

VACUUM DRYER EMV SERIES

SISTEMI PER
TRATTAMENTO DEL LEGNO

SISTEMAS PARA
EL TRATAMIENTO DE LA MADERA

SYSTÈMES POUR
LE TRAITEMENT DU BOIS

SYSTEME ZUR
HOLZBEHANDLUNG

СИСТЕМЫ ПО
ОБРАБОТКЕ ДЕРЕВА



ISVE WOOD

WOOD TECHNOLOGICAL PARTNER



ISVE GROUP

COMPETITIVE SUSTAINABILITY

TECHNICAL NOTES

INTRODUCTION

This brochure represents a synthetic reference about features and application possibilities of continuous/discontinuous vacuum kilns series EMV from ISVE srl.

Data. Features and illustrations are purely indicatives. ISVE srl reserves to make appropriate modifications.

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Appendix: some images of EMV kilns in the world.

1. INTRODUCTION

Modern technologies applied in the laboratories of wood process allowed to optimize use and process times of raw material. Anyway, trying to gain 0,5 mm of thickness on a table, or 1 mt per second of speed of a working machine without paying attention to “**non quality**” of drying, may cause **performance losses of 5-10% to the machine above-mentioned**. The kiln must be considered as a production machine, as a guarantee of a real saving on raw material and on quality of finished product.

Speed drying without defects is the target that ISVE pursues from 30 years of research in the vacuum scope.

Results we obtained refer to 2 camps:

1. **quantitatives**

- Better speed in the drying process than traditional system
- Costs abatement
- Reduction of stocking volumes of drying material

2. **qualitatives**

- Maximal homogeneity of final moisture
- Maximal reduction of cracking and twist phenomena of the material
- Respect of the natural features of the wood (colour, knots, . . .)
- Xylophagous and vermin elimination

To invest in quality of a drying plant means to invest in the quality of own wood. The choice of kiln type EMV, namely a machine for vacuum drying with ventilation, is due essentially to his practicality of use; the ideal vacuum kiln for timber merchants and sawmills.

Tables already decked at the exit of band saw can be prepared in packs that can be loaded and unloaded from the kiln through a forklift.



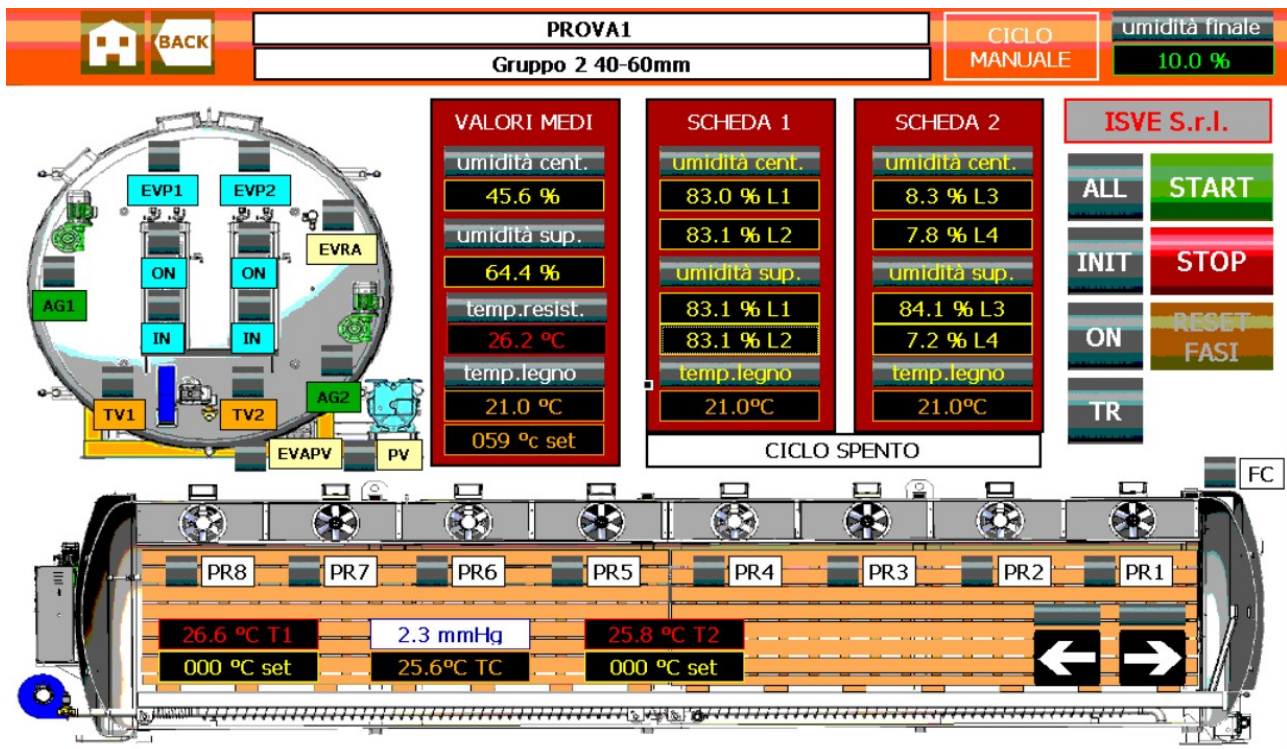
An EMV of 12mc in Spain.

