

Special Forest Products

12

12.1 Special Forest Products

Some scaling involves the measurement of partially or fully manufactured products instead of raw logs. These products are known as Special Forest Products. This chapter documents the classification and scaling requirements for these products. Topics covered include:

- when can timber be scaled as a special forest products instead of a log,
- exportability of partially manufactured products,
- product descriptions for each product including botanical forest products,
- timber marking requirements, and
- scaling methods and documentation requirements.

12.2 Definition of Special Forest Products

In some cases, operators are permitted to partially or fully manufacture products before having timber scaled. Such products are known as Special Forest Products.

Special Forest Products are designated in the Special Forest Products Regulation to include:

Christmas trees	Cants
Firewood	Posts and rails (split and round)
Mining timbers	Shake and shingle bolts, blocks and blanks
Stakes and sticks	Shakes
Woodchips	Hogged Tree Material

The *Special Forest Product Regulation* can be found at:

http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/34_241_2003

12.2.1 Classification as Special Forest Products

The *Forest Act* requires that timber must be scaled and graded as logs prior to manufacture into any product, except under specific conditions, special forest products may be scaled and classified.

To be classified as a Special Forest Product, all of the following apply:

1. The person must be authorized by the District Manager to process timber into a special forest product (for Crown Timber).
2. The product must be manufactured and conform to the special forest product description.
3. A waste assessment for the timber left on harvested areas must have been approved by the District Manager, before manufacturing the timber into a SFP.
4. The special forest product must be scaled at a site designated by the District Manager, which may be the site at which the timber is manufactured into the special forest product.

Timber that does not conform to these requirements must be scaled in log form using the B.C. Metric Scale and graded using the appropriate grade schedule (described in the *Timber Grading* chapters) prior to any manufacturing.

To facilitate the timely recovery of post harvest material from accumulations and for the purpose of this section only, the waste assessment requirement will be met if:

- the accumulations waste volume and grade data have been entered into the Ministry Waste System and accepted by the District Manager, including,
- a map that identifies those accumulations that have been waste assessed.

This does not alter the requirements in the *Provincial Logging Residue and Waste Measurement Procedures Manual* and for the licensee to conduct assessments and meet timelines for submission.

If a waste assessment has not been completed on the timber left on the cutting authority area, the *BC Metric Scaling* rules apply and material must be scaled and graded as timber.

12.2.2 Exporting Special Forest Products

While special forest products, by definition, are partially or fully manufactured, they still may not be considered manufactured for the purpose of export.

If scalers are asked to classify any material for the purpose of export, they must be familiar with the current export policy set by the Ministry. Contact either the district or regional office for copies of the policy and clarification.

12.3 General Requirements

12.3.1 Scaling

All special forest products are required to be scaled and recorded in a proper manner by an authorized scaler (see the Scaling Administration chapter for more information on scaling authorizations). Scaling may be performed at the harvest site or at another authorized site.

The underlying objective of special forest product measurement is to determine the net firmwood volume of the products. A notable exception is Christmas trees, which require a piece count by species and length category. Special forest products are not graded like other forms of timber.

Because of the size, shape, and ~~often~~ the number of pieces conventional piece scaling for special forest products is often not feasible. A number of other methods are in place to determine reliable volumes without the practical problems of scaling each piece. These include:

- the Piece Sampling method (applied mainly to round products),
- the Stacked method (applied mainly to split products),
- the Piece Count (used only for Christmas trees), and
- Weight Scaling or Volumetric Estimate method (applied mainly to woodchips and hogged tree material).

Each method is described in Section 12.6.

The recommended method(s) are given in the section that describes each product. In consultation with the operator and scaler, the Ministry will authorize the use of a method which is considered accurate and practical for the site. Once a method is determined, it must be applied consistently, and may not be changed without a change to the site and scaler authorizations.

12.3.2 Recording the Scale

Recording the scale is a three step process:

- the scale results are recorded to a scaler's tally sheet,
- the tallies are summarized to a scale summary, and
- the documents are submitted to the ministry (see the Documenting and Reporting Scale chapter for detailed information on forms completion and submission).

12.4 Special Forest Product Descriptions

To scale Special Forest Products, a scaler must be able to identify and code the products, know how to calculate the volume of the product in cubic metres, and be able to document the scale so that charges may be calculated.

The Ministry will approve the classification and scaling method of a special forest product when issuing a cutting authority, based on the following product descriptions and applications.

12.4.1 Christmas Trees

Product Code: XM

Description: In British Columbia, most Christmas trees are Douglas-fir. Trees are selected for appearance, density, form vigour, taper, balance, foliage condition, cleanliness, freshness and size. The Crown sells Christmas trees by the piece with charges dependent on the height of the tree. The height is to be measured from end to end.

Dimensions: Three height categories are recognized and segregated as grades, these are:

Height Category

Over 5 m	1
3 to 5 m	2
Under 3 m	3

Scale Method(s): Christmas tree piece count method is used in all cases.

12.4.2 Firewood

Product Code: FW

Description: Firewood is manufactured from round or split fuel logs to specific sizes for heating purposes. Firewood is a finished product.

Dimensions: Firewood lengths range from 30 to 60 cm. Although 60 cm is the longest common length, some modern heating systems will take a “cordwood” length up to 1.2 m. Firewood is consumer marketed in diameters up to 20 cm.

Scale Method(s): The Stacked Special Forest Product Method is used for scaling both split and round firewood. Unless specified in a cutting authority, firewood is not be classified as such.

12.4.3 Mining Timbers

Product Code: MT

Description: Mining timbers are round logs with the bark removed. They are used as support structures in mines. Props and caps are somewhat smaller pieces used in conjunction with the heavier timbers. They are an end product and are not to be classified as mining timbers, props or caps if they will not be used for their described purpose.

Dimensions: The top diameters range from 10 cm to a maximum of 38 cm. Lengths range from 1.4 m to a maximum of 2.4 m.

Scale The B.C. Metric Scale is used.
Method(s):

12.4.4 Stakes and Sticks

This section includes a variety of products which were previously assigned separate product codes. The same product code now applies to the entire group of products. The full list of products, previously classified separately, is included below for reference.

Car Stakes

Product Code: SS

Description: Car stakes are round stakes used as side supports on railroad flat cars. They often have one squared end to fit the side pockets built into the car deck and the remainder of the stake has the bark left on. It is now more common to make car stakes from sawn timbers from a mill. These sawn timbers are not classified as car stakes. Car stakes are a finished product and cannot be classified as such with the intent to further process the product into another finished product.

Dimensions: Stakes are approximately 10 to 15 cm in diameter and 3 to 5 m in length. The diameter at any place on a piece must not exceed 15 cm.

Scale Either the Piece Sampling method or the Stacked Special Forest
Method(s): Product method may be used.

Grape Stakes

Product Code:	SS
Description:	Grape stakes are either split or round pieces of any species, with or without bark, and are used to support grape vines. They are also used to support ginseng sun shades. Grape stakes are an end product.
Dimensions:	The diameter range is from 7 to 10 cm and may not to exceed 10 cm in diameter at any point. Maximum length is 3.5 m.
Scale Method(s):	The Piece Sampling Method is preferred if the stakes are round and well sorted by size categories and the Stacked Method used if the stakes are split and/or the stack is unsorted to size category.

Hop Poles

Product Code:	SS
Description:	Hop poles are either split or round pieces of any species without bark and are used to support hop vines.
Dimensions:	Top diameters range is from 7 cm to a maximum of 13 cm. Length ranges from 4 m to a maximum of 6 m. Hop poles are an end product and are not classified as such if their intended use is for manufacturing another product.
Scale Method(s):	As with grape stakes, the piece sampling method is preferred if the poles are round and well sorted by size categories and the stacked method used if the poles are split and/or the stack is unsorted by size. Unless provided for in the cutting authority, hop poles with diameters exceeding 10 cm at any point must be scaled using the B.C. Metric Scale.

Lagging (Split)

Product Code:	SS
Description:	Split wood of varying thickness, width and length. Lagging is split planking used especially for preventing cave-ins in earthwork or for supporting an arch during construction. As with cribbing, lagging is only manufactured for use as an end product at a specific site for a specified project.
Dimensions:	There are no restrictions for thickness, width or length but they cannot be classified as lagging if marketed for projects or uses other than their described use at a specific site.
Scale Method(s):	The Stacked Special Forest Product Method is used. No lagging has been scaled in many years because of its limited application.

Orchard Props

Product Code:	SS
Description:	Orchard props are split or round logs used to support fruit tree branches. Although not necessarily debarked, they are an end product and may not be used for a purpose other than their described purpose.
Dimensions:	The top diameters range from 7 cm to a maximum of 10 cm. The lengths can reach a maximum of 2.5 m.
Scale Method(s):	The Piece Sampling Method is preferred if the pieces are round and well sorted into size classes, and the Stacked Method is used if the pieces are split and/or not sorted into size classes.

*Pickets and Palings***Product Code:** SS

Description: Pickets and palings are split, bark free boards and stakes (usually red cedar), used in fence construction. All four faces are usually split, although the edges may be sawn. The faces are never sawn. They are typically rounded or pointed on the top and are considered to be a finished product. They may not be classified as a picket or paling if intended for another purpose or for further manufacturing.

