Newfoundland and Labrador

TIMBER SCALING MANUAL

2016 EDITION

Forest Service of Newfoundland and Labrador
Forest Engineering and Industry Services

NEWFOUNDLAND AND LABRADOR TIMBER SCALING MANUAL

2016 EDITION

Government of Newfoundland and Labrador
Department of Fisheries, Forestry and Agrifoods
Forest Engineering and Industry Services

FEIS Report No: 60

ISBN: 978-1-55146-614-9

Copies of this publication may be obtained free of charge from:

Forest Service of Newfoundland and Labrador
Forest Engineering and Industry Services
Department of Fisheries, Forestry and Agrifoods
P.O. Box 2006
Corner Brook, NL A2H 6J8

TABLE OF CONTENTS

LIST OF FIGURES

ACKNOWLEDGEMENTS

The 2016 edition of the Newfoundland and Labrador Timber Scaling Manual could not have been developed without the dedicated work of staff of the Forest Service of Newfoundland and Labrador. The editing process included a review and input from forest industry representatives from around the province. This input was extremely valuable in finalizing the procedures set forth in this manual.

This manual was prepared using the standards set down by the Canadian Standards Association. Several figures in this manual were reproduced with the permission of Canadian Standards Association from CSA 0302.1-09/0302.2-09 – Scaling roundwood/Measurement of wood chips, tree residues, and by-products.

The Nova Scotia Scaling Manual and the New Brunswick Scaling Manual were also used as sources of information for the production of this manual. Permission for use was granted by all sources.

DEFINITIONS

The following definitions apply to this manual:

Accuracy	the degrees to which individual measurements are in agreement with an accepted reference value when taken under similar conditions;
Act	the *Forestry Act*;
Biomass	residue created during the manufacturing of forest products;
Board	the Timber Scalers Board established under the *Forestry Act, section 123*;
Board foot	a unit of measurement used to measure sawn lumber or to estimate the lumber volume that can be sawn from a log;
Butt rot	rot or decay showing the tree trunk's thickest part, where the stem makes contact with the soil;
Certified scaler	a person who holds a certificate under section 127 of the Forestry Act;
Check scale	a comparative scale conducted by the Forest Service to assess a scaler's compliance to scaling standards;
Check scaler	an employee of the Forest Service, designated to perform check scales;
Chief scaler	an employee of the Forest Service who oversees provincial administration of regulated scaling and sits as a member of the Board;
Construction timber	timber used in its original form for posts, poles or pilings;
Contractor	person(s) or company who has entered a contract with respect to the supply of primary forest products;
Cubic metre (solid)	a unit of measurement consisting of one solid cubic metre of actual wood fibre;

Cubic metre (stacked)	a unit of measurement used to measure the quantity of round timber that can be properly piled within a space of one cubic metre without deduction for bark or normal air space;
Employer	a forest operator or other person who engages the services of a logger to perform the work involved in a logging operation whether payable on a piecework basis or by wages;
Foreign material	any material extraneous to primary forest products such as earth, ice, snow and branches, any of which adds mass to a load of primary forest products;
Green tonne	1000 kilograms of timber or biomass in its green state (including water);
Heart Check	a separation of wood fibres often occurring in overmature timber;
Heart Rot	a common defect seen as a hole or as rotten wood in one or both ends of a log.
Length	refers to the usable length of individual pieces of wood or length of a pile;
Licensee	the holder of a Crown timber license and includes the holders executors, administrators, successors, heirs and assigns;
Load cells	the key components of a weigh scale which are used to measure weight or force.
Logger	a person engaged in the cutting, trimming, peeling, hauling or loading of pulpwood or other forms of timber or in other work connected with a logging operation but does not include a person employed in the transporting of timber;
Lumber recovery factor	number of board feet of sawn lumber produced out of one solid cubic metre of wood;
Manual	the most recent Manual of Scaling Instructions as approved by the board;
Mass	the property of a body that is a measure of its inertia and that is commonly taken as a measure of the amount of material that it contains and that causes it to have weight in a gravitational field;

Minister	the Minister responsible for the Forest Service of Newfoundland and Labrador;
Moisture content	the mass of water in wood expressed as a percentage of its total mass in green or oven dry form;
Oven dry tonne	1000 kilograms of timber or biomass excluding water that is not hygroscopically bonded;
Precision	the degree of similarity among a series of measurements taken under similar conditions;
Primary forest product	any unmanufactured product of hardwood or softwood tree species, as well as wood chips and biomass produced at the harvest site;
Province	Newfoundland and Labrador;
Pulpwood	wood suitable for processing into pulp for making paper;
Regulations	the Timber Scaling Regulations – *Forestry Act*;
Sawlog	timber suitable for the manufacturing of dimensional lumber;
Scale	the measurement of primary forest products;
Scaler	any person certified by the Minister to scale primary forest products;
Shake	is the more or less complete separation of one (or more) adjacent annual rings in a log, believed to be caused by wind before a tree is felled.
Stud	an upright post in the framework of a wall for supporting sheets of drywall;
Studwood	logs that are intended to be manufactured into studs;
Weigh scale	weighing platform capable of measuring the entire weight of a transport truck and trailer load of roundwood, wood chips, tree residues or by-products;

INTRODUCTION

This manual has been developed for use by Scalers in the Province of Newfoundland and Labrador. Guidelines are provided for determining the quantity and quality of timber harvested in the province, as authorized by the Forestry Act, 1990, Chapter F-23, Part VII, and the Timber Scaling Regulations under the Forestry Act O.C. 96-452.

The Forestry Act provides for the appointment of a Timber Scalers Board to examine and recommend candidates and carry out other such duties as may be provided for under the Act and Regulations. All timber scalers in the province are certified to scale timber by the Timber Scalers Board and are responsible to the board for their actions concerning scaling.

Scalers must comply with this manual when performing regulated scaling in the province of Newfoundland and Labrador.

A scaler's measurements are relied upon for accurate accounting of primary forest products. It is of utmost importance that scalers make accurate and fair measurements to the best of their ability. The need for fair and accurate measure extends to all parties involved.

Scalers must ensure timber is measured with honesty, impartiality and without fear, favour or affection to anyone concerned.

This manual may be revised to reflect changes in the industry and technology. Revisions will be made through consultation with representatives from industry and the Forest Service.

1. SCALER CERTIFICATION, RESPONSIBILITIES & ACCOUNTABILITY

1.1 APPLICATION FOR SCALERS CERTIFICATE

Requirements:

1. Make application in writing to the Forest Service of Newfoundland and Labrador (see Appendix I).

2. Eighteen years of age before December 31st of current year.

3. Pass a Mathematics Proficiency Test supervised by Forest Service staff.

4. Provide references to attest that the applicant is of good character and trustworthiness.

1.2 TRAINING AND CERTIFICATION

Candidates for a scalers certificate must successfully complete both written and field exams administered by the Chief Scaler of the Forest Service.

If a person proves their competence in scaling through successful completion of examinations, that person is then qualified to hold a Timber Scalers certificate.

Before the certificate is issued the applicant shall take an oath in the following form:

I _____ of _____ in the District of _____ in the Province of Newfoundland and Labrador do swear that I will honestly, faithfully and impartially and to the best of my ability scale all timber which I am asked to scale without fear, favour or affection of or to any person.

Each scaler certificate is **valid for one year with the expiry date on the 31st of March of each year**. A scaler must measure a minimum volume of each form of timber calculated for a three year period to retain the right to scale that product (see Appendix II).

Re-fresher exams will be offered to all scalers who have not met the volume requirement or have let their licenses lapse.

1.3 SCALER CERTIFICATES

There are three classes of scaler certificates, Class A, Class B and Class C (Figure 1).

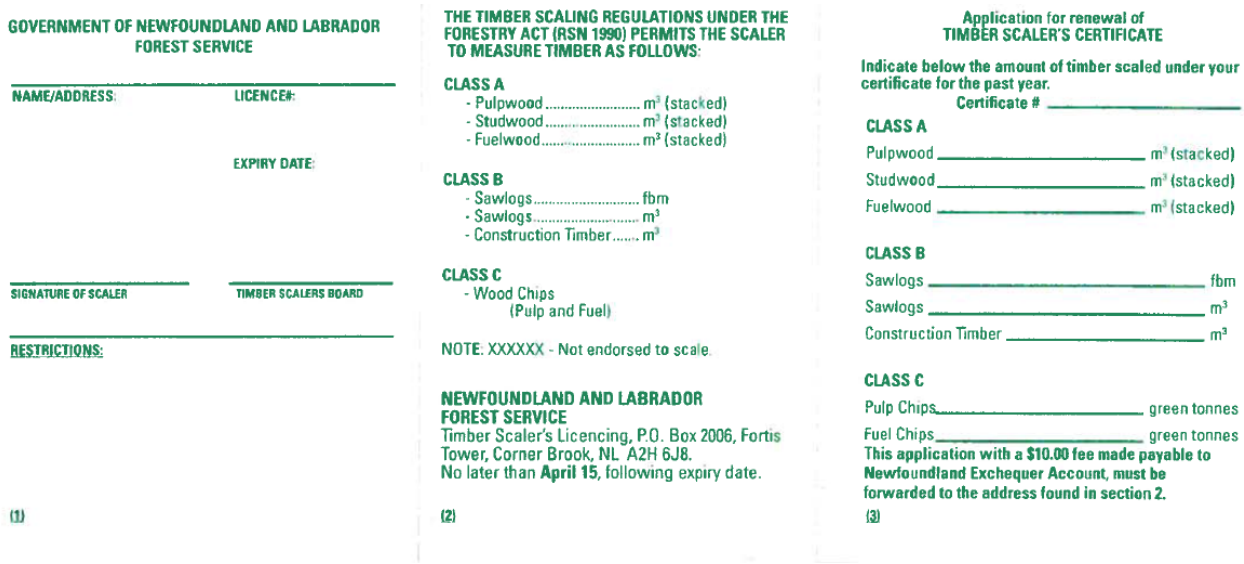
"Class A" certifies the scaling of timber measured collectively, as in the case of pulpwood, fuel wood, and studwood.

"Class B" certifies the scaling of timber as individual units, as in the case of sawlogs, poles, and pilings.

"Class C" certifies the scaling of pulp chips, fuel chips or residue biomass in a mass scaling operation. Any person determining mass volumes at scaling sites must be certified to do so under the Forestry Act.

With the approval of the Board, a scaler certificate may authorize the holder to scale only certain categories of timber mentioned under Class A, Class B or Class C. (i.e., sawlogs only, stacked wood only, etc.)

Every timber scaler and every official scaler shall on his/her appointment and before beginning his/her duties take the prescribed oath before a person empowered to administered oaths (Figure 2).



GOVERNMENT OF NEWFOUNDLAND AND LABRADOR
FOREST SERVICE

NAME/ADDRESS: LICENCE#:

EXPIRY DATE:

SIGNATURE OF SCALER TIMBER SCALERS BOARD

RESTRICTIONS:

(1)

THE TIMBER SCALING REGULATIONS UNDER THE FORESTRY ACT (RSN 1990) PERMITS THE SCALER TO MEASURE TIMBER AS FOLLOWS:

CLASS A
- Pulpwood ..... m³ (stacked)
- Studwood ..... m³ (stacked)
- Fuelwood ..... m³ (stacked)

CLASS B
- Sawlogs ..... fbm
- Sawlogs ..... m³
- Construction Timber ..... m³

CLASS C
- Wood Chips
(Pulp and Fuel)

NOTE: XXXXX - Not endorsed to scale.

NEWFOUNDLAND AND LABRADOR
FOREST SERVICE
Timber Scaler's Licencing, P.O. Box 2006, Fortis Tower, Corner Brook, NL A2H 6J8.
No later than **April 15**, following expiry date.

(2)

Application for renewal of
TIMBER SCALER'S CERTIFICATE

Indicate below the amount of timber scaled under your certificate for the past year.
Certificate # _____

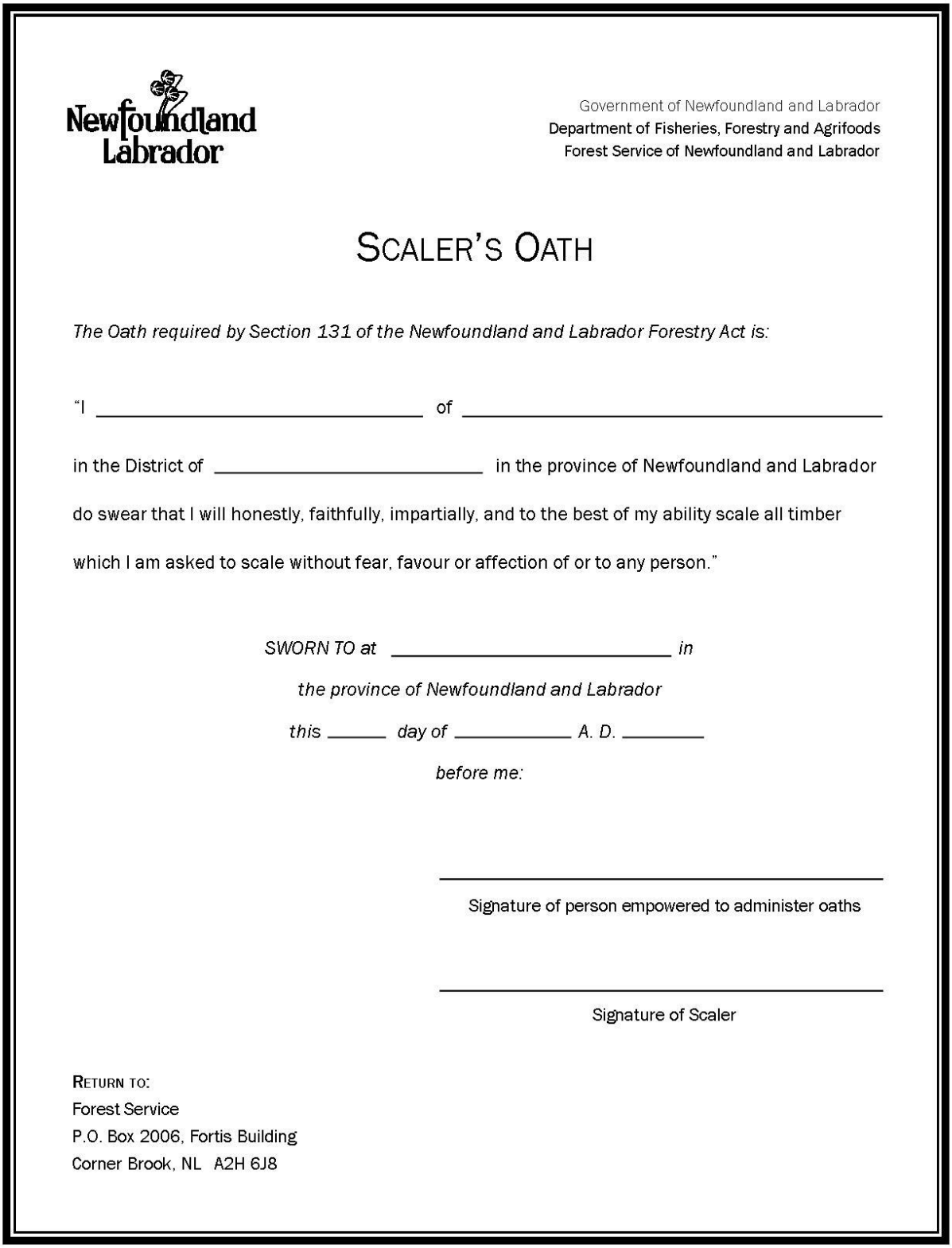
CLASS A
Pulpwood _____ m³ (stacked)
Studwood _____ m³ (stacked)
Fuelwood _____ m³ (stacked)

CLASS B
Sawlogs _____ fbm
Sawlogs _____ m³
Construction Timber _____ m³

CLASS C
Pulp Chips _____ green tonnes
Fuel Chips _____ green tonnes
This application with a $10.00 fee made payable to Newfoundland Exchequer Account, must be forwarded to the address found in section 2.

