STEAMERS

TECHNICAL DATA

STEAMER PLANT

INTRODUCTION

This brochure is a summary of the characteristics and application possibilities of the steamers produced by I.S.V.E. Srl.

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

BIBLIOGRAPHY : G. GIORDANO – TECHNOLOGY OF WOOD – UTET

ISVE Srl: double autoclave steamer

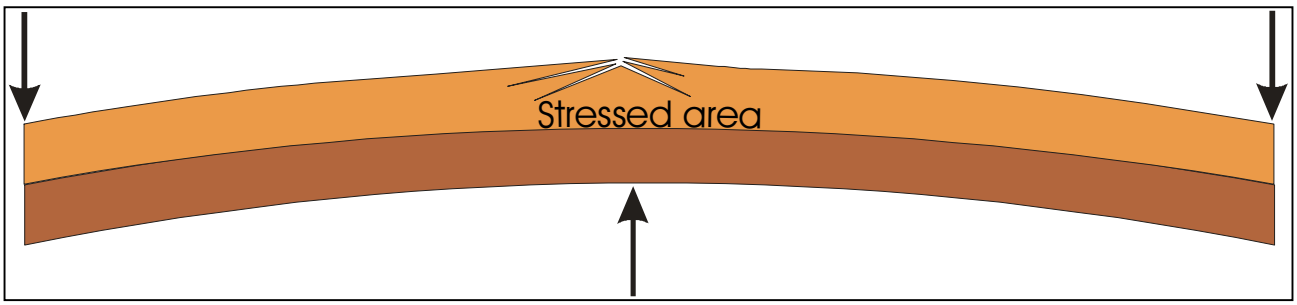
PLASTICIZATION AND BENDING OF SOLID WOOD

Wood, a very previous raw material, has particular structural characteristics derive from its biological nature.
Bending of wood, unlike other materials, for example metals, is often an unknown factor due to the non homogenous distribution of the fibres along the section.

In semi-finished products which undergo bending two types of forces are present:

- tensile stress in the convex peripheral zone;
- compression in the internal concave zone of the arc.

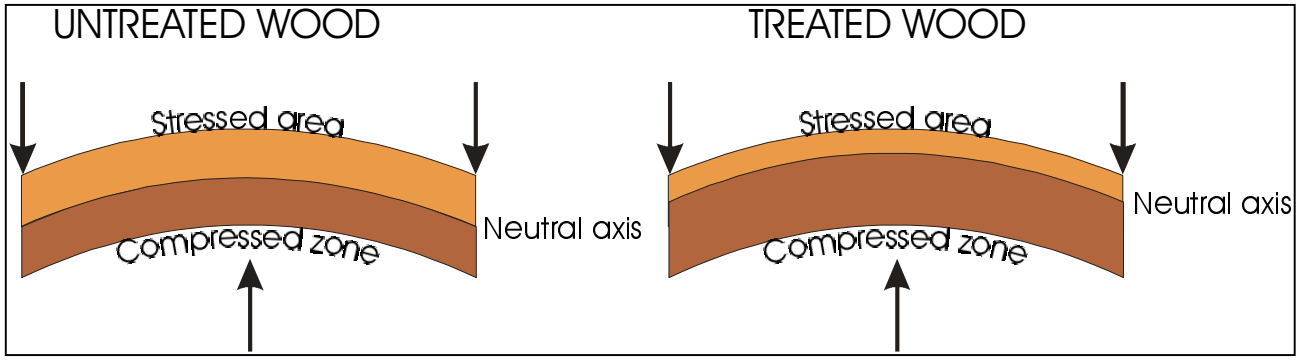
If subjected to overstrain, wood breaks, beginning with the surface layers on the external part of the bending arc.



Remaining in the field of elastic deformation, bending under normal temperatures returns to its primary state on termination of strain. To make a deformation permanent it is necessary to increase the "plasticity" of the wood, that is its capacity to assume a certain shape.

"PLASTICIZATION" OF WOODEN MATERIAL

Plasticization of wooden material increases by heating starting from a temperature of 70°C up to the optimum temperatures of between 145-150°C. As regards to humidity, the most convenient percentages are between 14 to 16%, but they may reach up to 25%.
From the physical point of view, maximum plasticity is reached due to compression, minimum in the strain zone (elongation). *During treatment the neutral line, that is the area where the two forces are balanced, tends to move towards the external area of the arc thus increasing the plastic section*
In order to facilitate this movement further, devices are used (shaped forms) which prevent elongation during bending.
Furthermore, if the hot curved wood is allowed to cool and dry in the form, the curve stabilizes and the wood re-acquires its original strength.
The production of solid curved wood has therefore three distinct phases:



1. plasticization due to the action of the heat;
2. bending;
3. stabilizing of the bending by drying of the wood at temperatures above 65°C.

