

THE INTERNATIONAL RESEARCH GROUP ON WOOD PROTECTION

Section 2

Testing Methodology and Assessment

Scots pine

**Natural durable timber – Basidiomycete test results
IRG/WP Durability Database**

Bongers, F.; Van der Zee, M.

Disclaimer

The responsibility for the data presented in this paper falls to the authors exclusively. The data presented are raw test data and intended to get used for scientific purposes only.

**IRG SECRETARIAT
Box 5609
SE-114 86 Stockholm
Sweden
www.irg-wp.org**

AIMS AND SCOPE OF THE IRG-WP DURABILITY DATABASE

The overall aim of the IRG-WP durability data base is the allocation of wood durability test results for comparative studies and re-analyses. The data base shall serve as pool for service life prediction and modelling and shall contribute to an enhanced understanding of wood durability. It is an open web-based platform for scientific exchange in the field of wood durability and wood protection.

It is NOT the aim of the data base to promote or denigrate any product or material. The data base will contain raw data only; no statistical evaluation will be included. Thus it will be the exclusive responsibility of the user to interpret the test results published in the data base.

For each data set, the full range of information about the test method, the test material, and other relevant parameters, is required to guarantee reliability of the data. For this reason every data set submitted is reviewed and checked for completeness of all relevant data.

The database allows submission of assessment data from all kinds of standardized and non-standardized wood durability tests.

Records of the IRG/WP Durability data base shall be cited as in the following example:

Brischke C., Meyer L. (2013) Douglas fir. Natural durable timber - Field test results. IRG/WP Durability Database. Stockholm: The International Research Group on Wood Protection, IRG/WP/DDB 13-00001.

INFORMATION

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AUTHORS

Corresponding author Ferry Bongers
Email ferry.bongers@accsysplc.com
Institution Accsys Technologies
Street/PO Box PO Box 2147
City Arnhem
Zip Code 6802 CC
Country Netherlands

Author 2 Marina Van der Zee
Email m.vanderzee@shr.nl
Institution SHR (Stichting Hout Research)
Street/PO Box PO Box 497
City Wageningen
Zip Code 6700 AL
Country Netherlands

TESTED TIMBER

Trade name Scots pine heartwood
Botanical name *Pinus sylvestris* L.
Origin Germany
Number of replicates 5

REFERENCE TIMBER

Trade name	Scots pine sapwood
Botanical name	<i>Pinus sylvestris</i> L.
Origin	Germany
Number of replicates	Depends on test fungus

TEST METHODS

Standard method	EN 113 (1996)
Alteration of standard	16 weeks exposure
Leaching/Ageing procedure	EN 84 (1997)
Specimen dimension and shape	50 x 25 x 15 mm ³

RESULTS

Assessment

Material	<i>Pinus sylvestris</i> L.					
Test fungus	<i>Coniophora puteana</i>			<i>Gloeophyllum trabeum</i>		
Measure	Relative mass loss	Final moisture content	Oven-dry density	Relative mass loss	Final moisture content	Oven-dry density
Replicate ID	[%]	[%]	[kg/m ³]	[%]	[%]	[kg/m ³]
1	1.8	30.2	574	0.2	27.7	556
2	5.9	32.9	530	0.8	28.3	514
3	4.7	33.3	661	1.7	26.5	690
4	11.2	38.0	582	1.2	31.1	575
5	1.0	29.5	475	0.5	41.4	474

Material	<i>Pinus sylvestris</i> L.					
Test fungus	<i>Postia placenta</i> (<i>Rhodonía placenta</i>)			<i>Serpula lacrymans</i>		
Measure	Relative mass loss	Final moisture content	Oven-dry density	Relative mass loss	Final moisture content	Oven-dry density
Replicate ID	[%]	[%]	[kg/m³]	[%]	[%]	[kg/m³]
1	10.9	38.9	609	1.1	28.9	577
2	11.5	47.4	531	1.8	28.2	532
3	9.3	31.2	648	1.2	27.0	648
4	9.3	49.9	587	1.1	30.2	558
5	13.4	39.6	464	0.4	25.6	470