(3)

FIGURE 1 - TIMBER SCALER CERTIFICATE



Government of Newfoundland and Labrador
Department of Fisheries, Forestry and Agrifoods
Forest Service of Newfoundland and Labrador

SCALER'S OATH

The Oath required by Section 131 of the Newfoundland and Labrador Forestry Act is:

"I _____ of _____

in the District of _____ in the province of Newfoundland and Labrador

do swear that I will honestly, faithfully, impartially, and to the best of my ability scale all timber

which I am asked to scale without fear, favour or affection of or to any person."

SWORN TO at _____ *in*

the province of Newfoundland and Labrador

this _____ *day of* _____ *A. D.* _____

before me:

_____

Signature of person empowered to administer oaths

_____

Signature of Scaler

RETURN TO:
Forest Service
P.O. Box 2006, Fortis Building
Corner Brook, NL A2H 6J8

FIGURE 2 - SCALER'S OATH

1.4 Duties and Responsibilities of Scalers

All timber shall be scaled in accordance with methods and procedures as outlined in the Timber Scaling manual.

A timber scaler shall make a monthly return on forms supplied by the Forest Service, showing the volume and class of timber scaled during the preceding month, the name of the employer of his/her services, and the permit number under which the timber was harvested, as well as the Forest Management District number and location where the timber was harvested.

Scalers shall keep identification and measurement records of all timber scaled and shall provide a copy upon request from a forestry official employed with the Forest Service, and shall provide other relevant information which the official may require. These records should be kept by the scaler for a minimum of two years.

The timber scaler must enter his/her certificate number on any official document concerning scaling.

1.5 Scaling Disputes

From time to time on logging operations, disputes or disagreements as to the net scale may occur. Every effort should be made to resolve the dispute before involving the Chief Scaler of the Forest Service. A scaler must have the opportunity to rescale the timber in question and check all compilations.

If the problem is not resolved, the following procedures are to be followed:

1. All timber under dispute shall be suitably marked and all persons involved in movement of this timber shall be notified that this timber shall not be disturbed, moved or tampered with in any way. This will be the responsibility of the scaler.

2. The logger or scaler will contact a Forestry Official at the nearest Forest Management District office. If unionized, the logger may request a shop steward or business agent to act on his/her behalf. All verbal requests must be followed immediately by a written request stating the nature of the disagreement, the pile numbers and the location of timber in question.

3. The district office will immediately contact the Chief Scaler of the Forest Service. The Chief Scaler will dispatch the Provincial Check Scaler or an Official Scaler to measure the timber in dispute.

4. During the re-measurement, no persons other than personnel from the Forest Service are to be present.

5. The Chief Scaler will receive all scale data at his/her office where a report will be compiled and results will be made available to both parties concerned.

6. The results are binding on both parties in the dispute.

7. As provided for in the Forestry Act, either party may appeal the Chief Scaler's decision to the Timber Scalers Board.

8. The Board's decision shall be final.

1.6 Refusal To Scale

A scaler may refuse to scale any timber which in his/her judgement is not piled according to instructions set down (see section 2.2), until such timber is re-piled in a satisfactory manner.

A scaler may refuse to scale any timber which in his/her judgement contains excessive cull, unless the cull pieces of wood are removed and the wood is again re-piled in a satisfactory manner.

Should the person responsible for this timber consider the scalers objections unreasonable, then the scaler refusing to scale shall notify the Chief Scaler of the Forest Service.

When notifying the Forest Service, the scaler should give the following information:

- Condition of irregular piles or loads
- Where they are located
- Name and address of wood cutter concerned
- Name of company and contractor
- A digital image of pile(s) or load(s) (if possible)

The Forest Service will send its representative as soon as possible after such notification to consult with the scaler and the person responsible for the piling of such timber in order to inspect the timber so refused. The decision of this representative as to whether or not any timber is satisfactory piled will be final.

If the refusal is justified, the representative from the Forest Service will advise the person responsible to re-pile the timber within one week. If he/she fails to do this within the required time the timber may then be re-piled at the expense of the person responsible and rescaled.

If the refusal is not justified, the Forest Service representative shall request the scaler refusing to scale to do so within one week from the date of request. If after one week this request is not carried out, necessary action will be taken to have the scaler's certificate suspended.

All complaints regarding any scale must be made before the wood in question has been moved from the brow or pile in which it was originally scaled.

1.7 Check Scalers

All duly certified timber scalers, regardless of employers, shall scale and make returns as provided for under the Act and Regulations.

All wood scaled by such scalers is subject to check scales by official scalers of the Forest Service. The official check scaler shall carry out regular check scales on certified timber scalers to ensure that all measurements and scale procedures are in accordance with the scaling regulations.

The official check scalers have the authority to inspect or audit all scaling records, summaries and statements of amount of timber scaled by any timber scaler.

Private companies may feel it necessary to carry out their own check scales on employees. This is permissible, however, company check scalers must make available all check scale records if requested to do so by an official check scaler of the Forest Service.

When performing his/her duties, the official check scaler is required to use red crayon to denote scale marks on piles. No other timber scaler, forest operator or logger is permitted to use this colour.

Check scales must be carried out while the wood is in the same form and location as when the original scale was made.

1.8 Competence of Check Scaler

Besides having sound practical experience, a check scaler must possess a thorough knowledge of the laws, regulations and instructions governing scaling, and adopt a method of work beyond reproach. He/she must never sacrifice accuracy for speed in carrying out a check scale.

Bias or favourtism must never influence the work or reports of the check scaler.

The check scaler must assuredly prevent fraud but his/her foremost duty is to analyze the work technique of the scalers under his/her orders and advise and direct them in such a way that scaling is carried out according to the letter and intent of the regulations and instructions in force.

The check scaler must work with fairness; he/she assumes the role of mediator between the woods-worker and the employer and must respect the interest of both parties.

Under these conditions, the net volume arrived at by the check scaler is used to establish the percentage of error between the volumes found by the scaler and the check scaler.

Scaling error is expressed as the percentage difference between an original scale and the check scale.

The acceptable tolerance for scaling error is as follows:

1. Stacked wood (pulpwood, studwood, fuelwood) in piles of similar length +/- 2.5%
2. Sawlogs (scaled using Newfoundland and Labrador Log Rule - FBM) +/- 5%

2. SCALING OF STACKED WOOD

The process of measuring primary forest products collectively and of uniform length in cubic metres stacked (Figure 3).

FIGURE 3 - STACKED WOOD MEASUREMENT PROCESS

2.1 UNIT OF MEASURE: CUBIC METRE STACKED

The cubic metre stacked is symbolized by m^3 (stacked) or m^3 (st) and is the unit of measure for determining the volume of wood that has been cut into certain uniform lengths and stacked into regular piles or racks.

A cubic metre stacked shall mean the quantity of round timber that can be properly piled within a space of one cubic metre without deduction for bark or for normal air space between the bolts.

Regardless of the species, size, shape, condition, or quality of the wood, only the quantity that will occupy one cubic metre can be defined as a cubic metre stacked.

2.2 PROPER PILING METHOD

All timber must be piled in a manner suitable to facilitate scaling and shall in particular satisfy the following conditions relevant to the scaling site:

1. Wood that has been stacked for scaling whether manually or mechanically must be done in a manner to ensure that proper measurements can be obtained. When landing areas become “soft”, skids are required and the scaler will use his/her discretion as to scale under these conditions.

2. Manually piled wood must be well supported at each end with good vertical posts (Figure 4). Machine piled wood (Figure 5) is not required to have vertical end posts but the operator must exercise care when sloping the pile ends so as to allow for proper width measurements.

3. Piles shall not be stacked higher than 3.0 metres from the bottom of the bolts in the lowest tier to the top of the bolts in the highest tier.

4. Every pile shall have a cleared space at both front and back of at least two metres.

5. All wood shall be properly trimmed and piled in such a manner so as not to permit abnormal holes and excessive airspace.

6. Wood loaded on trucks will be machine aligned to create a uniform face for scaling (i.e. load liner).

7. All stacked wood must be measured both front and back to determine average width and height.

8. Maximum allowable bolt length in stacked measure shall be 3.0 metres.

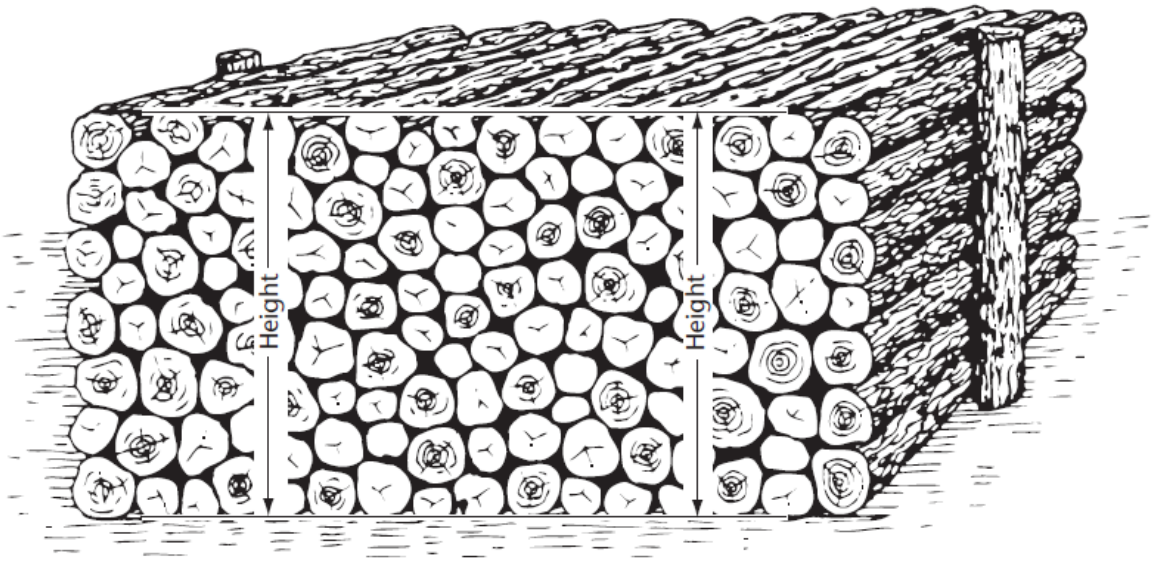


FIGURE 4 - PROPER PILING METHOD (MANUAL) - STACKS OF UNIFORM HEIGHT AND WIDTH

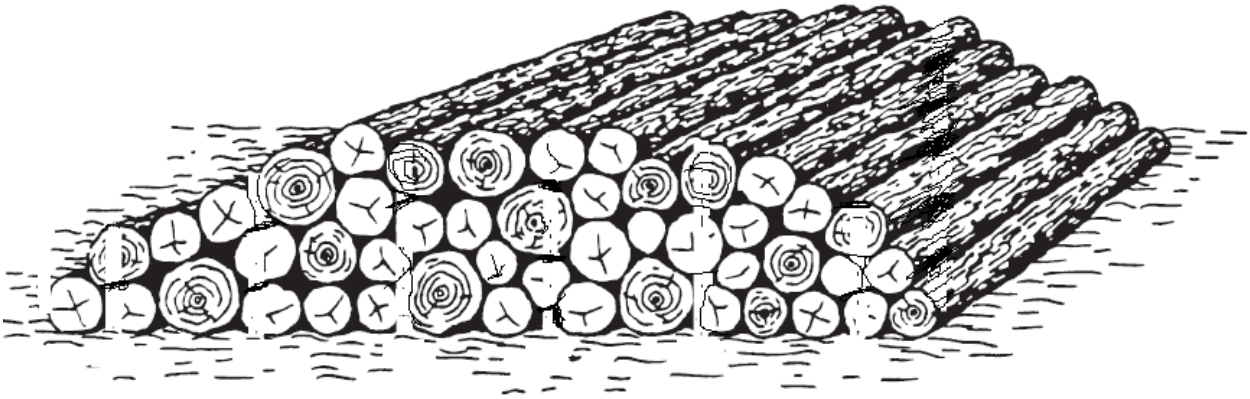


FIGURE 5 - PROPER MACHINE PILED WOOD

2.3 MEASUREMENT AND COMPILATION

The scaling of timber in cubic metres stacked requires the measuring and recording of the pile heights to the even centimetre class (0.02 m) and width to the nearest decimetre (0.10 m). Height measurements are taken with a scale rod graduated in metres and even centimetre classes. The pile width is measured using a logger's tape or chain graduated in metres and decimetres.

In the case of irregular piles or piles greater than 6.0 metres in width, measurements shall be taken on both front and back and averaged to determine the correct width.

In the case of stacked wood with timber measuring over 2.0 metres in length, the measurement for height and width shall be taken on both sides of each pile and averaged to determine correct dimensions.

2.3.1 Pile Height

The height of the pile shall be taken by measuring between the bottom of a bolt in the lowest tier of the pile, perpendicularly to the top of a bolt in the top tier, or the exterior tangent common to two adjacent bolts (Figure 6).

Height measurements shall be taken with a scaling rod graduated in metres and even centimetres. All height measurements are tallied from the rod in even centimetres (i.e. 1.02, 1.06, 1.08). The average of these heights will also be recorded to the even centimeter. The location of each height measurement should be marked on the pile by the scaler.

Height measurements must be taken on both sides of a pile of stacked wood.

The first height measurement may be taken anywhere from 0 to 1.5 metres from the end of the pile (Figure 7). Further height measurements will be taken at a maximum 1.5 metre interval along the face of the pile. If the top of the pile is irregular, the height measurement should be taken at a closer interval. The interval must be determined before starting to measure, and be maintained for that particular pile. These height measurements are then totaled and divided by the number of measurements taken to determine the average height of that particular pile.

If stacks of wood are placed on a slope, height measurements shall be taken at 90 degrees to the slope or perpendicular to the slope (Figure 8).

If wood drops off in height at one or both ends due to method of piling (i.e.) Roadside Piling, the placement of the scale rod for the first and last measurements can be determined by the width marks determined prior to taking the height measurements. This is commonly known as “squaring’’ the pile (Figure 9).

