

A GUIDE TO TRADITIONAL OAK BARRELS

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This publication is designed to be an informative guide for the use of traditional oak barrels in the wine aging process. In this guide, you will find the different types of oak used for barrels; differences between wood grains; a description of staves, ellagitannins, tannin potential, hybrid barrels, toasting, and barrel reconditioning; a toasting wheel; a barrel selection chart based on specific wine styles; and a list of cooperages.

TYPES OF OAK

French Oak

French oak barrels are made from pedunculate oak (*Quercus robur*) or sessile oak (*Quercus petraea*) grown in the forests of France. The most notable French forests are Allier, Limousin, Nevers, Tronçais, and Vosges. Broadly speaking, French oak barrels bring more subtle aromatics and flavors to wine and give the wine a silky, elegant texture. Tighter-grain wood tends to be associated more with French oak, especially in the cold growing regions.

Cost per barrel: \$900+

American Oak

American white oak (*Quercus alba*) is the oak used for American oak barrels. Most American oak used in barrel making is grown in the eastern half of the United States, from the Appalachian Mountains to Missouri, with some forests in Minnesota, Wisconsin, Oregon, and California. American oak imparts more assertive flavors into the wine and contains sweeter, vanillin-based compounds. American oak is the least expensive of the oak barrels and tends to be looser in grain.

Cost per barrel: \$500-\$600

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Eastern European Oak

As the name implies, Eastern European oak grows in Eastern European countries such as Romania, Hungary, and Slovenia. Eastern European oak and French oak have very similar aromas, flavors, and mouthfeel. This is because Eastern European oak and French oak are of the same species of oak tree (*Quercus robur* or *Quercus petraea*). Eastern European oak is used with many full-bodied wine varieties and imparts firm tannin structure with subtle oak aromas. Costing less than French oak, Eastern European oak is often seen as a midway point between French and American oak.

Cost per barrel: \$700-\$800

GRAIN TIGHTNESS IN OAK WOOD

Grain tightness in oak wood is the average distance between annual growth rings. A growth ring is the annual growth in girth, or width, of a tree for 1 year from early spring to winter. Older trees grow slower than younger trees, and trees grown in cool climates have a tighter grain than trees that grow in warmer climates. The very best oak trees used for barrel making are old oak trees grown in cooler growing regions.

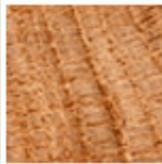
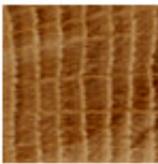
			
Course/ loose/ open grain >3.0mm	Medium grain 2.0-3.0mm	Fine grain 1.5-2.0mm	Extra- or super-fine grain <1.5mm

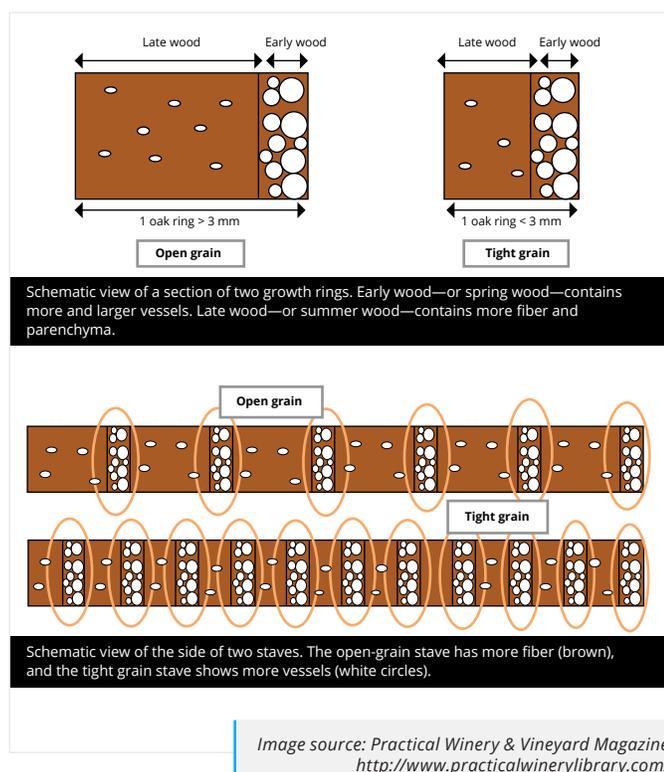
Image source: Vicard Cooperage, <https://www.groupe-vicard.com/en>

How grain tightness influences flavor and aromatics in wine

The tightness of grain within an oak barrel makes a huge difference in whether your wine will be delightfully aromatic or aggressively tannic. Super-fine grain releases more aromatics, while open grain gives more tannins. This is due to the ratio of spring wood (early wood) to summer wood (late wood) within an annual growth ring.

