

TreProX: Innovations in Training and Exchange of Standards for Wood Processing

ÍST INSTA 142:2009 NORDIC VISUAL STRENGTH GRADING RULES FOR CONIFEROUS TIMBER

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TREPROX - FÓLKID Á SÖGINNI - JANÚAR 2021



ÍST INSTA 142:2009

Nordic visual strength grading
rules for coniferous timber

Seminar - Program in Strength grading

Theoretical

- Introduction to the standard
- Wood science
- Wood moisture
- How we strength grade
- Theoretical project

Practical project

- Groups
- Individuals

Exam

- Theoretical
- Practical

Introduction

- This standard defines four visual strength grades for coniferous timber and populus. The grades are termed T3 -T2 -T1 –T0 in descending order of strength.
- The corresponding values of characteristic bending stresses have proved to be approximately:
30 N/mm², 24 N/mm², 18 N/mm² and 14 N/mm², for pine, spruce, fir and larch grown under average Nordic conditions.
- They are about the same for Populus (Aspen) as well.
- For other species and/or growth conditions the characteristic values may differ.

Strength classes

Assignment of timber grades

INSTA 142	EN 519/338	BS 4978
Visual	Mechanical	Visual
• T0 • T1 • T2 • T3	• C14 • C18 • C24 • C30	• GS • SS

Introduction

The present strength grading rules are based on the assumption that a significant relationship between annual ring width and density exists.

If no such relationship exists, additional limits on characteristic densities should be introduced.

Introduction

The rules are termed Nordic T-rules.

Three different sets of features specifications are given:

- One for pieces of thickness $\geq 45\text{mm}$ or width $\geq 70\text{mm}$.
- One for smaller sizes down to 25mm x 50mm.
- One for pieces used in glue laminated timber.

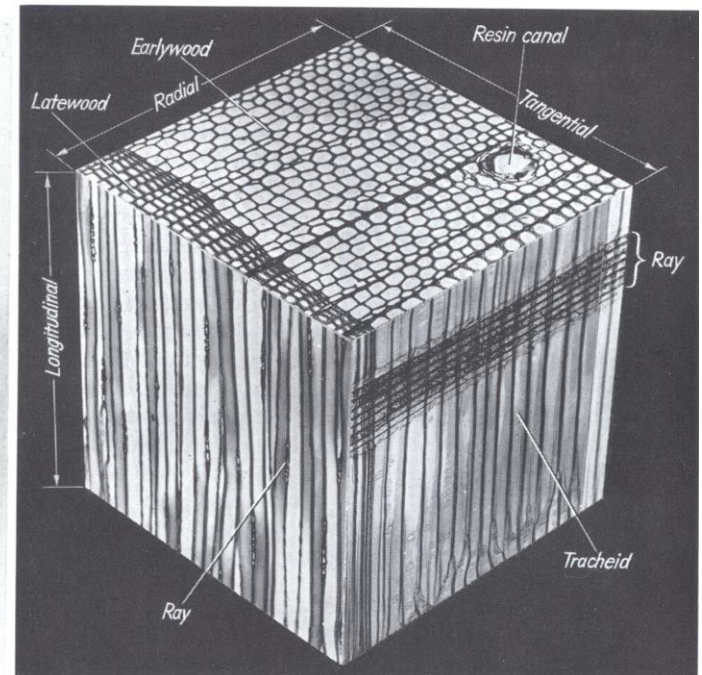
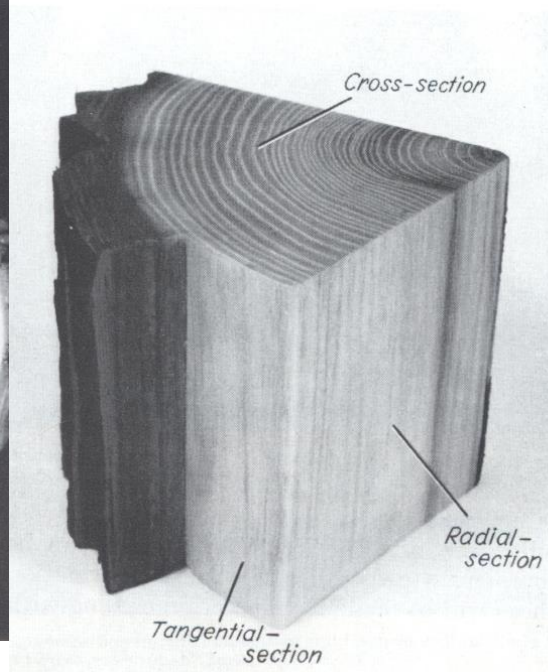
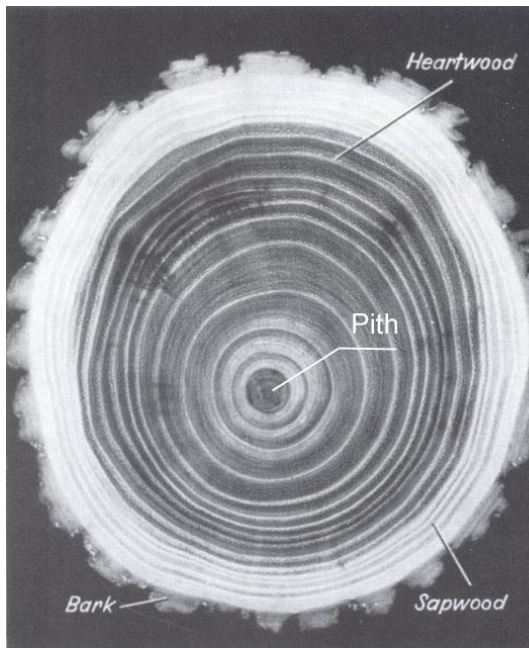
Specifications of the moisture content are not included in the rules, and should be given in the contract.

Introduction

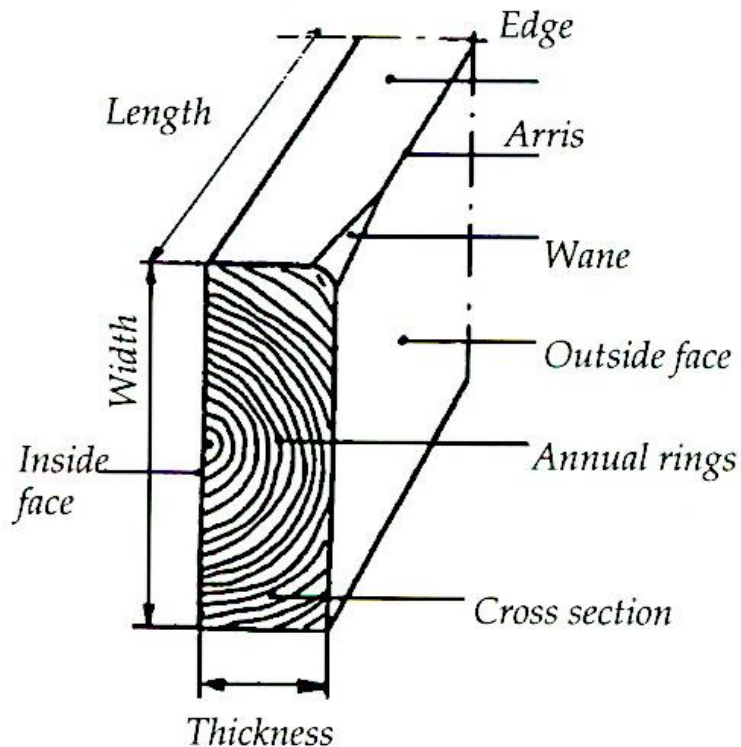
- Timber which is resawn after grading shall be subject to regrading.
- The rules are applicable to both treated and untreated timber.
- Surfacing according to EN 336 does not request regrading.
- Hunger-wood can not be graded according to this standard.

