MIOSHA Fact Sheet

Electrical Shock Hazards

How does electrical shock injure someone?

Body contact with an electric power source can result in burns, systemic shock, neurological damage, and ventricular fibrillation in the heart. Electricity always follows the shortest circuit and path of least resistance. If a human body provides that path, electricity will flow to ground or complete a circuit through the body.

Death caused by electrical shock is referred to as electrocution. Fatal electrical shocks can even happen to people who should know better or have worked a long time with electrical equipment and become over-confident. People have been killed by 120 volts AC in the home and with as little as 42 volts DC because sufficient current is generated at these low voltages to cause injury. The minimum current a human can feel is thought to be about 1 milliampere (mA). Currents approaching 100 mA may be lethal.

What are some common reasons people suffer electric shock injuries or fatalities?

- Body contact with overhead power lines
- Faulty insulation
- Improper grounding of equipment
- Loose connections or defective parts
- Ground faults in equipment
- Unguarded live (electric) parts
- Failure to de-energize electrical equipment when it is being repaired or inspected
- Use of defective and/or unsafe tools
- Use of tools or equipment too close to energized parts resulting in arc flash

What is arc flash?

Arc flash is a short circuit through air that flashes over from one exposed live conductor to another conductor or to ground. An arc blast is the pressure wave. Arc flash can cause serious burns or electrocution. According to the National Fire Protection Association Standard, (NFPA) 70E-2004, most burn hospital admissions due to electrical accidents are from arc flash burns, not from electrical shock. A report compiled by Capelli-Schellpfeffer, Inc., estimates that 5 to 10 arc flash explosions happen in the USA every day, resulting in 1 to 2 deaths per day. Common causes include: (1) coming close to a high-amp source with a conductive tool or body part; (2) dropping a tool or otherwise causing a short circuit; (3) equipment failure due to use of substandard parts, improper installation, or even normal wear and tear; (4) breaks or gaps in insulation; or (5) dust, corrosion, or other impurities on the surface of the conductor.

What methods can be used to protect people from electric shock hazards?

These include: providing personal protective equipment (PPE); modifying the design and configuration of electrical equipment; or maintaining a safe distance from the electrical equipment. The best way to eliminate the chance of any electrical shock hazard, including arc flash, is to de-energize electrical equipment when interacting with it, i.e. locking out the power source prior to working on energized equipment.

Who is exposed to electrical hazards in a workplace?

Electrically powered equipment is pervasive in the workplace, therefore exposure to electrical hazards can occur from the operation or maintenance of equipment. Employees who are in occupations that face a risk of electric shock must be trained.

There are generally two types of employees: the qualified person and the unqualified person. A qualified person is defined as one who is permitted

to work on or near exposed energized parts. Qualified persons are usually engineers, electricians, and other professionals who work directly with electricity or live parts, including working on overhead lines, cable harnesses, and circuit assemblies. Unqualified persons are those employees who also may reasonably be expected to face a comparable risk of injury due to electrical shock or other electrical hazards but are not specifically permitted to work on or near energized parts. These employees are usually machine operators, office workers and sales people and employees who work with electricity indirectly.

Is there a MIOSHA standard that addresses electrical work practices?

Part 40, Electrical Safety-Related Work Practices, covers electric work performed by qualified and unqualified persons. This standard describes training, PPE requirements, and other practices necessary to protect employees, such as lockout procedures or use of specialized equipment.

What are the training requirements for electrical hazards?

Many electrical shock accidents or actual electrocutions occur because employees did not receive adequate training and did not understand the degree of hazard involved with working on or near energized or live electrical parts. Training requirements for qualified persons are different from those for unqualified persons.

Only qualified persons may directly work on parts of an electric circuit or equipment that has not been de-energized. They must be familiar with the proper use of all of the following:

- Special precautionary techniques.
- Personal protective equipment.
- Insulating and shielding materials.
- Insulating tools.
- Testing equipment.

A qualified person must, at a minimum, be trained in, and familiar with, all of the following:

- The skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment.
- The skills and techniques necessary to determine the nominal voltage of exposed live parts.
- The clearance distances required and the corresponding voltages to which the person will be exposed.

Unqualified persons must be trained in, and familiar with, the safety-related work practices required by MIOSHA rules that relate to their respective job assignments.

Are there other standards that address electrical safety in the workplace?

- Part 39. Design Safety Standards for Electrical Systems.
- Part 86. Electric Power Generation, Generation, and Distribution.

Other industry specific standards may also apply.

How can I get more information?

More information is available from the MIOSHA Consultation Education and Training Division at (517) 284-7720 or online at www.michigan.gov/cet.