ESSICCATOI SERIE EMV

NOTE TECNICHE

ESSICCATOI SOTTOVUOTO EMV

INTRODUCTION

This brochure is a short reference book regarding the characteristics and application possibilities of the ES-ESC Vacuum driers produced by I.S.V.E. Srl..

Data, characteristics and illustrations are purely indicative. I.S.V.E. Srl reserves the right to make whatever changes it deems necessary

INDEX

1. INTRODUCTION

The modern technology applied in the wood workshops has resulted in the optimisation of the use and machining times of the raw materials.
However to try and save 0.5 mm on the thickness of a plank or 1 m. a second in the speed of a machine tool without paying the same attention to the **"non quality"** of the drying operation, can cause **losses in yield of between 5 to 10% on the aforementioned machines.**
The drier must therefore be considered as a machine which is part of production, guaranteeing a real saving on the raw material and on the quality of the finished product.
To dry quickly and without defects is the objective we at ISVE have been pursuing in over 20 years of research into the application of vacuum systems
The results we have achieved are of two kinds:

1. quantitative:

- increase of speed in the drying process compared with traditional systems;
- operating costs reduction
- reduction of storage volumes of material being dried.

2. qualitative:

- maximum homogeneity of final humidity;
- maximum reduction of cracking and warping defects;
- maintaining of the natural characteristics of the wood (colour, knots, etc.);
- elimination of xylophagans and other parasites.

To invest in the quality of a drying plant means to invest in the quality of one's wood.

One of the first dry kiln models with discontinuous vacuum produced by ISVE srl.

2. THE VACUTRONIC SYSTEM: THE "HEART" OF ISVE DRIERS WHICH GIVES A 98% GUARANTEE ON THE PERFECT SUCCESS OF THE DRYING PROCESS.

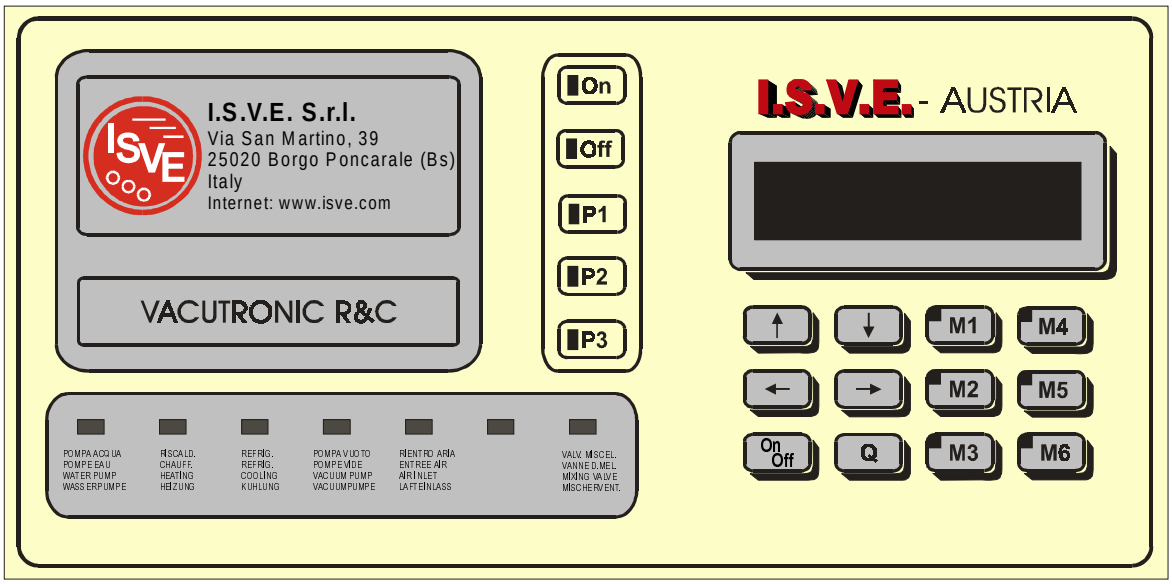
All our driers, from the smallest to the largest are equipped with a computer capable of controlling, second by second, the complete drying process.
ISVE has consequently developed exclusive software that, on the basis of the type of wood, thickness, initial and final humidity regulates all the drying phases.
In order to meet the requirements of the user, the microprocessor has three possible managing systems:

- completely automatic;
- semi-automatic;
- manual.

