SLS 985: 1992

**Sri Lanka Standard For
Grading of Timber
Part 3: Grading of Logs**

SRI LANKA STANDARDS INSTITUTION

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Sri Lanka Standard

GRADING OF TIMBER

Part 3 Grading of Logs

FOREWORD

This standard was approved by the Sectoral Committee on Timber and Timber based products and was authorized for adoption as a Sri Lanka Standard by the Council of the Sri Lanka Standards Institution on 1992-10-07.

Timber being a natural product has its inherent growth related defects and however carefully a tree is felled and converted, it will yield little or no timber entirely free from defects. Further, timber is subject to various defects at the time of felling, extraction and storage, such as splits, shakes, checks, borer holes and fungal rot. The purpose of grading is to limit the number of such unavoidable defects according to the purpose for which timber is required, and such rules must be framed to suit the type of defects commonly found in the timber to which they will be applied. As low yield in conversion arises due to defects, timber should be graded to differentiate its quality and consequently the price structure. The grading of timber is determined by its general character including the location, nature and combination of all the visible defects. The grading of logs will also minimize wastage and bring about optimum utilization of timber.

This standard is in three parts as follows :

Part 1   Species of timber;
Part 2   Terminology; and
Part 3   Grading of logs

It is intended to prepare further parts in this standard covering other categories such as sawn timber.

This part of the standard specifies rules relating to grading of logs. The following main grades with appropriate sub-divisions are specified in this part of the standard :
a) Pole grades;
b) Peeler log grades;
c) Saw log grades;
d) Fuel wood grade; and
e) Chipwood grade.

Part 1 of this standard provides a comprehensive list of Sri Lankan species of timber utilized for industrial, commercial and other purposes. Part 2 of this standard deals with terminology applicable for grading of timber.

The following standards have been used as guidance documents in the preparation of this standard.

a) Asia Pacific Regional Grading Rules for Hardwood logs other than Teak, Food and Agricultural Organization (FAO) : 1957;

b) South East Asia Lumber Producers Association : Log Grading Rules : 1981;

c) Food and Agricultural Organization. Working Paper No. : 8 Sept : 1982 (FO : RAS/78/010);

d) The Sri Lanka Forester (The Ceylon Forester) : Vol. XI Nos. 3 & 4 (New Series) Jan - Dec 1974 (special issue);

e) A Handbook to The Flora of Ceylon by Henry Trimen, M/S Bishen Singh Mahendra Pal Singh and M.S.Periodical Experts; and

f) The Revised Handbook to The Flora of Ceylon, Edited by M.D.Dassanayaka and F.R. Fosberg.

1 SCOPE

This standard specifies rules relating to grading of roundwood timber.

2 THE GRADING PROCESS

2.1 Preparation of logs for inspection

2.1.1 Officers authorised by the Sri Lanka Standards Institution to grade logs shall grade only logs presented for inspection.

NOTE

To obtain the maximum benefit from grading, only competent officers specifically trained in grading of logs will be employed for grading timber and a record maintained for each such officer to determine and rectify personal bias, if any.

2.1.2 Logs shall be graded preferably at the landing which must be safe and conveniently located.

2.1.3 All logs presented for grading shall be thoroughly cleaned.

2.1.4 Logs shall be so stacked and turnable to make parts or surface to be inspected visible.

2.1.5 Logs shall be so located as to be exposed to sufficient natural light.

2.2 Grading

2.2.1 Logs presented for grading shall bear the mark of the officer supervising the felling operations.

2.2.2 The authorised officer shall be provided with grading helpers.

2.2.3 The authorized officer shall undertake the following :

a) Determination of species, based on standard
   names (see Part 1 of this standard) ;
b) Measurement of girths, lengths and determination of
   log volumes ;
c) Determination and establishing the quality of logs and
   its proper classification in accordance with the
   grading rules and instructions given in this part of
   the standard ;
d) Order the grading helpers to trim or re-buck logs when
   necessary for purposes of improving quality and grade ;
e) Reject outright, logs not fit for the market or saw
   Mill/Plywood Plant ; and
f) Undertake regrading after a lapse of time period, if
   degrading has set in.

2.3 Recording

2.3.1 The authorised officer shall record all logs so measured and graded in an official Grading Advice, indicating log serial number, species, girth, length, volume as well as grade of each log (see Appendix C).

2.3.2 The authorised officer shall make available for scrutinizing his official grading advice to the superior officer when required.

2.4 Marking of logs
All logs graded by an authorised officer shall have the following information stamped/stencilled on the butt end surface :

a) Log serial number ;
b) Measurement in terms of mid girth, length and gross volume,
   where practicable;
c) Grade or log quality ; and
d) Hammer-mark of the authorised officer.

2.5 Re-inspection

2.5.1 The grading done by the authorised officer, shall be binding. However, in the case of dispute, a board consisting of three superior authorized officers shall undertake regrading of such logs, and their decision shall be final.

