Canadian Food Inspection Agency
Agence canadienne d'inspection des aliments

PI-07

2 nd Revision

The Technical Heat Treatment Guidelines and Operating Conditions Manual

Plant Products Directorate
Plant Health Division
Canadian Food Inspection Agency
59 Camelot Drive
Ottawa, Canada
K1A 0Y9

Canada

Table of Contents

Contact and Review

The next review date for this procedure is anticipated for June 27, 2007. For further information or clarification, please contact the CFIA Forestry Section.

Endorsement

Approved by:

Joanne Rousson, Quality Systems Document Committee Representative Date

Greg Stubbings, Director, Plant Health Division, Date

Amendment Record

Number of amendment:	Amended by:	Date of submission for approval of amendment:	Summary of amendment and number of amended page(s):

Distribution

1. Directive mail list (Regions, Areas, PHRA)
2. Provincial Government, Industry (via Regions)
3. National Industry Organizations (determined by Author)
4. Candidate Service providers
5. CHTWPCP Working Group
6. Internet

Introduction

The Technical Heat Treatment Guidelines and Operating Conditions Manual is a supplementary document designed to accompany the CFIA policy directive, D-03-02 , *The Canadian Heat Treated Wood Products Certification Program for Export* (CHTWPCP) and the CFIA policy directive, D-01-05, *The Canadian Wood Packaging Certification Program* (CWPCP). This manual provides information to heat treatment facilities regarding the heat treatment chamber operating condition and defines the technical requirements to participate under these export certification programs.

The Policy Directives D-03-02, D-01-05 and PI-07 use a quality systems approach, to ensure that certified heat treated wood products (hardwood and softwood) can be traced back to the treatment facility and ensure wood products are heated to a minimum core temperature of 56° Celsius for a minimum of 30 minutes. This heat treatment measure will allow Canadian wood products to countries specifying heat treatment prior to export and meet the ISPM# 15 standard.

Additional phytosanitary requirements are prescribed in other policy documents, (e.g. D-96-04, D-03-02, etc.).

Generic phytosanitary heat treatment schedules for all coniferous tree species and all deciduous species grown in Canada are contained within Section 4.0, *The Approved Generic Phytosanitary Heat Treatment Schedules for Lumber and Wood Products and Heat Treatment Chamber Operating Conditions*. These generic heat treatment schedules (Options A, B, C, D, E and F), are science-based and approved by the Canadian Food Inspection Agency (CFIA) and may be used by all treatment facilities registered under D-03-02 and D-01-05. Each generic schedule contains sufficient safeguarding measures to ensure that all wood products treated according to the schedule will meet the phytosanitary standard, a minimum wood core temperature of 56° Celsius for a minimum of 30 minutes.

Additional generic schedules will be added as they become available, but due to species-specific factors may require additional scientific verification.

Heat treatment facilities registered under the Policy Directive D-01-05 may use the generic phytosanitary heat treatment schedules for wood packaging products. The treatment of such products may require additional technical review by CFIA, recognized heat treatment evaluator or CFIA service providers to ensure proper chamber loading procedures are developed and that chamber air flow will be sufficient to heat treat wood packaging products. The choice of the appropriate heat treatment schedule for wood packaging will be based on the maximum individual lumber thickness (vertical or horizontal) or the combination of wood members in close contact. The combined thickness shall not exceed the wood thickness for the applied schedule (Options A, B, C, D, E and F).

Treatment facilities may choose to develop or use existing kiln-specific treatment schedules to increase the efficiency of their kiln and to decrease the minimum heat treatment time, to treat wood species or dimensional lumber not covered by the generic treatment schedules, or to enable the use of a kiln, or heat treatment chamber not meeting the prescriptive minimum criteria of the generic treatment schedules. Each specific schedule must be verified by the recognized heat treatment evaluator to ensure the kiln will consistently treat lumber and wood products to meet the phytosanitary standard. The recognized heat treatment evaluator will recommend the specific schedule or process for approval to the CFIA and if acceptable the treatment facility will add the specific schedule to their quality manual.

Any request for deviation to the operating conditions set out in this document will be referred to the CHTWPCP-CWPCP Technical Committee for review and approval.

A list of recognized heat treatment evaluators is maintained on the CFIA Forestry website at www.inspection.gc.ca. All costs for the development of specific schedules are the responsibility of the treatment facility.

Note: In this 2st Revision, the following modifications have been made:

- Sections, 4.1.4, 4.2.1.1, 4.2.1.4, 4.2.2, 4.3, 4.3.1.1, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 4.4.1.1, 4.4.2, 4.5.2, 4.6.1.1, 4.6.1.4, 4.6.2, 4.7, 4.7.1, 4.7.2, 4.7.3, 4.7.4, have been amended.
- Additional treatment schedules B-1 and F-1 have been introduced.
- The term "**Technical Committee**" has been introduced and a new definition provided.

1.0 Scope

This manual is intended for the use by registered facilities of the CHTWPCP (D-03-02) and the CWPCP (D-01-05), Service Providers involved in the evaluation and the review of heat chambers, CFIA inspection staff and any other authorized parties. This manual is a supplementary document to the CFIA Policy D-03-02 and the CFIA policy D-01-05. It outlines additional technical information for the export of certified wood products heat treated in accordance with foreign import requirements and International Standards for Phytosanitary Measures.

2.0 References

- Glossary of Phytosanitary Terms, Publication No. 5, FAO, October 2002.
- ISO Guide 8402, Quality Systems Terminology.
- Guidelines for Regulating Wood Packaging in International Trade, Publication No. 15, FAO, March 2002.
- Export Certification Systems, Publication No. 7, FAO, 1997.
- CFIA Policy D-01-05, The Canadian Wood Packaging Certification Program, October 2003.

- CFIA Policy D-03-02, The Canadian Heat Treated Wood Products Certification Program, October 2003.

