

**ES-ESC VACUUM DRIERS**



# TECHNICAL REPORT



**VACUUM DRIERS**





## 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**

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## 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.





## 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:

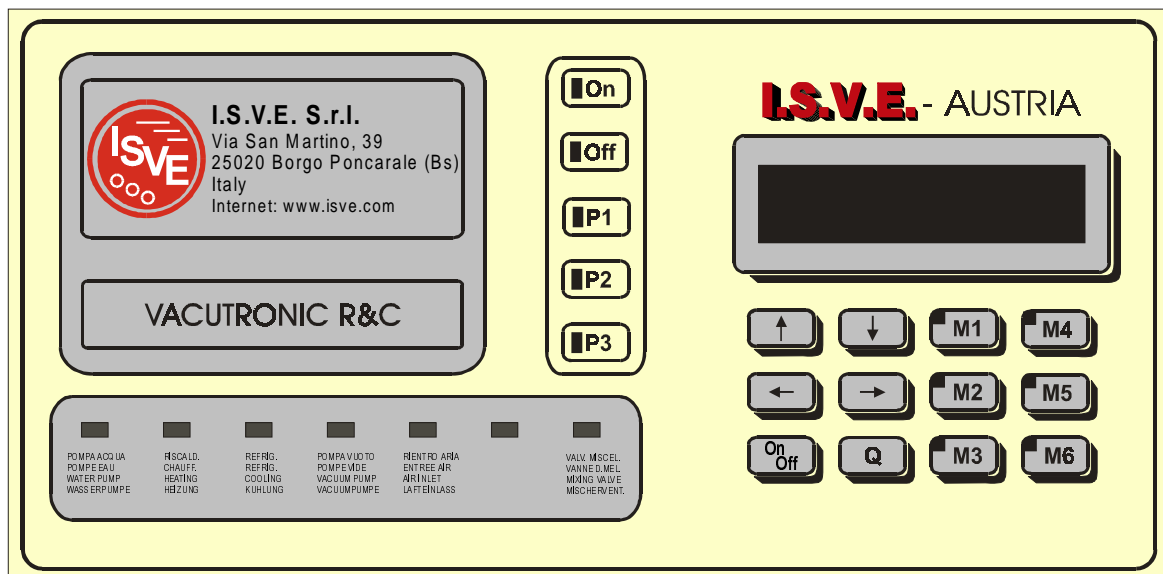
- humidity of material being dried (it is possible to control up to six probes);
- humidity in the air and temperatures during the pre-heating phases, intermediate heating and during the final equilibrium moisture content phase;
- the level of operating vacuum.

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](http://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 at low temperatures.

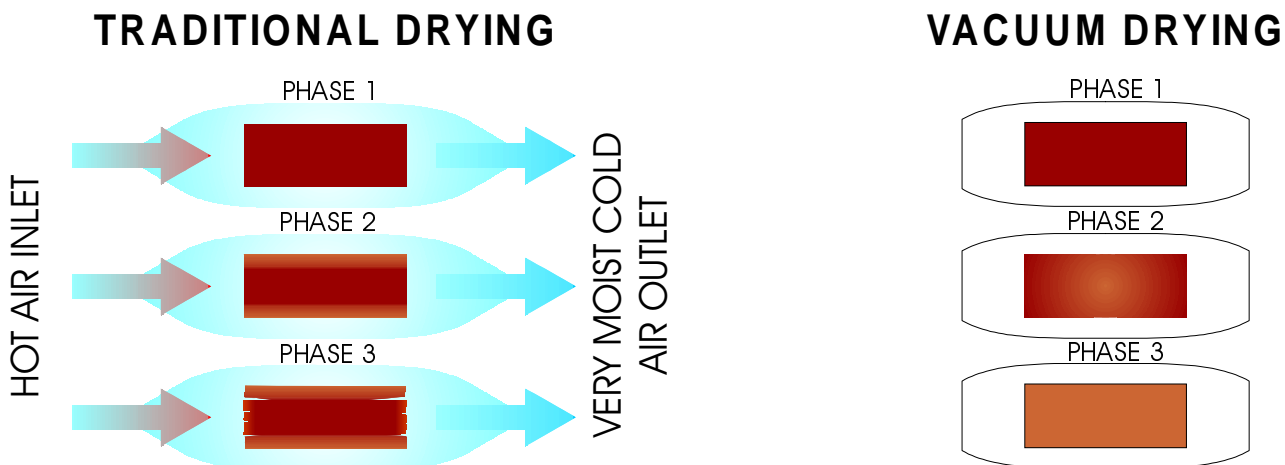
The second principle enables the quantity of humidity removed from the wood to be controlled and regulated, second by second, by adjusting the temperature of the condensers.

