://www.lightwiring.co.uk/tag/2-way-lighting-circuit-diagram/> (10/05/20)

https://www.flameport.com/electric/lighting_circuits/lighting_multiple_lights_one_switch.cs4 (10/05/20)

<https://www.shineretrofits.com/knowledge-base/lighting-learning-center/why-do-fluorescent-lamps-and-ballasts-fail.html> (10/05/20)