



TS 12037 Test Report

Report No.: 779228

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No. of appendices: 2

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Subject: ThermoTreat2.0 modified pine sapwood (*Pinus sylvestris* L.), beech (*Fagus sylvatica* L.), and spruce (*Picea abies* L.). The wood was tested with and without oil post treatment. The reference preservative was CCA, F2597/1. Untreated control samples of beech and pine sapwood were exposed as well.

Sampling: The wood was modified, and oil treated in January 2018. The reference preservative was in stock.

Method: CEN/TS 12037 (2003): *Wood preservatives - Field test method for determining the relative protective effectiveness of a wood preservative exposed out of ground contact - Horizontal lap-joint method.*

Period: The testing was carried out from 03-01-2018. Exposure was initiated on 21-05-2018 at UNIMAS (University of Malaysia) located near Kuching in Borneo, Malaysia.

Result:

Treatment	Wood species	Post-treatment	Exposure site: UNIMAS, Malaysia						
			Mean Retention kg/m ³	Median of Decay Rating in Lap					
				Year					
				1	2	3	4	5	6
Thermo-Treat2.0 modified	Beech	No oil	-	0	-*	0	0	0	0
		Clear oil	122	0		0	0	0	0
		Dark oil	84	0		0	0	0	0
	Pine sapwood	No oil	-	0		0	1	1	1
		Clear oil	89	0		0	0	0	0
		Dark oil	56	0		0	0	0	0
	Spruce	No oil	-	0		0	1	1	1
		Clear oil	17	0		0	0	0	0
		Dark oil	18	0		0	0	0	0
Untreated	Pine	-	-	2	3	3	4	4	
	Beech	-	-	2	3	4	4	4	
CCA	Pine	-	630	0	0	0	0	0	

*No evaluation took place in 2020 because of the COVID-19 situation.

Note: The interpretation of this test report and the practical conclusions that can be drawn from it require a basic knowledge of the problems of wood preservation. For this reason, this test report alone does not indicate any official approval of the wood preservative tested.

Terms: This accredited test was conducted accredited in accordance with international requirements (ISO/IEC 17025:2017) and in accordance with the General Terms and Conditions of Danish Technological Institute. The test results solely apply to the tested item. This analysis report/ test report may be quoted in extract only if Danish Technological Institute has granted its written consent.

Date/place: 25-02-2024, Danish Technological Institute, Wood and Biomaterials, Taastrup

Signature:



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27 February 2024

DANISH TECHNOLOGICAL INSTITUTE



TEST Reg.no. 2

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Product Information

Treatments under testing: WTT ThermoTreat2.0 modified wood with and without oil post treatment

Date of treatments: Thermo modification of the wood from the 03-01-2018 to 09-01-2018.
Posttreatment: 24-01-2018.

Concentrations tested: The thermal modification resulted in the following average Equilibrium Moisture Content at 65% RH at 20 °C.

Wood species	EMC _{65%}
Beech	5.4
Pine sapwood	5.8
Spruce	5.8

Two oil post treatments were tested (clear and dark oil). The composition is confidential but is known to DTI.

Reference preservative: CCA in 5.5 kg/m³ retention: F2597/1 containing

	Nominal value	Analysed value
Cu-%	8.91 %	8.62 %
Cr-%	15.91 %	14.96 %
As-%	11.27 %	9.98 %

Date of treatment of reference preservative: 05-04-2018

Concentration of reference preservative: 0.88 %

Solvent used for dilution: Deionized water for the reference preservative.

Method of treatment: Modification: WTT ThermoTreat2.0
Post-treatments: Impregnation with 80 °C hot oil with 0.7 bar in 2 minutes and 1 bar in 2 minutes.

CCA-References:
Full-cell treatment was used. Vacuum 0.10 bar for 60 minutes and subsequently pressure at 12 bar for 120 minutes.

Drying after preservative treatment: Air dried at 20 °C and 65 % relative humidity to constant mass before exposure.

Date of inspection:	MALAYSIA		MALAYSIA	
	1 year	08-04-2019	6 years	25-02-2024
2 years	-*			
3 years	22-06-2021			
4 years	01-05-2022			
5 years	18-04-2023			

*No evaluation took place in 2020 because of the COVID-19 situation.

Wood species and density: Thermally modified Beech (Danish origin, Copenhagen Hardwood 2"): mean 624 kg/m³ at 65% RH and 20 °C
Thermally modified Pine sapwood (Danish origin, TI own stock, Sonnerup Skov 2016/17): mean 480 kg/m³ at 65% RH and 20 °C
Thermally modified Spruce (Swedish origin, VIDA wood): mean 451 kg/m³ at 65% RH and 20 °C

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Number of replicates: 10 for each type of treatment and wood species.

Test Site: Universiti Malaysia Sarawak (UNIMAS), Borneo, Malaysia. 1°27'57.2"N; 110°26'58.9"E. Elevation: about 15.5 m. Average temperatures; maximum: 27-35°C, minimum: 22-25.5°C. Average annual precipitation: about 3900 mm. Humidity: 80-90%.

