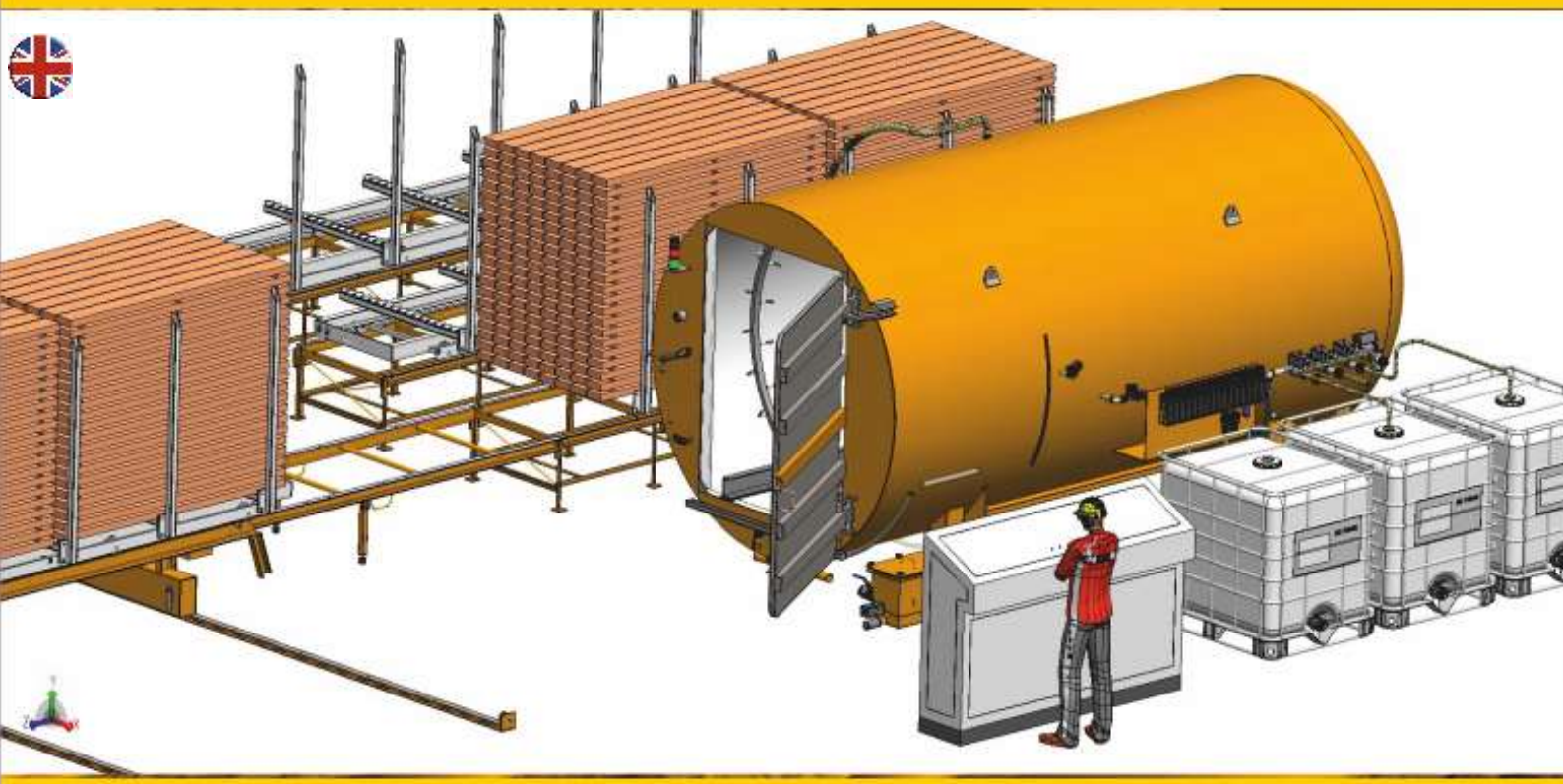

IMP-PG SERIES

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

UNIVERSIDAD POLITECNICA DE MADRID

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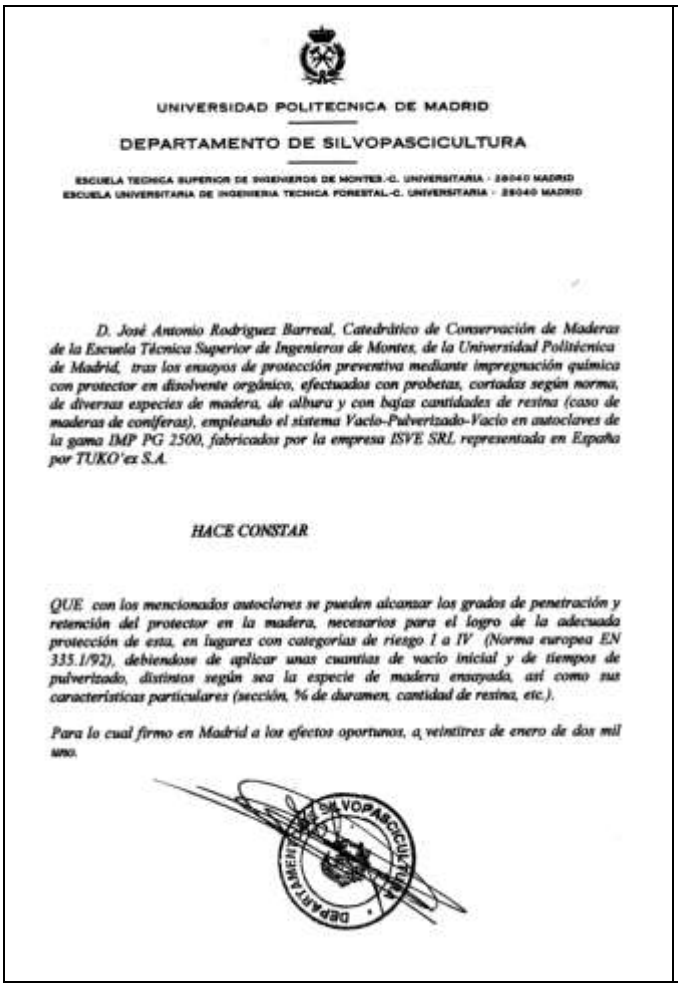

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ESCUELA UNIVERSITARIA DE INGENIERIA TECNICA FORESTAL.-C. UNIVERSITARIA - 28040 MADRID

D. José Antonio Rodríguez Barreal, Catedrático de Conservación de Maderas de la Escuela Técnica Superior de Ingenieros de Montes, de la Universidad Politécnica de Madrid, tras los ensayos de protección preventiva mediante impregnación química con protector en disolvente orgánico, efectuados con probetas, cortadas según norma, de diversas especies de madera, de albura y con bajas cantidades de resina (caso de maderas de coníferas), empleando el sistema Vacío-Pulverizado-Vacío en autoclaves de la gama IMP PG 2500, fabricados por la empresa ISVE SRL representada en España por TUKO'ex S.A.

