

# Introduction to Laser Cutting

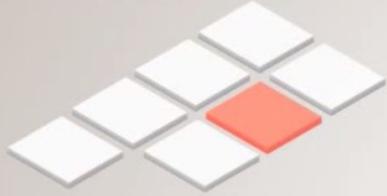
By Daniele Ingrassia

# Laser cutting - technology and machines

Laser cutting is a technology that uses a laser to cut materials by directing the output of a high-power laser, most commonly through optics. The focused laser beam is directed at the material, which then either cuts, melts, burns, vaporizes away, or is blown away by a jet of gas, leaving an edge with a high-quality surface finish.

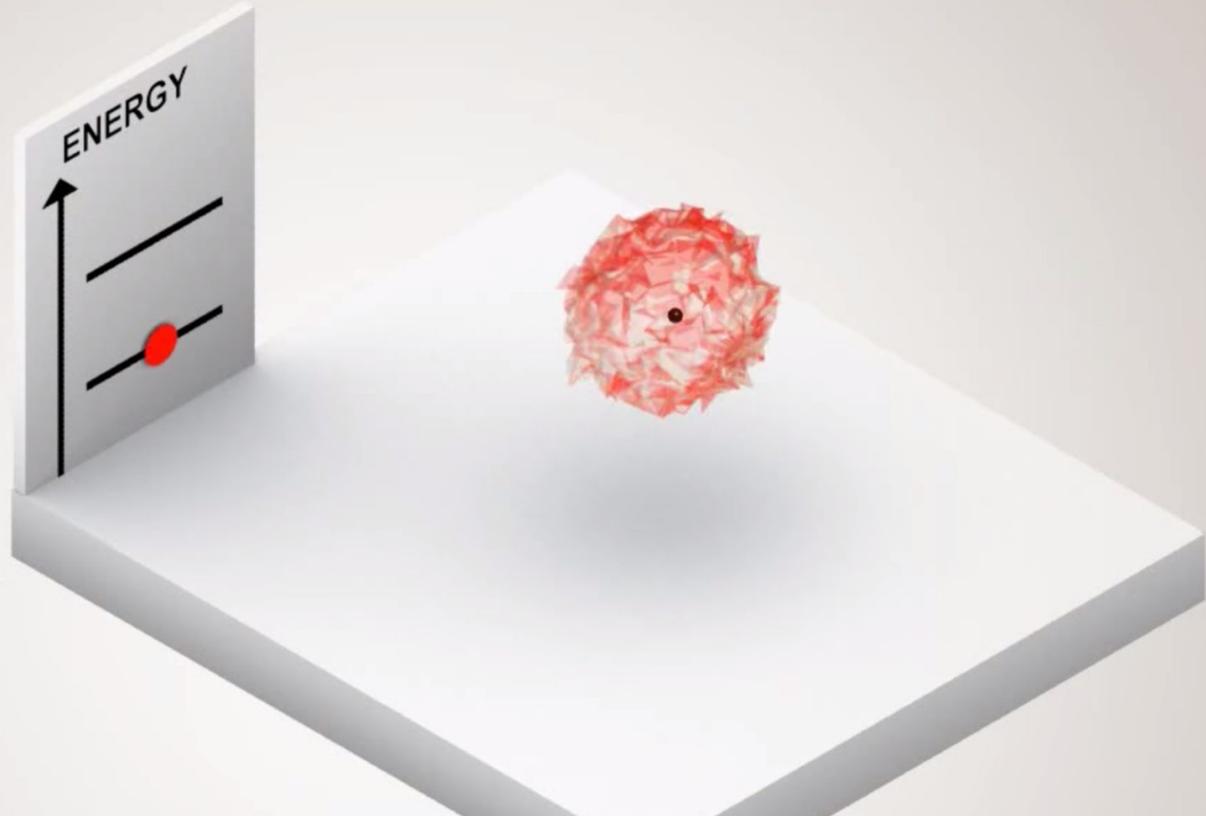


# Laser => Light Amplification by Stimulated Emission of Radiation



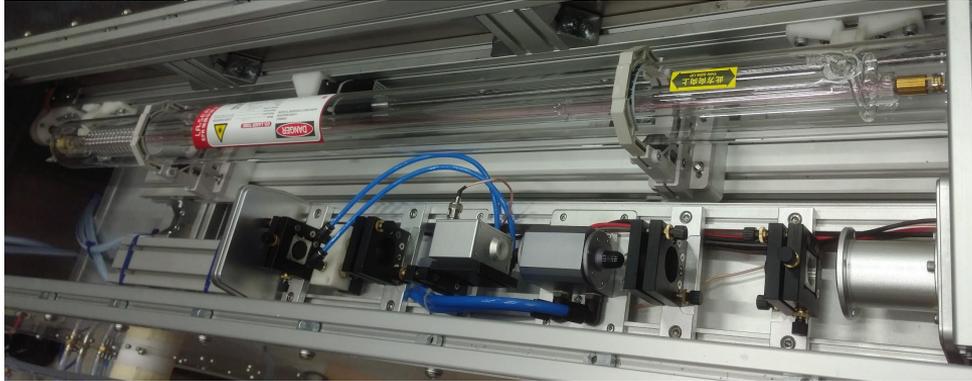