FIGURE 6 - HEIGHT READING USING EXTERIOR TANGENT METHOD, IN THIS CASE THE READING IS 202 CM

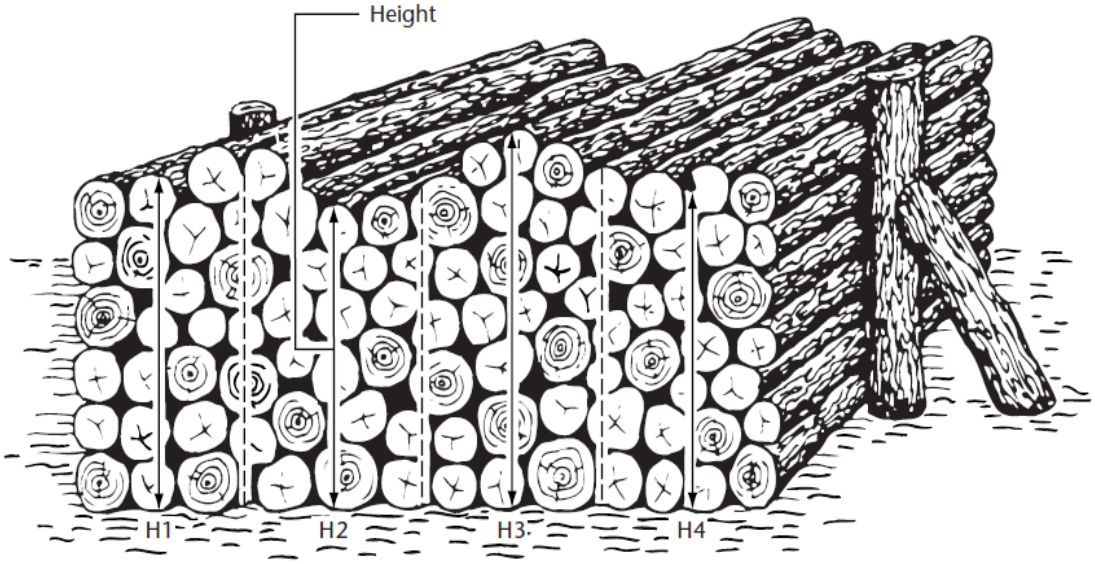


FIGURE 7 - HEIGHT MEASUREMENT INTERVALS - STACKS OF IRREGULAR HEIGHTS

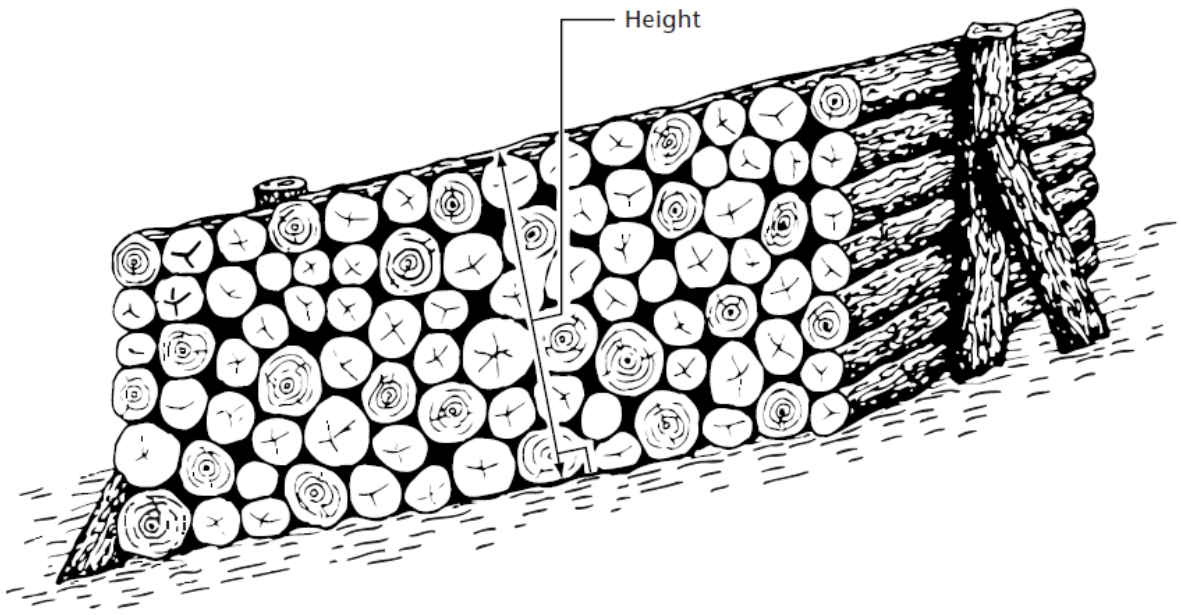


FIGURE 8 - MEASUREMENT OF HEIGHT OF STACK ON SLOPE

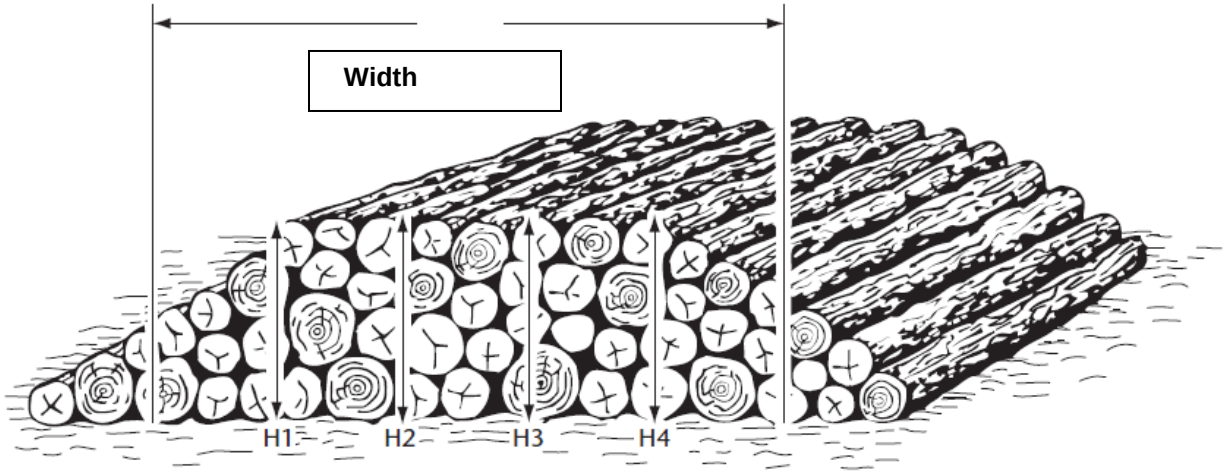


FIGURE 9 - MEASUREMENT OF HEIGHT AND WIDTH OF STACK WITH SLOPING ENDS ("SQUARING")

2.3.2 PILE WIDTH

Pile width shall be taken to the nearest decimeter using a steel loggers tape.

Parameters for pile width determination may vary slightly in their application, depending on the pile configuration to be measured. However, there is a basic common procedure for all.

The width is taken half-way up the face of the pile and between the marks or endpoints, identifying the width (Figure 10). The actual width shall be taken at and between the exterior edges of the bolts at these identified marks or endpoints. This shall be done on both pile faces and averaged for one width measurement.

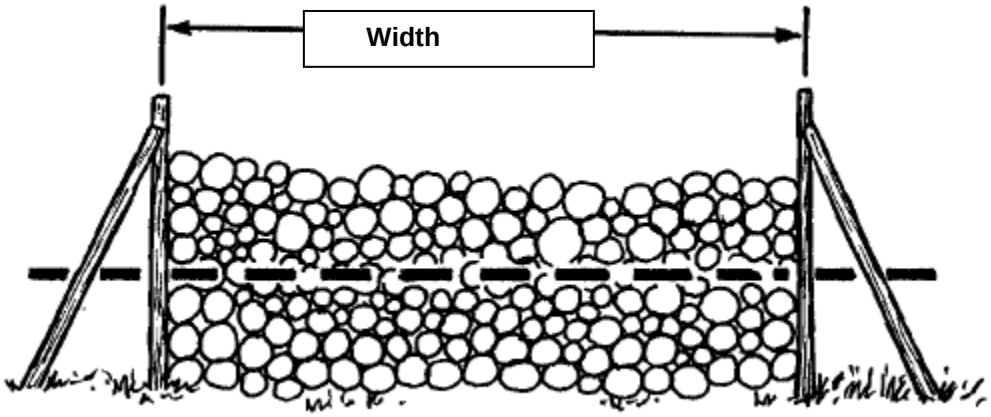


FIGURE 10 - WIDTH MEASUREMENT FOR PILE SUPPORTED ON ENDS

If the pile has ends that are sloping, width can be measured according to Figure 11. The "squaring'' method can also be used in which the point where width is determined should be well marked with a lumber crayon.

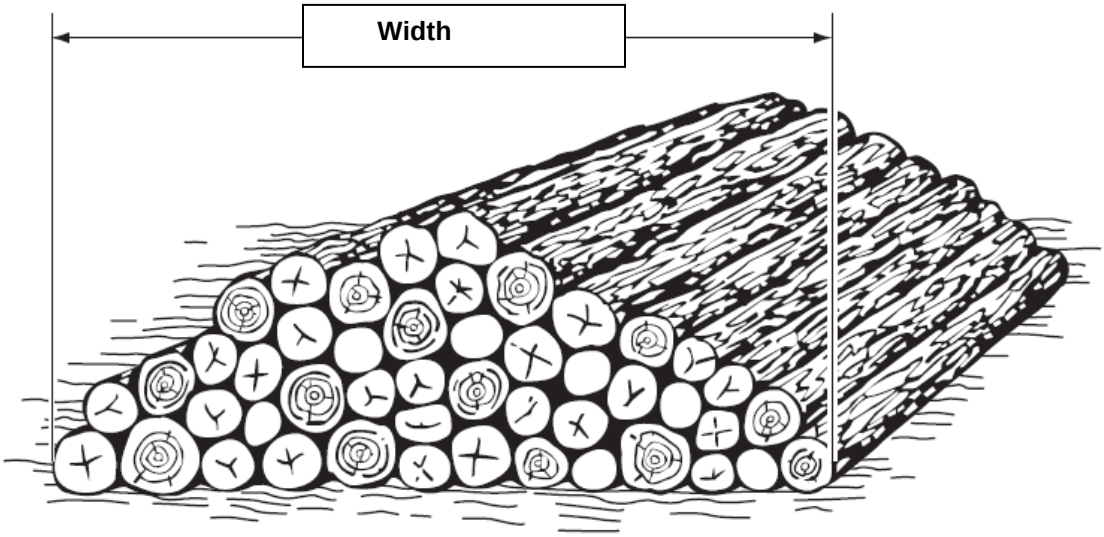


FIGURE 11 - WIDTH MEASUREMENT OF MACHINE PILED WOOD

Where a pile is on a slope, a scaler shall measure widths parallel to the bottom of the pile (or the slope of the ground) and heights perpendicular to the bottom of the pile (Figure 12).

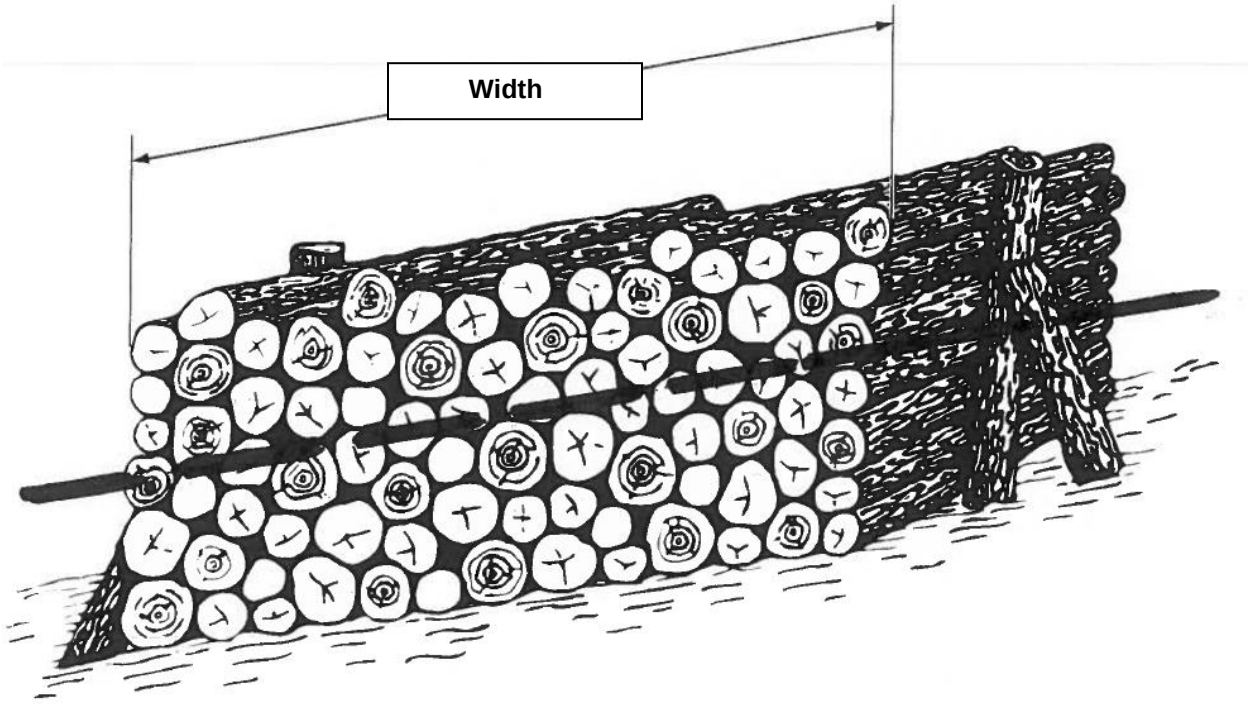


FIGURE 12 - WIDTH MEASUREMENT PARALLEL TO SLOPE OF GROUND

2.3.3 LENGTH OF WOOD

The length of the pile is in reality the length of the wood. This figure is usually dictated as a specification of the buyer (i.e. pulpwood 2.50 m). However, the maximum length for measuring in stacked form is 3.0 metres. All wood contained in the pile must be of equal length and is measured in metres and decimetres.

2.3.4 ROUNDING RULES

The following rules shall apply for rounding numerical data when calculating volumes:

When the first digit dropped is less than five, the last digit retained shall not be changed.

Examples: *12.174 m^3(st)* = *12.17 m^3(st)*
432.733 m^3(st) = *432.73 m^3(st)*

When the first digit dropped is greater than five, or if it is five followed by at least one digit, the last digit retained shall increase by one.

Examples: *12.157 m^3(st)* = *12.16 m^3(st)*
86.7651 m^3(st) = *86.77 m^3(st)*

When the first digit dropped is exactly five, followed only by zeros, the last digit retained shall be increased by one if it is odd, but not changed if it is even.

Examples: *12.135 m^3(st) = 12.14 m^3(st)*
12.145 m^3(st) = 12.14 m^3(st)

The following rules shall apply for rounding numerical data when calculating the average heights:

The boundary between 0.02 m size classes is on the odd number (Figure 13). In the preceding example the 2.16 class boundaries are > 2.15 m - ≤ 2.17 m, therefore the recorded average height is 2.16 m.

Averages of height measurements are always placed in even cm classes (i.e. recorded to the nearest 0.02 m unit).

Example: *The following height measurements have been taken on a pile of pulpwood:*

Side 1	*Side 2*
1.96	*1.98*
2.08	*2.06*
2.48	*2.24*
2.24	*2.18*

$$\text{Average height} = \frac{\text{sum of heights}}{\text{Number of height measurements}}$$

$$= \frac{17.22}{8}$$

$$= 2.152$$

$$= 2.16$$

FIGURE 13 - HEIGHT READING ON A SCALE ROD – IN THIS CASE, THE HEIGHT IS 184 CM

2.4 DEDUCTIONS

2.4.1 DEDUCTIONS FOR LOOSE PILING

Loose piling causes excessive air space in stacked wood and increases the gross stacked volume (Figure 14). It is most often caused by cross piling, poor trimming, crooked wood, etc.

Deductions, which are estimated on the scalers scrutiny of the pile face may be made for loose piling. These deductions must be shown on the scale sheet as a percentage of the gross stacked scale and are calculated first.

FIGURE 14 - TRAILER LOAD OF STACKED WOOD

Loose piling should not be confused with voids and should be assessed separately from voids. When a scaler records loose piling, the scaler should be able to account for the deduction by identifying on the pile face where the amount could fit.

It should be noted that stacked wood by its nature is not made up of perfect cylinders and therefore practically impossible to stack perfectly. If wood is stacked as well as it possible can then it is conceivable that loose piling could be zero percent.

Gross Vol. m^3 (stacked) x % Loose Piling = m^3 (stacked) deduction.

2.4.2 Deductions for Defects and Voids

When making deductions in pulpwood, the scaler will be guided by the culling rules laid down by the employer (i.e. cull such as heart rot, sap rot, undersized).

A void is a space on the scaling surface not filled by wood and large enough to contain a piece of wood of the average diameter for that pile.

When defects and voids are encountered in stacked wood, they must be measured and recorded on the scale card.

