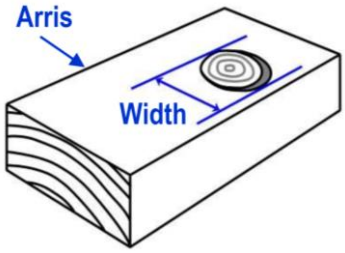
Visual stress grading rules for seasoned
RADIATA PINE F5 / F7

This ready-reckoner grading card is designed to be used by mill workers involved in visually stress grading radiata pine to F5 and F7. It provides a basic summary of the relevant grading rules from AS 2858. The card should not be relied upon as a formal statement of the grade requirements, or be used in place of the Australian Standard. For full details on grade requirements, see *AS 2858-2008: Timber - Softwood - Visually stress-graded for structural purposes.*

Seasoned timber must have a MC of **15% maximum** for 90% of the pieces in the parcel, with none more than 18% MC – measured at the time of production. The F ratings shown below all relate to seasoned radiata pine. Green radiata may be given an F rating; however, all grades will go down by one – i.e. F5 becomes F4, and F7 becomes F5.

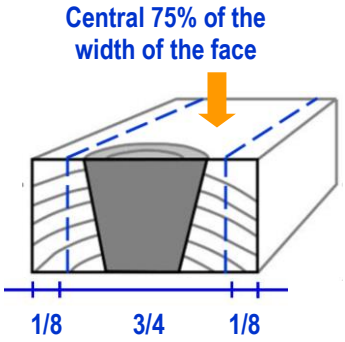
Green Douglas fir (oregon) from North America and green slash pine may also be graded using the same limitations and F grades as for seasoned radiata (F5 and F7). Seasoned Douglas fir is graded one grade higher for the same limitations (i.e. F7 and F8). Seasoned slash pine is graded two grades higher (i.e. F8 and F11).

Knots include knots that are tight or loose, sound or unsound, intergrown, round or oval, single or in clusters, knot holes and all holes other than insect holes, plus any bark encasement.



Measurement is taken at the widest point at right angles to the arris of the piece, and must include any bark or voids.

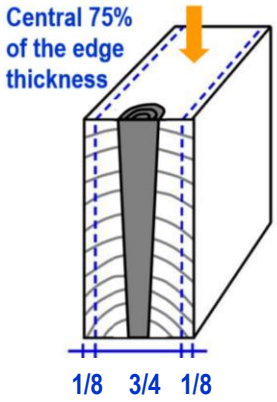
Knot Area Ratio (KAR) is the area that the knot takes up inside the piece, expressed as a percentage of the end section.



FACE KNOTS

F5: KAR 60%

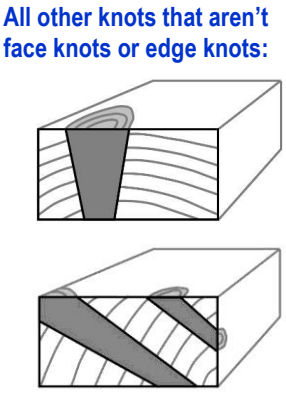
F7: KAR 50%



EDGE KNOTS

F5: KAR 60%

F7: KAR 50%



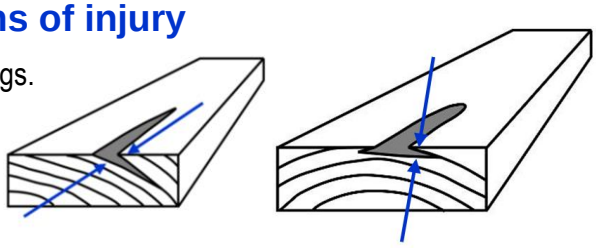
OTHER KNOTS

F5: KAR 40%

F7: KAR 30%

Resin pockets, bark pockets and overgrowths of injury

Width is measured radially, i.e. towards the pith, or 90^0 to growth rings.
(For backsawn boards, it will be like a depth measurement.)
Length is measured parallel to the length of the board.
The limitation is the same for F5 and F7.



