

### **Case 77. 28-year-old male roofer was electrocuted while in workshop.**

On October 30, 2004, a 28-year-old male roofer was electrocuted while conducting work activities in the firm's 2<sup>nd</sup> story metal working shop, which had a wooden floor. The owner took his son (the victim) to work in the morning on the day of the incident to finish fabricating roof vents and vent piping. MIOSHA noted 10 partially completed roof vents on the workbench. There were five sections of vent piping scribed with a marker that were to be cut in half by a cut-off wheel installed on a right angle grinder. The grinder was double insulated and connected to a 16-gauge, 25-foot long SJO extension cord. The cord was spliced, the ground prong was missing, and the extension cord was plugged into the duplex receptacle wall upside down (creating reversed polarity). The extension cord had multiple abrasions and tears in the jacket. The workbench had steel sheets laying on it. Stainless steel sheets standing vertically against a wall were in direct contact with steel sheets laying on the table and sheets lying on the floor. The wood flooring had metal strapping that was part of the original building construction. The wooden floor, on the second story, had grease, oil and dirt ground into the grain. The victim's mother noted that the victim's boots were wet and muddy. It appeared that the victim was attempting to use a hand-held portable electric grinder and suffered an electric shock. The owner returned to the business after someone notified him that the business door was left open. When he arrived, he found the victim on his back, unresponsive. The grinder and extension cord were plugged in and the grinder was on the floor.

Numerous electrical violations of equipment in the area, mainly of ungrounded and reversed polarity of electrical sources were discovered upon the MIOSHA inspection. A master electrician who accompanied the MIOSHA compliance officer measured about 105 volts to ground from the metal strap/table. The master electrician stated that the sidearm disconnect which had four branch feeds to the second story workshop were all ungrounded. He stated that the fuse panels were over-fused with 30-amp fuses and 15-amp fuses should have been used in the panels. He also stated that 14-gauge wiring was used in the main fuse panel. There were no ground fault circuit interruption (GFCI) devices present, and a recommendation was made to install GFCI devices in work areas of the building.

The owner stated that two to three years ago he had a new meter and new siding put on the building. The main fuse panel was not in compliance. MIOSHA did not observe inspection stickers on the meter or main fuse panel. The owner did not know if the contractor obtained a permit.

A master electrician accompanied the MIOSHA inspector and noted the following conditions:

- The ground clamp on the ground rod was a 2-piece type clamp and was visibly loose. The clamp itself was not code rated (1-piece) and was tightened to "finger tight" condition.

- The main service panel located on the interior of the building had several code violations. Several of the branch circuits in the panel were over-fused. 30-amp fuses were installed on circuits rated for 15-amp fuses maximum. The ground bar was not installed properly. It was installed with a screw from the rear of the panel and was loose to the touch. The grounding and bonding performance of the ground bar in the panel was questionable at best.
- Several of the branch circuits emitting from the panel were comprised of ungrounded nonmetallic sheathed cable (romex). Most notably was a 10/3 romex that was used to feed a 30-amp side arm disconnect (subpanel). This side arm disconnect is being used to feed the circuits in the 2<sup>nd</sup> floor workshop where the accident occurred. The four 15 amp branch circuits used to feed the workshop were also over fused with 30-amp fuses. All of the branch circuits originating from this side arm disconnect were ungrounded.
- The grinder being used by the deceased was double insulated and was connected to a 16-gauge outdoor rated extension cord. The cord had several frayed and cut sections, which allowed the conductors to be exposed. While no bare conductors were detected, the cord was a possible safety hazard due to its damaged condition. The male end of the cord had the ground stem removed which allowed the cord to be plugged into the ungrounded duplex outlet incorrectly, allowing the cord to have reverse polarity.
- The examination centered on all possible explanations as to how a possible electrocution could have occurred since the entire room was made of wood and all wiring was ungrounded. After extensive searching, it was determined that the sheet metal on the workbench was grounded. The ground was found to originate from a sheet of stainless steel that was leaning against the back wall of the shop and standing on a pile of sheet metal pieces. The pieces of sheet metal laying on the floor were in contact with a metal strap used in the original construction of the building. The strap in question, when tested, was found to have 105.1 V to ground.
- Please note that the findings have not enabled a determination of exact cause of death, but merely allow the possibility that an electrocution was possible. All conditions existed, including unsafe cords, ungrounded wiring, the absence of GFCI duplexes, and a definite grounded location where the deceased was working.

MIOSHA issued the following citations to the employer:

RECORDING AND REPORTING OF OCCUPATIONAL INJURIES AND ILLNESSES, PART OSH 11, RULE 1139(1).

Report orally, work-related fatalities or hospitalization of 3 or more employees as described in rule 408.22110 within 8 hours to the Michigan Department of Labor and Economic Growth, Michigan Occupational Safety and Health Administration.

Employer failed to report the death to the Michigan Department of Labor and Economic Growth, Michigan Occupational Safety and Health Administration.

FIRE EXITS, PART 6, RULE 632(1).

Prevent blocking means of egress and insure that it be continuously maintained free of all obstructions or impediments to full and instant use.

Fixed industrial stairway to second story blocks egress at exit door, main exit door, workshop area.

DESIGN SAFETY STANDARDS FOR ELECTRICAL SYSTEMS, PART 39, RULE 1910.303(b)(2) ADOPTED BY RULE 3902.

Assure that listed or labeled electrical equipment is installed and used in accordance with any instructions included in the listing or labeling.

Over-fused panels, main and sidearm disconnects had 30 amp fuses instead of 15 amp fuses in workshop areas.

DESIGN SAFETY STANDARDS FOR ELECTRICAL SYSTEMS, PART 39, RULE 1910.304(a)(2) ADOPTED BY RULE 3902.

Prohibit attachment of grounded conductor to any terminal or lead so as to reverse designated polarity.

Reversed polarity, extension cord with a ground prong missing, plugged upside down into ungrounded duplex receptacle, second story workshop.

DESIGN SAFETY STANDARDS FOR ELECTRICAL SYSTEMS, PART 39, RULE 1910.304(f)(4) ADOPTED BY RULE 3902.

Assure that the ground path from circuits, equipment and enclosures is permanent and continuous.

Ungrounded duplex receptacles, second story, workshop.

DESIGN SAFETY STANDARDS FOR ELECTRICAL SYSTEMS, PART 39, RULE 1910.305(g)(2)(iii) ADOPTED BY RULE 3902.

Assure that flexible cords are used only in continuous lengths without splice or tap.

Flexcord spliced, extension cord, second story, workshop area.

ELECTRICAL SAFETY-RELATED WORK PRACTICES, PART 40, RULE 4007(4).

Insure that portable cord and plug connected equipment and flexible cord sets (extension cords) that are defective or have evidence of damage that might expose an employee to injury are removed from service and not used until repaired and tested.

Jacket torn and cut, extension cord, second story workshop.