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Ministry of Forests
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Revenue Branch

MEMORANDUM

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January 20, 2010

BY EMAIL

To: Regional Executive Directors

From: Murray Stech
Director
Revenue Branch

Re: **Revision to the *Scaling Manual***

I hereby approve this revision to the *Scaling Manual* and attach a link to the scaling manual for your use: <http://www.for.gov.bc/hva/manuals/scaling/index.htm>.



This revision provides an update to the manual and appendices as follows:

- Updates to match previous legislative change to Coast grades U and X.

Murray Stech
Director
Revenue Branch

pc: Coast Scaling Advisory Committee
Interior Scaling Advisory Committee



Ministry of
Forests
and Range



MANUAL REVISION TRANSMITTAL

<p>FOR FURTHER INFORMATION OR IF YOU HAVE A CHANGE OF ADDRESS, PLEASE CONTACT:</p> <p>Steve Laberge Provincial Wood Measurement Specialist Revenue Branch Ministry of Forests 1st Floor, 1520 Blanshard Street Victoria, BC V8W 3C8 Phone: 356-7673 UseridSteve.Laberge@gov.bc.ca FAX: 387-5670</p>	MANUAL TITLE	
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Murray Stech Director, Revenue Branch		

Please make the following changes to your copy of the above Ministry manual.

ACTION (Remove/Insert)	(VOL.) CHAPTER-SECTION-SUBJECT TABLE OF CONTENTS	PAGE(S)	COMMENTS
Remove	Table of Contents	vii - xiv	After Table of Contents Tab
Insert		vii - xiv	
Remove	Chapter 10	9 - 36	After Chapter 10 Tab
Insert		9 - 38	
INSERT	Memo from Murray Stech and Transmittal Sheet		After Amendments Tab

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Appendices

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Glossary of Terms

10.4.3.4 No. 3 Sawlog Balsam and Hemlock, Grade Code I

10.4.3.4.1 Grade Rule

A log:

- 3.8 m or more in length and 19 cm or more in radius where at least 75 percent of the gross scale can be manufactured into lumber, and at least 50 percent of that lumber will be merchantable, or
- otherwise Grade Code H, 5 m or more in length and 19 cm or more in radius, where less than 75 percent but at least 50 percent of the gross scale can be manufactured into lumber and at least 65 percent of that lumber will be merchantable.

10.4.3.4.2 Log Requirements to Make the Grade

1. By log radii, maximum knot size diameters that should not prevent the manufacture of the lumber requirements of the grade are:

Log radius	Knot size diameter
19 - 24 cm	8 cm
25 - 37 cm	9 cm
38 + cm	10 cm

2. Maximum twist permitted over 30 cm of length is 10 percent of the diameter up to a maximum deviation of 9 cm.
3. Butt rot, butt shake, checks, conk, conk stain, crook, goitre, heart rot, loose knots, oversize knots, pocket rot, rotten knots, sap rot, shatter, splits, sweep, or other defects are permitted providing the portion of the log free from these defects is sufficient to meet the grade rule.

Grade codes J, U, X and Y rules and requirements are defined at the end of this section.

10.4.3.5 No. 4 Sawlog Balsam and Hemlock, Grade Code J

10.4.3.5.1 Grade Rule

A log 5 m or more in length and 8 to 18 cm in radius where at least 75 percent of the gross scale can be manufactured into lumber and at least 50 percent of that lumber will be merchantable.

10.4.3.5.2 Log Requirements to Make the Grade

1. By log radii, maximum knot size diameters that should not prevent the manufacture of the lumber requirements of the grade are:

Log radius	Knot size diameter
8 – 13 cm	4 cm
14 – 18 cm	6 cm

2. Maximum twist permitted over 30 cm of length is 10 percent of the diameter.
3. Butt rot, butt shakes, checks, conk, conk stain, crook, goitre, heart rot, loose knots, oversized knots, pocket rot, rotten knots, sap rot, shatter, splits, sweep or other defects are permitted providing the portion of the log free from these defects is sufficient to meet the grade rule.

10.4.3.6 No. 5 Chipper Balsam and Hemlock, Grade Code U**10.4.3.6.1 Grade Rule**

A log:

- 5 m or more in length, and
 - 5 to 7 cm in radius where at least 75 percent of the gross scale can be manufactured into lumber, or
 - 8 to 18 cm in radius where at least 66 2/3 percent of the gross scale can be manufactured into lumber, or
- 3.8 m or more in length and 19 cm or more in radius where at least 50 percent of the gross scale can be manufactured into lumber and at least 35 percent of that lumber will be merchantable.

10.4.3.6.2 Log Requirements to Make the Grade

1. By log radii, maximum knot size diameters that should not prevent the manufacture of the lumber requirements of the grade are:

Log radius	Knot size diameter
5 – 7 cm	4 cm
8 – 13 cm	6 cm
14 – 18 cm	8 cm
19 – 24 cm	10 cm
25 – 37 cm	12 cm
38 + cm	14 cm

2. Maximum twist permitted over 30 cm of length is 13 percent of the diameter up to a maximum deviation of 13 cm.
3. Butt rot, butt shake, checks, conk, conk stain, crook, goitre, heart rot, loose knots, oversized knots, pocket rot, rotten knots, sap rot, splits, shatter, sweep and other defects are permitted providing the portion of the log free from these defects is sufficient to meet the grade rule.

Grade codes X and Y rules and requirements are defined at the end of this section.

10.4.4 Cedar Grades

These grades apply only to red cedar.

10.4.4.1 Lumber Grades

The lumber grades identify logs with significant percentages of clear cutting as described in the grade rules.

Knot specifications for lumber quality slabs will be those appropriate to the original round log.

10.4.4.2 No. 1 Lumber Cedar, Grade Code D

10.4.4.2.1 Grade Rule

1. A log 5 m or more in length and 30 cm or more in radius, or a slab 5 m or more in length, 25 cm or more in radius and 38 cm or more in thickness, where at least 75 percent of the gross scale can be manufactured into merchantable lumber and at least 50 percent of that lumber will be clear.
2. A log 5 m or more in length and 60 cm or more in radius where at least $66 \frac{2}{3}$ percent of the gross scale can be manufactured into merchantable lumber and at least 50 percent of that lumber will be clear.

10.4.4.2.2 Log Requirements to Make the Grade

1. No powder worm damage is permitted.
2. Logs 30 to 37 cm in radius must have at least 75 percent of the visible surface clear with knots or knot indications permitted in the upper 25 percent of two sides or the upper 50 percent of one side.
3. Logs 38 cm or over in radius must have at least $66 \frac{2}{3}$ percent of the visible surface clear with knots or knot indications permitted on the upper $33 \frac{1}{3}$ percent of two sides or the upper $66 \frac{2}{3}$ percent of one side.
4. Maximum twist permitted over 30 cm of length is 4 percent of the diameter up to a maximum deviation of 6 cm.

