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DELIVERABLE D 4.5:
Certification of products

TV4NEWOOD PROJECT

AGREEMENT NUMBER:
ECO/12/333079/SI2.653690

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§ 1 Subject and Definition

(1) Certification of product described in this document is the procedure needed to guarantee minimum performance quality and homogeneity requirements for thermally modified timber (TMT) produced by a VacWood® Producer. The Certification VacWood® Mark certifies the compliance with specific requirements of selected properties of TMT, which are tested by defined test methods developed during TV4Newood project.

(2) Subject of the Certification VacWood® Mark is thermally modified timber, according to the TERMOVUOTO technology. General definition of TV modified Timber is similar to the ones given in CEN/TS 15679:2007 for TMT (Thermally Modified Timber).

(3) According to CEN/TS 15679:2007, TMT is timber in which the chemical composition of wood substance (wood cell wall) and its physical properties are modified by exposure to both high temperatures – typically in the range between 160 °C - 230 °C – and condition of reduced oxygen availability. The wood is modified in such a way that at least some of the basic characteristics (properties) are permanently and throughout altered compared to untreated wood. TMT is generally characterised by darker colours, higher dimensional stability, lower equilibrium moisture content and increased resistance against wood-destroying fungi compared to untreated wood. Due to the thermal treatment, wood strength is generally decreasing with increasing treatment intensity. The properties of TMT can vary depending on the wood species, process type, treatment level and specific process conditions.

(4) VacWood® is a special case of TMT produced only with ThermoVacuum technology and following the ThermoVacuum process. The process is classified as dry process in an open system. The oxygen is substituted by vacuum and the heat transfer from the system to the wood is based on convection. The VacWood® is generally characterised by low ML (Mass Loss) and absence of odour.

(5) The Certification VacWood® basically refers to a specific VacWood® set defined by wood species, grading, manufacturer (plant facility), and process/temperature conditions (treatment level see § 4 point (5), which is usually available as a semi-finished product.

(6) The Certification VacWood® guarantees the minimum performance and quality requirements and the expected level (within a given range of tolerance) of the modified technological properties (**MTP**) of the modified wood as determined in the D.4.3 Results of Laboratory Tests (**MEE, ASE, DL*, MOR, MOE, hardness, durability**). The **MTP** shall be valued in terms of variation with respect

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to an expected average value and range of variability.

§ 2 Awarding and content

The Certification VacWood®Mark is awarded to products:

- which conform to the definition of VacWood® according to § 1;
- which essential properties have been tested according to recognised standards and test methods as defined in D.4.3 and D.2.10 Laboratory data sheet for each essence;
- which fulfill the requirements of the specifications as defined in D2.5 Manual for the standard production of treated wood for the certification procedure (§ 4 and § 6);
- which fulfill the criteria for wood quality and property values that are declared by the producer and have to be kept within defined ranges of tolerance.

(7) The mass loss (**ML**) is the main mandatory feature measured as proof of certification since it is easy to measure with reliable preciseness. It is stated (D. 4.3) that ML is the main indicator of the modification intensity since it is strongly correlated with all the modified technological properties (**MTP**), excepted durability and **Tpr** (maximum process temperature). **ML** is correlated to the **Tpr** but also with other process parameters such as **t** (exposure time to a given **Tpr**) in a way that a given **M**L can be achieved by the producer by various combinations of process parameters. Accordingly, the producers can independently manage the process parameters to reach a defined result (in term of Mass Loss) in the framework of only general guidelines and prescriptions. Only for **VacWood® – D** the observance of the **Tpr** is prescribed.

(8) The expected average **MTP** (and the range of expected variations) are certified on the base of the measured **ML** (and measured variation of **ML**). For VacWood®**, Tpr** record is needed as additional proof of certification.

§ 3 Classes of treatment and wood species

(9) Currently the VacWood® brand applies to the following wood species:
Silver Fir (*Abies alba*), **Spruce** (*Picea abies*), **Maritime Pine** (*Pinus pinaster*), **Ash** (*Fraxinus* spp.), **Beech** (*Fagus sylvatica*), **Poplar** (*Populus* sp.) and **Oak** (*Quercus petrae*). All of the above species are expected to originate from Europe and are identified by the botanical name and the average basic density as indicated in the D.2.10. Genus *Populus* is expected to originate from France but the species are not identified. Correct identification of the treated wood species and provenience is important since the same commercial name often includes a variety of wood species from

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several proveniences, which may demand individual approach in the choice of technological parameters to avoid significant differences between the attended results.

(10) The quality of raw material is a fundamental prerequisite to produce a final certifiable product. The quality requirements of to the timber to be treated by TVW are deemed as fulfilled if:

- the sawn wood is free of pith
- at least 80 % of the assessed set are free of inner cracks

the set are used by at least 80 % of their length, i. e. they are free from end-to-end drying cracks in at least 80 % of their length (except micro-cracks).

(11) There are three treatment categories, which have been designed to guarantee the performance of the modified wood according to specific end uses and in line with the chemical and physical changes achieved due to different modification intensity applied. Each category foresees individual treatment for set thickness up to 33 mm.

