

## 85.14

### **85.14 - Industrial or laboratory electric furnaces and ovens (including those functioning by induction or dielectric loss); other industrial or laboratory equipment for the heat treatment of materials by induction or dielectric loss.**

8514.10 - Resistance heated furnaces and ovens

8514.20 - Furnaces and ovens functioning by induction or dielectric loss

8514.30 - Other furnaces and ovens

8514.40 - Other equipment for the heat treatment of materials by induction or dielectric loss

8514.90 - Parts

This heading covers a number of industrial or laboratory type electro-thermic machines, apparatus and appliances in which the heat is obtained electrically (e.g., by the heating effect of a current in a conductor; from an electric arc). The heading includes furnaces and ovens functioning by induction or dielectric loss and other industrial or laboratory equipment for the heat treatment of materials by induction or dielectric loss (e.g., industrial microwave furnaces, ovens and equipment). The heading **excludes** electro-thermic appliances of a kind used for domestic purposes (**heading 85.16**).

#### **(I) INDUSTRIAL OR LABORATORY ELECTRIC FURNACES AND OVENS (INCLUDING THOSE FUNCTIONING BY INDUCTION OR DIELECTRIC LOSS)**

Electric furnaces and ovens consist essentially of a more or less closed space or vessel in which a relatively high temperature is obtained. They are used for many purposes (melting, annealing, tempering, enamelling, welding, heat treatment of welds, etc.). The principal types include retort furnaces, bell-type furnaces, trough furnaces, crucible furnaces, tunnel furnaces, etc. Some of these furnaces may have special tilting attachments, or be provided with an inner vessel for the treatment of metals in a particular gas to prevent oxidation.

The furnaces and ovens covered by this group include, *inter alia* :

- (A) **Resistance heated furnaces and ovens** in which the heat is produced by the passage of a current through heating resistors. These heating elements (resistors) transfer heat to the stock or charge by radiation and convection.
- (B) **Resistance furnaces for heating bars of metal or granular materials** where the material to be heated serves as the resistor. These consist of a container in which current is passed through the material itself; the electrical resistance of the material produces the necessary heat.
- (C) **Liquid resistance furnaces** consisting of baths furnished with electrodes. In operation the bath contains molten metal, molten salts or special oil, maintained at the required temperature by the passage of electricity, via the electrodes, through the liquid; the object is heated by being plunged in the bath of liquid.
- (D) **Electrolytic furnaces for smelting or refining metals.** These are also liquid resistance furnaces fitted with electrodes immersed in a molten bath electrolyte. The bath contains the metal bearing constituent of the ore dissolved in a molten salt. Electrolytic dissociation which is caused by the passage of electricity through the electrolyte via the electrodes results in pure molten metal collecting at the cathode while a gas is given off at the anode.

- (E) **Low frequency induction furnaces.** Low frequency AC in a primary coil is linked magnetically by a soft iron core with the charge to be heated, and induces current in that charge thus causing it to be heated. In certain furnaces of this type, the molten charge circulates from the main crucible through vertical looped piping in which the heating currents are induced from the primary circuit.
- (F) **High frequency induction furnaces.** An AC of high frequency (often of radio frequency) in the primary coil induces eddy currents in the charge to be heated. This type of furnace has no iron core.
- (G) **Dielectric capacitance furnaces and ovens.** The charge, which must be electrically non-conducting, is placed between two metal plates connected to a source of AC. In effect the arrangement operates as a capacitor, and dielectric loss in the charge causes heat to be developed within it. This group includes **industrial microwave ovens**, in which dielectric products to be heated are subjected to the action of electromagnetic waves. By dielectric loss, the energy from the waves is converted simultaneously into heat throughout the mass of the product, ensuring very uniform heating. These ovens are used for drying, defrosting, moulding of plastics, firing ceramics, etc.
- (H) **Arc furnaces** in which the heat is generated by an electric arc, struck between electrodes or between an electrode and the charge to be heated. These furnaces are used for the production of pig iron, various ferro-alloys, calcium carbide, for reducing iron ore, for the fixation of nitrogen from the air, etc. Certain low temperature arc furnaces are also used for distilling materials of relatively low boiling point (e.g., zinc or phosphorus); if, however, they are equipped with condensers to collect the distillate, the whole is **excluded (heading 84.19)**.
- (IJ) **Infra-red radiation ovens** heated by a number of infra-red lamps or radiation plates.

