

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

**Forest Service Handbook 2409.11 – National Forest Log Scaling Handbook
Chapter 80 - Other Forms of Measurement**

Amendment: 2409.11-2006-1

Effective date: October 30, 2006

Duration: This amendment is effective until superseded or removed.

Approved by: Gregory Smith, For Joel Holtrop, Deputy Chief

Date approved: April 20, 2006

Responsible Staff:

Last Change: Amendment No. 7

Superseded Document(s): Entire Handbook, Title Page thru 247

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

10: Corrects minor typographical and technical errors throughout the chapter. Substantive changes are as follows:

13: Clarifies in paragraph 1 that the standard unit for saw timber scaling will be in cubic foot log scale, although board foot log scale is used under certain circumstances.

17.12: Changes the caption in exhibit 02 to clarify direction to allow full trim in the length measurement and record in 2 foot multiples.

17.18: Adds new direction and an exhibit for length measurements on forked logs.

17.2: Clarifies scalers will notify the contracting officer when improper trim allowance is detected.

17.3: Adds direction on how to record logs that are further reduced to the lower 2 foot multiple, but the diameter increases to the next diameter class, the increased diameter will be recorded as the proper scaling diameter.

17.33: Adds a list of butt characteristics to assist in identifying butt cut logs.

20: Corrects minor typographical and technical errors throughout the chapter. There are no changes to the substantive direction in this chapter.

30: Corrects minor typographical and technical errors throughout the chapter. Substantive changes are as follows:

33: Establishes defect types and new deduction procedures for: Burls, Foreign Material, Pecky Rot, Pistol Butt Defect, Pitch Pockets, and Spiral Grain.

Slope of Grain, and Twist have been included in the Spiral Grain definition.

Barber Chair and Pull, Stump or Sliver has been included in the Breaks and Splits definition.

Bark Seam has been included in the Pitch Seam, Heart Check, Frost Crack definition.

Adds new direction and exhibits for crook defect deduction process.

Combines Knots, large and Knots, clusters into a single new defect type, Knots. Establishes new knot size limits and knot deduction guide.

Adds definition of massed pitch and clarification of when a deduction is necessary.

Adds clarification of scaling cylinder position when deducting for sweep.

Reformats and rennumbers entire section to conform to FSH 2409.11a - Cubic Scaling Handbook, chapter 20.

40: Corrects minor typographical and technical errors throughout the chapter. Substantive changes are as follows:

44: Changes caption from Stump Scaling to Timber Trespass. Provides direction for measurements to be performed by certified scalers and cruisers and requires coordination with Law Enforcement staff prior to beginning field work.

44.1: Changes caption from Timber Trespass to Stump Scaling.

44.2: Changes caption from Scaling when Stump and other Direct Evidence is lacking to Stump Cruising.

44.3: Established this code and recodes direction formerly at section 44.2 to this section.

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51: Changes caption to selection of scaling locations. Changes responsibility for selection of scaling locations from District Ranger to Contracting Officer. Also removes direction on selecting truck-scaling locations.

52: Removes requirement for Forest Supervisor to develop additional safety specifications for scaling.

53: Removes the direction which discusses the need for the purchaser to keep government logs separate from private logs up to the point of scaling and for the use of distinctive marking between various sales.

54.1: Changes the direction for team scaling from "discouraged" to "must not be used." Also removes direction Regional Forester to authorize team scaling in limited situations. Changes the responsibility for taking corrective action when scalers to not perform to standard from District Ranger to Contracting Officer.

54.2: Removes direction on the benefits of mill visits and specific direction concerning various items to be observed while conducting a mill visit.

55.2 - 55.4: Removes obsolete direction, which referenced out of date equipment, processes and procedures.

55.5: Revises and recodes to section 55.2. Changes the responsibility for completing the Scaler Information Form from the Forest Service Representative to the Contracting Officer.

55.61: Removes section on standard scaling forms.

55.62: Recodes to section 553.

