The form of protection provided by the insulation of live parts would be:

Protection against direct contact

State three tests that may need to be applied to a ferrous enclosure which forms the sole c.p.c. for a circuit:

- **visual inspection**
- **continuity (low resistance ohmmeter)**
- **high current (25A) test**

List THREE items of information relating to the incoming supply that should be listed on the schedule of test results:

- **Zs at distribution boards other than at origin**
- **Prospective fault current**
- **Nominal voltage**

State the effect on insulation resistance of an installation if:

a. additional circuits are added

b. circuits were disconnected/removed

c. the length of a 6A lighting circuit was extended

a. insulation resistance decreases

b. insulation resistance increases

c. insulation resistance decreases

In the formula Zs = Uo/Ia what is represented by:

- **Uo**
- **Ia**
- **Zs**

Uo voltage to earth for TN systems

Ia current causing operation of overcurrent device

Zs impedance measured in ohms at the point in the circuit, which is furthest most the origin of the supply

Given that Zs = Uo/I, rearrange the formula in order to determine Ip

Ip = Uo/Zs

Where:

Ip = prospective fault current

Uo = voltage measured to earth

Zs = impedance

The maximum tabulated value of impedance Zs, for a particular circuit is 3.43Ω.. The circuit cables are 70°C general purpose p.v.c. insulated copper conductor (factor 1.2) and Ze = 0.4Ω: If the measured value of impedance at 20°C is 3.0Ω determine whether this value is acceptable.

Resume' Max permitted Zs = 3.43Ω
Ze = 0.4Ω, Factor 1.2, measured impedance 20°C = 3.0Ω

Measured Zs = Ze + (R_1 + R_2)

(R_1 + R_2) = Zs - Ze = 3.0Ω - 0.4Ω = 2.6Ω

Then (R_1 + R_2) x 1.2 = 2.66 x 1.2 = 3.12Ω

Therefore total Zs = 0.4 + 3.12 = 3.52Ω

Value exceeds 3.43 - Protection not achieved

State FOUR items of information that are required to be indicated on diagrams, charts etc for use by the inspecting engineer.

- **location of devices for isolation**
- **location of devices for overcurrent**
- **methods used for protection against indirect contact**
- **type and composition of circuits**

State

- why it is necessary to remove one end of a bonding conductor connection when verifying its continuity
- the instrument used to verify continuity
- a typical value of resistance when verifying the continuity of bonding conductors

- **to avoid parallel paths**
- **low-resistance ohmmeter**
- **less than 0.05Ω (50mΩ)**

An electrical contractor undertakes the following work in a small warehouse:

- **replace fifteen high-bay lighting fittings**
- **installation of new air conditioning plant**
- **inspection and test of existing installation.**

State the necessary certification for this installation

- **minor works for high-bay fittings**
- **installation certificate for new air conditioning plant**
- **periodic inspection certificate for existing installation.**

For the previous question construct a detailed circuit diagram showing one of the high-bay lighting units under phase to earth fault conditions. The earthing arrangement is TN-C-S.

