



NLGA INTERPRETATIONS

PART 2

NATIONAL LUMBER GRADES AUTHORITY (NLGA) INTERPRETATIONS

1.0 GENERAL



Unless otherwise specified the following NLGA Interpretations shall apply to all portions of the NLGA Grade Rule other than the NGR grades.

The limitations on knot sizes and other characteristics governing strength shall not be exceeded.

1.1 BEVEL SAWING

The loss of wood shall not exceed the equivalent of either the wane or skip permitted. Limited to occasional pieces.

1.2 CHIP AND SAW CHANNELS (RABBETED EDGE)



In rough lumber, such channels, tracking or stepping marks must not exceed $\frac{1}{16}$ " variation from the intended line of cut. Deeper channels shall not exceed the equivalent of either the wane or skip permitted, and shall be limited to occasional pieces. Channels which are equivalent to the full length wane provisions of a given grade shall be dropped to the next lower grade and limited to occasional pieces.

1.3 GRUB AND TEREDO HOLES

Grub and Teredo holes are evaluated on an equivalent smaller basis; Twelve $\frac{1}{4}$ " grub or teredo holes shall be accepted as an equivalent to a 1" hole. Grub and Teredo holes shall be counted on the worst face, and there shall be no increase permitted in concentrated areas.

1.4 "HIT & MISS" SKIP

The "Hits" shall be plainly visible surfaced areas approximately $\frac{1}{2}$ the width of the piece or more and 2" or more in length. "Hits" on the narrow face shall be completely across the narrow face and 2" or more in length. There shall be a minimum of one hit per 4 lineal feet and no piece shall have less than two "hits".



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1.5 PIN HOLES

Handle on an equivalent basis - use judgement based on the general appearance of the piece.

a) Limited - Approximately 30 per square foot. -
Concentrated area - 50% more if balance of piece better
(25% more in Clears).

b) Scattered - Approximately 15 per square foot.
- Concentrated area - as per a) above.

1.6 SKIPS ON FACE OF RESAWN BOARDS

Skips are permitted on the surfaced face of resawn boards as limited in the rules for the various grades, independent of the variation in thickness permitted in resawn boards.

1.7 SPLITS

Unless otherwise specified, the length of a split on a face shall be limited to the length as stated in the grade for the face under consideration.

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2.0 SPECIFIC GRADE INTERPRETATIONS



2.1 PARA. 108 INDUSTRIAL CLEARS

2.1.1 Faces Graded

For pieces 5" & narrower - the best face includes both edges.

For pieces 6" & wider - the best face includes one edge.

(A grader may combine the face with the edge which yields the highest grade, i.e. best face and worst edge).

2.1.2 Basic Size

The description of characteristics permitted in the grades are based on a piece 8" wide by 12' long (96 surface units - 96 SU). Larger pieces may permit more characteristics and smaller pieces permit fewer characteristics.

Example

A piece 4" x 12' (48 surface units) would be one half (1/2) the basic size and thus would permit only one half (1/2) the listed characteristics.

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2.1.3 Calculating Characteristics Permitted in Pieces Other Than Basic Size

To determine the number of characteristics permissible on the face of a piece that is other than basic size (96 surface units) use the following formula:

$$\frac{\text{Surface Units (SU) of Piece}}{96 \text{ SU}} \times \text{Number of Characteristics Permitted in Basic Size} = \text{Number of Characteristics Permitted in Piece}$$

Example:

In "D" clear, four - 1" knots are permitted. In a piece of 2 x 6 - 12':

$$\frac{72 \text{ SU (6 x 12)}}{96 \text{ SU (8 x 12)}} \times 4 \text{ knots per basic size} = 3 \text{ - 1" knots permitted in a piece this size}$$

When the calculation gives an answer such as 2.5 then the grade permits characteristics whose combined total is equal to two (2) full size and 1 half size (.5) characteristic, 3 in total.

Where characteristics are permitted to be equivalent smaller, the number of characteristics may be increased provided their combined size does not exceed the combined size of the characteristics allowed and each individual characteristic is less than the maximum size permitted.