Material	<i>Pinus sylvestris</i> L.					
Test fungus	<i>Trametes versicolor</i>					
Measure	Relative mass loss	Final moisture content	Oven-dry density			
Replicate ID	[%]	[%]	[kg/m³]			
1	0.5	27.8	623			
2	0.8	34.8	531			
3	5.2	32.2	711			
4	-0.8	27.2	558			
5	0.3	26.6	470			

Assessment - Reference

Material	<i>Pinus sylvestris</i> L. sapwood					
Test fungus	<i>Coniophora puteana</i>			<i>Gloeophyllum trabeum</i>		
Measure	Relative mass loss	Final moisture content	Oven-dry density	Relative mass loss	Final moisture content	Oven-dry density
Replicate ID	[%]	[%]	[kg/m ³]	[%]	[%]	[kg/m ³]
1	33.3	55.8	460	23.9	55.4	476
2	19.6	46.3	452	24.5	49.2	466
3	30.8	54.7	431	27.5	62.3	462
4	20.3	44.4	548	24.7	49.5	554
5	25.5	47.8	576	22.7	45.0	547
6	54.9	82.0	342	35.1	49.6	389
7	44.9	193.0	411	33.7	49.4	398
8	49.2	73.0	416	36.4	55.8	394
9	43.8	71.5	429	38.6	52.7	341
10	43.0	63.1	448	42.6	59.5	331
11	42.1	65.0	390	36.5	51.0	364
12	50.3	74.5	361	36.0	62.0	389
13	40.8	63.4	457	38.3	64.9	371
14	44.6	63.9	453	33.9	54.1	366
15	45.6	66.1	390	42.2	54.5	350
16	45.5	66.9	421	36.1	56.7	351
17	47.1	73.3	333	33.6	61.1	377
18	43.9	64.9	367	35.5	61.5	379
19	44.4	67.5	346	33.9	53.8	401
20	41.1	64.4	396	35.3	55.0	340
21	40.4	65.2	483	41.3	63.9	406
22	39.2	60.5	463	36.4	62.0	360
23	38.6	58.7	414	28.8	48.1	459
24	42.2	62.1	460	27.6	49.7	470
25	48.2	76.4	353	33.4	52.2	445
26	34.2	54.8	365	29.6	51.6	396
27	40.5	58.4	418	34.6	64.8	353
28	44.1	61.5	423	38.3	57.9	390
29	48.7	76.6	337	28.3	50.6	414
30	39.1	59.3	392	38.5	56.3	398
31	35.1	63.4	348	23.3	48.5	488
32	22.4	49.2	425	28.2	46.3	410
33	28.8	54.2	415	31.6	53.5	347
34	37.7	62.8	340	24.8	55.3	392
35	44.0	70.6	332	23.8	48.2	463
36	29.5	50.5	379	25.3	48.6	357

Material	<i>Pinus sylvestris</i> L. sapwood					
Test fungus	<i>Coniophora puteana</i>			<i>Gloeophyllum trabeum</i>		
Measure	Relative mass loss	Final moisture content	Oven-dry density	Relative mass loss	Final moisture content	Oven-dry density
Replicate ID	[%]	[%]	[kg/m ³]	[%]	[%]	[kg/m ³]
37	44.7	73.2	353	39.7	62.3	331
38	36.9	61.7	482	31.6	52.1	409
39	34.4	57.5	412	27.2	49.8	381
40	27.1	50.0	408	27.5	57.4	330
41	40.7	61.0	351	25.7	48.5	368
42	38.1	58.9	410	26.6	52.7	384
43	42.7	69.0	385	27.7	53.5	431
44	44.2	65.6	429	23.5	47.4	449
45	37.0	59.8	466	27.5	51.6	399
46	28.4	51.6	447	20.2	45.2	436
47	23.9	52.0	383	27.4	50.8	427
48	34.3	54.8	458	0.0	0.0	362
49	42.9	63.8	362	0.0	0.0	387
50	46.0	65.6	387	34.6	76.7	360
51	51.4	81.3	396	34.0	54.8	367
52	43.8	75.3	342	0.0	0.0	353
53	43.0	65.9	425	0.0	0.0	343
54	44.0	63.4	433	29.4	52.9	454
55	17.3	48.5	413	19.8	53.1	413
56	22.2	46.6	466	21.1	46.7	492
57	52.1	72.7	398	35.8	53.9	393
58	55.6	75.6	349	30.2	65.9	434
59	45.5	68.8	434	33.0	55.0	466
60	42.7	66.4	476	33.8	61.9	398
61	52.2	82.8	334	31.7	54.5	387
62	21.0	48.5	355	31.3	51.7	349
63	39.0	61.7	343	33.9	52.2	393
64	44.6	64.3	361	28.7	48.2	401
65	38.1	60.8	495	31.4	53.2	335
66	45.5	68.7	385	31.8	58.6	368
67	46.2	70.3	370	33.6	50.5	374
68	34.2	55.2	473	22.1	48.7	458
69	57.6	87.8	331	39.9	62.8	344
70	50.6	75.4	346	41.9	59.1	338
71	50.8	77.0	349	37.8	58.3	348
72	51.4	83.1	352	26.2	46.7	402
73	53.0	79.5	347	24.8	50.7	423
74	55.2	85.6	332	31.4	59.9	348
75	23.2	48.5	438	36.9	57.9	331

