ALBERT-LUDWIG-
UNIVERSITY
FREIBURG

Test protocol

ENV 807 (CEN/TS 15083-2)

Hard- and softwoods

Ohnesorge, D.[1]; Tausch, A.[2]; Krowas, I.[1]; Becker, B.[1], Fink, F.[2]
[1] Institute for Forest Utilization and Work Science
[2] Chair of Forest Botany

Contact:
University Freiburg,
Institute for Forest Utilization and Work Science,
Werthmannstr. 6, 79085 Freiburg
Phone: 0761/ 2033764
Fax: 0761/ 2033763
info@fobawi.uni-freiburg.de

Testing institute	Albert-Ludwig-University Freiburg, Institute for Forest Utilization and Work Science and Institute for Forest Botany and Tree Physiology, Chair of Forest Botany
Cooperation partner	Ets. Röthlisberger SA, Rue de la Gare 28 CH-2855 Glovelier, Schwitzerland; WTT A/S, Jyllandsvej 9, DK 7330 Brande, Denmark

Preliminary note

This report documents the results of an investigation into the resistance of hygrothermally modified wood to wood-decaying soft-rotting fungi. It was carried out as part of the research project Thermo-wood modified by the WTT process. The study was conducted in accordance with the EN 807 German standard. The analysis of the results and the preliminary classification of the wood samples into natural durability classes were undertaken in keeping with the CEN/TS 15083-2 standard. The validity of CEN/TS 15083-2 expired in June 2008. As yet it (CEN/TS) has not been converted to European standards. The classification of the natural durability of the wood samples was undertaken in laboratory trials, and the results need to be confirmed under field conditions.

Material and Methods

Standards used for testing and classification of the natural durability class:	ENV 807: Wood preservatives – Determination of the effectiveness against soft rotting micro-fungi and other soil inhabiting micro-organisms; German version ENV 807:2001 CEN/TS 15083-2: Determination of the natural durability of solid wood against wood destroying fungi, test – Methods – Part 2: Soft rotting micro fungi; German version CEN/TS 15083-2:2005 CEN/TS 15679: Thermal Modified Timber – Definitions and characteristics; German version CEN/TS 15679:2007
Species and stem zones in accordance with EN 350-1:	European beech (*Fagus sylvatica*): heart- and sapwood; European ash (*Fraxinus excelsior*): heart-, transition- and sapwood; Oak (*Quercus spec.*); heart-, transition wood, Norway spruce (*Picea abies*), Scots pine (*Pinus sylvestris*), White fir (*Abies alba*): heart- and sapwood
Number and origin of the trees:	Bottom stems (each 3, ash 2 stems); Switzerland (canton Jura); amplitude 400-600 NN; kiln dried (60-62°C, one week)
Characterisation of wood:	60 % of the oak boards shown decayed sapwood, beech without red heartwood, ash with little heartwood (olive green)
Tested wood product:	Standard test samples of hygrothermally treated (WTT technique) and untreated control samples of same species
Tested treatment variants:	Kiln dried wood (u= 12 % ± 2) of following variants:

variant	0	untreated controls
variant	160°C	treated with 160°C or 180°C
variant	180°C	

Sampling / weathering:	According to EN 350-1 and EN 84
Sterilisation method:	natural surface soil acc. to ENV807; pH-value: 7,4; water holding capacity: WHC = 30,1 %
Test period:	Between March'08 and January'09
Test duration:	In total 32 weeks with extractions at 8, 16 and 24 weeks
Deviations from the standard:	The required angle of the tree rings to the broad surfaces from 90 ± 15° could be observed only for about 80% of the test specimens. Required number of trees after ENV807 = 3, according to CEN / TS 15083-2 = 5; investigated trees: spruce, pine, fir, beech and oak = 3, ash = 2; in each experimental vessel were added three (untreated , 160 ° C, 180 ° C) instead of 2 specimens as specified in ENV807.
Report prepared by:	Denny Ohnesorge, Inga Krowas
Date:	6. May 2010

ALBERT-LUDWIG-
UNIVERSITY
FREIBURG

Test protocol

ENV 807 (CEN/TS 15083-2)

Hard- and softwoods

Ohnesorge, D.[1]; Tausch, A.[2]; Krowas, I.[1]; Becker, B.[1], Fink, F.[2]
[1] Institute for Forest Utilization and Work Science
[2] Chair of Forest Botany