5. Adventitious knots, bark seams, burls, butt rot, catface, checks, crook, heart rot, pocket rot, oversized knots, sap rot, shatter, splits, sweep, or other defects are permitted providing the portion of the log free from these defects is sufficient to meet the grade rule.

10.4.4.3 No. 2 Lumber Cedar, Grade Code F

10.4.4.3.1 Grade Rule

A log 5 m or more in length and 25 cm or more in radius, or a slab 5 m or more in length, 25 cm or more in radius and 38 cm or more in thickness, where at least 75 percent of the gross scale can be manufactured into merchantable lumber and at least 25 percent of that lumber will be clear.

10.4.4.3.2 Log Requirements to Make the Grade

1. No powder worm damage is permitted.
2. Logs 25 to 29 cm in radius must have the visible surface clear of knots and knot indications.
3. Logs 30 to 37 cm in radius must have at least $66 \frac{2}{3}$ percent of the visible surface clear with knots or knot indications permitted on the upper $33 \frac{1}{3}$ percent of two sides or the upper $66 \frac{2}{3}$ percent of one side.
4. Logs 38 cm or over in radius must have at least 50 percent of the visible surface clear with knots or knot indications permitted on the upper 50 percent of two sides or the upper 75 percent of one side.
5. Maximum twist permitted over 30 cm of length is 4 percent of the diameter up to a maximum deviation of 6 cm.
6. Adventitious knots, bark seams, burls, butt rot, catface, checks, crook, heart rot, oversized knots, pocket rot, sap rot, shatter, splits, sweep, or other defects are permitted providing the portion of the log free from these defects is sufficient to meet the grade rule.

10.4.4.4 Sawlog Grades

The sawlog grades describe logs suitable for the manufacture of lumber (i.e., basically round, sound logs that will permit efficient handling by a sawmill). These grades will permit frequent small to medium size knots. Slabs qualifying for these grades must be 38 cm thick and a shape regular enough to cut efficiently on a sawmill carriage.

10.4.4.5 No. 2 Sawlog Cedar, Grade Code H

10.4.4.5.1 Grade Rule

A log 5 m or more in length and 19 cm or more in radius where at least 75 percent of the gross scale can be manufactured into lumber and at least 65 percent of that lumber will be merchantable.

10.4.4.5.2 Log Requirements to Make the Grade

1. No powder worm damage is permitted.
2. On logs 19 to 24 cm in radius there must be no more than well-spaced knots up to 5 cm in diameter on the upper 50 percent of the visible surface or reasonably well-spaced knots up to 4 cm in diameter over all the visible surface.
3. On logs 25 cm or over in radius there must be no more than occasional knots up to 8 cm in diameter on the upper 50 percent of the visible surface, or well-spaced knots up to 5 cm in diameter on the upper 66 2/3 percent of the visible surface or reasonably well-spaced knots up to 4 cm in diameter over all the visible surface.
4. Maximum twist permitted over 30 cm of length is 7 percent of the diameter up to a maximum deviation of 8 cm.
5. Bark seams, burls, butt rot, catface, checks, heart rot, oversized knots, pocket rot, sap rot, shatter, splits, or other defects are permitted providing the portion of the log free from these defects is sufficient to meet the grade rule.

10.4.4.6 No. 3 Sawlog Cedar, Grade Code I

10.4.4.6.1 Grade Rule

A log:

- 3.8 m or more in length and 19 cm or more in radius where at least 75 percent of the gross scale can be manufactured into lumber and at least 50 percent of that lumber will be merchantable.
- 9.8 m or more in length and 25 cm or more in radius where at least 50 percent of the gross scale can be manufactured into lumber and at least 50 percent of that lumber will be merchantable.
- otherwise grade code H, 9.8 m or more in length and 19 cm or more in radius where at least 50 percent of the gross scale can be manufactured into lumber and at least 65 percent of that lumber will be merchantable.

10.4.4.6.2 Log Requirements to Make the Grade

1. By log radii, maximum knot size diameters which should not prevent the manufacture of the lumber requirements of the grade are:

Log radius	Knot size diameter
19 - 24 cm	8 cm
25 - 37 cm	9 cm
38 + cm	10 cm

2. Maximum twist permitted over 30 cm in length is 10 percent of the diameter up to a maximum deviation of 9 cm.
3. Butt rot, catface, checks, crook, bark seams, heart rot, insect holes, loose knots, oversized knots, pocket rot, powder worm, rotten knots, sap rot, shatter, splits, sweep, or other defects are permitted providing the portion of the log free from these defects is sufficient to meet the grade rule.

10.4.4.7 No. 4 Sawlog Cedar, Grade Code J

Grade Code J rules and requirements are defined at the end of this section.

10.4.4.8 Shingle Grades

Shingle grade logs will have fewer but possibly larger knots than sawlogs, so spaced to permit the production of shingle blocks. Shingle logs are generally not best utilized for the manufacture of lumber because of the nature of the knots or because they are irregular in shape, have excessive butt or heart rot, bark seams, open checks, rotten knots, shatter, or combinations of the above defects.

1. The shingle grade rules make no reference to the recovery of lumber. Scalers will judge the recovery percentage required to produce shingles or shakes.
2. Some very defective cedar logs should go into shingle grades.
3. 'D' quality logs with less than 75 percent suitable for lumber become 'K' grade, except D's 60 rads or larger which become K's if they have less than $66 \frac{2}{3}$ percent suitable for lumber.
4. 'F' quality logs with less than 75 percent lumber become 'L' grade, except that those from 25 to 29 rads which become K's if they have less than 75 percent suitable for lumber.

Other Shingle Considerations:

Other defective cedar logs may fit either into a sawlog or shingle grade. The following types of logs and slabs should be given serious consideration for the shingle grade.

1. Logs less than 7.8 m in length, broken at one end.
2. Logs less than 9.8 m in length, broken at both ends.
3. Those 'H' or 'I' quality logs at least 9.8 m in length containing 50 - 74 percent lumber, which are more suitable for quality shingle recovery and can meet grade 'L' requirements.
4. Logs less than 12.8 m in length and less than 75 percent lumber with a serious defect at both ends.
5. 'D' and 'F' quality logs cut too short for those grades.

10.4.4.9 No. 1 Shingle Cedar, Grade Code K

10.4.4.9.1 Grade Rule

A log 3.8 m or more in length and 25 cm or more in radius or a slab 3.8 m or more in length, 25 cm or more in radius and 38 cm or more in thickness, where at least 50 percent of the gross scale can be manufactured into shingles or shakes, and at least 75 percent of the shingles or shakes will be clear.

