

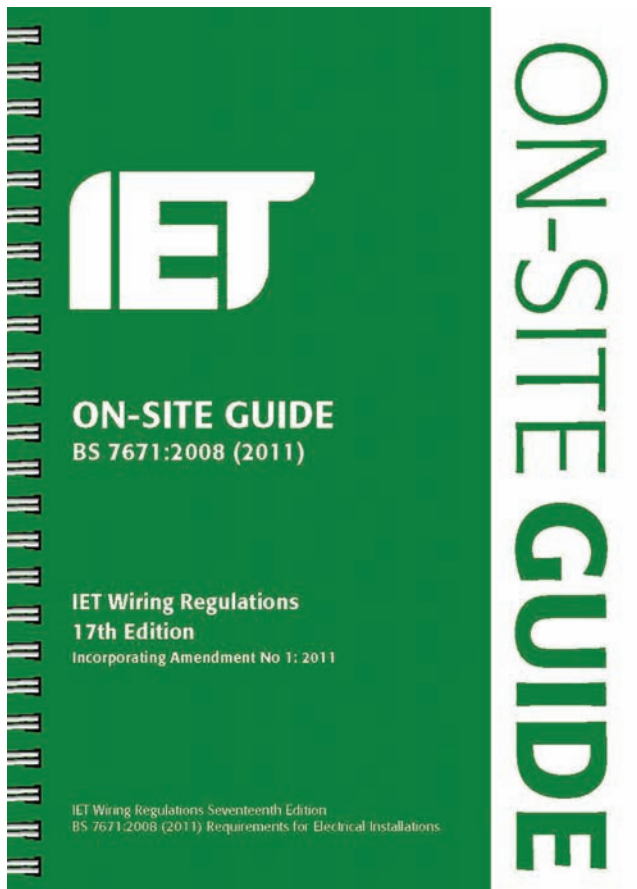
# Operation of portable generators



By Mark Coles



This article looks at the temporary use of portable generators in floating, earthed and reference-earthing scenarios.



**A new version of the On-Site Guide is in preparation**

BS 7671:2008(2011), the First Amendment to the 17th Edition of the IET Wiring Regulations, is due for publication on 1 July 2011. Accordingly, the IET's On-Site Guide is currently being aligned with the amended regulations, which itself, is due for publication in October 2011.

The On-Site Guide is intended to enable competent electrical installers to deal with smaller installations up to 100 A, single- or three-phase. The guide includes simple circuit calculations and provides essential information in a convenient, easy-to-use form, avoiding the need for detailed calculations.

One of the many new topics covered within the planned

On-Site Guide is portable generators.

**Types of generators for temporary use**

It is often necessary to temporarily supply electrical equipment or electrical installations with a generator where the mains or usual supply is unavailable.

There is a difference between generators used for short periods, for example, for up to one day and those used for longer time scales. The main consideration when using generators temporarily is how the temporary system will be earthed. From this viewpoint, two classes of temporary generators emerge, i.e. portable generators and mobile generators. ►

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- portable generators with an electrical output rating of up to 10 kVA are used for small scale work for short term use, i.e. less than one day; and
- mobile generators are those used for longer periods and can be in excess of 10 kVA.

**Portable generators**

Portable generators will be used in the following situations:

- use on a construction site;
- used to supply stalls on street markets;
- external gathering or function attended by the

general public, such as a country show.

Three scenarios will be considered:

- portable generator used with a floating earth;
- portable generator used

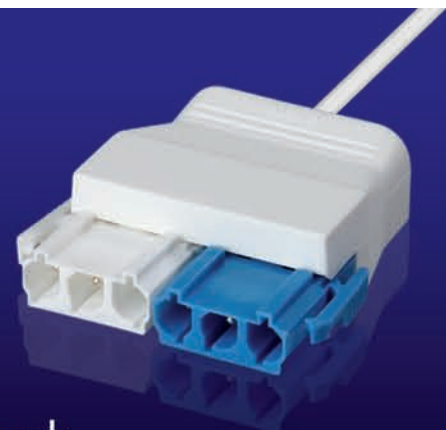
without reference to the general mass of the earth;

- portable generator referenced to the general mass of the earth.

For permanent use of generators see The IET's Guidance Note 5 and Section 551 of BS 7671:2008(2011).