Example:

The face of a "D" Clear of basic size, 4 - 1" knots or 8 equivalent smaller knots are permitted.

For a piece 6" x 10' (60 SU):

$$\frac{60 \text{ SU (6 x 10)}}{96 \text{ SU (basic size)}} \times 8 \text{ - } \frac{1}{2} \text{ " knots as equivalent smaller} = 5 \text{ - } \frac{1}{2} \text{ " knots or 2.5 total inches}$$

Therefore, any combination of five knots totalling 2¹/₂" or less may be permitted as long as no single knot exceeds the maximum knot size of 1". (ie. 1 - 1" & 2 - ³/₄" or 1 - ⁷/₈" & 2 - ³/₄" or 5 - ¹/₂" , etc.

The grade limit for knots is eight (8) equivalent smaller per basic size, the knots may **not** be broken down further; i.e. you could **not** take 10 - ¹/₄" knots as equivalent.

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2.1.4 Equivalent Characteristics

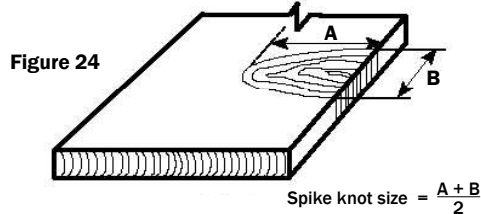
In "C" Clear & Better, characteristics such as knots (in "C" Clear only), pin holes, pockets and streaks are restricted to one or the other, or an equal combination: **ie.** - A "C" Clear may contain: 2 small knots; or 1 small knot & 2 small pockets; or 4 pin holes and 1/2 a small streak; or an equivalent combination of characteristics. A "D" Clear permits all characteristics listed to occur in the same piece.

2.1.5 Knots

2.1.5.1 Round and Oval Knots: are measured by averaging the largest and smallest diameters on the face they occur.

2.1.5.2 Irregular Knots: are measured as the average dimension of the smallest rectangle which will enclose the knot.

2.1.5.3 Spike Knots: are measured by adding the length of the knot and the width of the knot at its widest point and taking the average. (Figure 24)
(ie. $(5" + 1") \div 2 = 3"$ knot).



Example of Knot Allowances:

- Based on a **basic size** piece.
- On the face of a "C" Clear, 3 knots whose combined size does not exceed $1\frac{1}{2}"$ are permitted, providing no knot is greater than $\frac{3}{4}"$. These knots must be sound and tight.
- The face of a "D" Clear permits up to 8 knots whose combined size shall not exceed 4", of which none shall exceed 1". These knots may be unsound, but they must be fixed (Para. 718r).

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- The back of "D" Clear permits characteristics larger **or** more numerous knots. Thus the back may contain up to 8 knots totalling 5" of combined knots provided no knot exceeds 1¹/₄" **or** may permit up to 10 knots as more numerous totalling 5" of combined knots provided no knot exceeds 1".

2.1.6 Pockets

Pockets are restricted by their individual size and the combined length in inches. The total length of pockets permitted is based on the length of a 1/8" wide pocket in each of the pocket size classifications.

If the grade permits 4 small pockets, this means **any** number of pockets whose combined length in inches is equal to that of 4 small (4 x 4" = 16") is permitted. No pocket shall exceed the maximum individual size specified for that classification of pocket.

A pocket may be 1/16" x 6" and would be acceptable as a small pocket, but as in the above example the total length allowance shall not exceed 16".

Example 1: A 2 x 8 - 12' (Basic Size) "C" Clear permits 4 small pockets:

$$\begin{array}{rcccl} \mathbf{4} & & \mathbf{4} & & \mathbf{16"} \\ \text{(No. of small} & \mathbf{X} & \text{per } \frac{1}{8}" & = & \text{(of pockets} \\ \text{pockets allowed)} & & \text{pocket)} & & \text{permitted)} \end{array}$$

The grade permits any number or combination of small pockets (1/4" x 2" or 1/8" x 4" or 1/16" x 6") whose combined length is less than 16".