The test site is located in a secondary tropical forest approaching peat swamp forest ecosystem surrounded by 15-20 m high trees.

Grading system for decay:

Rating	Description	Definition
0	Sound	No evidence of decay.
1	Slight attack	Visible signs of decay, but no significant softening or weakening of the wood.
2	Moderate attack	Areas of decay (softened, weakened wood); typically not more than 3 cm ³ and to a depth of 2 to 3 mm.
2+	Moderate attack +	Approaching 3, severe attack.
3	Severe attack	Marked softening and weakening of the wood typical of fungal decay; distinctly more than 3 cm ³ affected and to a depth of 3 or 5 mm or 5 to 10 mm over a few cm ² .
3+	Severe attack+	Approaching 4, failure
4	Failure	Very severe and extensive rot, joint member(s) often capable of being easily broken.

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Details on retention and inspection data

Thermally modified Beech (EMC_{65%}: 5.4%) no oil.

Exposure site UNIMAS in Borneo, Malaysia.

Lap-joint no.	Oil Retention (kg/m ³)	Decay ratings for external upper side surface (UD)					Decay ratings for external lower side surface (LD)					Decay ratings for joint surface (JD)					
		Exposure period. Years					Exposure period. Years					Exposure period. Years					
		1 st year	2 nd year	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year	
DTI 11336-37	-	0	-	0	1	1	0	-	0	1	1	0	-	0	0	0	0
DTI 11338-39	-	0	-	0	1	1	0	-	0	1	1	0	-	0	1	1	0
DTI 11340-41	-	0	-	0	2	2	0	-	0	1	2	0	-	0	0	0	0
DTI 11342-43	-	0	-	0	1	1	0	-	0	1	1	0	-	0	0	0	0
DTI 11344-45	-	0	-	0	1	1	0	-	0	1	1	0	-	0	0	0	0
DTI 11346-47	-	0	-	0	1	1	0	-	0	1	1	0	-	0	1	1	0
DTI 11348-49	-	0	-	0	1	1	0	-	0	1	1	0	-	0	0	0	0
DTI 11350-51	-	0	-	0	1	1	0	-	0	1	1	0	-	0	0	0	0
DTI 11352-53	-	0	-	0	1	1	0	-	0	1	1	0	-	0	1	1	0
DTI 11354-55	-	0	-	0	1	1	0	-	0	1	1	0	-	0	0	0	0
*Median	-	0	-	0	1	1	0	-	0	1	1	0	-	0	0	0	0
Max	-	0	-	0	2	2	0	-	0	1	2	0	-	0	1	1	1
Min	-	0	-	0	1	1	0	-	0	1	1	0	-	0	0	0	0
Std dev	-	0	-	0	0.32	0.32	0	-	0	0	0.32	0	-	0	0.48	0.48	0.48

* Median for the decay rating and mean for the retention of oil.

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Details on retention and inspection data

Lap-joint no.	Oil Retention (kg/m ³)	Decay ratings for external upper side surface (UD)		Decay ratings for external lower side surface (LD)		Decay ratings for joint surface (JD)	
		6 th year	Exposure period. Years	6 th year	Exposure period. Years	6 th year	Exposure period. Years
DTI 11336-37	-	1		1		0	
DTI 11338-39	-	1		2		1	
DTI 11340-41	-	2		2		0	
DTI 11342-43	-	1		1		0	
DTI 11344-45	-	1		1		0	
DTI 11346-47	-	1		1		1	
DTI 11348-49	-	1		1		0	
DTI 11350-51	-	1		1		0	
DTI 11352-53	-	1		1		1	
DTI 11354-55	-	1		1		0	
*Median	-	1		1		0	
Max	-	2		2		1	
Min	-	1		1		0	
Std dev	-	0.32		0.42		0.48	

* Median for the decay rating and mean for the retention of oil.

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Details on retention and inspection data

Thermally modified Beech (EMC_{65%}: 5.4%) clear oil, Retention: 122 kg/m³.

Exposure site UNIMAS in Borneo, Malaysia.

Lap-joint no.	Oil Retention (kg/ m ³)	Decay ratings for external upper side surface (UD)					Decay ratings for external lower side surface (LD)					Decay ratings for joint surface (JD)				
		Exposure period. Years					Exposure period. Years					Exposure period. Years				
		1 st year	2 nd year	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year
DTI 11356-57	140	0	-	0	0	0	0	-	0	0	0	0	-	0	0	0
DTI 11358-59	92	0	-	0	0	0	0	-	0	1	0	0	-	0	0	0
DTI 11360-61	143	0	-	0	1	1	0	-	0	0	0	0	-	0	0	0
DTI 11362-63	117	0	-	0	0	0	0	-	0	0	0	0	-	0	0	0
DTI 11364-65	125	0	-	0	1	1	0	-	0	0	0	0	-	0	0	0
DTI 11366-67	89	0	-	0	1	1	0	-	0	1	1	0	-	0	0	0
DTI 11368-69	106	0	-	0	0	0	0	-	0	1	1	0	-	0	0	0
DTI 11370-71	134	0	-	0	1	1	0	-	0	0	0	0	-	0	0	0
DTI 11372-73	144	0	-	0	0	0	0	-	0	0	0	0	-	0	0	0
DTI 11374-75	129	0	-	0	0	0	0	-	0	1	1	0	-	0	0	0
*Median	122	0	-	0	0	0	0	-	0	0	0	0	-	0	0	0
Max	147	0	-	0	1	1	0	-	0	1	1	0	-	0	0	0
Min	85	0	-	0	0	0	0	-	0	0	0	0	-	0	0	0
Std dev	20.1	0	-	0	0.52	0.52	0	-	0	0.52	0.52	0	-	0	0	0

