IS 9576 (1980): Guide for mill sawing of timber [CED 9: Timber and Timber Stores]

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Indian Standard

GUIDE FOR MILL SAWING OF TIMBER

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INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

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Indian Standard

GUIDE FOR MILL SAWING OF TIMBER

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Indian Standard

GUIDE FOR MILL SAWING OF TIMBER

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 28 July 1980, after the draft finalized by the Timber Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 With the developments and advancement in the technique of engineering skills, greater achievements have been made in the manufacture of mill sawing machines for timber in India. For economical mill sawing of timber and also for reducing the wastage of timber to the minimum during such sawing, good practices with improved techniques suitable for different species of timber are needed. This standard has, therefore, been prepared to outline these methods of mill sawing of timber. It also takes into account the use of different types of machines for different purposes.

0.3 In the formulation of this standard due weightage has been given to international co-ordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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1. SCOPE

1.1 This standard covers different types of machines used in mill sawing of timber, their maintenance and general principles of mill sawing and saw doctoring.

*Rules for rounding off numerical values (*revised*).

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply and for definitions other than those given below, reference may be made to IS : 707-1976* (*see* Fig. 1).

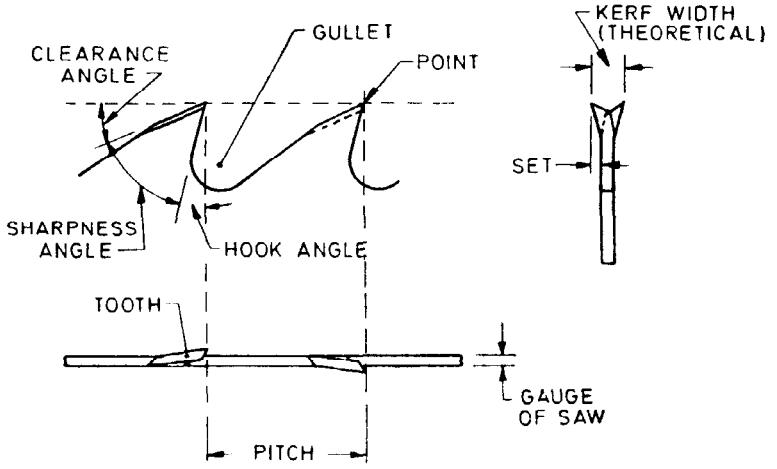

FIG. 1 DIAGRAM OF SAW TOOTH SHOWING TERMS USED IN DESCRIBING PARTS AND ANGLES

2.1 Conversion — The process of sawing logs and flitches into smaller sections.

2.2 Gauge (of the Saw Blade) — Thickness of a saw blade.

2.3 Gullet — Concave space between two consecutive saw teeth, for the saw dust during conversion.

2.4 Jointing — Process of accurately setting cutters. Effect of jointing is to make the cutters share equally in the work, and for a specified finish.

2.5 Kerf — Width of the cut made by any type of saw.

2.6 Kerf Loss — Loss of timber during sawing in the form of saw dust due to saw cut.

2.7 Tooth Pitch — The distance between the two consecutive saw teeth.

*Glossary of terms applicable to timber technology and utilization (*second revision*).

2.8 Dogs — The devices fixed to the saw mill carriages, whose function is to hold the log to keep steady during sawing.

2.9 Carriage — A vehicle used to carry the log while it is being fed into the saw or saws for conversion into timber.

2.10 Set — The amount of cut the teeth should be able to give clear of the body of the saw blade, so that there is freedom from friction between saw blade and timber. This is achieved either by bending over to right or left the cutting point of alternate tooth or by increasing the thickness of the cutting point of the teeth from the thickness of the saw blade. The former is called spring set while latter is called swage set. In India generally spring set is used.

2.11 Hook — The angle between the front face and a line from the tooth point to the centre of the circular saw or perpendicular to the back of a band saw.

2.12 Sharpness Angle — The angle between the front and the back of the teeth.

2.13 Clearance Angle — The angle between the tangent to the cutting circle and the grinding back of the teeth.

2.14 Cutting Speed — The speed at which timber is cut.

3. CROSS CUTTING OF LOGS

3.1 Logs, when brought to the saw mill in different lengths, are requirep to be cut across the grain into specified lengths with the use of cross cutting saws which are either chain or reciprocating saws. This operation may be completed in the forest itself.

