

NOTES ON THE SHRINKAGE OF WOOD.

PART II.

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The results of a number of shrinkage and density determinations were published a few years ago.¹ Since then, chiefly through the courtesy of the Forestry Commission of New South Wales, further samples of green timber have been received for examination. In general the procedure was similar to that already described, except that the small sections measuring 1 inch along the grain, 4 inches in width and 1 inch in thickness were allowed to air-season before oven-drying, and the air-dry and oven-dry shrinkages were determined from the same section, whereas in the earlier paper the air-dry and oven-dry shrinkages were measured from separate sections cut from the same board. The moisture content of the air-dry material was approximately 13%.

No attempt was made to eliminate collapse, and whilst such a condition is evident in timbers such as Brush Box, Turpentine, Murray Red Gum, in the majority it is apparently absent or occurs only to a minor degree.

It is sometimes assumed that the shrinkage, green to air-dry, is half the green to oven-dry shrinkage, but an examination of the figures in columns 4 and 5 indicates that the ratio is usually much greater, the air-dry shrinkage being commonly from 0.6 to 0.8 times the oven-dry shrinkage. A shrinkage factor of 0.5 for an air-dry moisture content of 13% presupposes a fibre saturation point of about 26%, and if the factor is greater than this, it indicates either that the fibre saturation point is above

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¹ M. B. Welch, Notes on the Shrinkage of Wood, *Jour. Roy. Soc. N.S.W.*, 1932, 65, 235-250.

	1	2	3	4	5	6	7	8	9
<i>Angophora Bakeri</i>	44.6	74.5	34.4	4.8	7.2	11.8	17.2	116	Q
" " <i>Baloghia lucida</i>	43.3	72.7	34.1	7.2	10.9	9.8	15.5	113	B
" " <i>Callitris glauca</i>	47.9	62.3	38.0	4.0	6.4	11.3	16.9	64	Q
" "	46.0	61.1	37.4	7.6	11.1	9.0	14.0	63	B
" " <i>Cypress Pine</i>	41.9	46.0	35.9	2.6	4.4	5.7	10.1	28	Q*
" "	41.7	46.9	35.9	2.7	4.6	5.5	10.1	30	Q
" "	45.9	49.5	38.0	3.6	6.1	7.1	11.6	30	Q
" "	38.5	42.3	32.6	3.3	5.5	5.8	9.9	30	B
" "	41.9	47.0	35.3	3.0	5.3	5.4	10.3	33	B
" "	38.1	42.9	32.2	3.4	5.7	5.9	9.8	33	B
" "	42.0	47.3	35.4	3.0	5.3	5.1	10.0	34	B
" "	44.1	50.2	37.2	3.4	5.6	6.4	10.5	35	B
" "	41.2	48.0	35.1	3.6	5.9	6.1	10.2	37	B
" "	40.4	48.2	33.9	3.1	5.4	6.2	10.4	39	B
" " <i>Cedrela Toona</i>	34.1	55.6	28.3	1.7	3.3	4.7	9.0	96	B
" "	27.6	43.8	23.7	3.1	5.1	5.1	8.7	84	Q
" " <i>Cryptocarya erythroxylon</i>	44.9	47.4	36.5	7.5	10.8	10.9	16.6	30	B
" " <i>Daphnandra micrantha</i>	42.2	59.6	34.7	2.0	3.6	8.7	13.9	72	P
" "	42.7	61.5	35.9	6.9	10.3	7.6	12.1	71	Q
" " <i>Diploglottis Cunninghamii</i>	42.1	55.1	34.8	2.7	4.5	8.4	13.3	58	Q
" " <i>Doryphora sassafras</i>	43.2	54.7	35.6	1.9	9.5	8.5	13.4	54	B
" "	32.1	44.0	26.0	3.3	3.3	8.0	12.6	69	Q
" " <i>Dysorcydon Fraserianum</i>	37.8	51.5	30.7	6.9	10.4	9.4	15.3	67	B
" "	47.4	55.0	38.3	2.6	4.6	7.2	12.3	40	Q
" "	44.0	47.0	36.1	3.4	6.3	5.4	10.7	30	B
" " <i>Endiandra Palmerstoni</i>	49.3	58.1	39.3	3.3	5.4	8.3	13.5	48	B
" " <i>Endiandra virens</i>	40.5	65.8	34.7	1.8	3.1	4.9	9.6	90	Q
" "	44.0	65.0	36.7	4.6	7.6	6.8	11.3	77	B
" " <i>Eucalyptus acmenoides</i>	53.0	63.0	42.5	4.2	6.5	11.0	16.8	48	Q
" "	51.5	64.3	41.7	7.4	10.7	9.8	15.6	54	B
" " <i>Eucalyptus amplifolia</i>	57.0	71.2	47.6	3.7	5.9	7.1	15.8	50	Q
" "	62.1	72.6	49.8	6.4	9.5	10.7	16.3	46	B
" " <i>Cabbage Gum</i>	67.2	77.6	46.8	7.9	11.1	20.8	26.6	66	Q
" "	64.0	74.5	43.3	10.1	13.0	23.4	28.7	72	B

