

# OSHA FactSheet

## Grounding Requirements for Portable Generators

Portable generators are internal combustion engines used to generate electricity. They are useful when temporary or remote power is needed, and are commonly used during cleanup and recovery efforts following disasters.

### Major Causes of Injuries and Fatalities

- Shocks and electrocution to users from improper use.
- **Shocks and electrocution to utility workers from improper connection to structures, such as residences, offices, shops and trailers.**

### Safe Work Practices

- Maintain and operate portable generators in accordance with the manufacturer's use and safety instructions.
- Never attach a portable generator directly to the electrical system of a structure (home, office or trailer) unless the generator has a properly installed open-transition transfer switch.
- Always plug electrical appliances and tools directly into the generator, using the appliance manufacturer's supplied cords. Use heavy-duty extension cords that contain a grounding conductor (3-wire flexible cord and 3-pronged cord connectors).
- Proper grounding and bonding are a means to prevent shocks and electrocutions.
- Use ground-fault circuit interrupters (GFCIs) as per the manufacturer's instructions.
- **Do not connect a generator to a structure unless the generator has a properly installed transfer switch.**
- Visually inspect the equipment before use; remove defective equipment from service; mark or tag it as unsafe for use.

### Grounding Requirements for Portable and Vehicle-mounted Generators

Under the following conditions, OSHA directs (29 CFR 1926.404(f)(3)(i)) that the

frame of a portable generator need not be grounded (connected to earth) and that the frame may serve as the ground (in place of the earth):

- The generator supplies only equipment mounted on the generator and/or cord- and plug-connected equipment through receptacles mounted on the generator, § 1926.404(f)(3)(i)(A), and
- The noncurrent-carrying metal parts of equipment (such as the fuel tank, the internal combustion engine, and the generator's housing) are bonded to the generator frame, and the equipment grounding conductor terminals (of the power receptacles that are a part of [mounted on] the generator) are bonded to the generator frame, § 1926.404(f)(3)(i)(B).

Thus, rather than connect to a grounding electrode system, such as a driven ground rod, the generator's frame replaces the grounding electrode.

If these conditions do not exist, then a grounding electrode, such as a ground rod, is required.

If the portable generator is providing electric power to a structure by connection via a transfer switch to a structure (home, office, shop, trailer, or similar) it must be connected to a grounding electrode system, such as a driven ground rod. The transfer switch must be approved for the use and installed in accordance with the manufacturer's installation instructions by a qualified electrician.

Grounding requirements for generators connected via transfer switches are covered by Article 250 of the National Electrical Code (NEC).

#### Safe Work Practices for Portable Tools include:

- Do not use underrated cords—replace them with appropriately rated cords that use heavier gauge wires.
- Never use electrical tools or appliances with frayed cords, missing grounding prongs, or damaged or cracked housings.
- Use double-insulated tools and equipment distinctively marked as such, where possible.
- Use battery-operated tools, where possible.

#### Verification by Testing

The integrity of the connection between the generator's frame and the equipment grounding terminals of power receptacles is important to the safe use of the equipment. The connection may be confirmed via testing by a competent electrician with the correct

equipment. The ohmic resistance should measure near zero and must not be intermittent, which indicates a loose connection.

#### Bonding Versus Grounding

Bonding and grounding are separate requirements for generators and other electrical distribution systems. Grounding means the connection, or the establishment of a connection, of an electric circuit or equipment to reference ground, which includes the generator's frame. Bonding is the intentional connection between the grounded circuit conductor (neutral) and the grounding means for the generator, which includes the generator's frame. Thus, effective bonding of the neutral conductor to the generator's frame is also a concern for the safe use of the equipment. As with grounding terminal connections, proper bonding of the neutral terminal of a power receptacle may be confirmed via testing by a competent electrician with the correct equipment, and the ohmic resistance should measure near zero and must not be intermittent, which indicates a loose connection.

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(800) 321-OSHA

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