55.63: Recodes to section 55.4. Removes significant amount of instruction, including exhibit's 01 and 02, on how to fill in scaling sheets. Stresses the use of field data recorders to record scaling information.

55.64 - 55.65: Removes obsolete direction from handbook.

56.1: Removes obsolete from handbook.

56.21: Removes obsolete direction from handbook.

56.22: Recodes to section 56.1.

56.3: Removes obsolete direction from handbook.

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60: Corrects minor typographical and technical errors throughout the chapter. Substantive changes are as follows:

64: Increases situations where Regional Foresters may deviate from established check scale standards.

65: Revises to require minimum check scale record and summary information. Removes outdated policy, procedures, and forms.

70: Reformats chapter.

71: Updates CFR reference.

80: Corrects minor typographical and technical errors throughout the chapter. Substantive changes are as follows:

82: Deletes previous documentation which was incomplete and adds reference to National Forest Cubic Scaling Handbook (FSH 2409.11a) for handbook direction.

85: Adds a cross reference on sample scaling to Forest Service Handbook 2409.11a, National Forest Cubic Scaling Handbook, chapter 50.

85.5: Recodes to section 86.1.

85.6: Recodes to section 86.2.

87.42: Establishes new direction for Fiber Scaling.

Appendix: Renames exhibits from "Table" to "Appendix." Removes Table 1A, Table VIII, Table IX - Exhibit A, Table XIV. Adds Appendix 15 - Factors for Computing Scribner decimal C Volumes and Appendix 16 - Scribner Decimal C Recorded Length and Segment Lengths.

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81 - Cord Measure

81.05 - Definitions

Cord. A unit of measure that expresses the volume of stacked wood. It differs from the board foot and cubic foot units because it is not a measure of the individual bolt or piece in terms of solid-wood content.

1. A standard cord is a pile of stacked wood measuring 8 feet long, 4 feet high, and 4 feet wide. The standard cord contains 128 cubic feet. The actual solid wood content is generally 100 cubic feet or less. Forest Service scalers measure in terms of 128 cubic feet of stacked wood. Reduce the total cubic feet occupied to cords by dividing by 128.

2. A long cord contains a greater volume of wood than the standard cord. This unit measures 8 feet long and 4 feet high with a width greater than 4 feet. A long cord may consist of pieces that exceed 4 feet in length. Often a long cord is 8 feet by 4 feet by 5 feet. Pulpwood is often sold by this unit.

3. A short cord is a unit smaller than the standard cord and is usually used for fuelwood less than 4 feet long. For fuelwood, a rick is a pile 8 feet long, 4 feet high, and 1 foot wide, or 4 ricks per cord. Fuelwood cut to a 16-inch length will stack three ricks per cord.

4. A sound cord contains only the merchantable pieces or bolts of a standard stacked cord. Merchantable pieces or bolts are defined in each timber sale permit or contract. Gross cubic foot measurement is reduced to net cubic measurement usually by applying the percentages of unmerchantable material. Since sound and net standard cord are synonymous use of the term "sound cord" is largely obsolete. A cord of shingle bolts usually measures 8 feet by 4 feet by 4 1/3 feet.

Rough wood. The term used to designate wood with bark in contrast to smooth or peeled wood, which is wood with the bark removed. Sales contracts are normally on a rough wood basis, and if measurements of peeled wood must be made, volume must be increased by an amount determined to be equitable for the material involved.

81.1 - Measuring Methods

1. The volume in cords may be calculated by measuring length, height, and width in feet and tenths, calculating the cubic volume and dividing by 128. The scale of 48-inch wood can be converted to any other length by applying converting factors listed below.

Length (inches)	Percent of 48-inch scale
36	75
38	79
40	83
42	87
44	92
46	96
50	104
52	108
54	112
56	117
58	121
60	125

Example: Find the contents of a stack of wood 38 feet long, average height of 52 inches, and 40 inches wide which would be 5.11 cords if it were 48-inch wood. Multiply 5.11 by 0.83, the converting factor for 40-inch wood. Answer: 4.24 standard cords.