	1	2	3	4	5	6	7	8	9
<i>Eucalyptus eugenoides</i>	White Stringybark	64.9	41.9	6.1	9.3	9.2	14.2	55	B
"	"	50.2	41.1	5.5	8.5	9.0	13.7	57	B
"	"	49.3	26.2	7.7	11.4	12.1	18.3	75	B
"	"	48.6	73.8	5.8	9.5	9.3	15.0	92	B
<i>fastigata</i>	Brown Barrel	73.4	39.5	3.7	6.5	11.6	19.2	85	Q
"	"	52.0	34.3	3.9	6.0	11.5	17.2	110	Q
"	"	44.6	38.9	7.3	11.1	11.3	18.1	80	Q
"	"	50.2	34.0	9.2	12.4	15.1	20.8	103	B
"	"	45.6	34.0	9.3	12.4	15.4	20.3	73	B
<i>globulus (bicostata)</i>	Eurabbie	52.4	40.0	4.2	6.2	14.2	19.4	70	B
<i>grandis</i>	Flooded Gum	69.2	39.5	4.2	9.8	10.2	15.0	73	Q
"	"	50.8	41.7	7.0	4.3	7.9	12.4	76	Q
"	Red Stringybark	51.4	41.4	2.5	4.8	7.7	12.0	77	Q
"	"	50.1	41.8	2.9	4.9	7.9	12.2	80	Q
"	"	50.4	41.6	6.4	9.1	10.8	15.1	75	B
"	"	50.3	41.6	5.5	8.2	8.6	12.9	77	B
"	"	51.7	40.7	5.6	8.2	8.8	13.2	77	B
"	"	49.1	40.7	6.1	9.0	14.7	20.8	60	Q
"	Spotted Gum	71.9	46.0	6.5	9.3	13.8	19.3	65	Q
<i>maculata</i>	"	73.5	44.4	4.4	7.1	10.8	16.8	70	Q
"	"	57.1	44.9	4.4	7.8	8.1	14.7	24	Q*
"	"	54.7	48.2	4.6	9.8	10.4	16.7	40	B
"	"	58.2	52.2	6.3	9.8	12.7	19.2	46	B
"	"	65.0	49.1	7.3	11.0	14.4	20.4	58	B
"	"	71.3	44.3	7.4	10.5	12.8	18.3	59	B
"	"	70.0	43.4	7.8	10.7	12.4	18.1	67	Q
"	"	69.1	45.2	6.9	10.0	12.4	18.5	48	Q
"	"	75.2	46.1	5.2	7.7	13.0	15.5	50	Q
<i>microcorys</i>	Tallowwood	68.2	48.3	3.3	5.5	10.2	15.5	51	Q
"	"	72.4	51.5	5.5	8.5	12.5	18.9	60	Q
"	"	77.6	49.5	4.0	6.8	10.8	17.3	46	B
"	"	78.9	51.0	6.4	10.2	10.1	16.3	48	B
"	"	74.8	48.3	6.7	10.0	12.0	17.1	56	B
"	"	63.3	50.3	5.8	9.1	9.0	15.9	56	B
"	"	60.9	48.3	6.1	9.6	10.7	16.8	56	B
"	"	71.2	50.3	6.1	9.6	10.7	16.8	56	B
"	"	78.6	50.3	6.1	9.6	10.7	16.8	56	B
"	"	79.4	50.9	6.1	9.6	10.7	16.8	56	B