HACE CONSTAR

QUE con los mencionados autoclaves se pueden alcanzar los grados de penetración y retención del protector en la madera, necesarios para el logro de la adecuada protección de esta, en lugares con categorías de riesgo I a IV (Norma europea EN 335.1/92), debiéndose de aplicar unas cuantías de vacío inicial y de tiempos de pulverizado, distintos según sea la especie de madera ensayada, así como sus características particulares (sección, % de duramen, cantidad de resina, etc.).

Para lo cual firmo en Madrid a los efectos oportunos, a veintitres de enero de dos mil uno.

UNIVERSIDAD POLITECNICA DE MADRID

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D. José Antonio Rodríguez Barreal, Catedrático de Conservación de Maderas de la Escuela Técnica Superior de Ingenieros de Montes, de la Universidad Politécnica de Madrid, tras los ensayos de protección preventiva mediante impregnación química realizados con el protector orgánico Vac-sol y con las especies madera:

Pinus pinaster Ait. (Variedad Atlántica).
Pinus radiata D.Don.
Pinus sylvestris L.
Quercus alba L.(Roble blanco americano).
Entandrophragma cylindricum Sprage (Sapelli).
Chlorophora excelsa (Wehv.) Benth. & Hook.(Iroko).

en los autoclaves de la gama IMP PG 2500/4500 con capacidad de realizar vacío de 700 mm. de Hg. , de sistema vacío-pulverizado-vacío, fabricados por la empresa ISVE SRL y representados en España por TUKO'ex S.A.

HACE CONSTAR

Que con los mencionados autoclaves se alcanzan los grados de retención y penetración del protector en la madera necesarios para localizaciones de esta en categorías de riesgo I a IV (norma Europea EN 335.1/92), caracterizados por una penetración P8 de la Norma Europea EN 351.1/95, debiéndose de aplicar unas cuantías de Vacío inicial y de tiempo de pulverizado distintas, según la especie de madera y sus características particulares (cantidad de duramen, de resina, sección, etc.).

Para lo cual firmo en Madrid, a veintiséis de enero de dos mil uno.

Fdo. José A. Rodríguez Barreal
Catedrático de Conservación de Maderas
de la Escuela Técnica Superior de Ing. Montes de Madrid

NORMA EUROPEA EN 335.1/92

CATEGORIAS DE RIESGO

I – II – III

AUTOCLAVE IMP PG 2.500

INTRODUCTION

This brochure besides being a brief reference on the characteristics and application possibilities of the IMP-PG impregnator series produced by I.S.V.E. Srl., aims to provide some information on the durability of wood according to the various environmental conditions.

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

Index

BIBLIOGRAPHY

G. GIORDANO – WOOD TECHNOLOGY – UTET
ENC (EUROPEAN NORMALISATION COMMITTEE) EUROPEAN STANDARD EN 335

IMPREGNATION TREATMENT AND COATING OF WOOD IN AUTOCLAVES USING THE DOUBLE VACUUM SYSTEM

People love and appreciate living and working in environments with wood finishing and panelling, they value its warmth and the unique incomparable **natural beauty** no other material of mineral or synthetic origin has.

These qualities are however penalised by a single factor: durability.

As atmospheric and biological agents such as fungi, insects and bacteria attack wood more or less rapidly, the preference has fallen on selecting and using "naturally" resistant wood.
The continual demand for these species has considerably reduced its availability and increased the price..
This has led to the need to use less long lasting but much more inexpensive wood, but however applying effective treatment to increase its natural resistance.

Right from the beginning of the last century the first applications of preservative products were attempted using autoclaves and the results were very encouraging.
Today I.S.V.E. Srl, aware of the results that can be reached using this technique, has applied the most recent technology to develop a treatment autoclave that enhances the use of the most modern industrial chemical products for preserving wood.

To preserve and treat does not however mean to destroy the natural characteristics of the wood: the possibility of using water-based impregnants and atomisation of the product in a hermetically closed autoclave means **total respect for the environment**.

Conservation and respect for the environment are the objectives of the I.S.V.E. Srl. IMP-PG SERIES OF VACUUM IMPREGNATORS.

1. THE ENEMIES OF WOOD

The destructive agents that cause the most damage to wood are fungi, xolophagi saprophyte insects and marine invertebrates.
The technology applied to I.S.V.E. autoclaves aims to kerb the action of these organisms.

1.1 Fungi

Fungi are lower vegetable organisms without chlorophyll that feed on already elaborated organic material.
This material may be the remains of organisms which had at one time been alive (in this case the Fungi are the so called *Saprophytes*) or an integral part of living organisms (in this case the Fungi are *Parasites*)
The importance of fungi in the wood sector is particularly relevant because of the destruction and disruption they cause in the wood.

Wood cavity fungi
In order for these fungi to develop the wood must have a humidity level of over 20%.

- **Basidiomycetes cavity fungi:** are fungi which when they attack the cellulose cause a loss in size of the wood, together with the formation of prism or cube shaped soft cracks, so soft they can be squashed with the fingers. The development area of the fungi becomes brown, thus the name *brown* or *destructive* cavities.
  Should the attack by basidiomycetes not be limited only to the cellulose but also attack the lignin, the colour of the wood becomes lighter than the healthy material and is reduced to a whitish fibrous mass (*white or corrosive cavities*).

- **Deuteromycetes soft cavity fungi:** fungi that cause a type of cavity characterised by softening of the surface of the wood, although it can also cause deep cavities. These fungi need a higher humidity level than the one required for basidiomycetes. They are particularly important for wood that is in contact with the ground or water.