2. Regional Foresters may specify the use of other methods of cordwood measurement if better adapted to local conditions. In lieu of measuring of stacked wood, tree or sample tree measurement, weight, or other measurement may result in lower scaling cost without sacrifice in accuracy.

81.2 - Measuring Stacked Wood

1. Measure stacks of wood accurately. Record length to the nearest foot, height to the nearest inch or tenth of foot. It is permissible to allow up to a maximum of 1 inch per foot of height to compensate for settling where long transportation to consumer is involved. The equitable settlement factor, if any, should be determined on the basis of documented tests, and not merely assumed.

2. If stacks are standing on slopes, measure the length parallel to the slope and the height at right angles to this plane. If end stakes are used here, obtain the length by measuring at a

point half the distance between the top and bottom. Otherwise, measure at enough places to obtain a fair average. Measure the height at several places to obtain the true average.

3. Check piece lengths sufficiently to make sure they do not regularly overrun those specified in the sale contract. If they do, follow the procedure outlined under section 42.

81.3 - Stamping or Painting and Numbering

Regional Foresters may issue special instructions for stamping, painting, and numbering. Straight lines made with a paint gun are most effective. Household bluing in a paint gun produces a good mark that does not interfere with pulp production. Otherwise stamp or paint both ends and top of each stack. Number each stack. Enter the measurements and contents of each stack opposite its number in the scalebook or field data recorder. Indicate whether roughwood, hand peeled, or machine peeled.

81.4 - Check Measurements

Minimum standards for check measurements are established by the Regional Forester with approval by the Washington Office. In the absence of specific Regional standards, make check measurements as instructed in chapter 60, Check Scaling. Follow the same procedure as to frequency of checks, methods, reports, and action.

82 - Cubic Foot Measurement

See National Forest Cubic Scaling Handbook (FSH 2409.11a) for direction on cubic foot measurement.

83 - Linear Measurements

Linear measurement involves the measurement of length only.

Posts, piling, fence poles, converter poles, telephone and power poles, hop poles, stulls, mine timbers, and lagging may be sold by the linear foot. Length and strength are often more important than the volume they contain. Timber sale contracts should specify the minimum length and diameter(s) of sticks classed as merchantable for each product. Contracts under which higher prices are charged for products cut from larger materials should set maximum lengths and diameters. For cedar poles and other products, the dimensions of material planned for each product should be specified.

Wherever necessary, similar specifications should cover the amount and kinds of defect admissible in products sold by the linear foot; also the character of the material considered merchantable for the purpose. This is especially important for valuable products like telephone and power poles, which often require the best grades of timber. Use Forest Service

specifications when available. Otherwise, use current commercial specifications of associations of local pole dealers or other associations.

83.1 - Measurement Method

Where pieces are cut in uniform standard lengths, make periodic measurements to check the buckers' work. When several products are cut in the same sale, make a similar current check of the diameter(s) of linear-foot material. Also, check periodically when prices depend upon both diameter(s) and length.

The standard trim allowance for telephone poles is 1 inch for each 5 feet of length. Regional Foresters may authorize greater allowances for specific products if local conditions require such action. Make utilization measurements for lengths with excessive trim as outlined in section 17.2. Sale contracts should specify trimming allowances for other classes of material where advisable. Sale contracts also may specify the equivalent in board feet versus linear feet. This facilitates the use of a flat stumpage rate per board foot. As standard practice, however, it is preferable to require payment on a linear foot or piece basis.

83.2 - Numbering and Stamping or Painting

Regional Foresters may establish procedures for numbering, and stamping or painting. In the absence of Regional instructions, number each pile of material measured. Do this with posts, fence poles, hop poles, converter poles, lagging, and other material which is small and of low value. Enter the number of pieces in each pile and their linear-foot contents opposite the pile number in the scalebook or the field data recorder. Number and stamp or paint large pieces equivalent in value to saw logs, such as telephone and power poles, piling, and stulls. Enter the length of each piece opposite its number in the scalebook or field data recorder.

