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THE HOW-TO HOMEBREW BEER MAGAZINE

REFERENCE GUIDE



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GRAINS AND ADJUNCTS

Brewer's little helper: Here's a composite list of grains and adjuncts. The color is listed in degrees Lovibond and the gravity is calculated from 1 pound of the ingredient in 1 gallon of water. Experiment and enjoy!

Malt	L	G	Description
AMERICAN GRAINS			
Crystal Malt	10°	1.033-35	Sweet, mild caramel flavor and a golden color. Use in light lagers and light ales.
Crystal Malt	20°	1.033-35	Sweet, mild caramel flavor and a golden color. Use in light lagers and light ales.
Crystal Malt	30°	1.033-35	Sweet, mild caramel flavor and a golden color. Use in light lagers and light ales.
Crystal Malt	40°	1.033-35	Sweet, mild caramel flavor and a light red color. Use in red and amber ales.
Crystal Malt	60°	1.033-35	Sweet caramel flavor, deep golden to red color. For dark amber and brown ales.
Crystal Malt	80°	1.033-35	Sweet, smooth caramel flavor and a red to deep red color. For porters, old ales.
Crystal Malt	90°	1.033-35	Pronounced caramel flavor and a red color. For stouts, porters and black beers.
Crystal Malt	120°	1.033-35	Pronounced caramel flavor and a red color. For stouts, porters and black beers.
Black Patent Malt	500°	1.026	Provides color and sharp flavor in stouts and porters.
Roasted Barley	300°	1.025	Sweet, grainy, coffee flavor and a red to deep brown color. For porters and stouts.
Black Barley	525°	1.023-27	Imparts dryness. Unmalted; use in porters and dry stouts.
Chocolate Malt	350°	1.034	Use in all types to adjust color and add nutty, toasted flavor. Chocolate flavor.
Dextrin Malt (carapils)	1.5°	1.033	Balances body and flavor without adding color, aids in head retention. For any beer.
Pale Malt (Brewers 2-row)	1.8°	1.037-1.038	Smooth, less grainy, moderate malt flavor. Basic malt for all beer styles.
Pale Malt (Brewers 6-row)	1.8°	1.035	Moderate malt flavor. Basic malt for all beer styles.
Munich Malt	10°	1.034	Sweet, toasted flavor and aroma. For Oktoberfests and malty styles.
Special Roast	50°	1.035	Provides a deep golden to brown color for ales. Use in all darker ales.
Vienna Malt	3.5-4°	1.035	Increases malty flavor, provides balance. Use in Vienna, Märzen and Oktoberfest.
Victory Malt	25°	1.034	Provides a deep golden to brown color. Use in nut brown ales, IPAs and Scottish ales.
Wheat Malt	2°	1.038	Light flavor and creamy head. For American weizenbier, weissbier and dunkelweiss.
White Wheat Malt	2°	1.037	Imparts a malty flavor. For American wheat beers, wheat bock and doppel bock.
BELGIAN GRAINS			
Aromatic Malt	20-26°	1.036	Imparts a big malt aroma. Use in brown ales, Belgian dubbels and tripels.
Biscuit Malt	23-25°	1.035	Warm baked biscuit flavor and aroma. Increases body. Use in Belgian beers.
Caramunich Malt	56°	1.033	Caramel, full flavor, copper color. For Belgian ales, German smoked and bocks.
Caravienne Malt	21-22°	1.034	Belgian light crystal malt. Used in lighter Abbey or Trappist style ales.
Pale Ale Malt	2.7-3.8°	1.038	Use as a base malt for any Belgian style beer with full body.
Pilsen Malt	1.5°	1.037	Light color, malty flavor. For pilsners, dubbels, tripels, whites and specialty ales.
Special B Malt	130-220°	1.030	Extreme caramel aroma and flavor. For dark Abbey beers and other dark beers.