* Median for the decay rating and mean for the retention of oil.

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Details on retention and inspection data

Lap-joint no.	Oil Retention (kg/m ³)	Decay ratings for external upper side surface (UD)		Decay ratings for external lower side surface (LD)		Decay ratings for joint surface (JD)	
		6 th year	Exposure period. Years	6 th year	Exposure period. Years	6 th year	Exposure period. Years
DTI 11356-57	140	0		0		0	
DTI 11358-59	92	0		1		0	
DTI 11360-61	143	1		0		0	
DTI 11362-63	117	0		0		0	
DTI 11364-65	125	1		0		0	
DTI 11366-67	89	1		1		0	
DTI 11368-69	106	0		1		0	
DTI 11370-71	134	1		0		0	
DTI 11372-73	144	1		0		0	
DTI 11374-75	129	0		1		0	
*Median	122	0.5		0		0	
Max	147	1		1		0	
Min	85	0		0		0	
Std dev	20.1	0.53		0.52		0	

* Median for the decay rating and mean for the retention of oil.

Details on retention and inspection data

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Thermally modified Beech (EMC_{65%}: 5.4%) dark oil, Retention: 84 kg/m³.

Exposure site UNIMAS in Borneo, Malaysia.

Lap-joint no.	Oil Retention (kg/m ³)	Decay ratings for external upper side surface (UD)					Decay ratings for external lower side surface (LD)					Decay ratings for joint surface (JD)				
		Exposure period. Years					Exposure period. Years					Exposure period. Years				
		1 st year	2 nd year	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year
DTI 11376-77	89	0	-	0	1	1	0	-	0	0	0	0	-	0	0	0
DTI 11378-79	82	0	-	0	1	1	0	-	0	0	0	0	-	0	0	0
DTI 11380-81	97	0	-	0	0	1	0	-	0	0	0	0	-	0	0	0
DTI 11382-83	95	0	-	0	1	1	0	-	0	0	0	0	-	0	0	0
DTI 11384-85	109	0	-	0	0	1	0	-	0	0	0	0	-	0	0	0
DTI 11386-87	66	0	-	0	1	1	0	-	0	0	0	0	-	0	0	0
DTI 11388-89	81	0	-	0	1	1	0	-	0	0	0	0	-	0	0	0
DTI 11390-91	53	0	-	0	1	1	0	-	0	0	0	0	-	0	0	0
DTI 11392-93	100	0	-	0	0	0	0	-	0	0	0	0	-	0	0	0
DTI 11394-95	69	0	-	0	1	2	0	-	0	0	0	0	-	0	0	0
*Median	84	0	-	0	1	1	0	-	0	0	0	0	-	0	0	0
Max	111	0	-	0	1	2	0	-	0	0	0	0	-	0	0	0
Min	52	0	-	0	0	0	0	-	0	0	0	0	-	0	0	0
Std dev	19	0	-	0	0.48	0.47	0	-	0	0	0	0	-	0	0	0

* Median for the decay rating and mean for the retention of oil.

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Details on retention and inspection data

Lap-joint no.	Oil Retention (kg/m ³)	Decay ratings for external upper side surface (UD)		Decay ratings for external lower side surface (LD)		Decay ratings for joint surface (JD)	
		6 th year	Exposure period. Years	6 th year	Exposure period. Years	6 th year	Exposure period. Years
DTI 11376-77	89	1		0		0	
DTI 11378-79	82	2		0		0	
DTI 11380-81	97	1		0		0	
DTI 11382-83	95	1		0		0	
DTI 11384-85	109	1		0		0	
DTI 11386-87	66	1		0		0	
DTI 11388-89	81	1		0		0	
DTI 11390-91	53	1		0		0	
DTI 11392-93	100	0		0		0	
DTI 11394-95	69	2		0		0	
*Median	84	1		0		0	
Max	111	2		0		0	
Min	52	0		0		0	
Std dev	19	0.57		0		0	

* Median for the decay rating and mean for the retention of oil.

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Details on retention and inspection data

Thermally modified Pine sapwood (EMC_{65%}: 5.8%) no oil.

Exposure site UNIMAS in Borneo, Malaysia.