83.3 - Check Measurements

See section 81.4 for direction on check measurements.

83.4 - Combined Linear and Diameter Measurements

Top diameters as well as lengths may affect the market value of products like telephone and power poles and stulls. Where this happens, use a schedule of stumpage rates for the various lengths and sizes. In such sales, accurately measure the diameter(s) of each piece. Average diameters to the nearest inch unless otherwise agreed upon. Number every piece and record it in a scalebook or field data recorder as with saw logs.

84 - Counting

84.1 - Procedure

Standard practice of the Forest Service is to count ties sold by the piece. Ties are also counted in sales where their board foot contents are specified in the sale contract. Where ties are scaled, follow the instructions under scaling. Count poles, posts, lagging, Christmas trees, and so on, when sold by the piece.

Contract requirements should conform to the local market specifications of products concerned. Designate clearly by special contract clauses the maximum and minimum piece sizes to be counted rather than scaled. Include specifications as to defect or class of material necessary to establish precisely what timber is merchantable for those products.

84.2 - Numbering and Stamping or Painting

Stamp or paint each piece of mine timbers, ties, posts, or poles counted. Painting helps identify the pieces counted. Christmas trees are usually counted and recorded by size classes.

Number each pile of material with crayon even though immediate removal is planned. Record the number of pieces opposite the number of the pile in the scalebook or field data recorder.

84.3 - Check Measurement

See section 81.4 for direction on check measurement.

85 - Sample Scaling

Direction on sample scaling is located in Forest Service Handbook 2409.11a, National Forest Cubic Scaling Handbook in chapter 50. Procedures found in chapter 50 apply to both Cubic and Scribner scaling methods.

86 - Weighing Products Other Than Saw Logs

Bark, stumps, limbs, or other material not readily measured otherwise may be sold by weight, normally with the ton as the unit. Obtain records of the actual weights whenever possible, for example, when the products are weighed by common carrier agents. Truck scales must be reliable. If the long ton of 2,240 pounds is used instead of the standard ton, specify this in the sale agreement.

86.1 - Scaling by Weight

Weight scaling is used to sell forest products by weighing every load. Weight sales should be sold using pounds/tons as the unit of measure. Weight scaling is a technically sound and an

efficient way to sell and measure forest products. Variations in weight occur from environmental and biological factors. Some variables to consider are: species, uniformity in size, seasonal conditions, and defects. When selecting a weight ratio, it is very important to ensure it is accurate and has been validated. There are several ways to achieve an accurate weight ratio (see FSH 2409.12, ch. 80).

87 - Fiber Scaling

Fiber scaling determines the wood content that, as a minimum, is suitable for the production of usable pulp chips. When scaling fiber logs, determine lengths and diameters using the same method as for sawlogs and record the results in accordance with the guidelines outlined in section 17.

87.1 - Defects in Fiber Logs

Fiber defect is any unsound wood that is stringy, crumbles, or crushes when rolled in the hand, or lacks the fibrous element that is basic in the development of specific items manufactured from wood chips. Other deductible defects in fiber logs are:

1. Voids - when there is an absence of wood fiber. Gouges, slabs, stump pull and open catface are examples of void.
2. Soft Rots - resulting from advanced decay such as conk rot, heart rot, sap rot, stump (butt) rot, and rot associated with rotten knots.
3. Char - when wood fiber has been charred.
4. Massed Pitch - when the wood fiber is saturated with accumulated pitch and considered unusable.

87.2 - Basic Defect Deduction Procedures

Use the following basic defect deduction procedures for scaling fiber logs when using any of the defect deduction methods described in section 873:

1. When a log or segment contains multiple defects, use a combination of any or all of the acceptable defect deduction methods for fiber scaling.
2. Make deductions for defects only when present in the scaling cylinder.
3. Consider the extent of the defect length in 1-foot multiples.