Dimensions: Thicknesses range from 1 to 2.5 cm and widths range from 7 to 13 cm. Picket lengths range up to 1.2 m but palings tend to be longer, as in a stockade type fence, up to 2.5 m.

Scale Method(s): The Stacked Special Forest Product Method is preferred as pickets and palings are split products.

*Stakes and Stocks (Sticks)***Product Code:** SS

Description: Stakes and stocks can be any product with or without bark and a large end diameter of less than 10 cm. Typical products are tepee poles, bulldoze sticks, spears, movie props and other special purpose products that are not defined elsewhere in this manual.

Dimensions: The large end diameter of the product must be less than 10 cm. There are no restrictions on length.

Scale Method(s): Any of the scaling methods may be chosen, including the B. C. Metric Scale method, the Piece Sampling Method or the Stacked Method, depending on practicality. A Ministry scaling representative will assist the scaler in determining that practicality.

12.4.5 Cants

Product Code: CA

Description: A cant is a partially manufactured product which has two flat faces that are further processed through an edger or resaw to make boards. Waney areas are where the bark or the sapwood surface are still present on the product. Cants are produced from dead and down post-logging residue that, as determined by the regional manager, would not make a sawlog.

Dimensions: There are no restrictions for end dimensions or length because the classification was established to allow improved utilization of waste material left on a harvest site.

Scale Method(s): The piece sampling method or the B.C. Metric Scale method may be used to obtain a volume in cubic metres.

12.4.6 Posts and Rails (Split and Round)

This section also includes a number of products which previously were individually classified as special forest products. The same product code now applies, and the full range of products within the coding is listed for reference.

Fence Posts (Round)

Product Code: PR

Description: Round fence posts are peeled logs (usually lodgepole pine) manufactured to various dimensions for use in the construction of a fence. Modern fence post manufacturing processes include sharpening and chemical treatment against decay. Fence posts are a finished product and are not further processed into another end product, but will not require treatment at the harvest site to qualify.

Dimensions: Posts are graded in sizes to suit consumer markets. Line post top diameters range from 6 to 15 cm and butt diameters range up to 18 cm in these size classes. Corner post top diameters are usually larger than line posts but do not exceed 22 cm. Standard length classes are "sixes" (1.8 m), "six-sixes" (2 m), "sevens" (2.2 m), "eights" (2.4 m), and "tens" (3 m). Posts exceeding these dimensions are an exception, and their consideration as a Special Forest Product is doubtful.

Scale Method(s): Either the piece sampling or the stacked methods may be used depending on practicality. Unless provided for in the cutting authority, piece scale or weight scale as logs using the B.C. Metric Scale described in the Firmwood Scaling Procedures and Timber Grading chapters of this manual.

Fence Rails (Split)

Product Code: PR

Description: Split fence rails are normally manufactured from trees unsuitable for the manufacture of lumber. They have three or four split, debarked faces and serve the same function as round rails. Both ends of rails are often chamfered to fit pockets drilled in split red cedar posts to suit the decorative rail fence market. Split fence rails are a finished product and are not manufactured further.

Dimensions: Each split face ranges from 5 to 10 cm in width at any point depending on the size class. In manufacture, a circumference range is often used to grade rails into sizes corresponding to particular markets. A "Jumbo" rail is about 33 cm around, a "pony" rail is about 25 cm around, and a "Garden" rail is less than 25 cm around. Length classes are the same as for round rails at 1.8, 2, 2.2, 2.4, 3, and 3.6 m.

Scale Method(s): The stacked method is considered the most practical scaling method.

*Fence Posts (Split)***Product Code:** PR

Description: Split fence posts are normally manufactured from red cedar trees considered unsuitable for the manufacture of lumber. They have three or four split, debarked faces and serve the same function as round posts. Pockets are often drilled for two or three fence rails to suit the decorative rail fence market. Split fence posts are a finished product and are not further manufactured.

Dimensions: Each split face ranges from 8 to 13 cm in width at any point depending on the size class. In manufacture, a circumference range is often used to grade posts into sizes. A "Jumbo" post is approximately 46 cm around, a "Pony" post is about 40 cm and a "Garden" post is less than 40 cm around. Corner post top diameters are usually larger than line posts but do not exceed 15 cm per face or 60 cm around. Length classes are the same as for round posts at 1.8, 2, 2.2, 2.4 and 3 m.

Scale Method(s): The Stacked Special Forest Product Method is the practical scaling method.

*Fence Rails (Round)***Product Code:** PR

Description: Round fence rails are peeled logs (usually lodgepole pine) manufactured to various dimensions for use in the construction of a fence. Fence rails are used in place of or in addition to wires and boards. Because rails are not exposed to conditions as harsh as posts are, treatment against decay is not as common. Fence rails are a finished product and are not processed further.

Dimensions: Rails are graded to diameter and length classes to suit site conditions or consumer markets. Rail diameters range up to 10 cm measured at any point in the length. Lengths are commonly classed in "sixes" (1.8 m), "eights" (2.4 m), "tens" (3 m) and "twelves" (3.6 m).

Scale Method(s): Either the Piece Sampling or the Stacked Methods may be used depending on the practicality. Unless provided for in the cutting authority, dimensions larger than 10 cm are scaled as logs using the B.C. Metric Scale.

12.4.7 Shake and Shingle Bolts, Blocks and Blanks**Product Code:** SB

Description: Shake bolts and blocks are usually bark free segments cut from logs or slabs, usually of red cedar but increasingly from other species used for the manufacture of shakes. Although they are commonly marketed at this stage, bolts and blocks are only a "partially manufactured" product, and may not be sold for a use other than their described use. Shake blanks are split from blocks, from which two "taper sawn" shakes are made from each blank.

Dimensions: Shake bolts are cut into lengths of approximately 1.4 or 1.45 m from which shake blocks are cut into the standard lengths of 46 cm (called "eighteens"), and 61 cm (called "twenty fours").

Scale Method(s): Blocks and blanks are typically close piled onto very uniform 1.5 cord pallets for shipping and marketing. It is common practice to use the stacked method of scaling after the blocks are loaded on pallets. An air space factor of 0.7 is used if the blocks are not debarked and a factor of 0.8 is used if they are debarked.

*Shingle Bolts and Blocks***Product Code:** SB

Description: As with shake bolts and blocks, shingle bolts and blocks are usually debarked segments cut from logs or slabs, usually of red cedar but increasingly from other species, used in the manufacture of shingles. The only difference is that they can be shorter and smaller than shake bolts. Although they are commonly marketed at this stage, bolts and blocks are a partially manufactured product, and may not be sold for another purpose other than their described purpose.

Dimensions: Shingle bolts are cut into lengths of approximately 1.3 and 1.45 m from which Shingle blocks are cut into standard lengths of 41 cm (called "sixteens"), 46 cm (called "eighteens"), and a maximum of 61 cm (called "twenty fours").

Scale Method(s): Because the blocks are typically close piled onto very uniform 1.5 cord pallets for shipping and marketing, it is therefore practical to use the stacked method of scaling after the blocks are palletized, as described for shake bolts and blocks.

12.4.8 Shakes**Product Code:** SK

Description: Shakes are split from blocks or are taper sawn from blanks and are usually of red cedar, but increasingly of other species. Shakes are a finished or end product and are marketed as such.

Dimensions: Shakes are variable in width and thickness according to grade but do not usually exceed 2.5 cm in thickness. They are almost always tapered. Lengths are in the standard lengths of 46 cm (called "eighteens") and 61 cm (called "twenty fours").

Scale Method(s): Because shakes are typically close piled onto very uniform 1.5 cord pallets for shipping and marketing, it is practical to use the Stacked method of scaling after the blocks are palletized. If this is the case, it is permissible to count the number of cords and convert to cubic metres by multiplying the number of cords by 3.62457. This provides the enclosed volume in cubic metres. Multiply this volume by a solid wood conversion factor of 0.8 to obtain the solid wood volume in cubic metres. The formula is:

$$\text{Volume (m}^3\text{)} = \text{cords} \times 3.62457 \times \text{Solid Wood Factor (0.8)}$$

12.4.9 Woodchips**Product Code:** CH**Description:** A Woodchip is a small, thin portion of wood cut from a larger piece by a mechanically operated knife.**Dimensions:** A woodchip shows two knife cuts and its width is always greater than its thickness.**Scale Method(s):** Weight Scaling using an established ration or using a volumetric estimate. It is reported by leading species.**12.4.10 Hogged Tree Material****Product Code:** HF**Description:** Hog Fuel is tree residue or by-products that have been shredded into fragments by mechanical action.**Dimensions:** Hogged tree material is grindings from all parts of a tree, including bark, needles and limbs.**Scale Method(s):** Weight Scaling using an established ratio or using a volumetric measurement or estimate. It is reported by leading species.

12.5 General Requirements

12.5.1 Timber Marking

The timber marking requirements for Special Forest Products are the same as for timber. That is, all products must be conspicuously marked on the area of origin prior to any transportation off the area in accordance with the Timber Marking & Transport Regulation. Exemptions to the marking requirements may be granted where practical. Alternate marking methods include:

- on each side of the load of timber, truck or rail car, by using one of the following methods:
 - writing the timber mark in paint or crayon on the timber,
 - attaching a sign displaying the timber mark to the timber, truck or railcar,
 - using another method as directed by a forest officer, and
- if the timber includes logs, by using a hammer indentation on at least 2 log ends at the front and at least 2 log ends at the back of the load of timber.

