

**Forest Service Handbook
National Headquarters - Washington Office
Washington, DC**

**Forest Service Handbook 2409.11a – National Forest Cubic Scaling Handbook
Chapter 40 - Utilization Assessment**

Amendment: 2409.11a-2003-1

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Approved by: Abigail R. Kimbell, Associate Deputy Chief, NFS

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Responsible Staff:

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Superseded Document(s): 2409.11a_40, Amendment 2409.11a-2002-3, May 7, 2002;
id_2409.11a-2002-2, June 21, 2002

Digest: Following is an explanation of the changes throughout the directive by section.

40: This amendment incorporates the direction formerly issued in interim directive (ID) 2409.11a-2002-2 into the parent text of the chapter.

42.62: Corrects errors in the table and in the direction for logs with pistol butt.

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This chapter provides guidelines for making field inspections of timber utilization on timber sale contracts.

41 - Utilization Inspections

Timber sale contracts provide for the greatest practicable utilization of the included timber. Product specifications normally include the minimum length, diameter, and merchantability factor.

1. Conduct utilization inspections in a timely manner. Felling and bucking practices must be monitored closely and inspected very soon after felling begins on a timber sale and whenever a new felling contractor starts on a timber sale. Early and ongoing monitoring of felling and bucking practices is essential to prevent or quickly correct improper practices (sec. 41.1).

2. Perform a second utilization inspection on areas after yarding has been completed. When mechanized logging equipment such as a stroke delimber is being used, the Sale Administrator should inspect the bucking practices for crooks, pistol butts, forks, rot, and so on. When more than incidental amounts of material meeting the product specifications have been left in the woods or at the landings, the Sale Administrator must promptly notify the purchaser in writing to remove the material in accordance with the timber sale contract.

41.1 - Improper Utilization

Some examples of improper utilization are:

1. A cull log manufactured under the terms of the contract, which would have met contract specifications if the end containing the major portion of the defect had been cut off.

2. A log left in the woods because its top diameter is smaller than the timber sale contract minimum, although it would equal minimum specifications if cut shorter.

3. Excessive sound material showing on one end of a defective log which, if properly bucked, should have been included on the adjacent log.

4. Sound material wasted in bucking-out defects, breaks, or crooks, which could have been utilized if bucking had been done correctly.

5. A tree not bucked so as to avoid excessive sweep deduction.

6. Top material containing a diameter larger than the minimum, when proper bucking would have included this material with the product removed.

7. Improper long butting. Long butts should include only material that would be cull by itself because of defect. Since stump rot usually tapers to a point, long butting becomes excessive when it attempts to eliminate all the stump rot.

8. Defective material where the defect does not exceed the merchantability factor as stated in the contract.

9. High stumps.

42 - Sawlog Utilization Assessment Procedures

All logs and pieces that meet the minimum contract specifications are required to be removed. When determining the proper utilization of sawlogs, consider each piece on its own merits.

Use the following criteria to estimate proper sawlog manufacturing in the woods and to assess merchantable material remaining after skidding:

1. The log end diameter and the diameter dimension of the defect.
2. The merchantability factor stated in the contract (normally 10.67).
3. The merchantability factor met at the point of bucking.
4. The capability of the piece to produce lumber at least 6 feet in length.

42.1 - Determining Diameters

1. Long Butts.

- a. If the butt end is defective, estimate the diameter at 4 feet above the butt end to compare to the defect diameter (large end) to determine if a long butt is warranted.
- b. When checking long butts for proper utilization, use the small end diameter where the piece is or should have been long butted.
- c. When long butts are less than 4 feet in length, measure at the small end, ignoring flare.

2. Other Logs.

- a. Assess defect at the large end of the defect.
- b. Use the small end diameter of the piece for log or segment diameter.
- c. Check each end of the piece for merchantability requirements, such as the merchantability factor of 10.67, where the log has been severed.
- d. Check the minimum top diameter as stated in the contract.

Direction for assessing the major types of defects is set out in sections 42.3 - 42.6.

42.2 - Proper Utilization

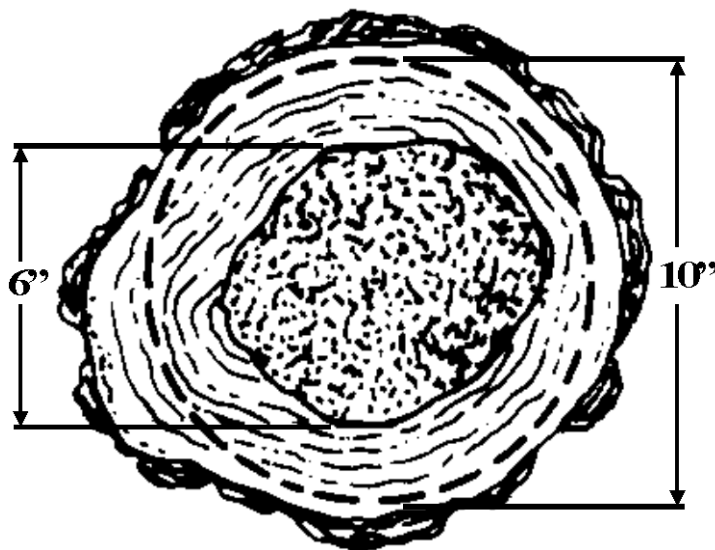
When determining proper utilization, consider each piece left in the woods on its own merits. When determining the merchantability of a piece and the correct bucking points, consider 2-foot multiples to determine piece length. Determine all log lengths in even lengths in 2-foot multiples plus the specified trim allowance. For example, use lengths of 10, 12, and 14 feet, and so forth.