4. Consider the defect shape (cylinder, cone) in determining average defect length.
5. Use actual defect dimensions when determining loss. (Do not add an inch for waste.)
6. Apply the give and take procedure when measuring irregular shaped square, rectangular or circular defects. Dimensions should balance the unsound wood with usable fiber (sec. 8732, ex. 01).

87.3 - Defect Deduction Methods for Fiber Logs

Each of the following deduction methods may be used in combination with a percentage for scaling fiber logs:

1. Squared area (sec. 8731);
2. Circular area (sec. 8732);
3. Length deduction (sec. 87.33); and
4. Diameter deduction (sec. 8734).

87.31 - Squared Area Deduction Method

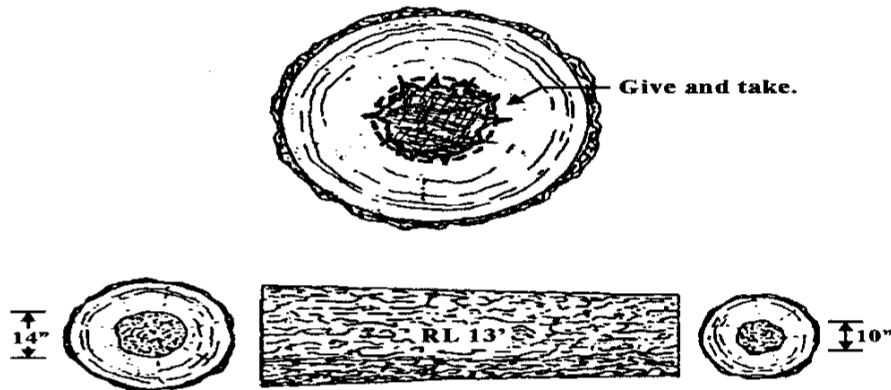
1. Square or rectangular shaped defects occurring in one or both log ends may be deducted by using the squared area deduction method (sec. 22.4 and 22.5).
2. When defect occurs in one log end, use actual defect dimensions for the length affected. When defect occurs in both log ends, average the end defect dimensions for the length affected.
3. When multiple squared area defects occur on log end(s), it is not required to take secondary defect dimensions at right angles to the primary (largest) defect.
4. See section 22 for further direction on using this deduction method.

87.32 - Circular Area Deduction Method

1. A defect that is determined to be circular in shape may be deducted by using the circular area deduction method.
2. Defect volume is calculated as core volume (do not square).

3. When defect occurs in one log end, use actual defect diameter for the length affected. When defect occurs in both log ends, average the end defect diameters for the length affected.

87.32 - Exhibit 01
Circular Area Defect



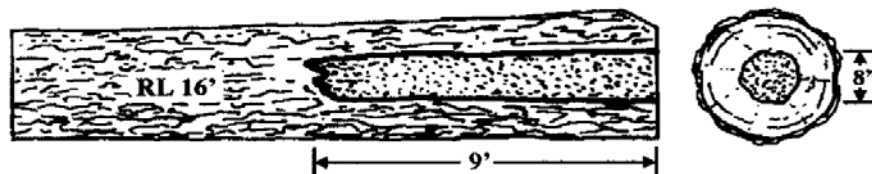
Given:

Average defect diameter = 12 inches

Defect length = 13 feet

Circular area deduction 12" x 13' = 6 Dec C

87.32 - Exhibit 02
Circular Area Defect



Given:

Defect diameter = 8 inches

Defect length = 9 feet

Circular area deduction 8" x 9' = 1 Dec C

87.33 - Length Deduction Method

1. Use the length deduction method when unsound wood affects a portion of the segment length.
2. Make segment length deductions to eliminate char that penetrates the wood fiber (sec. 8733, ex. 01 and 02).

