Topic: Switchboard Connections

1. Is it essential to mark a neutral link with the word 'Neutral' when it is installed on a switchboard? Give the AS/NZS 3000 Clause number.

2.9.5.3 *Bars and links*

Bars and links shall be identified to indicate whether they are active, neutral or earth.

Exception: Bars and links need not be identified at switchboards where the colour of the basic insulation of the conductors connected is visible and clearly indicates the nature of the bar or link.

Typical Answer - Yes. AS/NZS 3000:2007 Clause 2.9.5.3 WAER 6.7

2. A single domestic installation has a meter panel and consumer's switchboard located at the front of the house in a metal enclosure. No earth links are used. What is the minimum permissible size of the bonding conductor between the neutral link and the metal enclosure if the associated unprotected consumer's mains are 16 square mm cable?

5.5.3.5 *Unprotected consumers mains*

Exposed conductive parts associated with consumers mains not provided with short-circuit protection on the supply side shall be earthed by a conductor with a current-carrying capacity not less than that of the main neutral conductor.

This conductor shall be connected to—

(a) the main neutral conductor or bar; or

(b) the main earthing terminal/connection or bar, in which case, in accordance with Clause 5.3.5.2, the cross-sectional area of the MEN connection shall be not less than that of the main neutral conductor.

Typical Answer - 16 square mm. AS/NZS 3000 Clause 5.5.3.5.

3. Does the local supply authority allow a main switchboard in a domestic installation to be inside the house, separate from the meter panel enclosure at the front of the building?

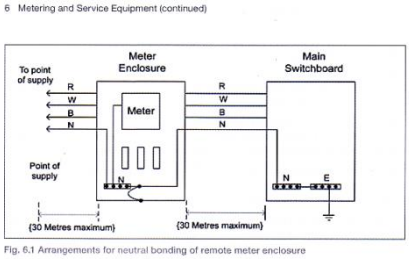


Fig. 6.1 Arrangements for neutral bonding of remote meter enclosure

Typical Answer - Yes. WAER Section 6

4. What is the minimum height for a main switchboard installed in a single domestic installation? Give the AS/NZS 3000 Clause number.

Typical Answer - 1.2 metres. AS/NZS 3000 Clause 2.9.2.5(a)

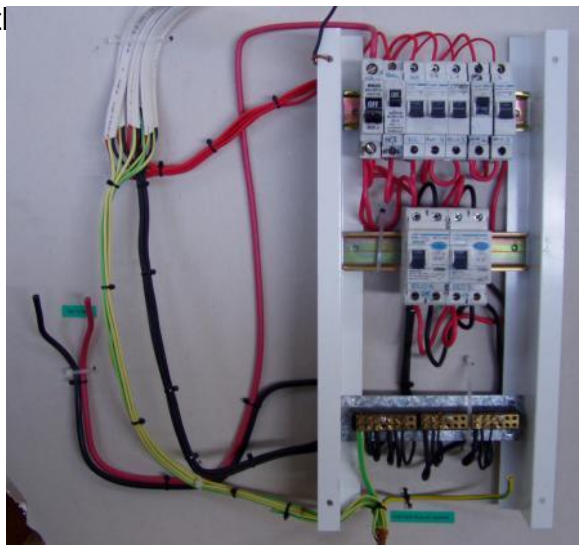
5. Is it permissible to terminate more than one circuit neutral in one of the terminals in a neutral link? Give the AS/NZS 3000 Clause number.

Typical Answer - No, a separate terminal is required for each outgoing circuit originating at the switchboard. AS/NZS 3000 Clause 2.9.4.3 (d)

NB: Sometimes circuits have more than one conductor at their origin. If conductors belong to the same circuit they must be in the same terminal.

Also worth noting is that WAER 6.7 states Neutral links must have a separate terminal for each conductor, this refers to Metering and Service equipment only.

6. What is the only permissible colour of the conductor which connects the neutral link to the metal enclosure in a domestic installation where the meter panel and main switchboard are in t



Typical Answer - Green/Yellow. AS/NZS 3000 Clause 3.8.1 Table 3.4.

7. Under what conditions is it necessary to legibly mark the connection for the main earthing conductor and the main neutral conductor at a neutral link in an MEN installation?

2.9.5.4 *Terminals of switchboard equipment*

Terminals of bars, links, circuit-breakers, fuses and other electrical equipment mounted on a switchboard shall be marked or arranged to identify the corresponding active and neutral connection for each circuit.

The terminals for the connection of the MEN connection and for the main neutral conductor shall be legibly and indelibly marked at the main neutral bar or link.

