

Contract Manufacturing Glossary of Terms

A

Aperture

An opaque device that controls the transverse mode performance of the laser cavity. Made of ceramic or SS, the aperture is usually a highly polished round disc with a center hole, which comes in various sizes.

Assist Gas for Cutting/Drilling

The gas that accompanies the laser through the nozzle, providing a moderate-to-high-pressure flow of oxygen or nitrogen, which removes molten metal from the cut area to provide a cleaner cut.

Assist Gas for Welding

The gas that accompanies the laser through the nozzle, typically argon, which provides a light flow over the weld area, preventing oxidation and splatter.

Athermal Laser Machining

Ablate bioabsorbable polymers, shape memory metals & other exotic alloys without introducing heat affected zones (HAZ) which yields parts that are clean and free of any slag or recast.

Automatic-feed

Continuous conveyance of raw stock into the work envelope for machining.

B

Barrel Finishing

Production finishing process that produces a low-pressure abrasion action by tumbling work pieces in a hexagonal or octagonal barrel together with an abrasive slurry.

Burring

A thin ridge or area of roughness produced in cutting or shaping metal.

C

Cabinet Blaster

Uses compressed air to propel aluminum oxide or glass bead against the surfaces of machined parts in an enclosed cabinet. Used for: cleaning (removes rust, paint, scale & corrosion); etching (metals, glass and plastic); finishing (small surface imperfections & matching marks blended-in).

CAD/CAM

Computer-Assisted Design/Computer-Assisted Manufacturing. A software package that can generate "Geometry" with the design portion of the software and then convert to a .txt file using the machining portion of the software. The .txt file is used by the Computer Numerical Control (CNC) to convert the file to table motion.

Class 100,000

Federally regulated standard of environmental cleanliness: airborne particulate level kept below 100,000 per cubic foot.

Cleanroom

Facility in which environmental elements (heat, humidity, microbial growth, etc.) and user cleanliness are controlled. Used for assembly/packaging of sensitive components.

CNC

Computer Numerical Control. A dedicated purpose computer that has the capability to read computer codes and convert them into machine control and driving motor instructions.

CO² Laser

A type of gas laser that uses a mixture of CO², nitrogen and helium to produce a continuous output of laser light at a wavelength of 10.6mm.

Coherent

The optical radiation resulting from wave trains vibrating in phase with each other. Because these wave trains are composed of the same wavelength of light, they are termed "coherent."

Coil-feed

Continuous unrolling and conveyance of coiled raw stock into the work envelope for machining.

Collimated

A laser with little divergence. Lasers can emit highly divergent beams of energy. For example, a CO₂ laser can emit a 1.2 mrad divergent beam (1 mrad = 1 milliradian = 1 millimeter divergence per 1 meter traveled), and an ND: YAG laser can emit a 1.2-25 mrad beam.

Convergence

From the laser's perspective, convergence refers to the laser growing smaller as it moves from point "a" to point "b." After the

laser passes through the focus lens, the beam converges until it reaches its waist point.

D

Diamond Laser

Coherent Diamond 64 CO² Laser - A 150 watt sealed beam laser.

Divergence

From the laser's perspective, divergence refers to the laser growing larger as it moves from point "a" to point "b." After the laser passes through the waist point, the beam begins to diverge.

D_{NC}

Direct Numerical Control. The direct control of a number of separate CNC machine tools by a large central host computer; part programs are downloaded directly into the memory of a CNC machine tool.

Drilling

Making a round hole or cavity by boring directly into a solid surface with rotating bits.

Dross

The small drops of re-solidified molten metal that cling to the bottom of the cut edge. Dross is easily removed in an acid-pickling bath.

E

E_{DM}

Electrical Discharge Machining. High-energy electric current melts base metal for burr-free machining. Wire EDM can produce intricate patterns, complex shapes with extreme precision. Microhole EDM used for high-speed drilling of micro-fine holes. Minimal variation throughout production.

Electrolytic

Produced or brought about by the passage of an electric current through a non-metallic conductor.

Electron beam welding

A process that uses energy from a fast-moving beam of electrons to produce a strong, very clean and narrow weld.

Electropolishing

Producing a smooth, bright surface on a metal by immersion in an electrolytic bath.

Endotoxin

Any of a class of poisonous substances present in bacteria but separable from the cell body only on its disintegration.

Esco concept

Modified Swiss turning machining process. Rotating tool head stock around stationary bar- or coil-fed metal.

Exotic metal

Any metal not commonly used in fabrication of parts, e.g., Waspaloy, Greek Ascoloy, Hastelloy, Kovars, Inconels.

F

Fiber optics

Thin transparent fibers of glass or plastic that are enclosed by material of a lower index of refraction and that transmit light throughout their length by internal reflections.

Four & five axis machining

The use of multi-directional tool movement in a machine in which tools are held on axes which provide rotating vertical and horizontal motions on different planes.

G

Glass bead finishing

Process utilizing compressed air to bombard a surface with small particles of fused soda lime glass. Results are controllable and predictable and will not wear machine components rapidly like other abrasives.

Glove box

A sealed, protectively lined compartment with ports to which gloves are attached for use in handling materials inside the compartment.