Lap-joint no.	Oil Retention (kg/m ³)	Decay ratings for external upper side surface (UD)					Decay ratings for external lower side surface (LD)					Decay ratings for joint surface (JD)				
		Exposure period. Years					Exposure period. Years					Exposure period. Years				
		1 st year	2 nd year	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year
DTI 11396-97	-	0	-	0	2+	2+	0	-	0	2	2+	0	-	0	1	2
DTI 11398-99	-	0	-	0	2	2	0	-	0	1	1	0	-	0	1	1
DTI 11400-01	-	0	-	0	2+	2+	0	-	0	1	2+	0	-	0	1	2
DTI 11402-03	-	0	-	0	2+	2+	0	-	0	1	2	0	-	0	1	1
DTI 11404-05	-	0	-	0	2	2	0	-	0	1	1	0	-	0	1	1
DTI 11406-07	-	0	-	0	2	2+	0	-	0	1	2	0	-	0	0	1
DTI 11408-09	-	0	-	0	2	2+	0	-	0	1	2	0	-	0	1	1
DTI 11410-11	-	0	-	0	2	2+	0	-	0	1	2+	0	-	0	1	1
DTI 11412-13	-	0	-	0	2+	2+	0	-	0	1	1	0	-	0	1	1
DTI 11414-15	-	1	-	1	2	2	1	-	1	1	2	0	-	1	1	1
*Median		0	-	0	2	2.5	0	-	0	1	2	0	-	0	1	1
Max		1	-	1	2.5	2.5	1	-	1	2	2.5	0	-	1	1	2
Min		0	-	0	2	2	0	-	0	1	2	0	-	0	0	1
Std dev		0.32	-	0.32	0.26	0.24	0.32	-	0.32	0.32	0.24	0	-	0.32	0.32	0.42

* Median for the decay rating and mean for the retention of oil.

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Lap-joint no.	Oil Retention (kg/m ³)	Decay ratings for external upper side surface (UD)		Decay ratings for external lower side surface (LD)		Decay ratings for joint surface (JD)	
		6 th year	Exposure period. Years	6 th year	Exposure period. Years	6 th year	Exposure period. Years
DTI 11396-97	-	4		4		4	
DTI 11398-99	-	2		2		1	
DTI 11400-01	-	2+		2+		2	
DTI 11402-03	-	2+		2		2	
DTI 11404-05	-	2+		2		2	
DTI 11406-07	-	3		2		1	
DTI 11408-09	-	2+		2		1	
DTI 11410-11	-	2+		2+		1	
DTI 11412-13	-	2+		1		1	
DTI 11414-15	-	2		2		1	
*Median		2.5		2		1	
Max		4		4		4	
Min		2		1		1	
Std dev		0.57		0.75		0.97	

* Median for the decay rating and mean for the retention of oil.

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Details on retention and inspection data

Thermally modified Pine sapwood (EMC_{65%}: 5.8%) clear oil, Retention: 89 kg/m³.

Exposure site UNIMAS in Borneo, Malaysia.

Lap-joint no.	Oil Retention (kg/m ³)	Decay ratings for external upper side surface (UD)					Decay ratings for external lower side surface (LD)					Decay ratings for joint surface (JD)				
		1 st year	2 nd year	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year
DTI 11416-17	88	1	-	1	2	2	1	-	1	1	1	0	-	0	0	0
DTI 11418-19	71	0	-	1	2	2	0	-	1	1	0	-	0	0	0	0
DTI 11420-21	66	0	-	0	2	2	0	-	1	1	0	-	0	0	1	1
DTI 11422-23	109	1	-	1	2	2	1	-	1	1	0	-	0	0	0	0
DTI 11424-25	113	0	-	0	2	2	0	-	0	1	0	-	0	0	0	0
DTI 11426-27	85	1	-	1	2	2	0	-	1	2	0	-	0	0	0	0
DTI 11428-29	85	0	-	0	2	2	0	-	0	1	0	-	0	0	0	0
DTI 11430-31	109	1	-	1	2	2	1	-	1	1	0	-	0	0	0	0
DTI 11432-33	69	0	-	1	2	2	0	-	0	1	0	-	0	0	0	0
DTI 11434-35	92	1	-	1	2	2	1	-	1	1	0	-	0	0	1	1
*Median	89	0.5	-	1	2	2	0	-	1	1	0	-	0	0	0	0
Max	140	1	-	1	2	2	1	-	1	2	0	-	0	1	1	1
Min	64	0	-	0	2	2	0	-	0	1	0	-	0	0	0	0
Std dev	21	0.53	-	0.48	0	0	0.52	-	0.42	0.32	0	-	0	0.42	0.42	0.42

* Median for the decay rating and mean for the retention of oil.