10.4.4.9.2 Log Requirements to Make the Grade

1. No powder worm damage is permitted.
2. Logs 25 to 29 cm in radius must have the visible surface clear of knots and knot indications.
3. Logs 30 to 37 cm in radius must have at least 75 percent of the visible surface clear with knots or knot indications permitted on the upper 25 percent of two sides or the upper 50 percent of one side.
4. Logs 38 cm or over in radius must have at least $66 \frac{2}{3}$ percent of the visible surface clear with knots or knot indications permitted on the upper $33 \frac{1}{3}$ percent of two sides or the upper $66 \frac{2}{3}$ percent of one side.
5. Maximum twist permitted over 30 cm in length is 4 percent of the diameter up to a maximum deviation of 6 cm.
6. Bark seams, burls, butt rot, catface, checks, crook, heart rot, oversized knots, pocket rot, sap rot, shatter, splits, sweep, or other defects are permitted providing that the portion of the log free from these defects is sufficient to meet the grade rule.

10.4.4.10 No. 2 Shingle Cedar, Grade Code L

10.4.4.10.1 Grade Rule

A log 3.8 m or more in length and 19 cm or more in radius or a slab 3.8 m or more in length, 19 cm or more in radius and 26 cm or more in thickness where at least 50 percent of the gross scale can be manufactured into shingles or shakes and at least 50 percent of the shingles or shakes will be clear.

10.4.4.10.2 Log Requirements to Make the Grade

1. No powder worm damage is permitted.
2. Logs must have at least 50 percent of the visible surface clear, with knots and knot indications permitted on the upper 50 percent of two sides, or on all of one side.
3. Logs over 30 rads or slabs will permit large knots spaced so sufficient clear shingle blocks can be cut from the area between the knots to meet the grade rule. The large knots must have 30 rads (0.6 m) spacing to allow shingle blocks to be cut between them, and the blocks must be a quadrant.
4. Maximum twist permitted over 30 cm of length is 7 percent of the diameter up to a maximum deviation of 8 cm.
5. Bark seams, burls, butt rot, catface, checks, crook, heart rot, oversized knots, pocket rot, sap rot, shatter, splits, sweep, or other defects are permitted providing the portion of the log free from these defects is sufficient to meet the grade rule.

10.4.4.11 No. 3 Shingle Cedar, Grade Code M

10.4.4.11.1 Grade Rule

A log 3.8 m or more in length and 19 cm or more in radius or a slab 3.8 m or more in length, 13 cm or more in radius and 16 cm or more in thickness where at least 50 percent of the gross scale can be manufactured into shingles and at least 25 percent of the shingles will be clear.

10.4.4.11.2 Log Requirements to Make the Grade

The following are the log requirements to make this grade:

1. No powder worm is permitted.
2. Logs must have at least 25 percent of the visible surface clear, with knots and knot indications permitted on the upper 75 percent of two sides, or all of one side and the upper 50 percent of the other.
3. Logs over 25 rads or slabs will permit large knots spaced so sufficient clear shingle blocks can be cut from the area between the knots to meet the grade rule. The large

knots must have 30 rads (0.6 m) spacing to allow shingle blocks to be cut between them, and the blocks must represent a quadrant.

4. Maximum twist permitted over 30 cm of length is 7 percent of the diameter up to a maximum deviation of 8 cm.
5. Bark seams, burls, butt rot, catface, checks, crook, heart rot, pocket rot, sap rot, shatter, splits, sweep, and other defects are permitted providing the portion of the log free from these defects is sufficient to meet the grade rule.

Grade codes U, X and Y rules and requirements are defined at the end of this section.

10.4.5 Cypress Grades

These grades apply to cypress, also known as yellow-cedar.

10.4.5.1 No. 1 Lumber Cypress, Grade Code D

10.4.5.1.1 Grade Rule

A log 4 m or more in length and 30 cm or more in radius where at least 75 percent of the gross scale can be manufactured into merchantable lumber and at least 50 percent of that lumber will be clear.

10.4.5.1.2 Log Requirements to Make the Grade

1. Logs 30 to 37 cm in radius must have at least 75 percent of the visible surface clear with knots or knot indications permitted on the upper 25 percent of two sides or the upper 50 percent of one side.
2. Logs 38 cm or over in radius must have at least $66 \frac{2}{3}$ percent of the visible surface clear with knots or knot indications permitted on the upper $33 \frac{1}{3}$ percent of two sides or the upper $66 \frac{2}{3}$ percent of one side.
3. Maximum twist permitted over 30 cm of length is 4 percent of the diameter up to a maximum deviation of 6 cm.
4. Adventitious knots, burls, butt rot, catface, checks, crook, frost checks, heart rot, oversized knots, pocket rot, ring rot, sap rot, shatter, splits, stain, sweep, or other defects are permitted providing the portion of the log free from these defects is sufficient to meet the grade rule.

10.4.5.2 No. 2 Lumber Cypress, Grade Code F

10.4.5.2.1 Grade Rule

A log:

- 4 m or more in length and 25 cm or more in radius where at least 75 percent of the gross scale can be manufactured into merchantable lumber and at least 25 percent of that lumber will be clear, or
- otherwise grade code D, 6.2 m or more in length and 30 cm or more in radius where less than 75 percent but at least 50 percent of the gross scale can be manufactured into merchantable lumber and at least 50 percent of that lumber will be clear.

10.4.5.2.2 Log Requirements to Make the Grade

1. Logs 25 to 29 cm in radius must have at least 75 percent of the visible surface clear with knots or knot indications permitted on the upper 25 percent of two sides or the upper 50 percent of one side.
2. Logs 30 cm or over in radius must have at least 50 percent of the visible surface clear with knots or knot indications permitted on the upper 50 percent of two sides or the upper 75 percent of one side.
3. Maximum twist permitted over 30 cm of length is 4 percent of the diameter up to a maximum deviation of 6 cm.
4. Adventitious knots, burls, butt rot, catface, checks, crook, frost checks, heart rot, oversized knots, pocket rot, ring rot, sap rot, shatter, splits, stain, sweep, or other defects are permitted providing the portion of the log free from these defects is sufficient to meet the grade rule.

10.4.5.3 No. 2 Sawlog Cypress, Grade Code H

10.4.5.3.1 Grade Rule

A log 4 m or more in length and 19 cm or more in radius where at least 50 percent of the gross scale can be manufactured into lumber and at least 65 percent of that lumber will be merchantable.

10.4.5.3.2 Log Requirements to Make the Grade

1. On logs 19 to 24 cm in radius there must be no more than well-spaced knots up to 5 cm in diameter on the upper 50 percent of the visible surface, or reasonably well-spaced knots up to 4 cm in diameter over all the visible surface.

2. On logs 25 cm or over in radius there must be no more than occasional knots up to 8 cm in diameter on the upper 50 percent of the visible surface, or well-spaced knots up to 5 cm in diameter on the upper 66 2/3 percent of the visible surface or reasonably well-spaced knots up to 4 cm in diameter over all the visible surface.
3. Maximum twist permitted over 30 cm of length is 7 percent of the diameter up to a maximum deviation of 8 cm.
4. Butt rot, catface, checks, frost checks, heart rot, oversized knots, pocket rot, ring rot, sap rot, shatter, splits, or other defects are permitted providing the portion of the log free from these defects is sufficient to meet the grade rule.