2.5.2 A scaling discrepancy in volume not exceeding
± 1.5 per cent of the gross volume of logs, shall be allowed.

3 GENERAL INSTRUCTIONS REGARDING PREPARATION, MEASUREMENT, UNITS OF MEASUREMENT AND VOLUME DETERMINATION

3.1 LOG PREPERATION

3.1.1 Logs shall be debarked or unbarked as recommended.
(see Appendix A)

NOTE

Buyers may specify otherwise, but at their own risk, for special reasons (eg. debarking of logs required for purpose of immediate sawing).

3.1.2 The minimum dimensions of all grades of logs shall be as prescribed in this part of the standard (see 5).

3.1.3 Losgs shall be prepared in reasonably straight lengths.

3.1.4 Log and pole grades shall be free from protuberances which shall be cut or axed flush to the longitudinal surface.

3.1.5 Logs shall have properly bucked ends.

3.1.6 Log ends of standard peeler grade and prime saw log grade shall be preferably coated to prevent end drying.

3.1.7 Logs which are susceptible to infestation and stain such as pinus, rubber and coconut shall be sprayed with prophylactic pesticide/fungicide (bio-degradable).

3.1.8 Defects due to handling such as drag holes and buttresses shall be trimmed off at the landing before transport.

3.2 Mode and system of measurement

3.2.1 Volume of logs shall be measured based on the formula :

$$V = \frac{G \times G \times L \times 7}{88} \times 1000$$

Where, V is the volume, in cubic decimetres (true volume);
G is mid-girth, under bark, in metres; and
L is length of the log in metres.

NOTE

1 cubic decimetre = 0.001 cubic metres = 0.3531 cubic feet

3.2.2 Lengths shall be measured along a straight line parallel to the central axis of the log from the centre of the top diameter to the centre of the butt diameter, to the nearest lower full decimetre (10 cm).

3.2.3 Mid-girth shall be measured at the middle of the log free from bark and recorded to the nearest centimetre.

3.2.4 The trimming allowance shall be considered as an exponent of the recorded length with a minimum of 0.1 decimetre (1 cm) and a maximum of 0.9 decimetres (9 cm).

3.2.5 For transmission poles in particular, two girth measurements shall be taken without bark at top end and at 1.5 metres from bottom end. The girth shall be measured to the nearest centimetre.

3.2.6 For other pole grades the girth measurement over bark shall be at 60 cm from the butt end. (See also 5.1).

3.3 Determination of volume

3.3.1 The volume of individual logs shall be determined from standard volume tables (see SLS 791) based on the volume of a cylinder (see 3.2.1).

3.3.2 Volume of trimming allowance shall be excluded by taking the length of the log as in 3.2.2.

3.3.3 No deduction of measurement for defects of any kind on a log of any grade shall be made.

3.3.4 The volume of defects as determined in accordance with Appendix B and Table 1 shall be used solely for establishing sound volume and grade of the log on the yield system.

4 STANDARD DEFECTS AND UNITS OF STANDARD DEFECTS

The extent of defects permitted in roundwood timber shall be as specified in 4.1 to 4.8 in units of standard defects.

4.1 Standard knot

4.1.1 Sound knots up to 2 cm in diameter shall be ignored.

NOTE

Logs with sound knots greater than 6 cm in diameter may be treated as in 2.2.3 (d) or 2.2.3 (e).

4.1.2 One sound knot over 2 cm up to 6 cm in diameter for every 2 metre log length or part thereof with interval between knots not less than 2 metres is equal to 1 unit of standard knot.

4.1.3 One sound knot over 2 cm up to 6 cm in diameter in any 2 metre log length or part thereof with interval (if applicable) between knots not less than 2 metres is equal to 1 unit of standard knot.

4.1.4 One sound knot over 2 cm up to 6 cm in diameter for every 2 metre log length or part thereof with interval between knots not less than 1.5 metres is equal to 2 units of standard knot.

4.1.5 One sound knot over 2 cm up to 6 cm in diameter in any 2 metre log length or part thereof with interval (if applicable) between knots not less than 1.5 metres is equal to 2 units of standard knot.

4.1.6 Two sound knots each over 2 cm up to 6 cm in diameter for every 2 metre log length or part thereof with interval between knots not less than 1 metre is equal to 3 units of standard knot.

4.1.7 Two sound knots each over 2 cm up to 6 cm in diameter in any 2 metre log length or part there of with interval (if applicable) between knots not less than 1 metre is equal to 3 units of standard knot.

4.2 Standard borer holes

For borer holes, see 2.4 of Part 2 of SLS .... : 1992.

4.2.1 Any concentration of pin holes of more than 15 up to 30 in any square of 125 mm x 125 mm for each such square is equal to 1/2 unit of standard borer holes.

4.2.2 For each additional 15 pin holes in any such square the unit value shall be increased at the rate of 1/4 unit of standard borer holes.

4.2.3 Any concentration of pin holes of not more than 15 in any square of 125 mm x 125 mm shall be ignored.

4.2.4 Any concentration of shot holes over 3 and up to 10 in any 3 m log length scattered on the surface of the log but not extending beyond the sapwood is equal to 1 unit of standard borer holes.