For stacked wood 2.5 metres in length, defects and voids shall be measured on both sides of the pile and considered to extend for 1/2 the length of the wood.

To facilitate check scaling, each void must be circled (Figure 15). Defective bolts (culls) shall be marked with an X (Figure 16).

The measurement of bolts, defects and voids shall be taken with a diameter rule graduated in even centimetres. The boundary between the size classes shall be the odd centimetre. Example: greater than 9 cm = 10 cm, equal to or less than 11 cm = 10 cm.

The Cull Deduction Table in Appendix III shows the volume for each diameter class which was calculated using the following formula.

The volume of defects and voids for stacked pulpwood with bark on shall be calculated as follows:

Volume m^3 (stacked) = D^2(m) X 1.183 X L

Example: A 1.25 metre bolt with a diameter of 20 centimetres is classed as cull.

Volume of deduction = D^2(m) X 1.183 X L

= 0.20^2 X 1.183 X 1.25

= 0.059 m^3 (s)

FIGURE 15 - VOID MEASUREMENT IN STACKED WOOD

FIGURE 16 - CULL MARKING IN STACKED WOOD

2.5 INDIVIDUAL BOLTS

Bolts lying outside the normal pile face may be measured as individual pieces and the volume in cubic metres stacked is then added to the net volume of the pile.

The logs are measured to determine the diameter inside bark, to the even centimetre for each end of the log. The same formula used for calculating deductions for defects and voids is also used to calculate the volume of individual bolts which lie outside the normal pile face. However, both ends of 2.50 metre bolt must be measured and both volumes are calculated using 1.25 metre lengths.

Example: A 2.50 metre bolt lying outside the pile has a diameter of 20 centimetres inside bark on the large end and 16 centimetres inside bark on the small end is measured.

Volume of large end $= D^2(m) \text{ X } 1.183 \text{ X } L$

$= 0.20^2 \text{ X } 1.183 \text{ X } 1.25$

$= 0.059 \ m^3 \ (s)$

Volume of small end $= D^2(m) \text{ X } 1.183 \text{ X } L$

$= 0.16^2 \text{ X } 1.183 \text{ X } 1.25$

$= 0.038\ m^3\ (s)$

Total Volume = Small end diameter + Large end diameter

$= 0.059\ m^3\ (s) + 0.038\ m^3\ (s)$

$= 0.097\ m^3\ (s)$

Note: The Cull deduction table (Appendix III) can also be used to calculate volumes of individual bolts lying outside the pile face.

2.6 Solid Wood Content of a Cubic Metre (stacked)

Although the cubic metre (stacked) occupies one cubic metre of space, it does not contain one cubic metre of solid wood. Stacked wood includes wood, bark, and normal air space as per definition (see section 2.1). However, solid wood is the fibre only component of one cubic metre (stacked). For example, for 2.50 metre length wood, it has been found that approximately 62.5% of the pile is solid wood. This gives 0.625 m^3 of solid wood per stacked cubic metre, which is the factor used to calculate the solid wood volume.
Many factors influence the solid wood content of a stacked cubic metre, some of which are:

a) Method of piling – the way wood is piled is one of the most important factors influencing the yield per stacked cubic metre in solid wood. Bolts of wood laid at an angle to each other or square piling increase the air space, whereas careful piling in hexagonal formation will reduce air space to a minimum. As compared to hexagonal piling, square piling may reduce the solid wood volume per stacked cubic metre as much as 10%.

b) Diameter of the wood – with large diameters there is more solid wood per stacked cubic metre than with small diameters. An increase in the number of bolts increases the air space.

c) Length of wood – the longer the bolts the less solid wood, as they do not pack as closely as short lengths.

d) Trimming – the presence of knots, broken limbs, or other similar irregularities on the surface of a bolt will increase the air space and therefore reduce the solid wood content of piles.

e) Peeled or Unpeeled – a stacked cubic metre of small diameter softwood with the bark on may be decreased by as much as 15% stacked measure when the bark is removed.

Therefore, peeled wood will contain more solid wood per stacked cubic metre than unpeeled wood.

f) Species – hardwoods yield less solid wood per stacked cubic metre than softwoods because of the greater smoothness and straightness of the softwoods.

g) Age/bark thickness – bark thickness increases with age, thus older wood has more bark and proportionally less solid wood.

2.7 FUELWOOD MEASUREMENT

Fuelwood can be scaled in cubic metres (stacked) using the criteria previously described in this manual. If present, deductions for loose piling and voids will be calculated to arrive at the net m^3 stacked scale.

In Newfoundland and Labrador firewood or fuelwood is commonly bought and sold in cords. If for the convenience of the buyer/seller of firewood, the scaler can convert m^3 stacked to cords by multiplying by a constant of 0.27589 or dividing by a constant of 3.62456.

2.8 STUDWOOD MEASUREMENT

Studwood refers to logs that are small in diameter and not more than 3.00 metres in length. The sawn lumber produced from these logs will generally be from 2" x 3" x 8' up to 2" x 6" x 8' and in the market place are referred to as “studs”. The market for 9 foot and 10 foot length studs is also becoming more common.

Generally this material arrives at sawmill sites in a manner that allows for the measurement of the load in stacked form. This timber must be properly piled and be of uniform length, not exceeding 3.0 metres.

Studwood must be scaled using the stacked wood measurement. The gross m^3 (stacked) volume can be reduced if voids and loose piling are present. The scaler must take into account that the final product is lumber, when reducing volume for cull pieces found in the load.

After deductions for loose piling and buyer specifications, the net stacked volume is determined. The net stacked volume is converted to m^3 solid by multiplying by 0.625 (or 62.5%) solid wood factor. The solid wood content can then be multiplied by the specific mills Lumber Recovery Factor to determine the FBM content.

2.9 CALCULATION OF GROSS AND NET VOLUME IN M^3 (STACKED)

The gross volume of a pile in m^3 (stacked) shall be determined as the product of multiplying the average height, average width, and length of wood.

Width x Height x Length = Vol. m^3 (stacked) (Gross Volume)

Deductions for loose piling, defects and voids are subtracted from the gross volume to yield net volume.

Gross volume (m^3 stacked) – Deductions (m^3 stacked) = Net Volume (m^3 stacked)

Figure 17 shows an example of a pile of stacked wood with defects and voids clearly indicated.

Example:

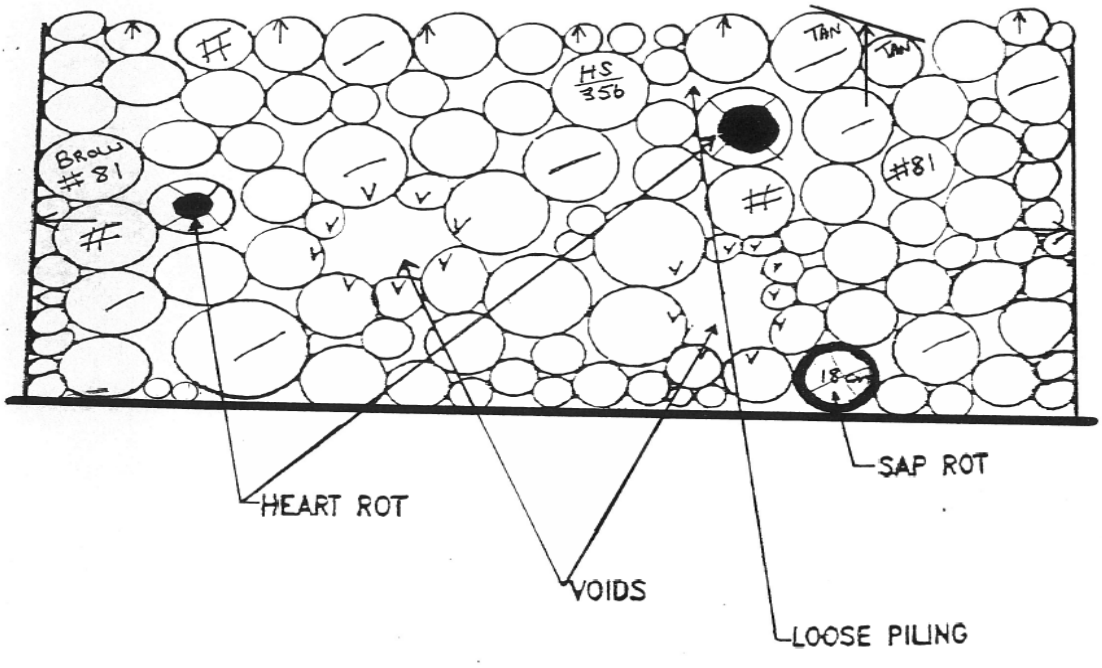


FIGURE 17 - STACKED WOOD WITH DEDUCTIONS

Height of Stack: 2.12 metres

Width of Stack: 7.80 metres

Length of Wood: 2.50 metres

H x W x L = m (stacked)

2.12 x 7.80 x 2.50 = 41.34 m^3 (stacked)

Loose Piling: 4 %

41.34 x 0.04 = 1.654 m^3 (stacked)

Cull: 3 pieces of cull

20 cm =	0.059 m^3 (stacked)
16 cm =	0.038 m^3 (stacked)
18 cm =	0.048 m^3 (stacked)
Total:	0.145 m^3 (stacked)

Void: 2 voids

20 cm hole = 0.059 m^3 (stacked)
18 cm hole = 0.048 m^3 (stacked)
Total: 0.107 m^3 (stacked)

Deductions:

Loose piling	=	1.654 m^3 (stacked)
Cull	=	0.145 m^3 (stacked)
Voids	=	0.107 m^3 (stacked)
Total	=	1.906 m^3 (stacked)

*Note: 1.906 m^3 (stacked) is then rounded to 2 decimal places to calculate net scale.

41.34 m^3 (stacked)	Gross scale
- 1.91 m^3 (stacked)	Total deductions
39.43 m^3 (stacked)	Net scale

39.43 m^3 (stacked)
x 0.625 Solid Wood Factor (62.5%)
24.64 m^3 (solid)

2.10 SCALING LONGITUDINALLY STACKED WOOD

A variation of stacked wood scaling occurs when timber of uniform length is stacked longitudinally on a trailer (Figure 18). This is more commonly known as the 'shotgun' piling method.

FIGURE 18 – SCALING LONGITUDINALLY STACKED WOOD ON A TRAILER

2.10.1 LENGTH OF WOOD

The maximum length for measuring in longitudinally stacked form is 3.0 metres. All wood contained in the pile must be of equal length and is measured in metres and decimetres.

As with standard stacked wood scaling, the length used to determine volume is the nominal length of the wood in the pile.

2.10.2 HEIGHT MEASUREMENT

Height measurements are taken to determine the average interval height of both ends of each pile.

The average interval height is determined by an ocular assessment of where the average height falls along the contour of the pile from the outside corner to the middle of the pile. Figures 19-23 illustrate how to determine average height of each interval for different variations of stacking.

Height measurements are taken to the nearest even centimeter outside the containment posts on all four corners of the piles.

2.10.3 PILING METHOD

Piling method should allow for a minimum of sixty centimetres between bunks to allow for ocular assessment of all ends of the piles. Pile faces should be made as evenly as possible with no intermixing of logs from one pile to another.

2.10.4 WIDTH MEASUREMENT

Pile width should be taken half way up the rear face of the back bunk. Width is to be recorded to the nearest decimeter ($1/10^{th}$ of a metre). Unlike stacked wood scaling of cross-piled wood, pile width of the back bunk is then multiplied by the total number of bunks to determine total width. Each bunk should be assessed to ensure all load supports are upright.

2.10.5 DEDUCTIONS

Deductions for loose piling and voids are to be assessed on a percentage basis by an ocular assessment of the visible pile face. Deductions for cull and oversize/undersize specifications are to be assessed following the downloading of the load. A randomized plot system for deductions may be used for this scaling method upon the approval of the agency and timber scalers board.

2.10.6 CALCULATION OF GROSS AND NET VOLUME

Example: A trailer carrying 2.50 metre wood with five bunks having a width of 2.4 metres each, would be calculated as follows:

Step 1: Calculate the average of the interval heights.

Step 2: Length is the nominal length of wood (ex. 2.50 metre wood)

Step 3: Measure pile width of the rear bunk and multiply by the number of bunks. This will give the total width.

Total Width = 5 bunks X 2.4 metres
Total Width = 12.0 metres

Step 4: Determine Gross Volume

Total Volume = Average height	*X*	*Total width*	*X*	*Length of wood*
Total Volume = 2.46 metres	*X*	*12.0 metres*	*X*	*2.50 metres*

Total Volume = 73.80 m^3 (stacked)

Step 5: Loose piling and voids to be assessed on a percentage from the visible pile face.

73.80 m^3 (s) X 6% Loose piling = 4.43 m^3 (s)

73.90 m^3(s)
- 4.43 m^3(s)
69.47 m^3(s)

Step 6: Apply solid wood factor of 0.625 to determine solid net volume.

69.47 m^3(s) X 0.625 = 43.42 m3(solid)

FIGURE 19 - RECORDING AVERAGE HEIGHT - WOOD STACKED EVENLY ACROSS THE TOP

FIGURE 20 - RECORDING AVERAGE HEIGHT – WOOD STACKED SLOPING TOWARD CENTER

FIGURE 21 - RECORDING AVERAGE HEIGHT – WOOD STACKED SLOPING FROM CENTER

FIGURE 22 - RECORDING AVERAGE HEIGHT – WOOD STACKED IRREGULARLY

FIGURE 23 - RECORDING AVERAGE HEIGHT – WOOD STACKED SLOPING FROM ONE SIDE

3. NEWFOUNDLAND AND LABRADOR LOG RULE (F.B.M)

FIGURE 24 - SAWLOG SCALING (USING NL LOG RULE)

3.1 BOARD FOOT MEASURE – NL LOG RULE

3.1.1 BOARD FOOT

The board foot is a unit used to measure sawn lumber, or in principle, a fair estimate of lumber volume that can be sawn from a log. A board foot is a piece of sawn lumber 12 inches square and 1 inch thick (Figure 25), or any piece as 3” X 4” or 2” X 6” which contains the same volume of wood. Thus, we can say that the number of board feet in a piece of sawn lumber is equal to the product of the thickness in inches by the width in inches by the length in feet, divided by 12.

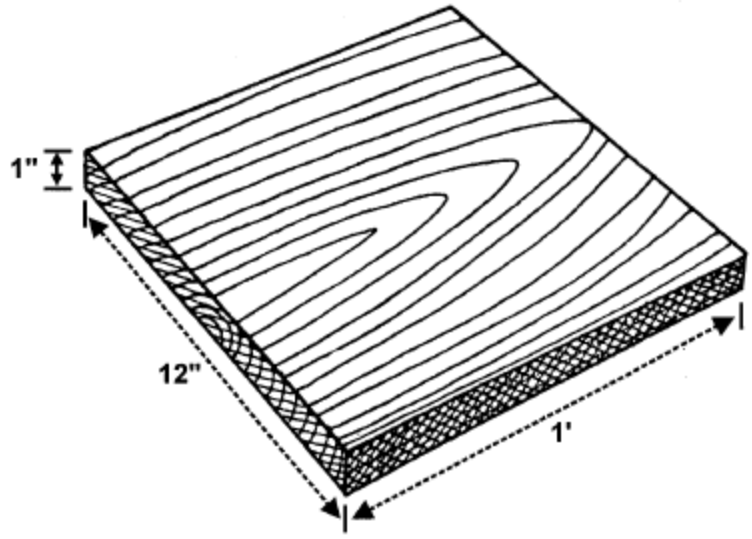


FIGURE 25 - A BOARD FOOT OF LUMBER

Example: A piece 2" X 4" X 8' would be calculated as follows:

$\frac{2\ X\ 4\ X\ 8}{12}$ *= 5.33 F.B.M.*

3.1.2 LOG RULE

The main requirement in preparation of a log rule is that it must be consistent for different lengths and sizes, and it must give values that can be sawn out. Different provinces have adopted their own legal log rule.