3.0 Definitions, Abbreviations and Acronyms

Recognized Heat Treatment Evaluator	An organization, company or person that has been authorized by the CFIA to conduct a scientific analysis pertaining to the treatment of wood products.
Canadian Phytosanitary Certificate	Certificate patterned after the model certification of the IPPC.
Certification	For the purposes of this document, the official process by which products may be exported from Canada, in compliance with the importing country's phytosanitary requirements.
CFIA	The Canadian Food Inspection Agency.
CHTWPCP	Canadian Heat Treated Wood Products Certification Program.
Commodity	A type of plant, plant product, or other article being moved for trade or other purpose.
CWPCP	Canadian Wood Packaging Certification Program for Export.
Heat Treatment	The process in which a commodity is heated until it reaches a minimum temperature for a minimum period of time according to an officially recognized technical specification.
Heat Treatment Certificate	A certificate issued by a registered facility, approved by the CFIA or by the United States Department of Agriculture.
HT	Heat treatment.
HT Stamp	A specific mark recognized by the CFIA which contains the letters HT and indicates that the wood products to which the stamp is applied has met the definition of HT.
Kiln-Drying	A process in which wood is dried in a closed chamber using heat and/or humidity control to achieve a required moisture content.

KD - HT	Lumber that has been heat treated to a minimum core temperature of 56ºC for a minimum of 30 minutes and has a moisture content of less than 20% expressed as a percentage of dry matter, at the time of manufacture.
KD-HT Stamp	A specific mark recognized by the CFIA which contains the letters KD-HT and indicates that the wood products to which the stamp is applied has met the definition of KD-HT.
Lumber	For the purposes of this document, a product derived from a log in a sawmill, or in a sawmill and planing mill, which when rough shall have been sawed, edged and trimmed at least to the extent of showing saw marks or other marks made in the conversion of logs on the four longitudinal surfaces of each piece for its overall length, and which has not been further manufactured other than by cross-cutting, ripping, re-sawing, joining crosswise and/or endwise in a flat plane surfacing with or without end matching and working.
Manufactured Wood	Articles comprised wholly of wood-based products such as plywood particle board, oriented strand board, veneer, wood wool, etc., which has been created using glue, heat and pressure or a combination thereof.
Mark	For the purposes of this document, a stamp or brand, applied to a regulated article to indicate compliance with the treatment requirements of the importing country.
Quality Manual	A document stating the quality policy and describing the quality system of an organization.
Registered Facility	For the purposes of this document, a lumber mill or other facility that has been approved and registered by the CFIA to produce, handle or export heat treated lumber in accordance with the specifications outlined in the CHTWPCP.
Service Provider	For the purposes of this document, a Service Provider is an organization, company or person who has entered into an agreement with the CFIA (such as the Verification Body Agreement) to recommend participation of a facility and to review a facility's compliance with standards prescribed by the CFIA.
Technical Committee	A committee composed of representatives from the Forestry Section of the CFIA, representatives from the CLSAB, CLSAB Accredited Grading Agencies, representatives from the Service Provider selected under the CWPCP and CHTWPCP and technical experts.

Treatment	Officially authorized procedure for the killing or removal of pests or rendering pests infertile.
Treatment Chamber	For the purposes of this document**,** a treatment chamber is a closed structure used for heating wood to a core temperature of 56°C for at least 30 minutes.
Wood	A commodity class for round wood, sawn wood, wood chips or dunnage, with or without bark.
Wood Packaging Material	Wood or wood products (excluding paper products) used in supporting, protecting or carrying a commodity (including dunnage).
Wood Products	For the purposes of this document, wood products includes lumber, logs, log homes, prefabricated home components and wood packaging and pallet kits.

4.0 The Approved Generic Phytosanitary Heat Treatment Schedules for Wood Products and Heat Treatment Chamber Operating Conditions

The generic phytosanitary heat treatment schedules (Options A, B, C, D, E and F) and heat treatment chamber operating conditions are for use by heat treatment facilities registered under CFIA Policy Directive D-03-02 and CFIA Policy Directive D-01-05. These schedules are designed to meet the phytosanitary standard and can be used to heat treat the following softwood and hardwood tree species.

- **Generic Phytosanitary Heat Treatment Schedules Options A, B C &** D

These schedules apply to:

1. All coniferous (softwood) species grown in Canada.

2. Some deciduous (hardwood) genus/species grown in Canada - Aspen (*Populus tremuloides*), poplar (*Populus* spp.), Manitoba maple (*Acer negundo*), basswood (*Tilia americana*) and red alder (*Alnus rubra*).

- **Generic Phytosanitary Heat Treatment Schedules Options E & F.**

These schedules apply to all deciduous (hardwood) genera grown in Canada including but not limited to - Maple (*Acer* spp.), Alder (*Alnus* spp.), Oak (*Quercus* spp.), Birch (*Betula* spp.), Ash (*Fraxinus* spp.) and Beech (*Fagus* spp.). These schedules would also be acceptable for coniferous (softwood) species grown in Canada.

A registered heat treatment facility must apply the appropriate generic phytosanitary heat treatment schedule and mandatory operating conditions and describe within their quality manual the process for its use.Although facilities should conform to the conditions specified, slight deviations from this operating manual may be acceptable if technically supported and pre-approved by the CFIA. Any modifications must be included in the quality manual and account for all the processes used to ensure that the phytosanitary standard is being met.

4.1 Mandatory General Heat Treatment Chamber Operating Conditions

To use a heat treatment option the heat treatment chamber and facility must meet both the general conditions prescribed below along with the specific heat treatment requirements specified with each option.

4.1.1 The quality manual must identify that adequate air flow occurs throughout all zones of the chamber. An air flow minimum of 0.5 meters/second (100 feet/minute), (measured on the air exit side of the chamber of the load) is required. A zone is an area of 5 m long by 2.5 m high.

4.1.2 Lumber must be stacked on stickers of no less than 9.5 mm (3/8 inch) in thickness and in a manner to provide adequate air flow. Wood packaging or other wood products may be piled in a manner to provide good air circulation through and over all wide surfaces of individual boards.

4.1.3 All equipment must be in proper working conditions and the quality manual must specify the practices that are undertaken by the facility to ensure the normal operation of all equipment including heat sensors.

4.1.4 Dry and wet bulb measuring system must accurately measure the temperature within ± **2.5°C (4.5 ° F)**. The verification of the measuring system will be required on an annual basis. This requirement may be removed where the temperature exceeds the requirement for option A-B-D-E-F by at least 5° C and by at least 10 ° C for option C

4.1.5 To ensure that facilities are prepared to deal with non-conforming equipment, the facility must specify procedures for dealing with failure or deficiencies in equipment operation including heat sensors, fans, etc.