4.2.5 For each additional 10 shot holes in any such 3 m log length scattered on the surface of the log but not extending beyond the sapwood, the unit value shall be increased at the rate of 1 unit of standard borer holes.

4.2.6 Any concentration of shot holes up to 3 scattered on the surface of the log but not extending beyond the depth of the sapwood in any 3 m log length shall be ignored.

4.2.7 For logs of length less than 3 m, 4.2.4, 4.2.5, 4.2.6 shall apply with the number of shot holes taken as the total occuring on the surface of the log.

4.2.8 Any concentration up to 3 worm holes scattered on the surface of the log in any 3 m log length is equal to 1 unit of standard borer holes.

4.2.9 For each additional 3 worm holes scattered on the surface of the log in any such 3 m log length the unit value shall be increased at the rate of 1 unit of standard borer holes.

NOTES

1) In the case of pin holes, the square with most number of pin holes determines the number of units of standard borer holes.

2) In the case of shot holes, the 3 m log length, selected in the log, with the most number of shot holes determines the number of units of standard borer holes.

3) In the case of worm holes, the 3 m log length, selected in the log, with the most number of worm holes determines the number of units of standard borer holes.

4.3 Standard split

4.3.1 One or more splits at either end with a total length up to 10 per cent of the length of the log are equal to 1 unit of standard split.

4.3.2 One or more splits at either end with a total length over 10 per cent up to 20 per cent of the length of the log are equal to 2 units of standard split.

4.3.3 Splits at both ends with a total length of the two longest splits
over 20 per cent up to 40 per cent of the length of the log are equal to 3 units of standard split.

4.3.4 Splits at both ends with a total length of the two longest split over
40 per cent of the length of the log are equal to 4 units of standard split.

4.4 Standard bend

Standard units for bend are given in Table 1.

TABLE 1 - Standard units of bend (Effects of bends on conversion)

Bend fraction $\dfrac{\text{dev}}{\text{sdt}}$ *	Defect value in per cent	Defect value in units
One bend of 1/12 One bend of 1/10 One bend of 1/8	5 7 8	one
One bend of 1/6 One bend of 1/5	12 14	two
One bend of 1/4 Two bends, or one bend of 1/3	17 23	three
Two bends, or one bend of 1/2 One bend or two bends of over 1/2	34 —	Reject or re-buck log into two standard length logs with reduced bend defects

NOTES

1) This table is based on mill studies on the effect of bend fraction on the loss in conversion. For example a log having a bend fraction of 1/12 on conversion will result in a loss of 5 per cent of the gross volume due to bend. Hence it has a defect value of one unit.

2) Bend fraction less than 1/12 shall be ignored.

* dev   is deviation or deflection of bend.
  sdt   is the shortest diameter of top end of log.

4.5 Standard heart defect

4.5.1 Heart defect on one or both ends of the log more than 10 per cent of the diameter of the log and up to 20 per cent is equal to 1 unit of standard heart defect.

4.5.2 For each additional 5 per cent of diameter of the log of heart defect measured as in 4.5.1, the unit value shall be increased at the rate of one unit of standard heart defect.

4.5.3 Heart defects measured as in 4.5.1, less than 10 per cent of the diameter of the log shall be ignored.

NOTE

For computation of sound volume with centre defects for different grades of saw logs see Appendix B.

4.6 Standard radial check

4.6.1 For each additional such check in the same quarter of the same end, the unit value shall be increased at the rate of 1/4 unit of standard radial check.

4.6.2 For each such check, in any other quarter or at the other end of the log, the unit value shall be increased at the rate of 1 unit of standard radial check.

4.6.3 Length of a radial check shall be measured by admitting a 3 mm diameter stiff wire probe and shall be estimated as double the depth of the penetration of that probe.

NOTE

Logs with a radial check or radial checks longer than 8 per cent of the length of the log may be treated as in 2.2.3 (d).

4.7 Standard cup or ring shake

4.7.1 Cup or ring shake more or less following a growth ring measured on the end surface and measured along the shake equal to more than 10 per cent of the diameter and extending to more than 5 per cent of the length of log, but not more than 20 per cent and 8 per cent respectively is equal to 1 unit of standard cup or ring shake.

4.7.2 Cup or ring shake as in 4.7.1 but with one or other of measurements up to 30 per cent and 16 per cent respectively is equal to 2 units of standard cup or ring shake.

4.7.3 Cup or ring shake less than 10 per cent of the diameter and extending up to 5 per cent of the length of the log shall be ignored.

4.7.4 A shake as it appears on the end surface of a log shall be measured by its greatest, linear dimension (measured along the shake). Where several shakes are found, the longest shake is measured.

4.7.5 Length of a cup or ring shake shall be measured by admitting a 3 mm diameter stiff wire probe and shall be estimated as double the depth of the penetration of that probe.

NOTE

Logs with a shake or shakes worse than that specified in 4.7.2, may be treated as in 2.2.3 (d) or 2.2.3 (e).

4.8 Standard wane (in squared logs)

4.8.1 Maximum ratio of width of wane at any and every point to the width of the narrowest adjacent flat face more than 15 per cent and up to 20 per cent is equal to 1 unit of standard wane.