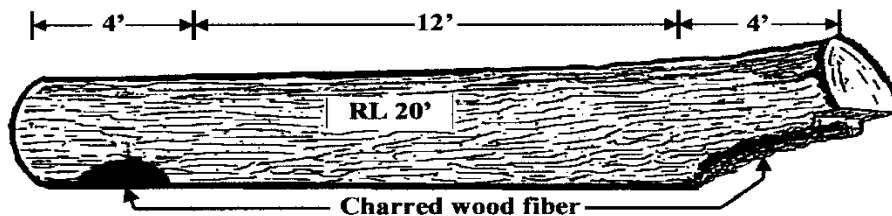
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3. Make segment length deductions when logs are not 90 percent debarkable (sec. 87.4).
4. See section 24 for further direction on using this deduction method.

Any char present in the wood fiber of a log causes the entire length affected to be unusable. Deduct 100% of the length affected. The remaining portion must meet contract minimum specifications for length, or the segment is cull.

The log in exhibit 01 has two areas of charred wood fiber. A length deduction of 8 feet is made to eliminate the affected areas.

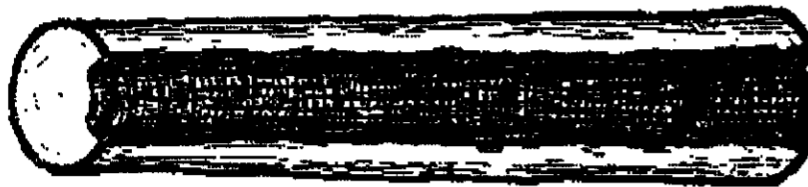
87.33 - Exhibit 01
Length Deduction for Char



Given:

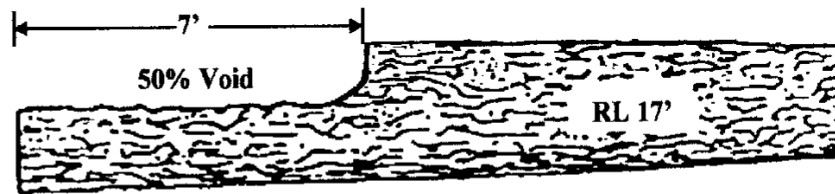
Recorded length = 20 feet
Defect length = 4 feet
Length deduction = 8 feet

87.33 - Exhibit 02
Cull Log Due to Char



Char affects the full length of this log; therefore, the entire log is not usable for utility pulp chips and is cull.

87.33 - Exhibit 03
Pie-Cut Deduction



Given:

Recorded length = 17 feet
Recorded diameter = 19 inches
Gross segment volume = 25 Dec C
Void affects 50% of 7 feet.
7-foot length deduction = 10 Dec C
50% Pie-cut deduction = $10 \times .50 = 5$ Dec C

87.34 - Diameter Deduction Method

1. Use the diameter deduction method for perimeter defects such as sap rot.
2. Reduce the original diameter of the segment according to the extent of defect to obtain net volume. The defect volume is the difference between the gross and net volume.
3. See section 25 for further direction on using this deduction method.

87.4 - Debarkability

A log segment shall be considered debarkable if it would not create a safety hazard, would not fall apart when subjected to the mechanical debarking process, and is 90 percent debarkable. The portion of a segment that cannot be mechanically debarked will have a length deduction made to eliminate 100% of the affected length. The remaining portion must meet contract minimum specifications for length, or the segment is cull.

87.41 - Shatter

Depending on the extent of defect, shatter can be considered a non-debarkable defect. In exhibit 01, shatter affects 7 feet on the large end segment that would fall apart, and may be a safety hazard when subjected to the debarking process. Use the length deduction method to deduct for the defect.

87.41 - Exhibit 01
Log With Shatter



Given:

Recorded length = 32 feet
Segment length = 16 feet
Shatter affects 7 feet
Length deduction = 7 feet

87.42 - Severe Crook

Exhibit 01 illustrates how to calculate defect volume for severe crook defects. Due to severe crook, this log would be considered less than 90% debarkable and should be culled. In addition, this log would be considered a safety hazard if debarked.

87.42 - Exhibit 01
Log With Severe Crook



Given:

Recorded length = 16 feet
Defect length = 16 feet
Log is cull