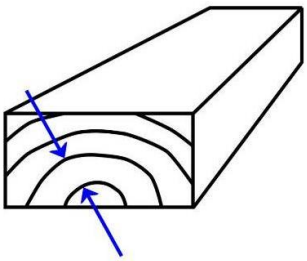
Width:
If on one surface only: **20 mm or 1/3 surface** – whichever is less.
One surface to another surface (face or edge) but not intersecting an end: **12 mm or 1/4 surface** – whichever is less.
One surface to another and intersecting an end: as for end splits (i.e. F5: up to width of board: F7: ½ width of board).

Individual length: 300 mm or 3 times the width of the surface – whichever is less.

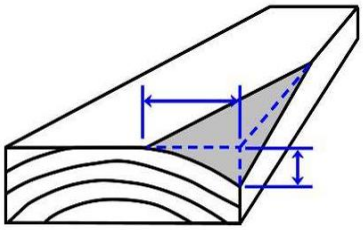
Width of growth rings indicate the density of the piece. They only need to be checked when the piece contains rings within 50 mm of the centre of the pith. Growth rings are measured radially, towards the pith.

F5: 20 mm max. spacing between rings (if within 50 mm of pith).

F7: 10 mm max. spacing between rings (if within 50 mm of pith).



Want and wane are measured in terms of how much of the face or edge is missing. The limitation is the same for F5 and F7.



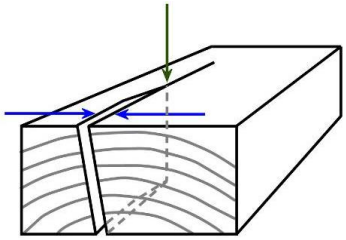
Wane is the underbark surface of the log. Want is the absence of wood from all other causes (e.g. forklift or chain damage).

In pieces up to 38 mm thick: **1/4 of face, 1/4 of edge.**

In pieces over 38 mm thick: **1/2 of face, 1/3 of edge.**

Note that other defects close to the arris may be assessed using the 'want or wane rule', other than enclosed termite galleries – that is, if the defect does not exceed the want or wane limitation, it can be accepted in the grade.

Splits are a lengthwise separation of fibres that go from one surface right through to another surface. End splits are measured parallel to the length of the piece on the shortest side (since it will be considered a surface check when it no longer goes right through).

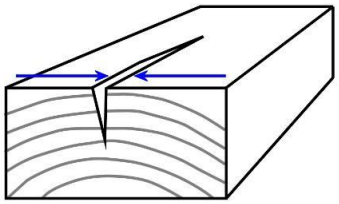


Splits: not permitted in the body of the board in any grade.

End splits individual length – F5: width of board; F7: 1/2 width of board.

End splits aggregate length (F5 and F7): twice the width or 200 mm – whichever is less.

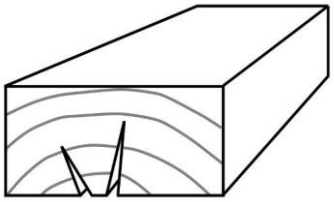
Surface checks are cracks that do not go from one surface to another (since that would be a split) and are generally caused by shrinkage stresses due to uneven drying. They run lengthwise with the grain.



Width is measured at right angles to the check. Length is measured parallel to the length of the board. The limitation is the same for F5 and F7.

Individual length: 600 mm. Width: 2 mm.

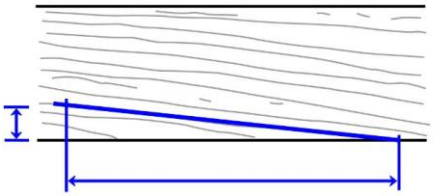
Heart shakes result from internal stresses in the tree (due to windstorms, felling impact, etc) and radiate from the heart of the log.



F5: permitted, as long as they don't exceed the limitations for checks or end splits.

F7: not permitted.

Sloping grain occurs when timber is cut at an angle to the direction of the grain in the log. It does not include the local deviation of grain around knots (since this is taken into account in the KAR calculation), or deviations that are no more than half the width of the piece.

