TABLE 33-B

HUMAN RESISTANCE TO ELECTRICAL CURRENT

Body Area	*Resistance (ohms)*
Dry skin	100,000 to 600,000
Wet skin	1,000
Internal body—hand to foot	400 to 600
Ear to ear	(about) 100

flow, it is measured in ohms

LOW VOLTAGE is a rather ambiguous term depending upon whether it is being used by a safety engineer, a plant electrician, or a lineman For the purposes of this chapter, low voltage is 24 to 600 volts, and "safety" low voltage refers to voltages below 24 volts

Electrical Injuries

Current flow is the factor that causes injury in electric shock, that is, the severity of electric shock is determined by the amount of current flow through the victim (Table 33-A) Experimental and field data from authoritative sources (see references for articles written by Charles F Dalziel) indicate that, in general, an alternating current of *100* milliamperes at commercial frequency (60 hz) may be fatal if it passes through the vital organs Similarly, it is estimated that a value of 16 milliamperes is the average current at which an individual can still release himself from an object held by the hand *Such current flow may readily be obtained on contact with low-voltage sources of the ordinary lighting or power circuit*

Because current flow depends on voltage and resistance, these factors are important Other factors affecting the amount of damage done are the parts of the body involved, the duration of current flow through the victim, and the frequency (if alternating current)

Resistance to current flow is mainly to be found in the skin surface Callous or dry skin has a fairly high resistance, but a sharp decrease in resistance takes place when the skin is moist (Table 33-B) Once the skin resistance is broken down, the current flows readily through the blood and body tissues

Whatever protection is offered by skin resistance decreases rapidly with increase in voltage High voltage alternating current of 60 Hz causes violent muscular contraction, often so severe that the victim is thrown clear of the circuit

Although low voltage also results in muscular contraction, the effect is not so violent The fact, however, that low voltage often prevents the victim from freeing himself from the circuit makes exposure to it dangerous

Death or injury by electric shock may result from the following effects of current on the body

1 Contraction of the chest muscles, which may interfere with breathing to such an extent that death will result from asphyxiation when the exposure is prolonged

2 Temporary paralysis of the nerve center, which may result in failure of respiration, a condition which often continues until long after the victim is freed from the circuit

3 Interference with normal rhythm of the heart, causing ventricular fibrillation In this condition the fibers of the heart muscles, instead of contracting in a coordinated manner, contract separately and at different times Blood circulation ceases and death ensues, since apparently the heart cannot spontaneously recover from this condition It has been estimated that 100 milliamperes is sufficient to cause ventricular fibrillation

4 Suspension of heart action by muscular contraction (on contact with heavy current) In this case the heart may resume its normal rhythm when the victim is freed from the circuit

5 Hemorrhages and destruction of tissues, nerves, and muscles from heat due to heavy current

In general, the longer the current flows through the body, the more serious may be the result Considerable current is likely to flow from high-voltage sources, and in gen-