Grounding Portable Electric Tools

Fatal electrical shocks are often caused by the breakdown of wiring insulation inside electrical hand tools. This insulation is necessary to keep the current-carrying wires from touching the metal frame of the electrical tool. A fatal shock hazard can also exist if an energized wire becomes disconnected inside the tool or, in some cases, if water or other electrically-conductive liquid enters the tool. In all cases, these hazards can be virtually eliminated through grounding of the exposed metal parts of the hand tools or by using portable tools protected by an approved system of double insulation.

Purchased electric hand tools will, almost without exception, be protected by double insulation or a built-in ground wire. With the latter, the grounding wire is part of the electrical cord which terminates in a 3-prong plug. Such plugs are designed for use with 3-hole receptacles installed as part of the permanent electrical system.

The grounding plugs and receptacles are arranged to make it impossible to mismatch the current-carrying conductors with the ground conductor. If the plug and receptacle were not so arranged, the grounding circuit could be accidentally energized, and electrical current would enter the frame of the tool.

Tools equipped with a grounding 3-wire cord and 3-prong plug should be checked regularly to determine continuity of the grounding circuit. Electrical test current must flow between the grounding prong on the plug and the frame of the hand tool. If it does not, the ground circuit is "open" - affording no protection to the user - and repairs are necessary to restore continuity before the tool is used.

The grounding receptacles should also be checked to make sure the electrical resistance between the grounded opening of the receptacle and the electrical system ground is within specifications. When grounding to a water supply pipe, the ground circuit resistance should not exceed three ohms. For an artificial ground, the resistance should not exceed 25 ohms.

Ground circuit resistance should be measured when the receptacles are installed and periodically thereafter. If the results of the resistance check show a significant change in readings from previous tests, or if the resistance exceeds the maximum specified, repairs must be conducted to ensure safe operation.

Whenever tools are not provided with a built-in grounding or a double insulation system, a separate ground wire can be installed. This is, however, recommended only when such tools cannot be replaced with grounded or double-insulated tools. In addition, the installation of a separate ground wire must be approved by the local authority having jurisdiction for enforcing the National Electrical Code.

The separate grounding wire should be at least 18 gauge flexible wire. It must be firmly connected to the frame of the tool and, at the opposite end, connected to a suitable ground with an alligator clip or permanently attached clamp. To facilitate using the tool with the additional wire, the grounding conductor can be taped to the power cord. To avoid strain on the wire, it should be at least one inch longer than the power cord.

An acceptable ground would be a water pipe, the plant grounding system, or other low resistance ground connection. As stated above, this method must be approved by the authority having jurisdiction to enforce the electrical code. An independent ground wire will be satisfactory only if adequate electrical and firm mechanical connections are made on the tool frame and to a positive, low resistance grounding medium.

For additional information on grounding of electrical hand tools, see the National Electrical Code, Article 250, as amended.