4. PROCESS OF CONVERSION

4.1 Stages of Conversion — Normally there are two stages of conversion, namely, break down of logs and further conversion.

4.1.1 *Break Down of Logs* — Under this operation the log shall initially be converted into cants by sawing longitudinally in a vertical band mill and by extension cants into large timber, preparatory to further conversion.

4.1.2 *Further Conversion* — The large size timber obtained from breakdown process shall be further converted into scantling, battens, etc, in vertical band saw or circular saw. Some time smaller logs which are not difficult to handle are directly converted into scantling or batten according to the requirement

4.2 Types of Sawing — There are two broad classifications of sawing the logs, namely, plain sawing and quarter sawing.

4.2.1 *Plain Sawing* — Under this process, the logs shall first be sawn into three pieces (*see* Portions marked *a*, *b* and *c* in Fig. 2) and thereafter pieces *a* and *c* shall be converted by giving cuts tangentially to the annual rings in line with the initial cuts but in case of piece *b* though the cuts shall also be given tangentially to the annual rings but these shall be perpendicular to the initial cuts used for breaking down of the logs.

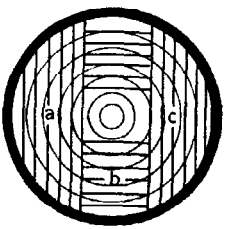

FIG. 2 PLAIN SAWING OF LOGS

4.2.2 *Quarter Sawing* — Under this process, log shall be sawn into four quarters, for subsequent radial conversion (*see* Fig. 3). Though *D* gives the best quality of timber it is not frequently practised due to difficulties in turning the log after each cut. A judicious combination of quarter sawing and plain sawing is given in Fig. 4.

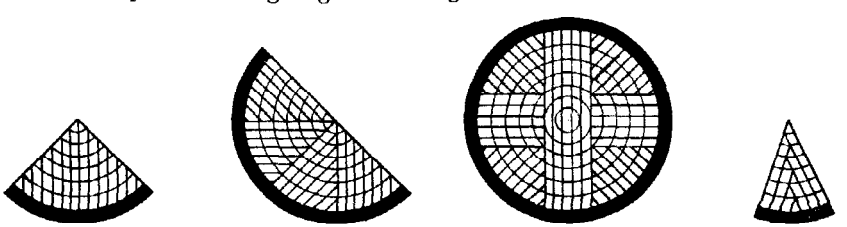

FIG. 3 QUARTER SAWING OF LOGS

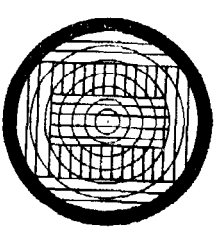

FIG. 4 COMBINATION OF QUARTER SAWING AND PLAIN SAWING OF LOGS

4.3 Machines for Sawing — Following machines are generally used for conversion of timber.

4.3.1 *Band Mill* (*Vertical*) — It shall mainly consist of the following parts (*see* Fig. 5):

a) A band of steel blade with teeth on one or both sides.

b) Heavy base or frame, which is generally a heavy casting. Function of this frame is to maintain all the components of the mill in proper position with respect to each other during operation.

c) The column, which is mounted on the heavy base and supports the upper wheel.

d) *Two pulleys* (*lower and upper*)

1) *Lower pulley* — This wheel is generally one piece iron casting and is of a heavy fly wheel type.

2) *Upper pulley* — This wheel is generally lighter in weight and usually consists of a rim with steel spokes.

e) *Adjusting mechanism* — The function of this mechanism is to raise or lower the upper wheel, in order to change the saw blade and is also to tighten the saw blade on the wheels.

f) *Straining device* — This device is to help the upper wheel of the mill to move downward when there is too much strain on the saw blade during operation.

g) *Guides* — These guides provide support for the saw blade when it enters the cut and when it is subjected to sudden shock and also damp excessive vibrations.

h) *Carriage* — This is a vehicle to carry the log while it is being fed into the saw. The carriage is moved along the track in feeding the log into the saw.