2. THE OPERATING SYSTEM

Our drying plants have recently been fully reviewed proposing some important innovations that make our range one of the most innovative of the market.

The core of the plant is the control system no longer based on dedicated electronic cards, such as the Vacutronic, but on high-level products easily available on international markets.

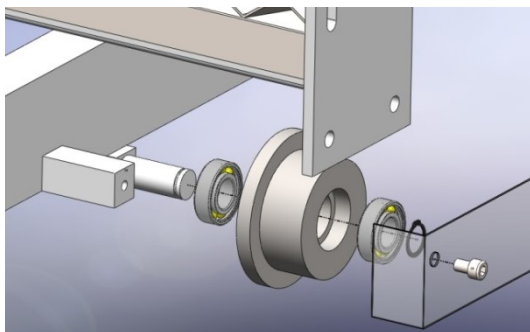
The PLC is Siemens brand of latest generation.



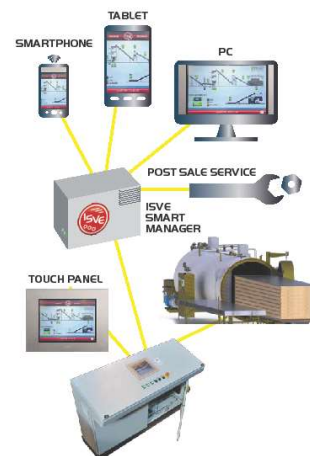
Operating cycles can be stored in various work programs, which the operator can easily use.

SIEMENS PLC: the new ISVE drying kilns are fitted with S7-1200 Siemens PLC of latest generation. The control system allows monitoring carefully all the cycle phases realizing continuously self-testing on the plant components.

CAREFUL 3D DESIGN: all plants are carefully designed by using 3D software of latest generation. The instruction manual includes layout and exploded diagrams to easily ask for assistance or spare parts.



ISVE SERVER CONNECT: all plants can be connected via Web to provide real-time information concerning the operation of the machine.



MADE IN ITALY and 24 MONTHS GUARANTEE:

ISVE checks the plants during each phase of manufacturing. The high-quality installed components let us granting 24 months guarantee to our international customers.



ADVANCED SOFTWARE: innovative control software which allows storing up to 8 different drying cycles. In this way the operator will be able to select the most suitable work program according to the wood essence.

ISVE MAINTENANCE PROGRAM: the plants are able to schedule maintenance interventions providing clear information to the operator through the control panel.