Contrary to popular belief, tight grain is actually more porous than loose grain. During spring growth, when the tree breaks dormancy, the oak tree draws up stored sap from its roots and pushes it through its trunk, toward the end of its branches to develop new leaves and shoots. When this happens, it creates large and numerous vessels, or pores, within the wood. These pores allow for more aromas to be released into the wine, as they once transported minerals, nutrients, and sugars. Spring wood is very consistent in size from year to year.

Summer wood consists of the trees' growth throughout the year after spring has passed. Summer wood varies depending on the growing climate (temperature, rainfall, sunlight, soil type, etc.) and majorly contributes toward grain tightness. After bud break, the leaves photosynthesize to create sugars and saccharides, which are stored in dense fibers within the tree (Pracomtal et al., 2014). These fibers compose summer wood and add to growth. Fibers are dense and contain fewer vessels than spring wood, which gives more tannin structure to the wine.



STAVES

Staves are the planks of wood that make up an oak barrel. Barrel staves have to be seasoned outdoors for at least 2 years before they can be used for barrel making. This outdoor seasoning process dries the wood naturally yet slowly. Staves are used to build the barrel, as well as the barrel ends, which are called “barrel heads.” Staves are cut to the same length, tapered, and beveled. Staves are concave on the inside and vary in width. This variation in stave width gives the skilled cooper more options for making a tighter barrel. Once the barrel is assembled with metal hoops, the taper of the staves, along with its concave design, causes the barrel to bulge in the middle. This bulge is called the “bilge.” Traditionally, as still today, the bilge helps roll and maneuver the barrel.

Barrel heads are circular and made of short staves—they are flat and untapered. Barrel heads fit into a “croze,” which is a groove that is cut on the inside of the barrel, close to the ends. The barrel “chime” is the rim of the barrel where the long barrel staves overlap the barrel head.

ELLAGITANNINS AND TANNIN POTENTIAL

Ellagitannins are hydrolysable tannins that are found in oak wood and react strongly with oxygen (Zhang et al., 2015). Ellagitannins that are extracted by the wine through *élevage*—or oak barrel aging—help protect the wine against oxidation, confer astringency, and help with prolonged color stability. During barrel making, ellagitannins can be degraded during the toasting process (Watrelot and Waterhouse, 2018). Higher toasting temperatures and longer toasting times can lead to a higher degradation of ellagitannins. The concentration of ellagitannins within an oak barrel will also vary by tannin potential (TP) of the oak stave.

Tannin potential refers to the concentration of total ellagitannins within a single untoasted oak stave and is predicted using near-infrared spectroscopy (NIRS) (Nikolantonaki et al., 2019). NIRS measures the micrograms of ellagitannins per gram of dry wood ($\mu\text{g/g}$) and helps categorize oak staves into low tannin potential (LTP), medium tannin potential (MTP), or high tannin potential (HTP). Tannin potential will vary from stave to stave, regardless of oak type or forest origin. However, grain tightness plays a role in tannin potential, as looser grain is usually associated with higher tannin potential. This is not a constant rule, though, as finer-grain wood can still net higher tannin potential on occasion.

Tannin potential also contributes to aromas released into the wine. At the same toasting level, HTP barrels exhibit more intense empyreumatic notes—or having an odor of burnt organic matter as a result of pyrolysis—such as toast,