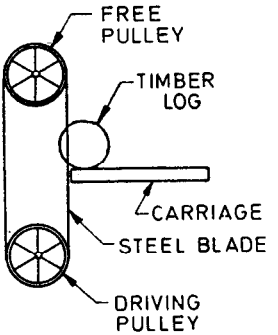

FIG. 5 BAND MILL (VERTICAL)

4.3.2 *Band Mill* (*Horizontal*) — It mainly consists of the following parts (*see* Fig. 6):

a) A heavy base or frame, which is generally a heavy casting; the main function of this frame is to maintain the mill in proper position.

b) *Columns* — These are mounted on the heavy base and support the two wheels on which the band of steel blade runs.

c) *Wheels* — These are two in number having same dimensions and are mounted on the columns for the support and running of the blade. These should run in perfect balance and in proper alignment. The faces of wheels should be free from undue or uneven wear, especially at the position where the saw is supported near its toothed edge.

d) *Saw blade* — It is round band of steel blade with teeth on one side and is mounted on the two wheels. The blade shall be correctly tensioned, so that it retains its position on the wheels and has the necessary tightness at the teeth to resist, without deflection, the load exerted by the log while it is being fed to the saw.

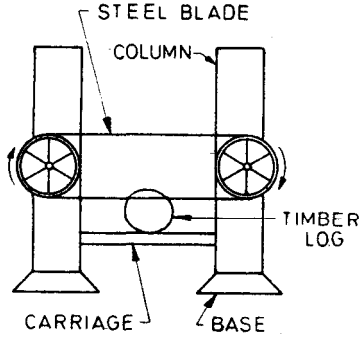

FIG. 6 BAND MILL (HORIZONTAL)

4.3.3 *Band Saw* — This machine is similar to band mills except that it does not have any carriage. The material is fed manually. The principal parts of the band saw are as under:

a) *Frame* — This is generally of heavy casting. The main function of the frame is to maintain all the components of the saw machine in proper position.

b) *Two wheels* — These wheels are identical in all respects. They are mounted on the frame, one directly above the other, and the steel band saw revolves around them. These wheels are usually made of cast iron. The upper wheel can be adjusted by moving up or down in order to put the saw blade in tension or for the removal of the saw blade for sharpening.

c) *Saw blade* — It is a thin, endless steel band with saw teeth in one edge. The size of the blade depends upon the diameter of the wheels.

d) *Table* — It is fastened to the frame casting directly above the lower wheel. A slot is provided in the table for the insertion and movement of the saw blade. Some tables are grooved for a mitre gauge.

e) *Throat plate* — This is a plate made of soft metal or wood which is fixed in the centre of the table.

f) *Saw guide* — It consists of two steel jaws between which the saw blade passes.

g) *Guards* — These consist of metal doors for the upper and lower wheels in order to avoid any accident when the saw blade breaks and also for dampening of excessive vibrations.

h) *Speed* — Band saws are driven by belt by means of direct motor drive or by motor drive connected to the shaft of the lower wheel.

4.3.4 *Circular Saw* — The machine is altogether different than band saw. In this a circular saw blade which is mounted on an arbor or shaft revolves through electric motor or diesel engine. The material is fed manually. The principal parts of the circular saw are as under:

a) *Frame* — This is generally of heavy casting. The main function is to maintain all the parts of the circular saw machine in proper position.

b) *Table* — This is generally of cast iron and is mounted on the frame. The upper surface of the table is well machined. A slot is provided in the centre of the table for the free movement of the circular saw blade. Also a rectangular slot is made in the table for the movement of a mitre gauge.

c) *Arbor shaft* — It is generally of mild steel and revolves on two bearings, which are bolted to the frame. It is driven by a belt which passes over a pulley on one end. On the other end of the shaft circular saw blade is mounted. This end of the arbor is threaded.

d) *Collar* — There are generally two collars of cast iron; one is fixed on the arbor to keep the saw blade in position from one side and other is a loose one.

e) *Pulleys* — There are generally two cast iron pulleys. One is mounted on the shaft and other is on the motor shaft.

f) *Saw blade* — It is a circular steel plate with teeth cut on its edge and hole drilled in the centre. The blade is slipped over the threaded portion of the arbor and fixed against the fixed collar. The loose collar is then put on the arbor and finally a hexagonal nut is screwed firmly on the threaded portion of the arbor to keep this blade in position.

5. GENERAL PRINCIPLES OF MILL SAWING

5.1 Before the log is brought from the storing place for sawing, it shall be studied and style of product required shall be considered carefully; as a particular method of conversion may be economical for certain sizes of timber, but not for other.