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Lap-joint no.	Oil Retention (kg/m ³)	Decay ratings for external upper side surface (UD)		Decay ratings for external lower side surface (LD)		Decay ratings for joint surface (JD)	
		6 th year	Exposure period. Years	6 th year	Exposure period. Years	6 th year	Exposure period. Years
DTI 11416-17	88	2		1		0	
DTI 11418-19	71	2		1		0	
DTI 11420-21	66	2		1		1	
DTI 11422-23	109	2		1		0	
DTI 11424-25	113	2		1		0	
DTI 11426-27	85	2		2		0	
DTI 11428-29	85	2		1		0	
DTI 11430-31	109	2		1		0	
DTI 11432-33	69	2		1		0	
DTI 11434-35	92	2		1		1	
*Median	89	2		1		0	
Max	140	2		2		1	
Min	64	2		1		0	
Std dev	21	0		0.32		0.42	

* Median for the decay rating and mean for the retention of oil.

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Details on retention and inspection data

Thermally modified Pine sapwood (EMC_{65%}: 5.8%) dark oil, Retention: 56 kg/m³.

Exposure site UNIMAS in Borneo, Malaysia.

Lap-joint no.	Oil Retention (kg/m ³)	Decay ratings for external upper side surface (UD)					Decay ratings for external lower side surface (LD)					Decay ratings for joint surface (JD)				
		1 st year	2 nd year	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year
DTI 11436-37	73	0	-	0	1	1	0	-	0	0	0	0	-	0	0	0
DTI 11438-39	70	0	-	0	1	2	0	-	0	0	0	0	-	0	0	0
DTI 11440-41	49	0	-	0	1	1	0	-	0	0	0	0	-	0	0	0
DTI 11442-43	56	0	-	0	1	1	0	-	0	0	0	0	-	0	0	0
DTI 11444-45	51	0	-	0	1	1	0	-	0	0	0	0	-	0	0	0
DTI 11446-47	43	0	-	0	2	2	0	-	0	0	0	0	-	0	0	0
DTI 11448-49	51	0	-	0	2	2	0	-	0	0	0	0	-	0	0	0
DTI 11450-51	55	0	-	0	1	1	0	-	0	0	0	0	-	1	1	1
DTI 11452-53	54	0	-	0	2	2	0	-	0	0	0	0	-	0	0	0
DTI 11454-55	59	0	-	0	1	1	0	-	0	0	0	0	-	0	0	0
*Median	56	0	-	0	1	1	0	-	0	0	0	0	-	0	0	0
Max	83	0	-	0	2	2	0	-	0	1	0	0	-	1	1	1
Min	37	0	-	0	1	1	0	-	0	0	0	0	-	0	0	0
Std dev	12	0	-	0	0.48	0.52	0	-	0	0	0	0	-	0.32	0.32	0.32

* Median for the decay rating and mean for the retention of oil.

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Details on retention and inspection data

Lap-joint no.	Oil Retention (kg/m ³)	Decay ratings for external upper side surface (UD)		Decay ratings for external lower side surface (LD)		Decay ratings for joint surface (JD)	
		6 th year	Exposure period. Years	6 th year	Exposure period. Years	6 th year	Exposure period. Years
DTI 11436-37	73	1		0		0	
DTI 11438-39	70	2		1		0	
DTI 11440-41	49	1		0		0	
DTI 11442-43	56	1		0		0	
DTI 11444-45	51	1		1		0	
DTI 11446-47	43	2		0		0	
DTI 11448-49	51	2		0		0	
DTI 11450-51	55	1		0		1	
DTI 11452-53	54	2		0		0	
DTI 11454-55	59	1		0		0	
*Median	56	1		0		0	
Max	83	2		1		1	
Min	37	1		0		0	
Std dev	12	0.52		0.42		0.32	

* Median for the decay rating and mean for the retention of oil.

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Details on retention and inspection data

Thermally modified Spruce (EMC_{65%}: 5.8%) no oil.

Exposure site UNIMAS in Borneo, Malaysia.

Lap-joint no.	Oil Retention (kg/m ³)	Decay ratings for external upper side surface (UD)					Decay ratings for external lower side surface (LD)					Decay ratings for joint surface (JD)				
		Exposure period. Years					Exposure period. Years					Exposure period. Years				
		1 st year	2 nd year	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year
DTI 11456-57	-	0	-	1	2	2	1	-	1	1	1	0	-	0	1	1
DTI 11458-59	-	0	-	0	2	2	1	-	1	1	1	0	-	0	1	1
DTI 11460-61	-	0	-	1	2	2+	0	-	0	1	1	0	-	1	1	1
DTI 11462-63	-	0	-	0	1	2	1	-	1	1	1	0	-	0	1	1
DTI 11464-65	-	0	-	0	2	2	0	-	0	1	1	0	-	0	1	1
DTI 11466-67	-	1	-	1	2	2	0	-	1	1	1	0	-	0	1	1
DTI 11468-69	-	0	-	0	2	2	0	-	0	1	1	0	-	0	0	0
DTI 11470-71	-	0	-	0	2	2	0	-	0	0	0	0	-	0	1	1
DTI 11472-73	-	0	-	0	2+	2+	0	-	1	2	2	0	-	0	2	2+
DTI 11474-75	-	0	-	0	2	2	0	-	0	1	1	0	-	0	1	1
*Median	-	0	-	0	2	2	0	-	0.5	1	1	0	-	0	1	1
Max	-	1	-	1	2.5	2.5	1	-	1	2	2	0	-	1	2	2.5
Min	-	0	-	0	1	2	0	-	0	0	0	0	-	0	0	0
Std dev	-	0.32	-	0.48	0.37	0.21	0.48	-	0.53	0.47	0.47	0	-	0.32	0.47	0.60

* Median for the decay rating and mean for the retention of oil.