The board measure of a log, NL Log Rule, shall be determined by multiplying the top diameter of the log inside the bark by one-half the said diameter in inches and multiplying the product by the length of the log to the nearest full foot, then dividing that product by twelve. The result shall be the board measurement of the log in feet.

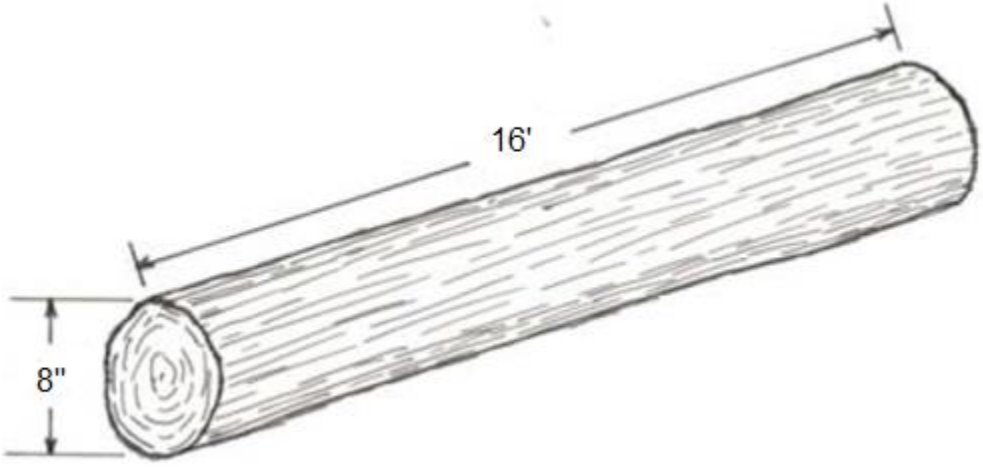


FIGURE 26 - BOARD MEASURE OF LOG

Example - A log 16 feet long has a top diameter of 8 inches (Figure 26).

Gross volume (NL Log Rule) = $\frac{D \text{ X } ½ \text{ D X } L}{12}$

Gross volume (NL Log Rule) = $\frac{8 \, X \, 4 \, X \, 16}{12} = \frac{512}{12}$ = 42.67 = 43 F.B.M

Gross volume (FBM) may be obtained from the Newfoundland and Labrador Log Rule Table (see Appendix IV).

There are many factors which influence the board foot yield of a log in sawn lumber. The chief ones are as follows:

a) Thickness of the saw – the thicker the saw, the greater the waste. Thus, a ¼ inch saw removes twice as much sawdust as one cutting 1/8 inch kerf.

b) Thickness of the slab – the thinner the slab is cut, the greater the volume that can be sawn from a log. However, there is a minimum width and thickness of slab below which it does not pay to cut.

c) Thickness of lumber – Log rules in board feet are made for a thickness of one inch. Therefore, if material of a 2 inch thickness is sawn, there will not be as many saw cuts and hence there will be a greater volume in board feet. This is offset to some extent by more waste in slabs and edgings.

d) Presence of defects in logs – interior or exterior defects will reduce the board foot yield.

e) Skill of the sawyer and efficiency of the machinery – a good sawyer has the ability to keep waste to a minimum. In like manner, efficient machinery will produce the maximum board foot yield.

f) Log Taper - Logs are scaled as cylinders having the diameter of the small end of the log. Therefore, a log with excessive taper or longer logs may yield more than the log rule specifies, as any lumber cut outside the cylinder is extra and is additional to the scale volume.

3.2 SAWLOG SCALING

Logs may be scaled where convenience offers the best opportunity (i.e. mill yards, roadside landing, etc.). Scaled logs should be identified by marking the top end with black or blue crayon. Culled logs are marked with “cull” or “X” on the top end.

To facilitate accuracy and ease of scaling, logs will be placed on skids or ramps to keep logs clear of mud and debris, thus increasing visibility and reducing physical demand while scaling.

Sawlogs piled for scaling shall have all the tops showing at one end of the pile and be so piled as to present a relatively even scaling surface.

Sawlogs of different lengths which are piled together on a landing shall have the lengths marked on the top with a blue or black crayon.

A scaler may refuse to scale any logs where in his/her opinion an accurate scale cannot be achieved (i.e. logs partially buried or covered in mud).

3.3 SCALE RECORD

The tally is the record kept by the scaler, or his/her assistant, on a tally/scale sheet as each log is scaled. This tally is a record of the diameter and length of each log. Deductions for defects may be made either by reducing the diameter or length of the log as tallied. The scaler should record the diameter or length of the log which corresponds most closely to the volume after the deduction for the defect has been calculated, or by subtracting the total volume of defects for the pile from the gross volume.

Example #1: A 12 inch log, 16 ft. long has a 4 inch continuous heart defect. The gross volume, NL Log Rule = 96 FBM

Volume of defect = $\frac{4\ X\ 4\ X\ 16}{15}$ *= 17 FBM (see formula for interior defects)*

Net Volume = 96 fbm – 17 fbm = 79 FBM

Example #2: The gross volume for a pile of logs is 2750 FBM. The total volume of defects for the pile is 58 FBM. The net volume for the pile = 2750 – 58 = 2692 FBM

3.4 LENGTH

Length is measured in full feet with the common practice being even foot lengths, thus 12’, 14’, 16’, etc. However, odd foot lengths are occasionally specified. A maximum trimming allowance up to 6 inches in order to allow for injury to the ends of the logs from machine processing may be permitted.

3.5 DIAMETERS

Small end diameters of the logs are measured inside the bark and recorded in one inch classes. Over 7.5 to 8.5 inch log is tallied as an 8 inch log and over 8.5 to 9.5 inch log is tallied as a 9 inch log. A fair diameter measurement will be taken of logs with regular sawn surfaces without seeking the largest or the smallest diameter. However, logs with irregular, oval or abnormally-shaped sawn surfaces require at least two fair measurements taken at right angles to each other from which the mean diameter is calculated and recorded. When determining mean log diameters, all fractions of an inch are dropped.

3.6 DEFECTS

If all logs were straight and sound, scaling would be a simple matter, but many logs have defects which lower the volume and quality of the manufactured product. In scaling logs, defect may be classified under two headings: interior defects (deductions made on a volume basis) or exterior defects (deductions made on a percentage basis).

3.6.1 INTERIOR DEFECTS

Interior defects occur on the inside of the log and are usually visible on one or both ends. The important ones are centre or heart rot (Figure 27), butt rot (Figure 28), heart check (Figure 29), or shake (Figure 30). The defect should be so confined to the heart as to allow for sawing the normal slab and at least one sound board from all sides. If such is not the case, the log should be reduced in length to the extent of the defect or, if more than ½ affected, should be classed as “cull”.

Deductions for interior defects will be based on the measurement of the defect in inches and feet and diagrammed or blocked out on the end of the log as a square or rectangle. The same formula which is used to compute the board measure content of a piece of sawn lumber is again used to arrive at the scale with this exception: A divisor of 15 is used instead of a divisor of 12. The reason for this is as follows – allowance for saw-kerf has already been deducted in constructing the log rule, and if 12 is used as a divisor, it would result in the allowance for sawdust not being deducted within the square or rectangle. Diameters of defects are measured in the regular inch classes and fractions are rounded up to the next inch class. For example, 8 ½ inch rot would read as 9 inch rot.

Example #1: Assume a log 12 inches in diameter at the small end, and 16 feet long with a heart rot extending clear through the log, 4 inches in diameter at the small end and 6 inches at the large end.

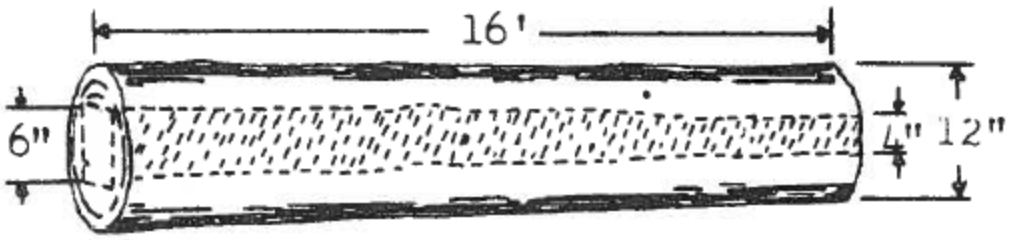


FIGURE 27 - NEWFOUNDLAND AND LABRADOR LOG RULE - LOG WITH HEART ROT

Proceed as follows:

Scale the log as sound = 96 board feet

Square the large end of the defect = 6 inches

Apply the formula: $\frac{6 \text{ X } 6X \text{ } 16'}{15}$ = 38 board feet

Net scale of the log equals 96 - 38 = 58 board feet

Example #2: A log 18 feet long with a top diameter of 14 inches has a butt rot 8 inches in diameter (interior defects shown at one end of the log are called partial and are considered to extend halfway through).

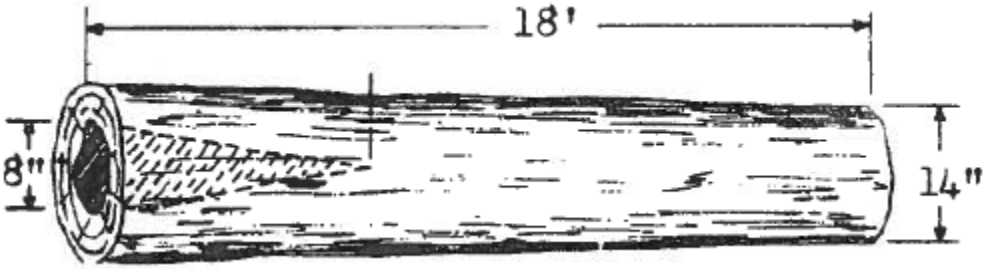


FIGURE 28 - NEWFOUNDLAND AND LABRADOR LOG RULE - LOG SHOWING BUTT ROT

Proceed as follows:

Scale the log as sound = 147 board feet

Apply the formula: Deduction = $\frac{8 \text{ X } 8X \text{ } 9'}{15}$ = 38 board feet

Net scale = 147 – 38 = 109 board feet

FIGURE 29 - NEWFOUNDLAND AND LABRADOR LOG RULE - LOG SHOWING HEART CHECK

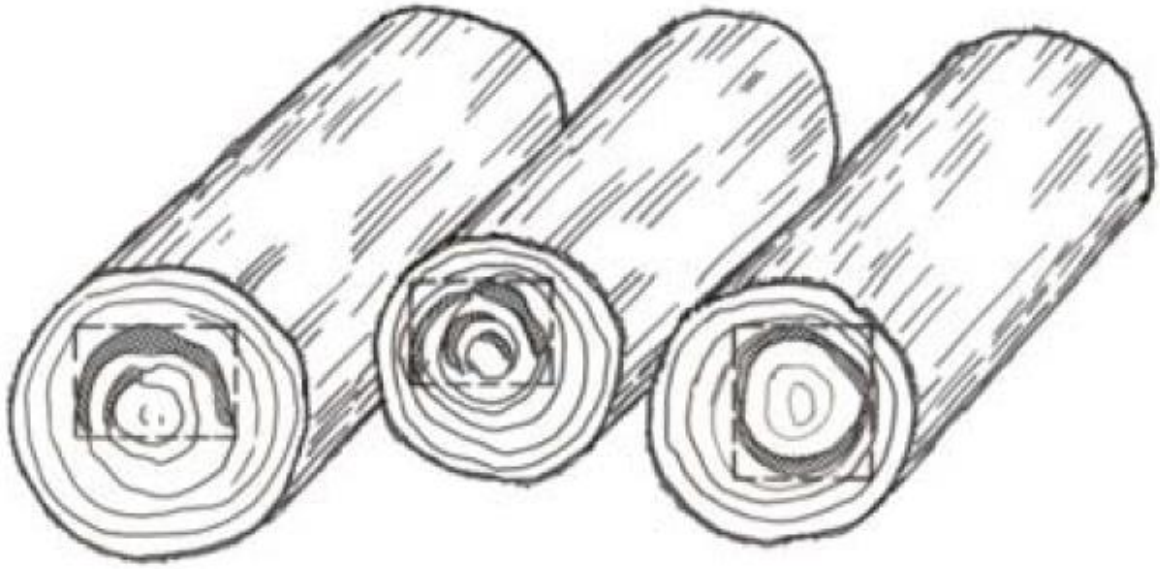


FIGURE 30 - NEWFOUNDLAND AND LABRADOR LOG RULE - LOGS SHOWING SHAKE

Note: Interior Defects Table (Appendix V) can also be used to determine deductions for interior defects in sawlogs.

3.6.2 EXTERIOR DEFECTS

Exterior defects occur on the outside of the log and are usually described as follows: straight seam (Figure 31), spiral seam (Figure 32), frost, wind or sun check, fire scar or lightning scar, crotch or fork, crook and sweep. Deductions are made only if the defect will reduce the quantity or quality of lumber that can be sawn from the log.

Deductions for exterior defects are made on a percentage basis. In logs where both exterior and interior defects are encountered, deductions for exterior defects are always made first.

Seams, lightning or fire scars, and frost, wind or sun checks may extend straight along the length of the log or spiral around it. The scaler, in making allowance for this type of defect, should take into consideration the depth of the scar, and the possibility of rot being associated with this injury.

Example #1: A 16 foot log has a 12 inch top diameter. Approximately 15% of the log is defected because of straight seam.

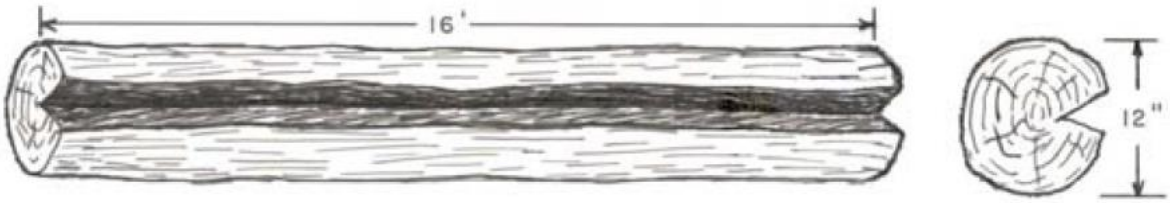


FIGURE 31 - NEWFOUNDLAND AND LABRADOR LOG RULE - LOG SHOWING STRAIGHT SEAM

Proceed as follows:

Scale the log as sound = 96 FBM

Deduction: 15% of 96 FBM = 14 FBM

Net scale of the log equals 96 – 14 = 82 FBM

Example #2: A sawlog 14 inches at the small end and 16 feet long, with a gross volume of 131 FBM, has a spiral seam which requires an estimated 40% deduction.

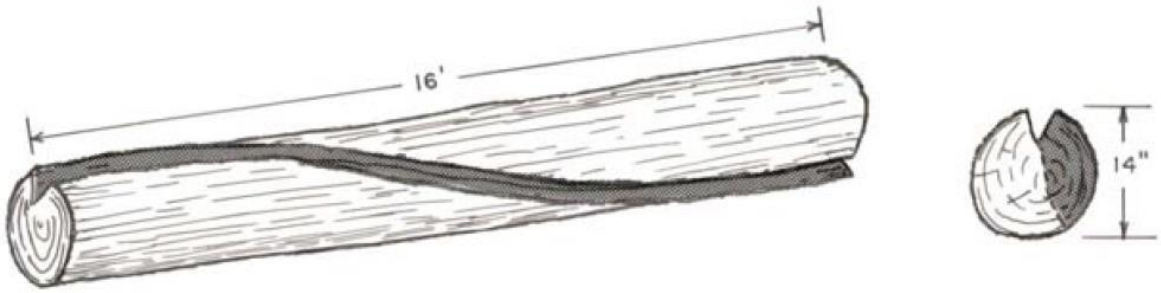


FIGURE 32 - NEWFOUNDLAND AND LABRADOR LOG RULE - LOG SHOWING SPIRAL SEAM

Proceed as follows:

Scale the log as sound = 131 FBM

Deduction: 40% of 131 FBM = 52 FBM

Net Scale of the log equals 131 – 52 = 79 FBM

Where two distinct and separate exterior defects occur which do not involve each other, separate percentage deductions will be made. The larger percentage deduction is always made first. The log is then reassessed to see if the lesser defect was eliminated by the first reduction.