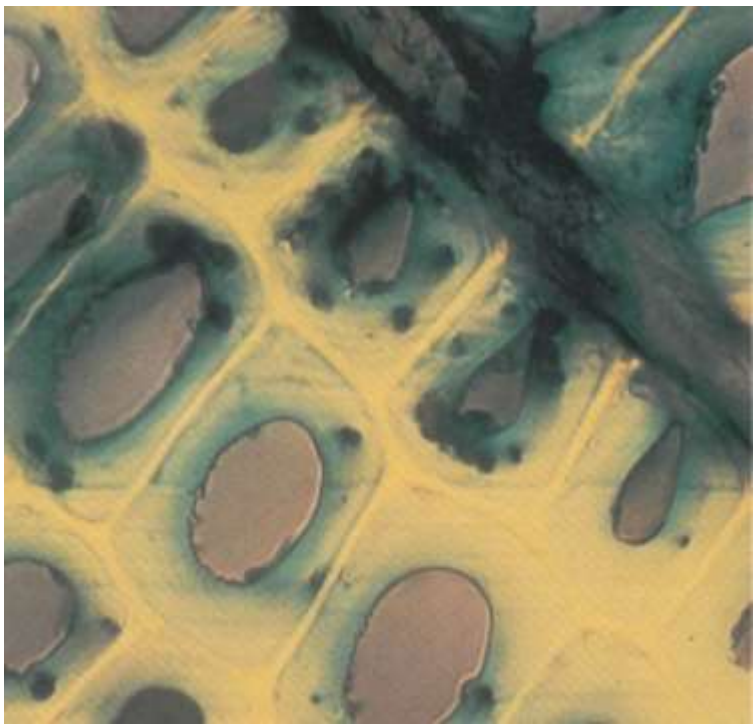


***Figure 1.1**: spreading of the "dark spot" fungus called "soft cavities" which will gradually destroy the structure of the wood making it similar to a brittle sponge.*

Colouring fungi

They cause the bluing and mildew on installed wood. These fungi may cause concern only from the point of view of aesthetics, spoiling in some cases decorative panelling.

- **Bluing fungi:** they cause permanent colouring from blue to black and at various depths, above all in the alburnum of certain wood. Attacks by these fungi do not impair the mechanical properties of the wood, but may increase the level of permeability.

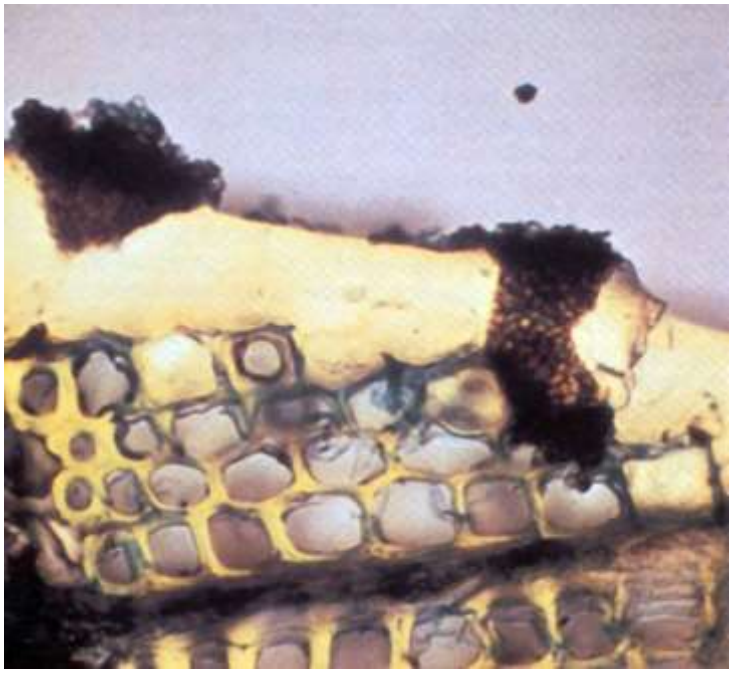


Figure 1.2: *action of blue fungus that during its development succeeds in breaking through the film of coating and reach the surface.*

- **Mildews:** fungi which appear as spots in various colours on the surface of damp wood and which can appear only when the humidity on the surface of the wood is over 20%. This condition appears when there is high relative humidity or condensation from steam. The attack by mildew does not have an important influence on the mechanical properties of the wood but which gives the wood an unwanted and unacceptable appearance. These fungi are not specific to wood and may appear on any material where humidity is high.

1.2 Insects

Beetles

Insects which fly and lay their eggs in the pores and cracks in wood. The larva causes the most serious damage, by burrowing internal galleries in the installed material. They are present throughout Europe, but attacks vary greatly depending on the geographic area.

The most important are *Hylotrupes bajulus, Anobium punctatum* and *Lyctus brunneus*. There are many other insects of less importance, which destroy the wood; among which, for example, are Hesperophanes and *Xestobium rufovillosum.*

- **Hylotrupes bajulus (House Longhorn):** is undoubtedly one of the worst enemies of installed wood, in particular conifers, and the damage caused by the larva is very serious. It is present up to an altitude of about 2,000-m, not so widespread in the North and Northwest of Europe. The vitality of this insect depends on the temperature and humidity of the air. The incubation period for the eggs may be 5 to 9 days at a temperature of 31.5°C and a humidity level of 90 to 95% or 48 days at a temperature of 16.6°C and environmental humidity at 18%

(the latter condition being very unfavourable). The larvae burrow galleries in particular in the alburnum which become full of gnawed waste causing serious structural damage to the wood which can lose all its structure and solidity.



- **Anobium punctatum (Furniture woodworm):** is particularly widespread in maritime climates and wherever there is high humidity. It attacks in particular timber or installed wood of conifers or hardwood indifferently, affecting the alburnum and the duramen. The larvae burrow galleries with coarse gnawed waste mixed with excrement. Even if heavily attacked the wood does not completely lose its resistance and the structure remains recognisable.



- **Xestobium rufovillosum (Death-watch beetle):** attacks preferably timber or already installed wood, of various **hardwoods** (Oak, Elm, Walnut, Ontano, Poplar) but which is fairly humid, or old lopped decaying willow trees. The damage caused by Xestobium is the same as the damage caused by Anobium. Its importance is felt in particular in the structures in old buildings throughout most of Europe.