3. THE VACUUM: the secret of quality of ISVE driers.

The wood drying made through the exposition to open air, or in traditional kilns, is based on the following processes:

- Removal of water from the surface of wood tables through hot air currents (Phase 1)
- Migration of moisture from the wetter centre of tables to the dryer surface (Phase 2)

If the 2 processes are not perfectly synthonized **it's easy to generate abnormal tensions** (Phase 3) that can cause deformation and cracking of wood.

Reliability of a traditional drying system is connected to the need of proceeding in long time, not to create moisture imbalances in the section to dry. Anyway this process is valid to break down the high water level of green wood.

The drying using vacuum method allows the use of two physical principles of nature:

1. pressure reduction (vacuum creation) determines the transformation of water inside wood into steam at low temperatures (45°C at -700 mmHg);
2. water steam moves always from hot areas to cold ones.

The first principle guarantees a speedy removal of water steam **from the centre** of wood and a drastic reduction of thermal energy needs, as the operation is made at low temperatures.

The second principle allows controlling and regulating, second per second, the moisture quantity that is removed from wood working on condenser temperature.

The synergy of the two processes allows the reduction of moisture in the wood uniformly and without stresses in the structure.

Considering the high technology applied to these machines and the possibility to regulate precisely every phase of process, the vacuum drying is useful to stabilize the percentage of moisture in the wood. This result has an unmatched value, above all in the phases of finish and assemblage of the semi finished product.

In case of wood with resin bags, the vacuum drying guarantees the complete evaporation of natural solvents, causing an irreversible crystallization of the resin itself.

DRYING TIMES

<u>ISVE kiln type</u>	<u>Wood essence</u>	<u>Reduction of times than traditional dryers</u>
ISVE discontinuous vacuum kiln serie EMV	FIR	15%
ISVE continuous/discontin. vacuum kiln serie EMV	BEECH	55%
ISVE continuous/discontin. vacuum kiln serie EMV	OAK	58%

Thermal energy consumption

<u>ISVE kiln type</u>	<u>Wood essence</u>	<u>Reduction of times than traditional dryers</u>
ISVE continuous/discontin. vacuum kiln serie EMV	FIR	12%
ISVE continuous/discontin. vacuum kiln serie EMV	BEECH	38%
ISVE continuous/discontin. vacuum kiln serie EMV	OAK	27%

Electricity consumption

<u>ISVE kiln type</u>	<u>Wood essence</u>	<u>Reduction of times than traditional dryers</u>
ISVE continuous/discontin. vacuum kiln serie EMV	FIR	21%
ISVE continuous/discontin. vacuum kiln serie EMV	BEECH	53%
ISVE continuous/discontin. vacuum kiln serie EMV	OAK	28%

Datas above reported refer to a thickness of 50 mm.