5.2 The log shall be examined in respect of its length, girth, defects, etc, to ascertain if the log is suitable for conversion to the required sizes. It shall also be examined in respect of end defects and centre heart so that maximum yield is obtained from the log.

5.3 Off-cut shall be cut as thinly as possible and the subsequent cuts made in those thicknesses which may bring out most favourable price.

5.4 Unless the specific sizes are required, the cutting shall be done so as to secure cants of as large a size as possible.

5.5 With crooked logs, the bulge shall be placed into the saw or away from it, but never sideways to it. If not specified otherwise, the crooked logs shall be sawn into planks, 2·5 cm thick, rather than thicker sizes.

5.6 Excessive taper, flutes and shakes cause conversion difficulties and conversion shall be judiciously done so as to reduce wastage.

5.7 Bole with extensive shakes shall be converted into scantlings if not otherwise specified.

5.8 A log with a large check shall be sawn parallel to the crack.

5.9 With unfigured timbers or for work like sleepers and scantling where figure is not a consideration, tangential sawing (plain sawing) shall be preferred. Where figure is important in most of the timbers radial sawing (quarter sawing) shall be preferred. Other comparative advantages and disadvantages of plain and quarter sawing are given under **5.9.1** and **5.9.2** respectively.

5.9.1 The following are the advantages of plain sawn timber:

a) It is easier and cheaper to cut at the mill, and there is less waste in cutting.

b) In some woods, it gives a more beautiful figure, such as mottle, and 'U's and 'V's due to growth rings.

c) It dries more rapidly than quarter-sawn timber under the same conditions.

d) It does not collapse so easily in drying.

e) If knots are present, these appear as round knots unlike in quarter-sawn boards in which these appear as splay knots.

5.9.2 The following are the chief advantages of quarter-sawn timber over plain sawn timber:

a) It shrinks or swells less across the width.

b) It shows less tendency to warp.

c) In many woods, it gives specialised grain or figure effects, such as silver grain, ribbon figure, fiddle back, and parallel lines due to growth rings.

d) It offers greater resistance to abrasion and wear.

e) It does not surface check or split open so badly in seasoning and, therefore, can be dried more rapidly in a kiln by giving it a more severe treatment.

f) It has a tendency to take a finish more uniformly.

6. MAINTENANCE OF MACHINES AND SAW BLADES

6.1 In order to keep the machines in efficient working order, it shall be necessary to keep different parts of the machine properly maintained. Points mentioned under **6.1.1** to **6.1.4** shall be kept in mind.

6.1.1 *Packing* — Packing shall be done, when the saw is in the bench and shall be so fitted that the saw runs steadily and slightly warmer at the centre than at the rim.

6.1.2 *Adjustment of Saw Fence* — Saw fence shall be extended to a suitable distance beyond the teeth at the front so that wood may not seize the saw owing to its not having sufficient room to open out as it leaves the saw. In cutting large logs or springy timber, which close in on the saw blade during conversion, wooden wedges shall be used in the kerf at the take-off end of the bench so as to give extra clearance to the saw to prevent jamming and buckling.

6.1.3 *Maintenance of Bearing* — All bearing shall be kept free from grit and dirt, and properly lubricated. These shall not be screwed up too tight but tight enough to prevent play. End play on spindle shall not be allowed to run hot and shall be trued up when necessary.

6.1.4 *Saw Doctoring Method and Machine* — The band saw blade to be used for conversion shall depend on the species to be converted. Specification of the teeth of band saw blade for three group of timbers, namely, coniferous wood, non-coniferous wood (low and medium density) and non-coniferous (heavy) wood are given in Table 1. The saw shall be kept in perfect condition. Proper setting, levelling, tensioning and sharpening of the saw shall be done to carry out successful conversion. The teeth shall be well sharpened and jointed so that all the teeth share the work equally, while cutting the log and correct amount of strain is applied to the saw. The body of the saw shall be free from lump and properly tensioned and levelled for the speed to be run. The proper set shall be given to provide sufficient clearance for the saw to prevent timber binding on the body of the saw as well as to avoid undue wastage due to greater kerf. The saw doctoring shall consist of the following operations.