Cross section

Name



Timber identifiers



3.15 face: Either of the wider longitudinal opposite surface of sawn timber or any longitudinal surface if the timber is of square cross section.

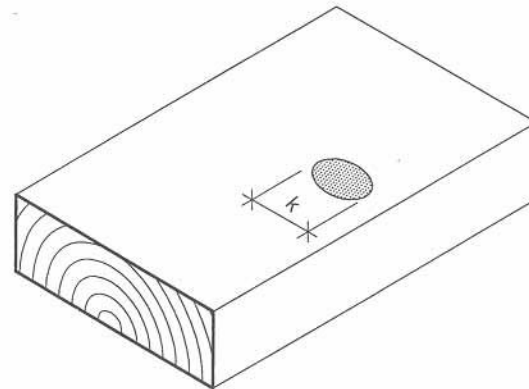
3.14 edge: Either of the narrower longitudinal opposite surfaces of square edged timber.

3.1 arris: Line of intersection of two faces or a face and an edge.

3.20 inside face (pith side): Face nearer to the pith of the log.

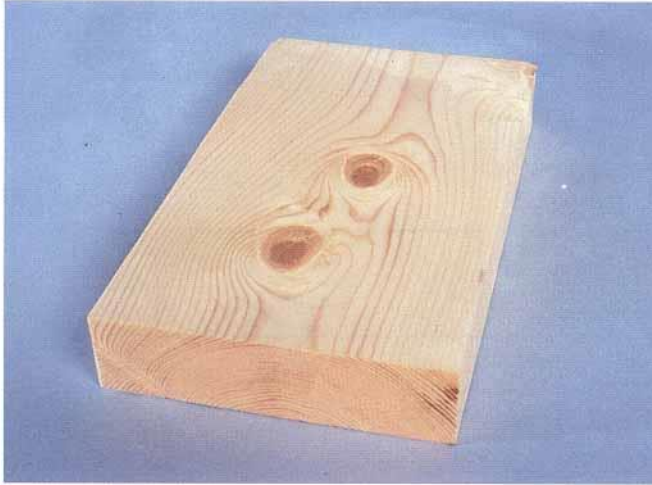
3.16 outside face: Face further from the pith of the log.

Knots

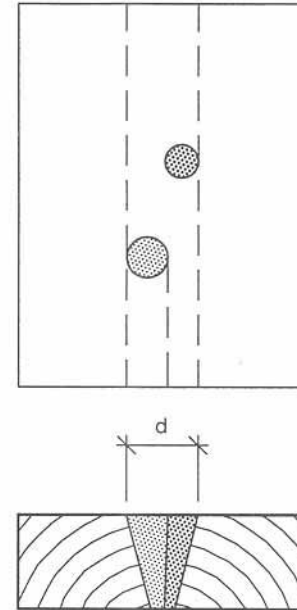


Figur 3: Måling av kvister
Figure 3: Measurement of knots

Knots

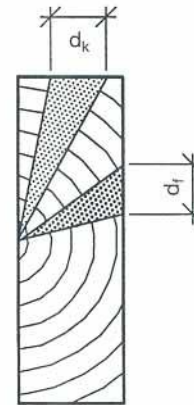


Kvistmål = d , gjelder også hvis kvistene er del av en kvistgruppe
Knots size = d , applies also if they are part of a knot cluster.



Figur 4: Overlappende kvister
Figure 4: Overlapping knots

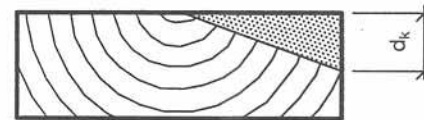
Knots



Kvistmål: flatsidekvist = d_f ; kantsidekvist = d_k
Knot size: Face knot = d_f ; Edge knot = d_k

Figur 5: Flatside- og kantsidekvist
Figure 5: Face knot and edge knot

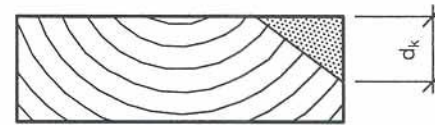
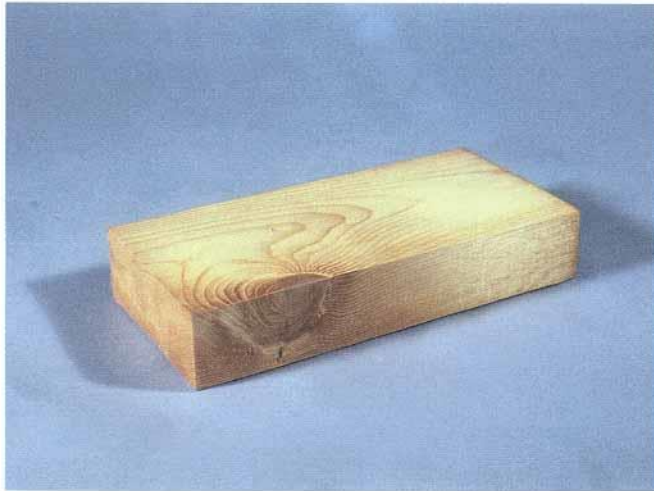
Knots



Kvistmål = d_k
Knot size = d_k

Figur 6: Hornkvist
Figure 6: Splay knot

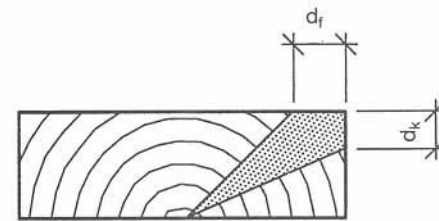
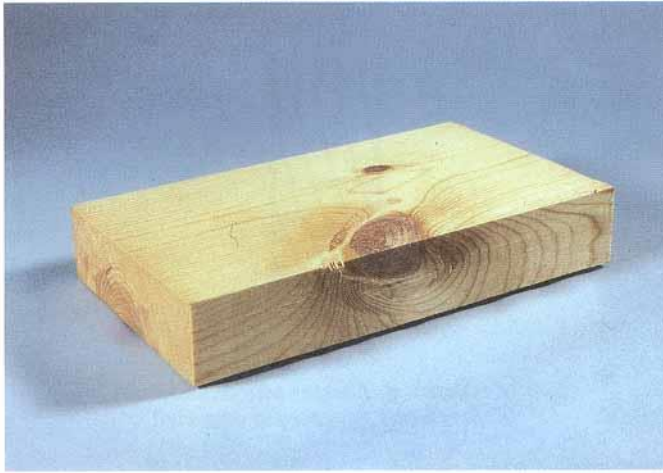
Knots