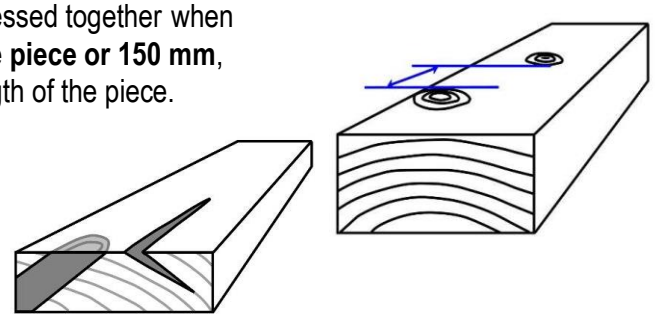


F5: 1 in 6 (e.g. 50 mm rise over 300 mm in length).

F7: 1 in 8 (e.g. 38 mm rise over 300 mm in length).

Note that the grain direction should not be confused with growth ring patterns (which may or may not run with the grain). Grain direction can be determined by looking for surface checks or pulling up a splinter of wood from the edge or face.

Combinations of characteristics must be assessed together when the distance between them is **less than twice the width of the piece or 150 mm**, whichever is less. The distance is measured parallel to the length of the piece.



Characteristics may appear on any face or edge, and may include multiple knots, or knots and resin pockets, or any other strength-reducing defects.

A combination is permitted if the aggregate (combined) size is less than one characteristic of maximum permissible size.

Other defects

Fractures and compression failures, including cross-shakes, felling shakes, wind shakes and fractured fibres due to heavy impact, are not permitted anywhere in the board, except when assessed as end splits.

Termite galleries are not permitted anywhere in the board if they are 'enclosed' (disappearing inside the timber). If they are not enclosed (fully visible), they may be assessed as for want and wane.

Occluded branch stubs occur when a knot appears on one surface but is 'occluded' inside the piece (e.g. when a branch has snapped or been pruned in the growing tree and then overgrown with new wood tissue).

F5: permitted and assessed as for knots – using the KAR measurement on the visible side.

F7: not permitted.

Fungal decay includes brown rot (also called 'dry rot') and all other types of fungi that destroy wood cells.

F5: permitted if no deeper than 6 mm and/or not extending across the surface more than 25 mm or 1/4 of the surface width (whichever is less).

F7: not permitted.

Stain is permitted in all grades, with no limitation on the amount. This includes sap stain fungi (such as 'blue stain') and surface moulds. Note that sap stain fungi feed on sugars inside the cells and do not break down wood fibres. Surface moulds tend to grow in the dust or dampness on the surface and also do not attack wood fibres.

Structural appearance grades are used for stress graded timber that also needs to satisfy appearance requirements – such as in exposed beams. The same structural grade limitations apply as for F5 and F7; however, the following characteristics are not permitted anywhere in the board: loose, unsound or defective knots; holes; termite galleries; pith on exposed surfaces; resin pockets, bark pockets, overgrowths of injury; checks wider than 1 mm; decay; want or wane; damage caused by hooks or ropes; stain or discolouration.

Borer holes tend not to be a problem in managed radiata pine plantations. Where they do occur, they are measured across the surface at 90 degrees to the longitudinal direction of the hole.

F5: Borer holes up to 3 mm diameter – unlimited if separated by at least twice the diameter of the hole.
Borer holes 3 mm to 10 mm (or when closer together than twice diameter) – 6 holes per 100 x 100 mm area.

F7: Borer holes up to 3 mm diameter – 30 holes per 100 x 100 mm area (or equivalent).
Borer holes 3 mm to 10 mm – 4 holes per 100 x 100 mm area (or equivalent).

Sizes and tolerances

Width and thickness:

- unseasoned sawn boards: may be up to 3 mm oversize or 3 mm undersize.
- seasoned (or MC specified) sawn boards: may be up to 5 mm oversize and 0 undersize.
- dressed (or planer gauged) boards: may be up to 2 mm oversize and 0 undersize.

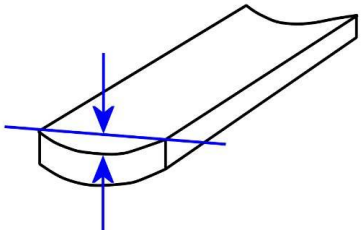
Size consistency in parcel: maximum variation of 2 mm between all pieces.