## THE LASER

- ▶ In quantum physics, the energy of an atom displays discontinuous levels. If the atom is excited, its energy suddenly raises to the next level.

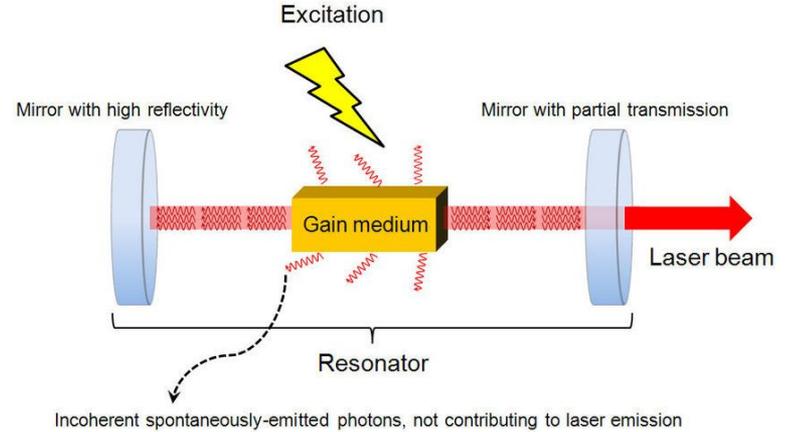


# How Laser is generated

## LaserDuo CO2 and Yag sources



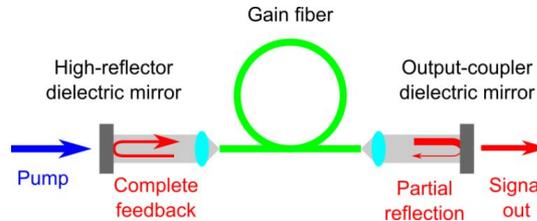
## Pumped Laser



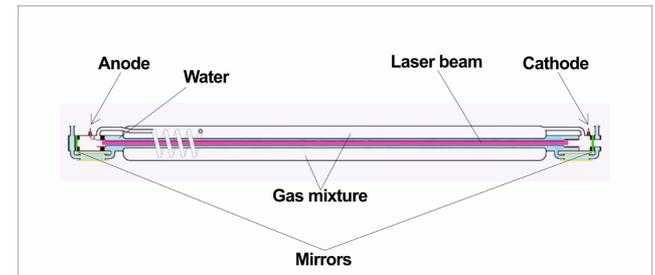
## Neodymium-Doped Yttrium Aluminum Garnet



## Fiber Laser



## CO2 Tube



# Common Laser Types

## Fiber/Yag - 1,064 nm



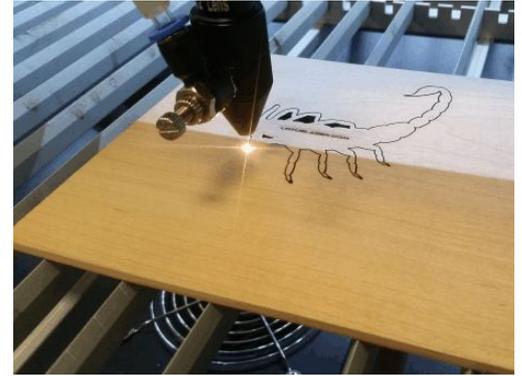
- Materials:
  - Metals
  - Ceramics
  - Silicons