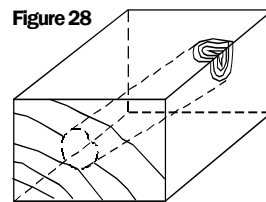
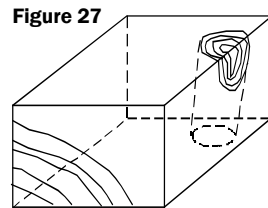
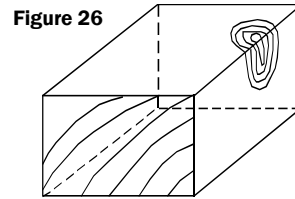
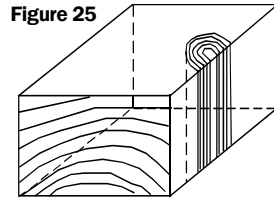
Example 2: A 2 x 6 - 12' (3/4 of Basic Size) on the face of a "C" Clear permits:

$$\begin{array}{rcccl} \mathbf{3/4} & & \mathbf{4} & & \mathbf{4} & & \mathbf{12"} \\ \text{(fraction} & \mathbf{X} & \text{(No. of small} & \mathbf{X} & \text{(per } \frac{1}{8}" & = & \text{(of pockets} \\ \text{of basic} & & \text{pockets} & & \text{pocket)} & & \text{permitted)} \\ \text{size)} & & \text{permitted)} & & & & \end{array}$$

The grade permits: **Six** - 1/4" x 2" pockets; or **two** - 1/16" x 6"; or **twelve** - 1/8" x 1"; or **one** - 1/16" x 6" + **one** - 1/8" x 4" + **one** - 1/4" x 2"; etc.

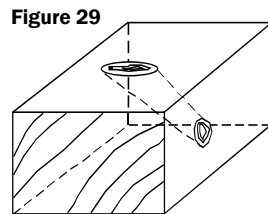
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Knot Measurement for Para. 108 Industrial Clears

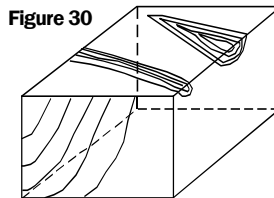


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Single knots (Figures. 25, 26, 27 & 28) - measure as average size on the wide face. The width of the knot on the edge cannot exceed the allowable knot size. Disregard the edge size in "D" Clear.



Any amount of wood between the knots and they are counted as two knots. On the wide face measure average diameter. On the narrow face measure the width only.



Single knot - Measure as average of the length and widest width of the knot.

2.1.7 Skips

Skips, 1/2 width or less, they may be accepted twice as long.



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2.1.8 **Wane**

Wane on the face and the edge of "D" Clear is evaluated separately. "D" Clear wane on the face may be equivalented for width and length (total area governing). Do not exceed the thickness allowance unless the wane will be accepted for the back.

50% more wane on the back of "D" Clear means a full 50% increase in allowable wane in face area or in depth or equivalent combination of smaller wane increases in both.

2.1.9 **Machine Burn**

Machine Burn is acceptable providing it is not deeper than the torn grain permitted in the grade and the discoloration does not exceed the following conditions:

- "B & Btr" - barely visible. Can be removed with a light sanding to be suitable for a natural finish.
- "C" Clear - colour is not controlled. Only slightly felt depth which is suitable for paint finishes.
- "D" Clear - colour is not controlled. Depth can be readily felt.



2.1.10 **Cut-outs**



If a 3" cut-out does not completely remove a characteristic, the remaining amount of the characteristic must be permitted in the grade of "D" Clear.

This clause can be applied to eliminate or reduce a single oversize characteristic or to reduce the total number of characteristics to that allowed.

2.2 **Para 112 SELECTS**

Any piece of lumber in the Select grades showing a serious combination of the listed characteristics which might impair its intended use is excluded from the grade.