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 ES OR ESC IS THE MOST SUITABLE FOR ONE'S REQUIREMENTS?

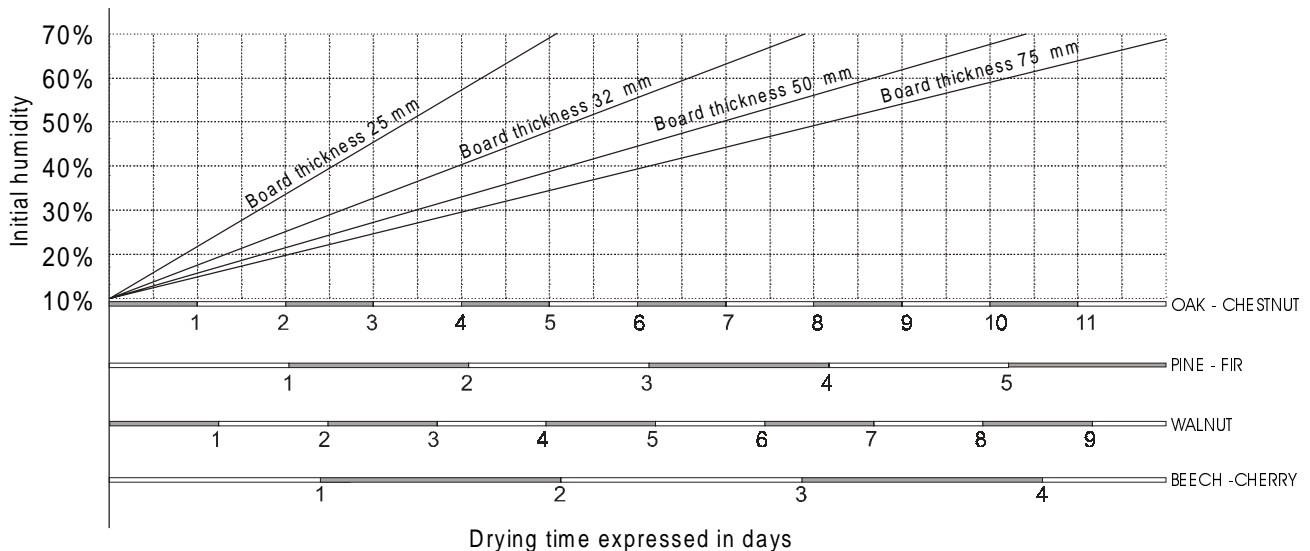
How to choose a vacuum drier, but above all how to calculate its size according to one's requirements?

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 semi-finished product 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 30 m<sup>3</sup> a month of oak having 40% initial humidity and a thickness of 32 mm, on the basis of the graph the time needed would be about 4 days /final humidity 10%).

Over a month, considering the plant will be working automatically, 6 drying cycles can easily be carried out.

