Vacuum drying oven normally has a chamber volume of between 20 and 150 litres and a temperature range starting at between +5 °C and +15 °C above room temperature up to +250 °C; some appliances can also operate at up to 400 °C (see details on the basic operation and fittings of a temperature control chamber).

The interiors are made of corrosion-free stainless steel 1.4301, resistant to most acids (acc. to standard ASTM 304), or the more robust 1.4404. Some manufacturers of vacuum drying ovens in addition smooth the interior and/or the sliding shelves by means of electrolytic polishing to make cleaning easier.

Underpressure accelerates drying in the vacuum drying oven

During the heat treatment, an underpressure in the range between 10 and 50 hPa is usually generated, which lowers the boiling point of fluids to close to room temperature. Heat-sensitive material can therefore be dried in the vacuum drying oven at low temperatures, and at the same time the drying time is considerably reduced. To avoid oxidation, an inert gas (e.g. nitrogen) can be fed into the chamber.

Vacuum pumps

Vacuum is generated by vacuum pumps. If several vacuum drying ovens are operated simultaneously, they are often connected to a central vacuum supply. Depending on the requirements of suction power, lifetime or end vacuum, and depending on the application (oil-free operation, chemical resistance, fumes released, etc.), membrane pumps, rotary vane pumps or scroll pumps can be used for low and medium vacuum applications.

Direct heating of the chamber load

Since heat transfer cannot take place in a vacuum, the
chamber load is heated or dried through direct contact with a heated surface. Two basic heating systems operate here in practice: Heat transfer from the side walls to the sliding shelves (with or without heated air jackets) or directly heated carrier plates/shelves.

With air jackets, the heat of an air chamber around the interior supports homogenous temperature distribution inside the chamber. However, this procedure is time-consuming.

With plate heating, the directly heated sliding shelves transfer heat to the chamber load thus shortening the drying time. In addition to digital temperature control, some manufacturers also offer a digital pressure control, enabling the programming of defined temperature / vacuum cycles.

Safety

If flammable materials such as gas, dust, fog or fumes are released in the vacuum during the drying process, a special explosion-proof vacuum drying oven must be used. The classification of appliances into different categories, depending on hazards, safety requirements, substance groups and potentially explosive zones is regulated for Europe in the ATEX directives.

Overview Glossary Temperature control chamber

Picture credit: Memmert GmbH + Co. KG

Autor:

www.atmosafe.net > Glossary > Thermal oven/drying oven > Vacuum

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