4. HOW TO CHOOSE THE MOST SUITABLE EMV MODEL FOR YOUR NEEDS?

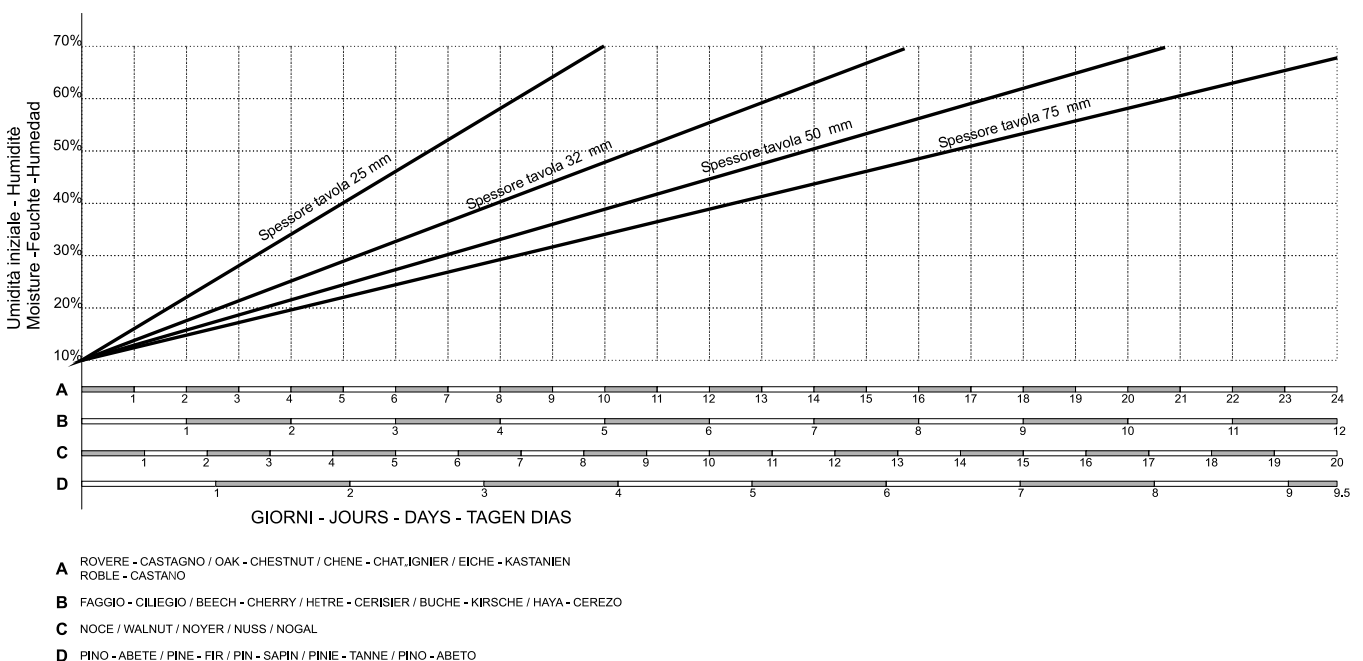
How to choose a vacuum kiln but, above all, how to dimension it concerning to your needs?

The main parameters to consider are the following:

- mc quantity of wood to dry per time unit;
- wood essence (pin, sapin, oak);
- thickness in mm of the tables;
- initial moisture.

From the graphic below you can have some indications about the dry times based on initial moisture and wood thickness.

If you make coinciding the initial moisture of the tables to the straight line of the thickness and going down until you cross the grey-white lines of the different wood essences, you will arrive to determine the duration expressed in days of the drying process.



E.g: if you suppose to dry 70 mm per month of pin or sapin at 30% initial moisture and with a thickness of 32 mm, based on the table you can estimate a dry time of 2 days (final moisture 10%).

In a month, considering the possibility of the plant to work automatically, you can be able to make 14 dry cycles.

The net capacity of the autoclave will be the same of: $70 \text{ mc/month} \div 14 \text{ monthly cycles} = 5 \text{ mc}$.

From this result it's easy to understand how the reduction of the dry times makes it easy, to work with drying kilns with limited capacity respect to the total volume of the dried product.

There are many advantages from the space saving to the easier insertion in the company logistic of the drying process.