## Laser Diodes



- Materials:
  - Depending on wavelength

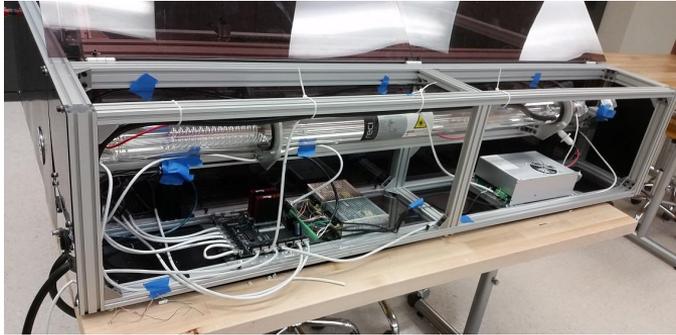
## CO2 - 10,600μm



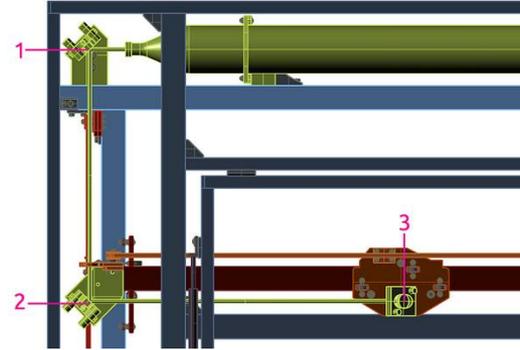
- Materials:
  - Wood
  - Plastics
  - Textiles