4.8.2 Similarly more than 20 per cent up to 25 per cent is equal to 2 units of standard wane.

4.8.3 Maximum ratio of width of wane at any and every point to the width of the narrowest adjacent flat face less than 15 per cent shall be ignored.

4.8.4 Wane shall be measured for this rule by laying a tape along the natural underbark surface between the adjacent cut faces.

NOTE

Squared logs with wane larger than that specified in 4.8.2, may be treated as in 2.2.3 (d).

5 DEFINITION OF GRADE

5.1 Pole grades

5.1.1 Standard transmission pole grade
Timber grades as standard transmission pole grade shall be grade marked as specified in SLS 848 and shall have the dimensions specified in SLS 848.

These dimensions are within the following limits.

a) length : 6.0 m to 16.0 m

b) minimum diameter at : 106 mm to 381 mm.
   ground line.

c) minimum diameter at : 2/3 of the diameter at the ground
   top end line.

d) ground line distance : 1.2 m to 2.1 m.
   from the butt end

The permitted defects for this grade shall be as specified in SLS 848.

5.1.2 Class I Pole grade (TPR 1)

5.1.2.1 This grade shall admit timber in round form having a girth over 30 cm and up to 45 cm at 60 cm from the butt end.

5.1.2.2 The length of a pole shall be greater than 2.5 m.

5.1.2.3 Timber graded as class I Pole grade shall be grade marked as TPR 1.

5.1.3 Class II Pole grade (TPR 2)

5.1.3.1 This grade shall admit timber in round form having a girth over 10 cm and up to 30 cm at 60 cm from the butt end.

5.1.3.2 The length of a pole shall be greater than 2.5 m.

5.1.3.3 Timber graded as class II Pole grade shall be grade marked as TPR 2.

5.1.4 Class III Pole grade TPR 3.

5.1.4.1 This grade shall admit timber in round form having a girth up to 10 cm at 60 cm from the butt end.

5.1.4.2 Timber graded as class III Pole grade shall be grade marked as TPR 3.

5.1.5 Fence pole grade (FPR)

5.1.5.1 This grade shall admit timber conforming to specifications in 5.1.2 or 5.1.3 with the length not exceeding 2.5 m.

5.1.5.2 Timber graded as fence pole grade shall be grade marked as FPR.

NOTE

Suitable species to be identified later.

5.2 Peeler log grades (also see Appendix D)

5.2.1 Special peeler log grade (SSP)

5.2.1.1 Mid girth of logs shall be 150 cm (diameter 47.7 cm) or larger and length shall be 2.5 m or longer as may be specified by the buyer.

5.2.1.2 Logs shall be fresh cut, cylindrical and straight grained with properly bucked ends.

5.2.1.3 Heart may be off centre but shall be within one-fifth of the average log diameter.

5.2.1.4 This grade may admit not more than two of the following defects :

a) up to one unit of standard knot;
b) up to one unit of standard borer holes;
c) up to one unit of standard split; and
d) up to one unit of standard bend.

5.2.1.5 This grade may admit logs with discoloured but sound sapwood.

5.2.1.6 Timber graded as special peeler log grade shall be grade marked as SSP.

5.2.2 Prime peeler log grade (SP 1)

5.2.2.1 Mid girth of logs shall be 120 cm (diameter 38.2 cm) or larger and length shall be 2.0 m or longer.

5.2.2.2 Logs shall be fresh cut, cylindrical and reasonably straight grained with properly bucked ends.

5.2.2.3 Heart may be off centre but shall be within one-fourth of the average log diameter.

5.2.2.4 This grade may admit not more than three of the following defects :

a) up to one unit of standard knot;
b) up to one unit of standard borer holes;
c) up to one unit of standard split; and
d) up to one unit of standard bend.

5.2.2.5 This grade may admit logs with discoloured but sound sapwood.

5.2.2.6 Timber graded as prime peeler log grade shall be grade marked as SP 1.

5.2.3 Standard peeler log grade (SP 2)

5.2.3.1 Mid girth of logs shall be 90 cm (diameter 28.6 cm) or larger and length shall be 2.0 m or longer.

5.2.3.2 Logs shall be fresh cut, cylindrical and reasonably straight grained with properly bucked ends.

5.2.3.3 Heart may be off centre but shall be within one-third of the average log diameter. This grade may admit small centre hole with clean and firm edges, cup or ring shake, brash/brittle heart or heart checks provided that these are confined within a circle centred on the pith not exceeding 15 cm in diameter and the log would be sound enough to provide secure anchorage for lathe spindle and chuck.

5.2.3.4 This grade may admit not more than three of the following defects:

a) up to two units of standard knot;
b) up to two units of standard borer holes;
c) up to two units of standard split; and
d) up to two units of standard bend.

5.2.3.5 This grade may admit logs with discoloured but sound sapwood.

5.2.3.6 Logs with, few surface checks confined within two quaters of the lateral surface of the piece not exceeding 5 cm in depth may be admitted.