- **Lyctus brunneus (Lyctus):** in the past it was given little importance, but the damage it causes in installed casings and furniture is at present considered very serious. The larvae which breeds at its best in very humid wood, attacks all indigenous Hardwood with soft wood and with large vessels, plus the alburnum of the hard species, in particular Oak. The only species that seems to be immune are Popular, Beech and Birch, whereas the Eucalyptus trees are very vulnerable. If the infestation is particularly strong, the whole mass of wood is transformed into a solid compressed gnawed waste where the structure of the texture is no longer recognisable. The Lyctus brunneus is the most common in Italy.



- **Hesperophanes sp.p.:** a species common to Central and South Europe. The wood that suffers most is: Cerro, Robinia, Beech, Popular, Walnut and Chestnut. The females usually lay their eggs in the nooks and cracks of installed wood such as framework for roofs, furniture, wooden floors and all types of frames. The damage caused by the larvae can be very serious because it involves the structure and mechanical resistance of the part without any possibility of repairing. It is also very difficult to diagnose.

Termites
Social insects divided up into various families. The most dangerous species for buildings are those which live underground, mainly **Reticulitermes lucifugus** and Reticulitermes **santonensis**.
In Europe termites can be found only in certain limited geographical areas; they are present in Italy throughout the whole peninsula and on the islands. In these areas, the use of wood preservants in the fight against termites is integrated by the use of other protective means, for example for floors, for foundation work and walls. The danger of the attacks stems from the fact that, as their activity is hidden from the light, a superficial inspection will not reveal their presence. They always respect the external surface of the pieces of wood so that the alarm (always to late) is given by some beam or frame collapsing. The infection is by this time widespread.

1.3 Marine organisms

A name given mainly to marine invertebrates such as **Limnoria sp.p.** and **Teredo sp.p**., which require a certain level of salt in the water and which burrow large tunnels and cavities in the wood.
These organisms can seriously damage both fixed and floating structures.

2. THE RISK CLASSES

As can be appreciated from the previous paragraphs, the agents causing degradation of wood are numerous. However, both as regards to fungi and insects, humidity is very often the limiting factor for their development. *Therefore there is a very important correlation between the environment the installed wood is in and the attacks of destructive biological agents*.
.
For example it is easy to imagine how wood protected in a closed, dry environment is more long lasting than the same wood in contact with humid ground.

The ENC (European Normalisation Committee) through the European standard EN 335 parts 1, 2, and 3 have identified 5 risk classes that have been established on the basis of the humidity the wood id exposed to under different conditions of use.
The higher the risk, the greater the need to increase the natural resistance level of the wood using impregnation treatment.

2.1 Definition of the risk classes

Risk class 1: situation where the wood or wood based product is shielded, completely protected from atmospheric agents and not exposed to humidity.

Risk class 2: situation where the wood or the wood based product is shielded, completely protected from atmospheric agents, but where high environment humidity may cause occasional but not persistent humidity.

Risk class 3: situation where the wood or the wood based product is not shielded and is not in contact with the ground. It is continuously exposed to the atmospheric agents or, even though protected from them, is subjected to frequent humidity.

Risk class 4: situation where the wood or the wood based product is in contact with the ground or fresh water and is therefore exposed to permanent humidity.

Risk class 5: situation where the wood or the wood based product is permanently exposed to salt water.

In the table that follows the distribution of fungi, insects and marine invertebrates is highlighted for each risk class. **The column regarding the type of protection shows the areas where the use of the IMP-PG plant is indicated**.

RISK CLASS	EXPOSURE CONDITIONS	EXPOSURE TO HUMIDITY	DISTRIBUTION OF BIOLOGICAL AGENTS				PROTECTIVE MEASURES	TYPE OF PROTECTION
			Fungi	Insects	Termites	Marine Organisms		
1	Wood for indoors in dry environment. Panelling and finishing.	None	-	Present	Locally present	-	Treatment optional depending on the fact whether its cost is not more than repair work or treatment.	Surface depth: from 1 to 3 mm
2	Wood for structural work used in closed environment.; Wood with risk of humidity.	Occasional	Present	Present	Locally present	-	Preventive treatment advisable, especially in the case of difficult and expensive repairs.	Inclusive from depth from 1 to 3 mm
3	Wood exposed to periods of humidity and dryness, no contact with the ground.	Frequent	Present	Present	Locally present	-	Preventive treatment	Surface, minimum 3 mm depth 65% alburnum
4	Wood in contact with permanent humidity source (Wood humidity>20%). Wood for indoors/ outdoors.	Permanent	Present	Present	Locally present	-	Preventive Treatment and suitable construction measures.	Average depth 3-6 mm. 100% alburnum
5	Wood in permanent contact with salt water. The humidity level of the wood is always over 20%. The part immersed attacked by marine invertebrates, part exposed to air risk class 4.	Permanent	Present	Present	Locally present	Present	Preventive Treatment with salts soluble in water plus suitable construction measures.	Deep; minimum 6 mm 100% alburnum