Material	<i>Pinus sylvestris</i> L. sapwood					
Test fungus	<i>Coniophora puteana</i>			<i>Gloeophyllum trabeum</i>		
Measure	Relative mass loss	Final moisture content	Oven-dry density	Relative mass loss	Final moisture content	Oven-dry density
Replicate ID	[%]	[%]	[kg/m ³]	[%]	[%]	[kg/m ³]
76	25.9	53.9	390	29.9	53.3	382
77	41.9	60.2	444	37.1	54.2	337
78	43.7	66.5	351	29.7	49.1	383
79	51.8	71.8	373	31.5	58.3	341
80	49.9	77.2	358	40.8	81.8	331
81	42.5	63.2	364	31.5	52.1	481
82	30.7	55.8	402	23.3	46.5	475
83	50.7	73.2	392	37.8	72.5	366
84	47.6	72.6	378	34.7	61.8	361
85	30.6	52.7	471	29.5	58.5	404
86	36.5	65.9	338	35.2	56.7	412
87	49.4	72.5	356	28.5	63.1	404
88	47.0	72.1	351	32.5	50.5	458
89	41.3	60.1	440	29.5	58.1	446
90	30.4	58.0	434	35.6	68.9	330
91	9.5	38.3	478	38.6	72.0	354
92	12.4	39.3	435	27.5	54.6	482
93	47.4	69.2	371	29.7	44.0	430
94	44.6	64.8	421	26.4	49.6	368
95	39.1	56.2	472	32.2	53.5	346
96	48.2	74.0	338	25.3	49.0	376
97	34.8	81.1	449	22.8	49.2	480
98	45.0	72.9	337			
99	52.0	84.0	353			
100	52.0	71.8	346			
101	31.3	56.9	396			
102	38.3	65.4	464			
103	46.0	68.7	330			
104	35.1	57.7	489			
105	49.4	70.3	380			
106	50.2	75.3	335			
107	54.5	69.2	352			
108	41.3	68.8	467			
109	45.5	72.8	347			
110	42.0	66.5	429			
111	44.9	65.7	354			
112	49.9	75.6	348			
113	39.8	66.2	331			
114	27.4	51.7	424			

Material	<i>Pinus sylvestris</i> L. sapwood					
Test fungus	<i>Coniophora puteana</i>					
Measure	Relative mass loss	Final moisture content	Oven-dry density			
Replicate ID	[%]	[%]	[kg/m ³]			
115	37.6	60.4	441			
116	38.2	60.6	402			