In order to achieve satisfactory results wood without knots and defects such as fibre deviations and internal stress must be used

THE PLASTICIZATION PROCESS

On an industrial level three hearing systems for bending are used:
1. hearing in a bath of water;
2. steaming;
3. dielectric heating.

The most suitable type of wood is Beech followed by Ash, Maple, Birch, Oak, Chestnut, Robinia, Cherry, Bagolaro, etc.
In the same way conifers and tropical wood are inappropriate.

Heating bath of water
When using a hot water bath the temperature is maintained between 70-80°C for the immersion period which guarantees the uniform distribution of the heat along the whole length of the wood.
This system, used mainly with Birch and Ash, has the drawback of wetting the wood too much which becomes soft and difficult to bend and stabilize
There is also the added problem of causing unpleasant variations in the colour of the wood.
The water bath, compared to the other two methods, is useful in cases where bending is required only along a certain portion of the length of the piece, this is because immersion can be limited to the area in question.

Steaming
Generally used with Beech this system uses cylindrical metal steamers at atmospheric pressure with saturated vapour at 100°C.
The steamer must be well insulated, the metal must be anti-rust and protected against corrosion.
During treatment the items become wet externally as much as 25% and if the condensate remains in the cylinder even up to 40%.
It has been proved that with condensate present plasticizing is better and faster.
As regards treatment times, it is important to avoid allowing the wood to plasticate too much so that it does not deform in the cross section during bending.
A steaming time of between 45 to 60 minutes for each 25 mm of thickness according to the type of wood should be sufficient.
At the end of the process there is a range of humidity going from the outside towards the inside which further helps the drying processes.

Dielectric Heating
This process makes use of electric current with a frequency of 5-15 MHz which causes immediate hearing of all the wood mass at 100°C with any loss of humidity.
Among the most important advantages must be remembered the possibility of plasticizing semi-finished wood with some defects in the fibre, whereas among the disadvantages is the high running cost of the application which limits the sectors it can be used in.

Minimum bending radii of some wood types, pieces with 25.4 mm thickness, wood seasoned and steam heated (by Stevens and Turner).

WOOD TYPES		***Radii in mm***	
Marketed as	***Botanical Name***	***With base***	***Without base***
Afrormosia	*Pericopsis elata*	360	740
Agba	*Gossweilerodendron balsamiferum*	510	410
Alder	*Alnus glutinosa*	360	460
Ash	*Fraxinus excelsior*	64	300
Beech	*Fagus sylvatica*	41	410
Cherry	*Prunus avium*	51	430
Chestnut	*Castanea sativa*	150	380
Douglas	*Pseudotsuga menziesii*	460	840
Elm	*Ulmus hollandica*	13	240
Hickory	*Carya sp.*	46	380
Carpino	*Carpinus betulus*	100	420
Larch	*Larix decidua*	330	460
African Mahogany	*Khaya ivorensis*	970	890
True Mahogany	*Swietenia macrophylla*	300	710
Makorè	*Tieghemella heckelii*	300	460
Mansonia	*Mansonia altissima*	250	390
Mutenye	*Guibourtia arnoldiana*	380	690
Niangon	*Tarrietia utilis*	460	760
Oak	*Quercus petraea*	51	330
Obeche	*Triplochiton scleroxylon*	460	430
Ramin	*Gonystylus bancanus*	910	940
Robinia	*Robinia pseudoacacia*	38	280
Sapeli	*Entrandrophragma cylindricum*	760	940
Maple	*Acer pseudoplatanus*	38	370
Teak	*Teclona grandis*	460	890
Walnut	*Juglans regia*	25	280