WOOD TYPES	NATURAL DURABIITY PROPRTIES N Non resistant R Average resistance MR Very resistant **A** Alburnum **LS** Healthy wood (duramen)										IMPREGNABILITY Not impr. Low impr Aver. Impr **Very impr.** Not possible Low Average High	
	FUNGI		**TERMITES**		**WOODWORM**		**LYCTUS**		**LONGHORN**			
	A	**LS**	**A**	**LS**	**A**	**LS**	**A**	**LS**	**A**	**LS**	A	**LS**
RESINOUS WOODS												
Douglas Fir	R	MR	N	N	N	MR	MR	MR	N	MR	Low impr.	Not impr.
Épicéa	N	N	N	N	N	N	MR	MR	N	N	Low impr.	Not impr.
Hemlock	N	N	N	N	N	N	MR	MR	N	N	Aver. Impr.	Not impr.
Larice	R	MR	N	N	N	MR	MR	MR	N	MR	Aver. Impr.	Not impr.
Austrian Black pine	N	R	N	R	N	MR	MR	MR	N	MR	**High impr.**	Not impr.
Maritime Pine	N	R	N	R	N	MR	MR	MR	N	MR	**High impr.**	Not impr.
Silvestre Pine	N	R	N	R	N	MR	MR	MR	N	MR	**High impr.**	Not impr.
Spruce	N	N	N	N	N	N	MR	MR	N	N	Avr. Impr.	Not impr.
Red Cedar	MR	MR	N	N	N	MR	MR	MR	N	MR	**High impr.**	Not impr.
Hardwood (TEMPERATE CLIMATES)												
Chestnut	R	MR	N	R	N	MR	N	MR	MR	MR	**High impr.**	Not impr.
Oak	N	MR	N	N	N	MR	N	MR	MR	MR	**High impr.**	Not impr.
Ash	N	N	N	N	N	N	N	MR	MR	MR	Aver. Impr.	Not impr.
Beech	N	N	N	N	N	N	MR	MR	MR	MR	**High impr.**	**High impr.**
Elm	R	R	N	N	N	MR	N	MR	MR	MR	Aver. Impr.	Non impr.
Popular	N	N	N	N	N	N	MR	MR	MR	MR	**High impr.**	**High impr.**
Walnut	N	MR	N	N	N	N	MR	MR	MR	MR	**High impr.**	Low imp.
Hardwood (TROPICAL CLIMATES)												
Mahogany	N	R	N	N	At present the opinion is that tropical hardwood can resist attacks from woodworm.		N	MR	MR	MR	**High impr.**	Non impr.
Afrormosia	R	MR		MR			N	MR	MR	MR	**High impr.**	Non impr.
Azobé	R	MR	R	MR			N	MR	MR	MR	Aver. Impr.	Low imp.
Balsam	N	N	N	N			MR				Low imp.	Low imp.
Ilomba	N	N	N	N			N	N	MR	MR	**High impr.**	**High impr.**
Iroko	N	MR	N	MR			N	MR	MR	MR	**High impr.**	Aver. Impr.
Samba	N	N	N	N			N	N	MR	MR	**High impr.**	Aver. Impr.

3. TECHNICAL STATUS

In the early stages of its development, impregnation in autoclaves was used to give processed wood the characteristics of **durability** and protection.
With the growing necessities of the market and with the increase in the demand for high quality standards, the necessity to add aesthetic characteristics to the wood such as, colouring, correction of possible defects and flaws and the enhancement of the typical grain of each type of wood has grown.

Thickly applied coatings giving the wood no possibility to breathe has over the years been modified thanks to the creation of thin film layers and lacquer. These products, besides being less expensive, intensify aesthetic characteristics, and the treated surfaces are also pleasant to the touch.
However, right from the start, less protection negatively influenced one very important factor: duration.

4. AN ISVE PROPOSAL

The realisation of mod. IMP-PG vacuum impregnation plants, designed to operate using a limited quantity of impregnant contained in the plant, has enabled firstly, the clear or coloured application of impregnants to be used followed by primer and finish coatings.

The plant, hermetically closed and operating automatically, eliminates the necessity for:

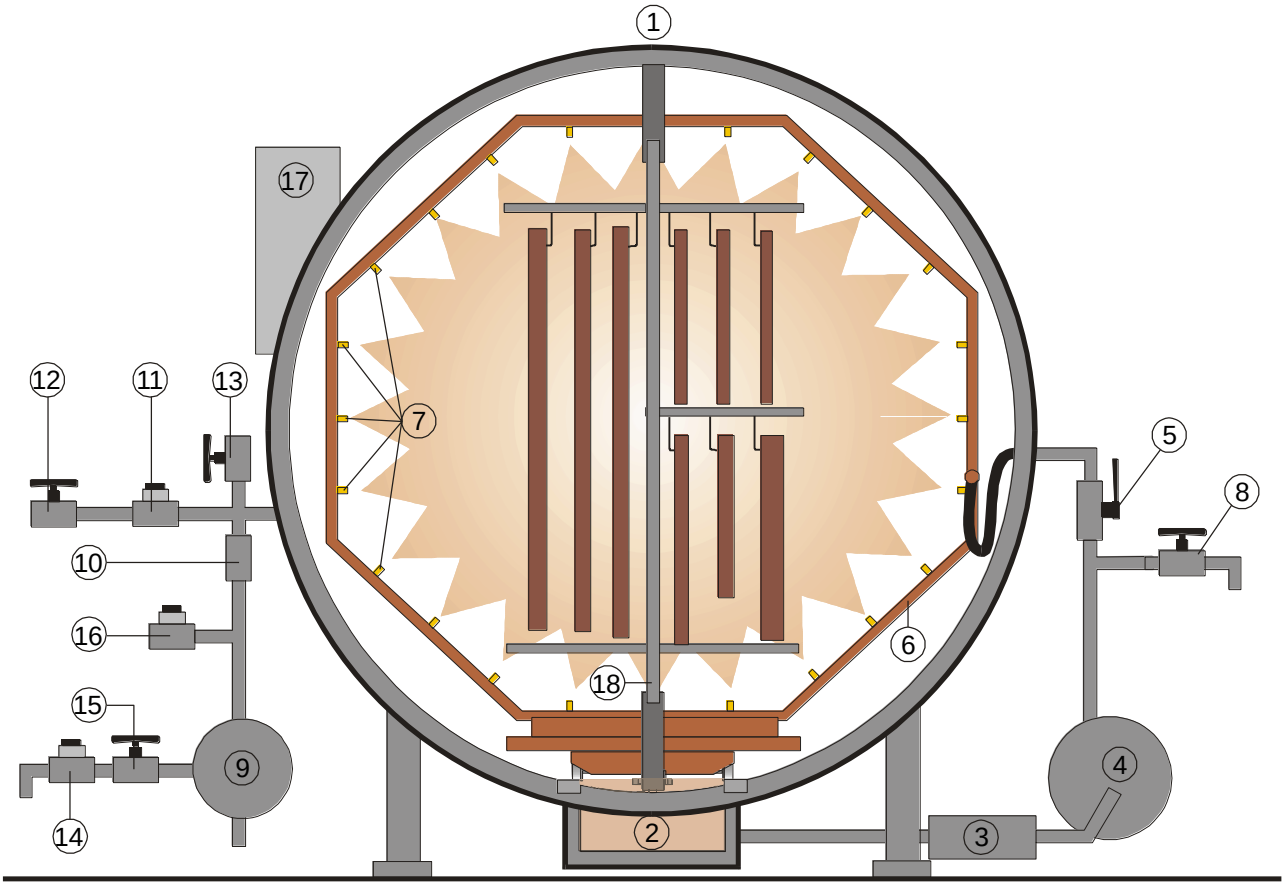
a) Specialised personnel
b) Expensive equipment for treating and filtering of waste from coating.
c) More coating product to be used than is necessary
d) Expensive controls to guarantee a constant quality level