6.1.4.1 *Lap grinding* — The ends to be jointed by overlapping by an amount equal to $1\frac{1}{2}$ times the pitch shall be ground to the required taper by a lap grinder, which consists of a vertical spindle with a grinder.

6.1.4.2 *Fluxing* — Before brazing saw blade borax mixed in water shall be applied on the tapered ends of the blade to prevent oxidation and to obtain clean joint.

6.1.4.3 *Brazing* — The taper ends of the saw blade shall be placed over the other with brass moulder in between and shall be pressed between the red hot iron blocks in a brazing fixture, which generally consists of four clamps, a mechanical press and two iron blocks (*see* Fig.7).

6.1.4.4 *Cleaning of joint* — The joint shall be properly cleaned and surplus material removed with a file.

6.1.4.5 *Sharpening* — After jointing, the blade shall be properly sharpened. Sharpening shall be generally done by a saw sharpening machine, which consists of the following:

a) A platform on which two wheels are mounted so as to accommodate saw blades of different length;

b) An adjustable grinder for adjusting to different gulleting (most of the grinders are provided with angle adjustment also); and

c) Pusher for rotating blade by one teeth at every stroke (this arrangement is carried out by changing the eccentricity of the pushing rod depending on the pitch of teeth).

TABLE 1 SPECIFICATION FOR THE TEETH OF BAND SAW BLADE

(*Clause* 6.1.4)

	Conifers			Non-Conifers					
				Low to Medium Density Sd. Sp. Gr. ≤ 0·6			Medium to Greater Density Sd. Sp. Gr. > 0·6		
Angle of Hook	25°			20°			15°		
Clearance Angle	15°			15°			10°		
Width of Saw (cm)	Thickness (mm)	Pitch (cm)	Gullet Depth (cm)	Thickness (mm)	Pitch (cm)	Gullet Depth (cm)	Thickness (mm)	Pitch (cm)	Gullet Depth (cm)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
10	1·18	4·5	0·95-1·12	1·18-1·25	4·5	0·95-1·12	1·25	3·8-4·5	0·95
12·5	1·18-1-25	4·5	0·95-1·12	1·25	4·5	0·95-1·12	1·40	3·8-4·5	0·95
15	1·25-1·40	4·5-5	1·12-0·85	1·40	4·5-5	1·12-0·85	1·60	4·5	1·12

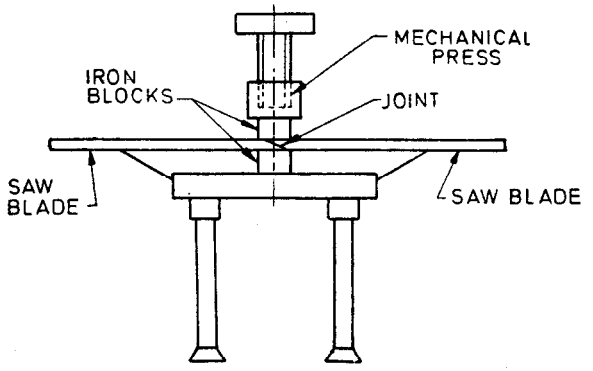

FIG. 7 BRAZING FIXTURE

6.1.4.6 *Tensioning and levelling* — Tensioning and levelling shall be done to prevent slip of blade over the wheels. This is done by making the saw blade convex with the help of a tensioning machine, which consists of tensioning rolls rotated with a power and a face plate fitted on a platform for proper rolling of the saw (*see* Fig. 8). Levelling is carried out with the help of level plate.

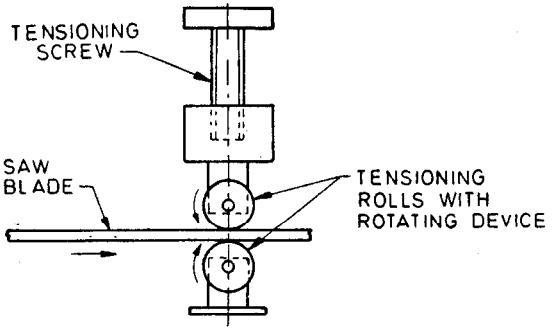

FIG. 8 TENSIONING MACHINE

6.1.4.7 *Setting* — After sharpening, setting is done so that width of cut is more than thickness of the blade. Alternate teeth are bent in opposite direction with the help of saw setter in case of spring setting (*see* Fig. 1).

(*Continued from page* 2)

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