VacWood® – C (COLOUR)
mainly for interior use. The thermal modification is intended to control the colour changes. No imposed property limits except ML, MC (Moisture Content) and in particular case, those relevant for a given end-use (e.g. hardness for flooring).
Certification requisites: ML must range from low (around 2% depending on wood species) to severe. MC must be not lower than 4%. Certified MTP are according to the measured ML.

VacWood® – S (STABILITY)
for interior and exterior use, even in moderately wet conditions (hazard class 2 according to EN 335-1). A high dimensional stability (ASE) and low hygroscopicity (MEE) are crucial factors for final use (e.g. facades, external joineries, flooring, internal doors and windows). Imposed limits for ML, EMC, ASE, MC and those relevant for a given end-use.
Certification requisites: ML must range from moderate (around 6-8% depending on wood species) to severe and to achieve minimum MEE > 35%. MC must be not lower than 4%. Certified MTP are according to the measured ML.

VacWood® – D (DURABILITY)
for exterior use (hazard class 3 according to EN 335-1: wet conditions above ground). When at least durability class 3 (i.e. resistance against biodegradation according to the EN 350-1) is needed (e.g. decking, cladding, fences, and other items exposed above ground). Imposed limits for ML, MC, Tpr (maximum process temperature), durability and those relevant for a given end-use.
Certification requisites: ML must range from high (8-10 % depending on wood species) to severe. Tpr must be not lower than 212 °C. MC must be not lower than 3% and Certified MTP are according to the ML.

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§ 4 Vacwood® producers: procedures for the release of the Vacwood® mark

As described below, today VacWood® Mark is applicable by VacWood® Producers only on 7 wood species: Silver Fir, Spruce, Maritime Pine, Ash, Beech, Poplar and Oak.
VacWood® Producer can be enabled to produce one or more wood species.
VacWood® Producer is only the Subject that has a plant authorized producing VacWood®.
An initial "qualification visit" is due by the Certification Body to the VacWood® Producer.
The "qualification visit" will focus on the treated wood species and the procedures through which the treatment takes place (prescription), and also the guarantee of "repeatability" of treatments over time.

The result of the "qualification visit" will be send to VacWood® Techincal Committee.
In its initial phase the VacWood® Techincal Committee will be composed by: one member of WDE-Maspell, one member of CNR-IVALSA, one member of Conlegno.

The release of VacWood® Mark to a VacWood® Producer will only happen by unanimous decision of all members of VacWood® Techincal Committee.

Conlegno takes care of the sending of the VacWood® License, and will also handle the management, promotion and protection of VacWood® Mark.

The VacWood® Mark with the initials of the State and progressive order as shown below

VacWood

IT - 001

must be applied to focus on each single element on which the treatment has taken place.

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The VacWood® Producer shall have the obligation to keep records in a register of "loading and unloading treated wood".
In these records it should also be indicated, in addition to quantity and treated species, also the clients to which the product has been sold.
Such records may be requested at any time and viewed by the independent Certification Body.

The VacWood® Brand could be used by the VacWood® Producer also for marketing and/or promotional information (eg. brochures, fairs, etc ...).

§ 5 Vacwood® producers: procedures for the audits for the maintenance of the Vacwood® mark

The VacWood® Producer might be at any times verified by the independent Certification Body.
For the maintenance of the VacWood® Mark it is mandatory at least one planned audit yearly.
The controls will focus on: cubic meters treated, wood species, the "prescription", the loading and unloading registers, storage mode, etc ...
As an indication see the ANNEX 2 below.
The result of the "maintenance visit" will be send to the VacWood® Techincal Committee.
Following evaluation by the VacWood® "Technical Committee", Conlegno will notify to the VacWood® Producers the outcome of the audit and in case of failure to maintain the mark, the Certification Body will be in charge of the withdrawal of the VacWood® Mark.

ANNEX 1: Qualification visit check list

Qualification visit is carried out by one Inspector of the Certification Body. It takes place at the production site and lasts from the charge operation of the plant with raw material until the end of the reference thermal process (usually 2-3 days).
During the visit the inspector will check the conformity of the following elements:

1. **Production registers;**
2. **Plant and equipment**: entirety and functionality of the plant with special regards to the measuring system (temperature and pressure probes), control and recording system, safety devices, anti pollution devices and procedures;
3. Pre and post **production facilities** (storerooms, logistic, quality grading procedure...);
4. **Product conformity**: 30 boards among different species and class are sampled from the stock before the treatment. A sample 1 m long is cut from the selected boards. Samples are cut in two sub-samples and properly labelled. The weight of each sub-sample is measured and recorded. Half of the matched sub-samples are charged (equally distributed in the stack volume) in the stack. After the reference thermal treatment, the weight of each sub-sample is measured and recorded again. Data are collected together with the

process diagram. A visual grading is performed by the Inspector together with the producer on the whole treated stack. All the samples are then transported to the Certification Laboratory where the **MC** and **ML** is calculated. At the Laboratory other parameters such as colour and NIR spectra are measured as well as visual qualitative parameters (internal checks, cracks, warpings). The examined samples are stored at the laboratory as references material. The results of all the above mentioned laboratory tests are ready within 3 days from the arrival of the material at the laboratory.