During the drying cycle and thanks to this system, the following parameters are constantly controlled:

- humidity of material being dried (it is possible to control up to six probes);
- humidity in the air and temperatures during the pre-heating phases, intermediate heating and during the final equilibrium moisture content phase;
- the level of operating vacuum.

Variations in parameters can be viewed by connecting the Vacutronic Computer of the drier to any PC using Windows® as an operating system.
This system, besides remote controlling the drying system (which can be done by using a simple office computer), can be used to store all the process phases.
Having an ISVE drying plant means having a tailored technical operating process: on examining the data stored the drying software can easily be modified **to suit the requirements of the customers.**
All the most recent programmes for computerised control of drying and impregnation plants can be downloaded directly free of charge from our Internet site www.isve.com.



3. THE VACUUM SYSTEM: the secret of ISVE drying quality.

Drying of wood by exposing it to the open air or when using traditional driers always the following processes:

- removal of water from the surfaces of the planks by exposing them to hot air (PHASE 1);
- migration of the humidity from the centre of the more humid planks towards the drier surfaces (PHASE 2).

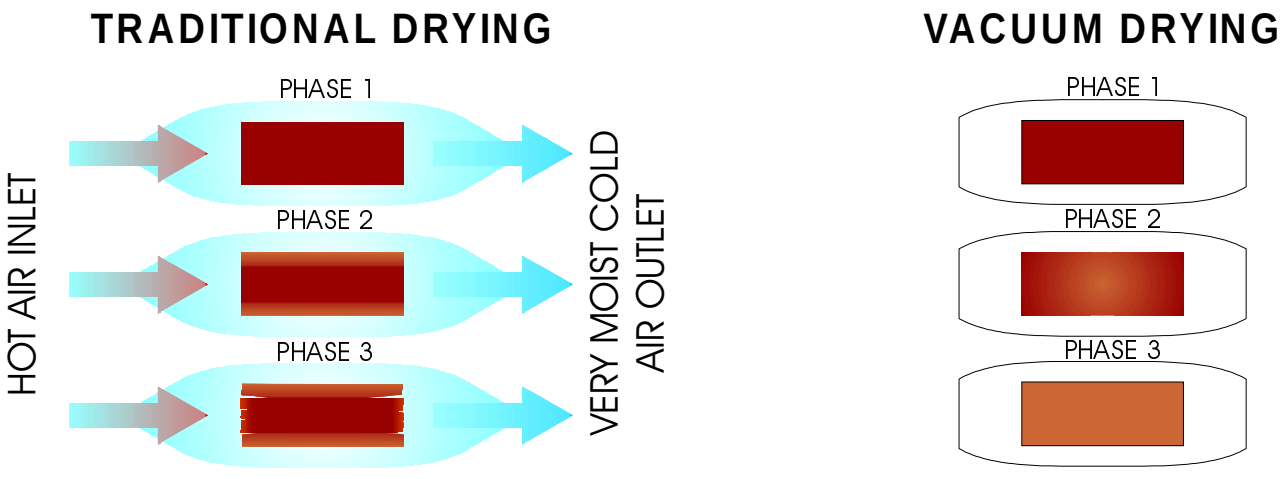
If the two processes are not carried out in perfect harmony **abnormal tensions may be created** (PHASE 3) causing warping and cracking of the wood.
The reliability of a traditional drying system is therefore tied to the need to use quite long process times so as not to create differences in humidity levels within the same area to be dried. This process is however valid for lowering the water content in green wood.