Exemptions will not be issued if timber will be water-borne, subject to export, or transported out of a jurisdiction unless a different level of marking is approved by the receiving jurisdiction.

12.5.2 Transport Documentation

Anyone transporting timber, Special Forest Products, or other forest products is required to carry documentation describing the product being transported. Every load must carry a manifest or bill of lading, which is provided for on the Christmas Tree Return (FS 200), the Record of Purchase of Special Forest Products (FS 222), or the Load Description Slip for products scaled in log form or transported as chips or hog fuel.

The purchaser of timber is responsible for obtaining and retaining documentation on proof of scale for material received at the purchaser's site. The purchaser may be responsible for payment of stumpage and any associated charges where the purchaser cannot prove that the timber was scaled previously.

12.5.3 Document Handling for Special Forest Products



Figure 12.1 Flow Diagram Outlining Selection of Scaling Methods and Forms.

12.6 Special Forest Product Scaling Methods

When choosing a method of scaling Special Forest Products, the scaler (in consultation with a Ministry scaling representative), must decide on a method to use to suit the product and the site conditions. Although method(s) are recommended in the product descriptions section for each product, it may be more practical to choose another method. Some guidelines are:

The Piece Sampling method is best for:

- uneven piles,
- product lengths exceeding 5 m,
- well sorted size classes,
- large numbers of smaller pieces, and
- round products, for example, round fence posts.

The Stacked method is best for:

- even piles,
- product lengths of 5 m or less,
- difficult to sort size classes,
- large numbers of very small pieces, and
- irregular shapes, for example, shake and shingle blocks.

The Piece Count is used only for Christmas trees.

The B.C. Metric Piece Scale is used for poles, pilings, and building logs, and where:

- material is not piled into units for sampling or stacked methods,
- material is not sorted into size, species and quality class, and
- another scaling method has not been authorized.

Volumetric Estimate or Weight Scale using a predetermined ratio is the best method for woodchips or hogged tree material.

In consultation with the operator and scaler, the Ministry will authorize the use of a method most accurate and practical for the site. Once a method is determined, it must be applied consistently, and may not be changed without a change to the scale site and scaler authorizations.

12.6.1 Round Piece Sampling Method

This method of determining the net volume of a Special Forest Product is used for scaling round small diameter special forest products such as round fence posts, round rails, grape stakes, orchard props, and sticks. The Weight Scaling Sampling chapter provides a comprehensive overview of sampling techniques used in weight scaling, and the piece sampling process is similar. Section 12.8.1 illustrates a method to determine the number of samples required for a given group or population.

The steps are:

1. Sort the product to be scaled into species, standard length classes (increments of 0.1 m), and top size (increments of one rad class). Normally, most products will be sorted into dimension classes as part of the marketing process. If this sort includes dimensions exceeding the above increments, more samples will have to be taken to achieve an accurate scale.
2. Scale a number of representative pieces using the BC Metric Scale described in the Gross Measurements Procedures chapter. A sufficient quantity of pieces must be scaled to establish an average volume with confidence. For example, if all of the pieces are nearly identical in length and diameter, fewer pieces would be sampled, but as the size variation increases within a pile, more samples are required. In all cases, a minimum number of samples may be set by the ministry.
3. Determine the average net volume per piece or the "volume factor" (to five significant figures) for each bundle or pile by dividing the total volume of the scaled pieces by the piece count of the scaled pieces.
4. Count the number of pieces in the bundle or pile.
5. Multiply the number of pieces in each bundle or pile by the volume factor to determine the net cubic volume of the bundle or pile.

12.6.1.1 Calculation of the Piece Sampling Method

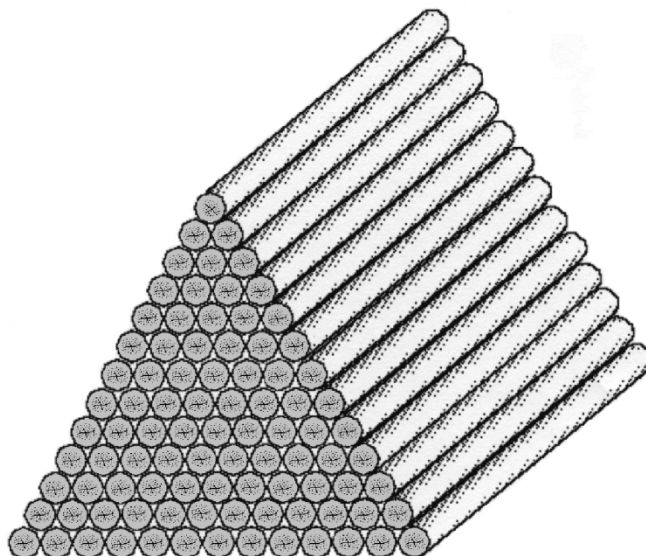


Figure 12.2 A Pile of Posts Sorted to Size Classes and Ready for Sampling.

In determining the volume for 100 round fence posts 12 cm in diameter and 2.4 m long, five sample posts were measured.

Post Number	Length	Top	Butt	Volume (dm ³)
1	2.4	6	7	14 + 18 = 32
2	2.4	6	6	14 + 14 = 28
3	2.4	6	7	14 + 18 = 32
4	2.4	7	7	18 + 18 = 36
5	2.4	6	6	<u>14 + 14 = 28</u>
Total volume of five posts:				0.156 m ³
Average volume per post (factor):				0.156 m ³ ÷ 5 = 0.0312 m ³
Total volume of 100 posts:				0.0312 x 100 = 3.1 m ³

6. The measurements are recorded on the FS 222 in the following manner (Figure 12.3).

On the FS 222, clearly indicate the factor used. Refer to Documenting and Reporting Scale for more details on completing this form.

TIMBER MARK		GEOGRAPHIC LOCATION OF TIMBER ORIGIN	
33969		East Side	
CONTRACTOR Mel Smith		BLOCK / LANDING / SETTING 1 / 1	HAUL DISTANCE 3.8 km
CARRIER COMPANY NAME Tedis Trucking		VEHICLE LICENSE NO. 6251TX	
TRANSPORT OPERATOR'S NAME Ted Jones		TRANSPORT OPERATOR'S SIGNATURE <i>Ted Jones</i>	
DATE OF TRANSPORT YY MM DD 04 03 30	TIME 6:30 am	DESTINATION OF SPECIAL FOREST PRODUCTS Acerville Wood Products	
PURCHASER Acerville Wood Products		VENDOR OR AGENT'S SIGNATURE Melanie Smith	
SCALER'S LICENSE # 0326		PLACE OF SCALING 69B	
VENDOR M Smith	SCALER'S RETURN # 312	SCALER'S SIGNATURE <i>Scaler</i>	
DATE OF SCALING YY MM DD 04 03 31	IF PREVIOUSLY SCALED PROVIDE ORIGINAL SCALER'S LICENCE # RETURN # DATE OF ORIGINAL SCALE		
DESCRIPTION	LENGTH OR # SQUARES	WIDTH OR # BUNDLES	HEIGHT OR # PIECES
LØ fenceposts (PR)			100
			312
			3.1 m ³

DISTRIBUTION: WHITE - MOF (copy of scale attached); CANARY - TRANSPORTER; PINK - VENDOR/CONTRACTOR; GREEN - REMAIN IN BOOKLET
FS 222 HVA 01/05 Please be advised that this information may be released under the Freedom of Information and Protection of Privacy Act.

Figure 12.3 Completed FS 222 for 100 Round Fence Posts.

7. After scaling, a Volume Estimate - Other (FS 701) is completed and submitted to the appropriate Forest District Office on or before the prescribed submission time (Figure 12.4).

VOLUME ESTIMATE - OTHER <small>Form Website: http://www.bccsa.gov.bc.ca/eng/bs/csb/csbforms.htm</small>									
 <div style="display: inline-block; vertical-align: middle; text-align: left;"> BRITISH COLUMBIA Ministry of Forests and Range </div> <div style="display: inline-block; vertical-align: middle; text-align: center;">  </div>		<div style="border: 1px solid black; padding: 2px;"> <small>Use this space to fill in the "Summary Document Number" that appears on the HRS screen at whom as you have used this volume estimate.</small> HRS DOCUMENT NUMBER </div>							
SCALER LICENCE	TIMBER MARK	SCALER RETURN NUMBER	SCALP RPT NUMBER	SCALE DATE	LOG COLAT				
0326	33969	3112	16918	2101040331	111010				
COMMENT (MAX 796 CHARACTERS)									
NOTATIONS (MAX 80 CHARACTERS PER LINE)									
FS 222 # 11234									
SPECIES	PRODUCT	GRADE	PIECES	VOLUME	COMPANY USE				
LØ	PIR		11010	1311					
					SCALER'S SIGNATURE				
									

Figure 12.4 Completed FS 701 – Volume Estimate – Other Summarizing the FS 222 in Figure 12.3.

12.6.2 Stacked Special Forest Products Method

The stacked method of scaling special forest products can be used for either split or round products.

Method

1. Stack the product so all the pieces are of one species and length. The stack should be of uniform length, width, and height.

2. Measure the length, width, and height of the stack to the nearest 0.02 m (2 cm). Refer to Figure 12.5 for the number of height measurements required to establish the average height of the stack.