The net capacity of the autoclave will therefore be equal to: 30 m<sup>3</sup> /month ÷ 6 monthly cycles = 5 m<sup>3</sup>

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. ISVE ES AND ESC CONTINUOUS VACUUM SERIES OF DRIERS FOR SEMI-FINISHED PRODUCTS

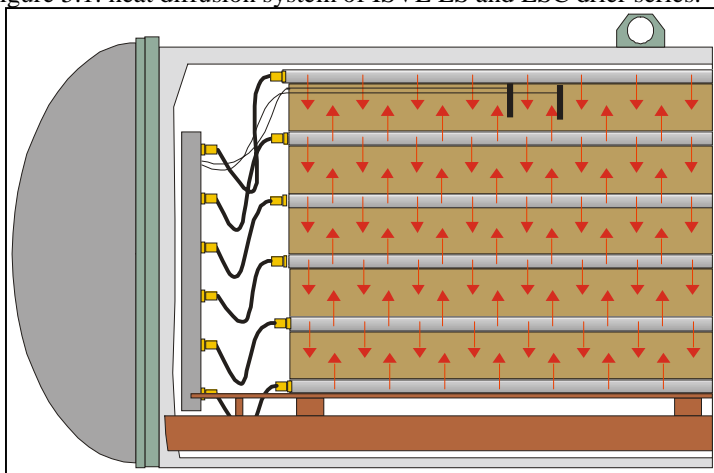
The ISVE ES and ESC series of driers are particularly suitable for drying **semi-finished products** using various types of wood.

In order to achieve optimal results the wood must be heated gradually and homogeneously.

This result using models ES and ESC is achieved thanks to a series of aluminium plates which spread the heat produced by the electric resistors or the hot water which flows inside the special coils.

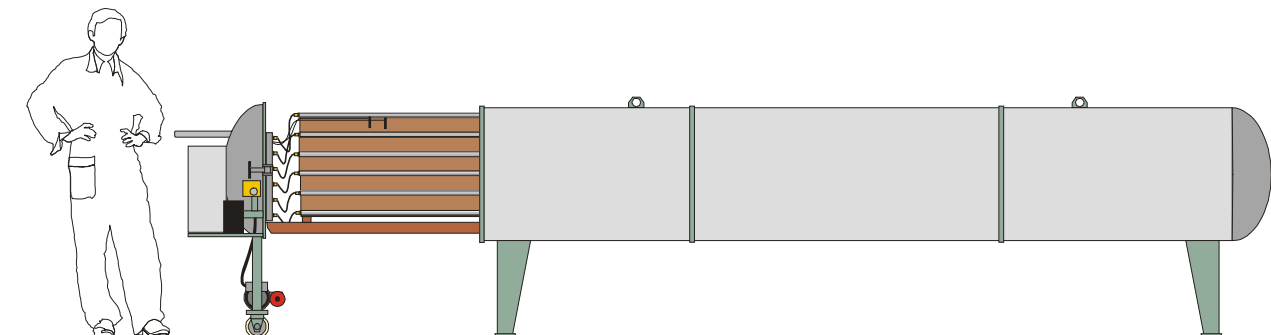
The rational use of the thermal energy produced does not penalise the use of a precious energy source such as electricity but it enhances it thanks to the drying process being completely computerised (however, the possibility always remains of connecting up to a hot water supply source if available).

Figure 5.1: heat diffusion system of ISVE ES and ESC drier series.



The reduced size compared with the productivity of these units produces 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.





### 5.1 MODEL ES JUNIOR and ES 2 DRIERS

The ES Junior series of continuous vacuum driers are the ISVE mini-driers traditionally used by small craftsmen.

They enclose all the technology and experience developed over twenty years of research into the application of the vacuum process in the treatment of wood.



