

Coast Grading

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10.1 Interpreting the Schedule of Coast Timber Grades

The Schedule of Coast Timber Grades is part of the *Scaling Regulation*. It is comprised of three parts.

- Part 1 applies to all species and describes the Firmwood Reject Grade (Grade Code Z).
- Part 2 describes the grades (other than Z) applicable to all commercial coniferous species except Yew (*Taxus brevifolia*).
- Part 3 describes the grades (other than Z) applicable to all commercial broadleaf (deciduous or "hardwood") species, and Yew.

10.1.1 Grade Applicability

Timber must be classified by grade in accordance with the Schedule of Coast Timber Grades if timber is cut in a forest region (usually the Coast) or part of a forest region where the policies and procedures approved by the minister under the Act specify that log selling prices must be used to determine the rates of stumpage applicable to the timber.

It is the area of harvest and not the place of scaling which determines the schedule of timber grades that must be used.

10.1.2 Grade Precedence

As per the *Scaling Regulation* scalers are instructed to record a log against the first grade in order of presentation in the scaling regulation. That same order is followed in this section.

10.2 Physical Characteristics Affecting Log Grades

Some aspects of the above factors have been explained earlier in this manual, while others require further explanation specific to coastal grading.

10.2.1 Potential for Manufacture of Products - Quantity

The proportions of a log's gross scale which are suitable, and not suitable, for the manufacture of products are important factors in determining its commercial value.

All the grades higher than No. 7 Chipper (Y) specify percentages of the gross scale which must be suitable to cut out lumber, veneer for fir peelers or shingles and shakes for shingle cedar.

Log defects which reduce recovery of the above products are identified in Section 8.3, and procedures for calculating the amount of loss they cause (grade reduction) are outlined in Section 8.4 of the *Timber Grading* chapter of this manual.

In order to ensure standard application of grade reduction procedures, some additional information on assessment of defect in coastal timber is provided here.

10.2.2 Log Size

The radius for the purpose of classifying the grade of timber under the Schedule of Coast Timber Grades, for timber greater than 12.8 metres in length, the radius is measured 12.8 metres from the large end of the log. Scaling Regulations section 9(3).

The following instructions provide further details on how to grade a log over 12.8 metres in length:

- Statutory grade – use the diameter at the point 12.8 metre from the butt.
- Knots – use the diameter at 12.8 metre to determine the maximum allowable knot size and distribution. The full length of the log is used to assess knot spacing and location (see example).
- Twist – measure twist at a point that is representative of the full length of the log. Use the diameter at 12.8 metres up from the butt to calculate the percentage of twist.
- Rings – measure at the top end (1/3 of top radius in from the bark).
- Firmwood deductions – base on log dimensions (diameter at 12.8 metre is not used in the calculations).
- Grade reductions – base on the log dimensions (diameter at 12.8 metre is not used in the calculations).

- Defects – checks, splits, pocket rot, and ring shakes are assessed at the end of where they occur. Butt star check and butt shake are assessed using the top diameter.

Example: a hemlock log 16.0 m x 23 rads x 30 rads has 4 rad knots on the top 6.0 m of the log. The lower 10.0 m of the log's surface is free of knots. The diameter at 12.8 m from the butt is 25 rads. There is a 4.0 metre grade reduction for breakage.

- The 25 rad diameter is large enough for an F grade. The knots run 37.5% down from the end which exceeds the 25% allowable for an F grade at 25 rads.
- The H grade allows 4 rad knots on the upper 50% of a 25 rad log. The knots run 37.5% down from the top so the grade of the log is H for knots.
- The H grade requires 75% recovery. The loss for breakage equals 25% so the log maintains an H grade.

10.2.2.1 Length

Length measurements specified in the grade rules are the actual unrounded gross measurements.

Where a log meets the minimum gross length for a grade but requires a deduction which reduces the net recorded length below the minimum, it is graded based on its gross length.

Length is a factor in log value, both in terms of efficiency in handling and lumber value potential.

10.2.2.2 Grade Reduction for Conk, Pin Rot and Indian Paint Rot

Where there are conk knots present, but the conk does not show in the log ends, the entire length affected is grade reduction. It is assumed that no lumber can be cut from 2.4 m and above and 3.6 m below the conk knots. Of course, residual sound end segments less than 2.5 m long must also be included as grade reduction.