Bow - The following amounts of bow are permitted in the various grades:

- 4/4 - Twice as much as crook permitted for 8" widths.
- 5/4 & 6/4 - 1¹/₂ times as much as crook permitted for 8" widths.
- Measure laying flat and natural with bow up.

2.2.1 **Knots in Para 112 SELECTS**

It is recommended that the number and size of knots be reduced when in combination with other characteristics that detract from the overall appearance of the piece.

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The following charts give the approximate number of $\frac{1}{4}$ " knots that are permitted in each size and grade.

Up to $\frac{3}{4}$ " count 3, up to $\frac{1}{2}$ " count 2, up to $\frac{1}{4}$ " count 1.

B & Btr - Allows two $\frac{1}{2}$ " knots or as equivalent, four $\frac{1}{4}$ " knots, in the basic size. That is one $\frac{1}{4}$ " knot per 24 units.

B & Btr		No. of $\frac{1}{4}$ " Knots								Maximum Size Knot Permitted
Width	Length									
	6'	8'	10'	12'	14'	16'	18'	20'		
4"		1	1	2	2	2	3	3	$\frac{3}{8}$ "	
6"	1	2	2	3	3	4	4	5	$\frac{1}{2}$ "	
8"	2	2	3	4	4	5	6	6	$\frac{1}{2}$ "	
10"	2	3	4	5	5	6	7	8	$\frac{1}{2}$ "	
12"	3	4	5	6	7	8	9	10	$\frac{5}{8}$ "	

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C Select - Allows two $\frac{3}{4}$ " knots or as equivalent, six $\frac{1}{4}$ " knots, in the basic size. That is one $\frac{1}{4}$ " knot per 16 units.

C Select		No. of $\frac{1}{4}$ " Knots								Maximum Size Knot Permitted
Width	Length									
	6'	8'	10'	12'	14'	16'	18'	20'		
4"	1	2	2	3	3	4	4	5	$\frac{1}{2}$ "	
6"	2	3	3	4	5	6	6	7	$\frac{5}{8}$ "	
8"	3	4	5	6	7	8	9	10	$\frac{3}{4}$ "	
10"	3	5	6	7	8	10	11	12	$\frac{7}{8}$ "	
12"	4	6	7	9	10	12	13	15	1"	

D Select - Allows four $\frac{3}{4}$ " knots or as equivalent, twelve $\frac{1}{4}$ " knots in the basic size. That is one $\frac{1}{4}$ " knot per 8 units.

D Select		No. of $\frac{1}{4}$ " Knots								Maximum Size Knot Permitted
Width	Length									
	6'	8'	10'	12'	14'	16'	18'	20'		
4"	3	4	5	6	7	8	9	10	$\frac{1}{2}$ "	
6"	4	6	7	9	10	12	13	15	$\frac{5}{8}$ "	
8"	6	8	10	12	14	16	18	20	$\frac{3}{4}$ "	
10"	7	10	12	15	17	20	22	25	$\frac{7}{8}$ "	
12"	9	12	15	18	21	24	27	30	1"	



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Knots should be spread out over the entire width and length of the piece.

Maximum characteristics should not be in combination within the same piece - a clear appearance must be evident.

Basic Size = 1" x 8" x 12' 96 units.

2.2.2 Para 112b. B & BETTER (SUPREME)

Wane - If maximum - should be held to pieces that are otherwise high grade. May extend across the reverse face only for approximately 1/12 the width.

Knots - Must be sound and tight, and only in very high grade pieces and scattered over entire board. (See chart on previous page for breakdown).

2.2.3 Para 112c. C SELECT (CHOICE)

Pin Holes - 1 in lieu of each pitch or bark pocket permitted.

Knots - Must be sound and tight and well scattered throughout piece.

- One fixed pin knot is permitted in 8" & wider x 12' pieces in otherwise high grade pieces (see chart on previous page for number).

2.2.4 Para 112d. D SELECT (QUALITY)

Pin Holes - 2 in lieu of each pitch or bark pocket permitted.