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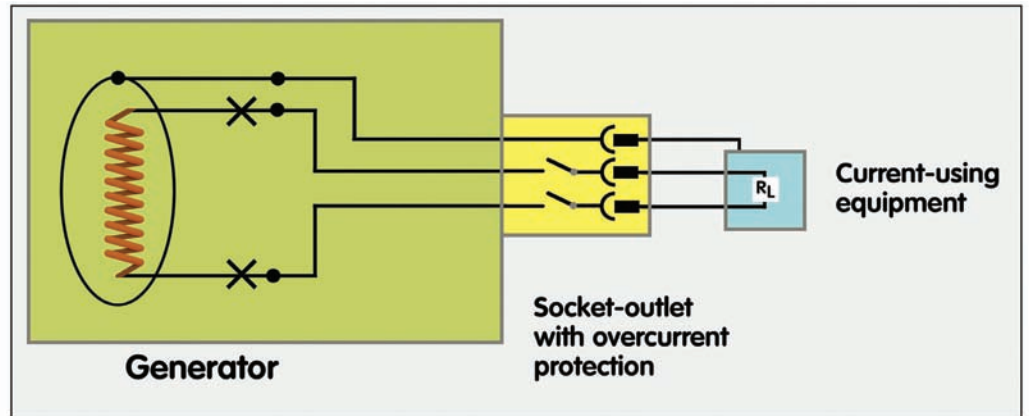
Where generators are used to supply concession vehicles, such as burger vans, see Section 717 Mobile and Transportable Units of BS 7671:2008(2011) and Guidance Note 7.

**Portable generator with floating earth**

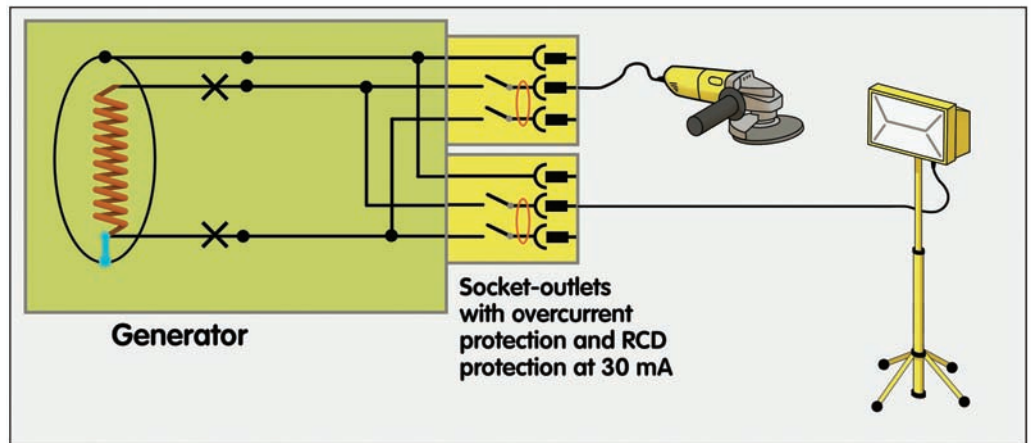
Small portable generators, ranging in output from 0.3 kVA to 10 kVA single-phase often have a floating earth, i.e. there is no connection between the chassis and/or earth connection of the socket-outlet of the unit to the neutral of the generator winding. The ends of the generator winding are brought out to one or more three-pin socket-outlets which should conform to BS EN 60309-2. The earth socket-tube of the socket-outlet(s) are usually connected internally to the frame of the generator only.

This arrangement is a form of electrical separation, where basic protection is provided by basic insulation of live parts and fault protection is provided by simple separation of the separated circuit from other circuits and from Earth.

The requirements for electrical separation can be found in Section 413 of BS 7671 where one item of equipment is supplied and Regulation Group 418.3 where more than



**Fig 2: Portable generator with floating output – no connection from winding to chassis or earth socket-tube of the socket-outlet**



**Fig 3: Generator supplying more than one item of equipment**

one item of equipment is supplied.

It is extremely important to note that the portable generator should only be used to supply equipment in the following permutations:

- one or more items of Class II equipment;
- one item of Class I

equipment;

- one or more items of Class II and one item of Class I equipment.

“The use of only Class II equipment, however, is preferable.”

More than one item of Class I equipment should not be used

simultaneously as faults can be presented as voltages and operatives can provide a path for current flowing between exposed-conductive-parts of faulty electrical equipment.

