

Lema: chemical versus thermal tempering in particular shapes and small thicknesses of glass

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LEMA SRL

Lema TC 9501 furnace for the chemical strengthening of glass



In this article, Lema Srl, with over 30 years' experience in the chemical tempering of glass, and the first manufacturer of equipment for this application, briefly explains the process involved. Properties of chemically tempered glass are also given, along with recommendations to reduce the risk of ruining glass or the bath.

Sectors such as aeronautics, aerospace, naval, military, motor, electronic and architecture, require glass with particular shapes and small thicknesses, which cannot be processed using thermal tempering due to its minimum limit of thickness of three millimetres; difficulty in bending glass articles; poor optical quality; considerable distortion, and so on. Given the continuous evolution of these sectors, chemical tempering is suitable to create an optimal combination between thickness and shape.

Today, with the development of new glass processing systems, chemical tempering allows to obtain glasses curved and then chemically tempered also starting from thicknesses inferior to two millimetres.

The shape of the glass sheet is not modified during tempering, successively obtaining perfectly coupled sheets during PVB lamination.

WHAT IS CHEMICAL TEMPERING?

Chemical tempering is a surface treatment made under vitreous transition. The glass sheets are dipped into a bath with melted potassium salt at a temperature superior to 380°C. Under these conditions, an exchange takes place between the potassium ions in the salt and the sodium ions on the surface of the glass.

PROPERTIES OF CHEMICALLY TEMPERED GLASS

PHYSICAL PROPERTIES

Types of glass	Sodium-calcic glass Glass materials with special chemical composition
Thickness of glass	From 0,5mm
Maximum size of glass	3,200 x 2,200 millimetres

MECHANICAL PROPERTIES

Depth of penetration	20-100 micron
Bending resistance	300-600Mpa M.O.R.ASTM C 158-95

Different values can be obtained depending on cycle length and temperature. The value must be selected according to special project requirements and conditions of use of articles.

Moreover, chemical tempered glass can be successively cut, ground, drilled, shaped and decorated.

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The introduction of potassium ions larger than those of sodium, involves, as a consequence, the establishment of residual stress characterized by a compressed tension on the surface, compensated by stress tension inside the glass.

Chemical tempering becomes essential in the following situations:

- when the thickness of glass is inferior to 2.5 millimetres. With this thickness, it is very difficult and almost impracticable to thermal temper;
- in the case of glass with very complex bending or dimensional characteristics that cannot be tempered with thermal equipment;
- the necessity of mechanical resistances superior to those obtainable with thermal tempering, in the case of special industrial or architectural applications;
- the necessity of impact resistances superior to those obtainable with traditional thermal tempering;
- the necessity to obtain, in addition to mechanical resistance, high optical requirements and total absence of glass surface deformation for industrial and motor applications.

LEMA EQUIPMENT

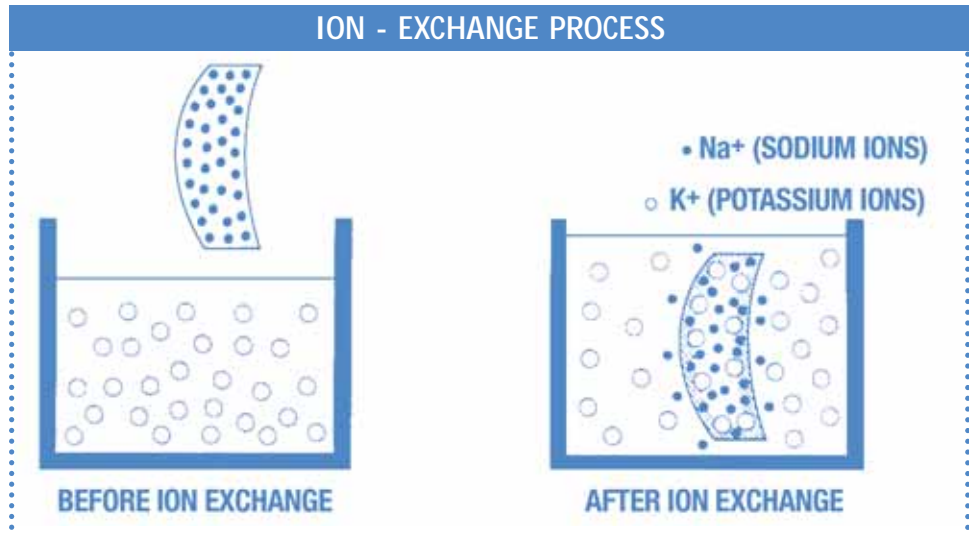
It is extremely important that treatment be made on automatic machines equipped with safety devices, so as to reduce the risks of ruining the glass and/or the bath.

LEMA units are the result of years of research and experience in collaboration with the most important glass industries.

Manufactured since 1972, LEMA units reach a high degree of perfection thanks to the company's profound knowledge of the process to which the machines strictly and carefully abide by.

THE TC 9501

For the chemical tempering of glass sheets measuring up to 3,200 x 2,200 millimetres, Lema, based in the area of Parma, northern Italy, has developed the *TC 9501*. This furnace



meets the needs of an increasing market and is particularly suitable for:

- thin glass (from 1 millimetre);
- printed glass;
- glass with complex shapes (for glass furniture, for example);
- glass in which optical quality must be maintained;
- different thicknesses of glass.

Chemically tempered glass is known to be at least two and a half times stronger than traditionally tempered glass, is five times stronger than un-tempered glass and can be ground, drilled and cut without any risk of breakage.

The TC 9501 is flexible, easy to operate, and features a fully automatic tempering cycle. ■

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