Example #1: A sawlog 10 inches at the small end and 16 feet long, has a scar on the outside which requires an estimated 10% deduction. The log also has a crook which requires a 15% deduction. Sawing to remove the crook will eliminate the scar. Therefore, the gross volume will be reduced by 15% using the deduction for the crook only.

Scaled gross volume = 67 FBM

Deduction: 15% of 67 FBM = 10 FBM

Net Scale of the log equals 67 – 10 = 57 FBM

Example #2: A 10 inch log, 14 feet long, has a spiral seam running the full length of the log which is estimated to affect 20% of the gross volume (straight seam usually requires less reduction). In addition, the log has a crook which requires a 25% deduction. The gross volume would first be reduced by 25%. The remaining volume would be further reduced by 20% for the spiral seam.

Scaled gross volume = 58 FBM

1st Deduction (Largest defect): 25% of 58 FBM = 14 FBM

58 – 14 = 44 FBM

2nd Deduction (Smaller defect): 20% of 44 = 9 FBM

44 – 9 = 35 FBM

It should be noted that the size of the logs will have a bearing on determining the percentage of deduction for sweep. A 3 inch sweep in a 15 inch, 12 foot log takes but a small percentage of total yield at the saw, while a 5 inch log with the same sweep will require a much greater percentage of deduction. There is no set rule to guide the scaler.

In the final analysis, it can be stated that experience gained in a sawmill is the best guide to a scaler for determining percentage deductions of sawlogs. The scaler who has this training will find it relatively easy to make such assessments.

The following illustrations (Figures 33-36) are meant as guidelines only in making percentage deductions for crook or sweep. To use the method, extend an imaginary line along the longest and straightest section of a log on the inside bend of the crook or sweep.

FIGURE 33 - LOG WITH 10% SWEEP

FIGURE 34 - LOG WITH 25% SWEEP

FIGURE 35 - LOG WITH 33 1/3 % SWEEP

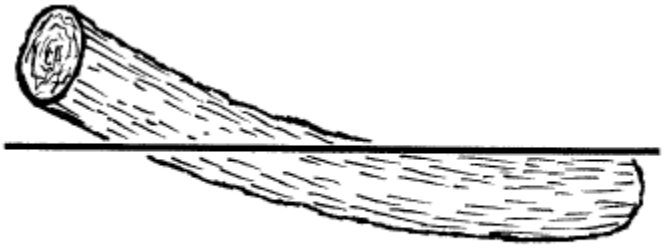


FIGURE 36 - LOG WITH 50% SWEEP

Crook is a defect that usually occurs at either end of the log. As a consequence it is common practice to allow for it by reducing the length of the log to the point where the crook begins (see Figure 37). It should be noted that crook at the butt can be deceiving if there is any amount of butt flare.

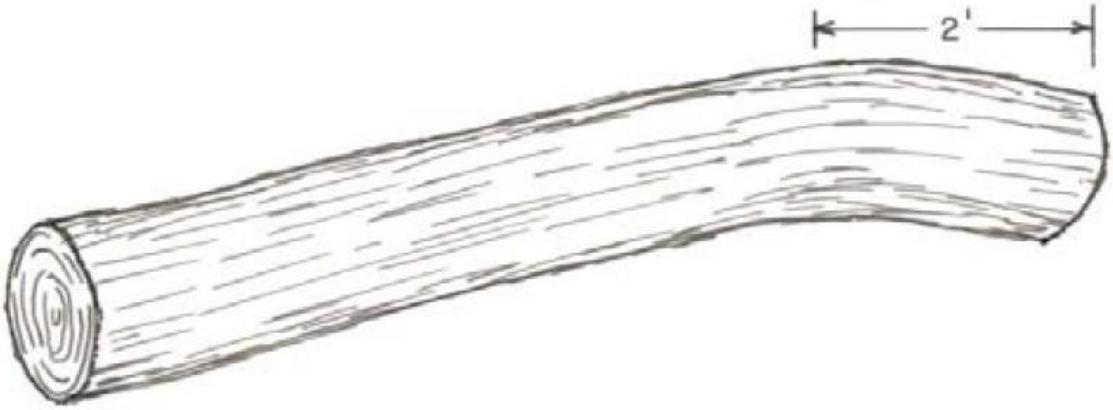


FIGURE 37 - LOG WITH CROOK

Gross Scale: 12' log, 12" top diameter = 72 FBM

Net Scale: 10' log, 12" top diameter = 60 FBM

If a representative measurement of the top diameter cannot be obtained from the sawn surface (i.e. log with crotch or fork – Figure 38), the diameter should be estimated just below the swelling. But care should be taken that this diameter does not exceed the butt-end diameter. The length of the log is then reduced by the length of the swollen portion and the measurement calculated accordingly.

FIGURE 38 - LOG WITH CROTCH

4. MASS SCALING

FIGURE 39 - TRUCK ON WEIGH SCALES

4.1 GENERAL

Mass Scaling is an accurate and economical method of measuring wood. Units of mass can be converted to units of volume by using mass/volume ratios approved by the Forest Service of Newfoundland and Labrador.

All regulated mass scaling transactions must be performed under the direction of a certified scaler. The scaler has the responsibility to ensure the load is weighed in accordance with this manual and that all reasonable measures have been taken to ensure the weigh scale device is functioning properly on a daily basis. This includes regular testing and ensuring maintenance is undertaken, as required (see Section 4.5).

Where mass to volume conversions are being applied to the transaction, the scaler must ensure scale documentation is accurate and complete as it relates to conversions. This includes verification of product, species and date. The scaler should also note obvious conditions of wood that could impact the mass of the load (i.e. excessively dry) and bring this to the attention

of the Newfoundland and Labrador Forest Service, as this may require an alternative conversion or sampling.

4.2 Measurement, Calculations and Compilation

When scaling primary wood products by mass, a scaler shall determine the mass by use of motor vehicle scales or such other appropriate weighing machines that conform to the *Weights and Measures Act (Canada)* and regulations thereunder.

The weigh scales must be of sufficient capacity to determine the mass of any loaded vehicle within the operation. Scales must be of sufficient length to accommodate entire truck and trailer.

The scaler shall:

1. Weigh the primary forest products together with the vehicle on which the products are being transported and determine their gross weight or mass.

2. After the products are unloaded, re-weigh the empty vehicle and determine its mass or tare weight.

3. Determine the mass of the load by subtracting the tare weight from the gross weight.

Note: The truck **must not** be refueled between gross and tare measurements.

The mass of a load of primary forest products shall be determined and expressed to the nearest 10 kg or 0.01 t and shall include, if present, bark, moisture, rot and foreign material.

4.3 Mass to Volume Conversion

Where mass is converted to volume, a mass to volume conversion factor shall be applied as approved by the Minister. Mass to volume conversion factors will account for deductions of bark, moisture, rot and foreign material through sampling procedures approved by the Minister, and no further deductions shall be made.

Where deductions of bark, moisture, rot and foreign material are not accounted for in a conversion to cubic metres, a scaler may make deductions for defects by

- A percentage reduction of the gross mass through procedures approved in scaling arrangements, or

- Measuring defect volume and converting to mass through procedures approved in scaling arrangements, then subtracting the mass of the defect from the gross mass.

4.4 Measurement Canada

Measurement Canada administers and enforces the Weights and Measures Act and Regulations, which applies to weigh scales used to measure primary forest products. The Forest Service cooperates with Measurement Canada through a working relationship to aid both agencies in an effort to ensure compliance with the legal requirements of both federal and provincial legislation.

4.5 Weigh Scale Maintenance and Testing

Weigh scale maintenance and testing is crucial to ensuring consistent and accurate measurement of primary forest products. Visual inspections, usage tests and weight indicator tests are minimum recommended practices that should be included in all scale operators routine scale maintenance programs.

If problems are detected, beyond acceptable tolerances, immediate attention is required to remedy the problem. Scale owners and operators are legally responsible to ensure corrective action is taken. If this is not possible, other means of measurement are to be used.

Special attention should be given to seasonal conditions that create problems with debris buildup, such as mud and ice around the platform and load cells. Freeze and thaw weather conditions create particularly troublesome conditions for weigh scale platforms. Scalers must ensure special attention to testing and maintenance under these conditions.

4.5.1 Weigh Scale Visual Inspection

The following visual inspections should be carried out on a regular basis.

1. Scale approach, platform and surrounding area free of foreign material.

2. Scale load cell unit should be free and clear of debris (ice, snow, water or mud).

3. Under the scale and ends should also be free and clear.

4. Note the function of the weight displays. Compare indicator, scoreboard and printer to ensure consistency.

5. Scalers must be aware of visual signs that a weigh scale device may not be functioning properly. These signs include slow or sluggish reading outputs or indicators that do not return to zero after the load is removed. Platforms should be free and clear to normal movement.

4.5.2 Weigh Scale Usage Tests

The following usage tests should be carried out on a regular basis.

1. For attended scales, verify that the operator is zeroing the scale before a load is supported on the truck scale. The operator must have visual confirmation that the load being weighed is fully supported on the scale and only then prints the weight.

2. For fully unattended scales, an automatic means must be displayed to the driver that the indicating element of the scale has returned to zero and the operator may drive onto the weigh scales. A printed ticket should not be given unless there is an automatic means to ensure that the load is fully supported on the weighing device.

3. When loads are removed from scales, observe the time required for the display to return to zero. The scale must return to zero within a few seconds (note: high wind may cause fluctuations of 10-20 kg).

4.5.3 SECTION TEST

This test should be performed at least once per week and should be done more frequently during freeze and thaw conditions. Records of section testing must be maintained on site by the scaler.

This test will indicate whether the device is weighing consistently at all points on the platform and will provide indication of a malfunctioning load bearing point (load cell).

The test is carried out by using a test vehicle (straight truck or loader) with a recommended minimum weight of 20 000 kg, although a lighter weight test vehicle may be used if necessary.

To test the sections, first zero the scale and then move the test vehicle onto the scale as close to the inbound end as possible and record the weight. Ensure that the load being weighed is fully supported on the scale. Move the test vehicle three to five positions on the scale (full coverage from end to end) and record the weight each time. The same procedure is then repeated by turning the vehicle around and moving it across the scales in the opposite direction.

The scale must return to zero when the truck is off the scale platform.

The difference between the highest and lowest reading gives the section error found on the scale. The scale is not within tolerance if the error is greater than the limits, as defined under Weights and Measures Regulations. This tolerance is incremental based on the weight of the test vehicle.

A tolerance guideline, for Motor Vehicle scales weighing in 10 kg increments, is as follows:

Test Vehicle Weight Tolerance

20 000 kg	30 kg
30 000 kg	50 kg
40 000 kg	60 kg
60 000 kg	80 kg

Example: Weights direction 1: 40 300, 40 320, 40 380, 40 310
Weights direction 2: 40 290, 40 310, 40 370, 40 300

Greatest difference is 40 380 – 40 290 = 90 kg

In this case, the section error exceeds tolerance therefore maintenance is required.

4.6 Scaling of Secondary Forest Products by Mass

The following rules apply to the measurement of mass for wood chips, including pulpchips and biomass (whole tree chips, planer shavings, sawdust).

Persons directly involved in the measurement of mass or determining moisture content of secondary forest products must be in possession of a Class C scaling license.

Mass can be expressed as "green tonnes", kilograms or grams or oven dry tonnes, kilograms or grams.

4.6.1 Measurements

Mass shall be measured on weigh scales or weighing equipment that have been inspected and approved by the Federal Weights and Measures personnel.

4.6.2 Capacity

The weigh scales shall be of sufficient capacity to determine the "green" mass of the loaded vehicle in one operation. After unloading, the empty vehicle shall be weighed in one operation to determine its tare.

The "green" mass shall be determined by the weighing device and shall include moisture if present.

Mass shall be recorded with a precision of 0.01 tonnes or 10 kilograms.

Deductions for mass of foreign material shall be made from the total mass if the mass of the foreign material can be accurately determined.

4.6.3 Determination of Oven Dry Mass

The following items are required:

A. Storage container

B. Laboratory balance accurate to within 0.1%

C. A drying oven with a thermostatic temperature control.

The sample shall be representative of the load and drawn in a random manner. The minimum sample size shall be 250 grams. At all times, the sample should be stored and handled with the necessary precautions to prevent changing its characteristics.

To ensure that there is no loss or gain of moisture from the sample between the time of sampling and the time of weighing each sample shall be placed in an airtight container such as polyethylene bag and tightly sealed.

The procedure is as follows:

a) Weigh the sample and container.

b) Weigh the empty container.

c) Subtract to determine mass of sample.

d) Place sample in a drying tray and place in an oven operating at 103°C + or -2°C.

e) Dry the sample until three separate checks show the weight to be constant. This will take approximately 20 hours.

f) Subtract the weight of the empty drying tray.

4.6.4 Calculating Moisture Content

The weight of the oven dry sample subtracted from the weight of the green sample, then divided by the weight of the dry sample, then multiplied by 100. This is the percentage moisture content (M.C.%).

The oven dry percent of the sample is 100 – M.C.% (express to nearest 0.1%).

Example: *Green Sample = 300 grams*
Oven Dry Sample = 250 grams

$$M.C.\% = \frac{300 - 250}{250} \times 100 = 20\% \text{ Moisture}$$

5. LOG SCALING (CUBIC METRES)

FIGURE 40 - SAWLOG SCALING (USING SMALIAN'S FORMULA)

5.1 CUBIC VOLUME MEASUREMENT

Method used to determine the solid wood volume of a log in cubic metres (Smalian's Formula or Huber's Formula).

This method is applied to:

1. Determine the solid wood content of stacked wood.

2. Calculate the solid volume of samples to create mass to volume conversion factors.

3. Construction Timber volumes.

4. Individual Log Volumes.

5.2 METHOD OF MEASUREMENT

The diameter measurements inside bark on both ends of the log are taken with a diameter rule to the even centimeter.

When recording diameters to the even centimeter class, the boundary between the size classes shall be the odd centimeter. Example: Greater than 9 cm = 10 cm; equal to or less than 11 cm = 10 cm.

A fair diameter measure must be taken without seeking the largest or smallest diameter. Logs with irregular or oval shaped diameters require two measurements taken at right angles to each other from which the mean diameter is calculated (Figure 41). When the average diameter falls on an odd number, the diameter will be decreased to the nearest even centimeter.

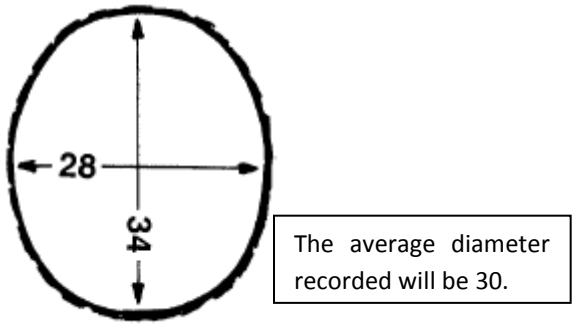


FIGURE 41 - RECORDING DIAMETERS OF LOGS WITH REGULAR AND IRREGULAR CROSS SECTIONS

Lengths are measured with a linen or steel tape graduated in metres and centimetres and recorded in the 0.20 m. Example: 5.89 m = 5.80 m. Greater than 0.10 m = 0.20 m; equal to or less than 0.30 m = 0.20 m.