**Portable generator used without reference to the general mass of the earth**

Where more than one item ▶





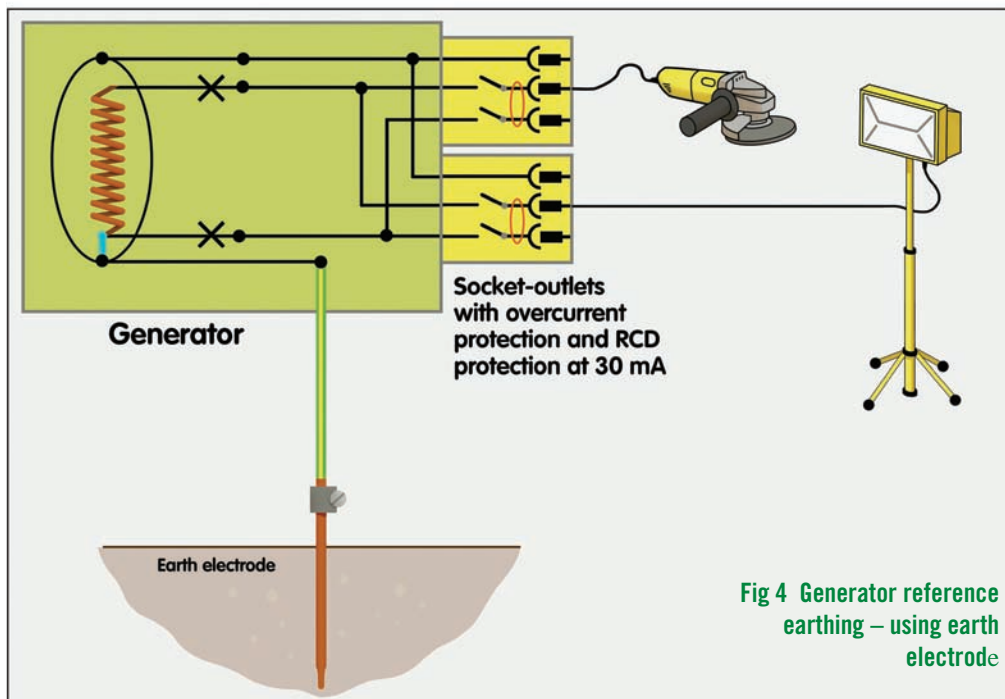
◀ of Class I equipment is to be supplied by a single-phase portable generator, it is important to ensure that the earth connections of the socket-outlets at the generator are connected to the neutral of

the generator winding in addition to the chassis or frame of the generator.

RCD protection at 30 mA is required for all circuits supplied in this manner.

Such a configuration will provide a return path for any fault current caused by contact between live parts and exposed-conductive-parts of the connected equipment.

If this method of supply is used, extreme care should be taken to ensure that there is no intended or casual interconnection with any other electrical systems, such as, extraneous-conductive-parts or exposed-conductive-parts from other electrical systems.



**Fig 4 Generator reference earthing – using earth electrode**

**Portable generator referenced to the general mass of the earth**

Where there are extraneous-conductive-parts or exposed-conductive-parts from other electrical systems present, generator reference earthing by means of an earth-electrode to the general mass of earth, should be installed.

Note that this does not create a TT arrangement; the supply will be TN-S from the generator but the neutral or star point will be referenced to the general mass of Earth.

Where an earth electrode is supplied it will need to be ►



◀ tested by the standard method using a proprietary earth electrode resistance tester. Note that an earth-fault loop impedance tester cannot be used for this test as the earth electrode is not used as a means of earthing it used to reference the portable generator to the general mass of the Earth. As the earth-electrode is used for referencing and not as a means of earthing, the resistance should, ideally, be less than 200 Ω.

If buried, generator reference earthing and/ or bonding conductors should be sized in accordance with Table 54.1 and suitably protected in accordance with Regulation

543.3.1.