Drying, using a vacuum process, enables two natural physical principles to come into play:

1. a reduction in pressure (to create a vacuum)) causes the water present in the wood to transform into steam at low temperatures (45°C at –700 mm Hg);
2. the water vapour always moves from the hot areas to the cold ones.

The first principle guarantees rapid removal of the water vapour starting from **the centre** of the wood mass and a drastic reduction of the needs for thermal energy, in that the operation is carried out a low temperatures.
The second principle enables the quantity of humidity removed from the wood to be controlled and regulated, second by second, by adjusting the temperature of the condensers.
The synergy of the two processes enables the humidity in the wood to be lowered uniformly and without causing stress.
Considering the high technology applied to these machines and the possibility of being able to adjust each process phase very precisely, drying in a vacuum is very suitable for establishing a definite percentage level of humidity in the wood.
This result is of the utmost importance, especially and above all during the later finishing and assembly phases of the semi-finished product.

In the case of wood which has cavities of resin, drying in a vacuum guarantees also the complete evaporation of vegetable solvents, thus causing irreversible crystallisation of the resin itself.



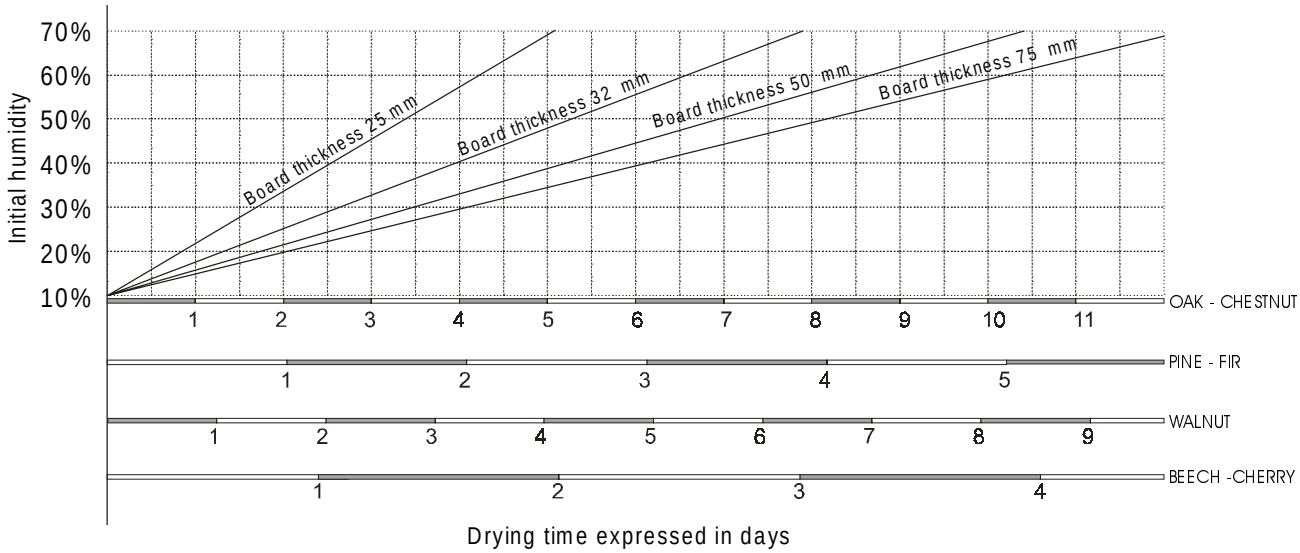
4. HOW TO CHOOSE WHICH EMV IS THE MOST SUITABLE FOR ONE'S REQUIREMENTS?

How to choose a vacuum drier, but above all how to calculate its size according to one's requirements?

The main parameters to be taken into consideration are as follows:

- cu.m of wood to be dried per unit of time;
- type of wood (pine, fir-wood, oak, etc.)
- thickness of semi-finished product in mm;
- initial humidity level.

From the graph below, some indications can be had of drying times on the basis of initial humidity level and thickness of wood.
By centring the initial humidity level of the boards with the vertical line of the thickness and then by moving down to where the whitish-grey lines of the different types of wood are crossed, the duration of the drying process, expressed in days, can be set.



