Oak

Flat sawn

Quarter sawn

Family. Fagaceae

Botanical Name(s).
Quercus petraea
Quercus robur

Continent. Europe

CITES. This species is not listed in the CITES Appendices (Washington Convention 2023).

Notes. The OAK species (*Q. petraea and Q. robur*) are the dominant deciduous species in temperate Europe. The species *Q. pubescens* (Pubescent Oak, White Oak, Downy Oak, Italian Oak...) is more southern. Although similar, it has different properties (notably its behaviour during drying) and is not the subject of this sheet.

Description of logs

Diameter. From 40 to 80 cm

Thickness of sapwood. From 1 to 4 cm

Floats. Pointless

Log durability. Moderate (treatment recommended)

Description of wood

Colour reference. Light brown

Sapwood. Clearly demarcated

Texture. Very variable, fine to coarse

Grain. Straight

Interlocked grain. Absent

Notes. Light brown wood to straw colour turning darker with light. The texture is medium but can be fine or coarse according to its origin. The pearly white silver figure is large and well visible. For the same species, the colour of the wood can vary greatly depending on the origin of the wood, the vegetation conditions and the sylviculture.

Physics and mechanics

The properties indicated are for mature wood. These properties may vary significantly depending on the origin and growing conditions of the wood.

Property	Average value
Specific gravity[1]	0.74
Monnin hardness[1]	4.2
Coefficient of volumetric shrinkage	0.44 % per %
Total tangential shrinkage (St)	9.7 %
Total radial shrinkage (Sr)	4.5 %
Ratio St/Sr	2.2
Fibre saturation point	31 %
Thermal conductivity (λ)	0.24 W/(m.K)

Lower heating value	18,390 kJ/kg
Crushing strength[1]	58 MPa
Static bending strength[1]	105 MPa
Modulus of elasticity[1]	13,300 MPa

[1] *At 12 % moisture content, with 1 MPa = 1 N/mm*

Notes. Oak trees with a slow growth have a smaller density than oak trees with a rapid growth. Several bibliographical sources mention a thermal conductivity for oak varying from 0.16 to 0.19 W/(m.K). The value of 0.24 W/(m.K) given above is the result of a test campaign, the results of which are given in the preliminary chapter "User guide: general information" of the Tropical Timber Atlas (https://www.itto.int/files/itto_project_db_input/3028/Technical/ITMT-SDP-010-12-R1-M-Tropical%20Timber%20Atlas.pdf).

Natural durability and preservation

Resistance to fungi. Class 2 - durable

Resistance to dry wood borers. Class D - durable (sapwood demarcated, risk limited to sapwood)

Resistance to termites. Class M - moderately durable

Treatability. Class 4 - not permeable

Use class ensured by natural durability.

Class 3 - not in ground contact, outside

Notes. This species is listed in the European standard NF EN 350 (2016). Durability is linked to the presence of water soluble tanins. It decreases with tanins washing in case of harsh exposition. According to the European standard NF EN 335 (2013), performance length might be modified by the intensity of end-use exposition.

Requirement of a preservative treatment

Against dry wood borer. Does not require any preservative treatment

In case of temporary humidification. Does not require any preservative treatment

In case of permanent humidification. Requires appropriate preservative treatment

Drying

Drying rate. Slow

Risk of distorsion. High risk

Risk of casehardening. No known specific risk

Risk of checking. High risk

Risk of collapse. Yes

Suggested drying program.

Phases	Duration (H)	MC (%) probes	T (°C)	Rh (%)	UGL (%)
Prewarm 1		> 50	40	86	17.0
Prewarm 2	4	> 50	43	85	16.5
Drying		> 50	45	83	15.7
		50 - 40	45	80.0	14.6
		40 - 35	45	77.0	13.8
		35 - 30	45	74.0	12.9
		30 - 27	47	69.0	11.5
		27 - 24	49	61.0	9.9
		24 - 21	50	52.0	8.4
		21 - 18	53	48.0	7.7
		18 - 15	56	41.0	6.6
		15 - 12	59	36.0	5.9
		12 - 9	61	30.0	5.0
		9 - 6	65	29.0	4.7
Conditioning	8		58	(3)	(2)
Cooling	(1)		Arrêt	(3)	(2)

(1)) Cooling: until the temperature inside the kiln no longer exceeds external temperature by more than 30 °C.

(2) UGL = final H% x 0,8 to 0,9.

(3) Subtract RH from the UGL determined in (2) and temperature, using the Hailwood-Horrobin equation.

Sawing and machining

Blunting effect. Normal

Sawteeth recommended. Stellite-tipped

Cutting tools. Tungsten carbide

Peeling. Good

Slicing. Good

Notes. Steaming is recommended before slicing.

Assembling

Nailing and screwing. Good but pre-boring necessary

Notes. Gluing must be done with care: wood is dense, slightly acid, rich in tanins, and prone to stain. Nail or screw corrosion if in contact with humidity.

Commercial grading

Appearance grading for sawn timbers.
According to European standard EN 975-1 (April 2009): possible grading for boules Q-BA, Q-B1, Q-B2, Q-B3, Q-B4; possible grading for individual selected boards Q-SA, Q-S1, Q-S2, Q-S3, Q-S4; possible grading for strips and square edged timber Q-F1a, Q-F1b, Q-F2, Q-F3, Q-F4 (for strips and square edged timbers, X or XX suffix indicates the presence and the size of sound sapwood); possible grading for baulks Q-PA, Q-P1, Q-P2.

Visual grading for structural applications
According to European standard EN 1912 (2012) and associated national standards, strength class D30 can be provided by visual grading. Strength classes D18, D24 and D30, however, can be provided by visual grading according to French standard NF B 52-001-1/A3 (2018).

Fire safety

Conventional French grading.

Thickness > 14 mm: M3 (moderately inflammable)
Thickness < 14 mm: M4 (easily inflammable)

Euroclasses grading. D-s2, d0

Default grading for solid wood, according to requirements of European standard EN 14081-1+A1 (August 2019).
It concerns structural graded timber in vertical uses and ceiling with mean density upper 0.35 and thickness upper 22 mm.

End-uses

- Cabinetwork (high class furniture)
- Cooperage
- Exterior joinery
- Flooring
- Heavy carpentry
- Hydraulic works (fresh water)
- Interior joinery
- Moulding
- Seats
- Sleepers
- Sliced veneer
- Stairs (inside)
- Turned goods
- Wood-ware

Notes. Tanins create a risk of smudges on woods if not well dried or if machined in a non protected area or if no product is used for protection or finish.

The flour store, Cluny Abbey - France (© Daniel GUIBAL)

Main local names

Country	Local name
France (temperate timber)	Chêne
France (temperate timber)	Chêne blanc europeen
Germany (temperate timber)	Eiche
Italia (temperate timber)	Quercia
Spain (temperate timber)	Roble
United Kingdom (temperate timber)	Oak