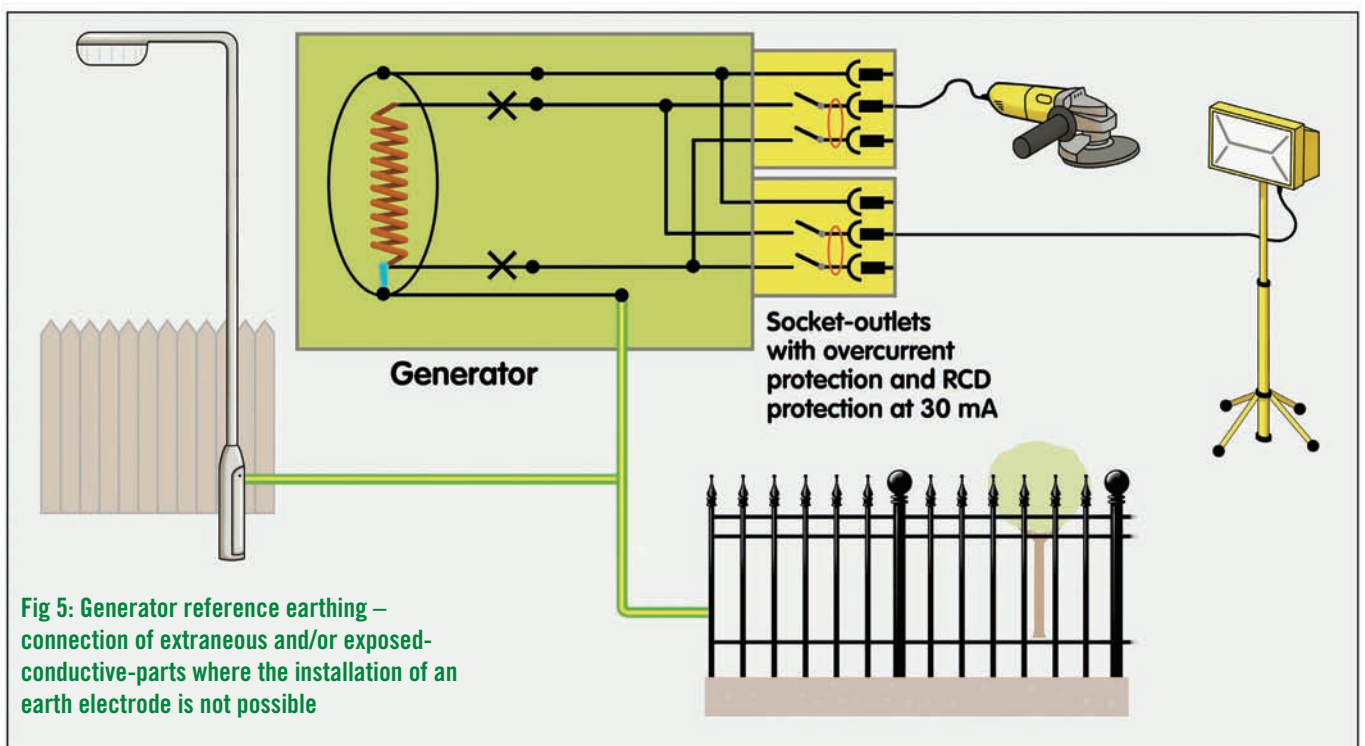
Where restrictions, such as concreted/paved areas or the portable generator is being used some distance above ground level, make it impossible to install an earth electrode, simultaneously accessible metal parts, i.e. accessible extraneous-conductive-parts or exposed-

conductive-parts from other electrical systems, may be bonded to the main earthing terminal of the generator; see below.

Where separate accessible extraneous-conductive-parts or exposed-conductive-parts from other electrical systems are connected together, protective conductors can be sized in accordance with Regulation 544.1.1.

**Further discussion**

Care must be taken to ensure



**Fig 5: Generator reference earthing – connection of extraneous and/or exposed-conductive-parts where the installation of an earth electrode is not possible**

that the generator and the cables connected to it are used and installed safely. It is extremely important to ensure that all equipment is inspected before each use.

Where items of equipment supplied from different generators are used in close proximity then the main earthing terminals of the generators should be interconnected; this method may be in addition to the scenarios shown in figs 4 and 5.

Where required, warning signs related to the presence or use of electricity should be provided, particularly where members of the public are present. All signs are expected to confirm to the Health and

Safety (Safety Signs and Signals) Regulations and BS 5499-11:2002 (AMD 16783)

Possible weather conditions should be taken into account when planning the operation of a portable generator. Some thought must also be given to the positioning of distribution units, plug and socket connectors, for example and cable runs should not be placed in a gutter, gully or depression serving as a drain or elsewhere that might fill with water.

It is important to emphasise that generators must be used in accordance with the manufacturers' instructions. Where generators are hired from plant-hire companies, it is

the responsibility of the plant-hire company to provide the hirer with information regarding the safe use of their equipment. Under no circumstances should hirers attempt to change the internal electrical connections of hired equipment.

Where doubt exists as to the internal earthing connections of the generator, a continuity test between neutral and earth socket-tubes at the socket-outlet can be undertaken; a very low reading, i.e. less than 0.1  $\Omega$ , would indicate that it is not a generator with floating earth. ■

#### Further reading

- IET Guidance Note 3 - Inspection and Testing
- IET Guidance Note 7 -

#### Special Locations

- BS 7909:2008(+A1) Code of Practice for temporary electrical systems for entertainment and related purposes
- Health and Safety Executive document OC 482/2, Electrical Safety of Independent Low-Voltage AC Portable and Mobile Generators and Connected Systems.
- BS 7375:2010 Code of Practice for distribution of electricity on construction and building sites
- BS 7430:1998 Code of Practice for Earthing.

#### Thanks:

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