	1	2	3	4	5	6	7	8	9
<i>Eucalyptus paniculata</i>	66.5	71.2	52.9	5.1	8.0	11.3	17.4	35	Q
"	76.0	79.8	58.4	6.5	10.0	14.7	21.7	37	Q
"	71.3	76.2	55.6	4.3	6.9	13.3	19.6	39	Q
"	74.2	77.4	58.6	6.5	10.0	11.5	17.3	32	B
"	76.8	79.5	58.8	8.8	12.4	15.3	22.2	35	B
"	69.0	77.5	57.2	4.9	8.3	7.5	13.1	36	B
"	48.5	73.1	36.6	4.1	5.8	15.8	19.9	100	Q
<i>phellandra</i>	49.8	73.6	36.2	4.3	6.0	18.6	22.8	103	Q
"	43.7	63.6	30.6	7.8	10.4	20.6	26.4	107	Q
"	51.1	75.3	40.1	8.0	10.7	12.5	16.8	88	B
"	50.2	74.3	37.1	12.5	15.0	17.5	21.4	100	B
"	43.8	66.2	30.2	13.4	16.2	21.2	27.6	119	B
"	62.3	73.0	48.9	6.4	9.3	12.4	19.8	49	Q
<i>pilularis</i>	55.9	72.4	44.0	5.4	7.8	12.4	17.9	54	Q
"	64.3	78.8	50.7	6.1	9.4	12.8	19.5	55	Q
"	55.2	69.9	44.7	3.8	6.2	9.0	14.3	56	Q
"	52.1	66.4	41.3	4.9	7.2	11.4	16.6	61	Q
"	60.6	69.2	48.6	7.0	10.6	10.7	16.7	43	B
"	59.9	68.0	46.6	7.5	10.9	13.3	19.1	46	B
"	61.9	76.3	49.3	6.8	10.0	11.5	17.1	55	B
"	57.6	70.5	44.3	7.0	9.7	15.0	17.4	59	B
"	55.7	71.9	44.8	6.1	9.9	8.4	14.5	61	B
"	53.3	69.4	42.3	7.5	10.0	12.2	17.9	64	B
"	60.5	77.4	46.3	8.4	11.5	14.3	20.1	67	B
<i>piperita</i>	57.6	69.5	43.5	4.8	7.0	15.3	20.4	60	Q
"	55.2	66.2	38.2	7.4	9.7	24.3	28.4	74	Q
<i>propinqua</i>	43.8	70.0	34.9	6.7	9.2	11.8	14.3	101	B
"	60.8	69.2	47.8	5.9	8.7	13.0	18.3	45	Q
<i>propinqua</i>	71.9	78.5	56.5	6.0	9.5	11.7	18.1	39	Q
"	68.1	75.8	54.4	6.2	9.7	10.3	16.1	39	B
"	65.2	73.5	51.5	7.0	10.3	11.9	17.4	43	B
<i>resinifera</i>	61.6	67.0	47.8	6.3	9.5	12.3	19.8	40	Q
"	60.9	72.5	48.4	6.1	8.9	12.0	17.8	51	Q
"	55.0	75.5	45.9	3.7	5.9	7.6	11.9	64	Q