Kvistmål = d_k
Knot size = d_k

9
Figur 7: Utgående hjørnekvist
Figure 7: Arris knot on internal face

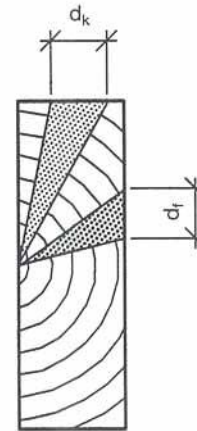
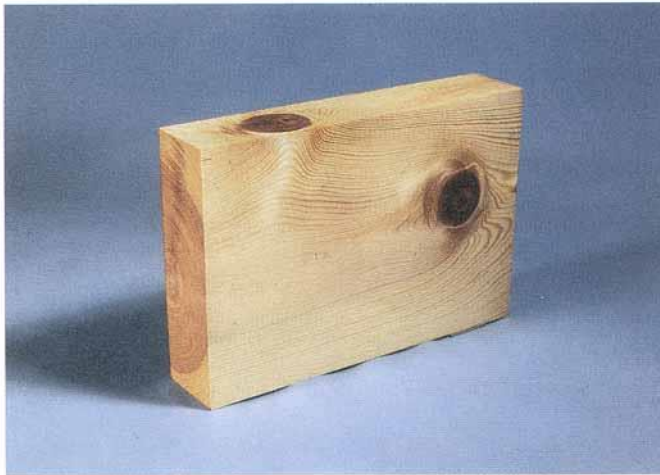
Knots



Kvistmål = $d_k + 1/2 d_f$
Knot size = $d_k + 1/2 d_f$

Figur 8: Inngående hjørnekvist
Figure 8: Through arris knot

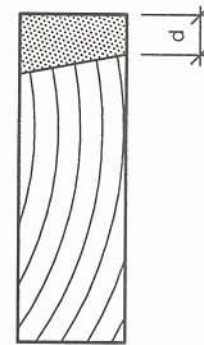
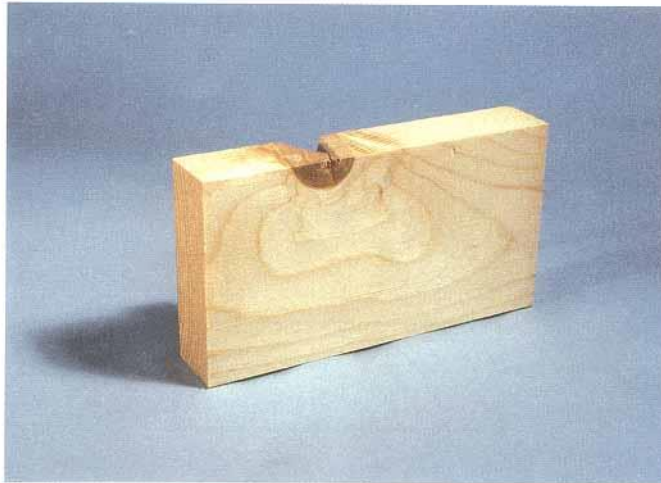
Knots



Kvistmål: flatsidekvist = d_f ; kantsidekvist = d_k
Knot size: Face knot = d_f ; Edge knot = d_k

Figur 9: Flatside- og kantsidekvist
Figure 9: Face knot and edge knot

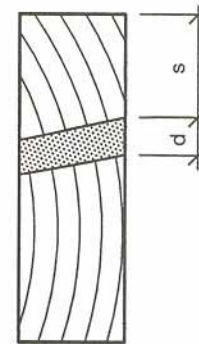
Knots



Kvistmål = d. Vurderes som kantsidekvist
Knot size = d. Evaluated as edge knot

Figur 10: Gjennomgående flatsidekvist
Figure 10: Through face knot

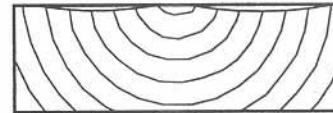
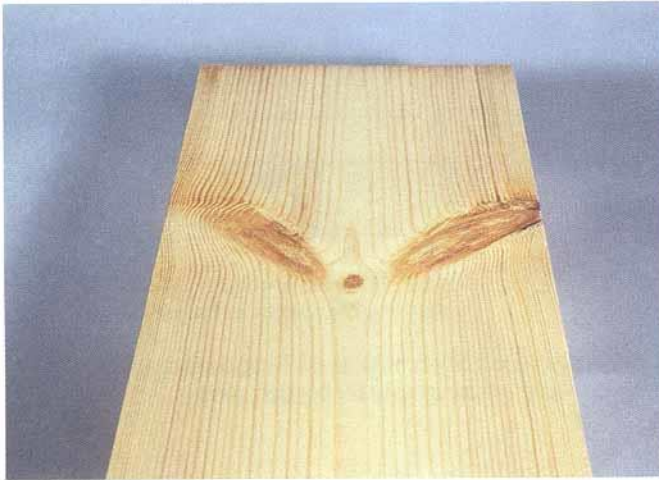
Knots



Kvistmål = d . Hvis s er mindre enn d , vurderes kvisten som kantsidekvist.
Knot size = d . If s is less than d , the knot is evaluated as edge knot

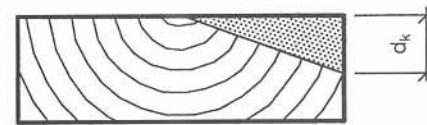
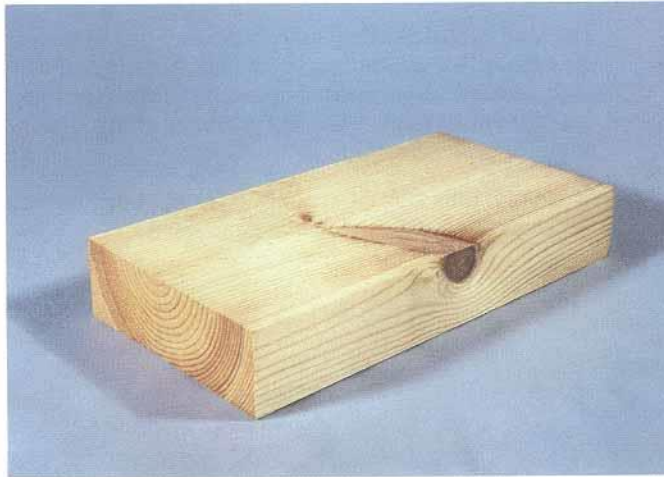
Figur 11: Gjennomgående flatsidekvist
Figure 11: Through face knot

