

M3-EN.3 ELECTRICAL HAZARD

M3-EN.3.1 Electrocutation

M3-EN.3.2 The spectrum of electrical accidents in metal processing

M3-EN.3.3 The effects of electric current on human body

M3-EN.3.4 First aid in case of electrocutation

M3-EN.3.5 Safety in electrical installations

Description of chapter

The specific chapter deals with issues concerning the potential electrical hazard at metal processing workplaces, particularly focusing on electrocutation accidents, the means of preventing electrical hazard, the impact of electric current flowing through human body, first aid measures and general safety guidelines.

M3-EN.3.1 Electrocutation

Electrocutation happens when electric current flows through human body while the latter becomes part of an electrical circuit, which has a voltage capable of overcoming the body's (electrical) resistance. The most crucial factor regarding injury is the quantity of electric current passing through human body.

An electrical accident usually occurs because of a direct (or indirect) contact with a bare wire or another live part of a circuit. On the other hand, in some cases, the approach of human body, especially when holding a conductive object, near a strong electromagnetic field may prove evenly dangerous.

M3-EN.3.2 Range of electrical accidents in metal processing workplaces.

Electrical accidents in metal processing may be classified into three categories:

- Electrical accidents caused by the direct effects of electric current on human body. These accidents include contact with:
 - plugs or sockets connected to eclectic hand tools such as drills, angle grinders, or other supplementary appliances like refrigerators, water boilers, etc
 - cables damaged by overheating due to overload, by exposure to harsh weather conditions (high temperatures, moisture), especially in outdoors installations, cables run over by vehicles on passageways, or even damaged by various rodents (rats, etc)
 - Battery poles found on eclectic vehicles such as fork lift trucks, loading vehicles etc
 - Step down transformers found in power substations. This is the case of industrial installations supplied directly with high voltage from the grid
 - Metal body of machinery like presses, cutting machines and generally all metallic surfaces, which are not properly earthed
 - Any machine due to a fault during maintenance procedure

- Indirect contact and skin burns caused by high thermal load originating from an eclectic arc. These accidents are prone to happen in larger industrial plants or some specific small workshops, mostly in the vicinity of power substations, usually accessed by qualified personnel only
- Minor accidents usually caused by weak (low voltage) currents, which may result for example in slipping or falling due to a panic reaction. This sort of accidents may happen during the replacement of light bulbs, or during various repairs performed in height, such as maintenance of air conditioning units, or fume extractors

M3-EN.3.3 Effects of electric current on human body

It is worth mentioning that the effects of electric current are a function of its intensity (measured in Amperes – A). Currents on the order of 0,9 to 1,2 mA are hardly perceptible. At higher intensities like 10 - 15 mA women can no longer release the live object, thus appearing the “grabbing effect”.

At values as high as 20 to 45 mA, muscles begin to cringe violently and painfully. If this contracture reaches the thoracic muscles, respiration is suppressed, a fact that may lead to death from asphyxiation. In the latter case, the only feasible means of recovery is performing C.P.R. (artificial respiration) to the victim. Current values higher than 200mA = 0,2A usually cause instant death.

M3-EN.3.4 First aid in case of electrocution.

- Move the victim away from the live part of the circuit by means of immediate power cut off, if this does not cause any severe problems (such as a total blackout, or interruption of operation of crucial equipment)
- Avoid any contact whatsoever with the victim using bare hands. In order to move the victim, always use insulating objects
- Never use pipes, gads or any other metal objects, commonly found at metal processing industries. Seek immediate medical attention
- In case the victim does not breath, perform C.P.R and chest compressions

M3-EN.3.5 Safety in electrical installations

In order to work safely in metal processing plants, the following guidelines should be implemented:

- The equipment maintenance should be always conducted by a licensed electrician, especially when heavy electrical load machinery, (heating and metal fusion kilns) is involved
- Where possible reduce operating voltage at 42V, particularly when working inside moist areas, as well as close to cooling water tanks
- Use isolation transformers (transform ratio 1:1), when working outdoors
- Always use well insulated hand tools
- All machinery having metal covers should be properly earthed

- Separation of electric circuits and use of multiple differential circuit breakers (one per circuit) for the effective protection of working personnel
- Switch off power and place appropriate signs and labels before any maintenance work is performed
- Always use explosion proof lighting fixtures wherever electric welding takes place or in areas where paints, solvents and other flammable substances are stored