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IMPLEMENTED QUALITY CONTROL SYSTEM PROCEDURE

DELIVERABLE D4.2

TV4NEWOOD PROJECT

AGREEMENT NUMBER:
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CONTENTS

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SUBJECT AND DEFINITION

The present document defines the procedures for the production of Thermovacuum treated wood according to the quality standards implemented in the project.

Integrant parts of this document are the ***D2.10*** *(Laboratory data sheet for each essence),* ***D. 2.7*** *(Standard production parameters for each essence) and* ***D 2.5*** *(Certification manual for thermal vacuum wood (tvw) production).*

Objective of the quality control system procedure is the production of material with standard and constant quality with certifiable characteristic.

Such procedures must be complied in the production site (the factory) under the responsibility of a nominated quality responsible.

The boundaries of the system procedure are from the pre-dried sawn timbers boards to the semi-finished treated elements ready to be delivered to the customer.

The system procedure is referred to the production of Thermovacuum treated wood of 7 different wood species named **spruce**, **fir**, **pine**, **ash**, **beech**, **poplar**, **oak** under the form of raw sawn timbers boards **22** mm or **33** mm thick

The processes included in the procedure are **drying** from pre-dried (MC 18%) to Ucr (4%), **High Temperature thermal treatment** for different categories (**TWV-C, TWV-S, TWV-D**), **equalisation and conditioning**, **packaging**, **labelling** and **storing** of the treated material.

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EQUIPMENT

The following equipment for the quality control system must be permanently present in the factory and it must be used properly:

Thermovacuum plant equipped with the following probes connected to a PC for the data recording:

- ✓ n. 4 Temperature probes (Thermocouples or thermoresistences) for the measure of the air T during the process in different parts of the plant;
- ✓ n.4 MC probes for the measure of wood MC during the drying stage;
- ✓ n. 1 vacuum pressure sensor.

Furthermore the following devices are needed:

- ✓ n.1 MC meter (conductive type);
- ✓ certified balance with a resolution not lower of 1 g and a maximum load not lower than 3 kg;
- ✓ indelible pen marks.

EQUIPMENT MAINTENANCE AND CALIBRATION

All the equipment must be used properly according to the datasheet specification.

Prior to each use the functionality of the devices must be checked.

The devices subjected to deterioration such as the T probe must be periodically substituted. Indicatively the service life of a T probe in normal operative condition is not longer than 20 cycles.

The T and vacuum probes controlling the process are fundamental devices for the production. **They must be yearly calibrated and certificated** by an authorised certification laboratory.

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QUALITY STEPS

The following productive steps influence the final quality and for this reason each of them undergone to a quality control step procedure;

1. Quality of the raw material;
2. boards stacking;
3. drying step;
4. thermal treatment step ;
5. equalisation and conditioning step;
6. packaging and storing.

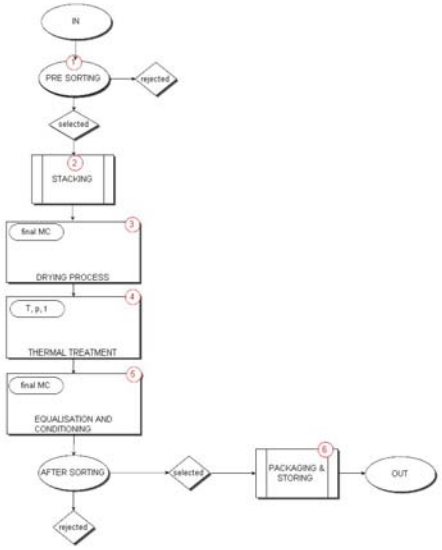

Fig.1 quality control system working flow

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Pre-sorting of raw material

The raw material must be pre-sorted and selected to a visual grading containing the following visual quality rules:

- No pith admitted;
- No boards deformed by bowing or twist admitted;
- No boards containing red heart in beech or black heart in ash are admitted;
- No rot (with rot in hardwood and black rot in softwood) are admitted;
- No end-cracks longer than 10 cm are admitted.

Stacking

The batch of selected board to be treated is composed of boards of the same species and same thickness. Stacking must be performed carefully because a correct stacking minimizes warp and maximises kiln productivity. Please pay attention:

- ✓ to use stickers of the proper thickness (as recommended by the plant producer);
- ✓ to produce square, level, straight-sided piles with stickers and bolsters in alignment throughout;
- ✓ to produce a stack of the right size and shape in order to avoid over load or under load in the plant.
- ✓ To insert MC probes at the core in different boards and in different positions

Drying step

The vacuum drying must be performed setting the control parameters according to the specification reported (see datasheet in **D4.1**), selected for the species and thickness.

Drying parameters ***T, p*** and ***U*** must be recorded and stored automatically by the system.

The drying stage ends when all the monitored MC probes are equal or below the Ucr;

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Thermal treatment step

The thermal treatment must be performed setting the control parameters according to the specification reported (see datasheet in **D4.1**), selected for the species and thickness.

Process parameters ***T, p*** must be recorded and stored automatically by the system.

Equalisation and conditioning step

The equalisation and conditioning must be performed setting the control parameters according to the specification reported (see datasheet in **D4.1**), selected for the species and thickness.

Process parameters ***T, p*** must be recorded and stored automatically by the system.