For example, supposing you needed to dry 70 m^3 a month of pine or fir having 30% initial humidity and a thickness of 32 mm, on the basis of the graph the time needed would be about 2 days (final humidity 10%).
Over a month, considering the plant will be working automatically, 14 drying cycles can easily be carried out.
The net capacity of the autoclave will therefore be equal to: 70 m^3 /month ÷ 14 monthly cycles = **5** m^3

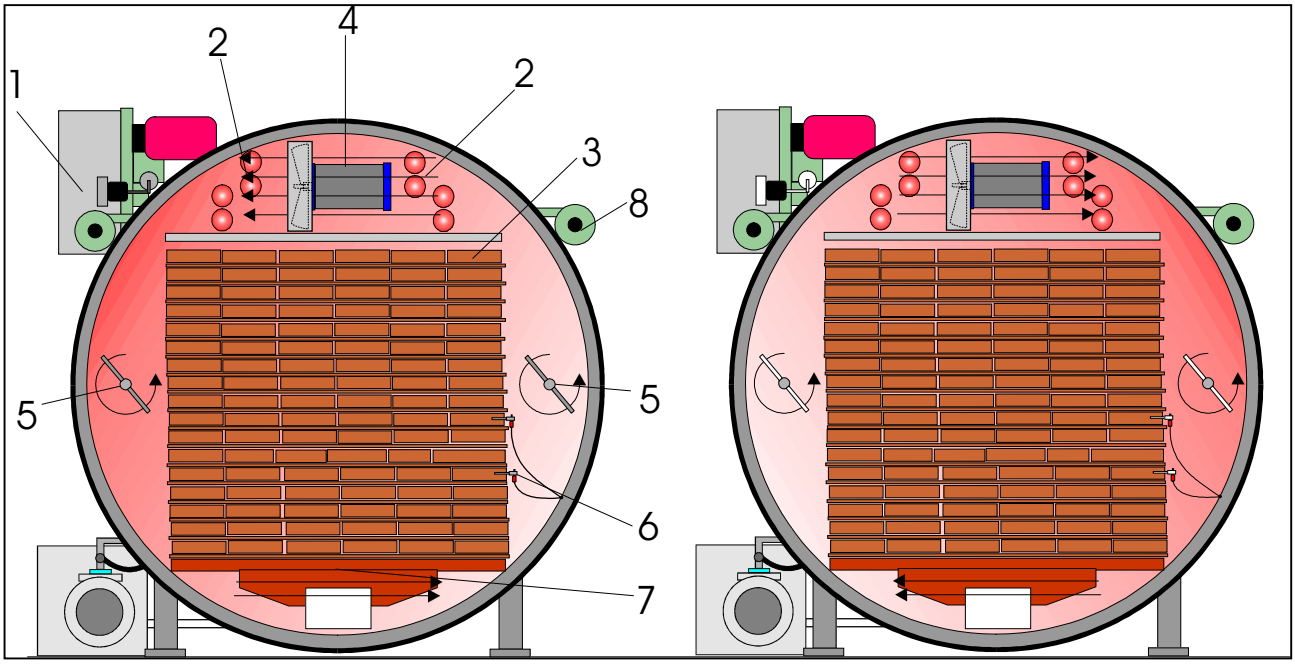
From this result it is easy to see how the reduction in drying times means smaller capacity driers can be used compared with the volume of wood to be dried
The advantages are clearly several and range from saving of space to easier insertion in the company drying process logistics.
Not least, the monolithic characteristics of ISVE driers permits easy re-positioning should a change be required in the company production line.

Quality of drying and **design quality** are two important features of ISVE ES and ESC driers, making them simple to use and easy to insert in the company production cycle.