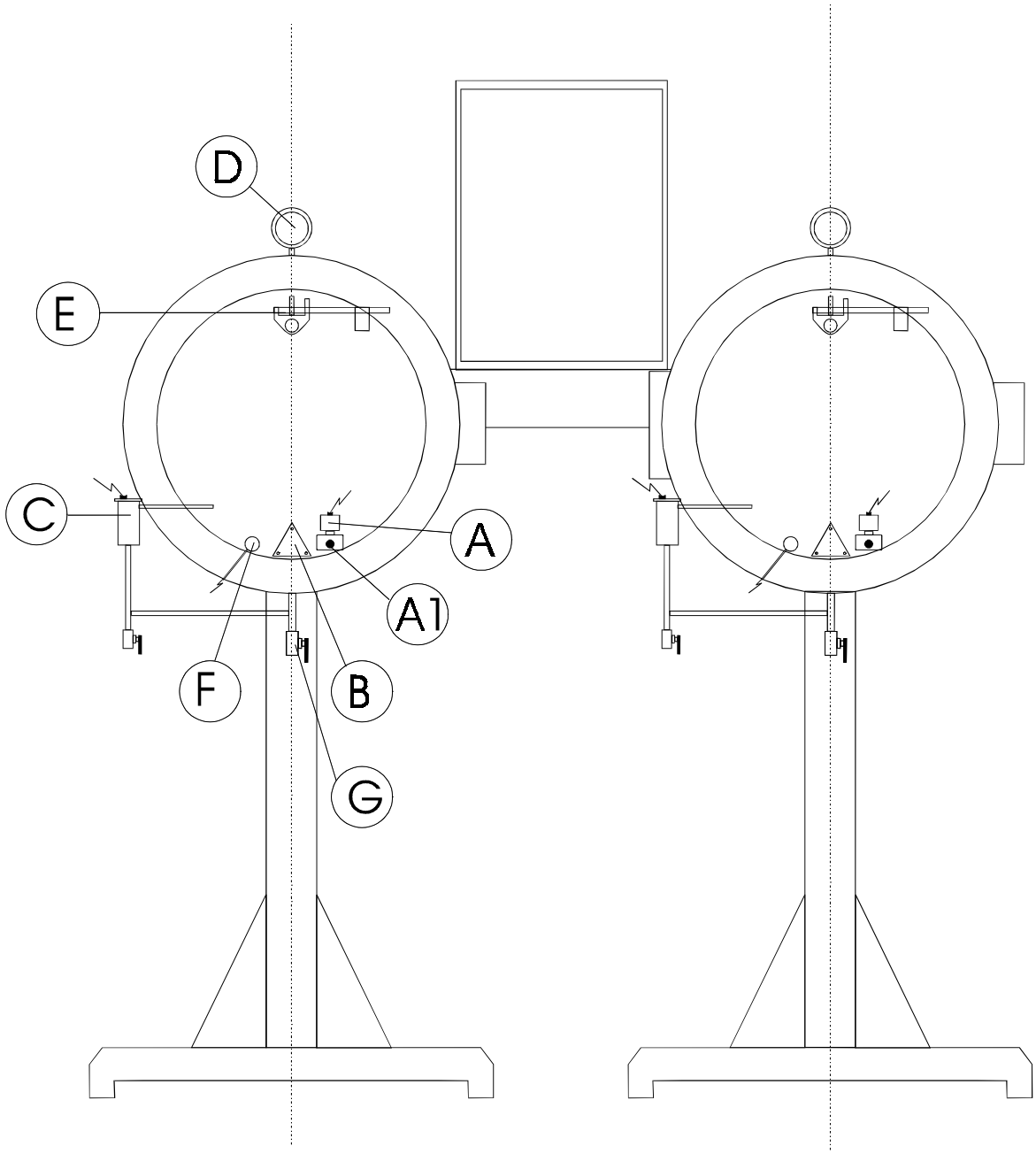
THE ISVE STEAMER

I.S.V.E. Srl, fortified by its over twenty years experience in the field of machinery for treating wood, has been producing electric driven steamers for plasticization of wood for over twelve years.

The complete plant is made up of two autoclaves made of AISI 304 steel with a 400 mm diameter, welded bottoms, hinged covers and hand wheel screw closures.
The insulating layer is made up of a 50 mm thick layer of insulating material covered by pre-coated sheet metal.
The supporting frame is made of steel profiles coated with undercoating and dual component finish.

LIST OF COMPONENTS	
nr. 2	manometers
nr. 2	Level gauges
nr. 2	Electric resistors
nr. 2	¾" Valves
nr. 2	Safety valves
nr. 2	Thermostats
nr. 1	Automatic water load solenoid
nr. 2	AISI 304 steel telescopically extractable wood holder trolley
nr. 1	Electric switchboard complete with timers for duration of cycle and operating selectors for the autoclave.

Overall length of autoclave:	**Electric capacity installed:**
mm. 2.000	10 kW
mm. 2.500	10 kW
mm. 3.000	12 kW
mm. 4.000	12 kW
Electric feed:	
380V 50 Hz	
For overall dimensions see enclosed drawings.	



