

Timber

Introduction

The term "timber" describes sawn wood that is 140mm (5-1/2") or more in its smallest dimension. There are two categories of timbers. Rectangular "Beams and Stringers" (width more than 51mm (2") greater than thickness) are typically used as bending members, and square "Posts and Timbers" (width less than 51mm (2") greater than thickness) are typically used for columns.



Wood timbers were widely used in traditional construction although they are less commonly used today. Materials available from lumber yard stock are usually sawn to order from large timbers and should be regarded after cutting. Because very big logs are required to obtain large timbers, the larger timbers most often come from the west. Sizes up to 394 x 394mm (15-1/2" x 15-1/2") are generally available in the Douglas Fir-Larch and Hem-Fir species combinations; however S-P-F and Northern species timbers are available only in smaller sizes. Availability of large size and long length timbers should always be confirmed with suppliers prior to specifying.



There has been little in-grade strength test data on timbers, due to the relatively small volume of timbers produced. Therefore, the design values for timbers continue to be determined on the basis of small clear testing adjusted for grade characteristics.

Timbers, along with other materials, such as glulam and parallel strand lumber (PSL), are used in post and beam construction.

Grades

Both categories of timbers, Beams and Stringers, and Posts and Timbers, contain three stress grades: Select Structural, No.1, and No.2, and two non-stress grades (Standard and Utility). These grades and their uses are shown in the table below.

The stress grades are assigned design values for use as structural members. Non-stress grades have not been assigned design values.

No.1 or No.2 are the most common grades specified for structural purposes. No.1 may contain varying amounts of Select Structural, depending on the manufacturer. Unlike Canadian dimension lumber, there is a difference between design values for No.1 and No.2 grades for timbers.

Select Structural is specified when the highest quality appearance and strength are desired.

The Standard and Utility grades have not been assigned design values. Timbers of these grades are permitted for use in specific applications of building codes where high strength is not important, as in the case of deck uses, blocking or short bracing.

Timbers are generally not grade marked, since they are surfaced rough and may be used in exposed locations. If needed, a mill certificate may be obtained to certify the grade.

Cross cutting can affect the grade of timber in the Beams and Stringers category because the allowable size of knot varies along the length of the piece (a larger knot is allowed near the ends than in the middle). Therefore, for this grade category, the timber must be regraded if it is cross cut.

| Canadian Timbers - Grades and Uses | | | |
|---|--------------------------|--|--|
| Grades | Smaller Dimension | Larger Dimension | Principal Uses |
| Beam and Stringer | | | |
| Select Structural N° 1 N° 2 Standard Utility | 114 mm (5 po) or more | Exceeds smaller dimension by more than 51mm (2") | Used for beams, stringers, and purlins where members are loaded in bending. |
| Post and Timber | | | |
| Select Structural No. 1 No. 2 Standard Utility | 114 mm (5") or more | Exceeds smaller dimension by 51mm (2") or less | Used for columns, posts, and struts where members are loaded in compression. |
| Notes : | | | |
| <ol style="list-style-type: none"> 1. Strength and appearance are best in the premium grades such as Select Structural. The lower grades are more economical and are suitable where appearance and strength are less important. 2. Timbers are available rough sawn or custom surfaced. | | | |

Sizes

Timbers are sometimes manufactured to large dimensions and resawn later to fill specific orders. The table below shows the most common sizes, which range from 140mm x 140mm (5-1/2" x 5-1/2") to 292 x 495mm (11-1/2" x 19-1/2") in lengths of 5m (16') to 9m (30') and longer, with longer lengths commanding a premium price.