Material	<i>Pinus sylvestris</i> L. sapwood					
Test fungus	<i>Postia placenta</i> (<i>Rhodonias placenta</i>)			<i>Serpula lacrymans</i>		
Measure	Relative mass loss	Final moisture content	Oven-dry density	Relative mass loss	Final moisture content	Oven-dry density
Replicate ID	[%]	[%]	[kg/m ³]	[%]	[%]	[kg/m ³]
1	12.5	93.1	481	51.6	58.1	341
2	10.3	80.4	466	32.8	42.5	414
3	16.6	66.0	476	-0.2	49.2	407
4	11.6	62.6	553	20.6	38.5	483
5	11.7	72.1	552	28.1	42.0	433
6	26.9	85.4	328	40.3	48.2	361
7	13.9	87.0	378	34.6	44.7	369
8	12.9	58.5	484	40.5	46.8	353
9	19.0	78.4	386	27.6	40.7	419
10	17.2	88.2	364	38.2	48.0	409
11	16.9	95.7	356	32.2	43.6	450
12	43.2	70.4	439	10.3	34.5	380
13	17.0	103.7	349	30.6	46.7	352
14	12.9	72.1	470	7.3	33.6	406
15	14.5	83.5	389	6.9	33.0	437
16	13.1	94.9	340	16.6	37.9	377
17	14.4	88.2	374	7.4	35.1	392
18	15.6	80.0	467	34.1	46.7	379
19	14.0	103.9	354	36.3	48.2	350
20	17.0	64.5	344	0.8	30.7	333
21	22.0	94.5	359	19.4	40.4	462
22	17.7	68.8	352	39.4	52.5	337
23	19.0	82.6	347	37.6	49.6	401
24	15.5	89.9	357	45.6	56.0	330
25	12.1	73.4	377	45.4	55.1	330
26	11.0	92.3	344	32.4	44.9	356
27	14.4	77.0	418	34.0	43.8	394
28	18.8	79.0	335	37.3	50.3	343

Material	<i>Pinus sylvestris</i> L. sapwood					
Test fungus	<i>Postia placenta</i> (<i>Rhodonía placenta</i>)			<i>Serpula lacrymans</i>		
Measure	Relative mass loss	Final moisture content	Oven-dry density	Relative mass loss	Final moisture content	Oven-dry density
Replicate ID	[%]	[%]	[kg/m³]	[%]	[%]	[kg/m³]
29	11.7	105.6	343	27.9	45.2	339
30	10.5	94.5	316	23.9	44.3	377
31	13.6	90.0	357	28.3	44.6	395
32	10.8	66.1	429	41.6	50.6	436
33	21.5	52.4	361	45.2	52.8	395
34	14.4	48.5	343	49.9	59.3	366
35	11.5	49.6	423	0.2	45.9	333
36	23.4	73.0	368	48.6	56.7	387
37	15.4	75.2	361	36.4	47.0	448
38	10.8	89.4	359	47.6	53.6	397
39	9.7	61.8	486	43.2	53.6	401
40	11.9	77.6	402	50.0	57.2	390
41	13.0	75.5	433	28.2	42.4	491
42	13.7	91.6	349	51.7	60.1	334
43	13.8	69.7	399	6.7	32.5	390
44	14.4	98.8	343	21.0	40.0	357
45	10.5	94.4	393	38.6	50.5	389
46	9.2	79.7	388	40.9	51.9	352
47	11.6	78.0	420	29.0	43.2	483
48	12.2	81.8	460	46.8	54.7	349
49	21.1	71.7	342	20.0	37.5	488
50	20.1	70.5	406	15.0	36.1	454
51	19.6	58.2	445	50.8	57.5	352
52	19.2	70.1	347	32.2	44.0	472
53	19.6	75.1	341	30.5	45.4	459
54	10.0	86.1	331	32.6	45.2	433
55	13.6	75.5	422	22.9	41.1	425
56	18.4	56.3	443	32.8	44.7	408
57	20.6	61.3	385	38.7	50.2	356
58	22.0	63.7	379	18.6	35.5	484
59	23.1	61.0	354	40.8	52.7	342
60	16.3	73.9	354	44.6	52.4	375
61	13.8	52.7	463	44.1	51.0	352
62	9.5	77.5	369	39.2	49.9	396
63	12.5	82.2	437	0.1	29.8	347
64	21.8	64.0	377	51.5	59.5	336
65	21.6	57.0	418	45.8	50.8	332
66	19.3	75.6	380	14.6	56.2	412
67	17.7	69.4	416	30.9	51.5	418