# Laser cutter anatomy

## Laser source



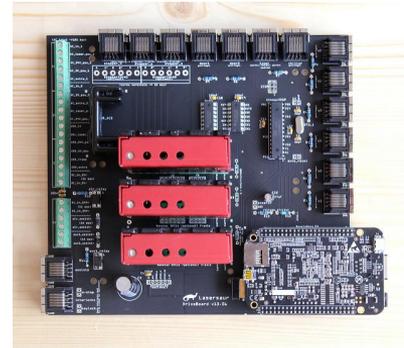
## Optics



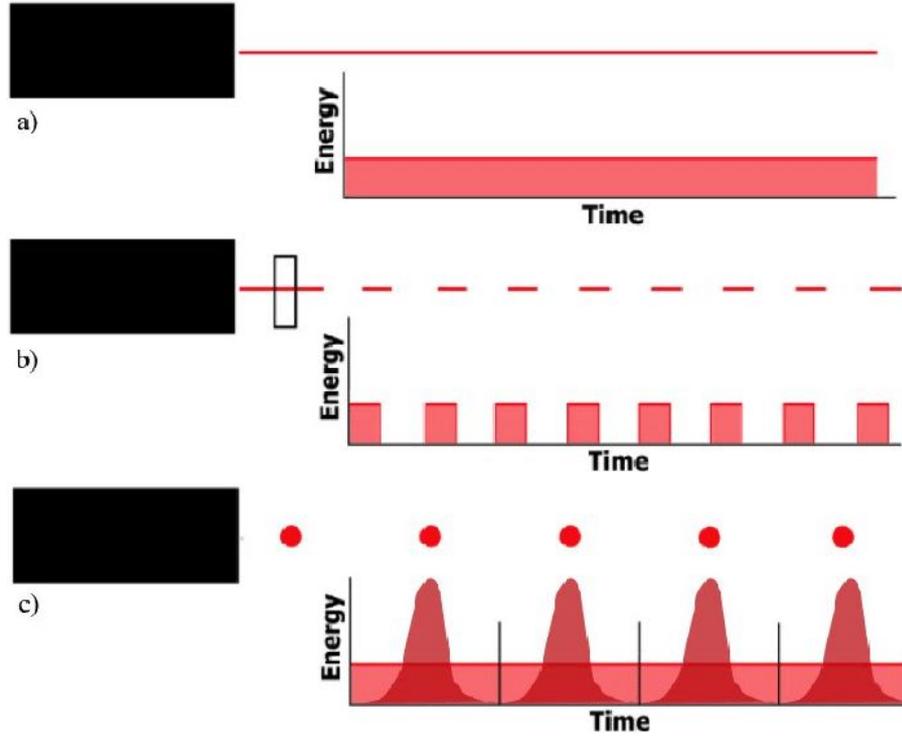
## 3(+) axis CNC



## Controller

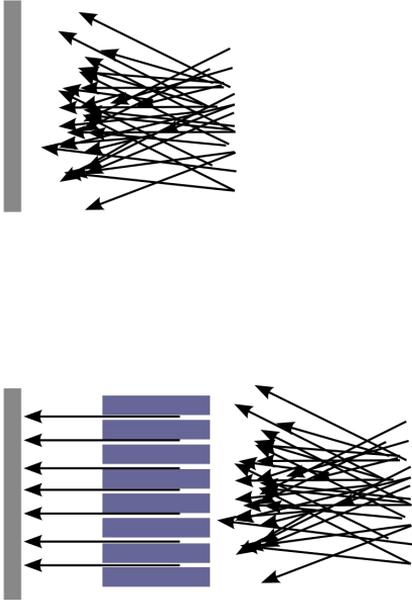