5. EMV WITH CONTINUOUS/DISCONTINUOUS VACUUM FOR BOARDS

The ISVE EMV driers are particularly suitable for drying **boards** using various types of wood.
They are called "dry kilns with continuous/discontinuous vacuum" because the vacuum phase can be interrupted by hot and humid air cycles allowing quick heating of the wood.
In order to achieve optimal results the wood must be heated gradually and homogeneously.
In our EMV, the pile is made of listeled boards which are placed on the carriage of the autoclave.
The drying cycle starts when you close the machine and set all parameters on the computer (Vacutronic).

Figure 5.1: heat diffusion system of ISVE EMV drier series.



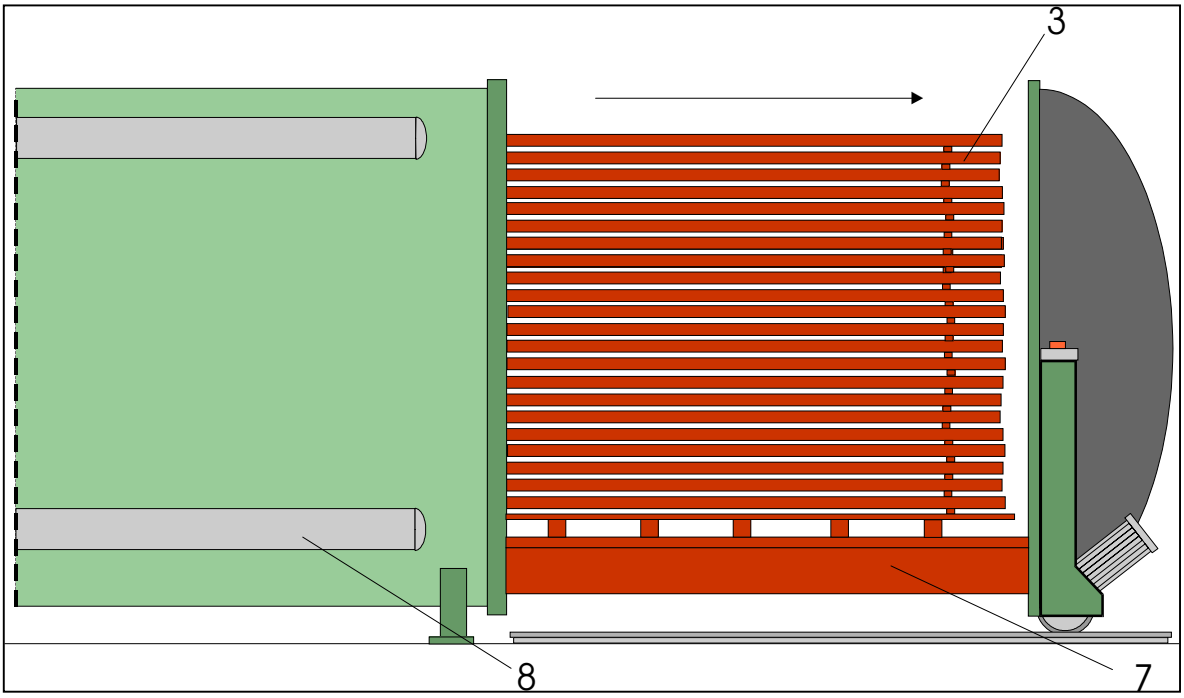
1	Control board (Vacutronic)	5	Turbulences
2	Hot water battery	6	Probes
3	Pile under drying	7	Loading motorized carriage
4	Alternate flow fans	8	Condensators

In a first phase, hot water with a high content of humidity circulates in the autoclave. At the beginning of the cycle, it is very important to increase the wood temperature gradually avoiding the beginning of drying of the board upper part. The humidity high value which is electronically controlled by probes, **hinders some dangerous strains along the wood from taking place.**
Once the temperature value of the pile has reached the required level, the vacuum pump eject air from the autoclave. When you reach the fixed vacuum value, the accumulated heating makes water evaporate from boards causing the drying.

These phases often take place during the process, mixing hot and humid air with vacuum which is an essential factor for a quick and good drying.

