# SAFE LEVELS OF CURRENT IN THE HUMAN BODY

Death or serious injury is unlikely to occur if current/time values are kept under:
1,000 milliamps for 30 milliseconds (1½ cycles) or 100 milliamps for 3 seconds *

Limiting current flow in the human body to safe levels is entirely dependent on the resistance of the short-circuiting jumper. To achieve this safe current level the voltage across the human body must not exceed 100 volts.

The following calculations apply:

Resistance of jumper $R = \frac{V}{I} = \frac{\text{Voltage across Jumper}}{\text{Fault current}} = \frac{100 \text{ Volts}}{10{,}000 \text{ Amps}} = 10 \text{ mOhms}$

Voltage across person/jumper $V = IR = 10{,}000 \text{ amps} \times 10 \text{ mOhms} = 100 \text{ Volts}$

Current through person $I = \frac{V}{R} = \frac{\text{Voltage across Person}}{\text{Resistance of person}} = \frac{100 \text{ Volts}}{1000 \text{ Ohms}} = 100 \text{ milliamps}$ *

# TABLES FROM I.E.C. 1000-05 AND ET 213:2007

| Current (mA) | Effect | Time Duration |
|---|---|---|
| 0.2 to 1.0 | Threshold of perception | Not critical |
| 10 to 16 | Limit of 'let go', muscles contract | Minutes |
| **30*** | **Breathing difficult, 'safe' limit** | **Seconds** |
| 50 | Irregular heartbeat | 1 heart beat or about 1 second |
| 60 | Respiratory problems, cannot breathe | |
| >60 | Heart fibrillation, electric burns | |

| Magnitude of the Current | Physiological Effects |
|---|---|
| From 0 to 0.5mA | Perception possible (10 secs) |
| From 0.5 to 5mA | Perception and involuntary muscular contractions likely but usually no harmful electrical physiological effects (5 secs) |
| From 5 to 50mA | Strong involuntary muscular contractions. Difficulty in breathing. Reversible disturbances of heart function. Immobilization may occur. Effects increasing with current magnitude. Usually no organic damage to be expected. (2 secs). |
| From 50 to100mA | Patho-physiological effects may occur such as cardiac arrest, breathing arrest, and burns or other cellular damage. Probability of ventricular fibrillation increasing with current magnitude and time up to 1 sec. Above 2 secs probability of ventricular fibrillation is approaching 50%. |

***"IT'S THE VOLTS THAT JOLT BUT IT'S THE MILLS THAT KILL"***

*Dalziel and IS EN 60479