Where conk shows in one or both ends and there are conk knots, it is presumed that no lumber can be cut from the length of log affected by the defect, with the following exceptions:

- Where the defect showing in the end(s) and the conk knots are confined to the same half of the log's diameter, it is possible to cut lumber from the unaffected side. In such cases scalers should calculate partial grade reduction for the affected log length based on the visual information available, or
- Where the defect is visible in the log end(s) but there are no conk knots, the grade reduction should be calculated in the same manner as for other rots.

10.3 Potential for Manufacture of Products - Quality

As well as prescribing a percentage of the gross scale which must be suitable to produce manufactured products, each grade rule above Y includes a specification regarding the quality of the potential product. Specifically, percentages of the lumber or shingles are required to be "clear" or "merchantable".

Each grade rule has guidelines appended which state requirements regarding quality factors. Some additional considerations specific to coastal grades are described below.

10.3.1 Size of Knots

Knots are measured at right angles to the log length except in peeler grades where the maximum diameter is used. The size of the knot does not include the shoulder.

Where the Grade Rule requirements stating maximum knot sizes and/or location are met, the merchantable or clear lumber percentage requirement for the grade will be satisfied.

10.3.2 Occasional Oversized Knots

All sawlog grades can have occasional larger knots. Occasional larger knots are allowed to the extent of one per 3 m of log length and must be located where knot sizes for portions of logs are specified.

Interpretation:

If a grade requirement allows 4 cm knots over the entire log, occasional larger knots can be anywhere on the log. Where the requirement states 4 rad knots are allowed on the upper half of a log, the occasional larger knots must be confined to this area as well, with knots no larger than 1 rad permitted on the lower half of the log.

10.3.3 Pitch

Pitch may accumulate in pockets between the rings or within a ring shake. The presence of pitch will lower the value of clear lumber and veneer.

The requirements for the peeler grades and the premium and lumber grades for subject species include limits on the number and size of pitch pockets allowed.

10.3.4 Growth Rate (Ring Count)

In addition to the quantity and the quality of the product out turn, some Coastal grade rules require a log to be fine grained. The fineness of grain relates to the separation between seasonal growth rings. Fine grained logs have a higher fibre density (proportionately more cellulose and lignin per unit volume) and will, therefore, produce stronger lumber and higher quality veneer.

The ring count of a log can greatly affect its value. The reason for this is that the narrower the separation between the rings, the denser the wood tissue. Denser wood tissue has more cellulose and lignin and is, therefore, stronger. In addition to this strength factor fine grained logs are easier to peel into veneer on a rotary lathe and yield higher quality and stronger veneer.

The annual rings may all be of equal thickness and centred perfectly around the central pith of the log, or they may be of varying thickness as a result of variations in growth rates (usually attributable to factors such as variations in nutrient availability, temperature, rainfall, and sunlight). They also may be offset from the geometric centre of the log.

When growth is not equally distributed and the heart is offset, the log will not peel well on a rotary lathe and cannot yield high quality veneer no matter how fine grained.

Growth rings are counted at a point 1/3 of the radius in from the logs outer circumference at the small end of the log. The rings are then to be counted in the one rad (2 cm) area from this point towards the outer circumference of the log and are to be counted where their separation is widest.

10.3.5 Stain

As described in the *Species Identification and Defects* chapter, the oxidation of phenolic compounds in tree tissues invaded and damaged or killed by micro-organisms (predominantly fungi) results in a pronounced discoloration of the wood tissue. This discoloration is commonly referred to as stain.

Some stains result soon after harvesting with the oxidation of newly exposed heartwood. Such stains are superficial and do not penetrate far into the log.

Also, the sawdust compacted between the cuts of logs bucked in the bush, but not separated, is often subject to staining fungus. These stains are also superficial and do not penetrate the log.

Stain does not cause any significant weakening of the wood fibre but it can detract from the appearance of the manufactured end products. Where these end products are for decorative or finishing purposes their value is lessened. For this reason the presence of stain is a grading consideration in some very valuable "clear lumber" coastal grades. Graders must also be aware that some types of stain can be faded when logs are left exposed to sunlight. Usually when this has happened the affected wood will still appear subtly different than the surrounding unaffected tissues.