42.3 - Massed Interior Defects

Refer to exhibits 01, 02, and 03 for examples of utilization assessments to determine merchantability of logs with interior defect. These examples are for a merchantability factor of 10.67 and a minimum piece length of 8 feet.

1. Assess a log or piece that contains interior defects to determine if it meets the contract utilization specifications.
2. Use utilization table 1, in exhibit 03 for logs or trees with interior defect:
 - a. When there is a need to determine if the defect can be bucked off, and to what extent.
 - b. To determine if defective pieces left in the woods are appropriate under the terms of the timber sale contract.
3. Use the appropriate diameter as specified in section 42.1 to compare to the defect diameter.
4. Compare the log or segment diameter to the defect diameter in the utilization table 1 in exhibit 03. When the defect diameter for a given log diameter listed on the table exceeds the maximum defect diameter, the defective portion may be bucked off to a point where the defect diameter is not less than the matching defect diameter shown in the table.

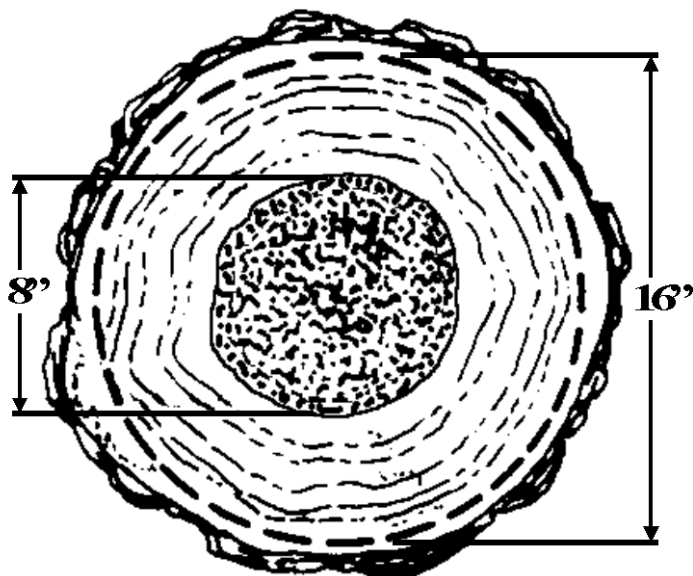
Cull Log End Due to Interior Defect



**Projected small
end diameter**

The log end shown in exhibit 01 exceeds the maximum interior defect. The tree may be long butted to a point where the interior defect diameter is more than the maximum shown on the interior utilization table 1 (ex. 03).

Merchantable Log with Interior Defect



**Projected small
end diameter**

For the log shown in exhibit 02, the maximum allowable inches of interior defect for a 16-inch log are 8 inches, according to utilization table 1 (ex. 03). Long butting of this log is not necessary.

42.3 - Exhibit 03

Utilization Table 1 for Interior Defect with a Merchantability Factor of 10.67

End Diameter (Inches)	Maximum Interior Defect Diameter (Inches)
8	3
9	3
10	5
11	5
12	6
13	6
14	7
15	8
16	8
17	9
18	10
19	11
20	12
21	12
22	13
23	14
24	14
25	15
26	16
27	17
28	17
29	18

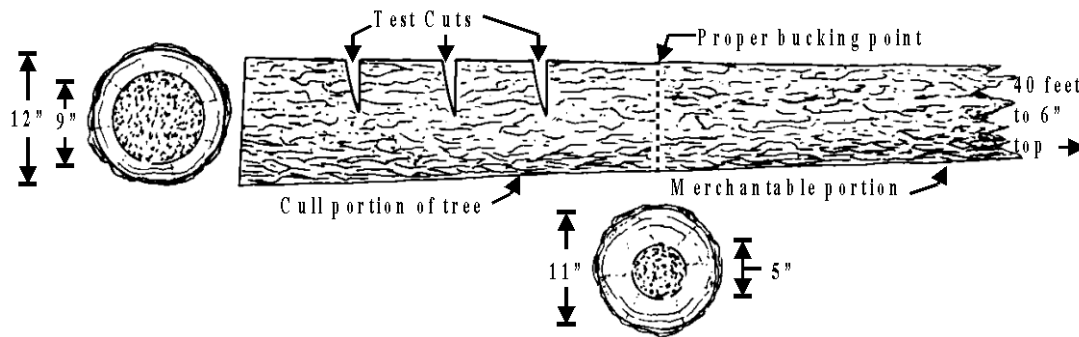
End Diameter (Inches)	Maximum Interior Defect Diameter (Inches)
30	19
31	20
32	20
33	21
34	21
35	22
36	23
37	24
38	24
39	25
40	26
41	27
42	27
43	28
44	29
45	29
46	30
47	31
48	31
49	32
50	33

42.31 - Proper Bucking Point for Logs with Massed Interior Defect

Examine logs to determine the extent of defect; make test cuts; and check to see if the piece is bucked at the point on the log meeting minimum contract requirements, such as 33-1/3 net scale in percent of gross scale, which is used in the example in exhibit 01.