10.4.5.4 No. 3 Sawlog Cypress, Grade Code I

10.4.5.4.1 Grade Rule

A log 4 m or more in length and 19 cm or more in radius where at least 50 percent of the gross scale can be manufactured into lumber and at least 50 percent of that lumber will be merchantable.

10.4.5.4.2 Log Requirements to Make the Grade

1. By log radii, maximum knot size diameters that should not prevent the manufacture of the lumber requirements of the grade are:

Log radius	Knot size diameter
19 - 24 cm	8 cm
25 - 37 cm	9 cm
38 + cm	10 cm

2. Maximum twist permitted over 30 cm in length is 10 percent of the diameter up to a maximum deviation of 9 cm.
3. Butt rot, catface, checks, crook, frost checks, heart rot, insect holes, loose knots, oversized knots, pocket rot, ring rot, rotten knots, sap rot, shatter, splits, sweep, or other defects are permitted providing the portion of the log free from these defects is sufficient to meet the grade rule.

Grade codes J, U, X and Y rules and requirements are defined at the end of this section.

10.4.6 Fir and Pine Grades

With the exception that pine has no peeler grades, these two genera are graded the same. The grades apply to all species of pine found in the province.

10.4.6.1 No. 1 Lumber Fir and Pine, Grade Code D

10.4.6.1.1 Grade Rule

A log 5 m or more in length and 38 cm or more in radius where at least 75 percent of the gross scale can be manufactured into merchantable lumber and at least 50 percent of that lumber will be clear.

10.4.6.1.2 Log Requirements to Make the Grade

1. No conk or conk stain is permitted.
2. Pocket rot is allowable only if it is contained within a circle $\frac{1}{3}$ the log radius, measured from the pith.
3. There must be no fewer than six annual rings in each 2 cm of diameter.
4. Logs must have at least 90 percent of the visible surface clear with only a few well-spaced knots or knot indications permitted on the upper 10 percent of two sides or the upper 20 percent of one side.
5. Maximum twist permitted over 30 cm in length is 4 percent of the diameter up to a maximum deviation of 6 cm.
6. Only small pitch pockets ranging in numbers per end from three for logs 38 cm in radius to six for logs 76 cm or over in radius are permitted.
7. No ring shakes (full or partial) are permitted in that part of the log between 8 cm and 20 cm of the bark.
8. A ring shake within 8 cm of the bark is only permitted if the log inside the shake is at least 38 rads, and the log meets the rest of the grade rule.
9. Insect or worm holes other than ambrosia must not penetrate beyond the sap wood.
10. Ambrosia, butt rot, burls, checks, crook, heart rot, ring shake, sap rot, shatter, splits, sweeps, or other defects are permitted providing the portion of the log free from these defects is sufficient to meet the grade rule.

10.4.6.2 No. 2 Lumber Fir and Pine, Grade Code F

10.4.6.2.1 Grade Rule

A log 5 m or more in length and 30 cm or more in radius where at least 75 percent of the gross scale can be manufactured into merchantable lumber and at least 25 percent of that lumber will be clear.

10.4.6.2.2 Log Requirements to Make the Grade

1. No conk or conk stain is permitted.
2. Pocket rot is allowed only if it is contained within a circle $\frac{1}{3}$ of the log radius, measured from the pith.
3. There must be no fewer than six annual rings in each 2 cm of diameter.
4. Logs 30 to 37 cm of radius must have at least 75 percent of the visible surface clear with only a few well-spaced knots or knot indications permitted on the upper 25 percent of two sides or the upper 50 percent of one side.
5. Logs 38 cm and over in a radius must have at least 50 percent of the visible surface clear with only a few well-spaced knots or knot indications permitted on the upper 50 percent of two sides or upper 75 percent of one side.
6. Maximum twist permitted over 30 cm in length is 4 percent of the diameter at the top of the log to a maximum deviation of 6 cm.
7. Only small pitch pockets ranging in number per end from two for logs 30 cm in radius up to six for logs 76 cm or over in radius are permitted.
8. A ring shake that encircles half or more of the circumference of the ring is not permitted in that portion of the log between 4 rads and 10 rads of the bark. A ring shake within 4 rads of the bark is only permitted if within that part of the log inside the shake is at least 30 rads and the log meets the rest of the grade rule.
9. Insect or worm holes other than ambrosia must not penetrate beyond the sap wood.
10. Ambrosia, butt rot, burls, checks, crook, heart rot, ring shake, sap rot, shatter, splits, sweeps, or other defects are permitted providing the portion of the log free from these defects is sufficient to meet the grade rule.

10.4.6.3 No. 2 Peeler Fir, Grade Code B**10.4.6.3.1 Grade Rule**

A log 5.2 m or more in length and 30 cm or more in radius where at least 80 percent of the gross scale can be manufactured on a rotary lathe into veneer.

10.4.6.3.2 Log Requirements to Make the Grade

1. No heart rot, conk, conk stain, or pocket rot is permitted.
2. There must be no fewer than six annual rings in each 2 cm of diameter.
3. Logs 30 to 37 cm in radius must have the 2.6 m butt block free of knots or knot indications.

4. Logs 38 cm or over in radius must have the 2.6 m butt block free of knots, - indications permitted.
5. No knots over 4 cm are permitted and knots or knot indications 4 cm or less in diameter must be well-spaced. Bunch knots that can be encircled in a 4 cm diameter are permitted.
6. Maximum twist permitted over 30 cm of length is 7 percent of the diameter up to a maximum deviation of 8 cm.
7. Butt rot must not be present in logs less than 8 m in length.
8. The diameter of butt rot in logs 8 m to less than 10.4 m in length must not exceed $33 \frac{1}{3}$ percent of the measured butt diameter after excluding flare.
9. The diameters of butt rot in logs 10.4 m or over in length must not exceed 50 percent of the measured butt diameter after excluding flare.
10. Butt star checks must not be longer than half the top diameter of the log.
11. No more than one heart check or split which must not affect the outer 25 percent of the radius is permitted at either end of log. A check appearing in both ends of the log must be considered to be the same check to be allowed.
12. Insect or worm holes other than ambrosia must not penetrate beyond the sap wood.
13. An angular heart check will be allowed if it does not vary more than 45 degrees from a straight line and does not affect the outer 25 percent of the radius.
14. Only small pitch pockets ranging in numbers per end from three for logs 30 cm in radius to seven for logs 76 cm or over in radius are permitted.
15. One partial ring shake which does not extend around half the circumference of the ring and does not have checks at right angles to the shake, or a full ring shake with a diameter not exceeding $33 \frac{1}{3}$ percent of the diameter of the log is permitted. An allowable shake in the outer $66 \frac{2}{3}$ percent of the diameter is permitted in one end only. An allowable shake in the inner $33 \frac{1}{3}$ percent of the diameter is permitted in both ends.
16. Ring shake with a check is permitted if both can be contained in the centre of a log by a circle not exceeding $\frac{1}{3}$ the diameter of the log.
17. Logs can exhibit sap rot or sun checks to a depth of 4 percent of the top diameter of the log. The maximum depth of a sap rot or sun checks shall not exceed 5 cm.
18. At the top end of a log, off centre heart is permitted only where distance from true centre does not exceed 10 percent of the top diameter of the log.