KEY: L = Degrees Lovibond • G = Gravity

Malt	L	G	Description
BRITISH GRAINS			
Amber Malt	35°	1.032	Roasted malt used in British milds, old ales, brown ales, nut brown ales.
Brown Malt	65°	1.032	Imparts a dry, biscuit flavor. Use in porters, brown, nut brown and Belgian ales.
Maris Otter Pale Malt	3°	1.038	Premium base malt for any beer. Good for pale ales.
Pale Ale	2.2°	1.038	Moderate malt flavor. Used to produce traditional English and Scottish style ales.
Lager Malt	1.6°	1.038	Used to make light colored and flavored lagers.
Crystal Malt	55-60°	1.033-35	Sweet caramel flavor, adds mouthfeel and head retention. For pale or amber ales.
Dark Crystal Malt	145-188°	1.033-35	Sweet caramel flavor, mouthfeel. For porters, stouts, old ales and any dark ale.
Mild Ale Malt	2.3-2.7°	1.037	Dry, nutty malty flavor. Promotes body. Use in English mild ales.
Cara-Pils Dextrin	10-14°	1.033	Adds body; aids head retention. For porters, stouts and heavier bodied beers.
Chocolate Malt	395-475°	1.034	Nutty, toasted flavor, brown color. Use in brown ales, porters, stouts and bocks.
Black Patent Malt	500-600°	1.026	Dry, burnt, chalky character. Use in porters, stouts, brown ales and dark lagers.
Peat Smoked Malt	2.8°	1.034	Imparts a robust smoky flavor and aroma. For Scottish ales and wee heavies.
Roasted Barley	500°	1.025	Dry, roasted flavor, amber color. For stouts, porters and Scottish ales.
Toasted Pale Malt	25°	1.038	Imparts nutty flavor and aroma. Use in IPAs and Scottish ales.
Wheat Malt	2°	1.038	Light flavor, creamy head. For wheat beers, stouts, doppelbocks and alt beers.
Torrified Wheat	1-1.5°	1.036	Puffed wheat created by high heat. Use in pale ales, bitters and milds.
GERMAN GRAINS			
Acidulated (Sauer) Malt	1.7-2.8°	1.033	High lactic acid. For lambics, sour mash beers, Irish stout, pilsners and wheats.
Carafa I	300-340°	1.038	Gives deep aroma and color to dark beers, bocks, stout, alt and schwarzbier.
Carafa II	375-450°	1.038	Carafa I, II and III also are available de-husked. Adds aroma, color and body.
Carafa III	490-560°		
Chocolate Wheat Malt	375-450°	1.038	Intensifies aroma; improves color. For dark ales, alt, dark wheat, stout and porter.
Chocolate Rye Malt	190-300°	1.030	Enhances aroma of dark ales and improves color. For dunkel rye wheat and ale.
CaraHell Malt (light crystal)	8-12°	1.033-35	For light colored beer for body; hefeweizen, pale ale, golden ale, Oktoberfest.
CaraMunich Malt I	30-38°	1.033-35	Provides body. For Oktoberfest, bock, porter, stout, red, amber and brown ales.
CaraMunich Malt II	42-50°	1.033-35	CaraMunich Malt III is dark crystal.
CaraMunich Malt III	53-60°	1.033-35	
Light Munich Malt	5-6°	1.034	For a desired malty, nutty flavor. Lagers, Oktoberfests and bock beer.
Dark Munich Malt	8-10°	1.034	Enhances body and aroma. Stout, schwarzbier, brown ale, dark and amber ales.
Melanoidin Malt	23-31°	1.033	For amber lagers and ales, dark lagers and ales, Scottish & red ales.
Rauch Smoked Malt	2-4°	1.037	For rauchbier, kellerbier, smoked porters, Scottish ales and barleywines.
Rye Malt	2.8-4.3°	1.029	Dry character. Can use as a base malt. For seasonal beers, roggenbier and ales.
Wheat Malt Light	1.5-2°	1.039	Typical top fermented aroma, produces superb wheat beers.
Wheat Malt Dark	6-8°	1.039	
Caramel Wheat Malt	38-53°	1.035	For dark ales, hefeweizen, dunkelweizen, wheat bocks and double bocks.
OTHER MALTS, GRAINS AND FLAKED GRAINS AND ADDITIONS			
Gambrinus Honey Malt	25°	1.034	Nutty honey flavor. For brown ales, Belgian wheats, bocks and many other styles.

Malt	L	G	Description
Scotmalt Golden Promise	2-4°	1.038	Scottish pale ale malt; base malt for all Scottish beers.
Flaked Barley	1.5°	1.032	Helps head retention, imparts creamy smoothness. For porters and stouts.
Flaked Maize	1°	1.037	Lightens body and color. For light American pilsners and ales.
Flaked Oats	1°	1.033	Adds body and creamy head. For stouts and oat ales.
Flaked Rye	2°	1.036	Imparts a dry, crisp character. Use in rye beers.
Flaked Wheat	2°	1.036	Imparts a wheat flavor, hazy color. For wheat and Belgian white beers.
Grits	1-1.5°	1.037	Imparts a corn/grain taste. Use in American lagers.
Irish Moss	NA	NA	Prevents chill haze. Use in all beers except cloudy wheat and white beers.
Malto Dextrin	NA	1.043	Adds body and mouthfeel. For all extract beers. Does not ferment.
Oak Chips	NA	NA	Creates cask-conditioned flavor and aroma. Use in IPAs, Belgian ales and Scottish ales. Steam for 15 minutes to sanitize.
SUGARS			
Belgian Candi Sugar (clear)	0.5°	1.036	Smooth taste, good head retention, sweet aroma and high gravity without being apparent. Use in Belgian and holiday ales. Use clear for tripels, amber for dubbels, and dark is used in brown beer and strong golden ales.
Candi Sugar (amber)	75°	1.036	
Candi Sugar (dark)	275°	1.036	
Brown Sugar	40°	1.046	Imparts rich, sweet flavor. Use in Scottish ales, old ales and holiday beers.
Dark Brown Sugar	60°	1.046	Imparts rich, sweet flavor. Use in Scottish ales, old ales and holiday beers.
Corn Sugar	1°	1.037	Use in priming beer or in extract recipes where flaked maize would be used in a mash.
Demerara Sugar	1°	1.041-42	Imparts mellow, sweet flavor. Use in English ales.
Dextrose (glucose)	1°	1.037	Imparts a mild sweet taste and smoothness. Use in English beers.
Dry Malt Extract	varies	1.044	Extra light (2.5°), Light (3.5°), Amber (10°), Dark (30°), Wheat (3°)
Honey	varies	1.032	Imparts sweet and dry taste. For honey and brown ales. Also: specialty ales.
Invert Sugar	NA	1.046	Increases alcohol. Use in some Belgian or English ales. Use as an adjunct for priming. Made from sucrose. No dextrins. Use 1 cup for priming.
Lactose	NA	1.043	Adds sweetness and body. Use in sweet or milk stouts.
Licorice Stick	NA	NA	Adds a smooth flavor to stouts, porters, holiday ales and flavored beers.
Lyle's Golden Syrup	0°	1.036	Increases alcohol without flavor. Liquid Invert Sugar. Use in English and Belgian (Chimay) ales.
Maple Syrup	35°	1.030	Imparts a dry, woody flavor if used in the boil. If beer is bottled with it, it gives it a smooth sweet, maple taste. Use in maple ales, pale ales, brown ales and porters.
Maple Sap	3°	1.009	Crisp dry, earthy flavor. Use in pale ales, porters and maple ales.
Molasses	80°	1.036	Imparts strong sweet flavor. Use in stouts and porters.
Rice Solids	.01°	1.040	Lightens flavor without taste. Use in American and Asian lagers.
Sucrose (white table sugar)	NA	1.046	Increases alcohol. Use in Australian lagers and English bitters.
Syrup Malt Extract	varies	1.033-1.037	Extra Light (3.5°), Light (3.5 -5°), Amber (10°), Dark (30°), Wheat (2°).
Treacle	100°	1.036	Imparts intense, sweet flavor. A British mixture of molasses, invert sugar and golden syrup (corn syrup). Use in dark English ales.