Furthermore it guarantees:

a) The use in the same plant of a wide range of impregnants for the protection or treatment against woodworm, termites, fungi etc., for wood subjected to **Risk Class 1, 2 and 3**.
b) Perfect homogenous protection against the sun's rays.
c) Protection against humidity and water: the perfectly homogenous application waterproofs up to the last micro-pore and makes the wood water repellent.
d) A new coating process, which gives a perfectly homogenous application and a total penetration of the resin in the joints, cracks and weak areas which when using other processes do not receive protection.
e) The fixing characteristics regarding the application of coating products in the absence of air using ultra high vacuum (vac-vac) enable penetration into the smallest of pores, **reaching a durability level 3 to 4 times higher** than normal coatings.
f) Maximum bond between primer and finishing coat.
g) Significant reduction in surface preparation time after applying the primer thanks to the reduced "lifting of skin" phenomena.
h) Recovery of the entire unused product.
i) There is no waste of product.

4.1 Description of a pg plant

The plant is made up of a very particularly thick autoclave (1) so as to support a maximum vacuum of 400 mmHg or 700 mmHg.
The elements to be treated are loaded and positioned on a moving frame (18) equipped with a trolley, which moves into the autoclave on rails held internally at the top and bottom.
At the bottom of the autoclave there is the deposit (2) containing 70 to 600 litres of impregnant or coating. A pump (4) pumps the product to a series of atomiser outlets (7) placed in a star formation on a frame (6) which moves horizontally forth and back along the whole length of the autoclave



IMP-PG operating diagram

1 – Autoclave
2 – Impregnant Deposit
3 – Filter
4 – Circulation pump
5 – Manual ball valve
6 – Manifold
7 – Nozzles
8 – Liquid discharge ball valve
9 – Vacuum pump
10 – Check valve
11 – Air intake solenoid valve
12 – Manual tap to adjust air intake speed
13 – Emergency air intake tap
14 – Vacuum pump water cooler control solenoid
15 – Water adjustment tap for vacuum pump
16 – Safety solenoid valve for return water from vacuum pump.
17 – Electric control panel
18 – Trolley frame for items to be treated

A standard treatment cycle lasting about 20 to 30 minutes, is as follows:

A - An initial vacuum phase to remove all air from the wood pores.

B – Treatment of items, with impregnant or finely atomised coating. During this phase the plant can operate both under constant vacuum or allowing air to enter to help the product penetrate deeply into the wood.

C - A series of changes of air inside the autoclave to facilitate dripping, drying and pacifying of the treated items.

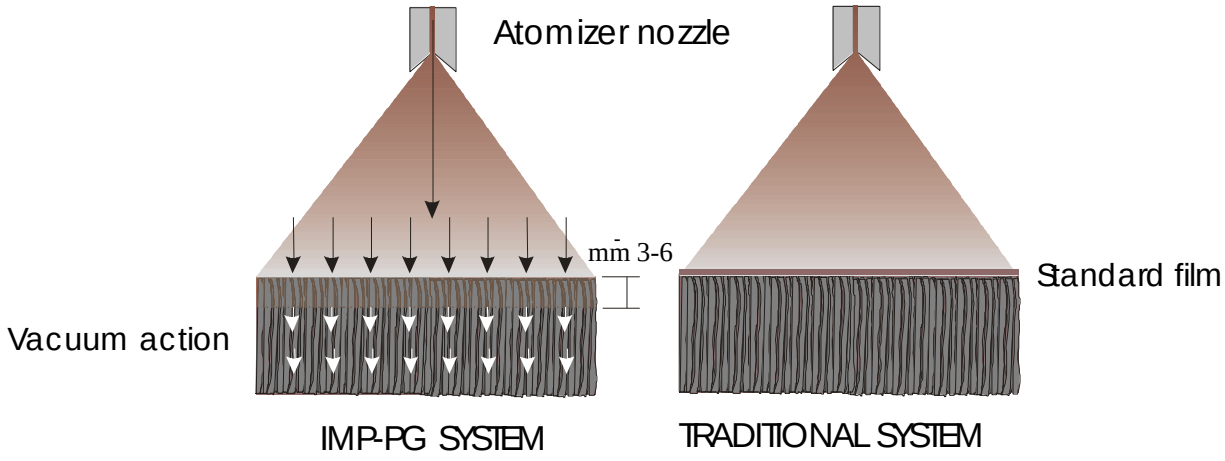
This treatment guarantees:

- When using impregnants:

  An absorption/ penetration of 3 to 6 mm. In the white part.

- When using primer/finishing coats:
  A very high penetration and adherence level of the coating to the internal surface of the wood pores, a result that can only be achieved thanks to the vacuum.

The exceptional penetration and adherence of the primer is the only guarantee for a perfect and lasting resistance of the finishing coat, both if applied using the same plant or using other techniques.



- Result guaranteed:

  Thanks to the completely automatic operation of the machine, any possible human error is excluded.

- Maximum respect of the environment

  The vacuum pump, which sucks in the air in the autoclave, is the liquid ring type: it also uses water in a closed circuit.

The impregnating and coating system operates in a perfectly hermetically closed autoclave that prevents any type of bad smell from exiting

Once the process has finished the product may be fully recovered by sending it back to the relative deposit.
The water used for washing the air entering the plant will be continuously recycled and periodically it must be discharged and changed. During drying the water may contain polluted substances made up principally of chemical products used in the coating products.
The autoclaves are built on the basis of the sizes of the items to be treated

The items exit the autoclave perfectly dry, treated or coated.

4.2 Examples of use

- treatment and coating of doors, windows, storm windows, shutters etc...
- treatment and coating of articles for use outdoors
- treatment of matchboard
- treatment of models
- coating wooden toys
- wooden items and accessories
- turned items
- in substitution for dip coating
- antique furniture, treatment and prevention
- treatment of daises

5. CONCLUSIONS

The purchase of an IMP-PG plant allows small to medium sized carpentry companies to face and brilliantly resolve the problem of treating and coating with solvents and water.
As an example, using model IMP-PG 2400/4500 40 windows a day made up of wings plus the frame (either assembled or disassembled) can be treated.
The complete cycle is as follows:

- application of a first coat of clear or coloured impregnant
- application of a second primer/finish coat.