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Details on retention and inspection data

Lap-joint no.	Oil Retention (kg/m ³)	Decay ratings for external upper side surface (UD)		Decay ratings for external lower side surface (LD)		Decay ratings for joint surface (JD)	
		6 th year	Exposure period. Years	6 th year	Exposure period. Years	6 th year	Exposure period. Years
DTI 11456-57	-	2		1		1	
DTI 11458-59	-	2		1		2	
DTI 11460-61	-	2+		1		2	
DTI 11462-63	-	2		1		1	
DTI 11464-65	-	2		1		1	
DTI 11466-67	-	2		1		1	
DTI 11468-69	-	2		1		0	
DTI 11470-71	-	2		0		1	
DTI 11472-73	-	2+		2		2+	
DTI 11474-75	-	2		1		1	
*Median	-	2		1		1	
Max	-	2.5		2		2.5	
Min	-	2		0		0	
Std dev	-	0.21		0.47		0.72	

* Median for the decay rating and mean for the retention of oil.

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Details on retention and inspection data

Thermally modified Spruce (EMC_{6.5%}: 5.8%) clear oil, Retention: 17 kg/m³.

Exposure site UNIMAS in Borneo, Malaysia.

Lap-joint no.	Retention (kg/m ³)	Decay ratings for external upper side surface (UD)					Decay ratings for external lower side surface (LD)					Decay ratings for joint surface (JD)				
		Exposure period. Years					Exposure period. Years					Exposure period. Years				
		1 st year	2 nd year	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year
DTI 11476-77	20	0	-	0	1	1	0	-	0	1	1	0	-	0	0	0
DTI 11478-79	20	1	-	1	1	1	0	-	0	1	1	0	-	0	0	0
DTI 11480-81	15	0	-	0	1	1	0	-	0	0	0	0	-	0	0	0
DTI 11482-83	19	0	-	0	1	1	0	-	0	0	0	0	-	0	0	1
DTI 11484-85	13	0	-	0	1	1	0	-	0	1	1	0	-	0	0	0
DTI 11486-87	15	1	-	1	1	1	0	-	0	1	1	0	-	0	0	0
DTI 11488-89	19	0	-	0	2+	2+	0	-	0	1	1	0	-	0	0	1
DTI 11490-91	16	0	-	0	1	1	0	-	0	1	1	0	-	0	0	0
DTI 11492-93	19	0	-	0	2	2	0	-	0	1	1	0	-	1	1	1
DTI 11494-95	19	0	-	0	1	1	0	-	0	0	0	0	-	0	0	0
*Median	17	0	-	0	1	1	0	-	0	1	1	0	-	0	0	0
Max	23	1	-	1	2.5	2.5	0	-	0	1	2	0	-	1	1	1
Min	13	0	-	0	1	1	0	-	0	0	0	0	-	0	0	0
Std dev	3	0.42	-	0.42	0.54	0.54	0	-	0	0.48	0.57	0	-	0.32	0.32	0.48

* Median for the decay rating and mean for the retention of oil.

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Details on retention and inspection data

Lap-joint no.	Retention (kg/m ³)	Decay ratings for external upper side surface (UD) Exposure period. Years		Decay ratings for external lower side surface (LD) Exposure period. Years		Decay ratings for joint surface (JD) Exposure period. Years	
		6 th year		6 th year		6 th year	
DTI 11476-77	20	1		1		0	
DTI 11478-79	20	1		1		0	
DTI 11480-81	15	1		1		0	
DTI 11482-83	19	1		1		1	
DTI 11484-85	13	1		1		0	
DTI 11486-87	15	1		1		0	
DTI 11488-89	19	2+		1		1	
DTI 11490-91	16	1		1		0	
DTI 11492-93	19	2		2		1	
DTI 11494-95	19	1		0		0	
*Median	17	1		1		0	
Max	23	2.5		2		1	
Min	13	1		0		0	
Std dev	3	0.54		0.47		0.48	

* Median for the decay rating and mean for the retention of oil.

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Details on retention and inspection data

Thermally modified Spruce (EMC_{6.5%}: 5.8%) dark oil, Retention: 18 kg/m³.

Exposure site UNIMAS in Borneo, Malaysia.