Knots



Figur 12: Bladkvist
Figure 12: Shallow splay knot

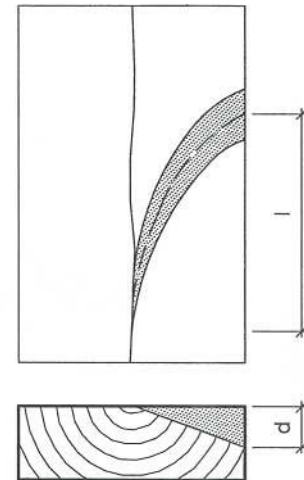
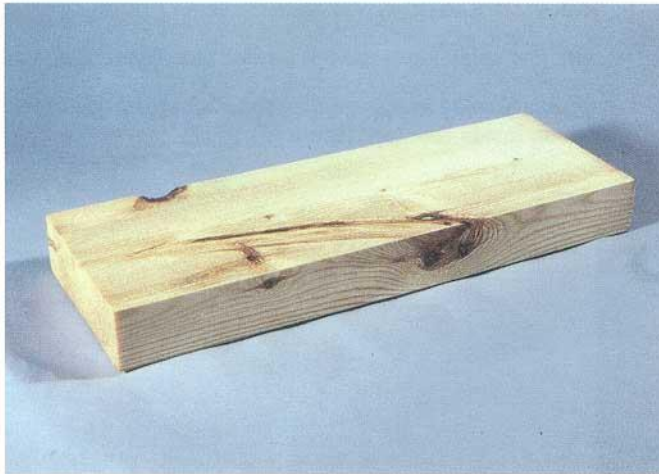
Knots



Kvistmål = d_k
Knot size = d_k

Figur 13: Hornkvist
Figure 13: Splay knot

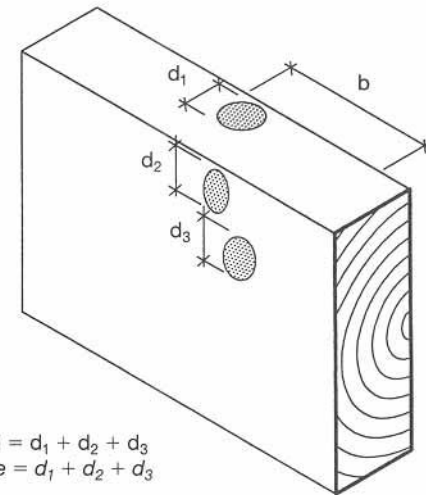
Knots



Kvistmål: diameter = d ; lengde = l
Knot size: Diameter = d ; Length = l

Figur 14: Gankvist (dvs. hornkvist med ekstremt liten vinkel på lengdeaksen)
Figure 14: Splay knot with an exceptionally small angle to length axis

Knots



Kvistmål = $d_1 + d_2 + d_3$
Knot size = $d_1 + d_2 + d_3$

Figur 15: Kvistgruppe
Figure 15: Knot cluster

Knots

Table 1: Quality specifications for pieces with thickness >45mm or with >70mm

Feature	T3	T2	T1	T0
See table 1 in the standard ÍST INSTA 142:2009				

Maximum sizes of knots

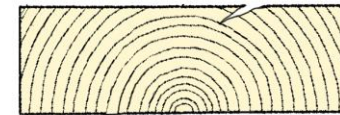
Thickness 50-100 mm

Material, thickness <45mm or <70mm

		Single knots in edge																			
Thickness		50				63				75				100							
Grade		T3	T2	T1	T0	T3	T2	T1	T0	T3	T2	T1	T0	T3	T2	T1	T0				
Knots size		17	25	40	50	21	32	50	63	25	38	60	75	33	50	80	100	knots in face			
		Knot cluster																T3	T2	T1	T0
With in mm	75	30	44	70	88	34	50	80	101	38	56	90	113	46	69	110	138	13	19	30	38
With in mm	100	34	50	80	100	38	57	90	113	42	63	100	125	50	75	120	150	17	25	40	50
With in mm	125	38	56	90	113	42	63	100	126	46	69	110	138	54	81	130	163	21	31	50	63
With in mm	150	42	63	100	125	46	69	110	138	50	75	120	150	58	88	140	175	25	38	60	75
With in mm	175	46	69	110	138	50	75	120	151	54	81	130	163	63	94	150	188	29	44	70	88
With in mm	200	50	75	115	150	54	82	125	163	58	88	135	175	67	100	155	200	33	50	75	100
With in mm	225	55	75	115	163	59	82	125	176	63	88	135	188	71	100	155	213	38	50	75	113

Checks

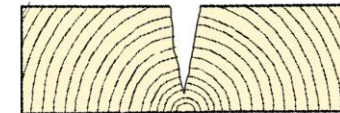
- Hair surface checks
- Ring checks
- Checks caused from drying
- Edge checks
- Checks, throughgoing



Yfirborðssprungur



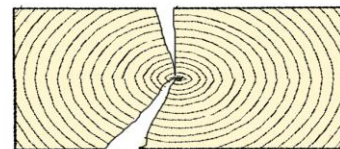
Hringsprungur



Þurrksprungur



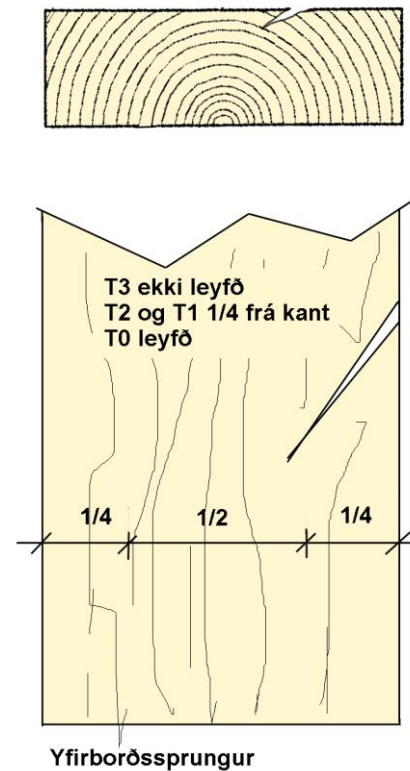
kantsprunga



Gegnumgangandi sprunga

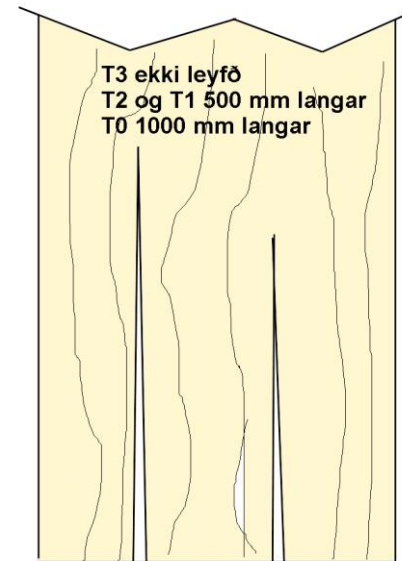
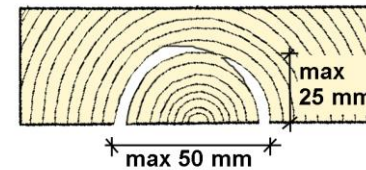
Surface Checks

- Fine separation of wood fibres along the grain originated from drying of the log
- T3 not permitted
- T2-T1 1/4 from edge
- T0 permitted