Tolerance on squareness: plus or minus 2 degrees.

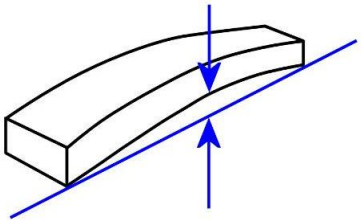
Distortions in the board

Cup is a curve across the face of the board. It is measured by holding a straight edge across the concave face and measuring the deviation at its worst point.

Maximum allowed in all grades: 1 mm per 50 mm of width.

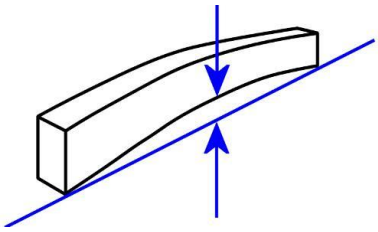


Bow is a curve along the length of a board that causes the face (wide surface) to move away from a flat plane – that is, if the board is laid flat with the concave face down, it will rise in the middle.



To measure bow, stretch a string line from one end of the board to the other, and measure the deviation at its maximum point.

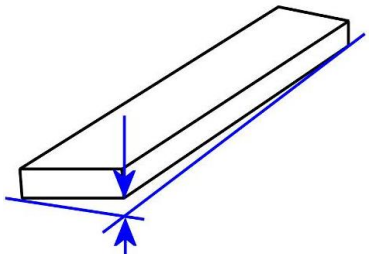
Spring is a curve along the length of a board that causes the edge (narrow surface) to deviate from a straight line – that is, if the board is turned on its edge, it will rise in the middle. It is measured using the same technique as for bow.



The table below shows the maximum permissible bow and spring for visually stress graded softwoods. To look up the bow tolerances, use the column headed with the board's thickness. To look up spring, use the column headed with the board's width.

Length (m)	For SPRING – use Width dimension of board. For BOW – use Thickness dimension of board								
	38 mm	**50** mm	**75** mm	**100** mm	**125** mm	**150** mm	**200** mm	**250** mm	**300** mm
1.8	10	10	7	5	4	3	3	2	1
2.4	20	15	12	9	7	6	4	4	3
3.0	35	25	19	14	11	9	7	6	5
3.6	50	35	25	20	16	13	10	8	7
4.2	60	45	28	25	22	18	14	11	9
4.8	70	50	30	30	29	24	18	14	12
5.4	75	55	40	40	36	30	23	18	15
6.0	80	60	45	45	45	37	28	22	19
6.6	85	65	50	45	45	45	34	27	23
7.2	90	70	55	50	50	50	40	32	27

Twist is a curl in the board that causes one end to move away from a flat plane. That is, if the board is laid flat on a bench, only three of the corners will be touching the bench.



To measure twist, lay the board down on a perfectly flat base, and measure between the base and the raised corner of the board while holding the rule at right angles to the base.

Note that a concrete floor is generally not flat enough to take an accurate measurement.

In workplaces where there are no steel bench tops or other reliably flat surfaces, the only way to assess twist is to sight along the board and estimate the deviation.

TWIST					
Length (m)	**Thickness** (nom. mm)	**Width** (nominal mm)			
		Up to 100	**101 – 150**	**151 - 200**	**201 - 300**
Up to 2.4	Up to 50	5	7	10	15
	51 – 75	4	6	8	11
	over 75	2	4	6	8
2.7 to 3.0	Up to 50	7	10	14	20
	51 – 75	5	8	11	15
	over 75	3	5	8	11
3.3 to 3.6	Up to 50	8	13	18	25
	51 – 75	6	9	13	19
	over 75	4	6	9	13
3.9 to 4.2	Up to 50	9	15	21	29
	51 – 75	7	11	15	22
	over 75	5	7	10	15
4.5 to 4.8	Up to 50	10	16	23	33
	51 – 75	7	12	17	24
	over 75	5	8	11	16
5.1 to 5.4	Up to 50	11	18	26	37
	51 – 75	8	14	19	27
	over 75	6	9	13	18
5.7 and over	Up to 50	12	20	28	40
	51 – 75	9	15	21	30
	over 75	6	10	14	20