5. Extra laboratory tests on one ore more modified technological properties (**MTP**) can be measured on the reference laboratory in case of justified cause.

The same procedure as descibed above must be repeated for each species/class. It is possible to treat two or more species during a single reference thermal treatment.

ANNEX 2: Maintenence visit check list

Maintenence visit is focused on the constancy and repeatibility of production over time. Accordingly, **ML** and **MC** must be measured on material produced on a new reference thermal treatment. In order to keep low time and costs of the visit the preparation and weight of samples before the thermal treatment can be performed autonomosly by the producer. In this case the producer must be equipped with a certified balance. As alternative the certified balance can be provided by the Certification Body. In case of autonomous procedure the producer must ship the sample and transfer results to the laboratory.

In order to measure the variations of temperature, each producer should have in the plant certified probes. As alternative the certified probes can be provided as a service by WDE-Maspell.

Special attention must be also focused on the entirety and functionality of the safety and anti-pollution devices.

ANNEX 3: Procedure for new wood species and/or new MTP VacWood® certification

In the case that the producer want to:

- ✓ certify a new wood species;
- ✓ certify a higher thickness;
- ✓ certify a new Modified Technological properties not specified at the point 6 of §1 (example thermal conducivity for joinery end-use);
- ✓ verify or improve the certified MTP
- ✓ develop new products

new laboratory tests are required.

In this case a new reference thermal treatment must be performed as described in ANNEX 1.

In addition an extra sampling of material (matched treated/untreated) from reference thermal treatment must be delivered to the laboratory for thr tests.

Alternatively the reference thermal treatment can be performed on small scale on the Piolot plant at IVALSA. In this last case the trasfereability of results is guaranteed and hence the qualification visit can be avoided.

After the conclusion of the tests the producers can achieve the new certification, and the new results become properties of the VacWood® mark which can extend the certification to other VacWood® producers.

ANNEX 4: Table of expected ML and MTP for each species and category

		category		
		VacWood® – C	**VacWood® – S**	**VacWood® – S**
Spruce and Fir	***ML*** [%]	**1±0,1**	**2,1±0,2**	**6±0,6**
	DL*	-11±2	-20±3,7	-43±7,8
	MEE [%]	-10,9±4,4	-19,8±4,4	-30±4,4
	ASE r [%]	13±11,3	27,1±11,3	23,8±11,3
	ASE t [%]	13,7±11,3	48,6±11,3	44±11,3
	ΔMOR [%]			
	Durability [class]	5	5	3
Maritime pine	***ML*** [%]	**1,9±0,5**	**3,4±0,9**	**5,2±0,8**
	DL*	-21,7±0,8	-27,2±1,2	-30,6±1,4
	MEE [%]	25,5±0,9	31,8±1,2	37,2±1,1
	ASE r [%]	31,7±4,4	31,9±4,8	38,7±6,5
	ASE t [%]	31,6±4,2	37,4±5,5	41,3±6,4
	ΔMOR [%]	/	/	
	Durability [class]	/	/	
Ash	***ML*** [%]	**3,5±0,4**	**5,5±0,6**	**12,8±1,3**
	DL*	-18,6±2,37	-25,5±2,85	-37,5±2,41
	MEE [%]	29,8±1,9	41,2±3,6	50,2±1,3
	ASE r [%]	17,9±4,76	43,1±21,09	60,3±18,06
	ASE t [%]	23,1±4,5	33,3±8,1	59,1±8,9
	ΔMOR [%]			
	Durability [class]	5	5	3
Beech	***ML*** [%]	**2,2±0,2**	**3,6±0,4**	**10,5±1,1**
	DL*	-20,4±2,50	-27,1±3,37	38±2,07
	MEE [%]	24,7±0,5	33,7±6,6	48,6±15,6
	ASE r [%]	0,6±	12,8±2,61	50,1±7,06
	ASE t [%]	20,8±2,1	26,5±2,7	58,4±6,9
	ΔMOR [%]	n.d.	n.d.	
	Durability [class]	5	5	3
Poplar	***ML*** [%]	**3.0±0,5**	**5,6±0,6**	**8,1±0,4**
	DL*	-20±0,5	-27,1±0,7	-29,6±1,4
	MEE [%]	32,1±2	39,1±2,6	44,2±3,2
	ASE r [%]	30,3±6,4	41,3±10,4	44,4±10,8
	ASE t [%]	36,1±5,3	44,6±7,9	51,3±10,2
	ΔMOR [%]	/	/	
	Durability [class]	5	/	0

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	ML [%]	**0,9±0,1**	**1,5±0,2**	**2,4±0,2**
	DL*	-12±2,1	-17±3,0	-22±3,9
	MEE [%]	19,5±1,3		/
Oak	***ASE r*** [%]	36,5±11,08		/
	ASE t [%]	16,6±2,9		/
	ΔMOR [%]	n.d.	n.d.	/
	Durability [class]	3	0	/

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