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B R E W E R ' S
DEFINITIONS AND CALCULATIONS

FROM ATTENUATION TO TEMPERATURE PROFILE MASHING: A BASIC BREWER'S GLOSSARY

alcohol by volume (ABV):

Method of expressing alcoholic content of a beverage based on alcohol volume and beverage volume. For example, a beer containing 5% alcohol by volume contains 5 milliliters of ethanol per 100 milliliters of beer.

alcohol by weight (ABW):

Method of expressing alcoholic content of a beverage based on alcohol weight and beverage weight. For example, a beer containing 5% alcohol by weight contains 5 grams of ethanol per 100 grams of beer. ABW is approximately equal to ABV multiplied by 0.79 (the density of alcohol). Since the specific gravity of beer varies and the conversion between beer volume and beer weight depends on specific gravity, this conversion is not exact.

alpha acids:

A class of substances in hops that contribute bitterness to beer.

alpha acid unit (AAU):

Alpha acid units are calculated by multiplying the alpha acid content of hops by the weight in ounces of the hops. For example, 1 ounce of 4% alpha acid hops contain 4 AAUs, and 0.75 ounces of 4% alpha acid hops contain 3 AAUs.

apparent degree of fermentation (ADF):

An expression representing reduction in specific gravity as measured with a hydrometer. $ADF = ((OG - FG) / (OG)) \times 100$. OG and FG must either be expressed in degrees Plato or gravity points; for example, 48 instead of 1.048. Beer with an original gravity of 1.048 (or 12° Plato) and a final gravity of 1.012 (or 3° Plato) has an ADF of 75%.

attenuate:

To weaken or reduce the density of liquid. In brewing terms, attenuate refers to the reduction in wort specific gravity as it is fermented.

brewhouse yield:

The amount of extract obtained from malt or adjuncts compared to the theoretical or laboratory yield. Brewhouse yield is a measure of efficiency.

condition:

To render fit. Brewers refer to aging and carbonation techniques as conditioning, as in bottle conditioning.

decoction:

Method of mashing that involves boiling a portion of the mash. The boiled portion of the mash is later added to the "rest mash," causing an increase in the temperature of the rest mash. A single decoction mash has one boiling step, a double decoction has two and a triple decoction has three.

dry hop:

To add hops to beer during or after fermentation.

EBC color:

A spectrophotometric color method adopted by the European Brewer Convention (EBC) that uses a wavelength of 530 nm. EBC color numbers are higher than ASBC (same as Lovibond and SRM): $EBC\ color = 2.65 \times ASBC\ color - 1.2$.

enzyme:

Any of numerous proteins with specific biochemical, catalytic properties. Enzyme names all end with the suffix -ase and the word preceding the suffix either refers to the compound for which the enzyme has specificity or the type of reaction the



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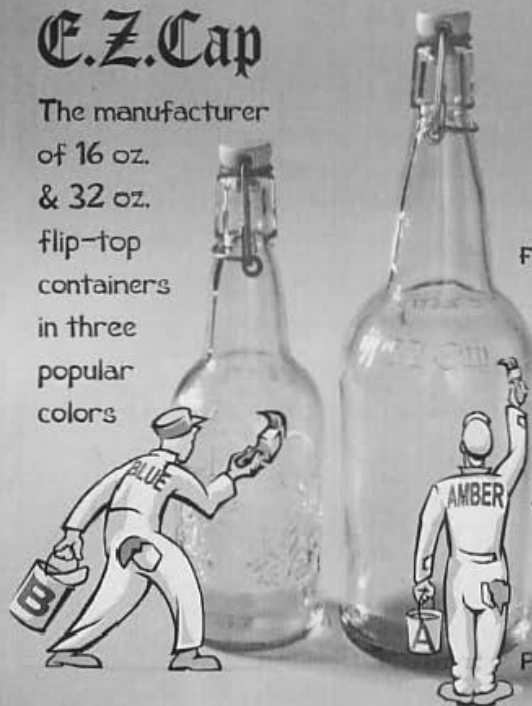
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CALCULATIONS & DEFINITIONS

enzyme catalyzes. For example, amylases are a class of enzymes that have specificity for starch (amylose and amylopectin are starches) and dehydrogenase enzymes catalyze the transfer of hydrogen atoms from one compound to another.

evaporation rate:

The percentage of water evaporated during one hour of boiling. For example, if 6 gallons of wort is reduced to 5.5 gallons during 90 minutes of boiling, the evaporation rate is equal to $((6-5.5)/6)/1.5 * 100$ or 5.6% evaporation per hour. Most brewers try to evaporate 8 to 10% of the initial wort during boiling.

extract yield:

The quantity of soluble solids extracted from malt and adjuncts during wort production. Extract yield is expressed as a weight percent.

final gravity (FG):

The specific gravity of beer after fermentation is complete. Also referred to as terminal gravity.

flocculate:

To form fluffy or lumpy masses. Yeast has a tendency to flocculate at the end of fermentation and some strains have better flocculating properties than others; yeast strains that tend to flocculate well are referred to as highly flocculent.

infusion:

Method of mashing that does not involve boiling (see decoction). Infusion mashing is most commonly used to refer to a single temperature mash.

International Bitterness Unit (IBU):

The weight of iso-alpha acids contained in a volume of beer. One liter of beer with 25 IBUs contains 25 milligrams of iso-alpha acids.

iso-alpha acids:

Isomerized alpha acids. Iso-alpha acids are much more soluble in aqueous solutions than alpha acids.

isomerize:

To convert a chemical substance to an isomeric form. Alpha acids are isomerized during boiling and are referred to as iso-alpha acids after boiling.

kraeusen:

To carbonate by adding a portion of actively fermenting beer in the very early stages of fermentation to beer that is fully attenuated.

lag time:

The period of time between adding yeast and the first indication of yeast growth and fermentation.

lauter:

The process used to separate wort from mash solids. The vessel used for lautering is referred to as a lauter tun.

Lovibond:

A system of color measurement using colored reference disks for grain, wort and beer. Water is 0° Lovibond, very pale beers are less than 5° Lovibond and stouts are usually greater than 60° Lovibond. Malts range in color from 2° Lovibond for pale malts to over 500° Lovibond for roasted malts.

malt:

Grain, usually barley, that has been hydrated (steeped), germinated and kilned. Malted grains contain enzymes, especially amylase enzymes, not present prior to germination.

mash out:

To stop enzymatic activity and reduce wort viscosity by increasing the mash temperature at the end of mashing. A typical mash out temperature is 170° F.

mash:

A mixture of malted grains, unmalted grains (sometimes) and water resulting in the enzymatic conversion of starch to fermentable sugars.

original gravity (OG):

The specific gravity of wort prior to fermentation.

partial mashing:

Producing wort by using a combination of grains and extracts.

pH:

A logarithmic scale ranging from 0 to 14 used to express the concentra-

tion of hydrogen ions in solution.

Acidic solutions range from pH 0 to 7 and basic or alkaline solutions range from pH 7 to 14. pH 7 is considered neutral.

pitching rate:

The amount of yeast added to wort prior to fermentation. Pitching rate is most commonly expressed in yeast cells per milliliter of wort and



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usually ranges from 5 million to 15 million yeast cells per milliliter of wort.

primings:

Fermentable solutions, usually corn sugar or wort, added to beer for the purpose of carbonation.

sparge:

To rinse extract from mash solids with hot water. Sparge water is usually heated to about 170° F. Sparge water hotter than this temperature is implicated in extracting too much tannin from the malt husk, resulting in excessive astringency in the finished beer.

Standard Reference Method (SRM):

A method of color measurement using a spectrophotometer set to a wavelength 430 nm. SRM color units are based on Lovibond numbers so that SRM units and degrees Lovibond agree. The SRM method

was developed by the American Society of Brewing Chemists (ASBC) to eliminate operator variation inherent in the Lovibond method. SRM color numbers are frequently referred to as ASBC color numbers.

strike:

To mix hot water and grains to begin the mashing process.

temperature profile mashing:

A mashing technique using multiple temperatures. Similar to decoction mashing, but does not involve boiling the mash. This method is also referred to as step mashing, upward infusion and sometimes (especially by German brewers) simply as infusion mashing.

Infusion mashing (calculation)

Traditional British brewers make their beers by infusion mashing. Infusion mashing involves heat-

ing water to a temperature higher than the desired mash conversion temperature. In an insulated vessel, the grains and the hot water are mixed. The heat of the water transfers to the malt and the mash reaches a temperature around 150° to 155° F. Using specific heat values for water and malt, hitting the desired conversion temperature in an infusion mash is easy.

Hm = heat capacity of malt = .3822 Btu/lb. °F

Hw = heat capacity of water = 1 Btu/lb. °F

Tmt = temperature of dry malt = ?° F

Tw = temperature of water = ?° F

Tma = temperature of mash = ?° F

M = weight of malt = ? lbs.

W = weight of water = ? lbs.

(1 gallon water = approx. 8.3 lbs.)

The equation:

$$W \times Hw \times (Tw - Tma) = M \times Hm \times (Tma - Tmt)$$

Now apply the equation to a recipe. The following is the grist bill for an Irish-style stout.

- 6 lbs. two-row pale malt
- 1 lb. flakes barley
- 1 lb. roasted barley
- 0.5 lb. crystal malt (40° Lovibond)

Step by step:

First, calculate the volume of mash water using .33 gallons/lb malt.

$$8.5 \text{ lbs malt} \times .33 \text{ gallons} = 2.8 \text{ gallons}$$

Now, calculate the desired water temperature.