Note: When using Smalian's or Huber's formula, diameter measurements may be taken to the nearest full centimeter (1.0cm) depending on the level of precision required.

Where butt swell visibly influences a diameter reading, the diameter of the large end inside bark shall be reduced to the diameter obtained by the projection of the line of normal taper (Figure 42). Another method to decrease the effect of butt swell on resulting volume, the first diameter measurement should be made at a distance not exceeding 1.0m from the butt end. Where bark is present, this diameter is to be taken outside bark using graduated calipers. A measurement of double bark thickness is obtained and subtracted from the outside bark diameter.

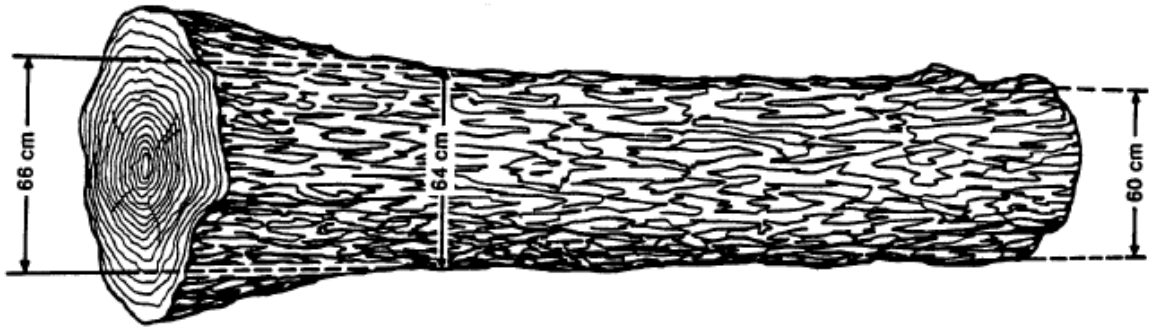


FIGURE 42 - REDUCING DIAMETER TO NORMAL PROJECTED TAPER

5.3 CALCULATION OF CUBIC METRE VOLUME

The gross volume of each log shall be calculated using:

(a) Smalian's formula:

Volume in cubic metres = $\pi \left(\frac{A1+A2}{2}\right)^2$ X L

Where:

π = 3.1416
L = length of log in metres

A_1 = area of large end of log, m^2

$= \pi \left(\frac{Diameter\ of\ large\ end}{2\ X\ 100}\right)^2$

A_2 = area of small end of log, m^2

$= \pi \left(\frac{Diameter\ of\ small\ end}{2\ X\ 100}\right)^2$

Or by using:

(b) Huber's formula:

Volume in cubic metres = $\pi \left(\frac{DIB}{2\ X\ 100}\right)^2$ X L

Where:

π = 3.1416
L = length of log in metres

DIB = mid-point diameter inside bark, determined by averaging the diameter of the small end and the diameter of the large end.

$$DIB = \frac{\text{Diameter small end + Diameter large end}}{2}$$

Note: Volume must be calculated to a minimum of 2 decimal places ($0.02m^3$)

5.4 DEFECTS

It must be remembered that with any timber, the buyer will nearly always specify the type of timber acceptable and timber which does not meet these specifications is culled. If deductions are necessary, the procedure outlined in the following paragraphs shall be followed.

Diameters of defects are measured to the even centimeter with a diameter rule graduated in even centimetres. The boundary between the size classes shall be the odd centimeter. Example: Greater than 9 cm = 10 cm; equal to or less than 11 cm = 10 cm.

For logs six metres and over, a defect showing on one end is assumed to extend a distance of three metres. For logs less than six metres, the length of defects showing on one end will be estimated by the scaler.

If a defect appears at both ends, the average diameter of the defect at both ends is made and the gross cubic metre volume of the log is reduced according to the volume of the defect.

Example: Using Huber's formula, a 4.0 m log has an average diameter of 20 cm. A heart rot extends all through the log and measures 6 cm at one end and 8 cm at the other end.

Gross Volume = $3.1416 \left(\frac{20}{2 \; X \; 100}\right)^2 \; X \; 4.0 = 0.13 m^3$

Volume of Defect = $3.1416 \left(\frac{7}{2 \; X \; 100}\right)^2 \; X \; 4.0 = 0.02 \; m^3$

Net Volume = $0.13 \; m^3 - 0.02 \; m^3 = 0.11 \; m^3$

6. ALTERNATE SCALING METHODS

6.1 DIGITAL SCALING

This method uses digital photography in combination with on screen digitizing, to capture a digital image of Stacked Wood (Figure 43 & 44).

All measurements are done on screen to traverse and capture the surface area of a stack of wood. The average surface area in combination with the known length of the wood is used to calculate the gross volume in m^3 stacked.

FIGURE 43 - DIGITAL SCALING USING CAMERA BASED TECHNOLOGY

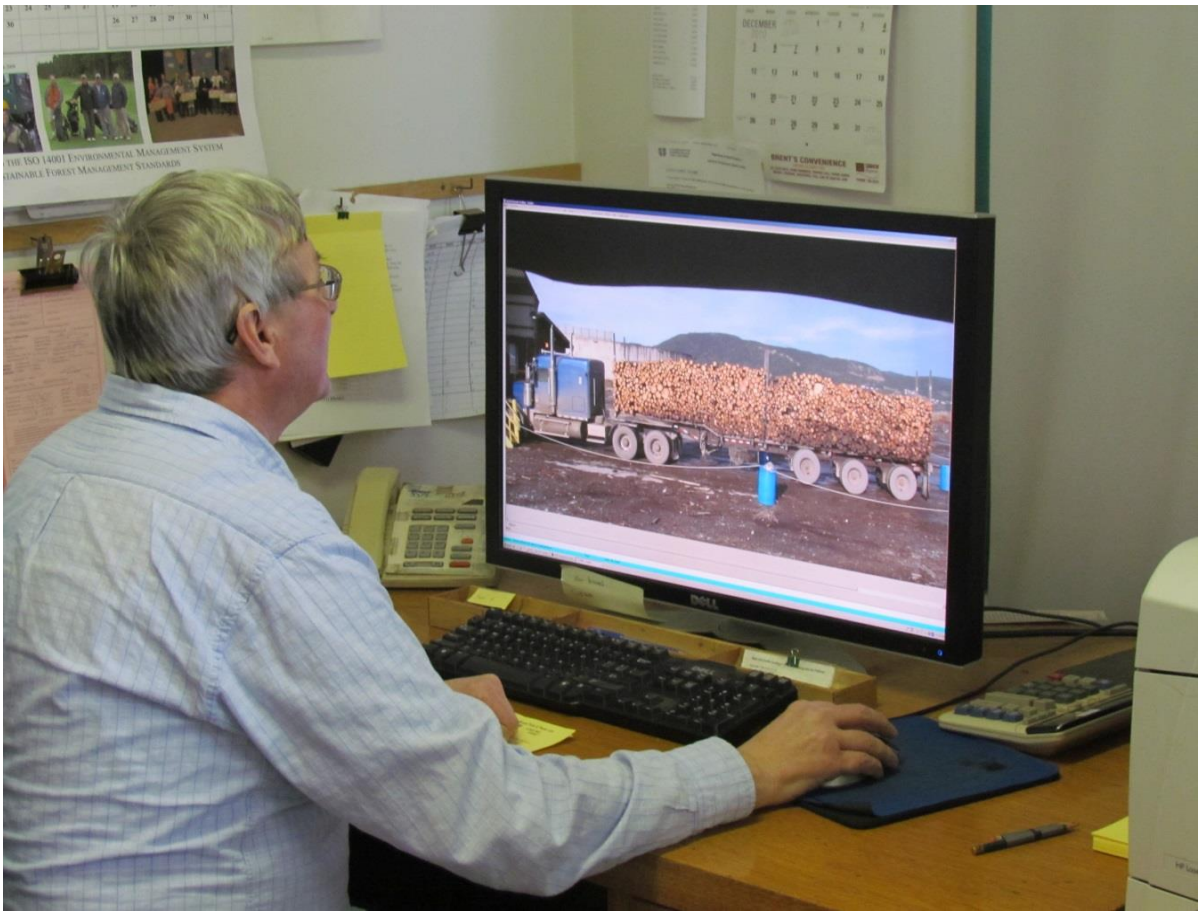


FIGURE 44 - ON-SCREEN DIGITIZING A TRUCK LOAD OF PULPWOOD

6.1.1 DEDUCTIONS

Deductions for cull, voids and undersized wood are based on buyer specifications. Loose piling is still estimated ocularly by a scaler. Deductions are done with the use of a randomized placement of a sample icon on the stack to statistically determine the required deductions (Figure 45). The system operates on a pre-determined number of plots or rolling average maintained in the system. It should be noted that the manual system of determining deduction can still be used.

FIGURE 45 - RANDOMIZED CULL DEDUCTION SAMPLING

6.1.2 CALIBRATION PROCEDURE

All alternate or new scaling methods must be approved by the minister and meet the accuracy tolerances according to the Timber Scaling Manual (see Section 1.8).

1. All persons using this system must be certified timber scalers.

2. All scalers must be check scaled by the Provincial Check Scaler to ensure they are in compliance with the scaling method.

3. All scalers will stick scale thirty stacks of wood to determine the Gross m^3 stacked.

4. All scalers will digitize the same stacks of wood to digitally determine the gross volume in m^3 stacked.

5. The digital measurement is then adjusted up or down to be aligned with the bench mark or manual stick scale measure.

6.2 TIMBER DIMENSIONAL MEASURING DEVICES (TDMD)

FIGURE 46 - LASER LOG SCANNER

A TDMD, also known as a laser scanner or log scanner, is a device which measures diameter of a natural occurring cross-section and length of a log (Figure 46). Their primary function is to provide the individual measurements to be used through formula (i.e. smalian's formula: to mathematically calculate the solid wood volume of individual logs).

The regulation and approval process of TDMD for legal use in trade is governed by Measurement Canada. All TDMD models must undertake the testing procedure outlined in Measurement Canada's *Timber Dimension Measuring Devices Approval Manual* and are subject to approval evaluation. It is the responsibility of the supplier or manufacturer of the TDMD to complete the request for approval testing for a specific device. This testing is completed in a laboratory setting, field setting and on site for an initial inspection.

Only the initial measurement for diameter and length of objects are used as part of the Measurement Canada testing procedure for TDMD's. The method of determining the calculated volume and any factors used for determining deductions for net volume is outside the scope of the Measurement Canada testing procedure. For TDMD use in Newfoundland and Labrador, the Forest Service will assess requests for methods and procedures as it relates to net volume calculations.

When a TDMD is approved for use in Timber Scaling, the Forest Service will accurately assess individual systems to ensure they continue to perform measurements to meet or exceed the scaling standards in place. TDMD's, like all other alternate scaling devices will require the operator to be a Certified Timber Scaler and to comply with provincial scaling regulations and legislation.

APPENDIX I

APPLICATION FOR EXAMINATION FOR TIMBER SCALER'S CERTIFICATE

UNDER THE FORESTRY ACT AND REGULATIONS

Name in full:_____

Home Address:_____
_____

Phone #:_____ Date of Birth:_____

Education Background: _____
_____
_____
_____
_____
_____

Previous Scaling Experience: _____
_____
_____
_____
_____
_____

Do you hold a Newfoundland and Labrador Temporary Scaler's Certificate? _____

What is your present occupation? _____

Class of Certificate applied for _____ (Indicate by X)

Class "A" (collectively)		Class "B" (Individually)		Class "C"	
( )	Pulpwood and Fuelwood	( )	Sawlogs	( )	Pulp Chips
( )	Studwood	( )	Ties, Poles, Pilings and Posts	( )	Fuel Chips

Each and all of the answers to the foregoing questions are true to the best of my knowledge and belief.

_____ _____
Date Signature of Applicant

Applications must be forwarded to the Chief Scaler at the address stated below at least thirty days prior to the examination date.

Forest Service of Newfoundland and Labrador
Forest Engineering and Industry Services
P.O. Box 2006, Fortis Building
Corner Brook, NL
A2H 6J8

APPENDIX II

CONSOLIDATED NEWFOUNDLAND AND LABRADOR REGULATION 987/96

TIMBER SCALING REGULATIONS

under the
Forestry Act
(O.C. 96-452)
Amended by:
2001 c42 s45

Under the authority of section 141 of the *Forestry Act* and the *Subordinate Legislation Revision and Consolidation Act* , the Lieutenant-Governor in Council makes the following regulations.

REGULATIONS

Short title

1. These regulations may be cited as the *Timber Scaling Regulations.*

168/93 s1

Definitions

2. In these regulations

(a) "Act" means the *Forestry Act;*

(b) "board" means the Timber Scalers Board established under the Act;

(c) "board foot" means board foot measure as determined by the Newfoundland and Labrador Log Rule;

(d) "department" means the department presided over by the minister;

(e) "green ton" means 1000 kilograms of timber including water;

(f) "manual" means the most recent Manual of Scaling Instructions as approved by the board;

(g) "minister" means the minister appointed under the *Executive Council Act* to administer this Act; and

(h) "oven dry ton" means 1000 kilograms of timber excluding water that is not hygroscopically bonded.

168/93 s2; 2001 c42 s45

All timber to be scaled

3. (1) All timber cut for commercial purposes on forest land in the province shall be scaled by a timber scaler before being manufactured.

(2) All timber cut on Crown land or public land upon which a royalty is due and payable to the Crown shall be scaled by a timber scaler before being manufactured.

(3) An individual who manufactures timber that is required to be scaled before it is scaled is guilty of an offence and is liable upon summary conviction to a fine of not less than the value of the timber manufactured.

168/93 s3

Certification required

4. A person shall not scale timber for the purpose of the Act and the regulations without having first been certified to do so by the board and obtained a certificate to that effect.

168/93 s4

Methods of scaling

5. (1) The methods used in the scaling of timber shall be those specified in the manual.

(2) Changes may be made to the manual with the approval of the board.

168/93 s5

Duty of timber scaler

6. It shall be the duty of every timber scaler to measure fairly and correctly to the best of his or her ability all timber that the timber scaler is asked to measure in accordance with the procedures outlined in the manual.

168/93 s6

Manner of certification

7. (1) The board may certify a timber scaler to scale timber measured

(a) collectively;

(b) as individual units;

(c) by mass; or

(d) by these categories, in combination.

(2) The board may further restrict scaler certification to reflect specific limitations as to the types of timber that may be scaled and the purpose for which timber may be scaled.

(3) Every certificate shall be in the form prescribed by the board and shall specify the class and type of timber within the class that the holder is authorized to scale.

168/93 s7

Administration of examinations

8. All examinations toward the requirements for a scaler's certificate shall be administered by the chief scaler.

168/93 s8

Application for examination

9. A candidate for examination must make written application to the board providing the information that may be required by the board.

168/93 s9

Responsibilities of timber scaler

10. It is the responsibility of a timber scaler to

(a) scale only those types of timber endorsed on the scaler's certificate;

(b) make all necessary deductions to allow for defects as prescribed in the manual;

(c) become familiar with any new techniques or measurement units that may have been developed since the scaler was licensed;

(d) know the conditions and specifications of sale or purchase for any timber the scaler is required to scale;

(e) know how to identify the commercially valuable tree species in log or bolt form common to the area;
(f) ensure that all scaling instruments and measuring tapes being used are properly calibrated and in good repair and of a type approved by the Newfoundland and Labrador Forest Service;
(g) supervise, instruct and counsel an assistant under the scaler's supervision;
(h) be responsible for work done by an assistant under the scaler's supervision;
(i) successfully complete a required refresher course to retain scaling privileges;
(j) keep those records and submit monthly returns as directed by the minister or a forestry official and make records and returns available upon request; and
(k) accurately check the work of other scalers when requested to do so.