42.31 - Exhibit 01

Proper Bucking Point for Log with Interior Defect



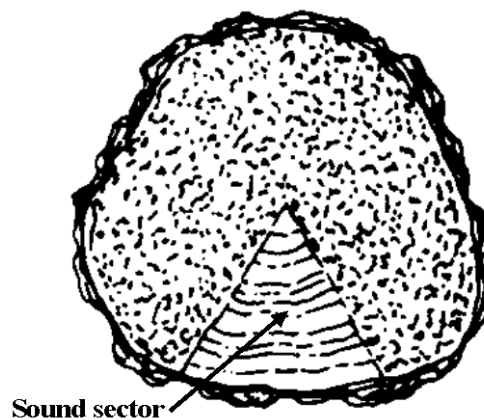
The log shown in exhibit 01 is cull at the large end because the defect of 9 inches exceeds the utilization table 1 (sec. 42.3, ex. 03) maximum diameter of 6 inches for a 12-inch log. The cull portion of the tree could be left in the woods. The piece should be test cut until the paired defect and log diameters meet minimum specifications, which for this example is 5 inches of rot for an 11-inch log diameter.

42.4 - Massed Defects with Sound Sector

On log ends containing defect, which can be confined to a portion of the end area of the log, use the length deduction method combined with percent (sec. 22.33) to assess merchantability. When using this method, a log end area estimated to be at least one-third sound would approximate a merchantability factor of 10.67.

42.4 - Exhibit 01

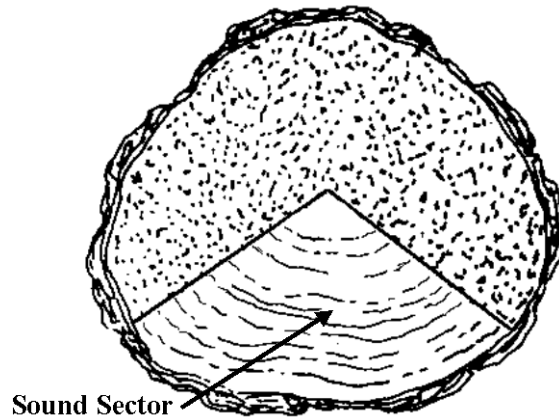
Sound Sector - Unmerchantable (Greater than 10.67)



For the log shown in exhibit 01, the defective portion may be bucked off to a point where the log end area meets the 10.67 merchantability factor.

42.4 - Exhibit 02

Sound Sector - Merchantable



Bucking out the defect is not justified on the log shown in exhibit 02 because the end area of the piece meets the merchantability factor of 10.67.

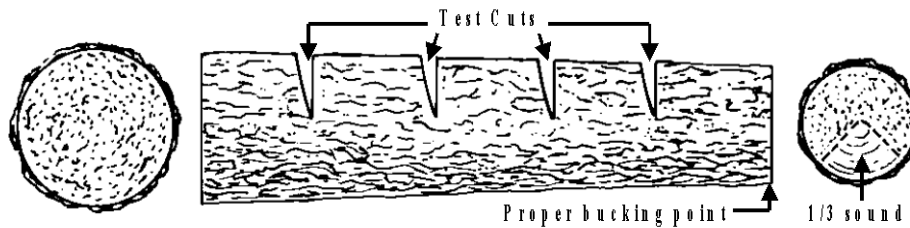
Cull the logs with diameters of 6, 7, and 8 inches that do not contain a product at least 4 inches in width.

42.41 - Proper Bucking Point for Logs with Sound Sector

When examining logs to determine the extent of defect, make test cuts. Buck the piece to the point on the log that meets minimum contract requirements such as a merchantability factor of 10.67.

42.41 - Exhibit 01

Proper Bucking Point for Log with Defect and Sound Sector



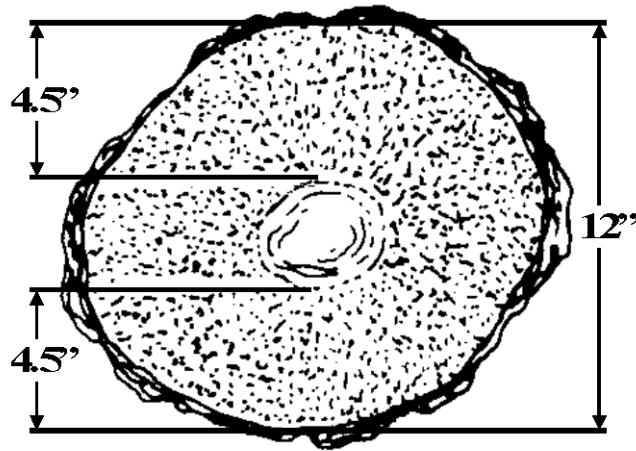
42.5 - Perimeter Defects

Refer to exhibits 01, 02, and 03 for examples of utilization assessments to determine merchantability of logs with perimeter defect. These examples are for a merchantability factor of 10.67 and a minimum piece length of 8 feet.