Ring shake

- Fissure following the line of a growth ring
- Max 50 mm wide
- Max 25 mm deep
- T3 not permitted
- T2-T1 500 mm long
- T0 1000 mm long



Hringsprungur

Checks

- Short, narrow and shallow fissure caused by drying
- T3 < 1/2 length of timber, not continuous nor in edge nor through going
- T2-T1 1/1 length of timber, not continuous nor through going and edge checks do not cover edge
- T0 not through going

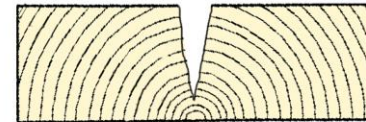
T3 1/2 timburl. ekki gegnumg. og í kanti



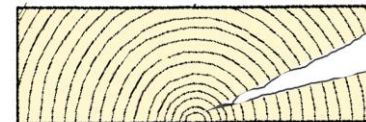
T2-T1 1/1 timburl. ekki samh. gegnumg. og kantsp ekki yfir brún



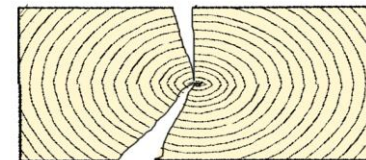
T0 ekki gegnumg.



þurrksprungur



kantsprunga



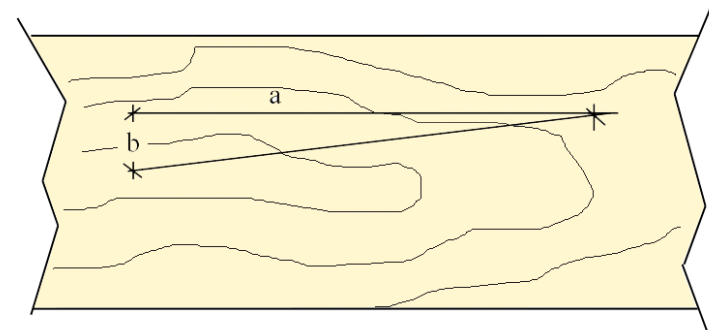
Gegnumgangandi sprunga

Check

Table 1: Quality specifications for pieces with thickness >45mm or with >70mm				
Feature	T3	T2	T1	T0
See table 1 in the standard ÍST INSTA 142:2009				

Slope of grain

- Divergence of the direction of the fibres from the longitudinal axis of the piece
- Slope of grain near knots

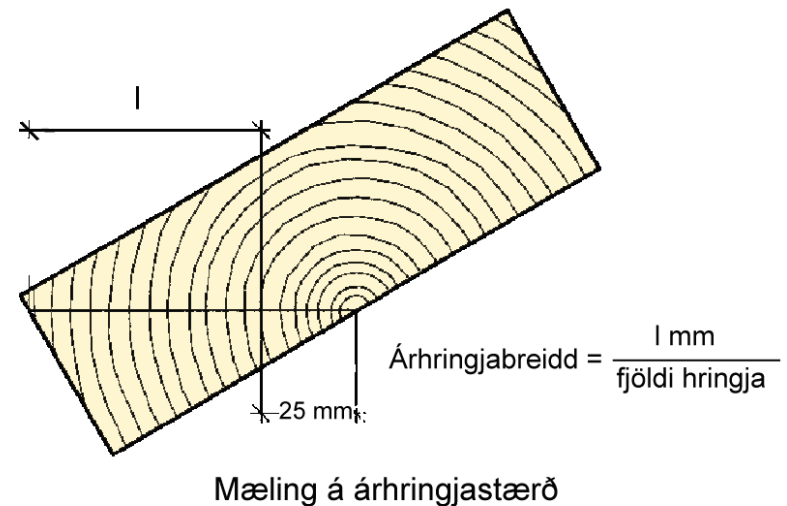


Trefjaskekkja = a/b

Mæling á trefjaskekkju

Width of annual ring

- Width of annual ring have influence on the strength
- Wide annual ring, less strength
- Narrow annual ring, more strength



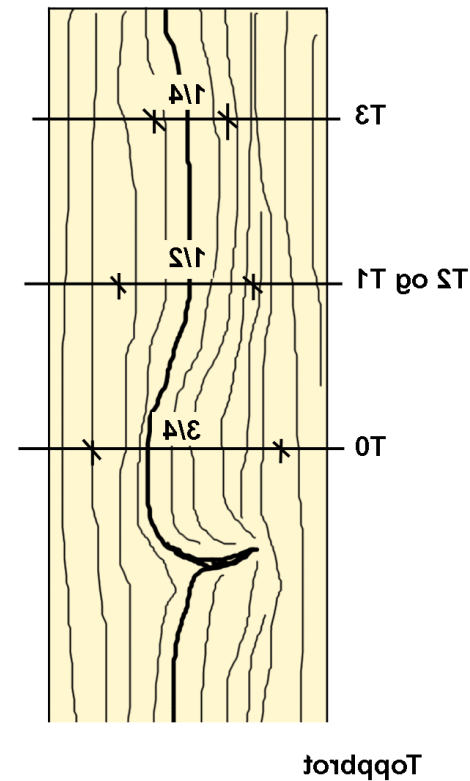
Slope of grain

Width of annual ring

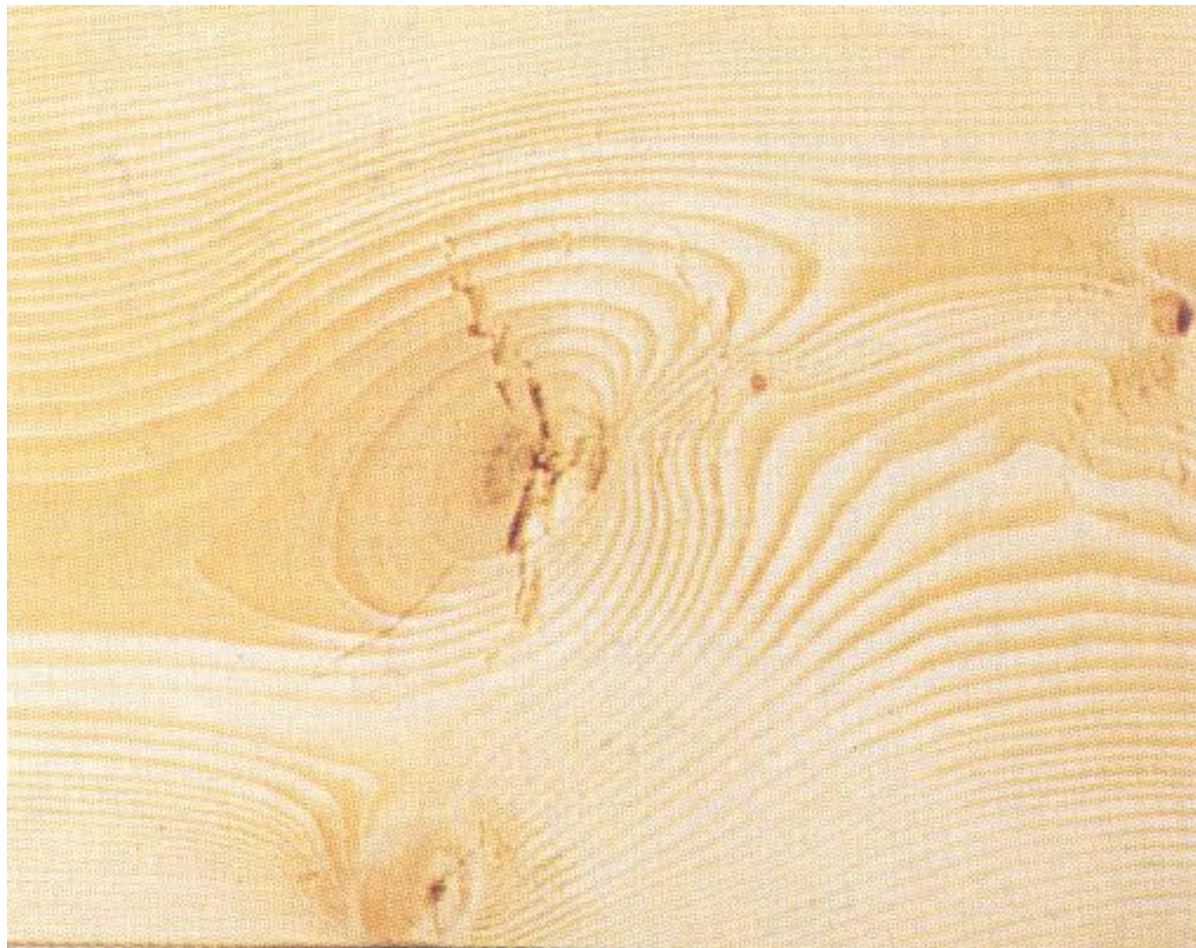
Table 1: Quality specifications for pieces with thickness >45mm or with >70mm				
Feature	T3	T2	T1	T0
See table 1 in the standard ÍST INSTA 142:2009				