# Continuous wave vs pulsed

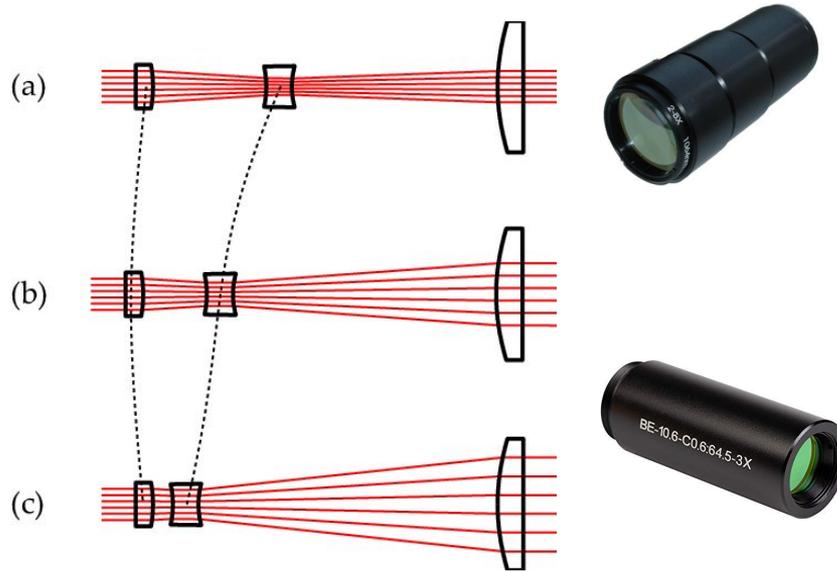


# Beam optics

## Collimator



## Expander/Reducer



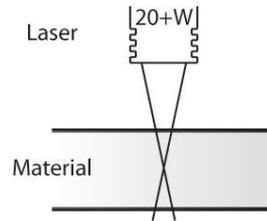
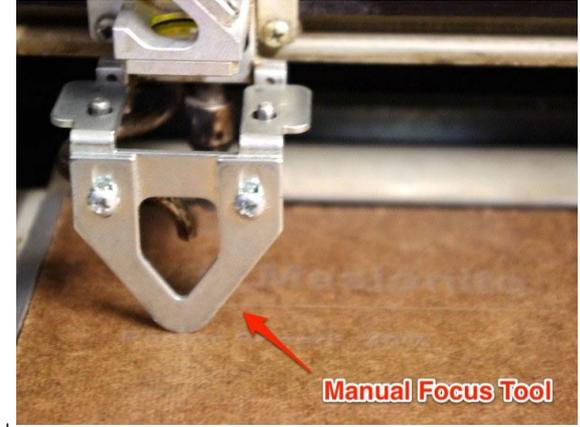
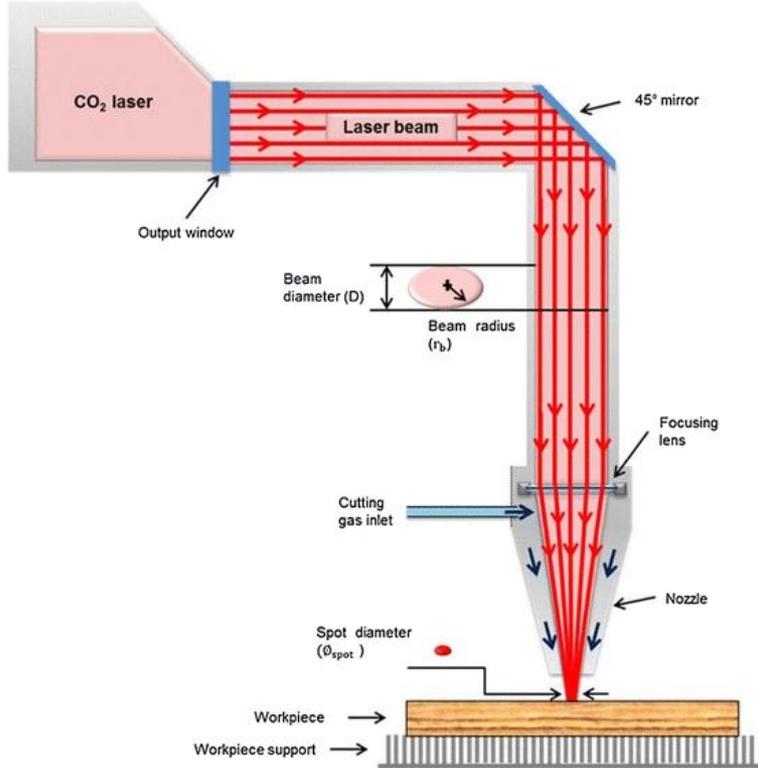
## Mirrors