Table 12-1 Table of Number of Pile Heights Taken for Various Lengths

	Number of Height Measurements	
Pile Length (Metres)	Regular Stacks	Irregular Stacks
2	2	3
3	2	3
5	3	6
10	6	12
15	8	12
20	10	12
25	10	15

3. Multiply the measured length, width and average height of the stack to obtain the volume of the stack in cubic metres.
4. Multiply the stacked volume by a factor (Table 12.2) to eliminate the volume of bark, air space, and defect in the stack and determine the net volume of the stack. The solid wood conversion factors in the following table have been developed over many years of experience. Although the factors may be accurate in the average manufacturing process, they may not always be appropriate, due to diverging methods, equipment, and/or raw materials. Therefore, the scaler may request a Forest Officer to authorize a more appropriate solid wood conversion factor.

Table 12-2 Table of Solid Wood Conversion Factors by Product

Product	Solid Wood Conversion Factor
Unpeeled round wood products	0.65
Unpeeled split products	0.70
Peeled round wood products	0.75
Peeled split products	0.80

5. The measurements will be recorded on the FS 222 in the following manner:

On the FS 222, clearly indicate the factor used.

BRITISH COLUMBIA		SPECIAL FOREST PRODUCTS SCALE RETURN AND TRANSPORTATION DOCUMENT			
TIMBER MARK WL211B		GEOGRAPHIC LOCATION OF TIMBER ORIGIN Westside			
CONTRACTOR Tom Brown		BLOCK / LANDING / SETTING 2 1	HAUL DISTANCE 26km		
CARRIER COMPANY NAME Ted's Trucking		VEHICLE LICENSE NO. 6251TX			
TRANSPORT OPERATOR'S NAME Ted Smith		TRANSPORT OPERATOR'S SIGNATURE <i>Ted Smith</i>			
DATE OF TRANSPORT YY MM DD 03/01/13	TIME 10:15am	DESTINATION OF SPECIAL FOREST PRODUCTS Epic Tonewoods Inc			
PURCHASER Epic Tonewoods		VENDOR OR AGENT'S SIGNATURE <i>T Brown</i>			
SCALER'S LICENSE # 0326		PLACE OF SCALING 69B			
VENDOR Tom Brown	SCALER'S RETURN # 311	SCALER'S SIGNATURE <i>S. Scaler</i>			
IF PREVIOUSLY SCALED PROVIDE ORIGINAL SCALER'S					
DATE OF SCALING YY MM DD 03/01/28	LICENCE #	RETURN #	DATE OF ORIGINAL SCALE		
DESCRIPTION	LENGTH OR # SQUARES	WIDTH OR # BUNDLES	HEIGHT OR # PIECES	FAC TOR	METRES ³
CE Shake Blocks	4.92	2.44	3.24	0.8	31.1

DISTRIBUTION: WHITE - MOF (copy of scale attached); CANARY - TRANSPORTER; PINK - VENDOR/CONTRACTOR; GREEN - REMAIN IN BOOKLET
FS 222 HVA 01/05 Please be advised that this information may be released under the Freedom of Information and Protection of Privacy Act.

Figure 12.5 A Completed FS 222 with Split Product.

6. After scaling, a Volume Estimate – Other (FS 701 – see Figure 12.6) is completed and submitted to the appropriate Forest District Office on or before the prescribed submission time.

[illegible]

Figure 12.6 A Completed FS 701 – Volume Estimate – Other – Summarizes the Information from the FS 222 in Figure 12.7.

12.6.3 Christmas Tree Piece Count Method

The Christmas Tree Piece Count method is used for Christmas tree scaling.

Method

1. The Christmas trees are sorted by species and height category. The height categories are:

Height Category	
Over 5 m	1
3 to 5 m	2
Under 3 m	3

2. A piece count is taken for each species and grade.
3. The piece count is recorded on the FS 200, Christmas-Tree Return. The height category (i.e., 1, 2, or 3) is recorded under the grade field on the tally sheet.
4. After scaling, an FS701 – Volume Estimate is completed and submitted to the appropriate Forest District Office on or before the prescribed submission time (Figure 12.7).

Figure 12.7 A Completed FS 701 – Volume Estimate – Other Which Summarizes the Information on the FS 200.

12.6.4 Estimating Volumes of Tree Length Piles

Often, a scaler is required to estimate the volume of decks of tree length logs. It is not enough to simply look at a deck and "guesstimate" the volume without some means of measurement to demonstrate confidence that the estimate is based on valid principles. These estimates are used for inventory control, contractor advances, interim invoicing, and the like, but are not adequate for final scale submissions unless pre-authorized by the Regional Manager or District Manager. Piece scaling, weight scaling, and the two Special Forest Products methods (piece sampling and stacked) are the only approved scales for final billing.

Two approaches may be taken, both being a variation of either the round piece sampling method or the stacked method. The level of detail required will influence the scaler's choice of method.

12.6.4.1 Sampling the Pile and Counting Pieces

This method will provide more information on species and grade, but will require enough sampling to develop confidence in the results. If the scaler is concerned with volumes only, then enough samples are taken to represent with confidence the diameter classes and lengths represented. If species and grade considerations are important, then correspondingly more samples must be taken.

1. Determine the number of samples required based on the level of information needed about the pile. Recognized sampling techniques are described in the Weight Scale Sampling chapter, but are more involved than necessary for this estimation process. For a more practical approach, select a sample area representative of the pile by estimation.
2. Scale every piece in the sample area as in Figure 12.8.

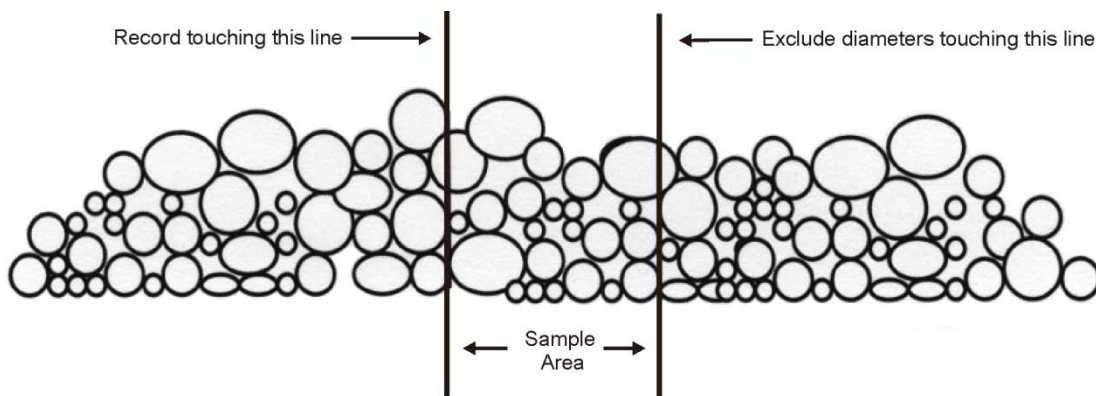


Figure 12.8 *Selecting a Sample Section from a Log Deck.*

3. Count the number of trees in the pile.
4. The frequency of each class in the sample is applied to the total count to determine the distribution of each class in the pile. For example, a sample area includes thirty six pieces. If nine pieces fall into species class BA, 20 pieces are SP and seven pieces are FI, then the BA distribution is $36/9$ or 1 in 4, SP is $36/20$ or 1 in 1.8, and FI is $36/7$ or 1 in 5.1. If there are four hundred and twenty five pieces in the pile, there will be approximately $425/4$ or 106 BA, $425/1.8$ or 236 SP, and $425/5.1$ or 83 FI. The same technique may be used for other classes, such as diameters, lengths, and grades.
5. If the piles can be tied into an existing weight scale population, that is, if it is known that the pile to be measured is from a production run that closely matches the profile that has been previously sampled as part of a weight scale strata, the statistical values from that series of weight scale samples will provide a detailed profile of the characteristics of the pile

12.6.4.2 Measuring the Pile and Applying a Factor

This method will represent a volume with reasonable satisfaction but may not provide enough detail for species and grade combinations:

1. Measure the height of the pile at 2 m intervals within 0.1 m. If the pile contains lengths exceeding 5 m or is predominately sorted with butts one way, it is necessary to take height measurements down both sides of the pile. Height measurements and length measurements are related. (See item 3 and Figure 12.9).
2. Find the average height of the pile by dividing the sum of the pile measurements by the number of measurements.
3. Measure the length of the pile within 0.1 m. Length measurements and height measurements are related, (Figure 12.9). If the total length of the pile is measured, the heights must be taken throughout the full length of the pile. When the length measurement is less than full length, (i.e., "squaring up" the pile, Figure 12.11), height measurements are taken only inside the square.