5.2.3.7 Timber graded as standard peeler log grade shall be grade marked as SP 2.

5.3 Saw log grades (also see Appendix D)

5.3.1 Prime saw log grade (SS 1)

5.3.1.1 Mid girth shall be 120 cm (diameter 38.2 cm) or larger and the length shall be 2.0 m or longer.

5.3.1.2 Logs shall be fresh cut, nearly cylindrical and reasonably straight grained with properly bucked ends.

5.3.1.3 This grade may permit the heart to be off centre and admit not more than three of the following defects:

a) up to three units of standard knot;
b) up to three units of standard borer holes;
c) up to three units of standard split; and
d) up to three units of standard bend.

5.3.1.4 This grade may admit logs with discoloured treated sapwood.

5.3.1.5 Any log in this grade must scale at least 75 per cent sound volume.

NOTE

Preservative treated sapwood shall be considered sound and can be included in sound volume.

5.3.1.6 Timber graded as prime saw log grade shall be grade marked as SS 1.

5.3.2 Standard saw log grade (SS 2)

5.3.2.1 Logs shall have a mid girth of 90 cm (diameter 28.6 cm) or larger and the length shall be 1.8 m or longer and must scale at least 60 per cent sound.

5.3.2.2 This grade may admit any log (2.32 of SLS ..: Part 2 : 1991) which does not meet the specifications of at least prime saw log grade provided it meets the requirements in 5.3.2.1.

5.3.2.3 Timber graded as standard saw log grade shall be grade marked as SS 2.

5.3.3 Saw log grade (SS 3)

5.3.3.1 Logs shall have a mid girth of 45 cm (diameter 14.3 cm) or larger and the length shall be 1.8 m or longer and must scale at least 50 per cent sound.

5.3.3.2 This grade may admit any log (see 2.32 of SLS...: Part 2 : 1991) which does not meet the specifications of at least standard saw log grade provided it meets the requirements in 5.3.3.1.

5.3.3.3 Timber graded as saw log grade shall be grade marked as SS 3.

5.3.4 Sawable log grade (SS 4)

5.3.4.1 Logs shall have a mid girth of 45 cm (diameter 14.3 cm) or larger, be 1.8 m in length or longer and must scale at least 40 per cent sound.

5.3.4.2 This grade may admit any log (see 2.32 of SLS...: Part 2 : 1992) considered sawable shorter than 1.8 m in length and must scale at least 40 per cent sound provided it meets the requirements in 5.3.4.1.

5.3.4.3 Timber graded as sawable log grade shall be grade marked as SS 4.

5.3.5 Short logs (SS 5)

5.3.5.1 Logs shall have a mid girth of 45 cm (diameter 14.3 cm) or larger. This grade may admit any log (see 2.32 of SLS...: Part 2 : 1991) considered sawable shorter than 1.8 m in length and must scale at least 40 per cent sound.

5.3.5.2 Timber graded as short logs shall be grade marked as SS 5

5.3.6 Merchantable grade (SS 6)

5.3.6.1 Logs shall have a mid girth of 45 cm (diameter 14.3 cm) or larger. This grade shall have no restriction on length and the log must scale not more than 40 per cent sound and not less than 20 per cent sound.

5.3.6.2 This grade may admit any log (see 2.32 of SLS...: Part 2 : 1992) not falling into any one of the earlier grade provided it meets the requirements in 5.3.6.1.

5.3.6.3 Timber graded as merchantable grade shall be grade marked as SS 6.

5.4 Fuel wood grade

5.4.1 This grade shall admit any roundwood not falling into any one of the earlier grades.

5.4.2 Timber in the fuel wood grade which does not exceed 1 m in length and not exceeding 45 cm in girth at either end of any species except those set out in schedule I and II of the Forest Ordinance but excluding branch wood of such species yet conforming to the above specifications shall be treated as fuel wood.

5.5 Chip wood grade

5.5.1 Logs shall be fresh cut and without bark.

5.5.2 Chip wood grade is similar to fuel wood grade or any other but shall not admit logs with discoloured wood, gums, resins and ingrown bark.

APPENDIX A

TIMBER RECOMMENDED FOR DEBARKING/REMOVAL OF SAPWOOD

A.1 De-barking is needed in certain species of timber to prevent borer attack before conversion. In some other species, in addition to de-barking, sapwood should also be removed for the above reason.

A.2 A list of species recommended for de-barking /removal of sapwood is given below.

a) Buruta (Chloroxylon Swietenia DC); de-barking only.

b) Kaluwara (Diospyros ebenum Koenig); de-barking including removal of sapwood.

c) Kos (Artocarpus hetrophyllus Lam.); de-barking including removal of sapwood.

d) Mahogany (Swietenia macrophylla King and Swietenia mahogani Jacq.); de-barking only.

e) Para-mara [Samanea saman (Jacq.) Merr.]; de-barking including removal of sapwood.

f) Peeler logs; de-barking only.