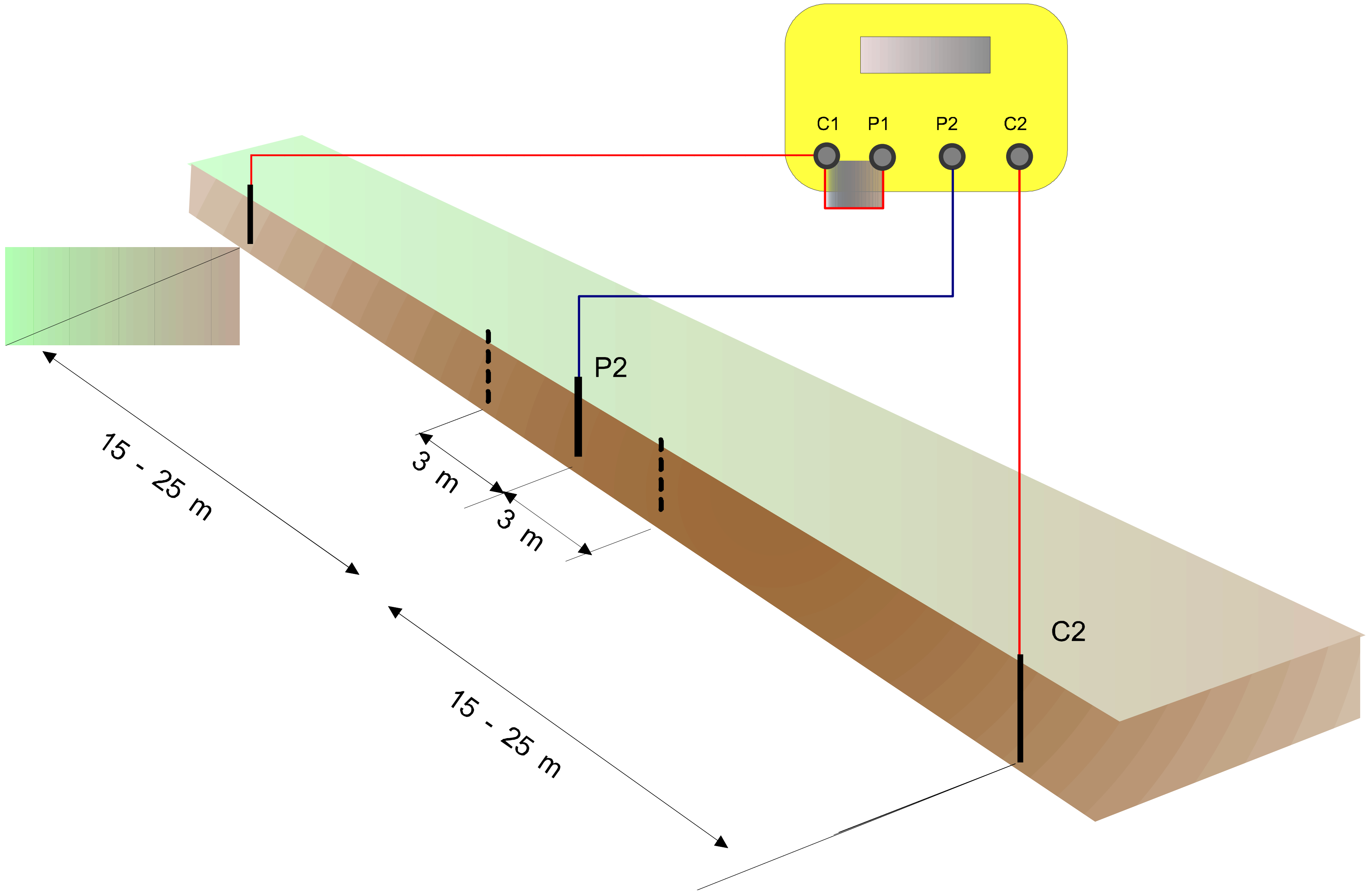
No I ain't bloodywell doing it for yer!!!!

State FOUR external influences that you would need to consider during the inspection process

- corrosion (corrosive atmospheres)
- mechanical damage
- vandalism
- extremes of temperature
- ingress of moisture or water
- extremes of temperature
- explosive atmospheres

Construct a labelled diagram showing how a proprietary earth electrode tester would be connected to verify the resistance of an earth electrode.

Earth electrode test



Why is it necessary to verify the continuity of c.p.c.'s prior to undertaking:

- **polarity checks**
- **insulation resistance checks**
- **r.c.d. tests**
- **impedance tests**

- **Method 1 relies on verifying polarity when undertaking test (uses c.p.c.)**
- **break or open- circuited c.p.c. resulting in incomplete insulation test**
- **Z/r.c.d. testing relies on c.p.c. for earth test. Danger of shock voltages - o/c c.p.c.**

State THREE measurements you would normally undertake at the origin of an installation with regards to the characteristics of the supply

- **external impedance Ze**
- **prospective short circuit current**
- **prospective earth fault current**

State ONE additional test that may be required when verifying the continuity of ferrous enclosures which form the sole c.p.c. for a circuit

- **High current test**
- **25A a.c. - open circuit voltage not greater than 50V**

State why a factor 1.2 is applied to (R1+R2) when determining the total value of phase and c.p.c. conductor resistance of a final circuit.