	1	2	3	4	5	6	7	8	9
<i>Eucalyptus resinifera</i>	65.0	74.3	53.4	4.9	8.2	8.6	15.2	28	B*
"	59.9	71.1	49.0	4.3	7.2	8.3	13.7	45	B
"	60.7	69.3	47.6	7.6	10.3	13.3	18.8	46	B
"	61.4	69.4	46.7	8.5	11.6	15.5	21.2	49	B
"	64.2	77.0	51.4	6.9	9.9	11.1	16.9	50	B
"	57.7	70.0	46.3	6.2	8.9	10.9	16.5	52	B
"	56.4	75.0	46.8	4.5	7.2	8.3	13.1	60	B
"	59.5	69.9	46.4	4.4	6.7	12.2	17.2	53	Q
<i>rostrata</i>	62.5	72.7	46.8	5.7	8.5	16.5	22.7	55	Q
"	58.7	73.7	46.8	4.5	7.1	10.3	16.0	57	Q
"	60.8	72.3	45.6	5.5	8.4	15.6	22.2	58	Q
"	60.6	64.9	45.0	7.3	10.1	15.5	21.4	58	Q
"	57.1	69.6	43.4	4.5	6.6	13.0	18.8	60	Q
"	59.4	73.5	45.7	5.0	6.8	12.8	17.3	60	Q
"	57.2	71.1	42.8	6.0	8.1	14.7	19.3	66	Q
"	59.3	72.4	46.3	6.7	9.9	10.4	15.8	56	B
"	55.9	72.4	44.0	7.9	11.1	11.6	17.2	65	B
"	57.7	68.0	41.6	11.4	14.3	17.4	23.2	67	B
"	52.1	71.8	42.6	9.5	11.9	14.7	18.0	69	B
"	55.1	74.3	43.7	7.0	9.4	10.5	15.5	70	B
"	58.2	74.2	43.5	11.6	14.0	15.3	19.6	71	B
"	56.2	75.5	43.1	6.6	9.5	10.7	15.9	75	B
"	47.4	70.8	37.6	4.3	6.4	8.6	12.8	83	B
"	59.6	70.5	46.5	5.1	7.7	13.1	18.7	51	Q
Blue Gum	57.4	64.6	42.6	7.8	10.6	17.2	22.0	52	Q
"	54.5	72.4	44.6	6.5	9.2	8.2	14.6	62	Q
"	53.4	68.0	40.8	4.9	7.7	13.2	19.5	66	Q
"	55.7	69.5	43.6	5.7	8.4	11.6	16.5	59	O
"	55.8	62.3	44.3	7.8	9.3	11.0	16.5	40	B
"	57.7	69.9	45.4	7.8	11.1	12.8	18.6	54	B
"	60.6	75.5	45.6	9.1	12.6	14.0	19.7	65	B
"	52.1	63.4	37.1	7.1	9.6	19.1	24.2	71	B
"	60.5	73.3	43.1	5.2	8.4	18.2	25.2	71	Q
Coast Ash	63.2	75.8	43.9	13.3	16.7	20.5	27.7	73	B

