

C&G I&T 2391

Introduction



Requirements

- The 2391 is an extension of the 2382 (IEE Wiring Regulations). As such, previous knowledge and experience is assumed.
- C&G recommends that you are broadly familiar with the use of test instruments and appropriate tests. This is not a programme to teach you a use of instrumentation or to introduce you from scratch to testing techniques.
- A high degree of self development and study is a requirement of the programme. A wide range of supportive texts exist in order to assist you in this study

Supportive Texts

- BS7671 2008 – Essential
- GN3 – Essential
- OSG – Desirable
- Others - Helpful

Review of Some Key Reg Points

- Purpose of Earthing Systems?
- Types of Earthing Systems?
- ADS
- Basic Protection & Fault protection
- (IP Ratings)
- Disconnection Times
- Earth Fault loop Impedance (Z_s & Z_e)

Earthing Systems

- P.32-34 of BS7671
- P.15-16 of OSG
- See Table 54.7 (P.130) BS7671:2008
- See Table 54.8 (P.134) BS7671:2008

Purpose

- In the event of a fault the earthing system shall provide a low impedance path to the source of supply.
- Such a path must produce high fault currents and disconnection times in line with the requirements of BS7671.

The 4 Earths

- With reference to p.32 of BS7671:2008 we can identify four earthing conductors.
- C.P.C.
- Main Equipotential Bonding Conductor
- Earthing Conductor
- Supplementary Equipotential Bonding Conductors

Circuit Protective Conductor (C.P.C)

- This is the protective conductor applied to each final circuit in the installation.
- It has a c.s.a related to the the size of the live conductors, although in some cases a reduced c.s.a may be applied.
- It is intended to connect exposed conductive parts of equipment to the main earthing terminal.

Main Equipotential Bonding

- Maintains exposed and extraneous conductive parts at the same potential by common connection to earth.
- It's size is related to the neutral of the supply conductor. (See Table 54.8 p.134 BS7671). Also 544 p.134 BS7671.

Earthing Conductor

- Connects the main earth terminal of an installation to an earth electrode or other means of earthing.
- It's size is related to the phase of the supply conductor. (See Table 54.7 p.132 BS7671).

Supplementary Bonding Conductors

- A protective conductor which links two exposed conductive parts or an exposed and extraneous conductive part.
- The required size is identified in 544.2 p.135 BS7671:2008.

ADS

- Automatic Disconnection of Supply.
- Discuss

Basic Protection

- Protection Against Includes:
 - Protection by SELV
 - Protection by insulation of live parts
 - Protection by barrier or enclosure
 - Protection by obstacles
 - Protection by placing out of reach.
 - Supplementary protection via use of RCD

IP Ratings

- See Handout

Fault Protection

- Protection against fault contact includes:
 - Protection by SELV
 - Protection by ADS
 - Protection by Class II equipment
 - Protection by Non-Conducting Location
 - Protection by Earth free local equipotential bonding
 - Protection by electrical separation

Disconnection Times

- BS7671 makes recommendations regarding the maximum time in which circuits must disconnect in the event of a fault.
- See 411 p.45 BS7671:2008 & Table 41.1 p.46
- Particular note should also be paid to 411.3.2.6.
- Also 411.3.3

Disconnection Times cont'd

- Values of Z_s related to protective devices can be found in Chapter 4 (P.48-49) BS7671 and values of fault current for protective devices to cause appropriate disconnection can be found in BS7671 appendix 3 (P.243).

Earth Fault Loop Path

- This is an extremely important concept which is often a requirement of the examination.
- It is related to the type of earthing system and may be broken down into 2 areas.
- One area external to the installation (Z_e) and one area internal to the installation ($R_1 + R_2$).
- The tutor will draw the earth fault loop path for a T-T system.

Earth Fault Loop Path

- Draw your own earth fault loop paths for:
 - a TN-S system
 - a TNC-S system.
- Note $Z_s = (Z_e + (R_1 + R_2))$

Quoted values of Z_e

- Although Z_e for each of the systems can be measured supply authorities may also be consulted for values.
- In answering they will generally quote the figures presented in the OSG:
 - TN-S 0.8Ω
 - TN-C-S 0.35Ω
 - T-T 21Ω