

Approximations for Determining Exposure Time to the Eye

1. Limiting time of inadvertent exposure to visible radiation
 • 250 msec (blink reflex)
2. Limiting time of inadvertent exposure to UV or NIR radiation
 • 10 sec (natural eye motion)
3. Limiting time of exposure for intentional viewing
 • 100 sec (during laser alignment)
4. Limiting time of long-term exposure
 • 28,800 sec or 8 hours

Measurement Values and Units

a : Beam Diameter (cm)

f : Beam Divergence (radians)

Q : Radiant Energy (Joules)

Φ : Radiant Power (Watts)

H : Radiant Exposure (J/cm^2)

E : Irradiance (W/cm^2)

MPE reported in these units

Beam Diameter

Gaussian

$1/e^2$: Contains $\approx 90\%$ of beam's energy

$1/e$: More common among laser manufacturers

$$a(1/e^2) = \sqrt{2} a(1/e)$$

Abn-Gaussian (Top Hat)

Radiant exposure is equal for all points in the diameter of beam

$$E_0 = \frac{4\Phi}{\pi a^2} \quad (\text{Irradiance at laser's exit port})$$

$$H_0 = \frac{E_0}{\text{exposure time (sec)}}$$

