Key points

- *This information sheet provides general background to softwood timber sizes and current EN standards; it also provides guidance when specifying timber sizes.*
- *The commercially available timber sizes in common use in Ireland today trace their origins to older imperial timber sizes measured in inches and feet but have generally been rounded down to an even metric number in centimetres or millimetres; this relates to both the length and cross section.*
- *The difference between the requested timber sizes when purchasing timber and the actual size (usually smaller) supplied is a frequent source of confusion. Sizes quoted on an invoice, as distinct from a delivery docket, can relate to the method of how sawmills calculate timber prices and this can be different from sawmill to sawmill.*
- *The range of terminology (including obsolete terms) used in relation to timber sizes has also created difficulties and confusion for specifiers and end users.*
- *Further machining or planing of the timber can cause a reduction in the dimensions of the timber which may not be reflected in the documentation.*
- *Changes in the moisture content of the timber after manufacture can also result in an increase or decrease in the dimensions of the timber and in particular the cross sectional dimensions.*
- *The various dimensional tolerances, deviations and allowances provided by the timber standards and timber producer often create confusion for end users and specifiers.*

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Timber sizes – solid timber for structural use

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Introduction

This information sheet provides general background to softwood timber sizes and the current EN standards which should be used when specifying timber sizes. Sawmills produce a wide range of timber sizes for both round and sawn timber and for structural and non-structural timber; this information sheet covers mainly softwood structural timber. Building designs in Ireland must now comply with the Eurocodes for structural design and timber for structural use must comply with the EN standards for the dimensional tolerances applicable to timber.

Reference standards

- EN 336: Structural timber - Sizes, permitted deviations
- EN 844: Round and sawn timber – Terminology Parts 1-6
- EN 1309-1: Round and sawn timber – Method of measurement of dimensions – Part 1: Sawn timber
- EN 1313-1: Round and sawn timber - Permitted deviations and preferred sizes. Softwood sawn timber
- EN 13183 Parts 1-3: Moisture content of a piece of sawn timber – oven dry / resistance / capacitance

Terms and definitions

Deviation: The difference between the actual size and the specified target size after making allowance for dimensional changes due to differences in moisture content from 20%. EN 336 gives positive and negative deviation values for two tolerance classes.

Fibre saturation point (FSP): The moisture content level at which the liquid sap (or free water) content of the wood cells has been removed by drying and the only moisture remaining is in the cell walls of the timber. The fibre saturation point for most softwood species is around 28-30 %. Drying the timber below the fibre saturation point results in shrinkage of the wood fibres and hence a reduction in the cross section of the timber.

Moisture content: The amount of water present in the timber expressed as a percentage of the oven-dry mass (weight) of the timber.

Target size: Target size specified (at the 20% reference moisture content), and to which any deviations, which would ideally be zero, are to be related.

Tolerance: The maximum and minimum deviations allowed in target size in thickness, width and length.

There are a number of terms still used by the timber industry; these include: regularised, basic, planed, finished, minimum, surfaced and sawn sizes. Some of these were sawmilling related and not relevant to the supplied finished size, in addition they often referred to sizes without a precise relationship between the different terms.

Terms such as planed and surfaced can still be used as they refer to the finish but the timber target size and tolerance class should still be given although tighter tolerances could be declared by a sawmill.

Timber dimensions should always be specified by Target Size and Tolerance Class and the supplied size checked against that ordered making allowances for moisture content. In the past timber was regularised to obtain a satisfactory uniform size but apart from a few special specific uses, this is not necessary today with sawmilling improvements in drying and sawing and the use of tolerance classes.

Hit and miss was a term that usually referred to timber used for roof trusses and related to a regularisation of the timber to the desired uniform thickness, the resulting thickness would be described today as the target size and Tolerance Class 2 but further described as having zero tolerance. It should be remembered that the tolerances given in the standards are maximum tolerances and ideally they should be zero.

CLS is a term which originally stood for Canadian Lumber Standard but in Ireland is generally understood to be an exact size, i.e. there are no positive or negative tolerances on the size. CLS falls under Tolerance Class 2 but again with zero tolerance. Therefore CLS should be ordered with the target size and Tolerance Class 2 with zero tolerance; the zero tolerance can be thought of as a special requirement.

Some standards still refer to minimum sizes so there should be no negative tolerance on these timber dimensions but often no maximum positive tolerance is given and users should be aware of any potential problems that might arise from variations in the timber size.

Measurement of timber sizes

Measurement of timber - length, width and thickness should comply with the requirements of EN 1309-1.

Where measuring tapes are used they should be calibrated or at least checked for accuracy against a calibrated meter rule regularly. Where digital callipers are used these instruments also should be calibrated. Tolerances for the measuring equipment are given in EN 1309-1.

Under the European Union Weights and Measures Regulations measuring tapes are classified into three levels of accuracy: Class 1, Class 2 and Class 3, with Class 1 being the most accurate. Tapes complying with these regulations will have markings indicating the accuracy class. Class 2 measuring tapes are sufficiently accurate for most carpentry and building purposes.