Lap-joint no.	Oil Retention (kg/m ³)	Decay ratings for external upper side surface (UD)					Decay ratings for external lower side surface (LD)					Decay ratings for joint surface (JD)				
		Exposure period. Years					Exposure period. Years					Exposure period. Years				
		1 st year	2 nd year	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year
DTI 11496-97	19	0	-	0	1	1	0	-	0	0	0	0	-	0	0	0
DTI 11498-99	17	0	-	0	1	1	0	-	0	0	0	0	-	0	0	0
DTI 11500-01	19	0	-	0	1	1	0	-	0	0	0	0	-	0	0	0
DTI 11502-03	18	0	-	0	1	1	0	-	0	0	0	0	-	0	1	1
DTI 11504-05	18	0	-	0	1	1	0	-	0	0	0	0	-	0	0	1
DTI 11506-07	21	0	-	0	1	1	0	-	0	0	1	0	-	0	0	1
DTI 11508-09	18	0	-	0	1	1	0	-	0	0	0	0	-	0	0	0
DTI 11510-11	13	0	-	0	1	1	0	-	0	0	0	0	-	0	0	0
DTI 11512-13	19	0	-	0	1	1	0	-	0	0	0	0	-	0	0	0
DTI 11514-15	18	0	-	0	1	1	0	-	0	0	0	0	-	0	0	0
*Median	18	0	-	0	1	1	0	-	0	0	0	0	-	0	0	0
Max	23	0	-	0	1	1	0	-	0	0	1	0	-	0	1	1
Min	10	0	-	0	1	1	0	-	0	0	0	0	-	0	0	0
Std dev	3	0	-	0	0	0	0	-	0	0	0.32	0	-	0	0.32	0.48

* Median for the decay rating and mean for the retention of oil.

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Details on retention and inspection data

Lap-joint no.	Oil Retention (kg/m ³)	Decay ratings for external upper side surface (UD)		Decay ratings for external lower side surface (LD)		Decay ratings for joint surface (JD)	
		6 th year	Exposure period. Years	6 th year	Exposure period. Years	6 th year	Exposure period. Years
DTI 11496-97	19	1		0		0	
DTI 11498-99	17	1		0		0	
DTI 11500-01	19	1		0		0	
DTI 11502-03	18	1		0		1	
DTI 11504-05	18	1		0		1	
DTI 11506-07	21	1		1		1	
DTI 11508-09	18	1		0		0	
DTI 11510-11	13	1		0		0	
DTI 11512-13	19	1		0		0	
DTI 11514-15	18	1		0		0	
*Median	18	1		0		0	
Max	23	1		1		1	
Min	10	1		0		0	
Std dev	3	0		0.32		0.48	

* Median for the decay rating and mean for the retention of oil.

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Details on retention and inspection data

Control, untreated Scots pine sapwood.

Exposure site UNIMAS in Borneo, Malaysia.

Lap-joint no.	Oil Retention (kg/m ³)	Decay ratings for external upper side surface (UD)					Decay ratings for external lower side surface (LD)					Decay ratings for joint surface (JD)				
		Exposure period. Years					Exposure period. Years					Exposure period. Years				
		1 st year	2 nd year	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year
DTI 11516-17	-	3	-	3+	3+	4	3	-	3+	3+	4	3	-	3+	3+	4
DTI 11518-19	-	2	-	3	3	4	3	-	3	3	4	2	-	3	3	4
DTI 11520-21	-	2	-	3	3	4	3	-	3	3	4	3	-	3	3	4
DTI 11522-23	-	3	-	3+	3+	4	3	-	3+	3+	4	3	-	3+	3+	4
DTI 11524-25	-	3	-	3+	4	4	2	-	4	4	4	2	-	4	4	4
DTI 11526-27	-	2	-	2	2+	4	2	-	2	2+	4	2	-	2+	2+	4
DTI 11528-29	-	2	-	3	3+	4	3	-	3+	3+	4	2	-	3+	3+	4
DTI 11530-31	-	2	-	2	2+	3	3	-	3	3	3+	2	-	3	3	3
DTI 11532-33	-	2	-	3	3	4	2	-	3	3	4	2	-	2+	3	4
DTI 11534-35	-	1	-	2+	3	4	1	-	3	3	4	1	-	2+	3	4
*Median	-	2	-	3	3	4	3	-	3	3	4	2	-	3	3	4
Max	-	3	-	4	4	4	3	-	4	4	4	3	-	4	4	4
Min	-	1	-	2	2.5	3	1	-	2	2.5	3.5	1	-	2.5	2.5	3
Std dev	-	0.63	-	0.64	0.47	0.32	0.71	-	0.53	0.42	0.16	0.63	-	0.52	0.42	0.32

* Median for the decay rating and mean for the retention of oil.

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Details on retention and inspection data

Lap-joint no.	Oil Retention (kg/m ³)	Decay ratings for external upper side surface (UD)		Decay ratings for external lower side surface (LD)		Decay ratings for joint surface (JD)	
		6 th year	Exposure period. Years	6 th year	Exposure period. Years	6 th year	Exposure period. Years
DTI 11516-17	-	4		4		4	
DTI 11518-19	-	4		4		4	
DTI 11520-21	-	4		4		4	
DTI 11522-23	-	4		4		4	
DTI 11524-25	-	4		4		4	
DTI 11526-27	-	4		4		4	
DTI 11528-29	-	4		4		4	
DTI 11530-31	-	3		3+		3	
DTI 11532-33	-	4		4		4	
DTI 11534-35	-	4		4		4	
*Median	-	4		4		4	
Max	-	4		4		4	
Min	-	3		3.5		3	
Std dev	-	0.32		0.16		0.32	

* Median for the decay rating and mean for the retention of oil.

