

# PUJOL's Temper Flex: a revolutionary glass tempering oven

**TEMPER FLEX is the first glass tempering oven on the market with high productivity and high installed power, able to adapt to produce with low energy consumption and low installed power if the customer requires it.**

**A** pioneering glass tempering oven on the market that offers both elevated productivity and high installed power, Temper Flex can adapt to produce with low energy

consumption and low installed power if the customer requires it. Indeed, at the energy level there are currently two completely different types of ovens on the market depending upon consumption range or installed power, namely:

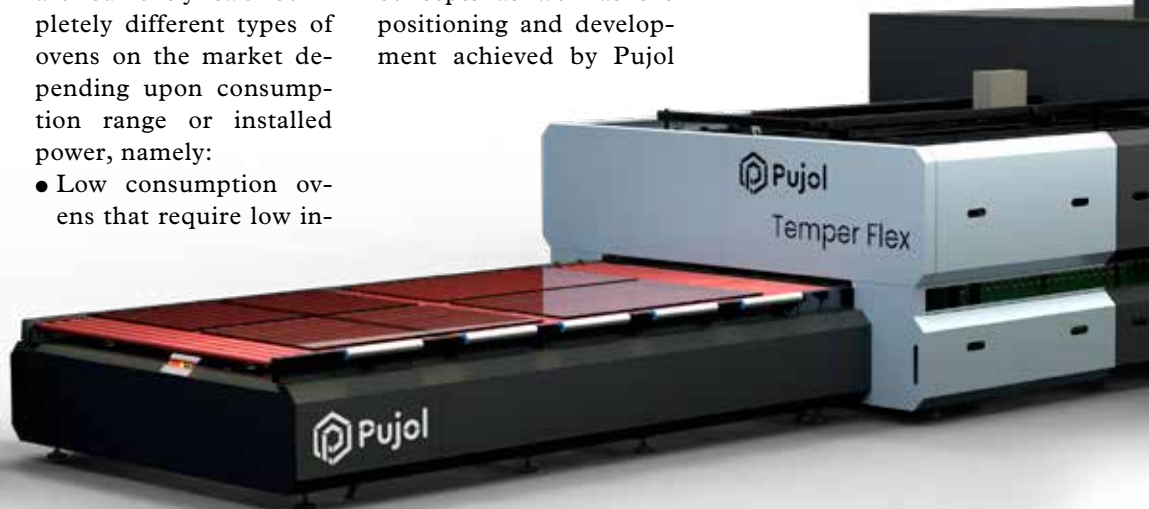
- Low consumption ovens that require low in-

stalled power.

- High productivity ovens that require high installed power.

To understand both oven concepts as well as the positioning and development achieved by Pujol

Group after the acquisition of the glass division of the Italian company Tekno Kilns, it is necessary to clarify some con-



cepts that will facilitate understanding of the advantages and disadvantages of working in each of the ranges of work described above.

### **REQUIRED ELECTRICAL OR TRANSFORMER POWER**

This is the maximum kW required for the kiln to temper according to the detailed production specifications. Low consumption ovens always refer to the machine consumption not to the sqm consumption.

### **INSTALLED POWER (KW)**

This is the amount of all the components that make up the machine. Such information is very important, since it will determine the capacity to increase production in

the future should the required maximum transformer power be lacking.

### **ENERGY CONSUMPTION SQ M (KWH)**

Efficient energy consumption, regardless of the installed power, depends upon the following two factors:

- The design of the oven and the Quenching (air blowing). That is, the machine is designed to maximize energy transfer (more on this later).
- Optimization of the load. The higher the load, the lower the sqm energy consumption. Therefore, it is recommended to compare actual load percentages to compare the consumption of different ovens or systems.

Reviewing these concepts and clearly understand-

ing that a mass of glass (regardless of its power) will always need the same calories to be heated and the same air pressure to be tempered, it can be concluded that the required electrical power or consumption ratio is proportional to the production and independent of the consumption per sqm; therefore, the higher the installed power, the higher the production and the better the return on investment, regardless of the sqm consumption.

### **ADVANTAGES OF A FLEXIBLE OVEN WORKING AT DOUBLE INSTALLED-POWER RANGE**

Based on the premise that a high production oven, although it has a higher manufacturing cost, provides a higher return on investment, Pujol has developed Temper Flex. This is a high production oven that can work at two speeds (Eco speed and Sport speed) - each related to the installed power required.

### **ECO SPEED (LOW CONSUMPTION)**

- Used when the customer's required power is limited and cannot grow and/or when the full power of the contracted transformer is not initially available.
- It helps to grow with the demand. For exam-

ple, when an oven is initially purchased, the actual sales are unknown, so it is not necessary to invest in the high production transformer until the necessary sales are available to amortize the investment in a larger transformer.