> At least three measurements of thickness and width should be taken on each piece measured and the smallest of these measurements taken as the thickness and width of the piece. Measurements should be taken at least 150 mm from each end and one measurement between the ends, usually at the centre. Measurements should be taken at clear timber, free of defects.

Knowing the moisture content of the timber the size can be adjusted to the reference moisture content of 20% or where appropriate to a specified moisture content. The timber can then be compared to the target or specified size.

Measurement of moisture content

Measurement of moisture content is in accordance with EN 13183-1. Acceptable methods of measurement include the oven-dry method and moisture meters using electrical resistance (usually using steel pins) or electrical capacitance.

Where electrical moisture meters are used they should be maintained in a calibrated condition to ensure the accuracy of readings. The technical instructions for the meter used should be carefully followed as corrections are normally required for different timber species and for use at different temperatures. Electrical moisture meters are only reliable below the fibre saturation point.

Moisture content – effect of changes in moisture content

European Standards relating to timber size such as EN 1313 and EN 336, assume that the timber is at *a reference moisture content of 20%* for measurement purposes. Changes in the moisture content of the timber will cause changes in the dimensions of the timber. These will be more significant in the cross-sectional dimensions such as width and thickness; changes in length are negligible and can be disregarded.

The change in softwoods and poplar timber size with a change in moisture content can be calculated as follows:

- For every 1% increase in moisture content above 20%, *an increase* in thickness and width of 0.25% will occur up to fibre saturation point (28-30%). No further increase in size occurs above the fibre saturation point.

- For every 1% decrease in moisture content below 20%, *a decrease* in thickness and width of 0.25% will occur.

The change in hardwood timber size with a change in moisture content can be calculated as follows:

- For every 1% increase in moisture content above 20%, *an increase* in thickness and width of 0.35% will occur up to fibre saturation point (28-30%). No further increase in size occurs above the fibre saturation point.
- For every 1% decrease in moisture content below 20%, *a decrease* in thickness and width of 0.35% will occur.

If there is more accurate information in relation to timber movement and moisture content for a particular species then this should be used in place of the above.

Example 1: Softwood timber with a dimension of 44 x 200 mm could potentially reduce to 43.6 x 198 mm if the moisture content reduced by four percentage points from for example 20% to 16% MC. If the moisture content further reduced by an additional four percentage points to 12% the dimensions could be down to 43.1 x 196 mm. In addition, as it is known that drying shrinkage in the 'tangential direction' is greater than in other directions (radial) the shrinkage in width could be even greater than in the example given which is based on an average of radial and tangential shrinkage.

Example 2: Softwood timber with a cross section dimension of 44 x 200 mm could potentially increase to 44.4 x 202 mm if the moisture content increased from 20% to 24%.

Note. Changes in timber dimensions due to moisture content changes are particularly significant for timber frame designers where dimensional changes in the cross-section of timber members can accumulate throughout the height of a timber frame building.

Standards for timber sizes and tolerances

For structural timber EN 336: 2013 defines target size and defines two Tolerance Classes (T1 and T2) for three ranges of thickness and width; dimensions below 100mm, from 100mm to 300mm and over 300mm.

Note: EN 1313-1 relates to timber sizes for sawmills and generally for production purposes. EN 1313-1 has tolerances the same as for Tolerance Class 1 in EN 336 up to dimensions of 300mm.

Tolerances

EN 336 gives two classes for structural timber; Tolerance Class 1 (usually applicable to sawn timber) and Tolerance Class 2 (usually applicable to finished timber as used e.g. in roof trusses and timber frame). The tolerances apply to timber at the reference moisture content of 20%.

Table 1: Permitted deviations for Tolerance Class 1 (TC 1)

Timber size (thickness and width)	Tolerance
Less than 100 mm	-1.0/ + 3 mm
100–300 mm	-2.0/ + 4 mm
Above 300 mm	-3.0/ + 5 mm

Table 2: Permitted deviations for Tolerance Class 2 (TC 2)

Timber size (thickness and width)	Tolerance
Less than 100 mm	-1.0/ + 1 mm
100 – 300 mm	-1.5 + 1.5 mm
Above 300 mm	-2.0/ +2.0 mm

The following table provides an example of how the above tolerances are applied.