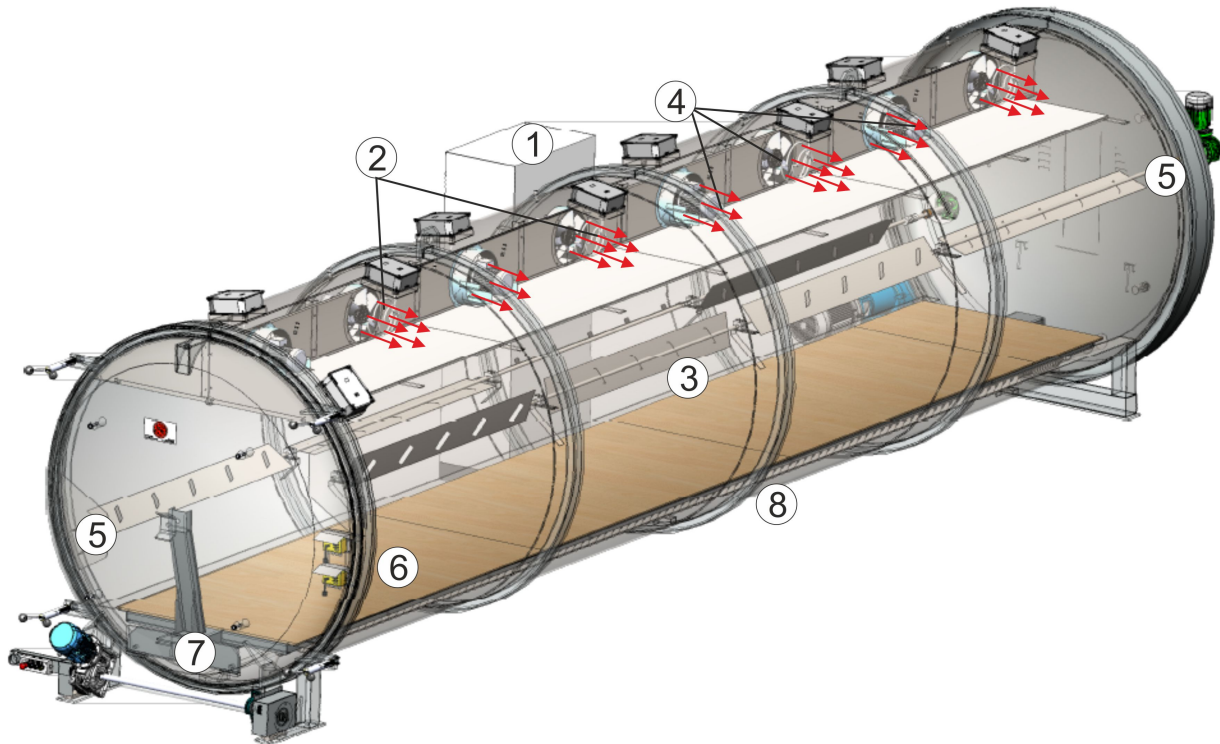
Not for last, the monolithic features of the ISVE driers allow an easy relocation after eventual resets of the working lines in the company.

Quality of the drying and project quality reflect them, in the ISVE driers – EMV series in the simply usage and easy insertion in the productive cycle of a company.

5. ISVE DRIERS IN CONTINUOUS/DISCONTINUOUS VACUUM EMV SERIE FOR TABLES

ISVE driers – EMV series are mainly made to dry tables with every kind of wood essences. These plants are called: “continuous/discontinuous vacuum” because the vacuum phase can be broken down from hot and damped air cycles that permit a fast heating of wood. In the EMV plants the timber is composed by decked tables which are positioned on the flatcar of the autoclave. Once closed the plant and set up the parameters on the PLC (control, PC), the drying cycle can start.

Picture 5.1: heating diffusion system in ISVE kilns – EMV series.



1	Control frame.	5	Turbolences
2	Hot water cell or electrical resistors	6	Moisture and temperature probes
3	Drying timber	7	Charge motorized cart
4	Altrnate flux fans	8	Condensers

The machine performs a first vacuum phase which permits the opening of charged wood pores, so in the autoclave is made circulate hot air with high moisture.

It's important that high temperature and wood temperature gradually increase, avoiding that drying begins from the most superficial part of tables. It's maintained an high value of moisture, electronically controlled with probes, which **prevent that dangerous tensions will be generated on the wood section and that pores can reclose themselves making the “superficial crust” phenomenon.**

At the same time the pump works periodically to maintain the right pressure value and to evacuate part of wood water that produces itself as steam, without taking off the part of water useful to maintain damped the surface.