4.1.6 If a facility is not in operation for a period of 6 months or longer, the facility must specify steps used in ensuring that the equipment is in normal operating condition before beginning treatments.

4.2 Option A, A-1, A-2, A-3, A-4, A-5, A-6 : Generic Phytosanitary Heat Treatment Schedule, Heat Treatment Without Moisture Reduction

4.2.1 Specific Heat Treatment Chamber Operating Conditions

4.2.1.1 Air flow should occur in each of two opposite directions within the treatment chamber for half of the time specified at the wet bulb temperature equal to or exceeding the wet bulb temperature run time (see tables for each option).

This requirement may be modified where it can be technically proven, by recognized heat treatment evaluator and when others mesures can compensate for deviation . This deviation will be referred to the Technical Committee for review . Any modifications must be included in the quality manual and account for all the processes used to ensure that the phytosanitary standard is being met.

4.2.1.2 Dry bulb temperature sensors can be located on either side of the heat treatment chamber. Sensors must be spaced not more than 7 meters (24 feet) apart, perpendicularly to the air flow with one located no more than 2.5 m (8 feet) from each end of the treatment chamber. The number of dry bulb sensors required will depend on the length of the individual kiln and the above sensor placement scale.The dry bulb temperature must exceed the wet bulb temperature during the heat treatment to ensure the uniformity of the heat treatment chamber conditions. The temperatures must be recorded at a minimum of every 30 minutes.

4.2.1.3 At least one wet bulb temperature sensor, either measuring wet bulb temperature or providing data to determine the wet bulb temperature must be located near the midpoint of the treatment chamber, on any one side. Temperatures must be recorded at a minimum of every 30 minutes.

4.2.1.4 The initial wood core temperature within the heat treatment chamber must be equal to or higher than 15°C in order to use generic schedules of options A for pieces of wood greater than 60 mm (2-1/4 inches) in thickness. If not, one of the two following methods to determine the pre-schedule time to be added at the heat treatment schedules must be as follows:

I The treatment chamber must be pre-heated until the wood core temperature of at least one piece of lumber of the thickest nominal size reaches 15ºC . At least one sensor (or equivalent process) must verify and record the wood core temperature.

or

II If no wood core temperature monitoring is conducted the pre-schedule time must be determined by one of the following means:

i. Measure initial wood core temperature by thermometer i.e. thermocouple

or
ii. Assume wood temperature is equal to the previous night's, outside, low temperature.

Please note that where the wood core temperature is below 15 ° C the temperature adjustment will need to be added to the Minimum Heat Treatment Run Time.

For Options A adjust as follows:

> 60mm ($2^1/_4$ inches) to 85 mm ($3^1/_4$ inches)	- add 10.0 minutes per 1°C (- add 5.6 minutes per 1 °F)
> 85 mm ($3^1/_4$ inches) to 110 mm ($4^1/_4$ inches)	- add 15.3 minutes per 1°C (- add 8.5 minutes per 1 °F)

Pre-schedule wood core temperature verification and the pre-heating process is not required for pieces of wood less than or equal to 60 mm (2-1/4 inches).

For Options A-1 to A-6 Adjust as follows:

- **not available** (refer to method I)

4.2.2 Option A: Generic Phytosanitary Heat Treatment Schedule

Lumber Thickness	Minimum Heat Treatment Run Time	Wet Bulb Temperature Run Time ≥ 60° C/≥ 140°F	Minimum Final Wet-Bulb Temperature (°C) / (°F)
Up to 60 mm ($2^1/_4$ inches)	6 hrs, 26 minutes	2 hrs, 3 minutes	63 /145
Up to 85 mm ($3^1/_4$ inches)	7 hrs, 20 minutes	3 hrs, 20 minutes	66 /151
Up to 110 mm ($4^1/_4$ inches)	10 hrs, 57 minutes	6 hrs, 34 minutes	67 /153

Note : The pre-schedule wood core temperature must be equal to or higher than 15°C or refer to 4.2.1.4.
Note : "Wet Bulb Temperature Run Time" is the continuous portion of the heat treatment time where the wet bulb temperature measures ≥ 60°C, measured in hours.

4.2.3 Option A-1: Generic Phytosanitary Heat Treatment Schedule

Lumber Thickness	Minimum Heat Treatment Run Time	Wet Bulb Temperature Run Time ≥ 70° C/≥ 158°F Note	Minimum Final Wet-Bulb Temperature (°C) / (°F)
Up to 127 mm (5 inches)	9 hrs, 38 minutes	5 hrs, 8 minutes	70 / 158
Up to 152 mm (6 inches)	11 hrs, 16 minutes	6 hrs, 46 minutes	70 / 158
Up to 178 mm (7 inches)	13 hrs, 14 minutes	8 hrs, 44 minutes	70 / 158
Up to 203 mm (8 inches)	15 hrs, 37 minutes	11 hrs, 7 minutes	70 / 158
Up to 228 mm (9 inches)	18 hrs, 25 minutes	13 hrs, 55 minutes	70 / 158
Up to 254 mm (10 inches)	21 hrs, 44 minutes	17 hrs, 14 minutes	70 / 158
Up to 279 mm (11 inches)	25 hrs, 36 minutes	21 hrs, 6 minutes	70 / 158
Up to 305 mm (12 inches)	30 hrs, 4 minutes	25 hrs, 34 minutes	70 / 158

Note : During the "Wet bulb temperature run time", the Dry Bulb temperature must be equal or exceed 160°F/71°C.