After-sorting of the treated material

The treated material must be sorted and selected by means of a visual grading in order to reject boards with warps and cracks.

MC at the core of 5% of the board of the batch must be measured and reported in a datasheet. If the MC of more than 35% of the measured boards is below the required ***Ueq***. (specified in the datasheet in **D4.1**) the whole batch must be subjected to an additional conditioning period. The additional conditioning period can be performed in the plant or in a storage room at environmental conditions. The batch can not be dispatched until less than 35% of the measured boards is below the required ***Ueq.***

Packaging and storing

At the end of the process the treated material must be packed and labelled for traceability. The packaging must ensure protection to direct exposition to rain and sun and to mechanical injuries.

The label of the pack must contain the identity information of the material such as species, thickness and treatment category. Moreover it must contains temporal and spatial elements for the traceability of the original batch.

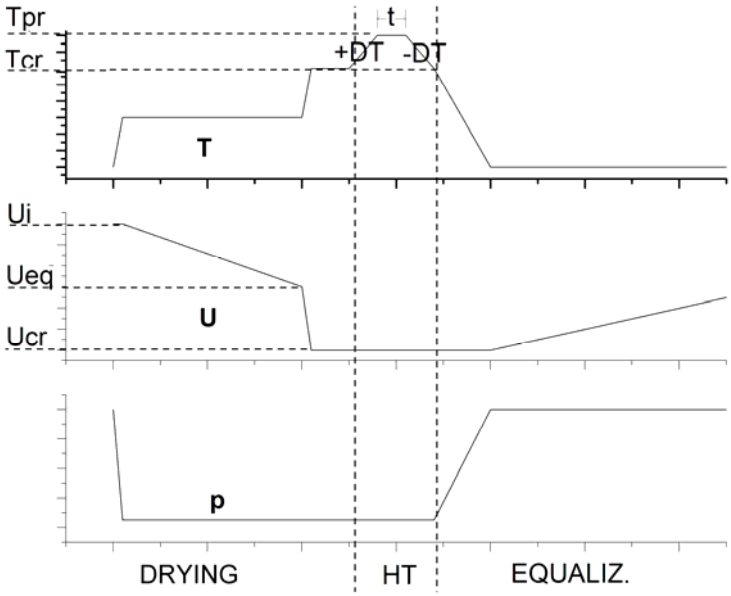
ANNEX 1 GUIDELINES FOR THE PROCESS SETUP

The process is composed by the following stages (outlined in the figure below):

1. Drying stages from ***Ui*** to ***Ucr***. This stage is usually performed under continuum vacuum conditions and with an increasing temperature (function of ***U***) from environmental ***T*** up to the ***Tcr***. Parameters and phases of the process must be tuned to reach an optimal drying quality with special regards to the internal stress, superficial and inner cracks.

2. High Temperature Thermal treatment stage composed by:
   a. Warm up phase from ***Tc***r to ***Tpr*** with a given ***+DT***
   b. Phase at constant ***Tpr*** for a ***t*** time;
   c. Cooling phase from ***Tpr*** to about 100° C with a given ***–DT*** (usually the same value of ***+DT***)

3. Equalizzaztion and conditioning.



GLOSSARY

Ui Initial MC (Moisture Content)

Ucr Critical MC: the MC that the wood must contain at the end of the drying stage and at the beginning of the thermal treatment.

Tcr Critical T: the T at which the modification reaction starts.

+DT Heating rate during the warm up of the thermal treatment from Tcr to Tpr.

Tpr Maximum constant T during the thermal treatment.

t Duration of treatment (hours) at Tpr.

p Vacuum pressure (mbar) during the thermal treatment.

-DT Cooling rate from Tpr to Tcr.

Ueq MC of wood after the treatment, ready to be used in operative conditions

NORMATIVE REFERENCES

EN 84:1997-05 Wood preservatives. Accelerated ageing of treated wood prior to biological testing. Leaching procedure

EN ISO 179-1:2001-06 Plastics -Determination of Charpy impact properties -Part 2: Instrumented impact test -Amendment 1: Pre-cision data

EN 252:1989 Holzschutzmittel; Freiland-Prüfverfahren zur Bestimmung der relativen Schutzwirkung eines Holzschutzmit-tels im Erdkontakt

EN 323:1994 Wood-based panels. determination of density

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EN 335-2:2006-10 Durability of wood and wood-based products – definition of use classes. Part 2: application to solid wood

EN 350-1:1994-10 Durability of wood and wood-based products – natural durability of solid wood. Part 1: Guide to the princi-ples of testing and classification of the natural durability of wood;

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Wood flooring -Characteristics, evaluation of conformity and marking

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CEN/TS 15083-2:2005-10: Determination of the natural durability of solid wood against wood-destroying fungi, test methods. Part 2: Soft rotting micro-fungi

CEN/TS 15397:2006-01-01 Wood preservatives -Method for natural preconditioning out of ground contact of treated wood specimens prior to biological laboratory test

CEN/TS 15679:2008-03 Thermal Modified Timber -Definitions and characteristics EN ISO/IEC 17025:2005 Conformity assessment. General requirements for the competence of testing and calibration laboratories

DIN 52184:1979-05 Prüfung von Holz; Bestimmung der Quellung und Schwindung

DIN 52189-1:1981-12 Prüfung von Holz; Schlagbiegeversuch; Bestimmung der Bruchschlagarbeit

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