1. Assess a log or piece that contains perimeter defects to determine if it meets the contract utilization specifications.
2. Use utilization table 2, exhibit 03, for logs or trees with perimeter defect:
 - a. When there is a need to determine if the defect can be bucked off, and to what extent.
 - b. To determine if defective pieces left in the woods are appropriate under the terms of the timber sale contract.
3. Use the appropriate diameter as specified in section 42.1 to compare to the defect diameter.
4. Compare the log or segment diameter to the diameter reduction in the utilization table 2 in exhibit 03. When the diameter reduction for a given diameter listed in the table exceeds the maximum diameter reduction, the defective portion may be bucked off to a point where the diameter reduction is not less than the matching diameter reduction shown in the table.

42.5 - Exhibit 01

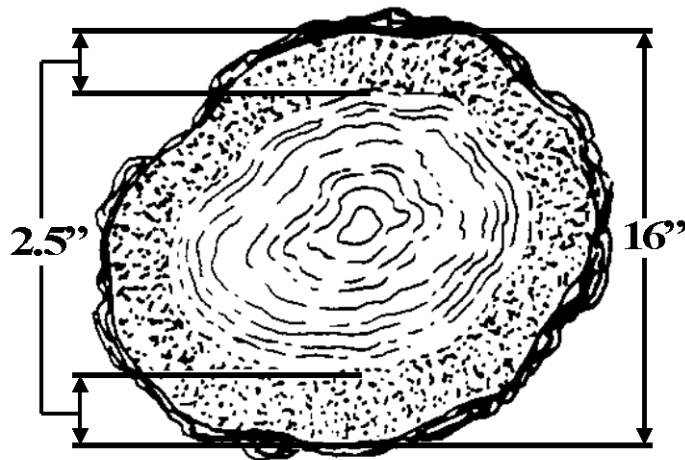
Cull Log End



For the log shown in exhibit 01, a defect thickness of 4.5 inches equals a diameter reduction of 9 inches. The defect exceeds the maximum log perimeter defect. The tree may be bucked to a point where the perimeter defect of the piece left in the woods is not less than the maximum shown on the perimeter utilization table 2 in exhibit 03.

42.5 - Exhibit 02

Merchantable Log End



For the log shown in exhibit 02, the maximum allowable perimeter defect for a 16-inch log is 6 inches. Bucking of the log would not be justified.

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42.5 - Exhibit 03

Utilization Table 2 for Perimeter Defects with a Merchantability Factor of 10.67

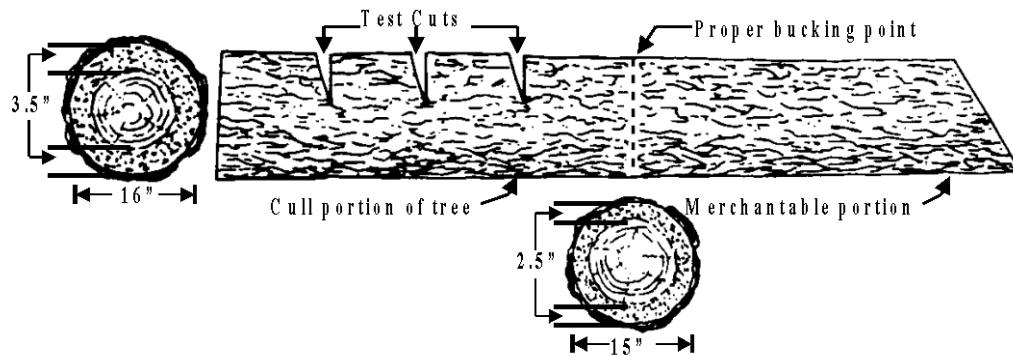
Diameter (Inches)	Diameter Reduction (Inches)	Diameter (Inches)	Diameter Reduction (Inches)
7	1	29	11
8	2	30	11
9	3	31	12
10	4	32	12
11	4	33	13
12	5	34	14
13	4	35	14
14	5	36	14
15	5	37	14
16	6	38	15
17	7	39	16
18	7	40	16
19	7	41	16
20	7	42	17
21	8	43	17
22	8	44	18
23	8	45	18
24	9	46	19
25	9	47	20
26	9	48	20
27	9	49	20
28	10	50	20

42.51 - Proper Bucking Point for Logs with Perimeter Defect

Make test cuts when examining logs to determine the extent of defect. The piece should be bucked at the point on the log meeting minimum contract requirements.

42.51 - Exhibit 01

Proper Bucking Point of Log with Perimeter Defect



The log shown in exhibit 01 is cull at the large end because the diameter reduction of 7 inches exceeds the utilization table 2 maximum defect of 6 inches for a 16-inch log (sec. 42.5, ex. 03). The cull portion of the tree could be left in the woods. Test cut this piece until paired defect and log end measurements meet minimum specifications, which for this example is a 5-inch diameter reduction for a 15-inch log end diameter.