- The oven has the capacity to grow without having to change it. For example, should limited installed plant capacity result in moving to another plant, the oven will be fully equipped to adapt without any cost to higher production as necessary.
- Greater revaluation of sale, when acquiring an oven, it is not known if the company to which a second-hand oven is sold has high or low installed power. The higher the range, the greater the possibility of sale and the greater the profit or return.

### **SPORT SPEED (HIGH INSTALLED POWER)**

- The higher the production, the higher the return on investment. Logically and independently of the design of the machine, the higher the production and the same sqm consumption (the design of the machine energy efficiency is not taken into account), the better the return will be.
- Increased production





capacity, providing a greater business opportunity in terms of service in terms of delivery times and increased customer base.

- Logically, when designed for a higher production speed, materials and components must be of high quality, which means improvements in tempered glass production.

In conclusion, having

two working speeds allows for adaptation of the energy to the production of the moment, thereby reducing consumption. It is not always convenient to run the machine at 100 percent of its capacity, as there are jobs that require downtime that makes it better to slow down production and use less energy to avoid bottlenecks. The greater the flexibility, the greater the

opportunity to maximize profits. A well-designed energy efficient oven results in lower energy costs and an accelerated return on investment.

### **WHAT IS ENERGY EFFICIENCY IN AN OVEN AND WHAT DOES IT DEPEND ON?**

Energy efficiency refers to the amount of energy an oven is able to convert into useful heat and is related to sq m consumption. Energy efficiency will depend mainly on the design of the machine for heat utilization, as well as the load on the kiln or the flexibility of the kiln to adapt to the rate required at any given time and according to demand. Good thermal efficiency optimally combines heat transfer by conduction, radiation and convection. Here's why Temper Flex has been designed to increase the profit per unit produced, mainly thanks to:

- Removal of the protective iron plate of the resistors. Many furnaces, in order to avoid the deterioration of the resistors after the breakage of a glass in the furnace, place an iron plate to preserve the life of the resistors. Thanks to the design of lower resistors using a system of ceramic modules with embedded high density and high thermal transfer resistors, the metal
- Design of the upper heaters by high-performance matrix panels and the integration of a series of Kanthal rod heaters of large diameter and high power W/sqm. This design avoids the mechanical deformation of the resistors, reduces the maintenance cost and at the same time increases the useful life of the heating equipment to a period of more than 12 years. In addition, Pujol offers an extended warranty of five years of useful life of the resistors for customer peace of mind.
- Use of the latest generation of high-quality insulating materials reduces energy consumption by helping to maintain thermal stability, reduces costs by avoiding energy losses and minimizes wear of internal components, thus extending the equipment's useful life.
- The continuous convection system distributes heat evenly and

plate is eliminated and the heat transfer to the rollers is direct, thus increasing the thermal transmission by conduction while reducing consumption and providing speed to the process by switching on and off the machine, temperature change, etc.



avoids hot and cold spots. Its control is very precise as it allows controlling the temperature and flow rate.

- The transformer power requirement control software allows flexible adjustment of the oven according to the desired production or consumption or the customer's installed power. Working at two speeds allows to adapt the installed power and to optimize the cadence to the times of the auxiliary machines in order to reduce the sqm consumption while avoiding production bottlenecks.

## HOW TEMPER FLEX ACHIEVES BETTER PLANIMETRY AND ANISOTROPY IN GLASS

Temper Flex is an oven designed to obtain glass quality based on planimetry and anisotropy. The quality of tempered glass is determined by the best planimetry and the lowest anisotropy at the lowest possible cost. Planimetry requires precise temperature and cooling control, homogeneous heat distribution and a high-performance automated system, while better glass anisotropy is achieved by reducing internal stresses and visual distortions caused mainly by unequal cooling. To achieve this, Temper Flex has been precisely de-

signed, obtaining a quality standard that differentiates it from other machines on the market

for the following reasons:

- The reduction of the roller diameter. Thanks to the high thermal insulation system used, it allows to reduce the distance between oven walls avoiding the buckling of rolls and favoring the distance between rollers axes. The smaller the diameter of the rollers, the smaller the distance between centres - with more to be gained by favouring the heat transmission and avoiding undulations on the glass.
- Through a better heat uniformity obtained by the innovative system of embedded and matrix

heating elements that make the oven surface radiate homogeneously and independently according to the load requirements.

- Due to an exhaustive adjustment of the fan motor speed in cooling according to the thickness of the glass to be tempered and the required production speed, avoiding uneven stresses and consequently improving the surface quality of the tempered glass.
- By means of a production optimization software that monitors and controls the energy consumption for further optimization and cost analysis.
- Advanced cooling control by independently adjustable air nozzles

on the entire surface of the glass.

- It can be concluded that Temper Flex is a high added-value product designed to provide real answers to the needs of professionals based on 5 main axes, namely:
  1. Return on investment
  2. Savings and profitability per square metre of glass produced
  3. Quality of the finished product
  4. Production flexibility
  5. Maintenance costs.



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