4.2.4 Option A-2: Generic Phytosanitary Heat Treatment Schedule

Lumber Thickness	Minimum Heat Treatment Run Time	Wet Bulb Temperature Run Time ≥ 69° C/≥ 156°F Note	Minimum Final Wet-Bulb Temperature (°C) / (°F)
Up to 127 mm (5 inches)	11 hrs, 10 minutes	6 hrs, 40 minutes	69 / 156
Up to 152 mm (6 inches)	12 hrs, 16 minutes	8 hrs, 46 minutes	69 / 156
Up to 178 mm (7 inches)	15 hrs, 49 minutes	11 hrs, 19 minutes	69 / 156
Up to 203 mm (8 inches)	18 hrs, 52 minutes	14 hrs, 22 minutes	69 / 156
Up to 228 mm (9 inches)	22 hrs, 29 minutes	17 hrs, 59 minutes	69 / 156
Up to 254 mm (10 inches)	26 hrs, 44 minutes	22 hrs, 14 minutes	69 / 156
Up to 279 mm (11 inches)	31 hrs, 41 minutes	27 hrs, 11 minutes	69 / 156
Up to 305 mm (12 inches)	37 hrs, 24 minutes	32 hrs, 54 minutes	69 / 156

Note : During the "Wet bulb temperature run time", the Dry Bulb temperature must be equal or exceed 160°F/71°C.

4.2.5 Option A-3: Generic Phytosanitary Heat Treatment Schedule

Lumber Thickness	Minimum Heat Treatment Run Time	Wet Bulb Temperature Run Time ≥ 68° C/≥ 154°F Note	Minimum Final Wet-Bulb Temperature (°C) / (°F)
Up to 127 mm (5 inches)	12 hrs, 18 minutes	7 hrs, 48 minutes	68 / 154
Up to 152 mm (6 inches)	14 hrs, 45 minutes	10 hrs, 15 minutes	68 / 154
Up to 178 mm (7 inches)	17 hrs, 44 minutes	13 hrs, 14 minutes	68 / 154
Up to 203 mm (8 inches)	21 hrs, 17 minutes	16 hrs, 47 minutes	68 / 154
Up to 228 mm (9 inches)	25 hrs, 30 minutes	21 hrs	68 / 154
Up to 254 mm (10 inches)	30 hrs, 26 minutes	25 hrs, 56 minutes	68 / 154
Up to 279 mm (11 inches)	36 hrs, 11 minutes	31 hrs, 41 minutes	68 / 154
Up to 305 mm (12 inches)	42 hrs, 49 minutes	38 hrs, 19 minutes	68 / 154

Note : During the "Wet bulb temperature run time", the Dry Bulb temperature must be equal or exceed 160°F/71°C.

4.2.6 Option A-4: Generic Phytosanitary Heat Treatment Schedule

Lumber Thickness	Minimum Heat Treatment Run Time	Wet Bulb Temperature Run Time ≥ 67° C/≥ 152°F Note	Minimum Final Wet-Bulb Temperature (°C) / (°F)
Up to 127 mm (5 inches)	13 hrs, 14 minutes	8 hrs, 44 minutes	67 / 152
Up to 152 mm (6 inches)	15 hrs, 59 minutes	11 hrs, 29 minutes	67 / 152
Up to 178 mm (7 inches)	19 hrs, 18 minutes	14 hrs, 48 minutes	67 / 152
Up to 203 mm (8 inches)	23 hrs, 16 minutes	18 hrs, 46 minutes	67 / 152
Up to 228 mm (9 inches)	27 hrs, 58 minutes	23 hrs, 28 minutes	67 / 152
Up to 254 mm (10 inches)	33 hrs, 29 minutes	28 hrs, 59 minutes	67 / 152
Up to 279 mm (11 inches)	39 hrs, 53 minutes	35 hrs, 23 minutes	67 / 152
Up to 305 mm (12 inches)	47 hrs, 17 minutes	42 hrs, 47 minutes	67 / 152

Note : During the "Wet bulb temperature run time", the Dry Bulb temperature must be equal or exceed 160°F/71°C.

4.2.7 Option A-5: Generic Phytosanitary Heat Treatment Schedule

Lumber Thickness	Minimum Heat Treatment Run Time	Wet Bulb Temperature Run Time ≥ 66° C/≥ 150°F Note	Minimum Final Wet-Bulb Temperature (°C) / (°F)
Up to 127 mm (5 inches)	14 hrs, 3 minutes	9 hrs, 33 minutes	66 / 150
Up to 152 mm (6 inches)	17 hrs, 2 minutes	12 hrs, 32 minutes	66 / 150
Up to 178 mm (7 inches)	20 hrs, 39 minutes	16 hrs, 9 minutes	66 / 150
Up to 203 mm (8 inches)	24 hrs, 59 minutes	20 hrs, 29 minutes	66 / 150
Up to 228 mm (9 inches)	30 hrs, 7 minutes	25 hrs, 37 minutes	66 / 150
Up to 254 mm (10 inches)	36 hrs, 7 minutes	31 hrs, 37 minutes	66 / 150
Up to 279 mm (11 inches)	43 hrs, 5 minutes	38 hrs, 35 minutes	66 / 150
Up to 305 mm (12 inches)	51 hrs, 9 minutes	46 hrs, 39 minutes	66 / 150

Note : During the "Wet bulb temperature run time", the Dry Bulb temperature must be equal or exceed 160°F/71°C.

4.2.8 Option A-6: Generic Phytosanitary Heat Treatment Schedule

Lumber Thickness	Minimum Heat Treatment Run Time	Wet Bulb Temperature Run Time ≥ 64° C/≥ 148°F Note	Minimum Final Wet-Bulb Temperature (°C) / (°F)
Up to 127 mm (5 inches)	14 hrs, 46 minutes	10 hrs, 16 minutes	64 / 148
Up to 152 mm (6 inches)	17 hrs, 59 minutes	13 hrs, 29 minutes	64 / 148
Up to 178 mm (7 inches)	21 hrs, 52 minutes	17 hrs, 22 minutes	64 / 148
Up to 203 mm (8 inches)	26 hrs, 31 minutes	22 hrs, 1 minute	64 / 148
Up to 228 mm (9 inches)	32 hrs, 1 minute	27 hrs, 31minutes	64 / 148
Up to 254 mm (10 inches)	38 hrs, 28 minutes	33 hrs, 58 minutes	64 / 148
Up to 279 mm (11 inches)	45 hrs, 57 minutes	41 hrs, 27 minutes	64 / 148
Up to 305 mm (12 inches)	54 hrs, 36 minutes	50 hrs, 6 minutes	64 / 148

Note : During the "Wet bulb temperature run time", the Dry Bulb temperature must be equal or exceed 160°F/71°C.