Certain furnaces or ovens use more than one method of heating (e.g., high and low frequency induction or resistance for melting and heating metals, etc.; infra-red and high frequency biscuit baking ovens; infra-red, resistance and dielectric capacitance (microwave) ovens for heating objects).

The furnaces and ovens described in this heading include, *inter alia* :

- (1) **Ovens for bread, pastry or biscuit making.**
- (2) **Dental ovens.**
- (3) **Crematorium furnaces.**
- (4) **Furnaces for incinerating waste.**
- (5) **Furnaces or ovens for annealing or tempering glass.**

This heading **excludes** electrically heated apparatus for drying, sterilising or similar operations (**heading 84.19**).

**(II) OTHER INDUSTRIAL OR LABORATORY EQUIPMENT FOR THE HEAT TREATMENT OF MATERIALS BY INDUCTION OR DIELECTRIC LOSS**

The heading also includes electric induction or dielectric heating equipment (for example, microwave equipment), even if not in the form of a furnace or oven. This equipment (used mainly for the heat treatment of small articles) consists essentially of electrical equipment for producing high-frequency oscillations, mounted together with the appropriate plates or coils, often of special design for the particular articles to be treated.

These include, *inter alia* :

- (1) Machines with induction coils for heating by induction objects made up of materials which are good conductors of electricity, by means of low, medium or high-frequency power (e.g., machines used for superficial hardening of crankshafts, cylinders, cog wheels or other metal parts; machines for melting, sintering, annealing, tempering or preheating metal parts).
- (2) Machines with electrodes serving as a capacitor (e.g., in the form of plates, bars) for dielectric (capacitive) heating of objects made up of materials which are non-conductors or bad conductors of electricity, by means of high frequency power (e.g., wood-drying machines; machines for preheating thermohardenable moulding materials in the form of pellets or powder, etc.).

Some special types of equipment are designed for the progressive heat-treatment of a bar passed through the coil, or for the repetitive treatment of a series of articles.

Rotary converters and high-frequency generators when presented together with heat-treatment equipment are also classified in this heading. When presented separately, they fall in **heading 85.02 or 85.43**, as the case may be.

However, machines for induction treatment used for soldering or brazing metals and machines for heat-treatment by dielectric loss used for welding plastics or other materials (e.g., high-frequency pressing machines for welding and high-frequency line welding machines) fall in **heading 85.15**. Presses incorporating heating devices are also **excluded (Chapter 84)**.

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This heading also covers furnaces and other appliances specially designed for the separation, by pyrometallurgical processes, of irradiated nuclear fuels, appliances for the treatment of radioactive waste (e.g., for the firing of clays or glass containing radioactive residues or for the combustion of graphite or radioactive filters) or those for the sintering or heat-treatment of fissile material recovered for recycling. However, appliances for isotopic separation are classified in **heading 84.01**.

## PARTS

Subject to the general provisions regarding the classification of parts (see the General Explanatory Note to Section XVI), parts of the goods of this heading are also classified here (e.g., armatures, doors, inspection holes, panels and domes, electrode holders and metal electrodes).

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However, the heading also **excludes** :

- (a) Bricks, blocks and similar refractory or ceramic goods for the construction or lining of electric furnaces (**Chapter 69**).
- (b) Electric furnaces and ovens for manufacturing semiconductor wafers or flat panel displays (**heading 84.86**).
- (c) Electric heating resistors (**heading 85.16 or 85.45**, as the case may be).
- (d) Electrodes of graphite or other carbon, with or without metal (**heading 85.45**).