These phases, simply resumed, are repeated more times in the process, melting in optimal way the use of hot damped air with vacuum, essential element of fast and qualified drying.

The contained dimensions respect to productivity of these plants allow a big space saving and an easy replace of autoclave inside the company, without doing building or lacing works. Quality materials used in the construction of the autoclave, as stainless steel and aluminium, guarantee duration against corrosion, and the choice of components from the principal Italian and foreign companies allows the attainment of high reliability. These features, commons to every ISVE drier, reflect on high drying quality realized in little time with extremely contained exercise costs.

Picture 5.2: charge cart with decked timber ready to be charged on the autoclave



EMV driers can be gifted both of water vacuum pumps and oil ones, the heating system can work with hot water using special radiators or with electricity using heating resistors. Making together one or more oil vacuum pumps and electrical heating system, you can obtain a really versatile machine that needs only EM force lacing and wood water discharge and can be moved easily in case of necessity.

5.1 EMV DRIERS CONTINUOUS/DISCONTINUOUS VACUUM OF BIG CAPACITIES

Discontinuous vacuum driers serie EMV with capacity from 6 to 75 m³ are indicated for big carpenteries or for timber dealers who are in search of drying **quality** combined with an high **productivity**. These plants contain all the technologies and experience developed in 40 years of planning and production of wood treatment plants.



EMV machine, working at low temperature, allows the evaporation of water in the treating timber without submitting it to thermal starts that can cause deformations and cracking.

Thanks to a steam generator and to drying timber evaporated water the surfaces of the material remain humidified avoiding the creation of little breaking that verifies itself with other drying systems.

The moisture gradient needed between environment and material, is constantly controlled by a condenser which make fall steam in suspension. The conditioning of the drying room is made by alternate flux fans or by deflectors which, through a cell of heated tubes with hot water or cell of electrical resistors, provide to raise air temperature that is made circulate in the timber to dry.

The environmental conditioning, with vacuum cycles, starts the process of transmigration of water through timber cellular walls, from inner parts to surface, from which water evaporates continually until the wished drying.

Condensate water on the bottom of the autoclave is periodically taken off to maintain the environmental conditions constant.

There are the following advantages:

PERFECT RESULTS FOR: absence of sensitive deformations; absence of colour alterations; absence of internal tensions; unchanged resistance of dried material.

POSSIBILITY TO DRY: materials with high thickness and maximum moisture; tables of every kind and essence.

EXERCISE COSTS FOR: minimum thermal losses; rational use of thermal and electrical energy; no needs of manual interventions.

LOW MAINTENANCE COSTS FOR: simple and rational construction; simple automation devices; anticorrosive materials.

Main features:

- Autoclave:
 - In painted steel with epoxy products to treat wood essences without tannin;
 - In stainless steel AISI 304 to dry wood with corrosive agents like oak, chestnut, etc . .
 - Isolating cover, covered by pre-painted sheet.
- Electrical frame work with PLC to conduct automatically drying and its stop.
- Control moisture probes of drying wood.
- Temperature control probes.
- Cart with motorized extraction.
- External guide to extract the cart.
- Condensation circuit of evaporated water from wood, composed of stainless steel tubes.
- Heating battery made of stainless steel tubes for hot water or through electric heating resistors.
- Vacuum pump completed of condensation system (with water or oil lubrication).
- Hot water circulation pump (for hot water heating system).
- Air moisturing system (normally a pressure steam generator).
- Alternate flux fans for the drying room conditioning.
- Mixers commanded by gearmotors to generate air turbulences from the inner of the autoclave.