The machine, operating at low temperatures, allows the timber to lose its water content without subjecting it to thermal changes which can cause cracking and warping. The evaporated water which remains in suspension in the container keeps the drying material surface continuously humidified, avoiding in this way the formation of small cracks which, in other drying systems is quite frequent. The humidity level which is necessary between environment and material is constantly maintained by a condenser which precipitates the steam in suspension. The conditioning of the drying chamber is kept constant and programmed in advance using probes connected to the heating and condensing circuits and to the timber. This conditioning of the environment sets the transmigration process of the water through the cellular walls of the timber in motion. Passing from their inside walls towards the surfaces, from which the water is continuously evaporated until the desired drying conditions are reached. The condensate which deposits at the bottom of the dry kiln, is periodically expelled in order to maintain the environmental conditions constant. In this way the following advantages are had:

**QUICKNESS OF DRYING:** owing to process without air and at low temperatures which enables hourly decreases in humidity never before reached by any other system.

**PERFECT RESULTS** due to: no cracks and no warping; no colour changes; no internal tension; unchanged strength of the dried material.

**POSSIBILITY OF DRYING:** very thick material and with a very high humidity level; such as planks and wood of all kinds, semi-finished items.

**LOW OPERATING COSTS** thanks to: low thermal loss; a rational use of thermal and electric energy; no need of manual operations.

**LOW MAINTENANCE COSTS** deriving from: simple and rational construction; simple automatic devices; anticorrosive materials.

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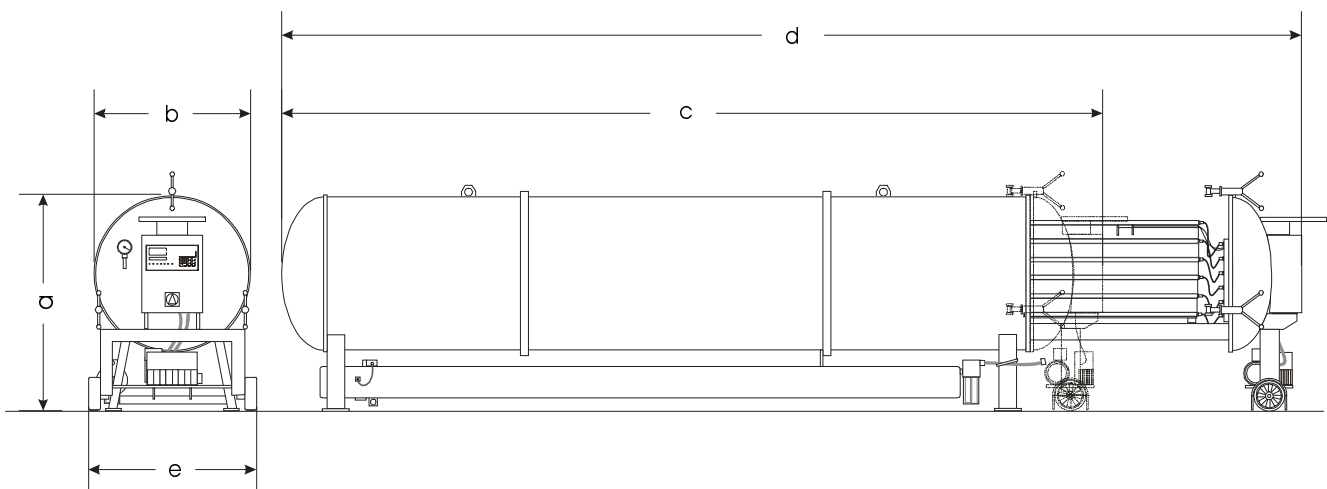
### Main Characteristics

- Autoclave:
  - steel coated with epoxy products for the treatment of wood without tannin.
  - AISI 304 stainless steel for drying wood containing corrosive agents (oak, chestnut, etc.)
  - Insulating covering
- Carriage opening.
- Electric control panel with microprocessor for automatic running and stopping of drier.
- Humidity control probes of a sample unit.
- Automatic discharge of condensate.
- Aluminium electric heating plates.
- Plate holder stand.
- Oil lubricated vacuum pump.