Exception: This marking is not necessary where—

1 *the MEN connection is made at a terminal at one extremity of the bar or link; and*

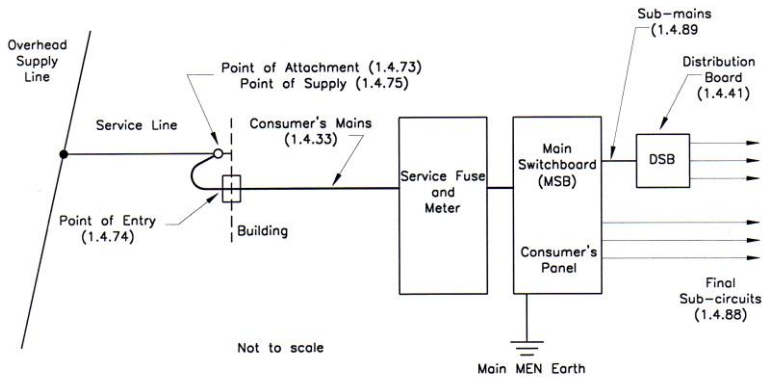
2 *the main neutral conductor is connected to the next adjacent terminal of the bar or link.*

Typical Answer - When the earthing conductor is at one extremity of the link and the neutral is connected adjacent to it. AS/NZS 3000 Clause 2.9.5.4

8. All outlet and lighting circuits in a new domestic installation must be protected by residual current devices. What is the exception according to the Wiring Rules?

Typical Answer - No exceptions. AS/NZS 3000 Clause 2.6.3.1.

9. What is the minimum permissible current carrying capacity of the consumer's mains in a single phase single domestic installation?



Typical Answer - 63 amps. WAER:2008 Clause 12.2

10. What is the minimum permissible current carrying capacity of the consumer's mains in a three phase single domestic installation?

Typical Answer - 32 amps. WAER:2008 Clause 12.2

11. What are the names of the three general types of earthing systems? Which type is the one recognised by AS/NZS 3000?

Typical Answer - a. Direct earthing system; Multiple Earthed Neutral system; ELCB
b. The MEN system.

12. Is it necessary to earth metallic boxes which form part of a wiring system if they are isolated from all other conductive material (other than metal which is earthed), and in no part accessible to personal contact?

Typical Answer - No. AS/NZS 3000 Clause 5.4.1.1 1.4.53

13. Is it permissible to install bare MIMS cable without earthing the copper sheathing?

Typical Answer - No. AS/NZS 3000 Clause 5.5.3.2(b)

14. Is it permissible to install a socket-outlet without connecting an earth wire to the earthing contact in the outlet?

Typical Answer - No. AS/NZS 3000 Clause 5.4.2.

15. Is it permissible to install an all insulated luminaire (such as an insulated batten holder) indoors without providing an earthing conductor at the lighting point?

Typical Answer -. No. AS/NZS 3000 Clause 5.4.3.

16. An aluminium luminaire is to be installed outdoors on a wooden pole, 3 metres from the nearest earthed metal. Does the Wiring Rules require the exposed metal casing of the luminaire to be earthed?

Typical Answer - No. AS/NZS 3000 Clause 5.4.3

17. Is it necessary to earth accessible metal parts of low voltage equipment if the accessible metal is separated from live parts by double insulation?

Typical Answer - No. AS/NZS 3000 Clause 5.4.1.1(i)

18. What is the internationally recognised symbol which means 'Double insulated - Do not earth'?

Typical Answer - One square inside another.

19. What precaution must be taken to prevent an internal conductor from coming into contact with accessible metal if it becomes detached from its terminal in a double insulated appliance?

Typical Answer - It must be protected, secured or insulated so that it (or its single insulation) cannot come in contact with accessible metal. Clause AS/NZS 3000 5.4.1.1.

20. Is it necessary to earth exposed metal in a 32 volt portable hand-lamp?

Typical Answer - No. AS/NZS 3000 Clause 5.4.1.1

21. Is it permissible to loop a MAIN earthing conductor into a luminaire to avoid having to run another earthing conductor to the luminaire?

Typical Answer - No. AS/NZS 3000 Clause 5.5.1.1

22. Is it permissible to connect a subsidiary earthing conductor to a main earthing conductor using a soldered tee joint?

Typical Answer - Yes. AS/NZS 3000 Clause 5.5.2.1(b) and 3.7.2

23. Is it permissible to earth equipment by connecting exposed metal to an earthing conductor which is being used to earth equipment supplied from another distribution board?

Typical Answer - No. AS/NZS 3000 clause 5.5.2.1(c)

24. What is the minimum permissible size of a single insulated TPI copper main earthing conductor?

Typical Answer - The minimum permissible size of main earthing conductor is 4 square mm AS/NZS 3000 Clause 5.3.3.2

25. A steel wire armoured (SWA) cable is installed in such a way that the armouring is required to be earthed. At which point in the installation must the armouring be earthed?

Typical Answer - It must be earthed at the end adjacent to the switchboard or at which the cable originates. AS/NZS 3000 Clause 5.5.3.2(b)

26. What limitation is placed on the use of metal conduit as the protective earthing conductor for cables which are contained in the conduit?

Typical Answer - The metallic enclosure and associated fittings must be electrically and mechanically continuous. AS/NZS 3000 Clause 5.5.4.2

27. A metal conduit is installed in such a way that it is required to be earthed. At which point in the installation must it be earthed?