Contact:
University Freiburg,
Institute for Forest Utilization and Work Science,
Werthmannstr. 6, 79085 Freiburg
Phone: 0761/ 2033764
Fax: 0761/ 2033763
info@fobawi.uni-freiburg.de

Methods

The following table shows the results of the study on resistance of hygrothermally modified wood against soft rotting micro-fungi and other soil inhabiting micro-organisms. Shown is the mean percent weight loss in relation to starting oven-dried weight of the test specimens. If an increase of oven-dried weight have been determined on test specimens at the end of the experiment, these values according to ENV 807 and CEN/TS 15083-2 has received a 0 % weight loss in the analysis. Contrary to the CEN/TS 15083-2 and in accordance with the ENV 807 the weight loss (WL_{uncorr}) was corrected with a correction factor (CF). The correction factor represents a change in weight, which is not related to the fungi attack in soil contact, and was determined in a separate stored control samples. In line with CEN/TS 15679, the validity criterion "wood moisture" generally applied according to ENV 807, was omitted in this study (wood moisture of the specimens from 40 to 150 % – measured immediately after removal from the soil substrate). The presence of soft-rotting fungi decay was microscopically confirmed in selected samples. The following table shows both the uncorrected percentage weight losses according to CEN/TS 15083-2, as well as the corrected weight losses according ENV 807 of all investigated specimens after 32 weeks of incubation include.

species	treatment	stem zone	no	ρ_0	WL_{uncorr}	s	C	WL_{corr}	s
				[kg/m³]	[%]	[%]	[%]	[%]	[%]
European beech	control [a]	heart	9	739	63,4	11,1	0,5	62,9	11,1
		sap	9	684	58,4	10,1	0,2	58,2	10,1
	160°C	heart	9	654	25,9	8,9	4,3	21,6	8,9
		sap	9	647	19,6	7,0	3,7	15,9	7,0
	180°C	heart	9	630	4,4	3,2	1,0	3,3	3,2
		sap	9	620	3,6	0,7	1,7	1,9	0,7
European Ash	control	heart	6	703	26,3	6,5	0,9	25,4	6,5
		transition	6	649	31,2	4,2	1,9	29,3	4,2
		sap	6	630	38,9	4,0	3,0	35,9	4,0
	160°C	heart	6	656	10,0	2,0	3,6	6,4	2,0
		transition	6	578	12,8	1,3	3,5	9,3	1,3
		sap	6	579	15,9	1,9	3,9	12,1	1,9
	180°C	heart	5	600	4,3	0,5	2,1	2,2	0,5
		transition	6	556	3,2	0,5	1,6	1,6	0,5
		sap	7	563	3,1	0,6	1,6	1,5	0,6
Oak	control	heart	9	608	24,7	6,8	3,0	21,8	6,8
		transition	9	548	26,1	3,7	4,5	21,6	3,7
	160°C	heart	9	628	9,7	2,8	4,4	5,3	2,8
		transition	9	488	7,6	2,5	4,0	3,7	2,5
	180°C	heart	3	550	4,2	1,1	3,2	1,0	1,1
		transition	3	521	2,9	0,8	1,4	1,5	0,8

[a] reference species; no. number of samples; ρ_0 = oven-dried density; DC = Code durability class: 1 = very durable, 2 = durable, 3 = less durable, 4 = little durable, 5 = not durable $WL_{uncorr.}$ / $WL_{corr.}$ = weight loss corrected and uncorrected; C = correction factor; s = standard deviation

Ohnesorge, D.[1]; Tausch, A.[2]; Krowas, I.[1]; Becker, B.[1], Fink, F.[2]
[1] Institute for Forest Utilization and Work Science
[2] Chair of Forest Botany

Contact:
University Freiburg,
Institute for Forest Utilization and Work Science,
Werthmannstr. 6, 79085 Freiburg
Phone: 0761/ 2033764
Fax: 0761/ 2033763
info@fobawi.uni-freiburg.de