Grit blasting

Process utilizing steel or iron that has been crushed from round particles (shot) or crushed organic abrasives made from dried nutshells or corncob. Steel grit used for removing heavy scale; iron to remove paint from steel; "soft" organic to remove contamination from delicate parts or to remove plastic flashing.

H

Hardness

The ability to resist penetration.

HAZ

Heat Affected Zone - the edge of the laser-machined surface that receives an excess of heat during the operation. In the HAZ, the microstructure is altered near the surface of the cut or weld - only into the first few thousandths of an inch of the parent material. Lasers produce significantly less HAZ than TIG or electron beam welding. Can be readily removed from metal work pieces by electropolishing.

ISO 9002

Designation that indicates a facility's conformance to quality standards in operations management, especially as it relates to quality control and customer service.

J

Joule

A unit of measured energy. One calorie is equal to 4.18 joules. One calorie is the amount of energy needed to raise the temperature of one gram of water one degree centigrade. In terms of power, one joule is equal to one watt-second. Performance in laser applications is defined by joules per pulse instead of average power because the amount of material melted or vaporized is directly related to laser's energy per pulse, *not* its average power.

K

Kerf

The area of metal removed during the first pass of the laser.

L

Laser

The acronym of Light Amplification by Stimulated Emission of Radiation. In the typical configuration, light or electrical discharges will excite certain materials to the point where it fluoresces or "lases." Using mirrors and certain components, the emission is collected and reinforced to form a continuous stream

Laser etching & marking

of aligned photons. When properly aligned, the beam will be coherent in time and space and have minimal divergence, while producing the greatest possible energy within its diameter.

The use of a laser to etch designs, lettering, numbers or symbols onto the surface of a material. The use of a YAG laser to produce marks and lettering or numbering on the surface of a part by burning the plating, such as an anodized surface.

Laser machining

The cutting of a material with a CO² or YAG laser to produce intricate part shapes and holes; it is usually a through-cut process.

Laser welding

A welding process that obtains fusion by directing a highly concentrated beam of coherent light on a very small spot.

Lasing medium

A material that emits coherent radiation by stimulation of electronic or molecular transitions to lower energy.

Lathe

A turning machine capable of producing round diameters by rotating a work piece against a stationary single-point cutting tool.

M

Memory metal

A metal which will take on a prescribed shape at certain temperatures.

Microblasting

Utilizing very fine particles in a small-diameter nozzle, extremely small parts can be blasted for cleaning and descale.

Microdeburring

The process of removing burrs from metal machined to subminiature dimensions.

Milling

A machining operation in which metal or other material is removed by bringing the work piece into contact with a horizontally or vertically mounted cutter.

N

ND:YAG

A round 3"-6" crystal of Yttrium, Aluminum and Garnet - doped with Neodymium - is the material excited in the ND:YAG laser.

Nitinol

Light energy from high-pressure arc lamps is focused onto this crystal in order to excite the electrons of the Neodymium doping. The ND:YAG laser emits a 1.06um (approximately .000040") wavelength beam, which is in the "near infrared" portion of the Electro Magnetic Band. The electrical efficiency of an ND:YAG laser is 2%-4%.

A "memory metal." Can be "trained" to take on prescribed shape at specific temperatures.

O

Optics

Any lens, prism or mirror used to direct light (as in an instrument).

Oxide

A compound of oxygen with one or more metallic elements.

P

Parameters

The variables which determine the dimensions of a machined part as well as the operational sequence of the machine tools used to produce the part.

P_{NC}

Parallel Numeric Control

R

Recast layer

The small amount of molten material that adheres to the walls of the laser-drilled hole or laser generated kerf. The amount of the recast layer depends on the material thickness, type of material and the laser parameters being used.

Repeatability

The ability of a machine to perform the same operation any number of times to a specified degree of accuracy.

S

Subchronic use

In use for less than three months.

Swiss automatics/Swiss turning

Micromachining process that uses high-speed turning of bar or coil stock with stationary tools. Extreme precision and speed for small-diameter parts. Milling, drilling, turning, tapping functions simultaneously or in sequence.

T

Tig (welding)

Gas tungsten inert arc welding (tungsten inert gas).

Tolerance

The range of variation permitted in maintaining a specified dimension, i.e., the difference between the upper and lower limits between which a size must be held.

Tooling

The selection of tools needed to produce the desired contours and dimensions of a machined metal part.

Tumble blaster

Similar to a cabinet blaster, but parts are rotating in a barrel while being blasted.

U

Ultrasonic cleaning

In a controlled bath, cleaning solutions are made up to remove surface contaminants found on parts. Often, it is advantageous to accelerate and enhance the solution's cleaning abilities by energizing transducers that agitate the solution, microscopically cavitating and exploding contaminants from the parts, leaving them exceptionally clean.

W

Waist

The smallest point on a focused beam, which is the only part that can be used for cutting.

Waterjet machining

A fine, high-pressure, high-velocity jet of water directed by a small nozzle is used to cut hard or soft materials. Abrasives such

Watt

as micro-grain diamond or garnet may be mixed into the water stream.

One watt is equal to one joule of energy per second. It is used to describe the average power output of the laser's performance within a given set of parameters.

Work envelope

Interior compartment of equipment where machining takes place. Includes tools and metal stock.