10.4 Coast Grade Rules and Requirements

10.4.1 Firmwood Reject - All Species - Grade Code Z (species code or code R)

Firmwood rejects are not considered for cut control purposes or charged stumpage, and some firmwood reject volumes are utilized in manufacturing processes.

The firmwood reject grade rule is identical for all species. When scaled in a weight scale sample Z logs can be identified by species code or the letter R in place of the species code. For piece scale loads the species code is used.

10.4.1.1 Grade Rule

1. A log where:
 - a. heart rot or hole runs the entire length of the log and the residual collar of the firmwood constitutes less than 50 percent of the gross scale of the log,
 - b. rot is in the log and the scaler estimates the net length of the log to be less than 1.2 m, or
 - c. sap rot or charred wood exists and the residual firmwood is less than 10 cm in diameter at the butt end of the log.
2. That portion of a log that is less than 10 cm in diameter or that portion of a slab that is less than 10 cm in thickness.

Note that this is the only grade rule that specifies diameter in cm rather than radius in cm (which equals diameter in rads).

10.4.2 Coniferous Grades

The following sections present the grade rules for each species, as they appear in the Scaling Regulation. Following each grade rule is a section outlining the detailed requirements a log must meet to make the grade

Each grade rule except Y states dimensions, a minimum percentage of product recovery potential, and a product quality requirement. The following Log Requirements to Make the Grade deal primarily with the product quality requirement. Where a log meets the Log Requirements to Make the Grade it will meet the product quality requirement of the grade rule.

10.4.3 Balsam and Hemlock Grades

These two genera are graded the same and the grades apply to all four species of balsam and both species of hemlock found in the province.

10.4.3.1 No 1 Lumber Balsam and Hemlock, Grade Code D

10.4.3.1.1 Grade Rule

A log 5 m or more in length and 33 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.

10.4.3.1.2 Log Requirements to Make the Grade

1. No conk, or conk stain is permitted.
2. There must be no fewer than six annual rings in each 2 cm of diameter.
3. Logs 33 to 37 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.
4. Logs 38 cm or over 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 both sides or the upper 40 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. Pocket rot is allowed. In balsam the pocket rot must be confined to the centre of the log within a circle $1/3$ of the log radius, measured from the pith.
7. Ambrosia, burls, butt rot, butt shake, checks, crook, goitre, heart rot, 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.

10.4.3.2 No. 2 Lumber Balsam and Hemlock, Grade Code F

10.4.3.2.1 Grade Rule

A log 5 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.

10.4.3.2.2 Log Requirements to Make the Grade

1. No conk, or conk stain is permitted.
2. There must be no fewer than 6 annual rings in each 2 cm of diameter.
3. Logs 25 to 32 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 33 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. Pocket rot is allowed. In balsam the pocket rot must be confined to the centre of the log within a circle $\frac{1}{3}$ of the log radius measured from the pith.
7. Ambrosia, burls, butt rot, butt shake, checks, crook, goitre, heart rot, 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.

10.4.3.3 No. 2 Sawlog Balsam and Hemlock, Grade Code H

10.4.3.3.1 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.
- otherwise Grade Code D or F, 25 cm or more in radius, where at least 50 percent of the gross scale can be manufactured into merchantable lumber and at least 25 percent of that lumber will be clear.

10.4.3.3.2 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 $\frac{2}{3}$ 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. Butt rot, butt shake, 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.

10.4.3.4 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 $66 \frac{2}{3}$ 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.
4. Powder worm damage is permitted in one end of the log only as long as there is no evidence of powder worm intrusion in that half of the log with the unaffected end (i.e. knots or bole openings showing larvae tracks).

10.4.4.7 No. 4 Sawlog Cedar, Grade Code J**10.4.4.7.1 Grade Rule**

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

10.4.4.7.2 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.

4. Powder worm damage is permitted in one end of the log only as long as there is no evidence of powder worm intrusion in that half of the log with the unaffected end. (i.e.: knots or bole openings showing larvae tracks).

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' grade 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.

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 75 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 75 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 4 rads and 10 rads of the bark.
8. A ring shake within 4 rads 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 or,
- 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):

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

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

- Formula #2 (cone-shape defects):

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

(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 (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 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.