Top rapture

- Grain deviation caused by damage to the top of the growing tree
- T3-1/4 of damage in center
- T2-1/2 of damage in center
- T1-1/2 of damage in center
- T0-3/4 of damage in center



Curly grain

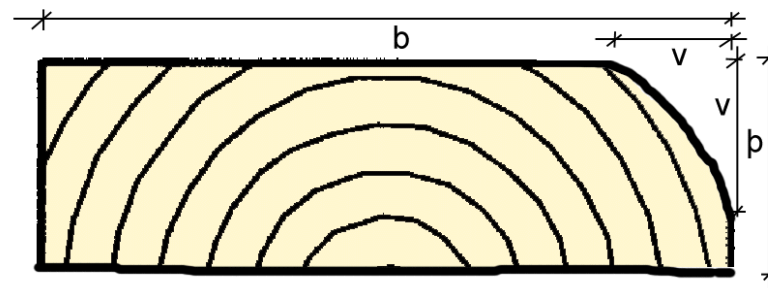


Top rupture

Table 1: Quality specifications for pieces with thickness >45mm or with >70mm				
Feature	T3	T2	T1	T0
See table 1 in the standard ÍST INSTA 142:2009				

Wane

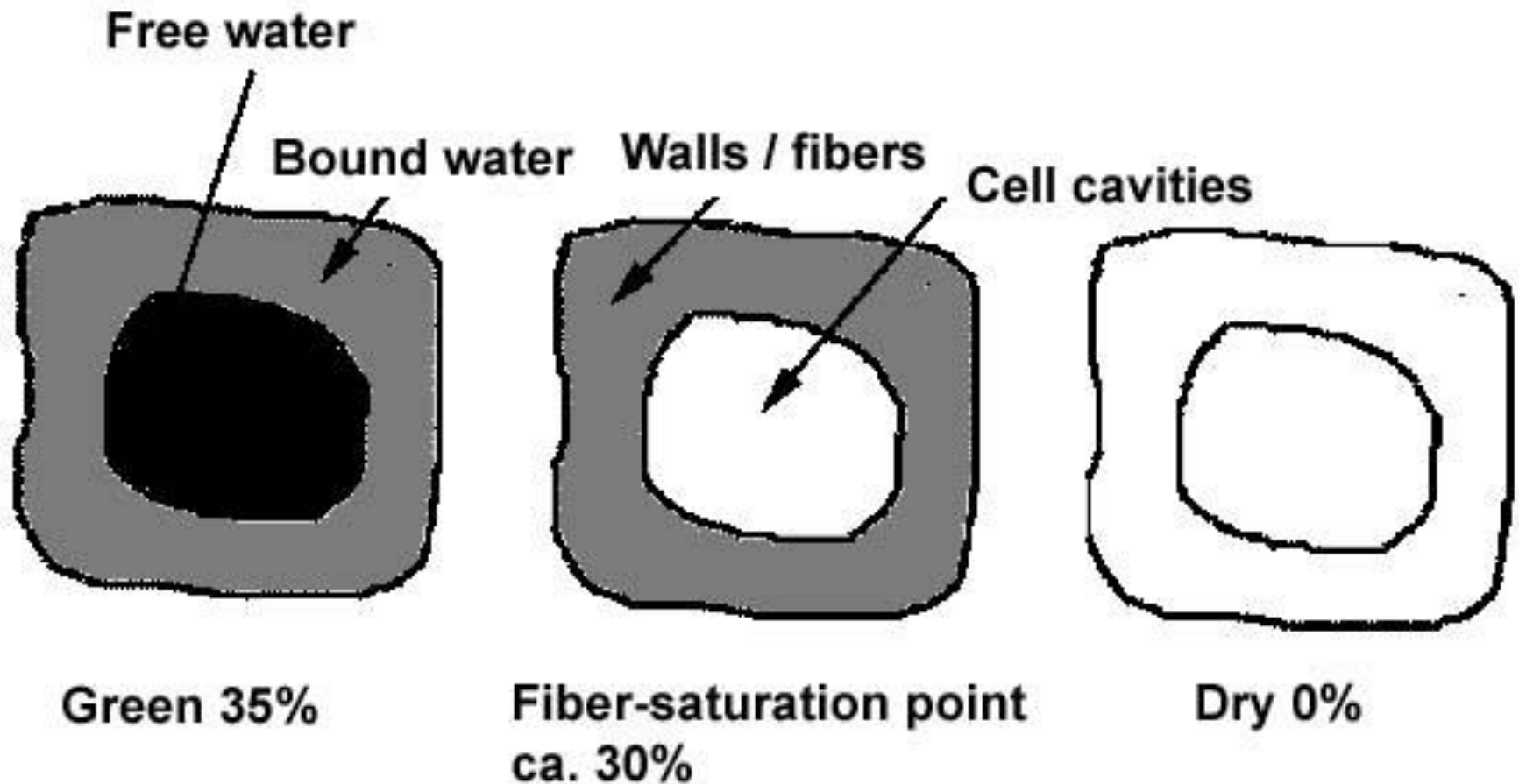
- Original rounded surface of a log, with or without bark, on any face or edge of sawn timber
- Measured on face and on edge
- T3, T2, and T1 in any cross-section at least 2/3 of any surface shall have been machined. T0 1/2.