19. Sweep is permitted to the following extent:
- a. logs 5.2 m to less than 8 m in length allow up to a 0.6 m consideration for sweep, with no mental bucking to reduce loss for sweep permitted in peelers less than 8 m long,
 - b. logs 8 m to less than 10.4 m in length allow up to a 1.2 m consideration for sweep, with one mental buck allowed for logs 8 m to less than 12.8 m long,
 - c. logs 10.4 m and over in length allow up to a 2 m consideration for sweep, with two mental bucks allowed for logs over 12.8 m long.
20. Crook (a definite kink) and pistol grip (a sharp bend near the large end of a butt log) is permitted to the following extent:
- a. logs 5.2 m to less than 8 m in length, no loss is allowed,
 - b. logs 8 m to less than 10.4 m in length, up to a 1.2 m consideration is allowed,
 - c. logs 10.4 m and over in length, up to a 2 m consideration is allowed.
21. On logs 10.4 m and over in length bucking breaks, splits and broken ends are allowed provided the defect can be eliminated in a length equal to the top diameter.
22. Burls are permitted to the extent of one medium or large size burl for every 2.6 m of log length.

10.4.6.4 No. 3 Peeler Fir, Grade Code C

10.4.6.4.1 Grade Rule

A log 5.2 m or more in length and 19 cm or more in radius where at least 80 percent of the gross scale can be manufactured on a rotary lathe into veneer.

10.4.6.4.2 Log Requirements to Make the Grade

1. No heart rot, conk, conk stain, or pocket rot is permitted.
2. There must be no fewer than six annual rings in each 2 cm of diameter.
3. No knots over 4 cm in diameter are permitted and knots 4 cm or less in diameter must be well spaced. Bunch knots that can be encircled in a 4 cm diameter are permitted.
4. Maximum twist permitted over 30 cm of length is 7 percent of the diameter up to a maximum deviation of 8 cm.
5. Butt rot must not be present in logs less than 8 m in length.

6. The diameter of butt rot in logs 8 m to less than 10.4 m in length must not exceed $33 \frac{1}{3}$ percent of the measured butt diameter after excluding flare.
7. The diameter of butt rots in logs 10.4 m or over in length must not exceed 50 percent of the measured butt diameter after excluding flare.
8. Butt star checks must not be longer than half the top diameter of the log.
9. No more than one heart check or split that must not affect the outer 25 percent of the radius is permitted at either end of the log.
10. Insect or worm holes other than ambrosia must not penetrate beyond the sap wood.
11. An angular heart check will be allowed if it does not vary more than 45 degrees from a straight line but must not affect the outer 25 percent of the radius.
12. Only small pitch pockets ranging in numbers per end from two for logs 19 cm in radius to seven for logs 76 cm or over in radius are permitted.
13. One partial ring shake that does not extend around half the circumference of the ring and does not have checks at right angles to the shake, or a full ring shake with a diameter not exceeding $33 \frac{1}{3}$ percent of the diameter of the log is permitted. An allowable shake in the outer $66 \frac{2}{3}$ percent of the diameter is permitted in one end only. An allowable shake in the inner $33 \frac{1}{3}$ percent of the diameter is permitted in both ends.
14. Ring shake with a check is permitted if both can be contained in the centre of a log by a circle not exceeding one third the diameter of the log.
15. No sap rot or sun checks are allowed in logs less than 25 cm in radius. Logs 25 cm in radius and greater can exhibit sap rot or sun checks to a depth of 4 percent of the top diameter of the log. The maximum depth of sap rot or sun check shall not exceed 5 cm.
16. At the top end of a log, off centre heart is permitted only where distance from true centre does not exceed 10 percent of the top diameter of the log.
17. Sweep is permitted to the following extent:
 - a. logs 5.2 m to less than 8 m in length allow up to a 0.6 m consideration for sweep, with no mental bucking to reduce the loss for sweep permitted in peelers less than 8 m long,
 - b. logs 8 m to less than 10.4 m in length allow up to a 1.2 m consideration for sweep, with one mental buck allowed for logs 8 m to less than 12.8 m long, and
 - c. logs 10.4 m and over in length allow up to a 2 m consideration for sweep, with two mental bucks allowed for logs over 12.8 m long.

18. Crook (a definite kink) and pistol grip (a sharp bend near the large end of a butt log) is permitted to the following extent:
 - a. logs 5.2 m to less than 8 m in length, no loss is allowed,
 - b. logs 8 m to less than 10.4 m in length, up to a 1.2 m consideration is allowed, and
 - c. logs 10.4 m and over in length, up to a 2 m consideration is allowed.
19. On logs 10.4 m and over in length bucking breaks, splits, and broken ends are allowed provided the defect can be eliminated in a length equal to the top diameter.
20. Burls are permitted to the extent of one medium or large size burl for every 2.6 m of log length.

10.4.6.5 No. 2 Sawlog Fir and Pine, Grade Code H

10.4.6.5.1 Grade Rule

A log 5 m or more in length and

- 19 cm or more in radius where at least 75 percent of the gross scale can be manufactured into lumber.
- 25 cm or more in radius where at least 50 percent of the gross scale can be manufactured into lumber and at least 65 percent of that lumber will be merchantable.

10.4.6.5.2 Log Requirements to Make the Grade

1. There must be no fewer than five annual rings in each 2 cm of diameter.
2. On logs 19 to 24 cm in radius there must be no more than well-spaced knots up to 5 cm in diameter on the upper 50 percent of the visible surface, or reasonably well-spaced knots up to 4 cm in diameter over all the visible surface.
3. On logs 25 cm or over in radius there must be no more than occasional knots up to 8 cm in diameter on the upper 50 percent of the visible surface, or reasonably well-spaced knots up to 5 cm in diameter on the upper 66 2/3 percent of the visible surface or reasonably well spaced knots up to 4 cm in diameter over all the visible surface.
4. Maximum twist permitted over 30 cm in length is 7 percent of the diameter up to a maximum deviation of 8 cm.
5. Insect or worm holes other than ambrosia must not penetrate beyond the sap wood.

6. Butt rot, checks, conk, conk stain, crook, heart rot, oversized knots, pitch pockets, pocket rot, ring shake, sap rot, shatter, splits, sweep, or other defects are permitted providing the portion of log free from these defects is sufficient to meet the grade rule.

