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Fire Protection – Have you specified the right type of RCD?

Government statistics indicate that changes to Fire Safety Regulations and associated regulations e. g. IEE Regs Ch. 42, have resulted in a reduction in the number of fires (circa 32,000 in 2001/02 to 20,000 2009/10 in non-domestic buildings).

Electrical fires can be caused by relatively low values of earth leakage current[1], a few hundred milliamps depending on location and surrounding conditions if not interrupted quickly, can produce ignition.

Keeping earth leakage currents within safe limits with the demands for increased comfort (HVAC), back up for IT systems (UPS), improved EMC (harmonic filters) and surge protection (Type 1 & 2 devices), all add to the complexity of designing a secure electrical supply - ref IEE Regs 314 , whilst retaining electrical safety.

Areas associated with the Public and Non Technical Staff which include electrical supplies with complex loads i.e. HVAC, Lighting, illumination level control, IT systems with UPS back up (Olympic stadiums would make a classic case study for designers), are particularly difficult to deal with safely. This requires a clear understanding of the associated risks, removal or reduction of the risk through other means, supported by the appropriate safety case and documentation. Where part of safety case (risk reduction) for the installation relies on automatic disconnection of the supply using RCDs, circuits containing power electronics e.g. Inverters and UPS, need to be segregated from circuits containing AC or Type A RCCBs and protected by their own Type B RCCB[2] – reference EN 50178 & IEE Wiring Regs. Ch 33.

Ref Documents:

IEE Regs Chapter 33 - Compatibility 331.1 (vii) earth leakage current & (ix) d.c. feedback (xi) necessity for additional connections to Earth

EN50178 / Fig 9 *Division of circuits in installations with electronic equipment.*

Basic requirements for the division of electrical circuits containing power electronics (b)- capable of producing DC residual currents under fault conditions from circuits containing A type type RCD's (a)- AC or pulsating DC fault currents.

Effective earth bonding/meshing required to reduce the risk of dc fault currents being transmitted from b) to a)

The reason; equipment containing power electronics can under certain conditions, produce DC fault currents within the AC network, which will interfere with the operation of afore mentioned devices.

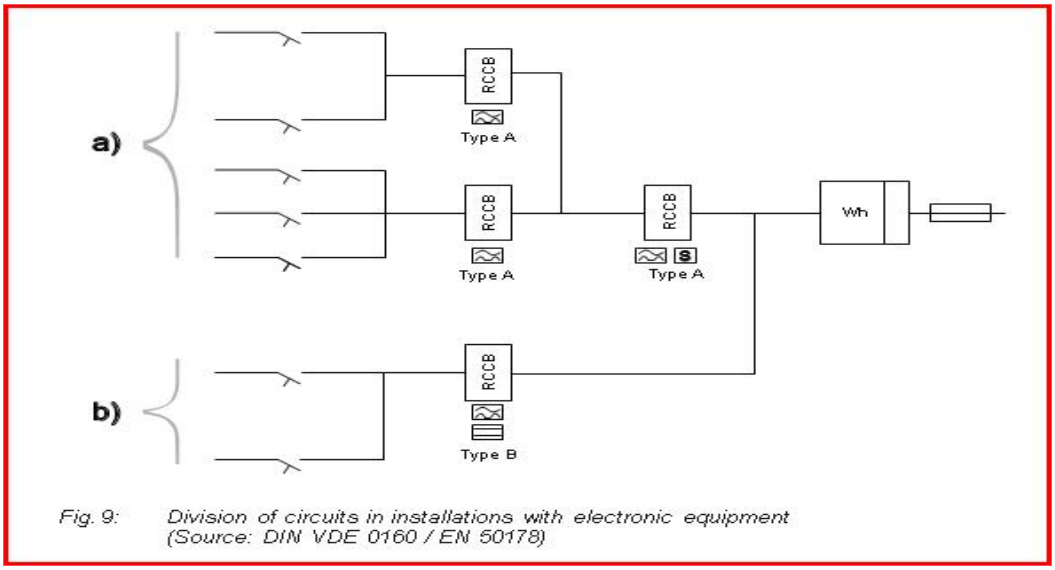

Fig. 9: Division of circuits in installations with electronic equipment (Source: DIN VDE 0160 / EN 50178)

Type B RCCBs are designed to sense DC earth leakage currents as well as high frequency AC leakage currents, which are also generated as a result of PWM and the associated filters (required to meet EMC regulations)– especially within lower cost solutions.

From a design and specification point of view these leakage currents can be significant across the complete frequency spectrum. If we take an inverter as an example to select the RCCB protection, there has to be a clear understanding of the leakage current characteristics across the frequency range of the inverter output; leakage current at 50Hz, maximum leakage current plus the frequency that it is generated at, leakage current at the maximum frequency – your inverter manufacturer has this information as it is required for their EMC test validation. This information will enable the specification and selection of appropriate protective devices, and reduce the risk of so called "nuisance trips"[3] i.e. the RCD is probably doing what it was designed to do!

If you would like more detailed information relating to this subject, Doepke UK have a free 60 page Technical Application guide available on request or information on Type B, A or AC RCCBs

www.doepke.co.uk/rcd/rcdR.html

1: Earth leakage – A natural phenomena normally associated with small values of current flowing/ tracking to earth from a live cable or appliance. These values are additive within an installation.

2: AC and Type A RCCBs rely on the change in the magnetising effect of AC current for the trip coil. DC current flowing in the circuit saturates the trip coil reducing the sensitivity or preventing tripping completely. Type B RCCBs have additional sensing circuits, designed to detect dc earth leakage currents.

3: The term "nuisance trip" is often applied when there is a lack of understanding about what is actually happening within the electrical installation: For some additional reading on this subject see www.marcspages.co.uk

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