- on reverse face: scattered in otherwise C Select & Btr type pieces.

Reverse Face - Common back.

2.3 Para 113 COMMONS

Any piece judged to contain a serious combination of characteristics, even though some of the characteristics may not be limiting by themselves, is excluded from the grade. Likewise, an otherwise high grade piece may be placed in a grade even though one or two of its characteristics may slightly exceed the limitation described in the rules.

2.3.1 Para 113a. NO. 1 COMMON (COLONIAL)

Checked Knots - An occasional red knot showing a barely perceptible check.

Black Knots - Should be held to 4 for each 12' of length in otherwise high grade pieces.



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- Pin Holes - 6 scattered in a 1" x 8" x 12'
Roller Check - A light roller check on back, not to exceed 2' or 1/8 the length whichever is less.



2.3.2 **Para 113b. NO. 2 COMMON (STERLING)**

- Wormholes - 1 small not through - occasional pieces.
Slough Knots - Up to 3 equivalent smaller not over 1/2 the thickness of the piece.
Branch or Spike Knots - Should be held to approximately 1/3 the width of the piece and approx. 1 1/4" wide - 3 per 12'. Must be smooth and sound.

2.3.3 **Para 113c. NO. 3 COMMON (STANDARD)**

- Knots Broken in Dressing - Equivalent to holes.
Breaks on Edge - Equivalent to holes. If the breaks show length-wise splitting, the aggregate of the splits shall not exceed 1/16" wide and the width of piece in length.

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- Branch or Spike Knots - 1/2 width of piece approx. 4 in 12'.
- 

2.3.4 **Para 113d. NO. 4 COMMON (UTILITY)**

- Honeycomb - Firm - 100%. Not Firm - equal to the unsound wood permitted.
Loose Knots and /or Holes - 3 of maximum size per 12'. Any number of equivalent smaller knots or holes provided their total size does not exceed the maximum amount of knot hole/loose knot permitted.
Unsound Knots - Restricted in size only. Must not exceed the size of loose knots permitted.
Shake - Scattered full length. The piece shall hold together in normal handling. Single shakes shall be held to 1/2 the length in otherwise high-line pieces.
Skips - In otherwise high-line pieces, skips may also include scantness up to 1/8" in thickness for 2', maximum 2 occurrences per 12' of length.
Splits - Limited to 1/3 the length on face and 1/2 the length on back.

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- Unsound Wood - The maximum size of spots of unsound wood shall be held to the area of the fixed knot allowed and the total area of all spots shall not exceed $\frac{1}{4}$ the face area.
- Wane - On back - wane may go through the thickness, however, the through portion must not exceed the area of the hole allowed. May extend across the width if equal to the skip allowed and no longer in length than twice the width of the piece.

2.3.5 Para 113e. NO. 5 COMMON (INDUSTRIAL)

- Knots & Holes - Approximately 75% of cross section in size - providing that piece will not break under ordinary handling.

Unsound Wood - Approximately 75% of cross section - must have fastening surface sufficient to hold.

Shake - Full length - piece must be usable.

Wane - Through wane equivalent to holes allowed.
- Reverse side - $\frac{1}{8}$ " deep full width.

White Speck

& Honeycomb - Not restricted - must have fastening surface sufficient to hold.

Skip - $\frac{1}{4}$ " in thickness and $\frac{1}{2}$ " in width in otherwise #3 Common & Btr type pieces; and $\frac{1}{8}$ " in thickness and $\frac{1}{2}$ " in width in otherwise NO. 4 or NO. 5 Common type pieces.

Splits - Two or three - $\frac{1}{2}$ the length - longer if fewer in number - as long as piece is usable.

A serious combination of the above irregularities is not permissible. Pieces must be usable full length.

2.4 Para 114 BOARDS

2.4.1 Para 114a. Select Merchantable Boards

Seasoning

Checks - Any number of medium checks, none through.

Broken Tongue
or Lap - 6"

Pitch Pockets - Not limited as to number. Should be well distributed and not open through.