10.4.6.6 No. 3 Sawlog Fir and Pine, Grade Code I

10.4.6.6.1 Grade Rule

A log:

- 3.8 m or more in length and,
 - 19 cm or more in radius where at least 75 percent of the gross scale can be manufactured into lumber, or
 - 25 cm or more in radius where at least 50 percent of the gross scale can be manufactured into lumber,
 - and at least 50 percent of that lumber will be merchantable, or
- Otherwise grade code H, 5 m or more in length and 19 to 24 cm in radius, where less than 75 percent but at least 50 percent of the gross scale can be manufactured into lumber and at least 65 percent of that lumber will be merchantable.

10.4.6.6.2 Log Requirements to Make the Grade

1. By log radii, maximum knot size diameters that should not prevent the manufacture of the lumber requirements of the grade are:

Log radius	Knot size diameter
19 - 24 cm	8 cm
25 - 37 cm	9 cm
38 + cm	10 cm

2. Maximum twist permitted over 30 cm of length is 10 percent of the diameter up to a maximum deviation of 9 cm.
3. Bunch knots, butt rot, checks, conk, conk stain, crook, heart rot, insect holes, loose knots, oversized knots, pitch pockets, pocket rot, ring shake, rotten knots, sap rot, shatter, splits, sweep, or other defects are permitted providing the portion of the log free from these defects is sufficient to meet the grade rule.

Grade codes J, U, X and Y rules and requirements are defined at the end of this section.

10.4.7 Spruce Grades

Wavy grain or "Horse Mane" is a grain defect peculiar to spruce. If present to more than a slight amount or in conjunction with spiral grain, the log must be degraded. For spruce 'D, E and F wavy grain is permitted only to a slight degree. Spruce 'G' wavy grain is permitted to a slightly greater extent in larger logs.

10.4.7.1 No. 1 Premium Spruce, Grade Code D

10.4.7.1.1 Grade Rule

A fine grained log 4 m or more in length and 50 cm or more in radius where at least 75 percent of the gross scale can be manufactured into merchantable lumber and at least 50 percent of that lumber will be clear.

10.4.7.1.2 Log Requirements to Make the Grade

1. No conk or conk stain is permitted.
2. Pocket rot is permitted if it is contained in a circle $\frac{1}{3}$ the log radius, measured from the pith.
3. There must be no fewer than 12 annual rings in each 2 cm of diameter.
4. Logs 50 - 59 cm in radius must have at least 90 percent of the visible surface clear with only a few well-spaced knots or knot indications permitted on the upper 10 percent of two sides or the upper 20 percent of one side.
5. Logs 60 cm or more in radius must have at least 80 percent of the visible surface clear with only a few well-spaced knots or knot indications permitted on the upper 20 percent of two sides or the upper 40 percent of one side.
6. Maximum twist permitted over 30 cm of length is 4 percent of the diameter up to a maximum deviation of 6 cm.
7. Only small pitch pockets ranging from three for logs 50 cm in radius to six for logs 76 cm and over in radius are permitted.
8. Insect or worm holes other than ambrosia must not penetrate beyond the sapwood.
9. Ambrosia, burls, wavy grain (horse mane), butt rot, checks, crook, heart rot, sap rot, shatter, splits, sweep, bell butt, flared butt, or other defects are permitted providing the portion free from these defects is sufficient to meet the grade rule.

10.4.7.2 No. 2 Premium Spruce, Grade Code E

10.4.7.2.1 Grade Rule

A fine grained log:

1. 4 m or more in length and 38 cm or more in radius where at least 75 percent of the gross scale can be manufactured into merchantable lumber and at least 25 percent of that lumber will be clear or,
2. Otherwise grade code D, 6.2 m or more in length and 50 cm or more in radius, where less than 75 percent but at least 66 2/3 percent of the gross scale can be manufactured into merchantable lumber and at least 50 percent of that lumber will be clear.

10.4.7.2.2 Log Requirements to Make the Grade

1. No conk or conk stain rot is permitted.
2. Pocket rot is permitted if it is contained within a circle 1/3 the log radius, measured from the pith.
3. There must be no fewer than 12 annual rings in each 2 cm of diameter.
4. Logs 38 - 49 cm in radius must have at least 75 percent of the visible surface clear with only a few well-spaced knots or knot indications permitted on the upper 25 percent of two sides or the upper 50 percent of one side.
5. Logs 50 cm in radius and over will allow a few well-spaced knots or knot indications on the upper 50 percent of two sides or the upper 75 percent of one side.
6. Maximum twist permitted over 30 cm of length is 4 percent of the diameter up to a maximum deviation of 6 cm.
7. Only small pitch pockets ranging from two per end for logs 38 cm in radius to six for logs 76 cm and over are permitted.
8. Insect or worm holes other than ambrosia must not penetrate beyond the sapwood.
9. Ambrosia, burls, wavy grain (horse mane), butt rot, checks, crook, heart rot, sap rot, shatter, splits, sweep, bell, butt, flared butt, or other defects are permitted providing the portion free from these defects is sufficient to meet the grade rule.

10.4.7.3 No. 1 Lumber Spruce, Grade Code F

10.4.7.3.1 Grade Rule

A log 4 m or more in length and 38 cm or more in radius where at least 75 percent of the gross scale can be manufactured into merchantable lumber and at least 50 percent of that lumber will be clear.

10.4.7.3.2 Log Requirements to Make the Grade

1. No conk or conk stain is permitted.

2. Pocket rot is permitted if it is contained within a circle $\frac{1}{3}$ the log radius, measured from the pith.
3. There must be no fewer than six annual rings in each 2 cm of diameter.
4. Logs must have at least 90 percent of the visible surface clear with only a few well-spaced knots or knot indications permitted on the upper 10 percent of two sides or the upper 20 percent of one side.
5. Maximum twist permitted over 30 cm of length is 4 percent of the diameter up to a maximum deviation of 6 cm.
6. Only small pitch pockets ranging from three per end for logs 38 cm in radius to six for logs 76 cm or over in radius are permitted.
7. Insect or worm holes other than ambrosia must not penetrate beyond the sap wood.
8. Ambrosia, burl, wavy grain (horse mane), butt rot, checks, crook, heart rot, sap rot, shatter, splits, sweep, or other defects are permitted providing the portion of the log free from these defects is sufficient to meet the grade rule.

10.4.7.4 No. 2 Lumber Spruce, Grade Code G

10.4.7.4.1 Grade Rule

A log 4 m or more in length and 30 cm or more in radius where at least 75 percent of the gross scale can be manufactured into merchantable lumber and at least 25 percent of that lumber will be clear.