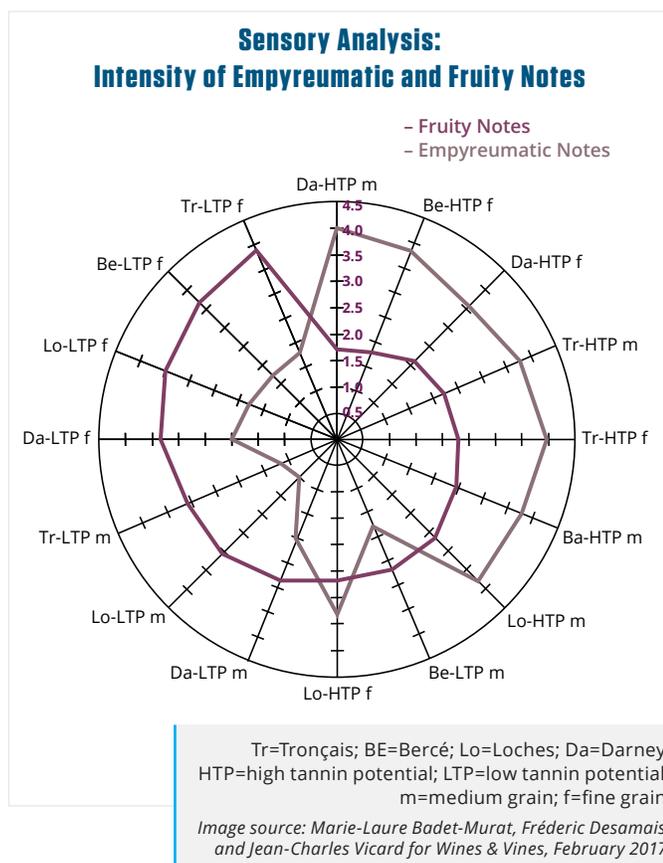
caramel, coffee, and chocolate, while LTP barrels express fruity characteristics (Badet-Murat et al., 2017).

Empyreumatic – Having an odor of burnt organic matter as a result of pyrolysis.

Charts via Wines & Vines Magazine:

DISTRIBUTION OF TANNIN POTENTIAL BY GRAIN SIZE			
	LOW TP	MEDIUM TP	HIGH TP
Fine grain	69%	17%	14%
Medium grain	17%	33%	50%

TP=Tannin Potential



Hybrid barrels

Hybrid oak barrels are barrels that are made using at least two different types of oak. All three types of oak can be used when making a hybrid barrel, although it is less common. The most common hybrid barrels use both American oak and French oak. Hybrid barrels can be made by using one type of oak for the barrel hull and another type of oak for the barrel heads, or by interspersing different oak staves throughout the entire barrel. The common percentage of oak used for hybrid barrels is 75:25 American/French oak or an even 50:50 mix. A 33:33:34 percentage would be common when using all three oak types together.

Hybrid oak barrels offer a combination of flavors and aromas from each kind of oak used. However, hybrid barrels will not attribute the full sensation you would get when using a single, one-oak type barrel. Hybrid barrels allow for greater creativity when oak aging wine, as it is important to keep in mind the desired style of the finished wine.

The price of a hybrid barrel falls somewhere between the prices of the type of oak used. Adding French oak barrel heads to an American oak barrel hull seems to be an economic way to deliver a bit of French oak attributes into an aging wine (Newton and Nolan, n.d.).

TOASTING

Toasting an oak barrel breaks down the wood's molecular structure by pyrolyzing lignin, cellulose, and hemicellulose. The decomposition of organic matter by heat at high temperatures gives the tannins a softer and more mellow feel while also changing the barrel's flavor. Placing the barrel hull over an open flame is the most common way to toast a barrel, and from a practical standpoint, toasting the wood also helps the cooper bend the staves into a barrel shape.

Convection toasting is another way to toast a barrel, which involves heating the inside of the barrel without an open flame. The barrel hull is first steamed and then fitted with stainless steel heads. A metal rod is inserted through one of the heads to transfer hot air into the barrel. This hot air then toasts the inside of the barrel to the desired level. Convection toasting has been claimed to be more precise and less prone to blistering the wood, as opposed to an open flame.

Vanillin compounds are commonly released as a result of toasting and can be found in some variation at all toasting levels. Toasted oak barrels can only be used about four different times before they are considered "neutral." Neutral oak barrels can still be used to store wine but will not offer any flavors or aromas to the wine. Neutral oak barrels can be reconditioned to extend their use.