species	treatment	stem zone	no	ρ_0 [kg/m³]	WL_{uncorr} [%]	s [%]	C [%]	WL_{corr} [%]	s [%]
Scots pine	control	heart	6	518	8,5	1,6	1,2	7,4	1,6
		sap	7	545	13,3	2,5	1,3	12,0	2,5
	160°C	heart	8	481	9,1	4,5	2,7	6,4	4,5
		sap	8	502	9,8	3,2	5,3	4,5	3,2
	180°C	heart	6	447	5,0	1,2	1,6	3,4	1,2
		sap	9	500	5,5	2,1	3,3	2,2	2,1
Norway spruce	control	heart	8	419	13,7	3,6	0,4	13,3	3,6
		sap	9	459	17,2	6,5	0,4	16,8	6,5
	160°C	heart	9	362	9,1	2,1	4,6	4,5	2,1
		sap	9	469	7,6	1,6	5,2	2,4	1,6
	180°C	heart	9	362	4,9	1,4	2,3	2,6	1,3
		sap	9	452	4,0	1,2	1,6	2,4	1,2
White fir	control	heart	9	414	11,2	1,9	1,6	9,6	1,9
		sap	9	417	10,7	1,7	0,5	10,2	1,7
	160°C	heart	8	379	4,5	2,1	2,1	2,6	2,0
		sap	9	400	4,7	1,8	3,6	1,1	1,7
	180°C	heart	7	349	1,2	1,1	1,0	0,6	0,6
		sap	9	388	1,6	1,5	1,4	1,0	1,4

[a] reference species; no. number of samples; ρ_0 = oven-dried density; DC = Code durability class: 1 = very durable, 2 = durable, 3 = less durable, 4 = little durable, 5 = not durable $WL_{uncorr.}$ / $WL_{corr.}$ = weight loss corrected and uncorrected; C = correction factor; s = standard deviation

Classification of natural durability

In the preliminary standard CEN/TS 15083-2 a method of classification of the natural durability of after soil contact trails is introduced. The classification was performed with an x-value, which was derived from ratio of the median percentage weight loss of the wood species tested and the median weight loss of reference wood species. Beech wood served as a reference wood species for hardwoods, and pine sapwood as the control wood species for softwoods. As this is merely a preliminary assessment, the following results are also preliminary.

ALBERT-LUDWIG-
UNIVERSITY
FREIBURG

Test protocol

ENV 807 (CEN/TS 15083-2)

Hard- and softwoods

Ohnesorge, D.[1]; Tausch, A.[2]; Krowas, I.[1]; Becker, B.[1], Fink, F.[2]
[1] Institute for Forest Utilization and Work Science
[2] Chair of Forest Botany

Contact:
University Freiburg,
Institute for Forest Utilization and Work Science,
Werthmannstr. 6, 79085 Freiburg
Phone: 0761/ 2033764
Fax: 0761/ 2033763
info@fobawi.uni-freiburg.de

species	treatment	stem zone	median weight loss [%]	x-value	DHC (CEN/TS 15083-2)	DC class
European beech	control	heart + sap	57,9	1,00	5	not durable
	160°C	heart + sap	16,7	0,29	3	less durable
	180°C	heart + sap	3,1	0,05	1	very durable
European ash	control	heart	19,8	0,34	3	less durable
		transition	28,4	0,49	4	little durable
		sap	30,8	0,53	4	little durable
	160°C	heart	7,5	0,13	2	durable
		transition	12,9	0,22	3	less durable
		sap	12,4	0,21	3	less durable
	180°C	heart	3,4	0,06	1	very durable
		transition	3,2	0,05	1	very durable
		sap	3,3	0,06	1	very durable
Oak	control	heart	19,5	0,34	3	less durable
		transition	19,7	0,34	3	less durable
	160°C	heart	7,3	0,13	2	durable
		transition	7,4	0,13	2	durable
	180°C	heart	3,4	0,06	1	very durable
		transition	3,4	0,06	1	very durable
Scots pine	control	heart	8,9	0,66	4	little durable
		sap [a]	13,4	1,00	5	not durable
	160°C	heart	6,3	0,47	4	little durable
		sap	9,4	0,70	4	little durable
	180°C	heart	4,8	0,36	3	less durable
		sap	5,6	0,42	3	less durable
Norway spruce	control	heart	13,7	1,03	5	not durable
		sap	18,4	1,38	5	not durable
	160°C	heart	8,4	0,63	4	little durable
		sap	7,4	0,55	4	little durable
	180°C	heart	5,5	0,41	3	less durable
		sap	3,9	0,29	3	less durable
White fir	control	heart	11,2	0,84	5	not durable
		sap	10,4	0,78	4	little durable
	160°C	heart	4,6	0,35	3	less durable
		sap	3,6	0,27	3	less durable
	180°C	heart	1,6	0,12	2	durable
		sap	0,9	0,07	1	very durable

[a] reference species; DC = durability code