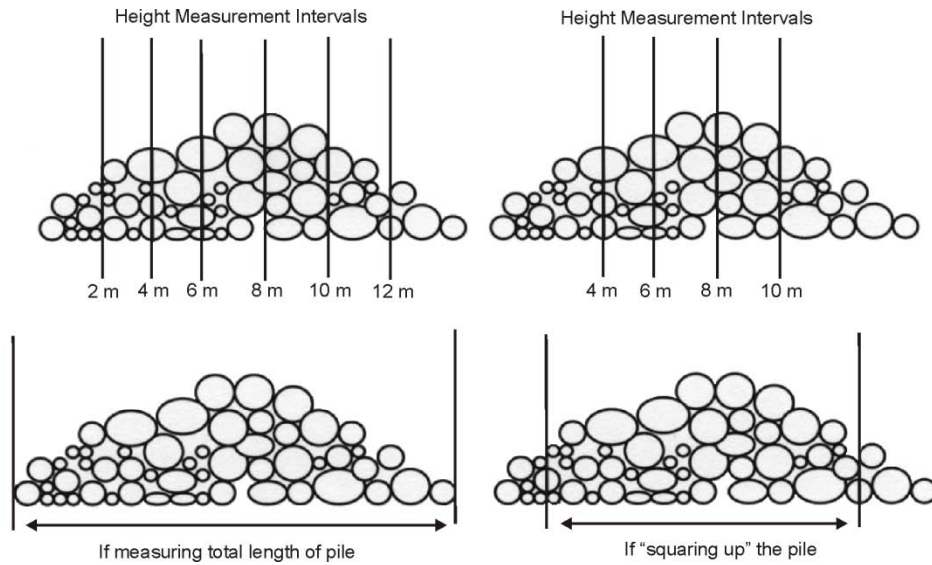


Figure 12.9 Two Methods of Measuring the Length and Height of a Pile.

4. Determine the average width of the pile by taking as many tree length measurements as possible and dividing the sum of the lengths by the number of measurements as in Figure 12.10.

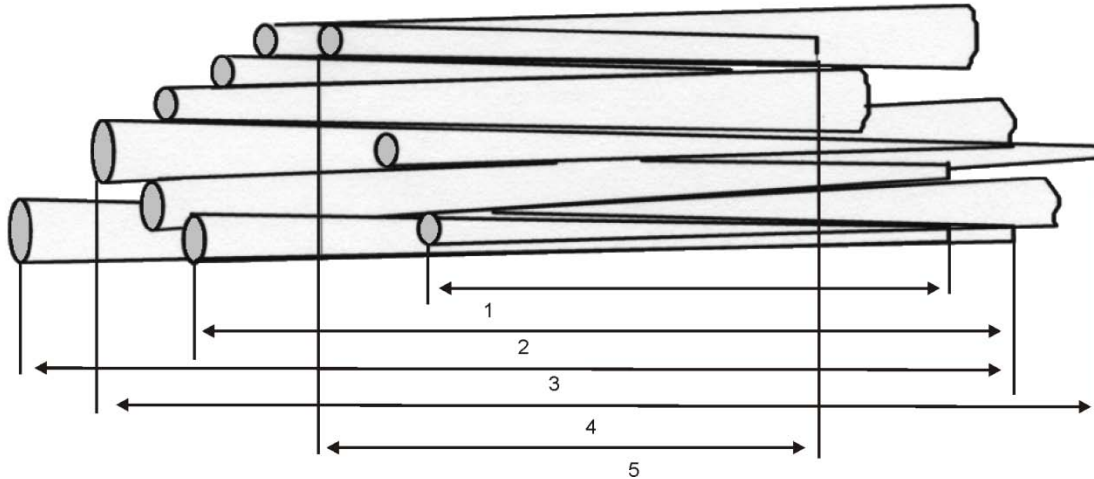


Figure 12.10 Finding the Average Width of a Pile by Averaging Five Representative Tree Lengths.

5. Multiply the pile height by the pile width by the pile length to arrive at the enclosed volume of the pile.
6. Multiply the enclosed volume by a factor of 0.65 to arrive at the estimated firmwood volume of the pile.

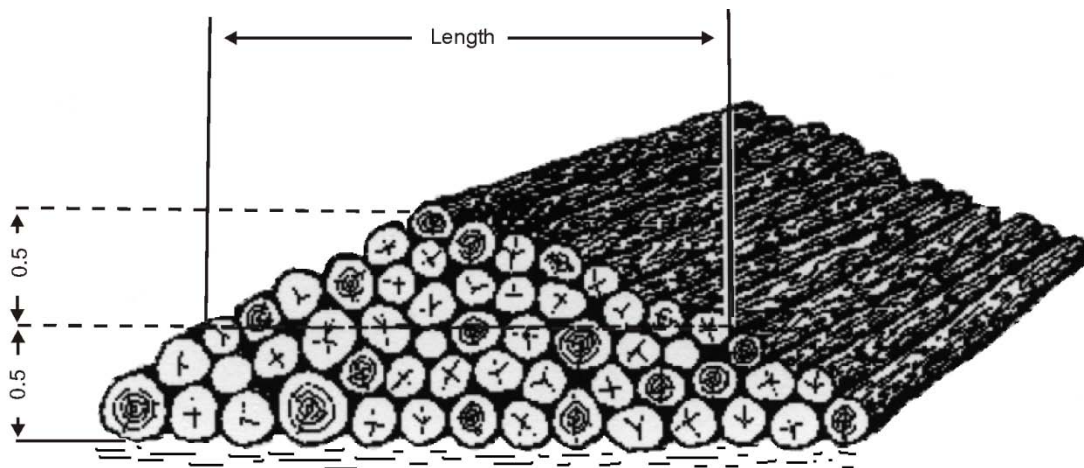


Figure 12.11 Squaring Up a Pile by taking Length Measurement at Exactly One-half the Height of the Pile.

12.6.5 Finding Piece Sample Requirements

Where a sampling method is authorized under Section 7 of the Scaling Regulation, use the following method to determine the number of samples required to meet the required sampling error of $\pm 1\%$, 19 times out of 20. From this calculation, the scaler will know with certainty how many pieces must be scaled in a group to achieve statistical reliability.

Assuming a producer is planning to take an estimated 5 000 lodgepole pine fence posts from an operating area. This is the "population" to be sampled, and the scaler will determine the sampling requirements as follows:

1. Scale a number of representative pieces to come up with an average volume per piece, for example,

Post Number	Length	Top	Butt	Volume (dm ³)
1	2.4	6	7	14 + 18 = 32
2	2.4	6	6	14 + 14 = 28
3	2.4	6	7	14 + 18 = 32
4	2.4	7	7	18 + 18 = 36
5	2.4	6	6	14 + 14 = 28
Total volume of five posts:				0.156 m ³
Average volume per post (factor):				0.156 m ³ ÷ 5 = 0.0312 m ³

2. Find the sample with the highest volume, in this case, 0.036 m³.
3. Find the standard deviation SD of the samples by subtracting the average piece volume from the piece with the highest volume and dividing by three,

$$SD = \frac{0.036 - 0.0312}{3} = 0.0016$$

4. Find the relative variance RV by dividing the square of the standard deviation by the square of the average piece volume,

$$RV = \frac{0.0016^2}{0.0312^2} = \frac{0.00000256}{0.00097344} = 0.0025683$$

5. From the total number of estimated pieces N (5 000) and the relative variance C, apply the formula described in Chapter 14 to arrive at the sample size n,

$$\pi = \frac{N \times 2^2 \times RV}{(N \times 0.0001) + (4 \times RV)} = \frac{5000 \times 4 \times 0.0025683}{0.5 + 0.01027} = \frac{51.366}{0.51027} = 100.7$$

6. Divide the total number of estimated pieces N by the sample size n to find the sampling intensity SI,

$$SI = \frac{N}{\pi} = \frac{5000}{101} = 49.5 = 50 \text{ (rounded)}$$

7. Scale every 50th piece and add it to the sum of the volumes of all of the samples.
8. At the end of the sampling period, divide the total volume of all of the samples V_s by the total number of samples n to arrive at the average volume per piece A . The total number of samples will differ from the sample size calculation in step 5 because the actual production will not likely match the estimated production,

$$A = \frac{V_s}{\pi} = \frac{3.151}{101} = 0.0312$$

9. Multiply the actual piece count by the average volume per piece to find the total volume for the population,

$$\text{Volume} = 5000 \times 0.0312 = 156 \text{ m}^3$$

10. Prepare a final scale return. Because the sampling term will usually be longer than the required frequency of scale submissions (every month), it is necessary to make adjustments to the final billing. For example, if it takes a period of three months to produce the 5 000 fence posts, returns are prepared based on the average volume per piece available at the time,

	Production	Average Volume/Piece	Volume for month
Month 1	2000 posts	0.03202	64.04 m ³
Month 2	1800 posts	0.0309	55.62 m ³
Month 3	1200 posts	0.0312	37.44 m ³ (unadjusted)
Total	5000 posts		157.10 m ³

The total volume in the final return must be adjusted to compensate for the use of an interim average volume per piece. Therefore, the sum of the first two interim monthly returns is subtracted from the total volume found in step 9 to arrive at the volume in the final return.

$$\text{Final return volume} = 156.00 - 64.04 - 55.62 = 36.34 \text{ m}^3$$

12.7 Botanical Forest Products

Increasingly, non-timber products are coming into commercial use. At present, the Ministry does not regulate the harvest of the vast majority of botanical Forest Products, but because they are related to the forest industry and affect forest management decisions and policy, these products will inevitably enter the scaling field. Measurement and recording of these products will become increasingly important to these processes as they evolve.

A current total of 222 recognized botanical forest products are harvested in B.C. These products can be grouped into eight general categories:

- medicinal and pharmaceutical products,
- wild edible mushrooms,
- floral and greenery products,
- wild berries and fruit,
- herb and vegetable products,
- landscaping products,
- craft products, and
- miscellaneous botanical forest products.