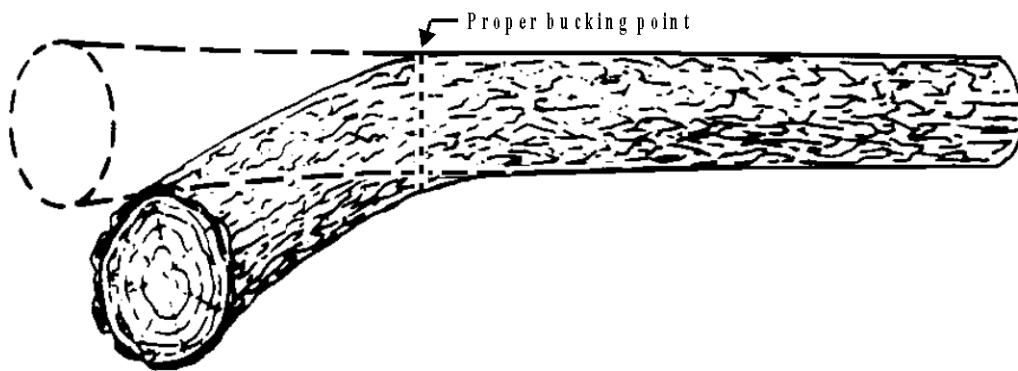
42.6 - Exterior Defects

42.61 - Crook and Sweep

1. Bucking may be permissible when severe crook is present. If no other internal defect affects the log, determine the bucking point by extending the log through the crook. The bucking point on logs with severe crooks is located where the extended log first emerges (ex. 01).

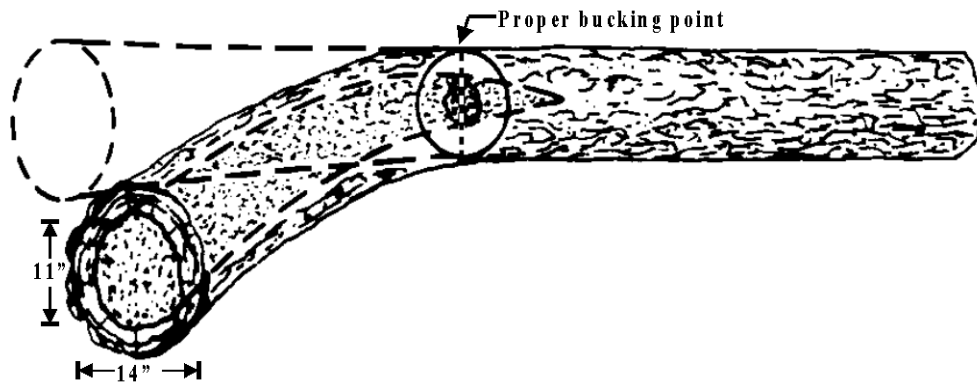
42.61 - Exhibit 01

Proper Bucking Point on a Log with Crook



2. The location of the bucking point changes for a log with crook or sweep that also contains internal defect such as heart rot. Additional bucking may be necessary in this circumstance. The initial bucking point is determined by using the "log through the crook procedure" described in the preceding paragraph 1. Determine the need for additional bucking due to internal defect by using the procedure for logs with interior defect (sec. 42.31). The procedure can be applied to butt rot in butt logs as well as internal defect in logs from any location in the tree. Basically, the internal defect is used to determine the length of the bucking when associated with a crook or sweep (ex. 02).

Proper Bucking Point on a Crooked Log with Interior Defect

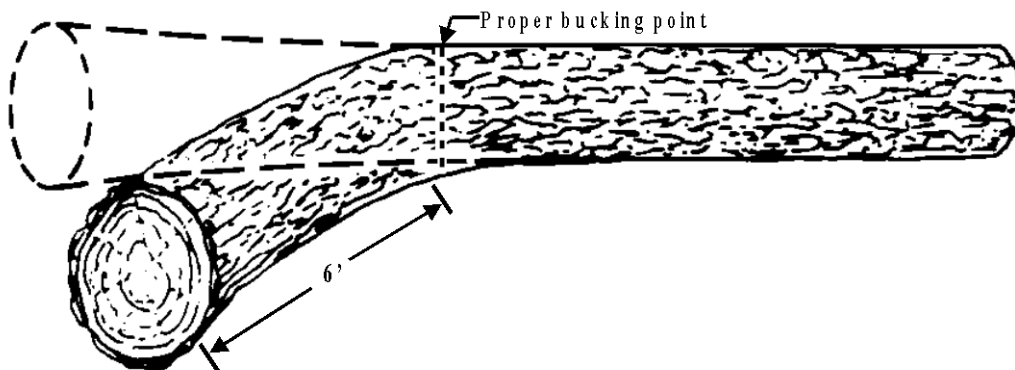


3. Bucking for sweep is permitted when the curvature is sufficiently severe to create an unmerchantable piece less than the contract minimum. These pieces more commonly occur in the top or butt end of a tree, but can occasionally occur in the middle if there is severe sweep. As with crook, it is essential to check for correct bucking prior to skidding.

- a. Bucking is permissible in the example shown in exhibit 03 because the sweep creates an unmerchantable piece less than the contract minimum. This is applied to both the bottom and the top of the tree.