APPENDIX B

DETERMINATION OF SOUND VOLUME (ROUNDWOOD YIELD) FOR LOGS WITH CIRCULAR DEFECTS

B.1 Logs with centre defects extending through the entire
length of the log

The percentage defect of a log with a centre defect can be obtained
from the following formula, where the log and the centre defect each
were considered to be cylindrical :

$$\text{Percentage defect} = \frac{\text{Volume of centre defect}}{\text{Volume of log}} \times 100$$

$$= \frac{\pi \cdot (d^2/4) \; l \times 100}{(D^2/4) \times l}$$

$$= \left(\frac{d}{D}\right)^2 \times 100$$

where, d = the diameter of centre defect measured
at the larger end of the hole

D = mid-girth diameter of the log; and

l = length of the log (see Figure 1).

Percentage sound volume = 100 − percentage defect

$$= \left[1 - \left(\frac{d}{D}\right)^2\right] \times 100$$

EXAMPLE :

Diameter of centre defect
measured at the larger
end of the hole   (d) = 30 cm
Mid-girth diameter of log (D) = 60 cm

Percentage defect $= \dfrac{30}{60} \times 100 = 25\%$

Percentage sound volume $= \left[1 - \left(\dfrac{30}{60}\right)^2\right] \times 100 = 75\%$

For the convenience of users Table 2 was developed based on the
latter formula. This table will correlate percentage centre defects
and grade of logs for various values of log diameter in centimetres
(or mid-girth in metres) and diameter of centre defect in centimetres.

TABLE 2 - Sound volume (round wood yield) and grading of logs with centre defects.

Sound volume		75%	60%	50%	40%	20%
Grade indication		SS 1	SS 2	SS 3	SS 4	SS 5
Mid girth	Diameter	Diameter of defective centres				
cm	cm	cm	cm	cm	cm	cm
0.62 - 0.64	20	10	12.64	14.14	15.49	17.88
0.65 - 0.67	21	10.5	13.28	14.84	16.26	18.78
0.68 - 0.70	22	11	13.91	15.55	17.04	19.67
0.71 - 0.73	23	11.5	14.54	16.26	17.81	20.57
0.74 - 0.76	24	12	15.17	16.97	18.59	21.46
0.77 - 0.79	25	12.5	15.81	17.67	19.36	22.36
0.80 - 0.83	26	13	16.44	18.38	20.13	23.25
0.84 - 0.86	27	13.5	17.07	19.09	20.91	24.14
0.87 - 0.89	28	14	17.7	19.79	21.68	25.04
0.90 - 0.92	29	14.5	18.34	20.5	22.46	25.93
0.93 - 0.95	30	15	18.97	21.21	23.23	26.83
0.96 - 0.98	31	15.5	19.6	21.92	24.01	27.72
0.99 - 1.01	32	16	20.23	22.62	24.78	28.62
1.02 - 1.05	33	16.5	20.87	23.33	25.56	29.51
1.06 - 1.08	34	17	21.5	24.04	26.33	30.41
1.09 - 1.11	35	17.5	22.13	24.74	27.11	31.3
1.12 - 1.14	36	18	22.76	25.45	27.88	32.19
1.15 - 1.17	37	18.5	23.4	26.16	28.66	33.09
1.18 - 1.20	38	19	24.03	26.87	29.43	33.98
1.21 - 1.23	39	19.5	24.66	27.57	30.2	34.88
1.24 - 1.27	40	20	25.29	28.28	30.98	35.77
1.28 - 1.30	41	20.5	25.93	28.99	31.75	36.67
1.31 - 1.33	42	21	26.56	29.69	32.53	37.56
1.34 - 1.36	43	21.5	27.19	30.4	33.3	38.46
1.37 - 1.39	44	22	27.82	31.11	34.08	39.35
1.40 - 1.42	45	22.5	28.46	31.81	34.85	40.24
1.43 - 1.45	46	23	29.09	32.52	35.63	41.14
1.46 - 1.49	47	23.5	29.72	33.23	36.4	42.03
1.50 - 1.52	48	24	30.35	33.94	37.18	42.93
1.53 - 1.55	49	24.5	30.99	34.64	37.95	43.82
1.56 - 1.58	50	25	31.62	35.35	38.72	44.72
1.59 - 1.61	51	25.5	32.25	36.06	39.5	45.61
1.62 - 1.64	52	26	32.88	36.76	40.27	46.51
1.65 - 1.67	53	26.5	33.52	37.47	41.05	47.4
1.68 - 1.71	54	27	34.15	38.18	41.82	48.29
1.72 - 1.74	55	27.5	34.78	38.89	42.6	49.19
1.75 - 1.77	56	28	35.41	39.59	43.37	50.08
1.78 - 1.80	57	28.5	36.04	40.3	44.15	50.98
1.81 - 1.83	58	29	36.68	41.01	44.92	51.87
1.84 - 1.86	59	29.5	37.31	41.71	45.7	52.77

Table 2 (Continued)