12.7.1 Medicinal and Pharmaceutical Products

The following descriptions are for only the most common products.

Product Codes: None

Description: Many plants and fungi produce compounds with medicinal value. Some of these products have long-established markets and represents a continuing economic opportunity. Medicinal plants used for herbal and alternative health products are marketed primarily through small buying houses which process and package the products for the retail market. Practically no information is available on the harvesting of these products except for cascara and western yew.

Extract of cascara bark is recognized as a useful tonic laxative and yew bark is the source of the drug Taxol, an important cancer therapy.

Scale Method(s): There is no requirement that harvesters or collectors of medicinal products to make payments to the Crown at this time. However, with respect to yew bark, it is a requirement to report the amount harvested in kilograms, specified in either dry weight or wet weight. If logs are removed, the logs must be scaled and reported in the same manner as any other commercial timber. Reporting details are available in the *Policy on Yew Bark Harvesting and Collection*.

12.6.2 Wild Edible Mushrooms

Product Codes: None

Description: Forest lands, particularly lodgepole pine forests, are a prime habitat for the Pine mushroom, one of the preferred species for texture and flavour among many groups. Because of its increasing importance as a commercial product, it is necessary to plan the harvesting process to ensure the long term survival of both the forest and the mushroom crop. Chanterelles and Morels are also important commercial species.

Dimensions: The Pine mushroom is sorted into six different grades by maturity, with the Grade 1 "button" being the most valuable, and the Grade 6 "over-mature" being the least valuable. Mushrooms classified in each grade are then weighed.

Scale Method(s): Mushrooms are not scaled or recorded at this time. If trees are removed or damaged, the logs must be scaled and reported in the same manner as any other commercial timber.

12.7.2 Floral and Greenery Products

Product Code: None

Description: The forest contains a huge inventory of plant species, providing many opportunities for crafts persons to design, manufacture and market decorative products such as wreaths and floral arrangements. These products can be grouped into five different categories:

- greenery
- conifer boughs
- essential oils
- basketry fillers
- fresh or dried flowers

Salal, cedar boughs and various ferns are the most prominent of the decorative vegetations at this time.

Dimensions: These products are usually not measured by weight.

Scale
Method(s): Cedar foliage harvest is recorded by weight according to agreements between harvesters and district managers. Most other products do not yet require recording. If trees are removed or damaged, the logs must be scaled and reported in the same manner as any other commercial timber.

12.7.3 Wild Berries and Fruit

Product Code: None

Description: At present, little information is available about the commercial harvest of wild berries and fruits. All regions in the province report extensive personal use of local fruits and berries, and is considered to have high recreational value. Thirty-four species are collected on a personal basis and seven species are harvested commercially. The most well known of such plants are the wild blueberry, wild blackberry and wild strawberry. Other popular berries include cranberries, huckleberries, salmonberries and thimbleberries.

12.7.4 Herb and Vegetable Products

Product Code: None

Description: Many plant species in British Columbia's forests have market potential for use as vegetables or food seasoning. There are about twenty-three plants used for these products and there is an increasing interest in their use as food products, both commercial and personally. Although such wild herbs and vegetables not only add variety to diets but also can provide food substitutes for people with acute allergies, there is little information on this industry.

12.7.5 Landscaping Products

Product Code: None

Description: Use of native plants for landscaping is an increasing part of the botanical forest product industry. Entire trees, shrubs or herbs may be collected for personal landscaping or for commercial sale to nurseries and garden centres. Landscaping with native species is a preferred alternative to using cultivated species because these plants are naturally adapted to local conditions.

About fifty-three native plant species used for landscaping in British Columbia have been identified, both for individual use and for commercial harvesting supplying nurseries and garden centres.

Scale Method(s): As the industry evolves, methods of determining volumes will be established according to agreements between the harvesters and District Managers.

12.7.6 Craft Products

Product Code: None

Description: North Americans have a growing interest in craft products made from native plant species. Although the commercial potential for these types of craft products is increasing, relatively little data on the industry is available. Participants report that whole plants, leaves, bark, roots or wood may be used to manufacture craft products and about twenty-four different species are popular.

Dimensions: Highly variable.

Scale Method(s): Many of the products manufactured from wood fall into the classification of stakes and stocks (sticks) described in Section 12.4.4. Other wood products, if over 10 cm in diameter, are scaled as logs. Any trees felled or damaged in the process of gathering craft products are scaled using the B.C. Metric Scale.

12.7.7 Miscellaneous Botanical Forest Products

Description: Several botanical forest products do not fit into any of the previous categories. These products include honey, beeswax, syrup, and smoke woods. At present, little is known about the commercial use of these products.

Scale Method(s): Smoke woods, commonly mountain alder and red alder, are scaled as stakes and stocks (sticks) described in Section 12.4.4. Pieces exceeding the diameters for sticks are scaled as logs.

12.8 Woodchips and Hogged Tree Material

Woodchips and hogged tree material are Special Forest Products for scaling purposes. Their measurement is the responsibility of an authorized scaler.

Wood chips and hogged tree material must be accounted for by predominant species and these products can be measured by volume or weight.

The volume of timber required to produce the chips is known as a solid wood equivalent. It is estimated by using a sampling method or use of standard conversion factors. Standard conversion factors generally do not satisfy ministry requirements on three accounts:

1. All timber must be accounted for by predominant species,
2. A volume estimate may be calculated on a container of woodchips or hogged tree material by using the following formula:

$$H \times L \times W \times (\text{air space}) \text{ Factor} = \text{Total Volume}$$

3. Chip moisture content (hence density) varies considerably.

As such, a sampling approach may be required. The basic components of a sampling approach include:

1. Randomly select truck or grapple loads for each timber mark,
2. Scale the load accounting for volume, grade and species,
3. Process the same load through the chipper,
4. Weigh the chip production,
5. Calculate the round wood volume/green chip weight conversion factor for each sample,
6. From all the samples taken, calculate the average factor (using the sum of all the sample weights and the sum of all the sample volumes), and
7. Calculate the firm wood volumes for each mark for billing purposes by applying the factor to the total production weight for a given period.

For example:

1. From all samples scaled, 57 m³ of round wood produced 35 tonnes (35 000 kg) of green chips,
2. The conversion factor derived from dividing the volume by the weight, (57 m³/35 t) = 1.628 5 m³ of firm wood per tonne of chips, and

3. If during the month 1 200 tonnes of chips are produced, the round wood (or firm wood) volume for stumpage billing and cut control purposes is calculated as, $1\,200\text{ t} \times 1.628\,5 = 1\,954.2\text{ m}^3$.

The above example is greatly simplified for conceptual purposes. In reality, because log grades and species must be accounted for, separate ratios must be developed for each species/grade combination. For example, using the same sample, if 20 m³ of the sample is HE grade Z and 37 m³ is HE grade X, the ratios are calculated as follows:

- HE Z ratio = $20\text{ m}^3/35\text{ t} = 0.571\,4\text{ m}^3/\text{tonne}$, and
- HE X ratio = $37\text{ m}^3/35\text{ t} = 1.057\,1\text{ m}^3/\text{tonne}$.

For recording and billing purposes, if 1 200 tonnes of chips were produced in a month from a mark, the volume would be calculated as follows:

- HE Z volume = $0.571\,4\text{ m}^3/\text{t} \times 1\,200\text{ t} = 685.7\text{ m}^3$, and
- HE X volume = $1.057\,1\text{ m}^3/\text{t} \times 1\,200\text{ t} = 1\,268.5\text{ m}^3$, a total volume of 1 954.2 m³.

As remote chipping grows in prominence, more standardized scaling and recording procedures will likely be implemented throughout the ministry.

12.9 Condensed Table of Half Volumes

This table of half volumes is for the convenience of scalers and compilers to obtain volumes when other means are not available.

Volumes are expressed in cubic decimetres to avoid the use of a decimal point in the tables. All volumes may be readily changed from cubic decimetres to cubic metres by dividing by 1000.

The half volumes are used rather than the full volumes of cylinders are used to simplify computation.

12.9.1 Application of the Table

To determine the volume of a log from this table, find the half volumes for the following dimensions:

- top diameter in rads and the length, and
- butt diameter in rads and the length.

The sum of the half volumes will equal the volume of the log in dm³ and division by 1000 will give the volume in m³.

Only lengths in increments of 1 to 10 m are shown;

To find the volume of a fraction of a metre, move the decimal place to the left by one point. For example, the volume for a length of 0.4 m is found by using the values in the 4 m column divided by 10.

To find the volume of a log longer than 10 m, add the values in applicable columns. For example, for a 14 m log, add the 10 m half volumes to the 4 m half volumes for the given diameters.

In combination, the volume of any length of log can be compiled. For example, the volume of a 14.4 m log is found by adding the half volumes of a 10 m log, the half volumes of a 4 m log, and for the 0.4 m, 1/10th of the half volumes of a 4 m log.