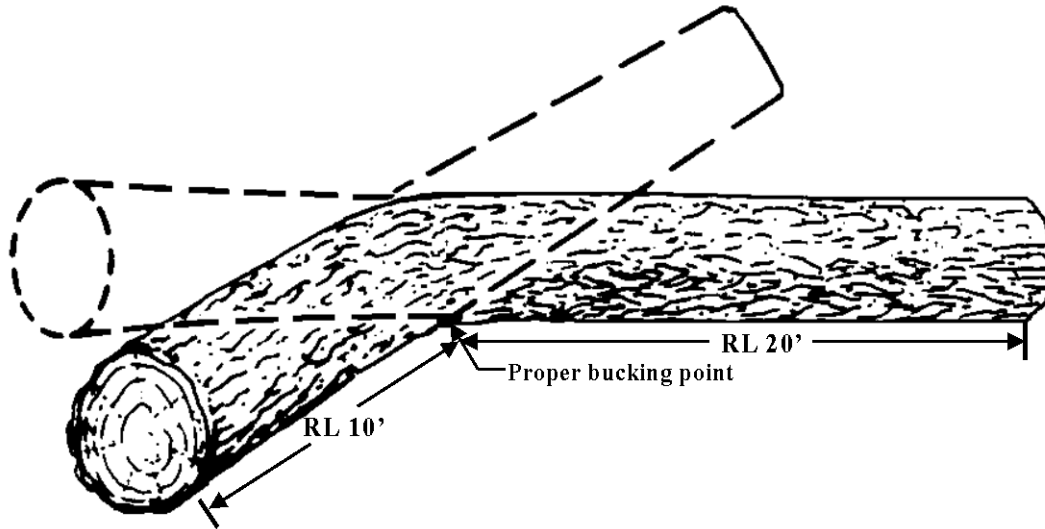
42.61 - Exhibit 03

Proper Bucking Point on a Long Butt



- b. Proper bucking in the example shown in exhibit 04 creates two merchantable logs.

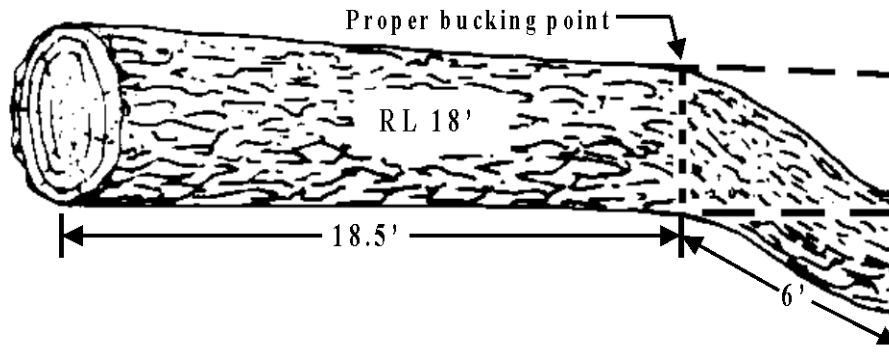
Proper Bucking Point on a Log with Merchantable Pieces on Each Side of the Crook



4. Logs containing multiple crook or sweep are considered merchantable if they meet the minimum merchantability factor in the contract and contain the minimum piece length. For example, the contract may state a minimum piece length of 8 feet, a minimum top diameter of 7.0 inches, and a merchantability factor of 10.67. When determining the merchantability of a piece and the correct bucking points, consider 2-foot multiples when determining piece length. All log lengths are determined in even lengths in 2-foot multiples plus trim; for example, lengths of 10, 12, and 14 feet, and so forth.

- a. Exhibit 05 is an example of a tree with an unmerchantable piece in the top due to multiple crooks.

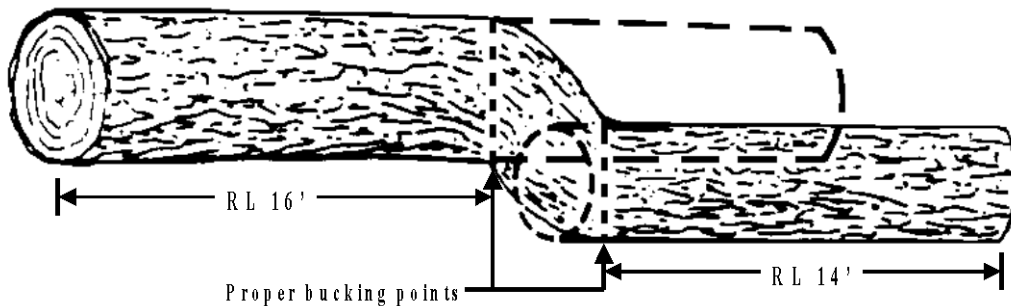
Proper Bucking Point To Eliminate Crook



b. Exhibit 06 is an example of a tree with unmerchantable material in the middle but merchantable material on both ends. For these types of external defects, it is essential for the Sale Administrator to check bucking prior to the removal of merchantable material.

42.61 - Exhibit 06

Proper Bucking Point To Eliminate Unmerchantable Piece



42.62 - Pistol Butt

Use the following guidelines for logs with pistol butt.

1. Project a straight line down the center of the butt segment from the small end.
2. Determine the small end diameter inside bark (d.i.b.) at the top of the butt segment.
3. Measure the distance between the projected straight line and the actual pith; then compare this distance to the following chart to determine the maximum long butt length that should be removed, if any.

Note: Only logs meeting the criteria in this table may be long butted for pistol butt.

Pith Off-center	Small End d.i.b. of Butt Segment	Maximum Long Butt Length
≥ 7 inches	≤ 17 inches	4 feet
≥ 13 inches	≤ 21 inches	6 feet
≥ 19 inches	\leq All diameters	6 feet
(\geq is greater than or equal to, and \leq is less than or equal to)		

At the point where the tree is severed from the stump, the actual pith may or may not have evidence of the pith core off-center. This includes compression wood with tight growth rings on the short radius and large growth rings on the opposite radius.