Table 3: Example of maximum and minimum tolerances on a target size of 75 x 275mm

Target size	Tolerance Class	Maximum acceptable sizes	Minimum acceptable sizes
75 x 275 mm	1	78 x 279 mm	74 x 273 mm
75 x 275 mm	2	76 x 276.5 mm	74 x 273.5 mm

Table 4: Sawn Softwood Timber – Commonly used target sizes in Ireland and UK

Thickness (mm)	Width (mm)											
	75	100	115	125	138	150	175	200	225	250	275	300
35(IRL)	X	X	X	X		X	X	X	X		X	
38(UK)	X	X	X	X	X	X	X	X	X	X	X	X
44(IRL)	X	X	X	X	X	X	X	X	X			
47(UK)	X	X		X		X	X	X	X	X		X
50	X	X		X		X	X	X	X	X		X
63	X	X		X		X	X	X	X		X	
75		X		X		X	X	X	X	X	X	X
100(UK)						X		X	X	X	X	X
150(UK)						X		X				X
250(UK)										X		
300(UK)												X

Note: Not all of the above sizes are available from general stock and some sizes may have to be ordered on request.

Example 3: Customers specification:
A softwood timber beam was ordered with a specified target size of **75mm x 275mm** and a **Tolerance Class of 1**.

Note. TC 1 timber with a thickness of 75mm has allowable tolerances of -1/+3mm. TC 1 timber with a width of 275mm timber has allowable tolerances of -2/+4mm (see Table 1 above).

Timber size as delivered:
The timber was measured at **12% moisture content** with dimensions of 71 x 270mm (i.e. based on the smallest dimension measured at the ends and centre of the timber length).

Does it comply with the customer's specified target size?

The difference in moisture content between 12% and 20% is 8%.

The cross-section dimensions will change by 8.0 x 0.25% (i.e. 2%).

Measured *thickness* 71mm (at 12% moisture content) - corrected to 20% moisture content:

- The 71mm timber thickness increases by 71 x 2/100 = 1.4mm when corrected from 12%mc to 20%mc.
- The target size is therefore 71mm + 1.4mm =72.4mm at 20%mc

For Tolerance Class 1 the target thickness should be between 74mm and 78mm; therefore it does **not comply** with the customer's specification.

Measured *width* 270 mm (at 12% moisture content) - corrected to 20% moisture content:

- The 270mm timber width increases by 270 x 2 / 100 = 5.4mm when corrected to 20%mc.
- The target width is therefore 270mm + 5.4mm = 275.4mm at 20%mc
- The width corrected from 12% to 20% is 270mm + 5.40mm = 275.4mm

For Tolerance Class1 the target width should be between 273mm and 279mm and therefore, it **does comply** with the customer's specification.

This of course does not address any specific practical issues that might be associated with moisture content whether the moisture content is too high or too low.

Where timber is larger than the target size then how the timber is to be used should be looked at, in a general larger timber dimension should not pose a problem but there may be occasions when large differences between members might be a problem e.g. when pressing plates into roof trusses members.

Permitted length deviations

There is no minus tolerance for length for structural timber.

Lengths – Common lengths

Softwood is generally available in lengths from 1.8 m up to 6.0 m or more measured in increments of 300 mm.

Other timber size terms

The end user should relate sizes only to target sizes which can apply to all timber processes. However an end user can specify specific sizes and moisture content and can use the information provided here for checking that the timber complies with the specification.

Regularised timber

It is common practice to further process structural timber by machining or planing one or both edges to ensure that the width or depth of the timber is the same throughout all the pieces. This often applies to floor joists to ensure a uniform level surface for the flooring. Regularised timbers should be specified to Tolerance Class 2.

Surfaced timber

Surfaced timber manufactured to North American and Canadian timber sizes (known as ALS for American Lumber Standard or CLS for Canadian Lumber Standard). CLS sizes, in particular, are widely used by the timber frame industry and while originally the timbers came from North America, CLS is now widely produced in Europe. Normally these timbers are planed and have rounded edges with specific sizes (38x89 mm and 38x140 mm being especially common); theses sizes tend to be exact sizes.

When timber is machined or planed to achieve a uniform dimension this could be carried out on the face or the edge of the timber or both the face and edge. If all the surfaces are planed then the timber is *planed all round* (PAR) or *planed 4 sides* (P4S). If the timber is worked then this will change the original target size.

Minimum timber sizes

Where timber size is specified to be a minimum size then as the name suggests the timber size should not be less than that specified. In this case, the EN 336 Tolerance Classes do not apply and the moisture content to which the minimum sizes apply should be specified. An example of this would be a solid timber fire cavity barrier for which compliance with the specified size is of critical importance.

Basic timber size

There was no common understanding of this term and often it did not relate to the size of the timber supplied. It has fallen out of use but some suppliers and sawmills might still use it for calculating timber prices. Its use is not recommended.

Summary

The information provided here allows for the correct specification and ordering of timber sizes. To ensure that the supplied timber sizes comply with the specification the timber measurements should be adjusted for moisture content and tolerance class as shown in example 3.

Timber sizes should be specified by target size and Tolerance Class (either TC 1 or TC 2) as described above. If there are any special requirements (specific moisture contents, planing, rounded edges etc.) then these should be specified as well. Following this practice should help to avoid later dispute.

In checking supplied timber an accurate moisture meter is essential as well as good quality (e.g. Euro Class 2) measuring tapes.