### Accessories on request:

- Air-bag pressing system
- Disinfecting System against xylophagan using insecticide tablets.

To start up the machine all that is required is an electric socket and discharge well for the condensate



TYPE	a mm	b mm	c mm	d mm	e mm	Weight kg	Cap. m <sup>3</sup>	Inst. power kW	Absorb. power. kWh
ES Jun. 4	1300	800	4800	9100	900	480	0,6	3,5	0,90
ES Jun. 5	1300	800	6000	11200	900	550	0,7	3,5	0,95
ES 2	1300	1100	6100	11200	1150	900	2	8	1,8



## 5.2 MODEL ESC DRIER WITH TOP OPENING

The ESC series vacuum driers are particularly suitable for carpenter workshops with problems of space.

**Top opening** means that the whole length of the autoclave can be used without having to extract the carriage, thus drastically reducing the overall size.



The machine, operating at low temperatures, allows the timber to lose its water content without subjecting it to thermal changes which can cause cracking and warping. The evaporated water which remains in suspension in the container keeps the drying material surface continuously humidified, avoiding in this way the formation of small cracks which, in other drying systems is quite frequent. The humidity level which is necessary between environment and material is constantly maintained by a condenser which precipitates the steam in suspension. The conditioning of the drying chamber is kept constant and programmed in advance using probes connected to the heating and condensing circuits and to the timber. This conditioning of the environment sets the transmigration process of the water through the cellular walls of the timber in motion. Passing from their inside walls towards the surfaces, from which the water is continuously evaporated until the desired drying conditions are reached. The condensate which deposits at the bottom of the dry kiln, is periodically expelled in order to maintain the environmental conditions constant. In this way the following advantages are had:

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**POSSIBILITY OF DRYING:** very thick material and with a very high humidity level; such as planks and wood of all kinds, semi-finished items.

**LOW OPERATING COSTS** thanks to: low thermal loss; a rational use of thermal and electric energy; no need of manual operations.

**LOW MAINTENANCE COSTS** deriving from: simple and rational construction; simple automatic devices; anticorrosive materials.

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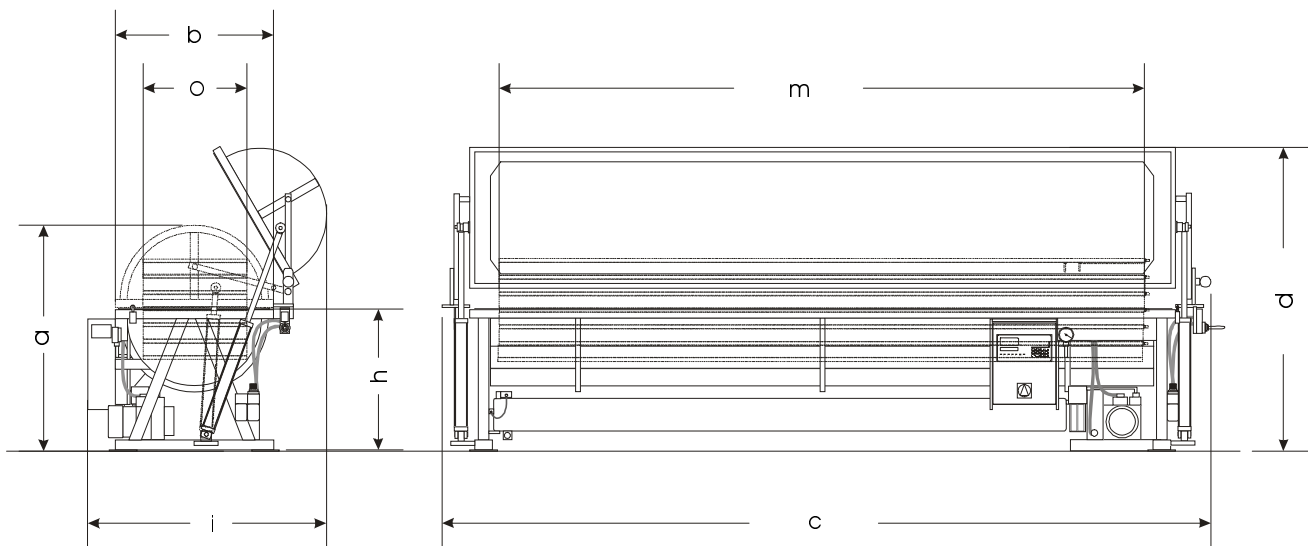
### Main characteristics