10.4.7.4.2 Log Requirements to Make the Grade

1. No conk or conk stain is permitted.
2. Pocket rot is permitted if it is contained within a circle $\frac{1}{3}$ the log radius, measured from the pith.
3. There must be no fewer than six annual rings in each 2 cm of diameter.
4. Logs 30 to 37 cm in radius must have at least 75 percent of the visible surface clear with only a few well-spaced knots or knot indications permitted on the upper 25 percent of two sides or the upper 50 percent of one side.
5. Logs 38 cm or more in radius:
 - a. must have at least 50 percent of the visible surface clear with only a few well-spaced knots or knot indications permitted on the upper 50 percent of two sides or the upper 75 percent of one side, or

- b. will permit large knots spaced so clear lumber, 2.5 m in length, shop type, can be cut from the area between the knots on at least 75 percent of the log's surface.
6. Logs 50 cm and over in radius will permit large knots spaced so clear lumber, 2.5 m in length, shop type, can be cut from the area between the knots on at least 50 percent of the log's surface.
7. Maximum twist permitted over 30 cm of length is 4 percent of the diameter up to a maximum deviation of 6 cm.
8. Only small pitch pockets ranging from two per end for logs 30 cm in radius to six for logs 76 cm or over in radius are permitted.
9. Insect or worm holes other than ambrosia must not penetrate beyond the sap wood.
10. Ambrosia, burls, wavy grain (horse mane), butt rot, checks, crook, heart rot, sap rot, shatter, splits, sweep, or other defects are permitted providing the portion of the log free from these defects is sufficient to meet the grade rule.

10.4.7.5 No. 2 Sawlog Spruce, Grade Code H

10.4.7.5.1 Grade Rule

A log:

- 4 m or more in length and 19 cm or more in radius where at least 75 percent of the gross scale can be manufactured into lumber and at least 65 percent of that lumber will be merchantable or,
- otherwise grade code D, E, F or G, 4 m or more in length and 30 cm or more in radius, where less than 75 percent but at least 50 percent of the gross scale can be manufactured into merchantable lumber and at least 25 percent of the lumber will be clear.

10.4.7.5.2 Log Requirements to Make the Grade

1. There must be no fewer than five annual rings in each 2 cm of diameter.
2. On logs 19 to 24 cm in radius there must be no more than well-spaced knots up to 5 cm in diameter on the upper 50 percent of the visible surface, or reasonably well-spaced knots up to 4 cm in diameter over all the visible surface.
3. On logs 25 cm or over in radius there must be no more than occasional knots up to 8 cm in diameter on the upper 50 percent of the visible surface, or reasonably well-spaced knots up to 5 cm in diameter on the upper 66 2/3 percent of the visible surface, or reasonably well-spaced knots up to 4 cm in diameter over all the visible surface.

4. Maximum twist permitted over 30 cm of length is 7 percent of the diameter up to a maximum deviation of 8 cm.
5. Insect or worm holes other than ambrosia must not penetrate beyond the sap wood.
6. Butt rot, checks, conk, conk stain, crook, heart rot, oversized knots, pitch pockets, pocket rot, ring shake, sap rot, shatter, splits, sweep, or other defects are permitted providing the portion of the log free from these defects is sufficient to meet the grade rule.

10.4.7.6 No. 3 Sawlog Spruce, Grade Code I

10.4.7.6.1 Grade Rule

A log 4 m or more in length and

- 19 cm or more in radius where:
 - at least 75 percent of the gross scale can be manufactured into lumber and at least 50 percent of that lumber will be merchantable, or
 - otherwise grade code H, where less than 75 percent but at least 50 percent of the gross scale can be manufactured into lumber and at least 65 percent of that lumber will be merchantable, or
- 25 cm more in radius where at least 50 percent of the gross scale can be manufactured into lumber and at least 50 percent of that lumber will be merchantable.

10.4.7.6.2 Log Requirements to Make the Grade

1. By log radii, maximum knot size diameters that should not prevent the manufacture of the lumber requirements of the grade are:

Log radius	Knot size diameter
19 - 24 cm	8 cm
25 - 37 cm	9 cm
38 - 49 cm	10 cm
50 + cm	13 cm

2. Maximum twist permitted over 30 cm of length is 10 percent of the diameter up to a maximum deviation of 9 cm.
3. Bunch knots, butt rot, checks, conk, conk stain, crook, heart rot, insect holes, loose knots, oversized knots, pitch pockets, pocket rot, ring shake, rotten knots, sap rot, shatter, splits, sweep, or other defects are permitted providing the portion of the log free from these defects is sufficient to meet the grade rule.

10.4.8 No. 4 Sawlog All Coniferous, Grade Code J**10.4.8.1 Grade Rule**

For a cypress and spruce log 4 m or more in length, for all other coniferous 5 m or more in length and 8 to 18 cm in radius where at least 75 percent of the gross scale can be manufactured into lumber and at least 50 percent of that lumber will be merchantable.

10.4.8.2 Log Requirements to Make the Grade

1. By log radii, maximum knot size diameters that should not prevent the manufacture of the lumber requirements of the grade are:

Log radius	Knot size diameter
8 - 13 cm	4 cm
14 - 18 cm	6 cm

2. Maximum twist permitted over 30 cm of length is 10 percent of the diameter.
3. Butt rot, butt shakes, checks, conk, conk stain, crook, goitre, heart rot, loose knots, oversized knots, pocket rot, rotten knots, sap rot, shatter, splits, sweep, or other defects are permitted providing the portion of the log free from these defects is sufficient to meet the grade rule.

10.4.9 No. 5 Utility All Coniferous, Grade Code U (except Balsam and Hemlock)

10.4.9.1 Grade Rule

A log:

- 5 m or more in length, and
 - 5 to 7 cm in radius where at least 75 percent of the gross scale can be manufactured into lumber, or
 - 8 to 18 cm in radius where at least 66 2/3 percent of the gross scale can be manufactured into lumber, or
- 3.8 m or more in length and 19 cm or more in radius where at least 50 percent of the gross scale can be manufactured into lumber and at least 35 percent of that lumber will be merchantable.

10.4.9.2 Log Requirements to Make the Grade

1. By log radii, maximum knot size diameters that should not prevent the manufacture of the lumber requirements of the grade are:

Log radius	Knot size diameter
5 - 7 cm	4 cm
8 - 13 cm	6 cm
14 - 18 cm	8 cm
19 - 24 cm	10 cm
25 - 37 cm	12 cm
SP only 38 - 49 cm	14 cm
SP only 50 + cm	16 cm

2. Maximum twist permitted over 30 cm of length is 13 percent of the diameter up to a maximum deviation of 13 cm.
3. Butt rot, butt shake, checks, conk, conk stain, crook, goitre, heart rot, loose knots, oversized knots, pocket rot, rotten knots, sap rot, splits, shatter, sweep, and other defects are permitted providing the portion of the log free from these defects is sufficient to meet the grade rule.