The reduced sizes compared with the productivity of these units produce noticeable saving in terms of space and easy housing on the company premises without the need for any special brickwork or connections.
The quality materials used in the construction of the autoclave, such as stainless steel and aluminium, guarantee long resistance against corrosion, whereas the choice of components from leading Italian and foreign companies means they are able to attain a high level of reliability. These characteristics, common to all ISVE driers, result in very high quality drying, short working times with reduced operating costs.

Fig. 5.2: loading carriage with pile of boards ready to be charged in the autoclave.



5.1 HIGH CAPACITY EMV SERIES CONTINUOUS/DISCONTINUOUS VACUUM DRIERS.

The EMV series of discontinuous driers with capacities from 6 to 50 m^3 are suitable for large carpenter's workshops or for timber yards requiring drying **quality** together with high productivity.
The plant is equipped with a control computer to facilitate programming of the process. There is no difficulty involved in learning the technology.
The variation of each parameter can be displayed by connecting the drier computer to a normal PC using Windows.
With this system, besides having remote control of the cycle, it is possible to store all the process phases.
These units house all the technology and know-how developed in twenty years of designing and manufacturing wood treatment plants.

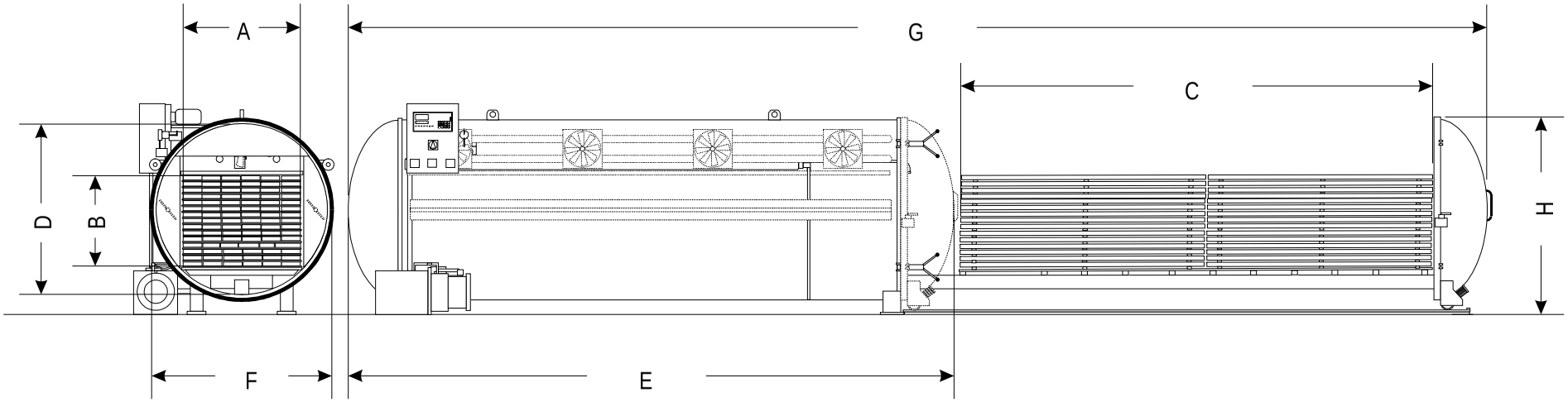
The plant, operating at low temperatures, allows the water in the wood being treated to evaporate without making it undergo sudden changes of temperature which could cause cracking or warping.
Thanks to a steam generator and the water evaporated from the wood during drying, the surfaces of the material are kept humid, thus avoiding the formation of small cracks, present in other drying systems.
The level of humidity necessary between the environment and the material, is constantly controlled by a condenser which precipitates the vapour in suspension.
Air conditioning of the drying chamber is carried out by alternating flow fans and by deflectors which, by means of a nest of hot water heated finned tubes, increase the temperature of the air which circulates in the pile.
This process of conditioning of the environment followed by a vacuum cycle, starts the transmigration process of the water through the cell walls of the wood, from the interior to the surface, from where the water is continually evaporated until the drying conditions wanted are reached.
The condensate deposits on the bottom of the autoclave and is periodically drained off in order to maintain the environment conditions stable.