Vankantur = hlutfallið milli b eða p og v
Dæmi: $p=50$ mm og $v = 25$ mm; Vankantur er 1/2 flötur

Mæling á vankanti

Free and bound water



Moisture classes (INSTA 141)

Classes	Thickness	Moisture content
Moisture class 8	≥ 25 mm	6,5 – 9,5 %
	≤ 25 mm	6,0 – 9,5 %
Moisture class 12	≥ 25 mm	10,0 – 14,0 %
	≤ 25 mm	9,0 – 14,0 %
Moisture class 18	≥ 25 mm	14,0 – 22,0 %
	≤ 25 mm	12,0 – 22,0 %
Moisture class S	All sizes	≤ 24 %

Deviation (ÍST EN 336)

- Reference moisture content is 20%
- Changes in moisture content of 1% refers to 0,25% of changes in size
- Example: from 24% to 20% = 4% change or 1% difference.
100 mm becomes 99 mm

Deviation (ÍST EN 336)

Tolerance class 1

a) For thicknesses and widths ≤ 100 mm: $\begin{pmatrix} +3 \\ -1 \end{pmatrix}$ mm

b) For thicknesses and widths > 100 mm: $\begin{pmatrix} +4 \\ -2 \end{pmatrix}$ mm

Tolerance class 2

a) For thicknesses and widths ≤ 100 mm: $\begin{pmatrix} +1 \\ -1 \end{pmatrix}$ mm

b) For thicknesses and widths > 100 mm: $\begin{pmatrix} +1,5 \\ -1,5 \end{pmatrix}$ mm

Deviation (ÍST EN 336)

Length:

- Same as the lowest value
- Negative deviations are not permitted
- If over length is likely to be a problem a limit should be placed in the contract at the time of purchase

Deviation (ÍST EN 1309)

Width and depth:

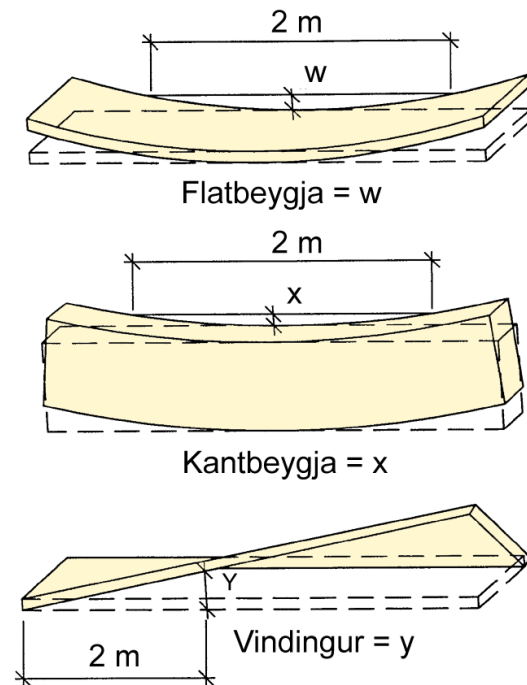
- Measured at right angles to the face or edge
- Measured at three points
- Closest to end 150 mm
- Minimum measurement stands, given in mm
- Length measured at shortest length, measurement written in meters with two digitals

Geometrical features

Table 2: Geometrical features				
Feature	T3	T2	T1	T0
See table 2 in the standard ÍST INSTA 142:2009				

Distortion

- Distortion is linked with moisture content and can therefore change with time
- **Three changes of forms:**
- Bow
- Spring
- Twist



Distortion

Table 3: Maximum distortion in mm over 2 m of length

Fature	T3	T2	T1	T0
--------	----	----	----	----

See table 3 in the standard ÍST INSTA 142:2009

Distortion is linked with moisture content and can therefore change with time.

Distortion is often linked to the dimensions of timber

Table 4: Maximum distortion in mm over 2 m of length

Fature	T3	T2	T1	T0
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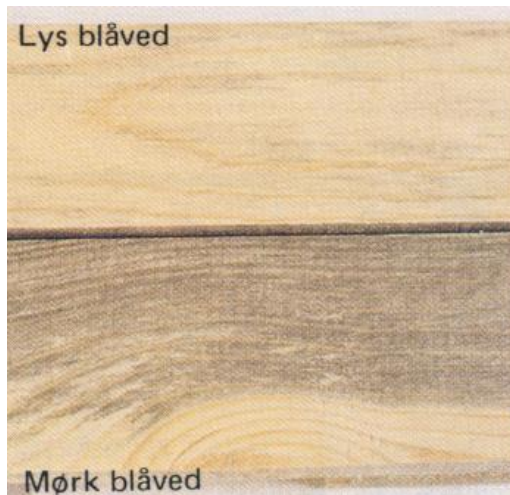
See table 4 in the standard ÍST INSTA 142:2009

Distortion is linked with moisture content and can therefore change with time.

Distortion is often linked to the dimensions of timber

Biological features

Blue stain



Dot



Rot

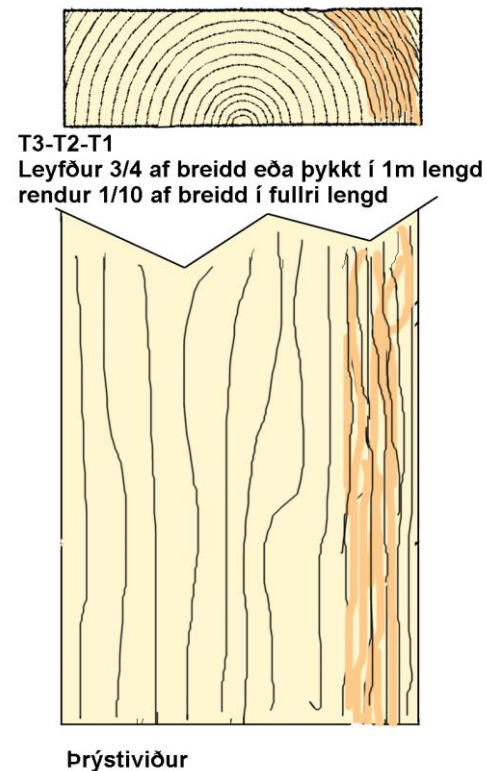


Biological features

Table 5: Biological features				
Feature	T3	T2	T1	T0
See table 5 in the standard ÍST INSTA 142:2009				