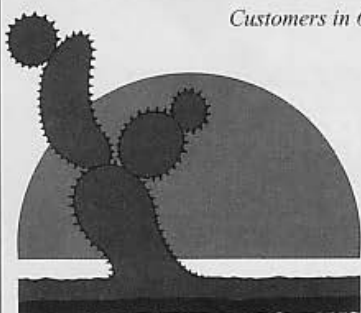
Hm = heat capacity of malt = .3822 Btu/lb °F

Hw = heat capacity of water = 1 Btu/lb °F

Tmt = temperature of dry malt = 74°F

Tw = temperature of water = ?

Tma = temperature of mash =



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150°F

M = weight of malt in lbs = 8.5 lbs.
W = weight of water = 2.8 gallons x
8.5 lbs = 23.8 lbs.

Now, substitute values into the equation and solve for Tw, the water temperature.

$W \times H_w \times (T_w - T_{ma}) = M \times H_m \times (T_{ma} - T_{mt})$

$23.8 \times 1 \times (T_w - 150^\circ) = 8.5 \times .3822 \times (150^\circ - 74^\circ)$

$T_w = 160.4^\circ \text{ F}$

For this brew, a water temperature of 160.4° F will drop to 150° F when the malt is mixed in.

When infusion mashing, use an insulated mash tun such as a picnic cooler or a pot wrapped in a sleeping bag. If you use a cooler, heat the mash water in a pot to a temperature slightly above your calculated strike temperature. Then transfer it to your mash tun. Close the lid and allow the temperature to come to equilibrium with the mash tun for 2 or 3 minutes.

If the temperature is too high add cold water by the cup until it reaches the desired temperature. If the temperature is too low, add boiling water. When the water temperature is right, mix the grains in well. Cover with a lid and allow the solution to come to equilibrium for a few minutes. Then check to make sure the mash temperature is correct. Once you are satisfied that you have reached the right temperature, leave the mash alone for an hour and allow the magic of conversion to happen.

Standard Carbonation Levels

While beer averages around 2.5 volumes of CO₂, it can vary. Beers that are traditionally low in carbonation might be under two volumes, but they will taste flat. Carbonation at three volumes of CO₂ is quite high, but exceptionally spritzly beers

could reach up to five volumes of CO₂. Here are some values for the carbonation level of different styles of beer, in volumes of CO₂:

Cask ales	1.5 - 2.0
European lagers	2.4 - 2.5
American lagers	2.5 - 2.8
Wheat beers	3.0 - 5.0

If you are planning to enter your

beer in a competition, then you'll be obliged to match your carbonation to the style guidelines. For more on carbonation, see page 25.

Glossary written by Ashton Lewis. The calculations were adapted from "Feel the Heat" by Alex Fodor (BYO September 1997) and "Master the Action" by Rob Lauriston (BYO January 1996).



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HOMEBREW YEAST STRAINS

With the plethora of yeast strains available from different companies, it can be hard to keep all of the products straight. Choosing the proper yeast strain is essential to the quality of your finished beer. Here's an overview of the most common strains currently available to homebrewers from North America's leading suppliers, who provided all of the information for this chart. Though we made every attempt to be accurate and comprehensive, this list may not include every strain and yeast supplier. To find a particular strain, ask your favorite homebrew supply shop or mail-order company.

KEY:

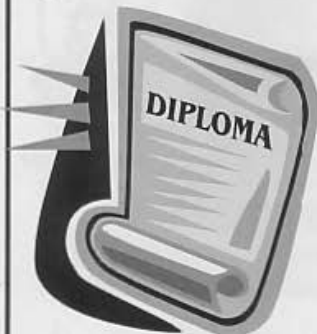
TYPE = TYPE OF YEAST • S = SLANT • D = DRY • L = LIQUID • FLOC = FLOCCULATION
ATTEN = ATTENUATION • TEMP = IDEAL FERMENTATION TEMPERATURE • YCK = YEAST CULTURE KIT COMPANY



ALE

Name and Number	Type	Lab	Floc.	Atten.	Temp.	Description
Abbey Ale WLP530	L	White Labs	Med./High	73% to 78%	Below 65° F	Produces fruitiness and plum characteristics.
Alt Ale BRY 144	L	Siebel Inst.	Medium	High	59° to 68° F	Full-flavored but clean tasting with estery flavor.
Alt Bier A 37	S	YCK	Medium	Medium	65° to 68° F	Bavarian origin, distinct profile.
American Ale A01	S	YCK	Medium	High	60° to 68° F	Clean, crisp, neutral, an all-purpose strain.
American Ale BRY 96	L	Siebel Inst.	Medium	High	64° to 72° F	Very clean ale flavor.
American Ale Y-1056	S	BrewTek				Ferments smooth, clean and malty.
American Ale 1056	L	Wyeast	Low/Med.	73% to 77%	60° to 72° F	Well balanced. Ferments dry, finishes soft.
American Ale II 1272	L	Wyeast	High	72% to 76%	60° to 72° F	Slightly nutty, soft, clean and tart finish.
Amer./California Ale YTA002	L	YeastTech	Medium	70% to 75%	63° to 68° F	All-purpose strain for any traditional ale recipe.
Amer.Microbrew. Ale #1 CL-10	S	BrewTek	Normal	73% to 76%	62° to 70° F	Clean malt flavor ideal for many American ales.
Amer.Microbrew. Ale #2 CL-20	S	BrewTek	Normal	73% to 75%	62° to 70° F	Rich and creamy malt profile with hint of diacetyl.
Australian Ale CL-270	S	BrewTek	Normal	74% to 76%	66° to 76° F	A malty, bready, nutty character with honey finish.
Australian Ale WLP009	L	White Labs	High	70% to 75%	65° to 70° F	For a clean, malty and "bready" beer.
Barleywine A08	S	YCK			65° to 68° F	Tends to leave a high residual sweetness.
Belgian Abbey II 1762	L	Wyeast	Medium	73% to 77%	65° to 75° F	Slightly fruity with a dry finish.
Belgian Ale A36	S	YCK	Medium	High	65° to 68° F	Estery and fruity with a spicy nose.
Belgian Ale WLP550	L	White Labs	Medium	72% to 78%	68° to 78° F	Phenolic and spicy flavors dominate the profile.
Belgian Ale 1214	L	Wyeast	Medium	72% to 76%	58° to 68° F	Abbey-style, top-fermenting yeast for high gravity.
Belgian Ale #1 CL-300	S	BrewTek	Med./High	75% to 77%	66° to 72° F	Robust and estery with clove and fruit.