4.3 Option B and B-1: Generic Phytosanitary Heat Treatment Schedule

Both wet-bulb and dry bulb temperatures are measured.

4.3.1 Option B and B-1: Specific Heat Treatment Chamber Operating Conditions

4.3.1.1 Air flow should occur in each of two opposite directions within the treatment chamber for approximately half of the time specified at the wet bulb temperature equal to or exceeding 60°C.

This requirement may be modified where it can be technically proven, by recognized heat treatment evaluator and when others mesures can compensate for deviation . This deviation will be referred to the Technical Committee for review . Any modifications must be included in the quality manual and account for all the processes used to ensure that the phytosanitary standard is being met.

4.3.1.2 At least one wet bulb temperature sensor either measuring wet bulb temperature, or providing data to determine the wet bulb temperature must be located near the midpoint of the heat treatment chamber, on any one side. Temperatures must be recorded at a minimum of every 30 minutes.

4.3.1.3 The initial wood core temperature within the heat treatment chamber must be equal to or higher than 15°C in order to use generic schedules of options B and B-1 for pieces of wood greater than 60 mm (2-1/4 inches) in thickness. If not, one of the two following methods to determine the pre-schedule time to be added at the heat treatment schedules must be as follows:

I. The treatment chamber must be pre-heated until the wood core temperature of at least one piece of lumber of the thickest nominal size reaches 15ºC . At least one sensor (or equivalent process) must verify and record the wood core temperature.

or

II If no wood core temperature monitoring is conducted the pre-schedule time must be determined by one of the following means:

i. Measure initial wood core temperature by thermometer i.e. thermocouple
or
ii. Assume wood temperature is equal to the previous night's, outside, low temperature.

Please note that where the wood core temperature is below 15 ° C the temperature adjustment will need to be added to the Minimum Heat Treatment Run Time.

For Options Band B-1 adjust as follows:

> 60mm ($2^1/_4$ inches) to 85 mm ($3^1/_4$ inches)	- add 10.0 minutes per 1°C (- add 5.6 minutes per 1 °F)
> 85 mm ($3^1/_4$ inches) to 110 mm ($4^1/_4$ inches)	- add 15.3 minutes per 1°C (- add 8.5 minutes per 1 °F)

Pre-schedule wood core temperature verification and the pre-heating process is not required for pieces of wood less than or equal to 60 mm (2-1/4 inches).

4.3.2 Option B: Specific Heat Treatment Chamber Operating Conditions With Moisture Reduction

4.3.2.1 This option can be used by a facility to heat treat the wood during the kiln drying process in order to reduce the moisture content below the fiber saturation point of the wood (approximately 30 % MC).

4.3.2.2 At least one dry bulb temperature sensor must be located near the mid point of the heat treatment chamber, on any one side. The dry bulb temperature must exceed the wet bulb temperature during the heat treatment to ensure the uniformity of the heat treatment chamber conditions. The temperatures must be recorded at a minimum of every 30 minutes.

4.3.3 Option B-1: Specific Heat Treatment Chamber Operating Conditions Without Moisture Reduction

4.3.3.1 At least 3 dry bulbs temperature sensor must be located on either side of the heat treatment chamber. Sensors must be spaced approximately at equal distance apart perpendicularly to the air flow. One sensor must be located at each end of the treatment chamber. These sensors should be placed closest to the end of the treatment chamber (approx. < 5 m(16,5 feet)) . For chamber equal to or less than 17 meters(56 feet) in length (in the direction perpendiculal to air flow) the number of dry bulb sensors can be reduced to 2 dry bulb sensors with the above placement criteria. The dry bulb temperature must exceed the wet bulb temperature during the heat treatment to ensure the uniformity of the heat treatment chamber conditions. The temperatures must be recorded at a minimum of every 30 minutes.

4.3.4 Option B and B-1: Generic Phytosanitary Heat Treatment Schedule

Lumber Thickness	Minimum Heat Treatment Run Time	Wet Bulb Temperature Run Time ≥ 60° C /≥ 140°F	Minimum Final Wet-Bulb Temperature (°C) / (°F)
Up to 60 mm (2 1/4 inches)	8 hrs, 29 minutes	4 hrs, 6 minutes	63 /145
Up to 85 mm (3 1/4 inches)	10 hrs, 40 minutes	6 hrs, 40 minutes	66 / 151
Up to 110 mm (4 1/4 inches)	17 hrs, 31 minutes	13 hrs, 8 minutes	67 /153

Note : "Wet Bulb Temperature Run Time" is the continuous portion of the heat treatment time where the wet bulb temperature measures ≥ 60°C, measured in hours.

Note : The pre-schedule wood core temperature of at least one piece of wood greater than 60 mm (2-1/4 inches) in thickness must be equal to or higher than 15°C or refer to 4.3.1.3.

4.4 Option C: Generic Phytosanitary Heat Treatment Schedule, Heat Treatment With Moisture Reduction

Only dry bulb measurement is required.

The following sets out the minimum conditions under which a facility may heat treat the wood during the kiln drying process in order to reduce the moisture content below the fiber saturation point of the wood. (approximately 30 % MC)

4.4.1 Option C: Specific Heat Treatment Chamber Operating Conditions

4.4.1.1 Air flow should occur in each of two opposite directions within the treatment chamber for approximately half of the time specified at the dry bulb temperature equal to or exceeding 60°C.

This requirement may be modified where it can be technically proven, by recognized heat treatment evaluator and when others mesures can compensate for deviation . This deviation will be referred to the Technical Committee for review . Any modifications must be included in the quality manual and account for all the processes used to ensure that the phytosanitary standard is being met.

4.4.1.2 The facility must employ the use of at least two dry bulb temperature sensors. The temperatures must be recorded at a minimum of every 30 minutes.

4.4.2 Option C: Generic Phytosanitary Heat Treatment Schedule

Lumber Thickness	Dry- Bulb Temperature Run Time ≥ 52°C / ≥ 126°F	Minimum Time at the End of the Treatment with the Dry-Bulb ≥ 60°C/ ≥ 140°F
Up to 28 mm (1 1/8 inches)	8 hrs	4 hrs
Up to 60 mm (2 $^1/_4$ inches)	18 hrs	6 hrs
Up to 85 mm (3 $^1/_4$ inches)	45 hrs	15 hrs
Up to 110 mm (4 $^1/_4$ inches)	72 hrs	24 hrs

Note : Dry bulb temperature run time is the continuous portion of the heat treatment time where the dry bulb temperature measures ≥ 52°C, measured in hours.