KEY:

A	Solenoid with rapid fit
D	Manometer
A1	Water from mains input
E	Mechanical safety valve
B	Electric resistor

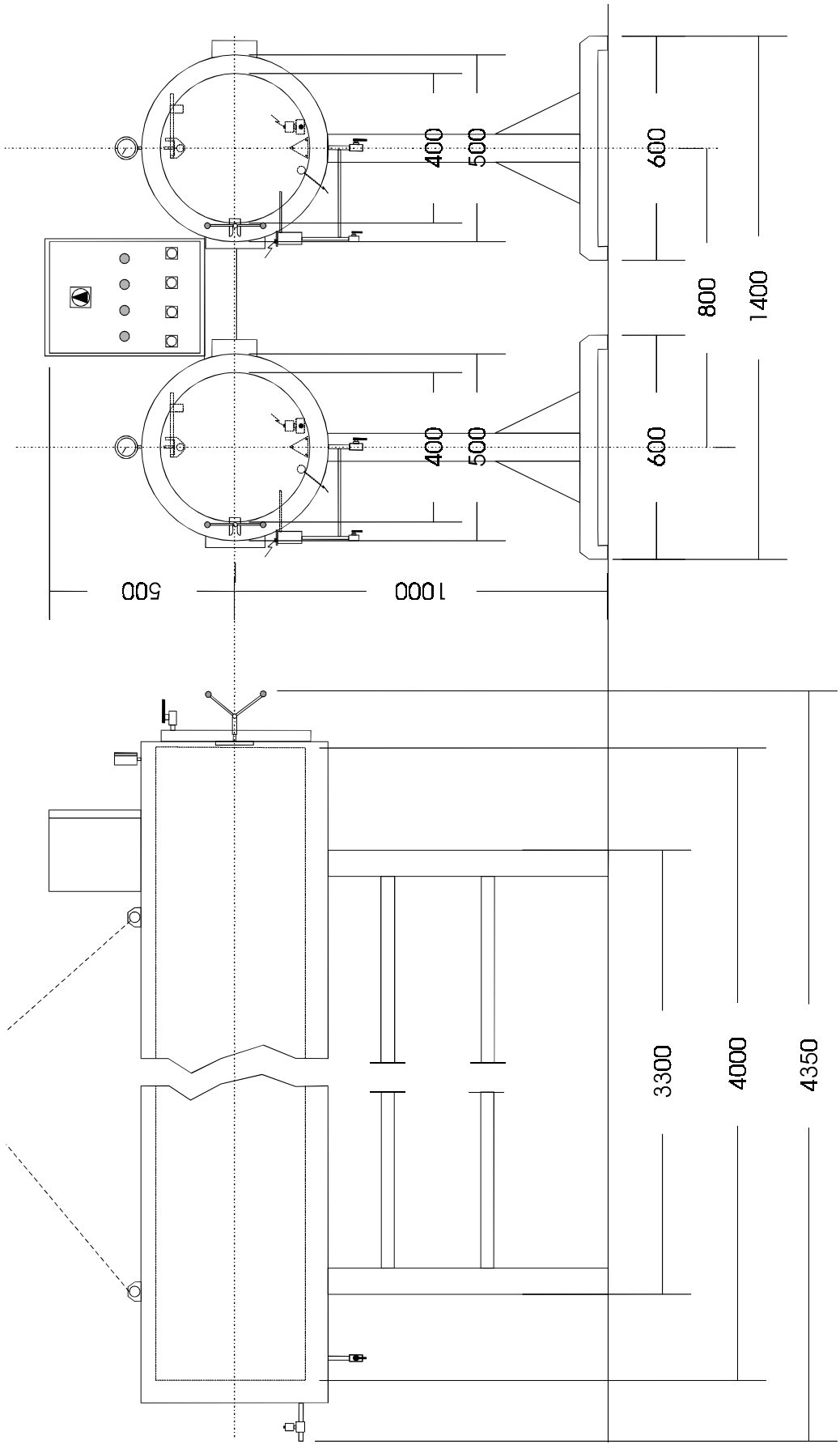
I.S.V.E. S.r.l. - Via San Martino, 39
25020 B. Poncarale (Bs) - Italy
tel. 030/2540351 - fax. 030/2640874
Internet: www.isve.com
E-mail: headoffice@isve.com

ELECTRICALLY POWERED STEAMER

Rear view

Scala

N° disegno



STEAMER

Dual steamer with electric heating to produce steam

Total weight kg. 500

12/05/98

Scala 1:15

N° disegno

I.S.V.E. S.r.l. - Via San Martino, 39
25020 B. Poncarale (Bs) - Italy
tel. 030/2540351 - fax. 030/2640874
Internet: www.isve.com
E-mail: headoffice@isve.com