When long butting, the proper bucking point is at the top of the bend. However, when long butting for pistol butt, the maximum length allowed to be removed is 6 feet.

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42.62 - Exhibit 01

Proper Bucking Point To Eliminate Pistol Butt

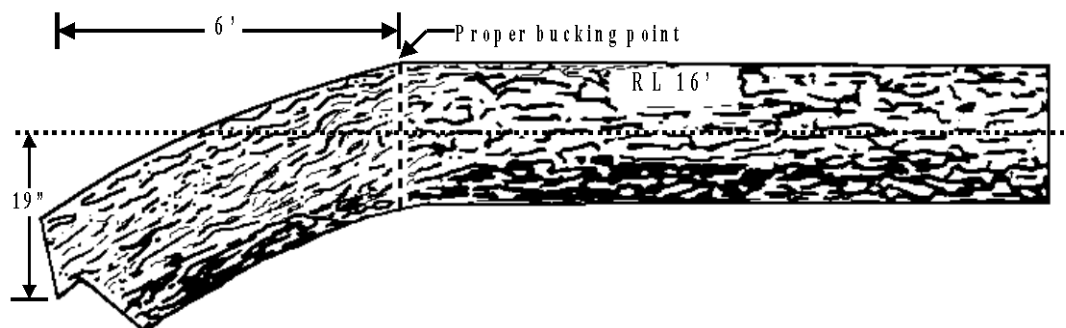


Exhibit 01 illustrates a 16-foot log with pistol butt affecting the bottom 6 feet. Since the pith off-center equals 19", the maximum long butt length allowed according to the preceding table, is 6 feet for all small end d.i.b. sizes.

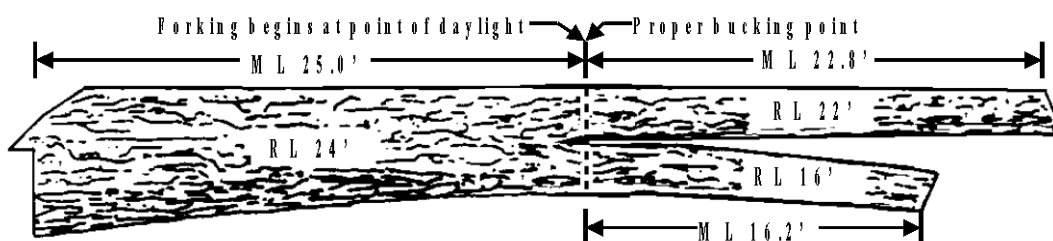
42.63 - Forked Logs

1. Proper bucking of crotched or forked logs can eliminate much of the defect loss that occurs from bark seams, splits, cross grain, and flat sides. The 2-foot multiple rule also applies to crotched logs. Measure lengths from the butt cut in 2-foot multiples, plus trim, to determine the bucking point for a crotch. The ideal bucking point when the top contains two merchantable logs would be when the 2-foot multiple falls exactly at the point where daylight shows in the crotch. When this does not occur, move back to the next 2-foot multiple toward the large end of the log as the bucking point.

Exhibits 01 and 02 are examples of bucking forked logs.

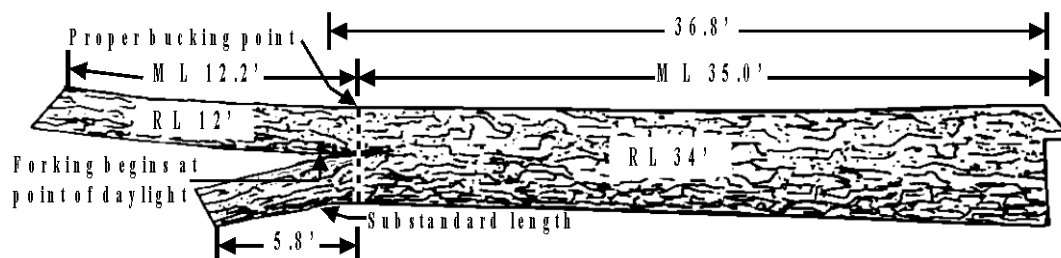
42.63 - Exhibit 01

Proper Bucking Point on Forked Logs



42.63 - Exhibit 02

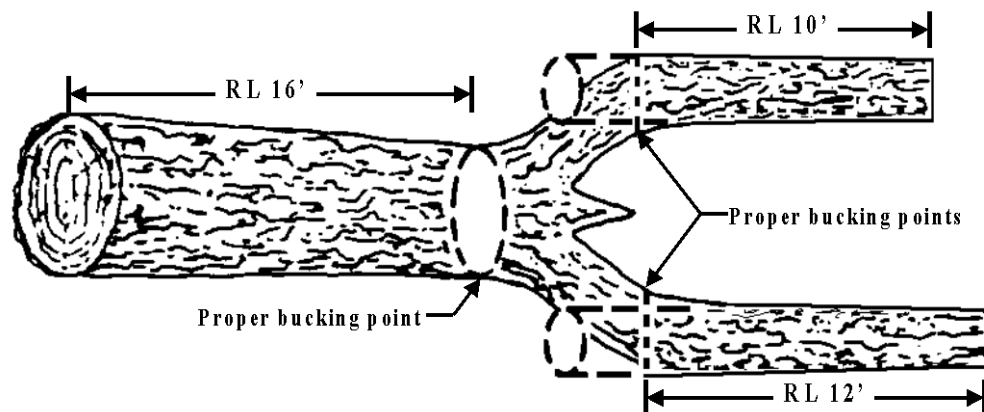
Proper Bucking Point on Forked Logs with a Substandard Fork



2. At times, bucking out forks may be necessary. This occurs when a defect such as rot caused by a sucker limb or old dead top is present in the fork or crotch. Determine the first bucking point by measuring the log length from the larger end in 2-foot multiples. Determine the second bucking point or upper end using the bucking procedure for crook, sweep, or internal defect, whichever applies (ex. 03).