Note : The "Minimum Time at the End of the Treatment with the Dry-Bulb ≥ 60°C, is included in the "Dry bulb temperature run time >52°C", measured in hours.

4.5 Option D - Generic Phytosanitary Heat Treatment Schedule, Heat Treatment with Moisture Reduction

Only dry bulb measurement is required.

The following sets out the minimum conditions under which a facility may heat treat the wood during the kiln drying process in order to reduce the moisture content below the fiber saturation point of the wood (approximately 30% MC).

4.5.1 Option D: Specific Heat Treatment Chamber Operating Conditions

4.5.1.1 The facility must employ the use of at least two dry bulb temperature sensors. The temperatures must be recorded at a minimum of every 30 minutes.

4.5.2 Option D: Generic Phytosanitary Heat Treatment Schedule

Lumber Thickness	Heat Treatment Run Time	Minimum time at the End of the Treatment with the Dry-Bulb ≥ 71° C (≥ 160°F)
Up to 60 mm (2 $^1/_4$ inches)	12 hrs	6 hrs

Note: The "Minimum Time at the End of the Treatment with the Dry-Bulb ≥ 71°C, is included in the "Heat treatment Run Time ", measured in hours.

4.6 Option E, E-1, E-2, E-3, E-4, E-5, E-6 : Generic Hardwood Phytosanitary Heat Treatment Schedule, Heat Treatment Without Moisture Reduction

4.6.1 Specific Heat Treatment Chamber Operating Conditions

4.6.1.1 Air flow should occur in each of two opposite directions within the treatment chamber for half of the time specified at the wet bulb temperature equal to or exceeding the wet bulb temperature run time (see tables for each option).

This requirement may be modified where it can be technically proven, by recognized heat treatment evaluator and when others mesures can compensate for deviation . This deviation will be referred to the Technical Committee for review . Any modifications must be included in the quality manual and account for all the processes used to ensure that the phytosanitary standard is being met.

4.6.1.2 Dry bulb temperature sensors can be located on either side of the heat treatment chamber. Sensors must be spaced not more than 7 meters (24 feet) apart, perpendicularly to the air flow with one located no more than 2.5 m (8 feet) from each end of the treatment chamber. The number of dry bulb sensors required will depend on the length of the individual kiln and the above sensor placement scale. The dry bulb temperature must exceed the wet bulb temperature during the heat treatment to ensure the uniformity of the heat treatment chamber conditions. The temperatures must be recorded at a minimum of every 30 minutes.

4.6.1.3 At least one wet bulb temperature sensor, either measuring wet bulb temperature or providing data to determine the wet bulb temperature must be located near the mid point of the treatment chamber, on any one side. Temperatures must be recorded at a minimum of every 30 minutes.

4.6.1.4 The initial wood core temperature within the heat treatment chamber must be equal to or higher than 15°C in order to use these generic schedules for pieces of wood greater than 60 mm (2-1/4 inches) in thickness. If not, one of the two following methods to determine the pre-schedule time to be added at the heat treatment schedules must be as follows:

I The treatment chamber must be pre-heated until the wood core temperature of at least one piece of lumber of the thickest nominal size reaches 15ºC . At least one sensor (or equivalent process) must verify and record the wood core temperature.

or

II If no wood core temperature monitoring is conducted the pre-schedule time must be determined by one of the following means:

i. Measure initial wood core temperature by thermometer i.e. thermocouple

or

ii. Assume wood temperature is equal to the previous night's, outside, low temperature.

Please note that where the wood core temperature is below 15 ° C the temperature adjustment will need to be added to the Minimum Heat Treatment Run Time.

For Options E adjust as follows:

> 60mm (2 $^{1}/_{4}$ inches) to 85 mm (3 $^{1}/_{4}$ inches) - add 12.7 minutes per 1°C. (- add 7.1 minutes per 1 °F.)

> 85 mm (3 $^{1}/_{4}$ inches) to 110 mm (4 $^{1}/_{4}$ inches) - add 19.3 minutes per 1°C. (- add 10.7 minutes per 1 °F.)

Pre-schedule wood core temperature verification and the pre-heating process is not required for pieces of wood less than or equal to 60 mm (2-1/4 inches).

For Options E-1 to E-6 Adjust as follows:

- **not available** (refer to method I)

4.6.2 Option E: Generic Hardwood Phytosanitary Heat Treatment Schedule

Lumber Thickness	Minimum Heat Treatment Run Time	Wet Bulb Temperature Run Time ≥ 60° C/≥ 140°F)	Minimum Final Wet-Bulb Temperature (°C) / (°F)
Up to 60 mm (2 $^{1}/_{4}$ inches)	8 hrs, 2 minutes	2 hrs, 46 minutes	63 / 145
Up to 85 mm (3 $^{1}/_{4}$ inches)	9 hrs, 10 minutes	4 hrs, 30 minutes	66 / 151
Up to 110 mm (4 $^{1}/_{4}$ inches)	13 hrs, 40 minutes	8 hrs, 52 minutes	67 / 153

Note : The pre-schedule wood core temperature must be equal to or higher than 15°C or refer to 4.6.1.4.

Note : "Wet Bulb Temperature Run Time" is the continuous portion of the heat treatment time where the wet bulb temperature measures ≥ 60°C, measured in hours.