10.4.10 No. 6 Chipper All Coniferous, Grade Code X

10.4.10.1 Grade Rule

A log 3 m or more in length and 5 cm or more in radius where at least 33 1/3 percent of the gross scale can be manufactured into lumber and at least 35 percent of that lumber will be merchantable.

10.4.10.2 Log Requirements to Make the Grade

1. By log radii, maximum knot size diameters that should not prevent the manufacture of the lumber requirements of the grade are:

Log radius	Knot size diameter
5 - 7 cm	4 cm
8 - 13 cm	6 cm
14 - 18 cm	8 cm
19 - 24 cm	10 cm
25 - 37 cm	12 cm
38 - 49 cm	14 cm
SP only 50 + cm	16 cm

Logs 25 cm and over in radius will allow oversize knots up to a maximum of two per 3 m of log length.

2. Maximum twist permitted over 30 cm of length is 13 percent of the diameter up to a maximum deviation of 13 cm.
3. Butt rot, butt shake, checks, conk, conk stain, crook, goitre, heart rot, loose knots, oversized knots, pocket rot, rotten knots, sap rot, splits, shatter, sweep, and other defects are permitted providing the portion of the log free from these defects is sufficient to meet the grade rule.

10.4.11 No. 7 Chipper All Coniferous, Grade Code Y

10.4.11.1 Grade Rule

Logs lower in grade than utility and higher in grade than firmwood reject.

10.5 Broadleaf Species And Yew

10.5.1 Applicability

The grades apply to all hardwood (i.e., deciduous) species harvested on the coast and to yew (*Taxus brevifolia*).

10.5.2 Sawlog, Grade Code W

10.5.2.1 Grade Rule

A log 2.6 m or more in length and 5 cm or more in radius, where at least 50 percent of the gross scale can be manufactured into merchantable lumber.

10.5.2.2 Log Requirements to Make the Grade

1. By log radii, maximum knot size that should not prevent the manufacture of the lumber requirements of the grade are:

Log radius	Knot size diameter
5 - 7 cm	4 cm
8 - 13 cm	6 cm
14 - 18 cm	8 cm
19 - 24 cm	10 cm
25 - 37 cm	12 cm
38 + cm	14 cm

2. Maximum twist permitted over 30 cm in length is 10 percent of the diameter up to a maximum deviation of 9 cm.
3. Adventitious knots, bunch knots, burls, butt rot, checks, conk, conk stain, crook, heart rot, insect holes, loose knots, oversize knots, pocket rot, ring shake, rotten knots, sap rot, shatter, splits, sweep, or other defects, are permitted providing the portion of the log free from these defects is sufficient to meet the grade rule.

10.5.2.3 Chipper, Grade Code Y

10.5.2.3.1 Grade Rule

A log lower in grade than grade W, but higher in grade than firmwood reject.

10.6 Applying the Principles of Grading Using Field Methods

The following methods for calculating grade reduction may be substituted for methods described in the *Timber Grading* chapter – Section 8.4: Apply the Principles of Grading.

The formulas describe three field methods for three distinct types of defect situations and includes a description of where each may be used. They express the grade reduction (GR) in terms of log length. The length of the grade reduction is then compared to the gross length of the log to determine the grade reduction percentage.

- Formula #1 (non-conical defects):

$$\frac{\text{UV of lumber loss}}{\text{average UV for the log}} \times \text{length of defect} = \text{GR length in metres}$$

(follow Formula #1 with Formula #3 to convert GR in metres to a percent)

- Formula #2 (cone-shape defects):

$$\frac{\text{UV of lumber loss}}{\text{average UV for the log}} \times \frac{\text{length of defect}}{3} \times 2 = \text{GR length in metres}$$

(follow Formula #2 with Formula #3 to convert GR in metres to a percent), and

- Formula #3

$$\frac{\text{length of GR}}{\text{log length}} \times 100 = \text{GR\%}$$

10.6.1 Formula #1

This formula is used when the linear portion of the log affected by defect is partially suitable to cut lumber and part grade reduction.

This formula may not be used for conical defects such as butt rot and water shake (see Formula #2).

The UV of lumber loss is the unit volume for the log end area unsuitable to cut a product, including trim allowance where applicable.

Where the defect has different sizes on either ends, as with full-length defects, the average of the two end volumes is used for the UV lumber loss.

The ‘average UV of the log’ is the average of the unit volumes for the top and butt diameters. For practical purposes, the UV for the average diameter may be used for most logs, but the accuracy of this shortcut decreases as taper increases.

The formula expresses the grade reduction in log length. That length is then compared to gross log length (as described in Formula #3) to obtain the percentage of the gross log that is grade reduction.

Examples of types of defects for which this formula may be used are heart rot, ring rot, pocket rot, ring shake, checks and sap rot.

10.6.2 Formula #2

This formula is used with butt rot and butt shake where the defect doesn't show in the top end of the log.

The 'UV of lumber loss is the unit volume for the base diameter of the defective area when viewed in terms of suitability to cut product. For irregular and scattered defect, that diameter will often be significantly larger than what would be used for a firmwood deduction.

The 'UV of lumber loss' does not include trim allowance or collars too thin to cut product when using this formula.

Once the 'UV of lumber loss is established, the grade reduction is the same as a firmwood deduction would be, except that the result is doubled

The 'average UV of the log' is the average of the unit volumes for the top and butt diameters. The alternative of using unit volumes of the average diameter becomes less accurate as the taper increases.

This formula expresses the grade reduction in log length, which is then compared to the gross length (as described in Formula #3) to obtain the percentage of the grade reduction.

Where the defect shows through to the top end Formula #1 is used. The 'UV of lumber loss' is the unit volume for the average of the two defect diameters plus trim.

10.6.3 Formula #3

10.6.3.1 For Converting Grade Reduction in Metres to a Percentage

This formula simply converts the length of a log lost to grade reduction to a percent of the gross log length, which is then used as the percent of grade reduction.

When Formula #3 is used to convert length reductions derived from either Formula #1 or Formula #2, it is completely accurate.

10.6.3.2 For Estimating Grade Reduction Percentage from Length Losses

A secondary application of Formula #3 is where an estimated length of log is completely lost for lumber recovery. In those cases the length of the grade reduction portion of the

log is compared to the gross log length (using this formula) to get an estimate of the grade reduction percentage.

Examples of where the formula may be used in this way are hear rot with a collar too thin to cut a product, conk, shatter or breakage, pistol grip or crook, and bark seams.

The procedure of using a direct length comparison without applying a factor to account for the taper of the log (as Formulae #1 and #2 do) is sometimes called the lineal method of grade reduction.

Because log taper is not considered, this method is not precise and the degree of error correlates with the amount of taper in the log. However, the errors tend to compensate over a number of logs and the lineal method is readily adaptable to practical use in scaling.

For the defect situations to which it applies, use of the lineal method is standard practise in coastal scaling for logs with up to 50% taper, or where the butt diameter is not more than 1.5 times the top diameter.