Table 12-3 Table of Half Volumes of Cylinders in dm³

Diameter rads	Length in Metres									
	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
1	0	0	0	0	0	0	1	1	1	2
2	0	1	2	3	3	4	4	5	6	6
3	1	3	4	6	7	8	10	11	13	14
4	3	5	8	10	13	15	18	20	23	25
5	4	8	12	16	20	24	27	31	35	39
6	6	11	17	23	28	34	40	45	51	57
7	8	15	23	31	38	46	54	62	69	77
8	10	20	30	40	50	60	70	80	90	101
9	13	25	38	51	64	76	89	102	115	127
10	16	31	47	63	79	94	110	126	141	157
11	19	38	57	76	95	114	133	152	171	190
12	23	45	68	90	113	136	158	181	204	226
13	27	53	80	106	133	159	186	212	239	265
14	31	62	92	123	154	185	216	246	277	308
15	35	71	106	141	177	212	247	283	318	353
16	40	80	121	161	201	241	281	322	362	402
17	45	91	136	182	227	272	318	363	409	454
18	51	102	153	204	254	305	356	407	458	509
19	57	113	170	227	284	340	397	454	510	567
20	63	126	188	251	314	377	440	503	565	628
21	69	139	208	277	346	416	485	554	623	693
22	76	152	228	304	380	456	532	608	684	760
23	83	166	249	332	415	499	582	665	748	831
24	90	181	271	362	452	543	633	724	814	905
25	98	196	295	393	491	589	687	785	884	982
26	106	212	319	425	531	637	743	849	956	1062
27	115	229	344	458	573	687	802	916	1031	1145
28	123	246	369	493	616	739	862	985	1108	1232
29	132	264	396	528	661	793	925	1057	1189	1321
30	141	283	424	565	707	848	990	1131	1272	1414
31	151	302	453	604	755	906	1057	1208	1359	1510
32	161	322	483	643	804	965	1126	1287	1448	1608
33	171	342	513	684	855	1026	1197	1368	1540	1711
rads	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
34	182	363	545	726	908	1090	1271	1453	1634	1816
35	192	385	577	770	962	1155	1347	1539	1732	1924
36	204	407	611	814	1018	1221	1425	1629	1832	2036
37	215	430	645	860	1075	1290	1505	1720	1935	2150
38	227	454	680	907	1134	1361	1588	1815	2041	2268
39	239	478	717	956	1195	1434	1672	1911	2150	2389
40	251	503	754	1005	1257	1508	1759	2011	2262	2513
41	264	528	792	1056	1320	1584	1848	2112	2376	2641
42	277	554	831	1108	1385	1663	1940	2217	2494	2771
43	290	581	871	1162	1452	1743	2033	2324	2614	2904
44	304	608	912	1216	1521	1825	2129	2433	2737	3041
45	318	636	954	1272	1590	1909	2227	2545	2863	3181

Diameter rads	Length in Metres		3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
	1.0	2.0								
46	332	665	997	1330	1662	1994	2327	2659	2991	3324
47	347	694	1041	1388	1735	2082	2429	2776	3123	3470
48	362	724	1086	1448	1810	2171	2533	2895	3257	3619
49	377	754	1131	1509	1886	2263	2640	3017	3394	3771
50	393	785	1178	1571	1963	2356	2749	3142	3534	3927
51	409	817	1226	1634	2043	2451	2860	3269	3677	4086
52	425	849	1274	1699	2124	2548	2973	3398	3823	4247
53	441	882	1324	1765	2206	2647	3089	3530	3971	4412
54	458	916	1374	1832	2290	2748	3206	3664	4122	4580
55	475	950	1425	1901	2376	2851	3326	3801	4276	4752
56	493	985	1478	1970	2463	2956	3448	3941	4433	4926
57	510	1021	1531	2041	2552	3062	3572	4083	4593	5104
58	528	1057	1585	2114	2642	3170	3699	4227	4756	5284
59	547	1094	1640	2187	2734	3281	3828	4374	4921	5468
60	565	1131	1696	2262	2827	3393	3958	4524	5089	5655
61	584	1169	1753	2338	2922	3507	4091	4676	5260	5845
62	604	1208	1811	2415	3019	3623	4227	4831	5434	6038
63	623	1247	1870	2494	3117	3741	4364	4988	5611	6234
64	643	1287	1930	2574	3217	3860	4504	5147	5791	6434
65	664	1327	1991	2655	3318	3982	4646	5309	5973	6637
66	684	1368	2053	2737	3421	4105	4790	5474	6158	6842
67	705	1410	2115	2821	3526	4231	4936	5641	6346	7051
68	726	1453	2179	2905	3632	4358	5084	5811	6537	7263
69	748	1496	2244	2991	3739	4487	5235	5983	6731	7479
70	770	1539	2309	3079	3848	4618	5388	6158	6927	7697
71	792	1584	2376	3167	3959	4751	5543	6335	7127	7918
72	814	1629	2443	3257	4072	4886	5700	6514	7329	8143
73	837	1674	2511	3348	4185	5022	5860	6697	7534	8371
74	860	1720	2581	3441	4301	5161	6021	6881	7742	8602
75	884	1767	2651	3534	4418	5301	6185	7069	7952	8836
76	907	1815	2722	3629	4536	5444	6351	7258	8166	9073
77	931	1863	2794	3725	4657	5588	6519	7451	8382	9313
78	956	1911	2867	3823	4778	5734	6690	7645	8601	9557
79	980	1961	2941	3921	4902	5882	6862	7843	8823	9803
80	1005	2011	3016	4021	5027	6032	7037	8042	9048	10053
81	1031	2061	3092	4122	5153	6184	7214	8245	9275	10306
82	1056	2112	3169	4225	5281	6337	7393	8450	9506	10562
83	1082	2164	3246	4328	5411	6493	7575	8657	9739	10821
84	1108	2217	3325	4433	5542	6650	7758	8867	9975	11084
85	1135	2270	3405	4540	5675	6809	7944	9079	10214	11349
86	1162	2324	3485	4647	5809	6971	8132	9294	10456	11618
87	1189	2378	3567	4756	5945	7134	8323	9511	10700	11889
88	1216	2433	3649	4866	6082	7299	8515	9731	10948	12164
89	1244	2488	3733	4977	6221	7465	8710	9954	11198	12442
90	1272	2545	3817	5089	6362	7634	8906	10179	11451	12723

12.9.2 Table of Full Volumes for Round Fence Posts

The following table is provided for obtaining volumes of round fence posts in a stack or pile. When sampling a stack, it is often very difficult to match the top and butt of inner posts. By measuring only the top diameter and the length of a post, the table will provide the full volume of the post in cubic metres, using known taper curves to accurately estimate the butt diameter. The scaler should sample a number of pieces where both tops and butt can be measured before using this table, so that the validity of the taper factor is proven in a particular application.

Table 12-4 Table of Full Volume (m3) for Top Measured Round Fence Posts

Top Diameter	2	3	4	5	6	7	8	9	10	11
Assumed Taper in rads per Metre	0.500									
Lengths	Vol.	Vol.	Vol.	Vol.	Vol.	Vol.	Vol.	Vol.	Vol.	Vol.
0.1	0.000	0.000	0.000	0.000	0.001	0.002	0.002	0.003	0.003	0.004
0.2	0.000	0.000	0.001	0.002	0.002	0.003	0.004	0.005	0.006	0.008
0.3	0.000	0.000	0.002	0.002	0.003	0.005	0.006	0.008	0.010	0.012
0.4	0.000	0.001	0.002	0.003	0.005	0.006	0.008	0.010	0.013	0.015
0.5	0.000	0.002	0.003	0.004	0.006	0.008	0.010	0.013	0.016	0.019
0.6	0.000	0.002	0.003	0.005	0.007	0.010	0.013	0.016	0.019	0.023
0.7	0.001	0.002	0.004	0.006	0.008	0.011	0.015	0.019	0.023	0.027
0.8	0.001	0.003	0.004	0.007	0.010	0.013	0.017	0.021	0.026	0.032
0.9	0.001	0.003	0.005	0.008	0.011	0.015	0.019	0.024	0.030	0.036
1.0	0.002	0.003	0.006	0.009	0.012	0.017	0.021	0.027	0.033	0.040
1.1	0.002	0.004	0.006	0.010	0.014	0.018	0.024	0.030	0.037	0.044
1.2	0.002	0.004	0.007	0.011	0.015	0.020	0.026	0.033	0.040	0.048
1.3	0.002	0.005	0.008	0.012	0.016	0.022	0.028	0.036	0.044	0.052
1.4	0.002	0.005	0.008	0.013	0.018	0.024	0.031	0.039	0.047	0.057
1.5	0.003	0.005	0.009	0.014	0.019	0.026	0.033	0.041	0.051	0.061
1.6	0.003	0.006	0.010	0.015	0.021	0.028	0.036	0.044	0.054	0.065
1.7	0.003	0.006	0.011	0.016	0.022	0.030	0.038	0.048	0.058	0.070
1.8	0.004	0.007	0.011	0.017	0.024	0.032	0.040	0.051	0.062	0.074
1.9	0.004	0.007	0.012	0.018	0.025	0.033	0.043	0.054	0.066	0.079
2.0	0.004	0.008	0.013	0.019	0.027	0.035	0.046	0.057	0.069	0.083
2.1	0.004	0.008	0.014	0.020	0.028	0.038	0.048	0.060	0.073	0.088
2.2	0.005	0.009	0.015	0.021	0.030	0.040	0.051	0.063	0.077	0.092
2.3	0.005	0.009	0.015	0.023	0.031	0.042	0.053	0.066	0.081	0.097
2.4	0.005	0.010	0.016	0.024	0.033	0.044	0.056	0.070	0.085	0.102
2.5	0.006	0.011	0.017	0.025	0.035	0.046	0.059	0.073	0.089	0.106
2.6	0.006	0.011	0.018	0.026	0.036	0.048	0.061	0.076	0.093	0.111
2.7	0.006	0.012	0.019	0.028	0.038	0.050	0.064	0.080	0.097	0.116
2.8	0.007	0.012	0.020	0.029	0.040	0.053	0.067	0.083	0.101	0.121
2.9	0.007	0.013	0.021	0.030	0.042	0.055	0.070	0.087	0.105	0.126
3.0	0.008	0.014	0.022	0.032	0.043	0.057	0.073	0.090	0.109	0.131
3.1	0.008	0.014	0.023	0.033	0.045	0.059	0.076	0.094	0.114	0.136
3.2	0.009	0.015	0.024	0.034	0.047	0.062	0.078	0.097	0.118	0.141
3.3	0.009	0.016	0.025	0.036	0.049	0.064	0.081	0.101	0.122	0.146
3.4	0.009	0.017	0.026	0.037	0.051	0.067	0.084	0.104	0.127	0.151
3.5	0.010	0.017	0.027	0.039	0.053	0.069	0.087	0.108	0.131	0.156
3.6	0.010	0.018	0.028	0.040	0.055	0.072	0.091	0.112	0.135	0.161
3.7	0.011	0.019	0.029	0.042	0.057	0.074	0.094	0.115	0.140	0.166
3.8	0.011	0.020	0.030	0.043	0.059	0.077	0.097	0.119	0.144	0.172
3.9	0.012	0.021	0.031	0.045	0.061	0.079	0.100	0.123	0.149	0.177
4.0	0.013	0.021	0.033	0.046	0.063	0.082	0.103	0.127	0.153	0.182
4.1	0.013	0.022	0.034	0.048	0.065	0.084	0.106	0.131	0.158	0.188
4.2	0.014	0.023	0.035	0.050	0.067	0.087	0.110	0.135	0.163	0.193
4.3	0.014	0.024	0.036	0.051	0.069	0.090	0.113	0.139	0.167	0.199
4.4	0.015	0.025	0.038	0.053	0.071	0.092	0.116	0.143	0.172	0.204
4.5	0.016	0.026	0.039	0.055	0.074	0.095	0.120	0.147	0.177	0.210
4.6	0.016	0.027	0.040	0.057	0.076	0.098	0.123	0.151	0.182	0.215