4.6.3 Option E-1: Generic Hardwood Phytosanitary Heat Treatment Schedule

Lumber Thickness	Minimum Heat Treatment Run Time	Wet Bulb Temperature Run Time ≥ 70° C/≥ 158°F Note	Minimum Final Wet-Bulb Temperature (°C) / (°F)
Up to 127 mm (5 inches)	11 hrs, 26 minutes	6 hrs, 56 minutes	70 / 158
Up to 152 mm (6 inches)	13 hrs, 38 minutes	9 hrs, 8 minutes	70 / 158
Up to 178 mm (7 inches)	16 hrs, 17 minutes	11 hrs, 47 minutes	70 / 158
Up to 203 mm (8 inches)	19 hrs, 30 minutes	15 hrs	70 / 158
Up to 228 mm (9 inches)	23 hrs, 17 minutes	18 hrs, 47 minutes	70 / 158
Up to 254 mm (10 inches)	27 hrs, 46 minutes	23 hrs, 16 minutes	70 / 158
Up to 279 mm (11 inches)	32 hrs, 59 minutes	28 hrs, 29 minutes	70 / 158
Up to 305 mm (12 inches)	39 hrs,1minute	34 hrs, 31 minutes	70 / 158

Note : During the "Wet bulb temperature run time", the Dry Bulb temperature must be equal or exceed 160°F/71°C.

4.6.4 Option E-2: Generic Hardwood Phytosanitary Heat Treatment Schedule

Lumber Thickness	Minimum Heat Treatment Run Time	Wet Bulb Temperature Run Time ≥ 69° C/≥ 156°F Note	Minimum Final Wet-Bulb Temperature (°C) / (°F)
Up to 127 mm (5 inches)	13 hrs, 30 minutes	9 hrs	69 / 156
Up to 152 mm (6 inches)	16 hrs, 20 minutes	11 hrs, 50 minutes	69 / 156
Up to 178 mm (7 inches)	19 hrs, 47 minutes	15 hrs, 17 minutes	69 / 156
Up to 203 mm (8 inches)	23 hrs, 54 minutes	19 hrs, 24 minutes	69 / 156
Up to 228 mm (9 inches)	28 hrs, 47 minutes	24 hrs, 17 minutes	69 / 156
Up to 254 mm (10 inches)	34 hrs, 31 minutes	30 hrs,1 minute	69 / 156
Up to 279 mm (11 inches)	41 hrs, 12 minutes	36 hrs, 42 minutes	69 / 156
Up to 305 mm (12 inches)	48 hrs, 55 minutes	44 hrs, 25 minutes	69 / 156

Note : During the "Wet bulb temperature run time", the Dry Bulb temperature must be equal or exceed 160°F/71°C.

4.6.5 Option E-3: Generic Hardwood Phytosanitary Heat Treatment Schedule

Lumber Thickness	Minimum Heat Treatment Run Time	Wet Bulb Temperature Run Time ≥ 68° C/≥ 154°F Note	Minimum Final Wet-Bulb Temperature (°C) / (°F)
Up to 127 mm (5 inches)	15 hrs, 2 minutes	10 hrs,32 minutes	68 / 154
Up to 152 mm (6 inches)	18 hrs, 20 minutes	13 hrs, 50 minutes	68 / 154
Up to 178 mm (7 inches)	22 hrs, 22 minutes	17 hrs, 52 minutes	68 / 154
Up to 203 mm (8 inches)	27 hrs, 9 minutes	22 hrs, 39 minutes	68 / 154
Up to 228 mm (9 inches)	32 hrs, 51 minutes	28 hrs, 21 minutes	68 / 154
Up to 254 mm (10 inches)	39 hrs, 31 minutes	35 hrs, 1 minute	68 / 154
Up to 279 mm (11 inches)	47 hrs,16 minutes	42 hrs, 46 minutes	68 / 154
Up to 305 mm (12 inches)	56 hrs, 14 minutes	51 hrs, 44 minutes	68 / 154

Note : During the "Wet bulb temperature run time", the Dry Bulb temperature must be equal or exceed 160°F/71°C.

4.6.6 Option E-4: Generic Hardwood Phytosanitary Heat Treatment Schedule

Lumber Thickness	Minimum Heat Treatment Run Time	Wet Bulb Temperature Run Time ≥ 67° C/≥ 152°F Note	Minimum Final Wet-Bulb Temperature (°C) / (°F)
Up to 127 mm (5 inches)	16 hrs, 17 minutes	11 hrs, 47 minutes	67/152
Up to 152 mm (6 inches)	20 hrs	15 hrs, 30 minutes	67 / 152
Up to 178 mm (7 inches)	24 hrs, 29 minutes	19 hrs, 59 minutes	67 / 152
Up to 203 mm (8 inches)	29 hrs, 50 minutes	25 hrs, 20 minutes	67 / 152
Up to 228 mm (9 inches)	36 hrs, 11 minutes	31 hrs, 41 minutes	67 / 152
Up to 254 mm (10 inches)	43 hrs, 38 minutes	39 hrs, 8 minutes	67 / 152
Up to 279 mm (11 inches)	52 hrs, 16 minutes	47 hrs, 46 minutes	67 / 152
Up to 305 mm (12 inches)	62 hrs, 15 minutes	57 hrs, 45 minutes	67 / 152

Note : During the "Wet bulb temperature run time", the Dry Bulb temperature must be equal or exceed 160°F/71°C.

4.6.7 Option E-5: Generic Hardwood Phytosanitary Heat Treatment Schedule

Lumber Thickness	Minimum Heat Treatment Run Time	Wet Bulb Temperature Run Time ≥ 66° C/≥ 150°F Note	Minimum Final Wet-Bulb Temperature (°C) / (°F)
Up to 127 mm (5 inches)	17 hrs, 24 minutes	12 hrs, 54 minutes	66 / 150
Up to 152 mm (6 inches)	21hrs, 25 minutes	16 hrs, 55 minutes	66 / 150
Up to 178 mm (7 inches)	26 hrs, 18 minutes	21 hrs, 48 minutes	66 / 150
Up to 203 mm (8 inches)	32 hrs, 9 minutes	27 hrs, 39 minutes	66 / 150
Up to 228 mm (9 inches)	39 hrs, 5 minutes	34 hrs, 35 minutes	66 / 150
Up to 254 mm (10 inches)	47 hrs, 11 minutes	42 hrs, 41 minutes	66 / 150
Up to 279 mm (11 inches)	56 hrs, 35 minutes	52 hrs, 5 minutes	66 / 150
Up to 305 mm (12 inches)	67 hrs, 29 minutes	62 hrs, 59 minutes	66 / 150

Note : During the "Wet bulb temperature run time", the Dry Bulb temperature must be equal or exceed 160°F/71°C.