Typical Answer - It must be earthed at the end adjacent to the switchboard or accessory at which the conduit originates. AS/NZS 3000 Clause 5.5.3.2(a)

28. How must a hinged door of a metallic electrical cubicle be earthed?

Typical Answer - By connecting a flexible conductor between the fixed component of the cubicle and the door. AS/NZS 3000 Clause 5.3.2.3(c)(ii)(B)

29. The exposed metal of electrical equipment on a wheeled overhead gantry crane is required to be earthed. Can metal-to-metal contact between the wheels and the rail be regarded as an effective connection for the purposes of earthing?

Typical Answer - Yes. AS/NZS 3000 Clause 5.3.2.3(c)(iii)

30. A particular electric motor is to be fixed in position using four bolts with nuts. Is it permissible to use one of the fixing bolts as the earthing terminal?

Typical Answer - No. AS/NZS 3000 Clause 5.5.6.2

31. What is the maximum permissible resistance of a main earthing conductor in a 415 volt three phase installation?

Typical Answer - The maximum permissible resistance of an earthing system is 0.5 ohms. AS/NZS 3000 Clause 5.4.6.3 and 8.3.5.2

32. What is the minimum permissible size of copper MAIN earthing conductor if the active conductor in the associated consumer's mains is 16 square mm?

Typical Answer - 6 square mm. AS/NZS 3000 Table 5.1

33. What is the minimum permissible size of single core TPI cable (building wire) which can be used an earthing conductor?

Typical Answer - 2.5 square mm. AS/NZS 3000 Clause 5.3.3.4(a)

34. In general, how must a clamped joint be made in copper earthing conductors up to 4 square mm?

Typical Answer - Secured to prevent spreading. AS/NZS 3000 Clause 3.7.2.5

35. What is the minimum permissible diameter of a copper-coated mild steel driven earthing electrode?

Typical Answer - 12 mm AS/NZS 3000 Table 5.2.

36. Is it permissible to use rigid metallic conduit as a driven earth electrode?

Typical Answer - No. AS/NZS 3000 Clause 5.3.6.2 Table 5.2

37. In general, where must a driven earth electrode be located?

Typical Answer - Exposed to the weather; outside the building; separated f rom metallic enclosures of other buried surfaces. AS/NZS 3000 Clause 5.3.6.4(a)

38. To what minimum depth must a driven earth electrode be driven?

Typical Answer - 1.2 metres. AS/NZS 3000 Clause 5.3.6.3(a)

39. What is the general meaning of the term 'equipotential bonding'?

Typical Answer - The electrical connection of non-electrical metallic piping to the main earth in an installation. AS/NZS 3000 Clause 1.4.52 and 5.6

40. What action must be taken if exposed metal of wiring enclosures is in unavoidable contact with metallic piping of other systems such as fire sprinklers, gas or hot water?

Typical Answer - The metallic parts must be connected using an equipotential bonding conductor. AS/NZS 3000 Clause 5.6.2.3

41. What is the minimum permissible size of copper equipotential bonding conductor?

Typical Answer - 4 square mm. AS/NZS 3000 Clause 5.6.3.2

42. Any situation which is external to a building and within .....?..... of exposed earthed metal is deemed to be an earthed situation. (Give the Wiring Rules Clause or Table Number)

Typical Answer - 2.5 AS/NZS 3000 Clause 1.4.44

43. What is the purpose of an equipotential bond in an installation?
To minimise the risk associated with voltage differences between accessible metal parts.

Typical Answer - AS/NZS 3000 Clause 5.6.1.

44. What are two requirements f or an effective earth joint?

Typical Answer - Joints must be mechanically and electrically sound. AS/NZS 3000 Clause 3.7.1

45. Is it necessary to earth the metal frame of a domestic installation?

Typical Answer - Yes. AS/NZS 3000 Clause 5.4.6.2.

46. What are two general types of earthing conductor which need not be insulated?

Typical Answer - Aerials; braided conductors; busbars; MIMS sheaths; catenarys. AS/NZS 3000 Clause 5.3.2.4.

47. What is the main reason why single insulated 240 volt equipment must be earthed?

Typical Answer - To provide a mechanism for automatically disconnecting the supply in the case of a short circuit to earth.

48. What is the only permissible colour for an insulated earthing conductor? (Give the Wiring

Typical Answer - Green/yellow. AS/NZS 3000 Table 3.4

49. What is the MAXIMUM permissible resistance of a main earthing conductor?

Typical Answer - 0.5 ohms. AS/NZS 3000 Clause 5.5.1.4

50. A 2.5 mm^2 final sub-circuit in a 240 volt domestic installation supplies a load consisting of 10 A, 2x socket outlets and is protected by a 16 A Type C circuit breaker. The internal fault-loop impedance, measured at the furthermost socket outlet is 1.99 ohms. Does this value ofinternal fault-loop impedance satisfy the requirements of AS/NZS 3000.

Typical Answer - No. 1.99 O is too high. AS/NZS 3000 Tables 8.1 an 8.2