| Timber Sizes | | | |
|--------------------------------|--|--|--------------------|
| Surfaced Metric Sizes mm | Surfaced Imperial Sizes in. (actual) | Rough Sawn Imperial Sizes in. (nom.) | Grade Category |
| 140 x 140 | 5-1/2 x 5-1/2 | 6 x 6 | Post & Timber |
| x 191 | x 7-1/2 | x 8 | |
| x 241 | x 9-1/2 | x 10 | |
| x 292 | x 11-1/2 | x 12 | Beam & Stringer |
| x 343 | x 13-1/2 | x 14 | |
| x 394 | x 15-1/2 | x 16 | |
| x 445 | x 17-1/2 | x 18 | |
| x 495 | x 19-1/2 | x 20 | |
| 191 x 191 | 7-1/2 x 7-1/2 | 8 x 8 | Post & Timber |
| x 241 | x 9-1/2 | x 10 | |
| x 292 | x 11-1/2 | x 12 | |
| x 343 | x 13-1/2 | x 14 | Beam & Stringer |
| x 394 | x 15-1/2 | x 16 | |
| x 445 | x 17-1/2 | x 18 | |
| x 495 | x 19-1/2 | x 20 | |
| x 495 | x 19-1/2 | x 20 | |
| 241 x 241 | 9-1/2 x 9-1/2 | 10 x 10 | Post & Timber |
| x 292 | x 11-1/2 | x 12 | |
| x 343 | x 13-1/2 | x 14 | |
| x 394 | x 15-1/2 | x 16 | Beam & Stringer |
| x 445 | x 17-1/2 | x 18 | |
| x 495 | x 19-1/2 | x 20 | |
| 292 x 292 | 11-1/2 x 11-1/2 | 12 x 12 | Post & Timber |
| x 343 | x 13-1/2 | x 14 | |
| x 394 | x 15-1/2 | x 16 | |
| x 445 | x 17-1/2 | x 18 | Beam & Stringer |
| x 495 | x 19-1/2 | x 20 | |

Notes:

Timbers are surfaced (dressed) and sold green.

Canadian Design Values

These design values for timber are intended for use by qualified designers and are for normal load duration and dry service conditions.

| Specified Strengths and Modulus of Elasticity for Beam and Stringer Grades (MPa) | | | | | | | | |
|--|-------|--------------------------------------|---------------------------|--------------------------|----------------------------------|----------------------------------|-----------------------|----------|
| Species Identification | Grade | Bending at extreme fibre, * f_b | Longitudinal shear, f_v | Compression | | Tension parallel to grain, f_t | Modulus of elasticity | |
| | | | | Parallel to grain, f_c | Perpendicular to grain, f_{cp} | | E | E_{05} |
| D. Fir-L | SS | 19.5 | 0.9 | 13.2 | 7.0 | 10.0 | 12,000 | 8,000 |
| | No. 1 | 15.8 | | 11.0 | | 7.0 | 12,000 | 8,000 |
| | No. 2 | 9.0 | | 7.2 | | 3.3 | 9,500 | 6,000 |
| Hem-Fir | SS | 14.5 | 0.7 | 10.8 | 4.6 | 7.4 | 10,000 | 7,000 |
| | No. 1 | 11.7 | | 9.0 | | 5.2 | 10,000 | 7,000 |
| | No. 2 | 6.7 | | 5.9 | | 2.4 | 8,000 | 5,500 |
| S-P-F | SS | 13.6 | 0.7 | 9.5 | 5.3 | 7.0 | 8,500 | 6,000 |
| | No. 1 | 11.0 | | 7.9 | | 4.9 | 8,500 | 6,000 |
| | No. 2 | 6.3 | | 5.2 | | 2.3 | 6,500 | 4,500 |
| Northern | SS | 12.8 | 0.6 | 7.2 | 3.5 | 6.5 | 8,000 | 5,500 |
| | No. 1 | 10.8 | | 6.0 | | 4.6 | 8,000 | 5,500 |
| | No. 2 | 5.9 | | 3.9 | | 2.2 | 6,000 | 4,000 |

* Specified strengths for beams and stringers are based on loads applied to the narrow face. When beams and stringers are subject to loads applied to the wide face, the specified strength for bending at the extreme fibre and the specified modulus of elasticity shall be multiplied by the following factors:

| | f_b | E or E_{05} |
|-------------------|-------|-----------------|
| Select Structural | 0.88 | 1.00 |
| No. 1 or No. 2 | 0.77 | 0.90 |

Notes:

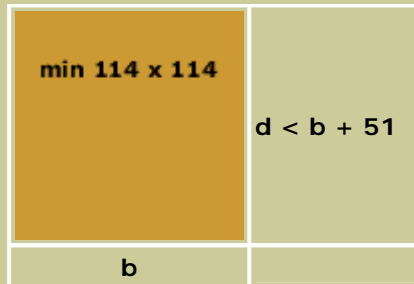
- (1) Beams and stringers have a smaller dimension of at least 114 mm, with a larger dimension more than 51 mm greater than the smaller dimension.
- (2) An approximate value for modulus of rigidity may be estimated at 0.065 times the modulus of elasticity.
- (3) With sawn members thicker than 89 mm that season slowly, care should be exercised to avoid overloading in compression before appreciable seasoning of the outer fibre has taken place; otherwise, compression for wet service conditions shall be used.
- (4) Beam and stringer grades listed in this table are not graded for continuity (see Clause 5.5.3).
- (5) Tabulated values are based on the following standard conditions:
 - (a) 343 mm larger dimension for bending and shear, 292 mm larger dimension for tension and compression parallel to grain;
 - (b) dry service conditions; and
 - (c) standard-term duration of load.

**Specified Strengths and Modulus of Elasticity
for Post and Timber Grades (MPa)**

| Species Identification | Grade | Bending at extreme fibre, * f_b | Longitudinal shear, f_v | Compression | | Tension parallel to grain, f_t | Modulus of elasticity | |
|------------------------|-------|--------------------------------------|------------------------------|-----------------------------|-------------------------------------|-------------------------------------|-----------------------|----------|
| | | | | Parallel to grain, f_c | Perpendicular to grain, f_{cp} | | E | E_{05} |
| | | | | | | | | |
| D. Fir-L | SS | 18.3 | 1.2 | 13.8 | 7.0 | 10.7 | 12,000 | 8,000 |
| | No. 1 | 13.8 | 0.9 | 12.2 | | 8.1 | 10,500 | 6,500 |
| | No. 2 | 6.0 | 0.9 | 7.5 | | 3.8 | 9,500 | 6,000 |
| Hem-Fir | SS | 13.6 | 1.0 | 11.3 | 4.6 | 7.9 | 10,000 | 7,000 |
| | No. 1 | 10.2 | 0.7 | 10.0 | | 6.0 | 9,000 | 6,000 |
| | No. 2 | 4.5 | 0.7 | 6.1 | | 2.8 | 8,000 | 5,500 |
| S-P-F | SS | 12.7 | 0.9 | 9.9 | 5.3 | 7.4 | 8,500 | 6,000 |
| | No. 1 | 9.6 | 0.7 | 8.7 | | 5.6 | 7,500 | 5,000 |
| | No. 2 | 4.2 | 0.7 | 5.4 | | 2.6 | 6,500 | 4,500 |
| Northern | SS | 12.0 | 0.8 | 7.5 | 3.5 | 7.0 | 8,000 | 5,500 |
| | No. 1 | 9.0 | 0.6 | 6.7 | | 5.3 | 7,000 | 5,000 |
| | No. 2 | 3.9 | 0.6 | 4.1 | | 2.5 | 6,000 | 4,000 |

Notes:

- (1) Posts and timbers have a smaller dimension of at least 114 mm, with a larger dimension not more than 51 mm greater than the smaller dimension.
- (2) Posts and stringers graded to beam and stringer rules may be assigned beam and stringer strength.
- (3) An approximate value for modulus of rigidity may be estimated at 0.065 times the modulus of elasticity.
- (4) With sawn members thicker than 89 mm that season slowly, care should be exercised to avoid overloading in compression before appreciable seasoning of the outer fibre has taken place; otherwise, compression for wet service conditions shall be used.
- (5) Tabulated values are based on the following standard conditions:
 - (a) 343 mm larger dimension for bending and shear, 292 mm larger dimension for tension and compression parallel to grain;
 - (b) dry service conditions; and
 - (c) standard-term duration of load.



U.S. Design Values

These design values for timber are intended for use by qualified designers and are for normal load duration and dry service conditions.

For more information, get the NDS from the American Wood Council.