- Autoclave:
  - steel coated with epoxy products for the treatment of wood without tannin.
  - AISI 304 stainless steel for drying wood containing corrosive agents (oak, chestnut, etc.)
  - Insulating covering.
- Shell-opening with pneumatic pistons.
- Electric control panel with microprocessor for automatic running and stopping of drier.
- Humidity control probes of a sample unit.
- Automatic discharge of condensate.
- Aluminium electric heating plates.
- Oil lubricated vacuum pump.

### Accessories on request:

- Air-bag pressing system
- Disinfecting System against xylophagan using insecticide tablets.

To start up the machine all that is required is an electric socket and discharge well for the condensate



TYPE	a mm	b mm	c mm	d mm	h mm	i mm	m mm	o mm	Weight kg	Cap. m <sup>3</sup>	Inst. power kW	Absorb. power kWh
ESC Jun. 4	1200	800	4900	1600	750	1200	4000	480	400	0,6	3,6	0,9
ESC Jun. 5	1200	800	5900	1600	750	1200	5000	480	460	0,7	3,6	0,95
ESC 1,5	1500	1450	4900	2200	820	1650	4000	800	700	1,5	8	1,3
ESC 2	1500	1450	5900	2200	820	1650	5000	800	800	2	8	1,8



### 5.3 MODEL ES LARGE CAPACITY DRIERS

The ES series of continuous vacuum driers with capacities from 3 to 25 m<sup>3</sup> for large carpenter works or timber yards looking for **quality** in drying coupled with high **productivity**. These plants enclose all the technology and experience developed over twenty years of research into the application of the vacuum process in the treatment of wood.



The machine, operating at low temperatures, allows the timber to lose its water content without subjecting it to thermal changes which can cause cracking and warping. The evaporated water which remains in suspension in the container keeps the drying material surface continuously humidified, avoiding in this way the formation of small cracks which, in other drying systems is quite frequent. The humidity level which is necessary between environment and material is constantly maintained by a condenser which precipitates the steam in suspension. The conditioning of the drying chamber is kept constant and programmed in advance using probes connected to the heating and condensing circuits and to the timber. This conditioning of the environment sets the transmigration process of the water through the cellular walls of the timber in motion. Passing from their inside walls towards the surfaces, from which the water is continuously evaporated until the desired drying conditions are reached. The condensate which deposits at the bottom of the dry kiln, is periodically expelled in order to maintain the environmental conditions constant. In this way the following advantages are had:

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**POSSIBILITY OF DRYING:** very thick material and with a very high humidity level; such as planks and wood of all kinds, semi-finished items.

**LOW OPERATING COSTS** thanks to: low thermal loss; a rational use of thermal and electric energy; no need of manual operations.

**LOW MAINTENANCE COSTS** deriving from: simple and rational construction; simple automatic devices; anticorrosive materials.