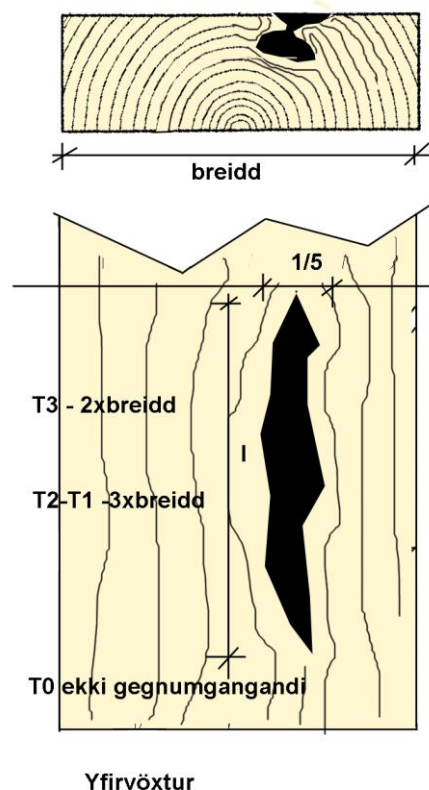
Compression wood

- Reaction wood formed typically on lower sides of branches and of leaning or crooked stems of softwood trees
- Bending material
- Permitted 3/4 of width of 1m
Narrow stripes 1/10 of width are accepted in full length, even passing through from face to face, but not so if close to edge



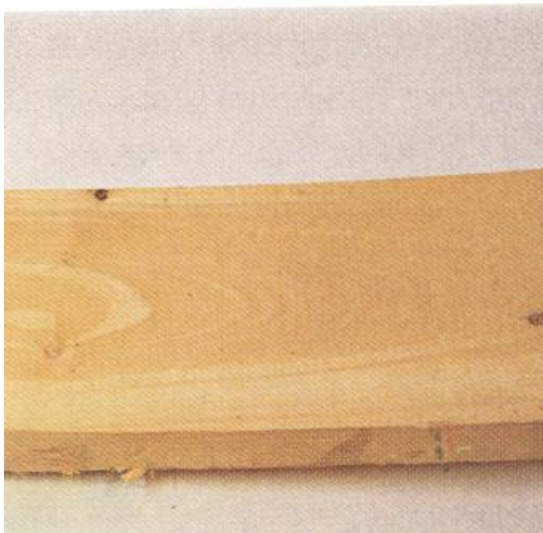
Bark pocket / Rind gall

- Bark that is partly or wholly enclosed in wood
- T3 - width of rind gall $\frac{1}{5}$ of width and length $2 \times$ width
- T2-T1 - $3 \times$ width
- T0 - permitted but not through going

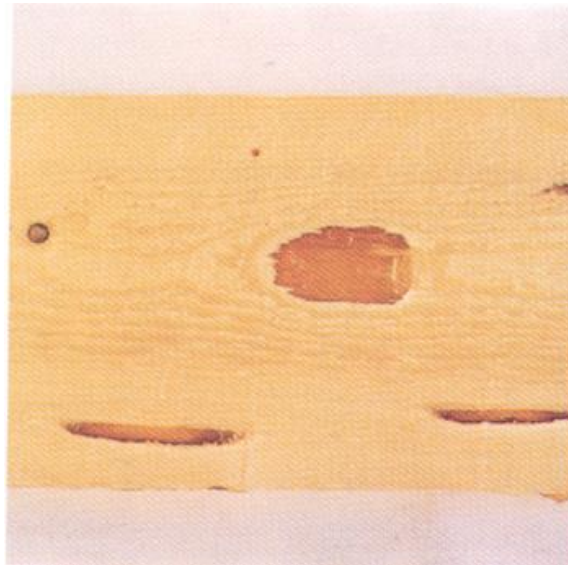


Other features

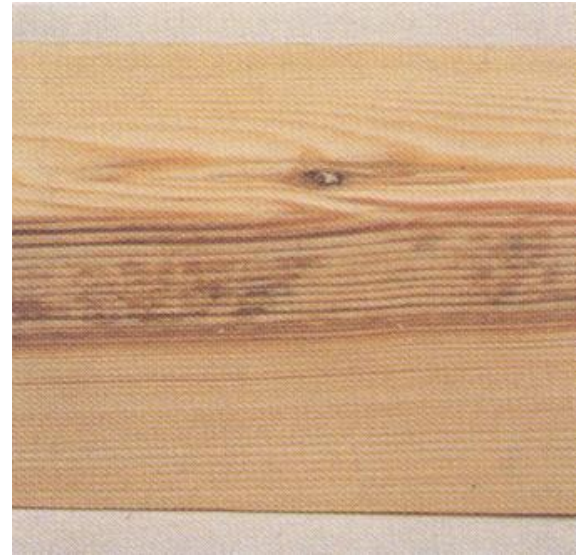
Compression wood



Resin pockets

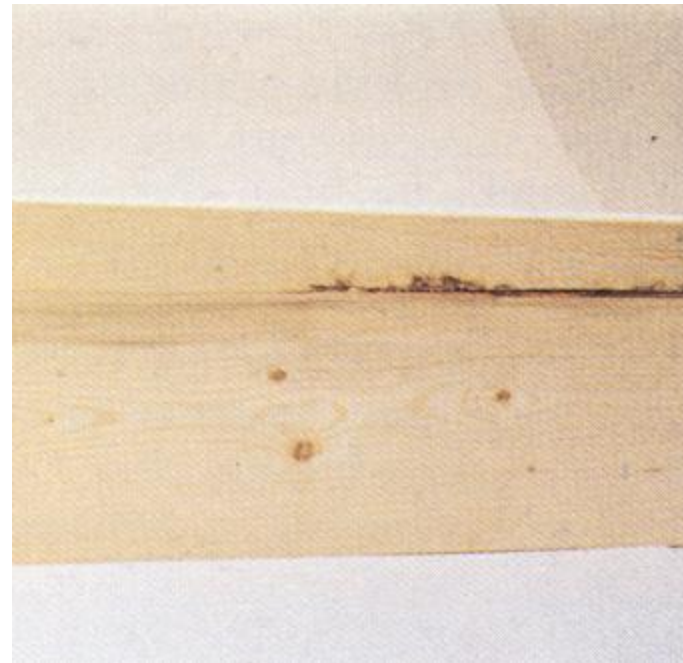


Resinous / Pitch wood



Other features

Ring gall



Other features

Table 6: Other features				
Features	T3	T2	T1	T0
See table 6 in the standard ÍST INSTA 142:2009				

Smaller timber

9.5 Limitations for strength reducing characteristics for timber with thickness < 45 mm and width < 70 mm down to $25 \text{ mm} \times 50 \text{ mm}$

Smaller timber

Tabell 7: Kvalitetskrav for trelast med tykkelse < 45 mm og bredde < 70 mm ned til 25 mm × 50 mm
Table 7: Quality specifications for pieces with thickness < 45 mm and width < 70 mm down to 25 mm x 50 mm

Virkesfeil/Feature	T2	T1
See table 7 in the standard ÍST INSTA 142:2009		

Smaller timber

Tabell 8: Geometriske virkesfeil/*Table 8: Geometric features*

Virkesfeil/ <i>Feature</i>	T2	T1
See table 8 in the standard ÍST INSTA 142:2009		

Smaller timber

Tabell 9: Biologiske virkesfeil/*Table 9: Biological features*

Virkesfeil/ <i>Feature</i>	T2	T1
See table 9 in the standard ÍST INSTA 142:2009		

Smaller timber

Tabell 10: Andre virkesfeil/*Table 10: Other features*

Virkesfeil/ <i>Feature</i>	T2	T1
See table 10 in the standard ÍST INSTA 142:2009		