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ALE

Name and Number	Type	Lab	Floc.	Atten.	Temp.	Description
Belgian Ale #2 CL-320	S	BrewTek	Normal	74% to 76%	66° to 72° F	Dry, fruity and estery, malt profile.
Belgian Ale #3 CL-340	S	BrewTek	Normal	74% to 76%	66° to 72° F	Trappist character with esters of spice and fruit.
Belgian Golden Ale WLP570	L	White Labs	Low	75% to 80%	68° to 75° F	A combination of fruitiness and phenolic flavors.
Belgian Saison I WLP565	L	White Labs	Medium	65% to 75%	68° to 75° F	Produces earthy, spicy, and peppery notes.
Belgian Ale Strain YTS003	L	YeastTech	Medium	High	63° to 68° F	Dry, estery flavor with light spicy character.
Belgian Strong Ale 1388	L	Wyeast	Low	73% to 77%	65° to 75° F	Fruity nose and palate, dry, tart finish.
British Ale 1098	L	Wyeast	Medium	73% to 75%	64° to 72° F	Ferments dry and crisp, slightly tart and fruity.
British Ale II 1335	L	Wyeast	High	73% to 76%	63° to 75° F	Malty flavor, crisp finish, clean, fairly dry.
British Ale WLP005	L	White Labs	High	67% to 74%	65° to 70° F	English strain that produces malty beers.
British Draft Ale CL-160	S	BrewTek	Normal	72% to 78%	64° to 70° F	Full-bodied, well-rounded flavor with diacetyl.
Brit. Microbrewery Ale CL-110	S	BrewTek	Normal	73% to 75%	64° to 69° F	A complex, oaky, fruity ester profile.
British Pale Ale #1 CL-120	S	BrewTek	Normal	75% to 77%	63° to 68° F	Bold, citrusy character; mineral and hop flavors.
British Pale Ale #2 CL-130	S	BrewTek	Normal	74% to 76%	64° to 69° F	Smooth, well-rounded; caramel and malt nuance.
British Real Ale CL-150	S	BrewTek	Low/Med.	66% to 70%	64° to 69° F	Woody, complex ester profile, mildly sweet.
Burton Ale WLP023	L	White Labs	Medium	69% to 75%	68° to 73° F	Subtle fruity flavors; apple, clover honey and pear.
California Ale WLP001	L	White Labs	Medium	73% to 80%	68° to 73° F	Clean flavors accentuate hops; very versatile.
California Ale V WLP051	L	White Labs	Med./High	70% to 75%	66° to 70° F	Produces a fruity, full-bodied beer.
Calif. Pub Brewery Ale CL-50	S	BrewTek	Normal	74% to 76%	60° to 70° F	Big, soft, well-rounded caramel malt flavor.
Canadian Ale CL-260	S	BrewTek	Normal	74% to 76%	62° to 68° F	Lightly fruity and pleasant with a complex finish.

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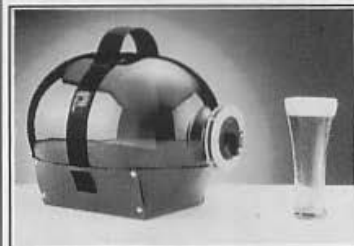
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ALE

Name and Number	Type	Lab	Floc.	Atten.	Temp.	Description
Classic British Ale CL-170	S	BrewTek	Med./High	75% to 77%	64° to 69° F	Complex ale with British tones and fruity esters.
Coopers Homebrew Yeast	D	Coopers	High	High	70° to 80° F	Clean, round flavor profile.
Dusseldorf Alt WLP036	L	White Labs	Med./High	65% to 72%	65° to 69° F	Produces clean, slightly sweet alt beers.
East Coast Ale WLP008	L	White Labs	Med./High	70% to 75%	68° to 73° F	Very clean and low esters.
Edinburgh Ale WLP028	L	White Labs	Medium	70% to 75%	65° to 70° F	Malty, strong Scottish ales.
English Ale A15	S	YCK	Medium	Medium	65° to 68° F	Complex, with strong yeast flavors.
English Ale BRY 264	L	Siebel Inst.	Very High	Medium	68° to 72° F	Clean ale with slightly nutty and estery character.
English Ale Strain YTA001	L	YeastTech	Medium	High	63° to 68° F	Used for traditional English style ales.
English Ale WLP002	L	White Labs	Very High	63% to 70%	65° to 68° F	Very clear with some residual sweetness.
European Ale 1338	L	Wyeast	High	67% to 71%	60° to 72° F	Full-bodied complex strain and dense malty finish.
German Ale A04	S	YCK	High	Medium	65° to 68° F	Clean, fruity, exquisitely flavorful light bodied ales.
German Ale 1007	L	Wyeast	Low	73% to 77%	55° to 66° F	Ferments dry and crisp with a mild flavor.
German Ale II WLP003	L	White Labs	Medium	73% to 80%	65° to 70° F	Clean, sulfur component that reduces with aging.
German Ale/Kölsch WLP029	L	White Labs	Medium	72% to 78%	65° to 69° F	A super-clear, lager-like ale.
German Ale YTA003	L	YeastTech	Low	73% to 75%	63° to 68° F	Crisp, clean German style ales.
High Gravity Eng. Ale WLP007	L	White Labs	High	70% to 80%	65° to 70° F	A clean, highly flocculant and attenuative yeast.
Irish Ale A13	S	YCK	Medium	High	65° to 68° F	Nutty, woody and complex. From Ireland.
Irish Ale 1084	L	Wyeast	Medium	71% to 75%	62° to 72° F	Slight residual diacetyl and fruitiness.
Irish Ale WLP004	L	White Labs	Med./High	69% to 74%	65° to 68° F	Light fruitiness and slight dry crispness.