The following advantages are achieved:
PERFECT RESULTS DUE TO: absence of warping and cracking; no alterations in colour; no internal tension; no change in resistance of dried material.
POSSIBILITY OF DRYING: very thick material with very high humidity; planks of all types of wood.
LOW RUNNING COSTS DUE TO: minimum heat loss; rational use of thermal and electric energy; no need to intervene manually.
LOW MAINTENANCE COSTS DUE TO: simple, rational construction; simple automative devices; non-corrosive materials.

Main features

- Autoclave:
  - Epoxy coated steel for treatment of different kinds of wood without tannin;
  - in AISI 304 stainless steel for drying wood containing corrosive agents (bay oak, chestnut, etc.);
  - lined with insulating material covered with pre-coated sheet-steel.
- Electric control panel with microprocessor for automatic running and stopping of the drying process.
- Humidity control probes for the wood being dried.
- Temperature control probes for the wood being dried.
- Motor driver extractor trolley.
- External control for extracting trolley.
- Condensate circuit of water vapour from the wood, made up of stainless steel finned tubes.
- Heating unit made up of stainless steel finned tubes
- Hydraulic vacuum pump complete with condensate system.
- Hot water circulation pump.
- Humidification system.
- Alternative flow fans for air conditioning of the drying chamber.
- Agitators driven by gearmotors to generate air turbulence inside the autoclave.

To start up the plant simply connect it to:
1. A f.e.m. socket;
2. A cold water supply;
3. Draining well to drain off the water condensate from the wood.



TYPE	A mm.	B mm.	C mm.	D mm.	E mm.	F mm.	G mm.	H. mm.	WEIGHT t.	Net capacity m^3	Hot water heating 90°C				Elecrtic heating
											Inst. power		Consum. m/h		Absorb. KW/h
											Cal.	kW	Cal./h	KW/h	
EM 6V	1220	1220	5000	2000	5800	2250	12000	2300	4	6,5	20000	6,5	8000	2,7	7
EM 8V	1220	1220	8000	2000	9460	2250	17000	2300	6,5	8	30000	9	10000	3	10
EM 12V	1220	1220	10600	2000	11560	2250	23000	2300	8,8	12	50000	11	15000	3,2	13
EM 20V	1500	1500	12000	2400	13000	2400	24000	2500	15,2	19	100000	25	30000	6	22
EM 25V	1500	1500	16000	2400	18000	2400	33000	2500	18	25	150000	28	38000	18	-
EM 50 V	2400	2400	11500	3600	13000	3800	25000	3800	25	44	300000	37,5	80000	22	-

5.2 MODEL EM2V DRIER

The ISVE EM2V vacuum drier has been designed and manufactured especially for small to medium sized carpenter's workshops, with small quantities of wood to be dried, but requiring high quality and short drying times.
The plant is equipped with a control computer to facilitate programming of the process. There is no difficulty involved in learning the technology.
This system (Vacutronic) can operate using three different modes:

- Completely automatic;
- Semi-automatic;
- manual.