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Details on retention and inspection data

Control, untreated Beech.

Exposure site UNIMAS in Borneo, Malaysia.

Lap-joint no.	Oil Retention (kg/m ³)	Decay ratings for external upper side surface (UD)					Decay ratings for external lower side surface (LD)					Decay ratings for joint surface (JD)				
		Exposure period. Years					Exposure period. Years					Exposure period. Years				
		1 st year	2 nd year	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year
DTI 11536-37	-	1	-	3	4	4	1	-	4	4	4	1	-	3	4	4
DTI 11538-39	-	1	-	2	3	4	2	-	2	4	4	1	-	3	3	4
DTI 11540-41	-	3	-	3	3	4	2	-	3	4	4	2	-	2	3	4
DTI 11542-43	-	3	-	4	4	4	3	-	4	4	4	2	-	4	4	4
DTI 11544-45	-	3	-	3	4	4	3	-	4	4	4	2	-	2+	4	4
DTI 11546-47	-	2	-	2	3	4	2	-	2	4	4	2	-	2	2	4
DTI 11548-49	-	3	-	3	3	4	1	-	3+	4	4	2	-	3	3	4
DTI 11550-51	-	3	-	3	4	4	2	-	4	4	4	2	-	3	4	4
DTI 11552-53	-	3	-	3	4	4	3	-	4	4	4	2	-	3	4	4
DTI 11554-55	-	3	-	3+	4	4	2	-	4	4	4	2	-	3	4	4
*Median	-	3	-	3	4	4	2	-	4	4	4	2	-	3	4	4
Max	-	3	-	4	4	4	3	-	4	4	4	2	-	4	4	4
Min	-	1	-	2	3	4	1	-	2	2	4	1	-	2	2	4
Std dev	-	0.85	-	0.60	0.60	0	0.74	-	0.83	0.80	0	0.42	-	0.60	0.60	0

* Median for the decay rating and mean for the retention of oil.

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Details on retention and inspection data

Reference, CCA treated Scots pine sapwood, Retention: 630 kg/m³.

Exposure site UNIMAS in Borneo, Malaysia.

Lap-joint no.	CCA Retention (kg/m ³)	Decay ratings for external upper side surface (UD)					Decay ratings for external lower side surface (LD)					Decay ratings for joint surface (JD)				
		Exposure period. Years					Exposure period. Years					Exposure period. Years				
		1 st year	2 nd year	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year
DTI 11556-57	577	0	-	0	0	0	0	-	0	0	0	0	-	0	0	0
DTI 11558-59	628	0	-	0	0	0	0	-	0	0	0	0	-	0	0	0
DTI 11560-61	612	0	-	0	1	1	0	-	0	0	0	0	-	0	0	0
DTI 11562-63	642	0	-	0	0	0	0	-	0	0	0	0	-	0	0	0
DTI 11564-65	633	0	-	0	0	0	0	-	0	0	0	0	-	0	0	0
DTI 11566-67	658	0	-	0	0	0	0	-	0	0	0	0	-	0	0	0
DTI 11568-69	647	0	-	0	0	0	0	-	0	0	0	0	-	0	1	1
DTI 11570-71	625	0	-	0	0	0	0	-	0	0	0	0	-	0	0	0
DTI 11572-73	620	0	-	0	0	0	0	-	0	0	0	0	-	0	0	0
DTI 11574-75	656	0	-	0	0	0	0	-	0	0	0	0	-	0	0	0
*Median	630	0	-	0	0	0	0	-	0	0	0	0	-	0	0	0
Max	661	0	-	0	1	1	0	-	0	0	0	0	-	0	1	1
Min	576	0	-	0	0	0	0	-	0	0	0	0	-	0	0	0
Std dev	24	0	-	0	0.32	0.32	0	-	0	0	0	0	-	0	0.32	0.32

* Median for the decay rating and mean for the retention of preservative.

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Details on retention and inspection data

Lap-joint no.	CCA Retention (kg/m ³)	Decay ratings for external upper side surface (UD)		Decay ratings for external lower side surface (LD)		Decay ratings for joint surface (JD)	
		6 th year	Exposure period. Years	6 th year	Exposure period. Years	6 th year	Exposure period. Years
DTI 11556-57	577	0		0		0	
DTI 11558-59	628	0		0		0	
DTI 11560-61	612	1		0		0	
DTI 11562-63	642	0		0		0	
DTI 11564-65	633	0		0		0	
DTI 11566-67	658	0		0		0	
DTI 11568-69	647	0		0		1	
DTI 11570-71	625	0		0		0	
DTI 11572-73	620	0		0		0	
DTI 11574-75	656	0		0		0	
*Median	630	0		0		0	
Max	661	1		0		1	
Min	576	0		0		0	
Std dev	24	0.32		0		0.32	

* Median for the decay rating and mean for the retention of preservative.