Sound volume		75%	60%	50%	40%	20%
Grade indication		SS 1	SS 2	SS 3	SS 4	SS 5
Mid girth	Diameter	Diameter of defective centres				
1.87 – 1.89	60	30	37.94	42.42	46.47	53.66
1.90 – 1.93	61	30.5	38.57	43.13	47.25	54.56
1.94 – 1.96	62	31	39.21	43.84	48.02	55.45
1.97 – 1.99	63	31.5	39.84	44.54	48.79	56.34
2.00 – 2.02	64	32	40.47	45.25	49.57	57.24
2.03 – 2.05	65	32.5	41.1	45.96	50.34	58.13
2.06 – 2.08	66	33	41.74	46.66	51.12	59.03
2.09 – 2.11	67	33.5	42.37	47.37	51.89	59.92
2.12 – 2.15	68	34	43	48.08	52.67	60.82
2.16 – 2.18	69	34.5	43.63	48.79	53.44	61.71
2.19 – 2.21	70	35	44.27	49.49	54.22	62.6
2.22 – 2.24	71	35.5	44.9	50.2	54.99	63.5
2.25 – 2.27	72	36	45.53	50.91	55.77	64.39
2.28 – 2.30	73	36.5	46.16	51.61	56.54	65.29
2.31 – 2.33	74	37	46.8	52.32	57.32	66.18
2.34 – 2.36	75	37.5	47.43	53.03	58.09	67.08
2.37 – 2.40	76	38	48.06	53.74	58.86	67.97
2.41 – 2.43	77	38.5	48.69	54.44	59.64	68.87
2.44 – 2.46	78	39	49.33	55.15	60.41	69.76
2.47 – 2.49	79	39.5	49.96	55.86	61.19	70.65
2.50 – 2.52	80	40	50.59	56.56	61.96	71.55
2.53 – 2.55	81	40.5	51.22	57.27	62.74	72.44
2.56 – 2.58	82	41	51.86	57.98	63.51	73.34
2.59 – 2.61	83	41.5	52.49	58.68	64.29	74.23
2.62 – 2.65	84	42	53.12	59.39	65.06	75.13
2.66 – 2.68	85	42.5	53.75	60.1	65.84	76.02
2.69 – 2.71	86	43	54.39	60.81	66.61	76.92
2.72 – 2.74	87	43.5	55.02	61.51	67.38	77.81
2.75 – 2.77	88	44	55.65	62.22	68.16	78.7
2.78 – 2.80	89	44.5	56.28	62.93	68.93	79.6
2.81 – 2.84	90	45	56.92	63.63	69.71	80.49
2.85 – 2.87	91	45.5	57.55	64.34	70.48	81.39
2.88 – 2.90	92	46	58.18	65.05	71.26	82.28
2.91 – 2.93	93	46.5	58.81	65.76	72.03	83.18
2.94 – 2.96	94	47	59.45	66.46	72.81	84.07
2.97 – 2.99	95	47.5	60.08	67.17	73.58	84.97
3.00 – 3.02	96	48	60.71	67.88	74.36	85.86
3.03 – 3.06	97	48.5	61.34	68.58	75.13	86.75
3.07 – 3.09	98	49	61.98	69.29	75.91	87.65
3.10 – 3.12	99	49.5	62.61	70	76.68	88.54
3.13 – 3.15	100	50	63.24	70.71	77.45	89.44

B.2 Defective outer cylinder of the log

In addition to centre defects (see **B.1**) circular defects (such as unsound sap and deep lateral checks over 5 cm deep) which are located near the sapwood are also common.

The following formula gives the percentage defects of the outer cylinder:

$$\text{Percentage defects} = \frac{\dfrac{\pi}{4}(D^2 \times l) - \dfrac{\pi}{4}(D - 2t)^2 \times l}{\dfrac{\pi}{4} D^2 \times l} \times 100$$

$$= \frac{4t(D - t)}{D^2} \times 100$$

where,

D = midgirth diameter of the log ;
l = length of the log ; and
t = depth of outer cylinder defect (see Figure 1)

$$\text{Percentage sound volume} = 100 - \text{Percentage defect}$$

$$= 100 - 4t \frac{(D - t)}{D^2} \times 100$$

$$= \left[1 - \frac{4t(D - t)}{D^2} \right] \times 100$$

Example 1 :

Let mid-girth dia., D = 60 cm
Let depth of outer cylinder defect, t = 6 cm

$$\text{Percentage defects} = \frac{4 \times 6(60 - 6)}{60^2} \times 100 = 36\%$$

$$\text{Percentage sound volume} = \left[1 - \frac{4 \times 6(60 - 6)}{60^2} \right] \times 100 = 64\%$$

Example 2 :

Let mid-girth diameter, D = 60 cm
Let depth of outer cylinder defect, t = 6 cm
Let diameter of centre defects   = 15 cm
Percentage defect due to defects in the outer cylinder

$$= \frac{4 \times 6 \ (60 - 6)}{60^2} \times 100 \ = 36\% \quad \text{(see formula in B.2)}$$

Percentage defect due
to centre defect $= \left(\frac{15}{60}\right)^2 \times 100 \ = 6.25\%$
                                                  (see formula in B.1)

Total percentage defect due to outer cylinder defects and centre
defect

$$= \ (36 + 6.25)$$

$$= \ 42.25\%$$

Percentage sound volume in the log $= (100 \ - 42.25\%)$

$$= \ 57.75\%$$

B.3 Logs with butt rot or centre holes not extending the entire length of the log

This defect is common in species where heartwood is normally sound (such as in Tekka, Buruta, Palu etc.) and utilized, but develops butt rot or centre hole that does not affect the entire length of the log.