Skips - 20% of any face - occasional pieces.

Mismatched

Lumber - $\frac{1}{32}$ " mismatch.

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- Star Checked
Knots - May be accepted, if tight.
Pin Holes - Limited (30 per square foot).

2.4.2 Para 114b. Construction Boards

- Pitch Pockets - Not limited as to number, but should be well distributed.
Skips - 20% of face and edges in occasional pieces
Mismatched Material - $\frac{1}{32}$ " mismatch
Broken Tongue or Lap - 1'

2.4.3 Para 114c. Standard Boards

- Shake - Individual through shakes may be accepted up to $\frac{1}{4}$ the length of the piece but must not run into the edge in such a manner that the piece will break during normal handling. On the ends, shake is limited the same as splits. **2**
Unsound Wood - On reverse face - equivalent to Utility & must not be through.
Mismatched Lumber - $\frac{1}{32}$ " mismatch.
Medium Skips - Hold to two medium in 12' of length on face side.
Wane - Utility wane on reverse face, limited to $\frac{3}{4}$ the thickness.
Broken Tongue or Lap - 2'

2.4.4 Para 114d. Utility Boards

- Unsound Wood - Spots $1\frac{1}{2}$ " wide by nominal width of piece - 1 per 2' or equivalent 1 streak $\frac{1}{3}$ width x 10% of length.
Shake - Separated through shakes may be permitted full length of piece if adequately bonded for ordinary handling without coming apart.
Broken Tongue or Lap - 3'
Honeycomb - Must be firm. Pieces must hold nails.
Mismatched Lumber - $\frac{1}{16}$ " mismatch.

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2.5 Para 116, 117 & 118 BOARDS

2.5.1 Pitch - Red Pine

The term "Due to the inherent nature of the species, allowable pitch for red pine is much greater" is interpreted to mean:

- Natural pitch streaks surrounding knots are disregarded.

2.5.2 Para 117b. D Select

Reverse face of a D Select - Para. 118, 3 Common Type Back

2.6 Para 118 COMMONS

Knot descriptions are given in Para. 718. Because most Board lumber is produced from the inner portion of the log, the size of a knot may not be the determining factor in establishing a particular grade. Therefore, some pieces of a lower grade may have smaller knots than some pieces of a higher grade. It is generally the character or condition of the knot and not the size that determines the grade of the piece.

Except for limitation of the grade, spike knots are permitted in all grades of Board lumber less than 6/4 in thickness providing the knot or knots have not more effect than the other knots permitted.

2.7 Para 128 MACHINE GRADED LUMBER

2.7.1 Visual Quality Level (VQL) Requirements

Knots partially or wholly at the edges of the wide faces, shall not occupy more of the net cross-section than those listed in NLGA Para. 128 for Machine Graded Lumber (MGL) and each knot at the edge of the wide faces is treated separately including knots in the same cross-section. Knots in the untested portion of lumber are described in Para. 128.

2.7.1.1 Edge Knot Conditions:

For a knot to be considered an Edge Knot, one of the following conditions shall be present:

- When a wide face knot overlaps for **more than** 1/2 the thickness (**Figure 31**).

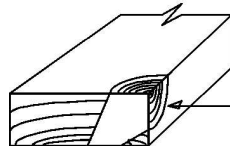


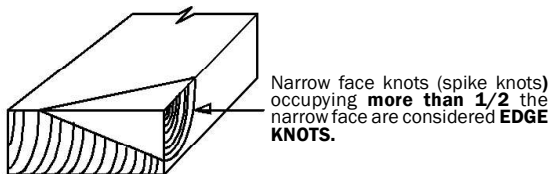
Figure 31

Knots overlapping **more than** 1/2 the narrow face are considered as **EDGE KNOTS**.

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- b. When a narrow face knot (spike knot) occupies **more than** 1/2 the narrow face (**Figure 32**).

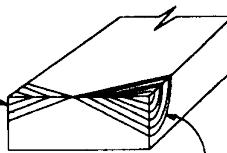
Figure 32a.