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ALE

Name and Number	Type	Lab	Floc.	Atten.	Temp.	Description
Irish Ale YTA008	L	YeastTech	Medium	75%	63° to 68° F	Slight diacetyl production with some fruitiness.
Irish Dry Stout CL-450	S	BrewTek	Normal	76% to 78%	60° to 68° F	Has a bold, vinous, almost lactic character.
Kölsch CL-450	S	BrewTek	Med./High	75% to 78%	58° to 66° F	Clean, slightly yeasty aroma; subtle esters.
Kölsch 2565	L	Wyeast	Low	73% to 77%	58° to 64° F	Malty with a subdued fruitiness and a crisp finish.
Kölsch Strain YTA009	L	YeastTech	Low	75%	63° to 68° F	Combines characteristics of ale and lager yeasts.
London	D	Danstar		Med. to High	64° to 70° F	Clean and well balanced.
London Ale YTA005	L	YeastTech	High	75%	63° to 68° F	Produces very light, fruity flavors.
London Ale 1028	L	Wyeast	Medium	73% to 77%	60° to 72° F	Bold and crisp with a rich mineral profile.
London Ale III 1318	L	Wyeast	High	71% to 75%	64° to 74° F	Very light and fruity, with a soft, balanced palate.
London ESB Ale 1968	L	Wyeast	High	67% to 71%	64° to 72° F	Rich, malty character with balanced fruitiness.
Manchester	D	Danstar		Medium	64° to 70° F	Very complex, woody and full-bodied ale.
Northwest Ale 1332	L	Wyeast	High	67% to 71%	65° to 75° F	Malty, mildly fruity, good depth and complexity.
Norwich Ale YTA006	L	YeastTech	High	75%	63° to 68° F	Clean and very fast fermenting.
Nottingham	D	Danstar	High	High	57° to 70° F	Neutral for an ale yeast; fruity estery aromas.
Old German Ale CL-400	S	BrewTek	Normal	75% to 77%	58° to 66° F	Smooth, attenuated yet mild malt flavor.
Old London YTA004	L	YeastTech	High	70%	63° to 68° F	Rich, malty character balanced by yeast fruitiness.
Ringwood Ale 1187	L	Wyeast	High	68% to 72%	64° to 74° F	A malty, complex profile that clears well.
Saison CL-380	S	BrewTek	Normal	74% to 76%	66° to 72° F	Full character; mild esters of apple pie spices.
Scotch Ale A34	S	YCK	Medium	High	55° to 60° F	A rich, clean, malty profile.



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Name and Number	Type	Lab	Floc.	Atten.	Temp.	Description
Scottish Ale CL-200	S	BrewTek	Med./High	77% to 80%	60° to 68° F	Fruity, malt profile; woody ester like malt whiskey.
Scottish Ale 1728	L	Wyeast	High	69% to 73%	55° to 70° F	Suited for Scottish-style ales, high-gravity ales.
Scottish Ale YTA007	L	YeastTech	High	70%	63° to 68° F	Ideal for Scottish ales and any high-gravity ales.
Scottish Bitter CL-210	S	BrewTek	Med./High	73% to 75%	62° to 68° F	Big ester complex of ripe fruit, apricots and rose.
Stout Ale A06	S	YCK	Medium	Low	65° to 68° F	Residual diacetyl blends with dry barley.
Southwold Ale WLP025	L	White Labs	Medium	68% to 75%	66° to 69° F	Complex fruits and citrus flavors.
Super High Gravity WLP009	L	White Labs	Medium	>80%	65° to 69° F	Can ferment up to 25% alcohol. From England.
Swedish Ale 1742	L	Wyeast	Medium	68% to 72%	64° to 74° F	Scandinavian origin; floral nose, malty finish.
Thames Valley Ale 1275	L	Wyeast	Medium	72% to 76%	62° to 72° F	Clean, light malt character with low esters.
Trappe Ale A16	S	YCK	Medium	High	68° to 72° F	Typical Trappist aroma; good for Chimay.
Trappist Ale BRY 204	L	Siebel Inst.	Low	High	68° to 72° F	Dry, estery flavor with a light, clove-like spiciness.
Trappist Ale WLP500	L	White Labs	Med./Low	73% to 78%	65° to 70° F	Distinctive fruitiness and plum characteristics.
Trappist High Gravity 3787	L	Wyeast	Medium	75% to 80%	64° to 78° F	Ferments dry, rich ester profile and malty palate.
Whitbread Ale 1099	L	Wyeast	High	68% to 72%	64° to 75° F	Mildly malty and slightly fruity.
Windsor	D	Danstar		Medium	64° to 70° F	Full-bodied, fruity English ale.
Wyeast Ale Blend 1087	L	Wyeast	High	71% to 75%	64° to 72° F	A blend of the best strains to provide quick starts.
American Lager 2035	L	Wyeast	Medium	73% to 77%	48° to 58° F	Bold, complex and aromatic; slight diacetyl.
American Lager BRY 118	L	Siebel Inst.	High	Medium	50° to 57° F	Produces slightly fruity beer; some residual sugar.
American Megabrewery CL-620	S	BrewTek	Normal	74% to 76%	46° to 54° F	Best for light, clean lagers, unobtrusive yeast.