Material	<i>Pinus sylvestris</i> L. sapwood					
Test fungus	<i>Postia placenta</i> (<i>Rhodonias placenta</i>)			<i>Serpula lacrymans</i>		
Measure	Relative mass loss	Final moisture content	Oven-dry density	Relative mass loss	Final moisture content	Oven-dry density
Replicate ID	[%]	[%]	[kg/m ³]	[%]	[%]	[kg/m ³]
68	20.2	65.0	424	38.6	65.9	334
69	20.5	56.1	426	25.7	45.2	335
70	21.6	53.3	471	-0.7	28.7	437
71	21.9	59.8	444	41.3	50.1	333
72	24.4	59.5	365	25.5	42.9	377
73	23.1	65.0	378	-1.3	29.3	362
74	12.3	99.2	336	7.2	33.9	362
75	17.5	75.8	443	21.0	42.0	333
76	15.1	109.9	336	30.2	42.6	396
77	17.6	91.3	346	41.4	50.0	340
78	12.4	77.1	394	46.2	54.1	344
79	19.2	72.8	372	36.6	47.9	378
80	13.0	86.8	383	26.9	42.1	446
81	8.9	84.7	329	32.0	48.6	360
82	12.5	71.0	479	20.0	40.0	414
83	22.0	61.6	460	40.7	52.9	354
84	13.2	82.9	330	25.9	44.6	372
85	10.6	86.8	346	5.5	115.0	392
86	13.6	89.6	386	2.2	119.5	343
87	12.6	99.9	381	1.8	32.9	470
88	10.5	86.3	392	-0.2	43.7	340
89	15.5	52.5	395	-0.2	28.4	382
90	9.6	49.7	369	-0.4	59.0	388
91	9.2	44.7	390	51.3	56.8	346
92	23.6	64.0	353	46.5	53.2	384
93	22.2	49.5	420	31.2	45.8	491
94	17.9	86.6	362	38.1	51.1	445
95	21.7	68.7	330	32.2	50.1	426
96	20.0	82.8	357	49.4	55.0	396
97	18.3	68.8	384	39.8	49.4	398
98	18.2	55.0	479	40.5	52.3	353
99	23.9	63.2	339	21.8	41.2	371
100	16.3	68.4	393	34.4	44.8	430
101	30.5	66.3	339	25.0	42.1	472
102	12.4	96.1	366	44.8	51.5	391
103	19.7	71.3	349	35.9	47.1	436
104	14.3	72.7	458	38.3	51.1	407
105	25.2	61.3	383	40.8	52.0	450
106	24.4	59.8	340	57.2	60.5	356

Material	<i>Pinus sylvestris</i> L. sapwood					
Test fungus	<i>Postia placenta</i> (<i>Rhodonias placenta</i>)			<i>Serpula lacrymans</i>		
Measure	Relative mass loss	Final moisture content	Oven-dry density	Relative mass loss	Final moisture content	Oven-dry density
Replicate ID	[%]	[%]	[kg/m ³]	[%]	[%]	[kg/m ³]
107	25.2	61.1	348	59.3	62.1	334
108	27.6	63.5	350	42.1	53.9	336
109	20.0	52.5	479	54.2	59.4	376
110	24.9	60.7	343	58.1	59.2	343
111	17.1	87.4	357	37.4	50.3	342
112	32.9	60.0	342	33.3	45.2	470
113	12.7	63.5	440	38.8	47.9	458
114	15.8	97.0	332	23.0	71.7	453
115	10.2	79.0	394	33.1	46.0	523
116	14.9	94.4	384	4.4	100.1	557

Material	<i>Pinus sylvestris</i> L. sapwood					
Test fungus	<i>Trametes versicolor</i>					
Measure	Relative mass loss	Final moisture content	Oven-dry density			
Replicate ID	[%]	[%]	[kg/m ³]			
1	11.1	42.2	481			
2	5.2	38.5	472			
3	11.5	52.8	494			
4	5.1	36.8	552			
5	5.7	37.6	555			
6	11.9	37.8	374			
7	14.3	35.9	444			
8	19.8	53.7	362			
9	14.4	41.7	341			
10	22.0	62.6	354			
11	23.5	54.9	384			
12	19.6	49.3	405			
13	18.5	43.2	445			
14	15.3	38.3	487			
15	17.6	40.5	438			
16	14.9	41.9	395			
17	16.5	48.5	361			
18	16.7	46.8	354			
19	16.8	44.1	358			
20	17.9	46.6	339			