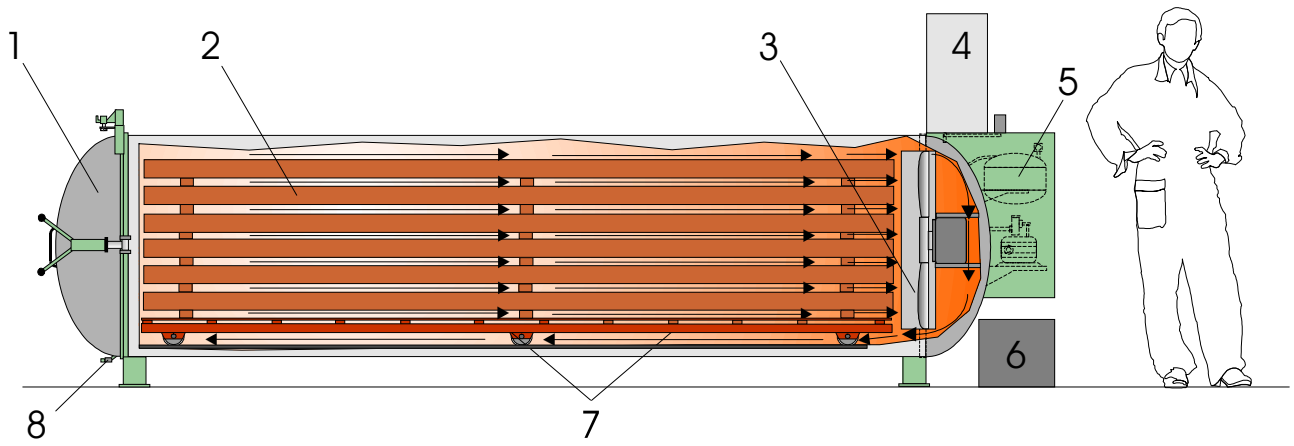
The variation of each parameter can be displayed by connecting the drier computer to a normal PC using Windows.
With this system, besides having remote control of the cycle, it is possible to store all the process phases.

The plant, operating at low temperatures, allows the water in the wood being treated to evaporate without making it undergo sudden changes of temperature which could cause cracking or warping. Thanks to a steam generator and the water evaporated from the wood during drying, the surfaces of the material are kept humid, thus avoiding the formation of small cracks, present in other drying systems.
The level of humidity necessary between the environment and the material, is constantly controlled by a condenser which precipitates the vapour in suspension.
Air conditioning of the drying chamber is maintained thanks to an electric fan with heating elements which heats the air made to circulate in the pile of wood.
This process of conditioning of the environment followed by a vacuum cycle, starts the transmigration process of the water through the cell walls of the wood, from the interior to the surface, from where the water is continually evaporated until the drying conditions wanted are reached.
The condensate deposits on the bottom of the autoclave and is periodically drained off in order to maintain the environment conditions stable.

The following advantages are achieved:
PERFECT RESULTS DUE TO: absence of warping and cracking; no alterations in colour; no internal tension; no change in resistance of dried material.
POSSIBILITY OF DRYING: very thick material with very high humidity; planks of all types of wood.
LOW RUNNING COSTS DUE TO: minimum heat loss; rational use of thermal and electric energy; no need to intervene manually.
LOW MAINTENANCE COSTS DUE TO: simple, rational construction; simple automative devices; non-corrosive materials.

Main features

- Autoclave:
  - in AISI 304 stainless steel;
  - lined with insulating material 50 mm thick.
- Electric control panel with microprocessor for automatic running and stopping of the drying process.
- Humidity control probes of a sample element.
- Manual removal of trolley with the following characteristics:
  - Capacity equal to a 700 x 700 mm pile with a length of 6,000 mm.
  - External tracks for sliding the trolley.
- Heating using 3 elements positioned at the bottom of the autoclave.
- Hydraulic vacuum pump complete with condensate system.
- Humidification system with steam generator.
- 600 mm diameter fan
- Aluminium strips, 20 mm thick.



1	Door	5	Steam generator
2	Wood pile	6	Vacuum pump
3	Electric fan	7	Trolley
4	Electric control panel with Vacutronic	8	Discharge valve

TECHNICAL DESCRIPTION OF EM2V VACUUM DRIER			
• Heating elements : • Maximum sizes of pile being dried (mm): • Internal diameter of autoclave (mm): • Overall sizes of base: • Overall sizes height:	n. 3x2,5 kW 700x700x6.000 1.000 1.070x7.000 1.200	• Total weight (kg): • Electric connection: • Electric power installed (kW): • Average hourly consumption of electricity (kW/h):	800 380 V 50 Hz 9,25 5