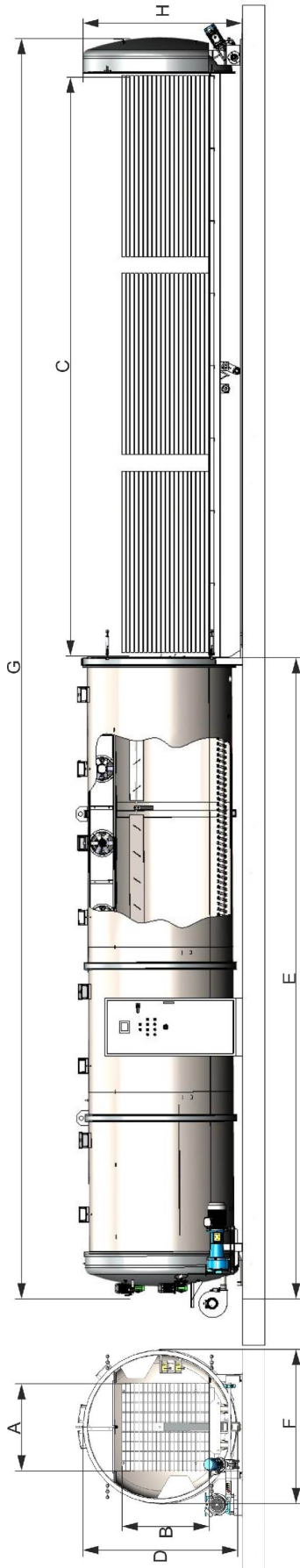
For the starting up of the plants is enough to connect them to:

1. an E.M.F. socket;
2. a cold water intake;
3. a discharge well to evacuate condensed water from wood;
4. a hot water intake of 90°C (from model EM6V to model EM25V).

For electric EMV:

1. an E.M.F. socket;
2. a discharge well to evacuate condensed water from wood;
3. a cold water intake (only for humidification system).





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 at 90°C				Electric	
											Inst. power. kW	Hourly		Inst kW	KW /h	
												Cal.	Cal./h			KW/h
EM 6V	1220	1220	5000	2000	5800	2250	12000	2300	4	6,5	20000	13	8000	2,7	15	8
EM 8V	1220	1220	8000	2000	9460	2250	17000	2300	6,5	8	30000	15	10000	3	21	11
EM 12V	1220	1220	10600	2000	11560	2250	23000	2300	8,8	12	50000	20	15000	3,2	30	16
EM 12VS	1220	1220	12000	2000	13000	2250	24000	2300	9,8	13	70000	21	17000	3,9	33	17
EM 20V	1500	1500	12000	2400	13000	2400	24000	2500	15,2	19	100000	25	30000	12	33	22
EM30V	1500	1500	18000	2400	19500	2400	38500	2500	22	30	150000	38	50000	18	51	34
EM25VL	1200	2300	13000	2700	14500	2700	27000	2800	16,2	25	130000	33	39000	16	43	29
EM35VL	1200	2300	18000	2700	19500	2700	37000	2800	23,5	35	180000	40,3	60000	24	60	41
EM25V	2400	2400	6000	3600	7500	3700	13000	3800	13	25	125000	33	40000	16	35	28
EM50V	2400	2400	12000	3600	13500	3700	25000	3800	25	50	250000	66	80000	32	69	55
EM75V	2400	2400	18000	3600	19500	3700	37000	3800	38	75	375000	99	115000	48	104	83

5.2 MODELS EM2V AND EM5V DRY KILNS

ISVE vacuum kiln EM2V is made and realized for little carpentry laboratories, with little quantities of timber to dry, but with elevated qualitative demands and short drying times and practical of use of this type of machine. The way of operation of the plant of 2 or 5 mc is totally identical to the one of our plants with bigger dimensions, they are also in some constructive and technical features; e.g.: type of heating is only electrical through heating resistors.

Also in this machine there's a steam generator which avoid the formation of little breakings and holes because it humidifies opportunely the drying wood surfaces. The moisture gradient needed between environment and material is constantly monitored through a condenser which makes falling the steam.

