Threshold Limit Values

Static Magnetic Fields

The American Conference of Governmental Industrial Hygienists *(*ACGIH) has developed threshold limit values (TLVs) guidelines for static magnetic field flux densities to which it is believed that nearly all workers may be exposed to day after day repeatedly without experiencing adverse health effects.

The TLVs for a routine (8-hour) occupational exposure from static magnetic fields are listed in Table 1. Workers with implanted ferromagnetic or electronic medical devices should not be exposed to static magnetic fields exceeding 0.5 millitesla (mT).

Table 1.TLVs for Static Magnetic Fields

Exposure	8-hour TWA (Time-Weighted Average)		Ceiling	
Whole body	60 mT	600 G	2 T	20,000 G
Limbs	600 mT	6,000 G	5 T	50,000 G
Medical electronic device wearers			0.5 mT	5 G

G = gauss; T = tesla

Sub-radiofrequency (30 kHz and Below) Magnetic Fields

These TLVs refer to the amplitude of the magnetic flux density (B) of sub-radiofrequency (sub-RF) magnetic fields in the frequency range of 30 kilohertz (kHz) and below that nearly all workers may be exposed to repeatedly without adverse health effects. The magnetic field strengths in these TLVs are root-mean-square values.

Occupational exposures in the extremely low frequency range of 1–300 hertz (Hz) should not exceed the values listed in Table 2.

Table 2. TLVs for Sub-RF (30 kHz and Below) Magnetic Fields

Exposure	Frequency Range	TLV/Ceiling	
Extremely low frequency	1 Hz to 300 Hz	B_{TLV} (mT) = 60/f	
	60 Hz	1 mT	10 G
	30 Hz to 30 kHz	0.2 mT	2 G
	30 kHz at 160 A/m	0.2 mT	2 G
Whole and partial body	300 Hz to 30 kHz	0.2 mT	2 G
Hands and feet	<300 Hz	2 mT	20 G
Arms and legs	<300 Hz	1 mT	10 G
Point contact current	1 Hz to 2.5 kHz	1.0 mA	
	2.5 kHz to 30 kHz	0.4·f mA (f in kHz)	

A/m = amperes per meter; B_{TLV} = magnetic flux density, measured in millitesla (mT); f = frequency, measured in Hz; mA = milliampere

Sub-radiofrequency (30 kHz and Below) and Static Electric Fields

The TLVs listed in Table 3 refer to the maximum unprotected workplace field strength of sub-RF electric fields (30 kHz and below) and static electric fields. They represent conditions on limiting the currents on the body surface and induced internal currents to levels below those that all workers may be exposed to repeatedly without adverse health effects. The electric field intensities in these TLVs are root-mean-square values. The electric field strengths stated in these TLVs refer to the field levels present in air, away from the surfaces of conductors (where spark discharges and contact currents may pose significant hazards).

Table 3. TLVs for Sub-RF (30 kHz and below) and Static Electric Fields

Exposure	Frequency Range	TLV/Ceiling
Whole body and partial body	0 Hz (DC) to 100 Hz	25 kV/m
	100 Hz to 4 kHz	$E_{TLV} = 2.5 \times 10^6/f$
	4 kHz to 30 kHz	625 V/m

E_{TLV} = electric field strength in volts per meter (V/m); kV/m = kilovolts per meter

Field strength greater than approximately 5–7 kV/m can produce a wide range of safety hazards, including startle reactions associated with spark discharges and contact currents from ungrounded conductors within the field. In addition, safety hazard associated with combustion, ignition of flammable materials, and electro-explosive devices may exist when a high-intensity electric field is present. Care should be taken either to remove ungrounded objects or to ground them; in addition, ensure that insulated gloves are worn when handling ungrounded objects. Use protective devices (e.g., suits, gloves, and insulation) in all fields exceeding 15 kV/m.

For workers with cardiac pacemakers, the TLVs may not protect against electromagnetic interference with pacemaker function. Some models of cardiac pacemakers have been shown to be susceptible to interference by power-frequency (50 to 60 Hz) electric fields as low as 2 kV/m. It is recommended that the exposure of pacemaker and medical electronic device wearers be maintained at or below 1 kV/m.