For technical support, call the AWC helpdesk at (202) 463 4713

| Beams and Stringers | | | | | | | | | |
|---|----------------------|----------------------|------------------|--|--|--|--|----------------------------------|----------------------------|
| Design values are in pounds per square inch (psi) | | | | | | | | | |
| | Grade | Size | Bending F_b | Tension parallel to grain F_t | Shear parallel to grain F_v | Compression perpendicular to grain F_c perp | Compression parallel to grain F_c | Modulus of Elasticity E | Grading Rules Agency |
| S-P-F | Select Structural | 5x5 and larger | 1100 | 650 | 125* | 425 | 775 | 1,300,000 | NLGA |
| | No. 1 | | 900 | 450 | | | 625 | | |
| | No. 2 | | 600 | 300 | | | 425 | | |
| Douglas Fir- Larch (North) | Select Structural | 5x5 and larger | 1600 | 950 | 170* | 625 | 1100 | 1,600,000 | NLGA |
| | No.1 | | 1300 | 675 | | | 925 | | |
| | No.2 | | 875 | 425 | | | 600 | | |
| *New Shear Design Values | | | | | | | | | |

| Posts and Timbers | | | | | | | | | |
|---|----------------------|----------------------|------------------|--|--|--|--|----------------------------------|----------------------------|
| Design values are in pounds per square inch (psi) | | | | | | | | | |
| | Grade | Size | Bending F_b | Tension parallel to grain F_t | Shear parallel to grain F_v | Compression perpendicular to grain F_c perp | Compression parallel to grain F_c | Modulus of Elasticity E | Grading Rules Agency |
| S-P-F | Select Structural | 5x5 and larger | 1050 | 700 | 125* | 425 | 800 | 1,300,000 | NLGA |
| | No. 1 | | 850 | 550 | | | 700 | | |
| | No. 2 | | 500 | 325 | | | 500 | | |
| Douglas Fir- Larch (North) | Select Structural | 5x5 and larger | 1500 | 1000 | 170* | 625 | 1150 | 1,600,000 | NLGA |
| | No.1 | | 1200 | 825 | | | 1000 | | |
| | No.2 | | 725 | 475 | | | 700 | | |
| *New Shear Design Values | | | | | | | | | |

Moisture Control

The large size of timbers makes kiln drying impractical due to the drying stresses which would result from differential moisture contents between the interior and exterior of the timber. For this reason, timbers are usually dressed green (moisture content above 19 percent), and the moisture content of timber upon delivery will depend on the amount of air drying which has taken place.

Like dimension lumber, timber begins to shrink when its moisture content falls below about 28 percent. The degree of shrinkage depends on the climatic conditions of the environment. For example, timbers exposed to



the outdoors usually shrink from 1.8 to 2.6 percent in width and thickness, depending on the species. Timbers used indoors, where the air is often drier, experience greater shrinkage, in the range of 2.4 to 3.0 percent in width and thickness. Length change in either case is negligible.

When constructing with Posts and Timbers or Beams and Stringers, allowance should be made for anticipated shrinkage based on the moisture content at the time of assembly. Where the building envelope relies on caulked seals between timbers and other building components, the selection of caulks should take into account the amount of movement which must be accommodated as shrinkage occurs.

Minor checks on the surface of a timber are common in most service conditions and therefore an allowance has been made for them in the assignment of working stresses. Checks in columns are not of structural importance unless the check develops into a through split that will divide the column.

Fire Safety

Timbers offer increased resistance to fire compared to unprotected dimension lumber. Because of this, timber is often used in Heavy Timber construction to meet minimum size and fire-resistance rating requirements of North American building codes.

The Fire Safety Design in Buildings book provides basic information on the minimum sizes and arrangement of timber members necessary to meet code requirements for Heavy Timber construction. Information is also provided on the means for calculating the fire resistance of timber beams and columns.

Heavy Timber Framing Links

Acorn Timber Frames Ltd. (Nova Scotia)

Arlington Timber Frame Company (Nova Scotia)

Bensonwood Homes (New Hampshire)

Finn Log Homes International (Alberta)

Gillis & Company Timber Frames (Nova Scotia)

Hamlet Heavy Timberwork (Quebec)

HübertHaus Timber Frames (British Columbia)

International Log Builders' Association

Lancaster County Timber Frames Inc. (U.S.)

Legacy Timber Frames (Nova Scotia)

Normerica Authentic Post & Beam Homes (Ontario)

Northern Timberhouse Ltd. (Ontario)

Owl Ridge Timber Framing Inc. (British Columbia)

Pacific Timber Frame (British Columbia)

Thistlewood Timber Frame Homes (Ontario)

Timber Frame Business Council (U.S.)

Timber Framers Guild (U.S.)