The conditioning of drying room is maintained only from an electro-fan which, with electrical resistors



provides to air heating that circulates in the timber longitudinally. This environmental conditioning, in concomitance with vacuum cycles, puts into effect the process of transmigration of water through the cellular walls of timber, from the inner parts to the surfaces, from which water is continually evaporated until reaching wishes drying conditions. Condensate water which deposited on the bottom of the autoclave is periodically taken off to maintain environmental conditions constant.

Following advantages:

PERFECT RESULTS FOR: absence of sensitive deformations; absence of colour alterations absence of internal tensions; no alteration of resistance of drying material.

POSSIBILITY TO DRY: high thickness material and with maximum moisture; tables of every kind and essence.

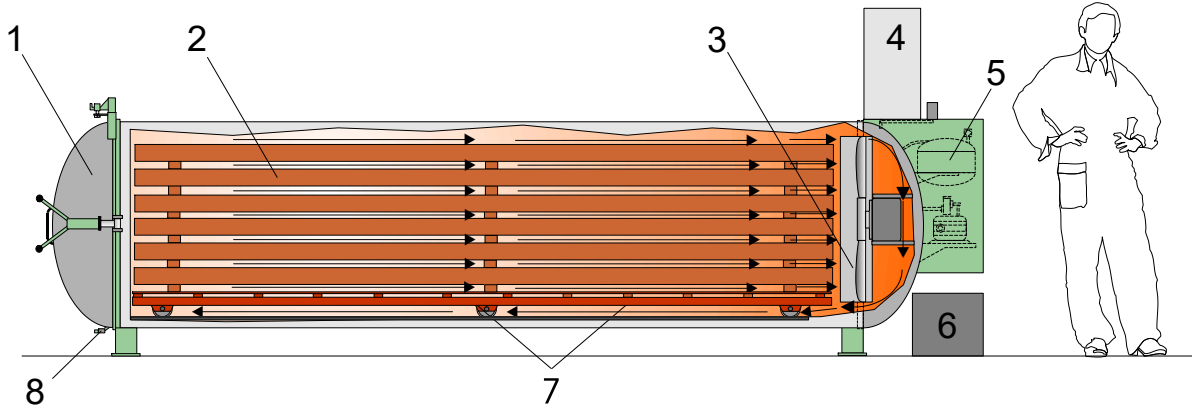
LOW EXERCISE COSTS FOR: minimal thermal losses; rational use of thermal and electrical energy; no needs of manual interventions.

LOW MAINTENANCE COSTS FOR: simple and rational constructions; simple automation devices; anti-corrosive materials.

Main features

- Autoclave:
 - In stainless steel AISI 304
 - Isolating cover in isolating material of thickness: 50 mm.
- Electric frame work with microprocessor for automatic conduction of drying and its stopping.
- Moisture control probes of a sample.
- Manual extraction cart with following features:
 - Capacity equal to a timber of mm700x700 – length 6000 mm for EM2V
 - Capacity equal to a timber of mm 1100x900 – length 5000 mm for EM5V
 - External binaries for cart scrolling.
- Heating by 3 resistors on the bottom of the autoclave.
- Vacuum hydraulic pump completed with condensation system.
- Humidification system with steam generator
- Fan with diameter 600 mm for EM2V and diameter 1300 mm for EM5V
- Aluminium filet – thickness 20 mm

1	Door	5	Steam generator
2	Wood timber	6	Vacuum pump
3	Electrofan	7	Cart
4	PLC framework	8	Discharge valve



APPENDIX: SOME IMAGES OF EMV KILNS AROUND THE WORLD



EM12V in Yecla (Spain)



EM8V near a kiln with plates in Trentino (Italy)



EM5V in Brianza (Italy)



EM18V in Alsace (France)



n.2 EM12V in Tuscany



EM12V in Sudtirool



EM20V near Zurich (Switzerland)



n.2 EM6V in Slovenia



EM6V in Slovenia



EM6V elettrico in Valtellina