- **To allow for increase in resistance with temperature rise.**
- **Allows for increase in resistance from 20° to 70°C**

State the possible outcomes if the factor of 1.2 was not applied to (R1+R2)

- **Under phase to earth fault conditions the the final value of impedance Zs may be greater than those tabulated in Tables 41**
- **Extended disconnection time resulting in the possibility of shock and or fire**

State FIVE items of technical information that are required to be completed on an installation or periodic inspection and test report

- **external impedance Ze**
- **prospective fault current**
- **earthing arrangements**
- **maximum demand**
- **rating of overcurrent device at the origin of the installation**

- **State the reason for undertaking a continuity test on the phase and c.p.c. conductors of a ring final circuit .**

- **to ensure that each ring is complete without interconnections**

- **State TWO other tests automatically carried out when undertaking the above**

- **polarity/(R_1+R_2)**

State four prerequisite checks that need to be applied prior to undertaking an insulation resistance test.

- **verify supply is isolated**
- **disconnect any voltage sensitive equipment**
- **all current using equipment disconnected**
- **all local switches closed**

State THREE areas within a construction site which are not subject to Part 6 of BS 7671.

- toilets
- mess rooms
- site offices

State THREE types of installation that would be subject to Part 6 of BS 7671

- **construction sites**
- **swimming pools**
- **hot air saunas**

State at which point within an installation and between which conductors would the following tests be made:

- **external loop impedance Ze**
- **prospective short circuit current**
- **prospective earth fault current**

- **all tests made at the origin**
- **Ze between phase & earth (bonds off)**
- **Ip between phase and neutral**
- **If between phase & earth (bonds on)**

State the danger that may arise if earth fault loop impedance tests are undertaken prior to verifying the continuity of the c.p.c.

possibility of shock from exposed and extraneous conductive parts

State the name of each of the following conductors, which:

- **connect exposed to extraneous conductive parts**
- **connects the consumers main earthing terminal to the incoming sheath of a TN-S system**
- **connects between the main earthing terminal and earth block of the c.c.u.**

- **equipotential bonding conductor**
- **earthing conductor**
- **circuit protective conductor c.p.c.**

Describe how you would carry out a phase earth loop impedance test on a fluorescent lighting circuit containing ten luminaires.

- ensure continuity of c.p.c.'s verified
- inspect test instrument/leads for signs of damage
- ensure instruments are within calibration
- erect warning signs/barriers
- isolate supply to motor, remove terminal cover connect impedance tester to motor terminal and earth terminal
- energies supply and take impedance test twice and compare results
- isolate supply and remove test leads. Replace cover

State SEVEN methods of protection against direct contact:

- **insulation of live parts**
- **barriers**
- **enclosures**
- **placing out of reach**
- **obstacles**
- **limitation of discharge energy**
- **SELV**

State SIX methods of protection against indirect shock protection:

- **EEBADOS**
- **earth-free local equipotential bonding**
- **Class II installation**
- **non-conducting location**
- **limitation of discharge energy**
- **SELV**

Name the THREE electrodes used when employing a proprietary tester to measure the resistance of a rod-type electrode:

- **main electrode under test**
- **potential electrode (temporary)**
- **current electrode (temporary)**

State the necessary test to be applied to a piece of equipment which has site applied insulation:

- **apply 3750 volt a.c.**
- **test voltage to be applied for 60sec**
- **flashover/insulation breakdown**
- **should not occur during test period**

When measured end to end the value of for each of the three rings of an A1 ring circuit are as follows:

phase ring 0.5Ω
neutral ring 0.73Ω
c.p.c ring 0.83Ω
Determine the value of $R_1 + R_2$ for this circuit

Which reading appears to be incorrect?

- **Add phase and c.p.c. resistance together.**

$0.5\Omega + 0.83\Omega = 1.33\Omega$

therefore $1.33/4 = 0.332\Omega$

- **Neutral has abnormally high resistance**
- **Outline method of verification**

State in the correct sequence the first FIVE tests to be undertaken during a periodic inspection and test:

- **continuity of protective conductors**
- **polarity**
- **earth fault loop impedance**
- **insulation**
- **functional**