Note: Knots in Figures 31 and 32 cannot be re-located.

Figure 32b.

Not an EDGE KNOT condition: Knot occupies less than 1/2 narrow face.



EDGE KNOT condition: Knot occupies more than 1/2 the narrow face.

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- c. When there is **less than** one-sixth (1/6) the size of the knot of clear, straight grained wood covering the knot. (**Figures 33 & 34**).

Example: A 3/4" knot requires the equivalent of 1/8" of clear, straight grained wood covering the knot.

(Calculation: $\frac{3}{4} \times \frac{1}{6} = \frac{3}{24}$ or $\frac{1}{8}$) A 1 1/2" knot would require at least 1/4" good wood

(Calculation: $1\frac{1}{2} \times \frac{1}{6} = \frac{3}{2} \times \frac{1}{6} = \frac{3}{12}$ or $\frac{1}{4}$).



Figure 33

Figure 34

Less than 1/6 clear wood

2.7.1.2 Non-Edge Knot Conditions

The following are **not** considered Edge Knots:

- a. When there is at least 1/6 the size of the knot of clear, straight grained wood covering the knot (**Figures 35 and 36**).

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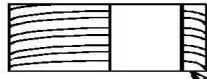


Figure 35



Figure 36

More than 1/6 clear wood

Note: Relocation knots are **NOT** considered edge knots provided the 1/6 clear wood condition is present.

- b. When a narrow face knot (spike knot) occupies **less than** 1/2 the narrow face (Figures 37, 38 and 39).

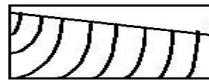


Figure 37

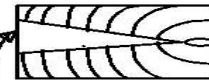
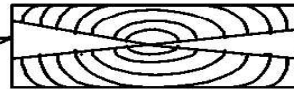


Figure 38

Narrow face (spike knots) occupying **less than** 1/2 the narrow face.

Figure 39



Combination narrow face (spike knots) are measured individually and each is **less than** 1/2 the narrow face.

2.7.2 Sawcuts (Sawkerfs) in Machine Graded Lumber

This characteristic occurs in two ways as depicted in Part 1, NGR Interpretations - Figures 15 and 16.

Note: Generally no sawcuts shall be permitted in MGL.

2.7.3 Timber Breaks

Timber breaks are **not** permitted in MGL lumber.



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2.8 **Para 130 BEAMS AND STRINGERS**

- Checks - when checks on ends are deeper than that permitted for the grade, they shall be limited as splits.
- Shake - breaking into a face becomes a NO. 2 or lower grade depending on severity.
- "orequivalent" means "away from ends" through shakes up to 4' long, well separated".
- Soft Honeycomb - limited as unsound wood
- Splits - are measured by average penetration.
- Unsound Wood - the size of a spot on unsound wood in a NO. 2 be held to 1/6 the width square of the face under consideration or equivalent longer.

2.9 **Para 131 POSTS & TIMBERS**

- Checks - when checks on ends are deeper than that permitted for the grade, they shall be limited as splits. **2**
- Shake - breaking into a face becomes a NO. 2 or lower grade depending on severity.
- Soft Honeycomb - limited as unsound wood.
- Splits - are measured by average penetration.
- Unsound Wood - the size of a spot on unsound wood in a NO. 2 be held to 1/6 the width square of the face under consideration or equivalent longer.

2.9.1 **Para 131d. Standard**

- Shake - "orequivalent" means "away from ends" through shakes up to 4' long, well separated.
- Unsound Wood - individual spots shall not exceed an area 1/4 of the width square.
- Knots - may exceed 1/2 width on face provided knot does not exceed 50% total displacement.

2.9.2 **Para 131e. Utility**

- Shake - **not through:** a single shake may be full length
- **through:** several, the length of individual through shakes shall not exceed 1/2 the length of piece.
- Unsound Wood - individual spots shall not exceed an area 1/2 of the width square.
- Knots - may exceed 3/4 width on face provided knot does not exceed 75% total displacement.