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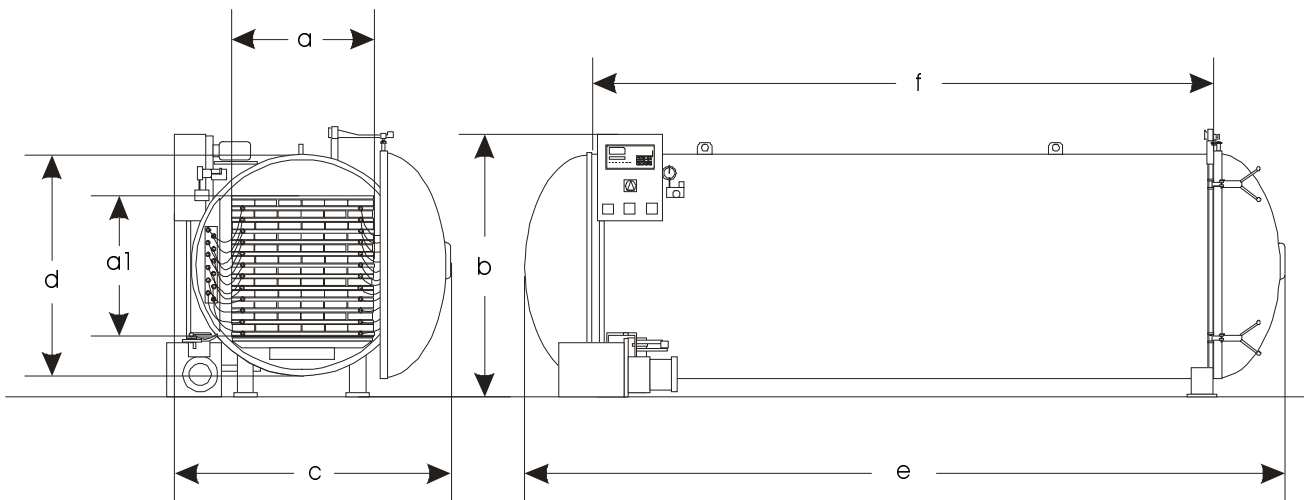
**Main Characteristics**

- Autoclave:
  - steel coated with epoxy products for the treatment of wood without tannin.
  - AISI 304 stainless steel for drying wood containing corrosive agents (oak, chestnut, etc.)
  - Insulating covering
- Carriage opening plate and wood holder.
- External carriage guides.
- Electric control panel with microprocessor for automatic running and stopping of drier.
- Humidity control probes of a sample unit.
- Stainless steel condensate tubes with two cooler fans.
- Hot water circulation pump.
- Four-way powered pump to be used to connect up to a hot water source.
- Automatic discharge of condensate.
- Aluminium electric heating plates.
- Plate holder stand.
- Oil lubricated vacuum pump.

**Accessories on request:**

- Air-bag pressing system
- Disinfecting System against xylophagan using insecticide tablets.

To start up the machine all that is required is an electric socket and discharge well for the condensate



TYPE	a1 mm	a mm	b mm	c mm	d mm	e mm	f mm	Weight t.	Cap. m <sup>3</sup> netta	WATER HEATING OF 85°C			
										Inst. power		Consumption m/h	
										kW	Cal.	KW/h	Cal./h.
ES 3	795	822	2000	2100	1300	5900	5000	1,7	3				
ES 5	990	1100	2300	2390	1620	5900	5000	4,1	5	2,1	25000	1,5	9000
ES 8	1200	1220	2300	2650	2100	8000	7000	4,8	8	2,5	35000	2,0	10000
ES 5+5	Trattasi di due essiccatoi con unico gruppo comando							9,5	10	2,2	50000	2,1	18000
ES 12	1400	1280	2400	2750	2300	8000	7000		12	3,2	50000	2,8	25000
ES 20	1600	1280	2500	2850	2500	12000	11000		20	3,2	50000	3	40000
ES 25	2400	2400	3700	4000	3600	9000	7000		25	5,4	80000	4	60000

Electric heating: ES 3 (Installed power 10,7 kW, absorb. 3,5 kW/h), ES 5 (Installed power 14 kW, absorb. 7,0 kW/h), ES 8 (Installed power 22 kW, absorb. 9,0 kW/h), ES 5+5 (Installed power 28 kW, absorb. 14 kW/h).