4.7	0.017	0.028	0.042	0.058	0.078	0.101	0.126	0.155	0.186	0.221
4.8	0.018	0.029	0.043	0.060	0.080	0.104	0.130	0.159	0.191	0.227
4.9	0.018	0.030	0.044	0.062	0.083	0.106	0.133	0.163	0.196	0.232
5.0	0.019	0.031	0.046	0.064	0.085	0.109	0.137	0.167	0.201	0.238
5.1	0.020	0.032	0.047	0.066	0.087	0.112	0.140	0.172	0.206	0.244
5.2	0.021	0.033	0.049	0.068	0.090	0.115	0.144	0.176	0.211	0.250
5.3	0.021	0.034	0.050	0.070	0.092	0.118	0.148	0.180	0.216	0.256
5.4	0.022	0.035	0.052	0.071	0.095	0.121	0.151	0.185	0.222	0.262
5.5	0.023	0.036	0.053	0.073	0.097	0.124	0.155	0.189	0.227	0.268
5.6	0.024	0.038	0.055	0.076	0.100	0.128	0.159	0.194	0.232	0.274
5.7	0.025	0.039	0.056	0.078	0.102	0.131	0.163	0.198	0.237	0.280
5.8	0.026	0.040	0.058	0.080	0.105	0.134	0.167	0.203	0.243	0.286
5.9	0.026	0.041	0.060	0.082	0.108	0.137	0.170	0.207	0.248	0.292
6.0	0.027	0.042	0.061	0.084	0.110	0.140	0.174	0.212	0.254	0.299
6.1	0.028	0.044	0.063	0.086	0.113	0.144	0.178	0.217	0.259	0.305
6.2	0.029	0.045	0.065	0.088	0.116	0.147	0.182	0.221	0.265	0.311
6.3	0.030	0.046	0.066	0.090	0.118	0.150	0.186	0.226	0.270	0.318
6.4	0.031	0.048	0.068	0.093	0.121	0.154	0.190	0.231	0.276	0.324
6.5	0.032	0.049	0.070	0.095	0.124	0.157	0.195	0.236	0.281	0.331
6.6	0.033	0.050	0.072	0.097	0.127	0.161	0.199	0.241	0.287	0.337
6.7	0.034	0.052	0.074	0.100	0.130	0.164	0.203	0.246	0.293	0.344
6.8	0.035	0.053	0.076	0.102	0.133	0.168	0.207	0.251	0.299	0.351
6.9	0.037	0.055	0.077	0.104	0.136	0.171	0.211	0.256	0.304	0.357
7.0	0.038	0.056	0.079	0.107	0.139	0.175	0.216	0.261	0.310	0.364
7.1	0.039	0.058	0.081	0.109	0.142	0.179	0.220	0.266	0.316	0.371
7.2	0.040	0.059	0.083	0.112	0.145	0.182	0.225	0.271	0.322	0.378
7.3	0.041	0.061	0.085	0.114	0.148	0.186	0.229	0.276	0.328	0.385
7.4	0.042	0.063	0.088	0.117	0.151	0.190	0.234	0.282	0.334	0.392
7.5	0.044	0.064	0.090	0.120	0.154	0.194	0.238	0.287	0.341	0.399
7.6	0.045	0.066	0.092	0.122	0.158	0.198	0.243	0.292	0.347	0.406
7.7	0.046	0.068	0.094	0.125	0.161	0.202	0.247	0.298	0.353	0.413
7.8	0.048	0.069	0.096	0.128	0.164	0.206	0.252	0.303	0.359	0.420
7.9	0.049	0.071	0.098	0.130	0.168	0.210	0.257	0.309	0.366	0.428
8.0	0.050	0.073	0.101	0.133	0.171	0.214	0.261	0.314	0.372	0.435
8.1	0.052	0.075	0.103	0.136	0.174	0.218	0.266	0.320	0.378	0.442
8.2	0.053	0.077	0.105	0.139	0.178	0.222	0.271	0.325	0.385	0.450
8.3	0.055	0.078	0.107	0.142	0.181	0.226	0.276	0.331	0.391	0.457
8.4	0.056	0.080	0.110	0.145	0.185	0.230	0.281	0.337	0.398	0.465
8.5	0.057	0.082	0.112	0.148	0.188	0.234	0.286	0.343	0.405	0.472
8.6	0.059	0.084	0.115	0.151	0.192	0.239	0.291	0.348	0.411	0.480
8.7	0.061	0.086	0.117	0.154	0.196	0.243	0.296	0.354	0.418	0.487
8.8	0.062	0.088	0.120	0.157	0.199	0.247	0.301	0.360	0.425	0.495
8.9	0.064	0.090	0.122	0.160	0.203	0.252	0.306	0.366	0.432	0.503
9.0	0.065	0.092	0.125	0.163	0.207	0.256	0.311	0.372	0.439	0.511
9.1	0.067	0.094	0.127	0.166	0.211	0.261	0.317	0.378	0.446	0.519
9.2	0.069	0.096	0.130	0.169	0.214	0.265	0.322	0.384	0.453	0.527
9.3	0.070	0.099	0.133	0.173	0.218	0.270	0.327	0.391	0.460	0.535
9.4	0.072	0.101	0.135	0.176	0.222	0.274	0.333	0.397	0.467	0.543
9.5	0.074	0.103	0.138	0.179	0.226	0.279	0.338	0.403	0.474	0.551
9.6	0.076	0.105	0.141	0.183	0.230	0.284	0.344	0.409	0.481	0.559
9.7	0.078	0.108	0.144	0.186	0.234	0.289	0.349	0.416	0.488	0.567
9.8	0.079	0.110	0.147	0.189	0.238	0.293	0.355	0.422	0.496	0.575
9.9	0.081	0.112	0.149	0.193	0.242	0.298	0.360	0.429	0.503	0.584
10.0	0.083	0.115	0.152	0.196	0.247	0.303	0.366	0.435	0.511	0.592
10.1	0.085	0.117	0.155	0.200	0.251	0.308	0.372	0.442	0.518	0.601
10.2	0.087	0.120	0.158	0.203	0.255	0.313	0.377	0.448	0.526	0.609
10.3	0.089	0.122	0.161	0.207	0.259	0.318	0.383	0.455	0.533	0.618
10.4	0.091	0.125	0.164	0.211	0.264	0.323	0.389	0.462	0.541	0.626
10.5	0.093	0.127	0.168	0.215	0.268	0.328	0.395	0.469	0.549	0.635
10.6	0.095	0.130	0.171	0.218	0.273	0.333	0.401	0.475	0.556	0.644
10.7	0.098	0.132	0.174	0.222	0.277	0.339	0.407	0.482	0.564	0.653
10.8	0.100	0.135	0.177	0.226	0.282	0.344	0.413	0.489	0.572	0.662
10.9	0.102	0.138	0.180	0.230	0.286	0.349	0.419	0.496	0.580	0.670

This page is intentionally left blank.