BARREL RECONDITIONING

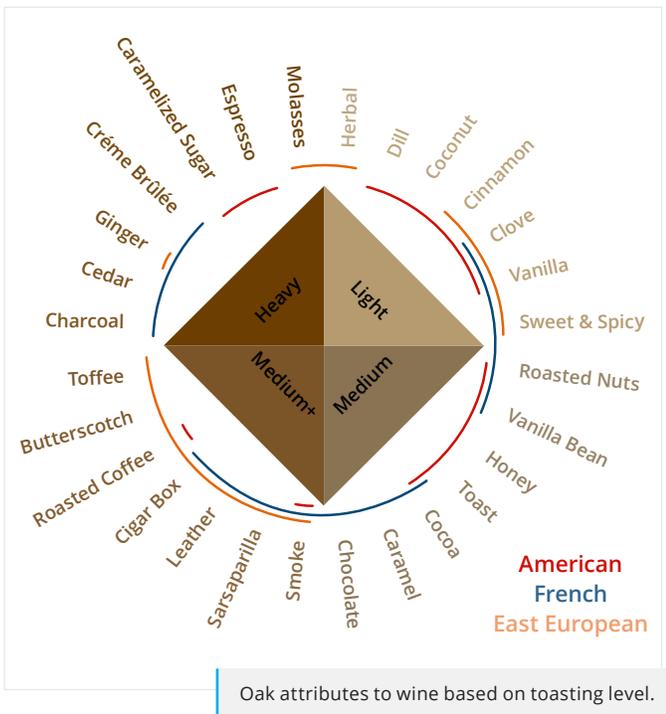
As barrels wear out with repeated use, they can be reconditioned to restore lost flavors. Reconditioning oak barrels is the process of deconstructing the barrel, shaving the inside of the oak staves to remove tartrates and expose fresh wood, cleaning, retoast, and then reassembling. Another technique used for reconditioning oak barrels is called "barrel blasting." Barrel blasting involves blasting the oak barrel with dry ice (solid CO₂), which removes tartrates without removing the toast. Since the toast is not removed, there is no need to retoast the barrel.

Both reconditioning techniques breathe new life into old oak barrels and help to extend their use. The cost of the reconditioning barrels can vary from \$55 to \$100 per barrel.

RED WINE				
STYLE	OAK	TOAST	GRAIN/TP	AGE
Young red	American oak	L/M	Loose/HTP	6–10 months
No fuss table wine	American oak	M	Medium/MTP, HTP	8–12 months
Reserve or proprietary blend	American, French, or Eastern European oak	L/M/M+/H	Any/Any	10–24 months
Intense fruit made from very ripe grapes	French oak	M/M+/H	Super Fine/LTP	12–24 months
Premium wine with extended ageability	Eastern European or French oak	M/M+	Fine, Super Fine/MTP, HTP	12–24 months
Fortified wines	Eastern European or French oak	M-M+/H	Medium, Fine/MTP	1–5 years

WHITE WINE				
STYLE	OAK	TOAST	GRAIN/TP	AGE
Most Whites	No oak			
Viognier/Chenin Blanc/ Pinot Grigio/Survinon Blanc	Eastern European or French oak	L/M/M+/H	Fine/LTP	6–12 months
Barrel Fermented Chardonnay	French oak	M/M+	Super Fine/LTP	<i>Sur lies</i> 6–12 months
Orange wines	Eastern European or French oak	M	Fine/MTP	6–12 months

This table is a very broad and general guide, as it does not take into account of the environment where the barrels will be, the percentage of new oak, aging time, and other possible impacting factors.



A LIST OF COOPERAGES

Vicard Cooperage – Cognac, France

<https://www.groupe-vicard.com/en>

Taransaud Cooperage – Merpins, France

<https://www.taransaud.com/en/>

Canton Cooperage – Santa Rose, CA

<https://www.cantoncooperage.com>

Kadar Cooperage – Budapest, Hungary

<http://www.kadarhungary.com>

Boros Oak Barrels – Budapest, Hungary

<http://www.borosoakbarrels.com>

Unicom Wood Production – Rosiorii de Vede, Romania

<http://unicom-group.ro/woodprod/en/barrels.html>

Barrel Builders – Calistoga, CA

<https://barrelbuilders.com>

Seguin Moreau – Napa, CA

<https://www.seguinmoreaunapa.com>

World Cooperage – Napa, CA

<http://www.worldcooperage.com>

Tonnellerie Radoux – Napa, CA

<http://tonnellerieradoux.com>

Barrel Blasting – Napa, CA

<http://www.barrelblasting.com>

Rewine Barrels – Jefferson, OR

<https://www.rewinebarrels.com>

Oregon Barrel Works – McMinnville, OR

<http://oregonbarrelworks.com/index.html>

East Coast Wood Barrels – Medford, NY

<https://eastcoastbarrels.com>

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