The plant is equipped to use mono-component impregnants or paint as long as they are sufficiently fluid. The maximum viscosity for correct operating must not exceed 25-30", measured using a 4mm diameter COPA FORD.

When using water based impregnants or paint we suggest version A.C (anti-corrosion) where the internal surfaces of the autoclave have been treated with epoxy paint and mechanical parts and conduits are rust proof.

6. SPECIAL APPLICATIONS

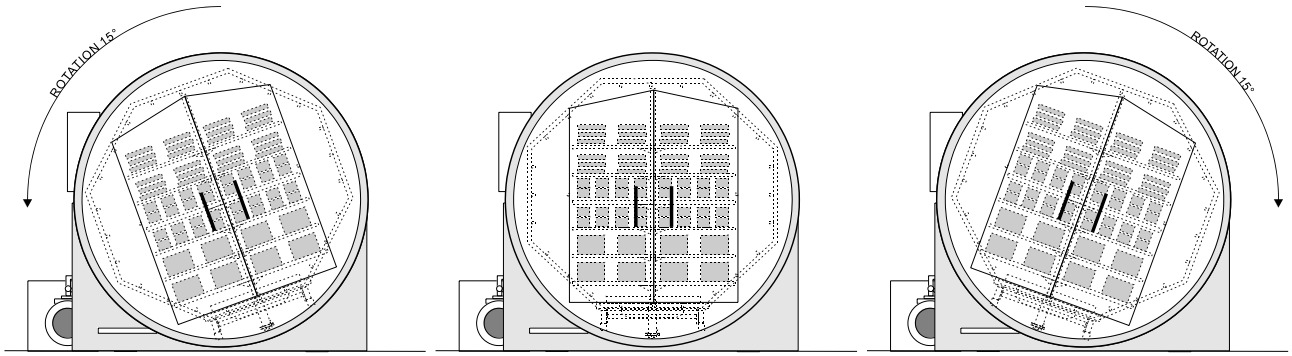
6.1 Oscillating "rain" impregnation plant for roof framework

I.S.V.E. Srl has recently increased its range of spray impregnators to include the new IMP-PG "Oscillating" model. This vacuum autoclave enables the impregnation of **roof framework** placed in properly braced packs. The application and use of the IMP-PG is equipped to give wood protection against the following Risk Classes:

Risk class 1: situation where the wood or wood based product is shielded, completely protected from atmospheric agents and not exposed to humidity.

Risk class 2: situation where the wood or the wood based product is shielded, completely protected from atmospheric agents, but where high environment humidity may cause occasional but not persistent humidity.

Risk class 3: situation where the wood or the wood based product is not shielded and is not in contact with the ground. It is continuously exposed to the atmospheric agents or, even though protected from them, is subjected to frequent humidity.
In these three cases, defined by ENC, (European Normalisation Committee), IMP-PG guarantees protection and long lasting esthetical quality of the wood.



OSCILLATING "RAIN" IMPREGNATION PLANT FOR ROOF FRAMEWORK

6.1.1 Operating Principal

The beams to be treated are braced in packs and loaded onto a trolley that is positioned inside the autoclave. The impregnation cycle begins with the activating of the vacuum pump, which has the function of eliminating the air present in the wood fibres. In this phase, the opening of the wood pores favours the successive penetration of the impregnant. There is a deposit positioned on the bottom of the autoclave containing 100-600 litres of preserving solution. A pump pumps the product to a series of automatic atomiser nozzles positioned on two circular frames.

The atomiser rings are assembled on a trolley that moves forth and back horizontally over the length of the autoclave. This movement has the obvious function of spraying the whole length of the pieces. The impregnant is atomised creating a very fine mist which deposits in all
The hollow spaces of the wood completely covering the surface.
The excess product deposits on the bottom of the autoclave and is used again to avoid any waste.

A standard treatment cycle lasting about 45 minutes can be summarised as follows:

1. An initial vacuum phase to remove all air from the wood pores.
2. Treatment of items, with impregnant or finely atomised coating. During this phase the plant can operate both under constant vacuum or allowing air to enter to help the product penetrate deeply into the wood.
3. A series of changes of air inside the autoclave to facilitate dripping, drying and pacifying of the treated items.

During the process phase the longitudinal axis of the machine terms both to the left and to the right to avoid the product collecting on the surface of the beams.

6.1.2 Efficiency and uniformity of the treatment

This type of treatment, if used with a good impregnant, ensures perfect water repellent, fungicidal and insect repellent protection of the surfaces of the beams.
The advantages which can be reached are evident: above all in terms of yield there is no loss of product or exit of solvent from inside the autoclave which, in order to guarantee the vacuum, must be hermetically sealed. Automation of the process means a saving in time of about 60% compared to traditional treatment using brushes or spray guns.
In terms of quality, the framework is perfectly impregnated and with uniform colouring whereas as regards to the environment, there are no losses or unpleasant smells.
The action of the vacuum means penetration is in depth and the bond between the coating and the internal surface of the wood pores is very solid. This result can only be achieved by treatment using an autoclave.