Material	<i>Pinus sylvestris</i> L. sapwood					
Test fungus	<i>Trametes versicolor</i>					
Measure	Relative mass loss	Final moisture content	Oven-dry density			
Replicate ID	[%]	[%]	[kg/m ³]			
21	18.8	45.0	397			
22	14.4	43.8	330			
23	15.1	42.5	351			
24	17.5	43.9	406			
25	16.5	42.7	353			
26	15.6	38.1	446			
27	14.5	43.2	330			
28	17.6	46.3	331			
29	15.8	43.9	368			
30	18.6	40.7	418			
31	11.9	37.3	447			
32	10.6	40.0	396			
33	12.4	42.8	350			
34	13.7	45.3	366			
35	17.4	50.6	389			
36	17.4	47.3	392			
37	16.4	47.8	363			
38	23.0	60.7	341			
39	16.5	40.7	452			
40	16.6	40.6	384			
41	20.6	53.4	340			
42	17.6	48.3	400			
43	20.5	47.7	363			
44	13.5	38.9	412			
45	15.4	45.8	401			
46	20.5	51.3	357			
47	16.3	47.8	385			
48	16.1	49.3	392			
49	20.7	56.2	335			
50	15.9	38.3	489			
51	15.1	46.9	351			
52	15.1	50.5	336			
53	20.7	50.3	370			
54	18.1	51.8	349			
55	18.5	48.7	363			
56	17.8	42.1	446			
57	16.3	51.3	339			
58	17.4	49.0	391			
59	8.5	39.5	398			

Material	<i>Pinus sylvestris</i> L. sapwood					
Test fungus	<i>Trametes versicolor</i>					
Measure	Relative mass loss	Final moisture content	Oven-dry density			
Replicate ID	[%]	[%]	[kg/m ³]			
60	17.1	44.8	398			
61	12.2	41.5	391			
62	17.2	42.5	341			
63	13.5	37.0	482			
64	16.1	44.2	394			
65	14.1	44.3	341			
66	17.4	53.0	360			
67	12.7	37.6	407			
68	14.9	46.3	379			
69	17.7	53.1	343			
70	15.7	45.9	363			
71	16.4	50.2	351			
72	10.5	37.3	371			
73	16.0	41.0	341			
74	14.8	37.8	412			
75	13.2	39.1	345			
76	17.9	43.7	463			
77	14.7	40.9	414			
78	12.0	33.3	462			
79	6.7	31.8	438			
80	16.0	38.3	431			
81	15.0	46.8	393			
82	11.3	33.7	487			
83	10.3	34.2	405			
84	14.6	39.1	371			
85	13.6	35.4	414			
86	15.4	38.2	382			
87	7.0	38.9	377			
88	7.4	37.1	401			
89	6.7	33.5	361			
90	17.2	44.0	356			
91	17.5	50.9	354			
92	25.6	69.7	335			
93	17.7	44.4	382			
94	18.8	53.2	342			
95	15.8	41.7	380			
96	18.3	55.5	343			
97	15.1	48.3	355			
98	16.5	43.7	335			

Material	<i>Pinus sylvestris</i> L. sapwood					
Test fungus	<i>Trametes versicolor</i>					
Measure	Relative mass loss	Final moisture content	Oven-dry density			
Replicate ID	[%]	[%]	[kg/m ³]			
99	16.6	42.0	459			
100	16.7	44.6	392			
101	21.7	52.8	384			
102	18.2	44.9	350			
103	18.7	45.8	448			
104	20.5	53.7	375			
105	23.7	59.4	391			
106	15.8	46.3	416			
107	16.0	47.1	385			
108	20.6	55.0	363			
109	20.0	48.7	383			
110	19.7	52.0	329			
111	20.7	46.7	335			
112	20.7	43.6	441			
113	14.4	44.1	354			
114	16.8	39.0	414			