	1	2	3	4	5	6	7	8	9
<i>Eucalyptus tereticornis</i>	65.6	78.8	50.4	4.7	6.8	8.0	14.8	56	B
" "	63.9	79.0	52.2	5.2	6.7	8.0	13.7	51	B
" <i>viminialis</i>	50.0	67.5	35.2	5.8	8.5	20.0	26.8	93	B
" "	41.7	65.5	32.8	7.4	10.6	11.3	16.9	99	B
<i>Flindersia acuminata</i>	33.7	47.6	27.9	3.2	4.9	8.6	13.1	71	Q
<i>Litsea reticulata</i>	33.8	36.8	28.9	2.6	4.3	5.5	9.6	27	Q
" "	42.2	46.0	34.0	6.5	9.5	11.2	17.4	35	Q
" "	28.7	39.4	24.3	5.3	7.8	7.0	11.5	62	B
<i>Melaleuca leucadendron</i>	47.0	64.3	37.6	3.1	5.3	10.6	16.4	71	Q
" "	43.9	60.1	35.1	6.9	10.6	9.4	15.2	76	B
<i>Schizomeria ovata</i>	37.6	46.2	31.1	4.7	7.0	9.3	13.2	49	O
<i>Sloanea Woolsii</i>	35.8	54.8	29.6	2.7	4.1	8.9	13.1	85	Q
" "	36.6	55.9	30.6	7.5	9.9	8.4	12.2	83	B
<i>Sterculia acerifolia</i>	27.8	54.6	26.0	3.1	4.4	8.4	14.9	109	Q
" "	29.4	58.0	26.9	7.5	9.3	9.9	13.7	107	B
<i>Syncarpia laurifolia</i>	59.4	62.1	41.5	6.3	8.9	21.4	26.8	50	Q
" "	60.2	69.0	45.1	7.0	9.7	14.7	19.8	53	Q
" "	60.4	71.6	41.1	10.3	13.2	23.2	29.0	74	Q
" "	66.1	68.2	51.4	7.1	10.2	13.1	18.0	33	B
" "	65.9	69.3	49.9	8.9	11.9	15.6	20.8	39	B
" "	52.2	55.9	38.9	6.0	9.0	15.8	20.5	44	B
" "	55.5	60.7	39.6	13.2	16.9	19.9	25.2	54	B
" "	62.7	74.2	45.6	11.0	14.3	18.4	23.8	63	B
<i>Tristicta actinophylla</i>	56.7	68.0	44.6	4.4	7.0	12.7	18.3	52	Q
" <i>peralata</i>	53.2	69.3	42.3	9.3	12.8	11.5	17.7	64	B
" "	50.7	66.0	37.3	5.2	7.8	16.5	22.8	77	Q
" "	53.0	66.0	41.1	7.5	11.3	11.6	18.0	61	B
" "	50.2	67.1	38.4	7.7	11.8	11.7	18.4	75	B
<i>Tristania conferta</i>	55.6	69.8	44.4	3.1	4.8	12.1	16.2	57	Q
" "	62.9	75.6	44.0	9.3	12.1	22.6	28.2	72	Q
" "	53.3	69.9	44.0	6.5	9.0	8.8	12.8	59	B
" "	54.2	71.3	43.8	8.3	11.5	12.1	17.5	63	B
" "	53.6	67.0	40.9	10.9	13.9	15.2	20.3	64	B
" "	52.9	75.5	43.4	5.7	8.4	9.0	13.5	74	B
<i>Villaresia Moorei</i>	47.4	61.0	39.8	2.1	3.8	6.6	11.8	53	Q
" "	47.9	61.5	40.3	5.2	8.4	6.5	11.9	57	B

26% or that collapse has occurred during the initial seasoning.

Although the results are too few for any attempt to be made to correlate density and shrinkage (in general in the same species shrinkage should vary directly as density), it is evident that many anomalies occur. Again, in a number of species the tangential is greater than the radial shrinkage for different samples, although collapse may have influenced the results in some instances. It is recognised that shrinkage may be modified, apart from density, by the conditions of drying and by the size and shape of the material, and is undoubtedly so variable that mean results must be used with great caution.

Whilst the ratio of radial to tangential shrinkage is usually less than 2 : 1, Sassafras again shows a high ratio of approximately $3\frac{1}{2} : 1$, a result which might have been anticipated when the warping tendencies of this wood are known, yet quarter-cut material should be quite suitable for joinery. The tangential shrinkage of Cedar was again shown to be as little as 3%. The tangential shrinkage of Cypress Pine also ranges between 3% and 4%, indicating the value of this wood for flooring, since even when it is used in a partially seasoned condition shrinkage is not excessive.

The figures given in the table are self-explanatory, and apart from shrinkage give some indication of the moisture content in freshly sawn timber, and also of the weight per cubic foot of green and air-dry timber.

The volumes of the sections were determined by the displacement of mercury, a method which has given very satisfactory results ; in the most open textured wood used, no penetration of mercury could be detected by weighing before and after immersion.

EXPLANATION OF TABLE.

1. Weight per cubic foot, air-dry volume and weight.
 2. Weight per cubic foot, green volume and weight.
 3. Weight per cubic foot, green volume and oven-dry weight.
 4. Lateral shrinkage green to air-dry.
 5. Lateral shrinkage green to oven-dry.
 6. Volumetric shrinkage, green to air-dry.
 7. Volumetric shrinkage, green to oven-dry.
 8. Moisture % on oven-dry weight.
 9. Direction of cut. Q=radial or quarter cut, B=tangential or "backed off", O=oblique (45° to rays). 15° tolerance permitted.
- * Possibly below fibre saturation point.



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<https://doi.org/10.5962/p.360135>.

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