6.2 Spray impregnation plant for anti-woodworm treatment of antique furniture.

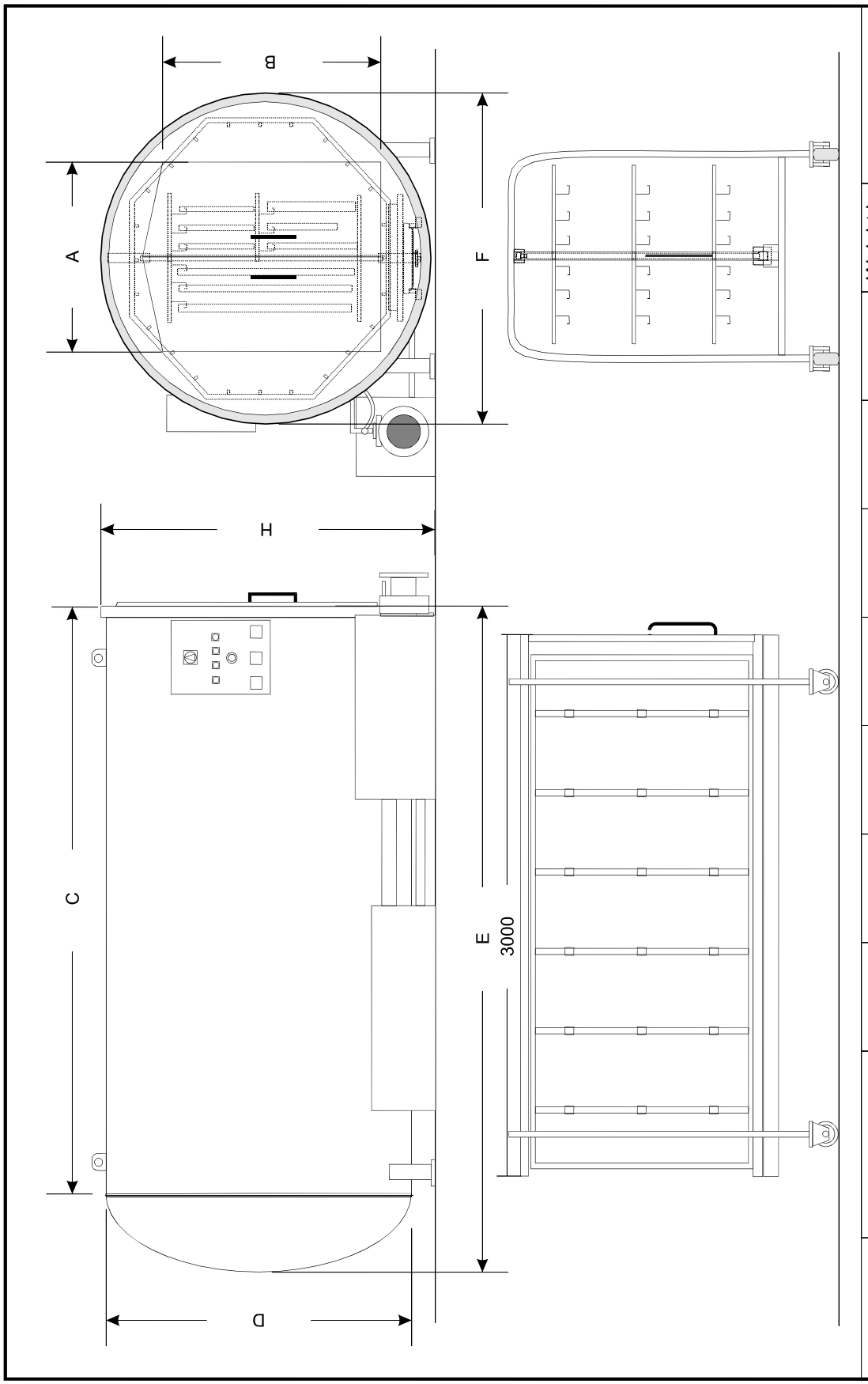
Among the special applications the IMP-PG is employed in is the "treatment" of antique furniture infested with xylophages, such as woodworm or other beetles.

The furniture is partially disassembled and placed on the trolley frames. Once the load is complete, the material is positioned in the autoclave for treatment using special products.
In this phase, thanks to the combined action of the vacuum and the atomisation of the repellent, penetration of the treating agent is very high and is able to penetrate into the most difficult parts to reach of the furniture.
The elimination of woodworm and other insects guarantees the long life of the element without altering its structure or natural beauty.

IMP-PG I.S.V.E. SRL Installations

WOOD	INITIAL VACUUM mmHg	CONSTANT VACUUM TIME Minutes	COSTANT SPRAYING TIME Minutes	DECREASING VACUUM SPRAYING TIME Minutes	DRAINING TIME Minutes	MINIMUM VACUUM mmHg	MAXIMUM VACUUM mmHg
Pinaster Pine	**150**	**3**	**4**	**2**	**15**	**50**	**150**
Radiant Pine	**150**	**4**	**4**	**3**	**15**	**50**	**150**
Pine parana	**150**	**4**	**4**	**2**	**15**	**50**	**150**
Russian pine	**200**	**4**	**4**	**3**	**15**	**50**	**200**
Pine suecia	**300**	**5**	**4**	**3**	**15**	**50**	**150**
Holm-oak pine	**300**	**15**	**15**	**6**	**15**	**50**	**250**
Silvestris pine	**300**	**20**	**20**	**6**	**15**	**50**	**250**
Gallic Pine	**300**	**15**	**15**	**6**	**15**	**50**	**250**
Pyrenean pine	**300**	**15**	**15**	**6**	**15**	**50**	**250**
Fir	**550**	**30**	**25**	**6**	**15**	**150**	**400**
Clear Sapeli	**400**	**15**	**20**	**6**	**15**	**100**	**350**
Reddish Sapeli	**620**	**30**	**25**	**6**	**15**	**150**	**400**
Iroko	**550**	**30**	**25**	**6**	**15**	**150**	**400**
White oak	**600**	**20**	**20**	**6**	**15**	**150**	**400**
European oak	**650**	**25**	**25**	**6**	**15**	**150**	**450**
Beech	**200**	**5**	**5**	**3**	**15**	**50**	**150**
Chestnut wood	**450**	**20**	**20**	**5**	**15**	**150**	**400**
Tek	**650**	**30**	**25**	**10**	**15**	**150**	**450**
White eycalyptus	**500**	**15**	**20**	**15**	**15**	**150**	**400**

NOTE: All data are of orientation because they can change according to the own wood characteristics inside a same kind, to the sapwood and duramen %, to the wood initial moisture at the beginning of the process and to the % of resin in the case of conifer wood. Impregnation cards indicated correspond to the TOTAL penetration of sapwood that correspond to the P8 of the EN351.1/95 European Rule.
Retention of wood protection liquid from 22 to 28 litres/m3. Penetration conditions enough for wood to locate in places with III and IV risk class. If the wood to treat is in another risk class I/II, times will be a little bit lower. Attention: for the treatment wood must be a moisture lower than 15%



TYPE	A	B	C	D	E	F	H	Weight kg	Inst. Power
IMP PG 1600	1000	1100	3000	1600	3700	1800	2000	2000	8,37 kW
IMP PG 2300	1400	1800	3000	2300	3700	2600	2600	3700	8,37 kW
IMP PG 2300/4500	1400	1800	4500	2300	5000	2600	2600	4500	8,37 kW
IMP PG 2300/12000	1200	1200	12000	2300	12500	2600	2600	9000	12,87 kW

Autoclave IM PG

Particolari dell'impianto per il cambio colore

Carrello per perline/profili

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Documentazione fotografica	Scala
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