4.6.8 Option E-6: Generic Hardwood Phytosanitary Heat Treatment Schedule

Lumber Thickness	Minimum Heat Treatment Run Time	Wet Bulb Temperature Run Time ≥ 64° C/≥ 148°F Note	Minimum Final Wet-Bulb Temperature (°C) / (°F)
Up to 127 mm (5 inches)	18 hrs, 22 minutes	13 hrs, 52 minutes	64 / 148
Up to 152 mm (6 inches)	22 hrs, 42 minutes	18 hrs, 12 minutes	64 / 148
Up to 178 mm (7 inches)	27 hrs, 57 minutes	23 hrs, 27 minutes	64 / 148
Up to 203 mm (8 inches)	34 hrs, 13 minutes	29 hrs, 43 minutes	64 / 148
Up to 228 mm (9 inches)	41 hrs, 39 minutes	37 hrs, 9 minutes	64 / 148
Up to 254 mm (10 inches)	50 hrs, 21 minutes	45 hrs, 51 minutes	64 / 148
Up to 279 mm (11 inches)	60 hrs, 27 minutes	55 hrs, 57 minutes	64 / 148
Up to 305 mm (12 inches)	72 hrs, 8 minutes	67 hrs, 38 minutes	64 / 148

Note : During the "Wet bulb temperature run time", the Dry Bulb temperature must be equal or exceed 160°F/71°C.

4.7 Option F and F-1: Generic Hardwood Phytosanitary Heat Treatment Schedule, Heat Treatment

Both wet-bulb and dry bulb temperatures are measured.

4.7.1 Option F and F-1: Specific Heat Treatment Chamber Operating Conditions

4.7.1.1 Air flow should occur in each of two opposite directions within the treatment chamber for approximately half of the time specified at the wet bulb temperature equal to or exceeding 60°C.

This requirement may be modified where it can be technically proven, by recognized heat treatment evaluator and when others measures can compensate for deviation . This deviation will be referred to the Technical Committee for review . Any modifications must be included in the quality manual and account for all the processes used to ensure that the phytosanitary standard is being met.

4.7.1.2 At least one wet bulb temperature sensor either measuring wet bulb temperature, or providing data to determine the wet bulb temperature must be located near the midpoint of the heat treatment chamber, on any one side. Temperatures must be recorded at a minimum of every 30 minutes.

4.7.1.3 The initial wood core temperature within the heat treatment chamber must be equal to or higher than 15°C in order to use generic schedules of options F for pieces of wood greater than 60 mm (2-1/4 inches) in thickness. If not, one of the two following methods to determine the pre-schedule time to be added at the heat treatment schedules must be as follows:

I The treatment chamber must be pre-heated until the wood core temperature of at least one piece of lumber of the thickest nominal size reaches 15ºC. At least one sensor (or equivalent process) must verify and record the wood core temperature.

or

II If no wood core temperature monitoring is conducted the pre-schedule time must be determined by one of the following means:

i. Measure initial wood core temperature by thermometer i.e. thermocouple

or

ii. Assume wood temperature is equal to the previous night's, outside, low temperature.

Please note that where the wood core temperature is below 15 ° C the temperature adjustment will need to be added to the Minimum Heat Treatment Run Time.

For Options F adjust as follows:

> 60mm (2 $^1/_4$ inches) to 85 mm (3 $^1/_4$ inches)	- add 12.7 minutes per 1°C. (- add 7.1 minutes per 1 °F.)
> 85 mm (3 $^1/_4$ inches) to 110 mm (4 $^1/_4$ inches)	- add 19.3 minutes per 1°C. (- add 10.7 minutes per 1 °F.)

Pre-schedule wood core temperature verification and the pre-heating process is not required for pieces of wood less than equal to 60 mm (2-1/4 inches).

4.7.2 Option F: Specific Heat Treatment Chamber Operating Conditions With Moisture Reduction

4.7.2.1 This option can be used by a facility to heat treat the wood during the kiln drying process in order to reduce the moisture content below the fiber saturation point of the wood (approximately 30 % MC).

4.7.2.2 At least one dry bulb temperature sensor must be located near the mid point of the heat treatment chamber, on any one side. The dry bulb temperature must exceed the wet bulb temperature during the heat treatment to ensure the uniformity of the heat treatment chamber conditions. The temperatures must be recorded at a minimum of every 30 minutes.

4.7.3 Option F-1: Specific Heat Treatment Chamber Operating Conditions Without Moisture Reduction

4.7.3.1 At least 3 dry bulbs temperature sensor must be located on either side of the heat treatment chamber. Sensors must be spaced approximately at equal distance apart perpendicularly to the air flow. One sensor must be located at each end of the treatment chamber. These sensors should be placed closest to the end of the treatment chamber (approx. < 5 m(16,5 feet)) . For chamber equal to or less than 17 meters(56 feets) in length (in the direction perpendicular to air flow) the number of dry bulb sensors can be reduced to 2 dry bulb sensors with the above placement criteria.The dry bulb temperature must exceed the wet bulb temperature during the heat treatment to ensure the uniformity of the heat treatment chamber conditions. The temperatures must be recorded at a minimum of every 30 minutes.

4.7.4 Option F and F-1: Generic Hardwood Phytosanitary Heat Treatment Schedule

Lumber Thickness	Minimum Heat Treatment Run Time	Wet Bulb Temperature Run Time ≥ 60° C/ ≥ 140°F	Minimum Final Wet-Bulb Temperature (° C) / (°F)
Up to 60 mm (2 $^{1}/_{4}$ inches)	10 hrs, 36 minutes	5 hrs, 32 minutes	63 / 145
Up to 85 mm (3 $^{1}/_{4}$ inches)	13 hrs, 20 minutes	9 hrs	66 / 151
Up to 110 mm (4 $^{1}/_{4}$ inches)	21 hrs, 54 minutes	17 hrs, 44 minutes	67 / 153

Note : "Wet Bulb Temperature Run Time" is the continuous portion of the heat treatment time where the wet bulb temperature measures ≥ 60°C, measured in hours.

Note : The pre-schedule wood core temperature of at least one piece of wood greater than 60 mm (2 ¼ inches) in thickness must be equal to or higher than 15°C or refer to 4.7.1.3.