Example :

Let length of log, l = 5.0 m

Let mid-girth diameter of the log, D = 6 cm

Let diameter of rot or hole defect, d = 30 cm

Let depth of rot or hole measured along the length = 2.4 m

Assuming defect is present throughout the log (5.0 m) percentage defect

$$= \left(\frac{d}{D}\right)^2 \times 100 \text{ (see formula in B.1)}$$

$$= \left(\frac{30}{60}\right)^2 \times 100 = 25\%$$

As the defect is present up to 2.4m only,

$$\text{percentage defect} = 25.\% \times \frac{2.4}{5.0}$$

$$= 12 \%$$

A P P E N D I X C

SPECIMEN FORM FOR GRADING OF ROUND TIMBER

GRADING OF ROUNDWOOD TIMBER

GRADING ADVICE

Date of grading ....

Name of landing or depot ....

Name of authorised officer ....

Hammer mark of authorised officer ....

Authorising agency ....

Stock book folio No.	Landing or depot No.	Species	Length in metres	Mid girth in metres	Volume in cubic decimetres	Grade	Remarks

....
Signature of authorised officer
and registration number

APPENDIX D

TABULATED SUMMARY OF GRADING RULES FOR PEELER LOGS AND SAW LOGS

Requirements	PEELER LOG GRADES Special SP	Prime SP 1	Standard SP 2	Prime SS 1	Standard SS 2	Economy SS 3	SAWLOG GRADES Sawable SS 4	Short logs SS 5	Merchantable SS 6
1. Length	2.5m & over	2.0m & over	2.0m & over	2.0m & over	1.8m & over	1.8m & over	1.8m & over	Shorter than 1.8 m	—
2. Mid-girth (diameter) cm	150(47.7)	120(38.2)	90(28.6)	120(38.2)	90(28.6)	45(14.3)	45(14.3)	45(14.3)	45(14.3)
3. Condition	Fresh cut	Fresh cut	Fresh cut	Fresh cut					
4. Roundness	C	C	C	NC					
5. Trim	ALL LOGS TO BE WELL TRIMMED								
6. Bend	1 unit	1 unit	2 units	3 units					
7. Grain	Straight grained	R S G	R S G	R S G					
8. Knot	1 unit	1 unit	2 units	3 units					
9. Bore holes	1 unit	1 unit	2 units	3 units					
10. Checks/splits	1 unit	1 unit	2 units	3 units					
11. Heart displacement	1/5	1/4	1/3	N A	N A	N A	N A	N A	N A
12. Shake	NOT ADMITTED			N A	N A	N A	N A	N A	N A
13. Defect limits	2 STDS	3 STDS	3 STDS	3 STDS					—
14. Sapwood	ADMITS DISCOLOURED BUT SOUND SAPWOOD								—
15. Surface defects	NOT ADMITTED		5.0cm within 2 quarters see 5.2.3.3						—
16. Utilizable yield	solid	solid	solid and over	N A 75 % and over	N A 60 % and over	N A 50 % and over	N A 40 % and over	N A 40 % and over	N A not more than 40 % & not less than 20%

ABBREVIATIONS :

1. N A = not applicable
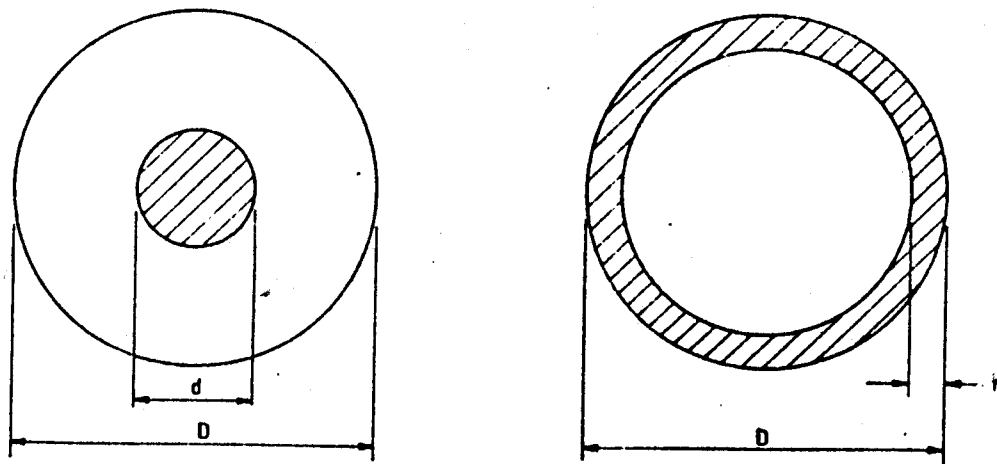2. RSG = reasonably straight grained.
3. C = cylindrical
4. NC = nearly cylindrical

FIGURE 1 − Measurement of circular defects