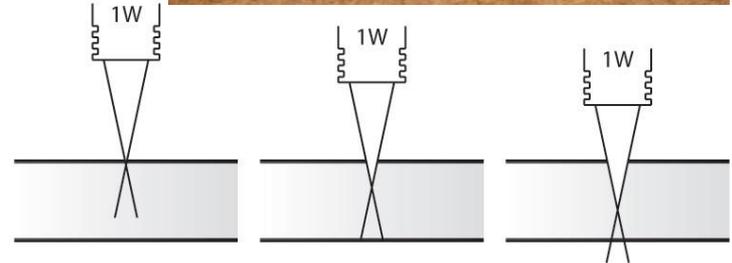
## Lenses



# Laser focus



Fixed-focus

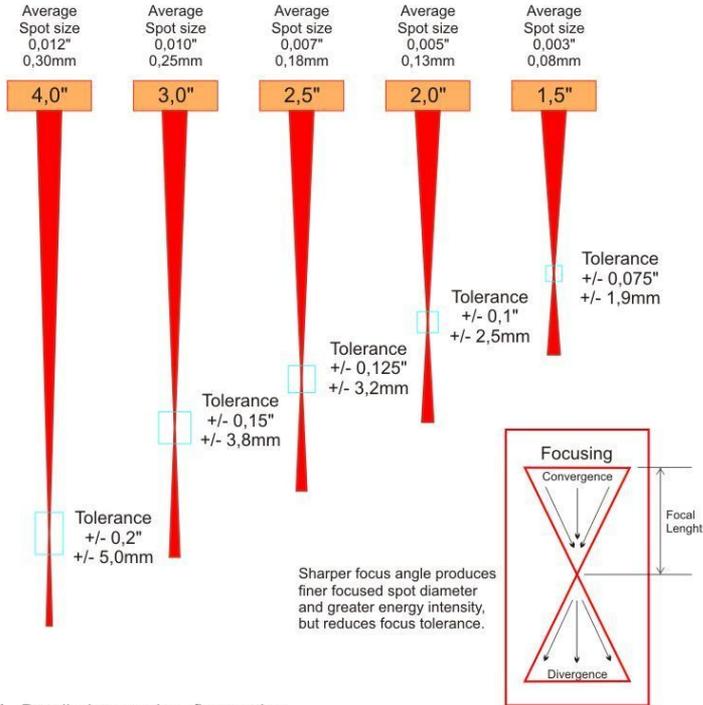


Focus decends for each point along path

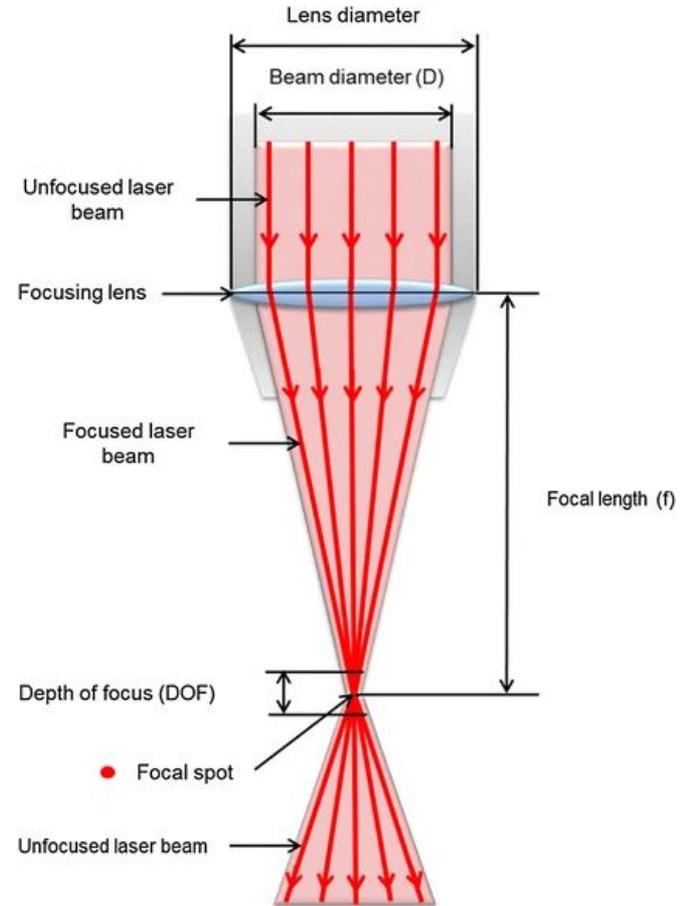
# Focus lenses



## Lense options

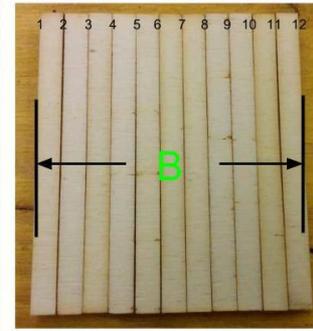
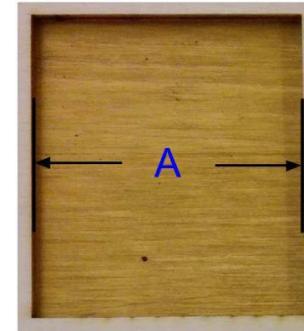
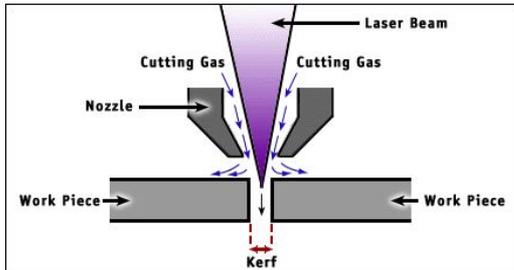
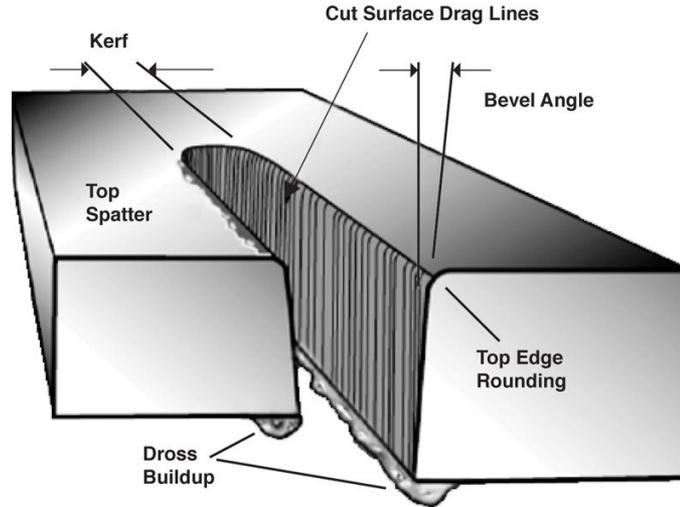
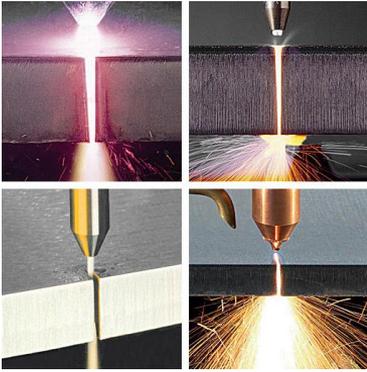


- 1.5" - Detailed engraving, fine cutting
- 2.0" - Versatile lens for multi-purpose engraving and cutting, majority of applications
- 2.5" - Excellent cutting lens for thicker materials due to longer focus tolerance
- 3.0" - For cutting thicker materials or when greater working distance is needed
- 4.0" - For greater working clearance or large spot size is needed



# Kerf

Kerf is defined as the width of material that is removed by a cutting process. It was originally used to describe how much wood was removed by a saw, because the teeth on a saw are bent to the side, so that they remove more material than the width of the saw blade itself, preventing the blade from getting stuck in the wood.



$$\text{kerf} = (A - B) / 12$$