168/93 s10; 2001 c42 s45

Oath or affirmation required

11. Before receiving a timber scaler's certificate, a candidate must complete an oath or an affirmation as prescribed by the board.

168/93 s11

Expiration of certificate

12. The scaler's certificate expires on March 31 following the date of issue unless otherwise stated.

168/93 s12

Fees

13. Fees for scaler's examinations and certificate renewal shall be as prescribed by the minister.

168/93 s13

Cancellation of certificate

14. Failure to perform duties or to scale timber in accordance with the manual, the regulations or the Act may result in cancellation of a scaler's certificate by the board.

168/93 s14

Renewal of certificate

15. (1) In order to have a certificate renewed, a scaler must measure at least minimum volumes over the previous 3 year period as follows:

	Minimum Volume
Class "A"	
Pulpwood	1000 cubic metres (stacked)
Bulk Scaling (tree length)	1000 cubic metres (stacked)
Class "B"	Minimum Volume
Sawlogs	30,000 fbm
Construction timber	100 cubic metres
Class "C"	Minimum Volume
Pulp chips	N/A over-dry tons N/A green tons
Fuel chips	N/A oven-dry tons N/A green tons

(2) Failure to meet these minimum requirements shall result in refusal to renew the certification until the scaler has completed a scaling course as approved by the board.

168/93 s15

Monthly returns

16. A timber scaler shall make monthly returns to the Newfoundland and Labrador Forest Service in the form and containing the information that the minister prescribes and failure to do so may lead to suspension or cancellation of a scaler's licence.

168/93 s16; 2001 c42 s45

Non-interference with scaler

17. A person shall not hinder, obstruct or interfere with a timber scaler in the discharge of his or her duties.

168/93 s17

Measurements checked

18. (1) A timber scaler in the employ of the Newfoundland and Labrador Forest Service may check another scaler's measurements and procedures without interference.
(2) Results of the original scale and the check scale must be presented to the chief scaler.

168/93 s18; 2001 c42 s45

Payment for scaling

19. When timber is scaled for the purpose of payment, the following units of measure apply:

Timber	**Unit of Measure**
Pulpwood	Cubic metre (stacked) or cubic metre (solid)
Fuelwood	Cubic metre (stacked) or cubic metre (solid)
Treelengths (when scaled collectively)	Cubic metre (stacked) or cubic metre (solid)
Sawlogs	Board foot or cubic metre (solid)
Construction timber	Cubic metre (solid)
Treelength (when scaled individually)	Cubic metre (solid)
Pulp chips	Green ton or oven dry ton
Biomass (fuel chips)	Green ton or oven dry ton

168/93 s19

Other measurement

20. The use of indirect measurements and/or conversion factors in the scaling of timber are not permitted except where procedures for verification and use have been approved by the board.

168/93 s20

Location of scaling

21. Timber shall be scaled in the immediate harvest area unless otherwise determined by a forestry official.

168/93 s21

Removal of timber

22. Where a logger is paid on the basis of scaled volume, timber may not be removed from the immediate harvesting area until it has been scaled or written permission for another scaling location is given by the logger.

168/93 s22

Statement re timber

23. Where a logger requests, a timber scaler shall provide the logger with a signed statement concerning all timber that the scaler has measured for the purpose of payment to the logger and it shall contain

(a) pile numbers;
(b) pile measurements;
(c) the volume deducted for defects; and
(d) gross and net scale.

168/93 s23

Offence

24. Contravention of these regulations is an offence punishable in accordance with sections 139 and 140 of the Act.

168/93 s24

Repeal

25. The Timber Scaling Regulations, Newfoundland Regulation 168/93, are repealed.

APPENDIX III

CULL DEDUCTION TABLE

TABLE SHOWING VOLUME OF PULPWOOD BOLTS BY DIAMETER. IN STACKED CUBIC METERS.

APPLICABLE ONLY TO 2.5 METRE ROUGH PULPWOOD
(*These volumes represent one half the length of 2.5 metre wood – see formula below*)

DIAMETER	NUMBER OF PIECES									
cm	1	2	3	4	5	6	7	8	9	10
6.0	0.005	0.011	0.016	0.021	0.027	0.032	0.037	0.043	0.048	0.053
8.0	0.009	0.019	0.028	0.038	0.047	0.057	0.066	0.076	0.085	0.095
10.0	0.015	0.030	0.044	0.059	0.074	0.089	0.103	0.118	0.133	0.148
12.0	0.021	0.043	0.064	0.085	0.106	0.128	0.149	0.170	0.192	0.213
14.0	0.029	0.058	0.087	0.116	0.145	0.174	0.203	0.232	0.261	0.290
16.0	0.038	0.076	0.114	0.151	0.189	0.227	0.265	0.303	0.341	0.379
18.0	0.048	0.096	0.144	0.192	0.240	0.287	0.335	0.383	0.431	0.479
20.0	0.059	0.118	0.177	0.237	0.296	0.355	0.414	0.473	0.532	0.591
22.0	0.072	0.143	0.215	0.286	0.358	0.429	0.501	0.572	0.644	0.716
24.0	0.085	0.170	0.255	0.341	0.426	0.511	0.596	0.681	0.766	0.852
26.0	0.100	0.200	0.300	0.400	0.500	0.600	0.700	0.800	0.900	0.999
28.0	0.116	0.232	0.348	0.464	0.580	0.696	0.811	0.927	1.043	1.159
30.0	0.133	0.266	0.399	0.532	0.665	0.798	0.931	1.065	1.198	1.331
32.0	0.151	0.303	0.454	0.606	0.757	0.908	1.060	1.211	1.363	1.514
34.0	0.171	0.342	0.513	0.684	0.855	1.026	1.196	1.367	1.538	1.709
36.0	0.192	0.383	0.575	0.766	0.958	1.150	1.341	1.533	1.725	1.916
38.0	0.214	0.427	0.641	0.854	1.068	1.281	1.495	1.708	1.922	2.135
40.0	0.237	0.473	0.710	0.946	1.183	1.419	1.656	1.893	2.129	2.366
42.0	0.261	0.522	0.782	1.043	1.304	1.565	1.826	2.087	2.347	2.608
44.0	0.286	0.572	0.859	1.145	1.431	1.717	2.004	2.290	2.576	2.862
46.0	0.313	0.626	0.939	1.251	1.564	1.877	2.190	2.503	2.816	3.129
48.0	0.341	0.681	1.022	1.363	1.703	2.044	2.385	2.725	3.066	3.407
50.0	0.370	0.739	1.109	1.479	1.848	2.218	2.587	2.957	3.327	3.696
52.0	0.400	0.800	1.199	1.599	1.999	2.399	2.799	3.198	3.598	3.998
54.0	0.431	0.862	1.293	1.725	2.156	2.587	3.018	3.449	3.880	4.311

FORMULA: $D^2 \times 1.183 \times L = m^3$ (stacked)

Where: D = Diameter of piece Inside Bark expressed in metres
1.183 = constant
L = 1.25 metres (i.e.: ½ of 2.50m pulpwood or studwood)

APPENDIX IV

LOG RULE TABLE

NEWFOUNDLAND AND LABRADOR

Correct to the nearest full foot

RULE: Multiply diameter of top by half the diameter in inches, and the product by the length in feet, divide by twelve; the result will be the board measurement in feet.

Formula: $\frac{D \times \frac{1}{2} D \times L}{12}$

D = diameter (inside bark)
L = length to nearest full foot

Diameter in inches	Length in Feet																		
	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
4	4	5	5	6	7	7	8	9	9	10	11	11	12	13	13	14	15	15	16
5	6	7	8	9	10	11	12	14	15	16	17	18	19	20	21	22	23	24	25
6	9	10	12	13	15	16	18	19	21	22	24	25	27	28	30	31	33	34	36
7	12	14	16	18	20	22	24	27	29	31	33	35	37	39	41	43	45	47	49
8	16	19	21	24	27	29	32	35	37	40	43	45	48	51	53	56	59	61	64
9	20	24	27	30	34	37	40	44	47	51	54	57	61	64	67	71	74	78	81
10	25	29	33	37	42	46	50	54	58	62	67	71	75	79	83	87	92	96	100
11	30	35	40	45	50	55	60	66	71	76	81	86	91	96	101	106	111	116	121
12	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126	132	138	144
13	42	49	56	63	70	77	84	92	99	106	113	120	127	134	141	148	155	162	169
14	49	57	65	73	82	90	98	106	114	122	131	139	147	155	163	171	180	188	196
15	56	66	75	84	94	103	112	122	131	141	150	159	169	178	187	197	206	216	225
16	64	75	85	96	107	117	128	139	149	160	171	181	192	203	213	224	235	245	256
17	72	84	96	108	120	132	144	157	169	181	193	205	217	229	241	253	265	277	289
18	81	94	108	121	135	148	162	175	189	202	216	229	243	256	270	283	297	310	324
19	90	105	120	135	150	165	180	196	211	226	241	256	271	286	301	316	331	346	361
20	100	117	133	150	167	183	200	217	233	250	267	283	300	317	333	350	367	383	400
21	110	129	147	165	184	202	220	239	257	276	294	312	331	349	367	386	404	423	441
22	121	141	161	181	202	222	242	262	282	302	323	343	363	383	403	423	444	464	484
23	132	154	176	198	220	242	264	287	309	331	353	375	397	419	441	463	485	507	529
24	144	168	192	216	240	264	288	312	336	360	384	408	432	456	480	504	528	552	576
25	156	182	208	234	260	286	312	339	365	391	417	443	469	495					
26	169	197	225	253	282	310	338	366	394	422	451	479	507	535					
27	182	213	243	273	304	334	364	395	425	456	486	516	547	577					
28	196	229	261	294	327	359	392	425	457	490	523	555	588	621					
29	210	245	280	315	350	385	420	456	491	526	561	596	631	666					
30	225	262	300	337	375	412	450	487	525	562	600	637	675	712					
31	240	280	320	360	400	440	480	521	561	601	641	681	721	761					

APPENDIX V

INTERIOR DEFECTS IN F.B.M.

– SAWLOGS

Formula F.B.M. $\frac{W \times T \times L}{15}$

Defects In Inches	LENGTH IN FEET																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 x 1								1	1	1	1	1	1	1	1	1	1	1
1 x 2				1	1	1	1	1	1	1	1	2	2	2	2	2	2	2
1 x 3			1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4
1 x 4		1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	5	5
1 x 5		1	1	1	2	2	2	3	3	3	4	4	4	5	5	5	6	6
1 x 6		1	1	2	2	2	3	3	4	4	4	5	5	6	6	6	7	7
1 x 7		1	1	2	2	3	3	4	4	5	5	6	6	7	7	7	8	8
2 x 2		1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	5	5
2 x 3		1	1	2	2	2	3	3	4	4	4	5	5	6	6	6	7	7
2 x 4	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	9	9	10
2 x 5	1	1	2	3	3	4	5	5	6	7	7	8	9	9	10	11	11	12
2 x 6	1	2	2	3	4	5	6	6	7	8	9	10	10	11	12	13	14	14
2 x 7	1	2	3	4	5	6	7	7	8	9	10	11	12	13	14	15	16	17
3 x 3	1	1	2	2	3	4	4	5	5	6	7	7	8	8	9	10	10	11
3 x 4	1	2	2	3	4	5	6	6	7	8	9	10	10	11	12	13	14	14
3 x 5	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
3 x 6	1	2	4	5	6	7	8	10	11	12	13	14	16	17	18	19	20	22
3 x 7	1	3	4	6	7	8	10	11	13	14	15	17	18	20	21	22	24	25
4 x 4	1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19
4 x 5	1	3	4	5	7	8	9	11	12	13	15	16	17	19	20	21	23	24
4 x 6	2	3	5	6	8	10	11	13	14	16	18	19	21	22	24	26	27	29
4 x 7	2	4	6	7	9	11	13	15	17	19	21	22	24	26	28	30	32	34
5 x 5	2	3	5	7	8	10	12	13	15	17	18	20	22	23	25	27	28	30
5 x 6	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36

APPENDIX VI

TALLY CARD – SAWLOGS (F.B.M.)

Limits_____ Date_____

Location_____ Scaler_____

Contractor_____ Certificate No._____

Top Diameter Inches	Length in Feet											Number Pieces	Total Scale f.b.m.	Cull	Number Pieces	Total Cull f.b.m.
	6	7	8	9	10	11	12	13	14	15	16					
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																
13																
14																

INTERIOR DEFECTS

Defect in Inches	Length in Feet.																Deductions F.B.M.
	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
1 X 1																	
1 X 2																	
1 X 3																	
1 X 4																	
1 X 5																	
1 X 6																	
2 X 2																	
2 X 3																	
2 X 4																	
2 X 5																	
2 X 6																	
3 X 3																	
3 X 4																	
3 X 5																	
SUBTOTAL																	

EXTERIOR DEFECTS

TOP DIAM OF LOG	LENGTH	VOLUME	DEDUCTION PERCENT	DEDUCTIONS F.B.M.
SUBTOTAL				

APPENDIX VII

TALLY CARD - STACKED WOOD MEASURE

Tally Card- Stacked Wood Measure

Limits: _____ Location: _____ Contractor: _____

Scaler: _____ Date: _____ Length of Wood:_____

Pile Number	Pile Number	Pile Number	Pile Number	Pile Number	Pile Number	Pile Number	Pile Number	Pile Number	Pile Number
Heights	Heights	Heights	Heights	Heights	Heights	Heights	Heights	Heights	Heights

Pile Number	Height	Width	Gross m^3 (s)	Culls & Voids													Culls & Voids m^3(s)	Loose Piling m^3(s)	Total deductions m^3(s)	Net m^3(s)
				6	8	10	12	14	16	18	20	22	24	26	28	30					

APPENDIX VIII

CONVERSION FACTORS

A) Stacked Wood

Unit of measure: stacked cubic metre symbolized by m^3 (stacked)

Solid Wood:

Unit of measure: cubic metre solid symbolized by m^3

To convert from a stacked cubic metre to solid cubic metre multiply by 0.625*

i.e. $100m^3$ (stacked) X 0.625 = 62.5 m^3

* 0.625 is the solid wood conversion for wood with lengths of 2.50 m to 3.00 m. A stack of properly piled 2.50 – 3.00 m wood contains approximately 62.5% solid wood.

To convert from a solid cubic metre to a stacked cubic metre multiply by 1.6

Since most timber harvested in Newfoundland and Labrador for pulpwood is 2.50m, this figure should be used for various transactions.

If a conversion is necessary for stacked wood that is shorter than 2.50 m or longer than 3.00 m, contact the Forest Engineering and Industry Services division.

To convert m^3 (stacked) 2.50 metre wood to cords multiply by 0.27589

i.e. 100 m^3 (stacked) X 0.27589 = 27.59 cords

or

divide by 3.62456

i.e. 100 m^3 (stacked) ÷ 3.62456 = 27.59 cords

To convert m^3 solid to cords (2.50 metre wood) divide by 2.265.

B) Sawlog (Roundwood)

To convert 1 m^3 of solid wood multiply by the Lumber Recovery factor for the specific mill.

C) Studwood (8'- 10' wood)

Some operations find it necessary to measure small diameter sawlog timber (studwood) in a stacked form. This timber usually arrives at the mill on a truck in the same configuration as pulpwood. The procedure for measuring this material is as follows:

1. Scale the truck in m^3 (stacked).

2. Subtract deductions if present.

3. Convert net m^3 (stacked) to m^3 (solid) using a solid wood factor of 0.625.

4. To convert m^3 (solid) to board feet multiply by the mill's current lumber recovery factor.

* Note: This type of measurement must be used with 8' to 10' studwood only. All other sawlog lengths must be scaled by the Newfoundland Log Rule or an approved alternate scaling method.