

## 84.56

**84.56 - Machine-tools for working any material by removal of material, by laser or other light or photon beam, ultrasonic, electro-discharge, electro-chemical, electron beam, ionic-beam or plasma arc processes; water-jet cutting machines.**

- Operated by laser or other light or photon beam processes :

8456.11 -- Operated by laser

8456.12 -- Operated by other light or photon beam processes

8456.20 - Operated by ultrasonic processes

8456.30 - Operated by electro-discharge processes

8456.40 - Operated by plasma arc processes

8456.50 - Water-jet cutting machines

8456.90 - Other

The machine-tools of this heading are machines used for the shaping or surface-working of any material. They must meet three essential requirements :

- (i) They must work by removing material;
- (ii) They must carry out operations of the kind performed by machine-tools equipped with conventional tools;
- (iii) They must use one of the following seven processes : laser or other light or photon beam, ultrasonic, electro-discharge, electro-chemical, electron beam, ionic-beam or plasma arc.

This heading also covers water-jet cutting machines described in Part (H) below.

This heading, however, **excludes** the following kinds of machines, which are provided for in **heading 84.86** :

- (i) Machines for working any material by removal of material, of a kind used solely or principally for the manufacture of semiconductor boules or wafers, semiconductor devices, electronic integrated circuits or flat panel displays.
- (ii) Machines for working any material by removal of material, of a kind used solely or principally for the manufacture or repair of masks and reticles.
- (iii) Machines for dry-etching patterns on semiconductor materials.

Examples of the foregoing products are (1) laser-beam machine tools which drill semiconductor crystals and (2) ultrasonic process machine-tools which cut semiconductor chips or which cut or drill ceramic substrates for integrated circuits.

### **(A) MACHINE-TOOLS FOR WORKING BY LASER OR OTHER LIGHT OR PHOTON BEAM PROCESSES**

Laser-beam machining (photonic machining) consists of bombarding a target with photons. This group covers, in particular, machines for drilling (metals, rubies for watches, etc.), machines for cutting metals or other hard materials and machines for engraving (figures, letters, lines, etc.) on various highly resistant materials.

The principle of the machine-tools operated by laser processes is the removal of material by melting, burning or vaporization (also referred to as "ablation"), which are caused by a focused intense laser beam directed at the workpiece. In certain machine-tools of this type, the laser beam may be coupled into a low-pressure water jet, which is used to guide the laser beam, and to remove debris and cool the material.

The other machine-tools of this group differ from the machine-tools operated by laser beam processes by the type of beam used for the removal of material.

#### **(B) MACHINE-TOOLS FOR WORKING BY ULTRASONIC PROCESSES**

Ultrasonic machine-tools consist of a punch subjected to ultrasonic vibrations and an abrasive in suspension in a liquid. These machines may incorporate an abrasive recycling system.

This group includes machine-tools which are used, in particular :

- (1) For working diamond or metal carbide dies;
- (2) For drilling or shaping minerals;
- (3) For engraving glass;
- (4) For milling, broaching or polishing.

#### **(C) MACHINE-TOOLS FOR WORKING BY ELECTRO-DISCHARGE PROCESSES**

The principle of this type of machining is the removal of metal between two metallic electrodes (the workpiece and the tool) by sudden electrical discharges of very short duration at the rate of several hundred thousand cycles per second. This group covers, for example, **high-frequency electric-spark cutting machines**.

#### **(D) MACHINE-TOOLS FOR WORKING BY ELECTRO-CHEMICAL PROCESSES**

The principle of this type of machining is the removal of metal by electrolysis. The workpiece (anode) is a conductor of electricity as is the tool (cathode). Both are submerged in a selected electrolyte which makes cathodic deposition impossible, and all that occurs is anodic dissolution.

This group includes :

- (1) **Electrolytic polishing apparatus**, used for polishing specimens for microscopic or metallurgical examination.
- (2) **Electrolytic sharpeners** for sharpening cutting tools, cutting chip-breaker grooves or cutting metal carbide plates; these machines utilise a diamond wheel.
- (3) **Machines for deburring** various kinds of gear-wheel by anodic dissolution.
- (4) **Machines for precision** finishing flat surfaces, etc.

#### **(E) MACHINE TOOLS FOR WORKING BY ELECTRON BEAM PROCESSES**

Electron beam machining consists of bombarding the workpiece on a very small surface with electrons emitted by a cathode, accelerated by an intense electrical field, and focussed by a system of magnetic or electrostatic lenses.

**(F) MACHINE-TOOLS FOR WORKING  
BY IONIC-BEAM PROCESSES**

The beam of these machine-tools works by continuous action, not by impulses as in the case of the laser beam.

**(G) MACHINE-TOOLS FOR WORKING  
BY PLASMA ARC PROCESSES**

Plasma arc machining involves intense ionisation of a gas by means of an electric current produced by a magnetic impulse generator under high tension. It permits cutting plates at a very high speed and rough-cutting and machining coarse-feeding threads.

**(H) WATER-JET CUTTING MACHINES**

This group includes water-jet and water-abrasive jet cutting machines. These are machines designed to cut materials by a process using streams of water or of water mixed with very fine abrasives, typically at a velocity of 2 to 3 times the speed of sound. They operate under pressures of 3,000 to 4,000 bars and are capable of making multiple types of precision cuts in a variety of materials. Water-jet cutting machines are typically used for softer materials (foam, soft rubber, gasket material, foils, etc.). Water-abrasive jet cutting machines are typically used for harder materials (tool steel, hard rubber, composites, stone, glass, aluminium, stainless steel, etc.).

**PARTS AND ACCESSORIES**

**Subject** to the general provisions regarding the classification of parts (see the General Explanatory Note to Section XVI), parts and accessories of the machines of this heading are classified in **heading 84.66**.

\*  
\* \*

The heading also **excludes** :

- (a) Ultrasonic apparatus for cleaning (**heading 84.79**).
- (b) Soldering, brazing or welding machines and apparatus, whether or not capable of cutting (**heading 85.15**).
- (c) Testing machines (**heading 90.24**).