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42.63 - Exhibit 03

Proper Bucking Point on Forked Log with Internal Defect

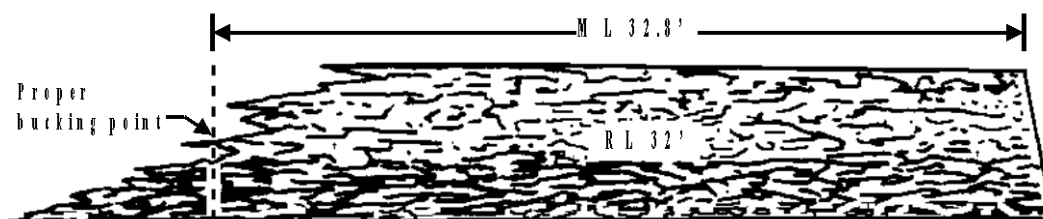


42.64 - Logs with Breaks

1. The bucking of breaks requires balancing wood fiber and the voids.
 - a. Breaks commonly occur in the tops of trees during felling. To determine if a piece is merchantable and/or the position of the proper bucking point, locate the point that represents a balance between wood fiber and voids.

42.64 - Exhibit 01

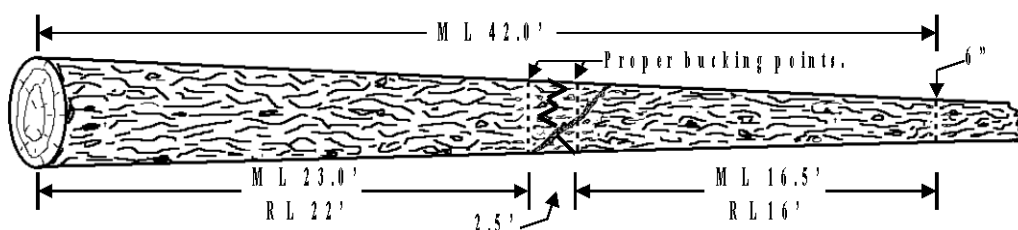
Proper Bucking Point on Broken End Log with Length Determination



- b. Breaks frequently occur in a tree during felling. Utilization should occur in the bottom log(s) by measuring from the butt to the break. The length should be in 2-foot multiples to a point meeting contract specifications (ex. 02).

42.64 - Exhibit 02

Proper Bucking Point for Tree with Breaks in Mid-section

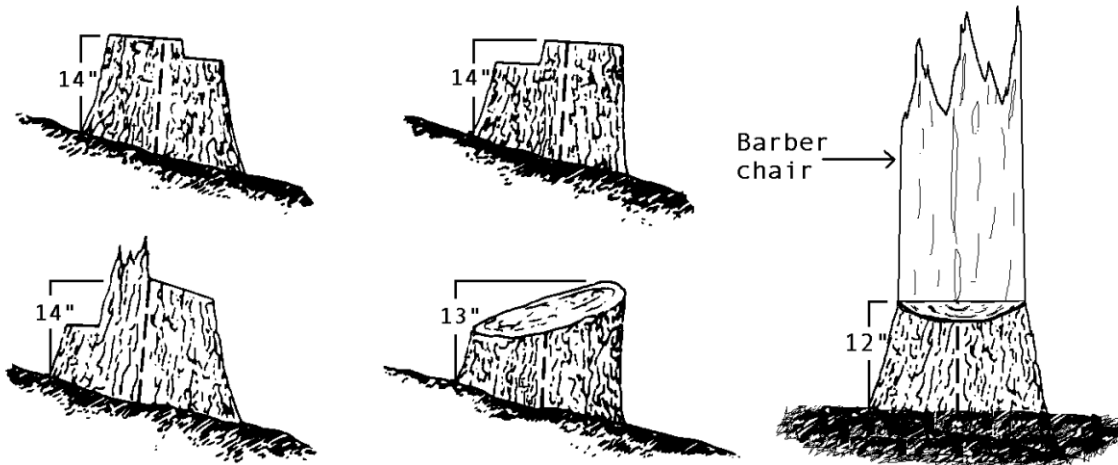


42.7 - Stump Heights

Measure stump heights from high ground paralleling the vertical axis of the stump up to the point where a projected right angle intercepts the highest mechanical cut on the top of the stump. Exhibit 01 shows examples of unacceptable stump heights where the maximum allowable stump height is 12 inches. Exhibit 02 shows examples of acceptable stump heights where it is necessary to have a higher stump for safe and efficient logging.

42.7 - Exhibit 01

Measurements of Unacceptable High Stumps



42.7 - Exhibit 02

Acceptable High Stumps Due to Safety Needs or Obstructions