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Name and Number	Type	Lab	Floc.	Atten.	Temp.	Description
American Microbrewery CL-630	S	BrewTek	Normal	74% to 76%	48° to 56° F	Strong fermenter; clean, full-flavored malty finish.
Amer. Pilsner Lager WLP840	L	White Labs	Medium	75% to 80%	50° to 55° F	Dry and clean with a very slight apple fruitiness.
Bavarian Lager 2206	L	Wyeast	Medium	73% to 77%	48° to 58° F	Produces rich, malty, full-bodied beers.
Bohemian Lager 2124	L	Wyeast	Medium	69% to 73%	46° to 54° F	Ferments clean and malty.
California Common YTL002	L	YeastTech	High	70%	53° to 58° F	Traditional yeast for brewing West Coast lagers.
California Gold CL-690	S	BrewTek	Normal	74% to 76%	58° to 64° F	Slightly estery, well-attenuated, yet malty finish.
California Lager 2112	L	Wyeast	High	67% to 71%	58° to 68° F	Produces malty, brilliantly clear beers.
Continental Lager YTL001	L	YeastTech	High	70% to 75%	53° to 58° F	Produces clean, crisp pilsners.
Czech Pils 2278	L	Wyeast	Med./High	70% to 74%	48° to 58° F	Dry but malty finish.
Danish Lager 2042	L	Wyeast	Low	73% to 77%	46° to 56° F	Rich Dortmund style with crisp, dry finish.
East European Lager CL-680	S	BrewTek	Normal	75% to 78%	46° to 54° F	Smooth, almost creamy, clean finish, malt flavor.
European Lager II 2247	L	Wyeast	Low	73% to 77%	46° to 56° F	Clean, very mild flavor, slight sulfur production.
German Lager L09	S	YCK	Medium	High	48° to 52° F	Common strain in German breweries, malt accent.
German Lager WLP830	L	White Labs	Medium	74% to 79%	50° to 55° F	Malty and clean; great for all German lagers.
Munich Lager 2308	L	Wyeast	Medium	73% to 77%	48° to 56° F	Very smooth, well-rounded and full-bodied.
North American Lager 2272	L	Wyeast	High	70% to 76%	48° to 56° F	Malty finish, traditional Canadian lagers.
North European Lager BRY 203	L	Siebel Inst.	High	High	50° to 57° F	Well balanced beer, fewer sulfur compounds.
N. German Lager CL-660	S	BrewTek	Normal	74% to 76%	46° to 54° F	Classic, strong fermenting, clean and malty finish.
Oktoberfest/Märzen WLP820	L	White Labs	Medium	65% to 73%	52° to 58° F	Produces a very malty, bock-like style.

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HOMEBREW YEAST STRAINS

LAGER

WHEAT

Name and Number	Type	Lab	Floc.	Atten.	Temp.	Description
Old Bavarian Lager CL-650	S	BrewTek	Normal	74% to 76%	46° to 54° F	Well-rounded and malty; subtle ester complex.
Original Pilsner CL-600	S	BrewTek	Normal	74% to 76%	48° to 54° F	Full-bodied lager with a sweet mild finish.
Pilsner Lager WLP800	L	White Labs	Med./High	72% to 77%	50° to 55° F	Somewhat dry with a malty finish.
Pilsen Lager 2007	L	Wyeast	Medium	71% to 75%	48° to 56° F	Smooth malty palate; ferments dry and crisp.
Pilsen Lager L17	S	YCK	Medium	Medium	48° to 50° F	Extremely clean, malty, and full-bodied.
San Francisco Lager WLP810	L	White Labs	High	65% to 70%	58° to 65° F	For "California Common" type beer.
So. German Lager WLP838	L	White Labs	Med.toHigh	68% to 76%	50° to 55° F	A malty finish and balanced aroma.
Swiss Lager CL-670	S	BrewTek	Normal	74% to 76%	48° to 54° F	Clean, crisp lager flavor with smooth maltiness.
Wyeast Lager Blend 2178	L	Wyeast		71% to 75%	48° to 56° F	For classic pilsners to full-bodied bock beers.
Amer. Hefeweizen WLP320	L	White Labs	Low	70% to 75%	65° to 69° F	Slight amount of banana and clove notes.
American Wheat 1010	L	Wyeast	Low	74% to 78%	58° to 74° F	Produces a dry, slightly tart, crisp beer.
American White Ale CL-980	S	BrewTek	Low	74% to 76%	64° to 70° F	Soft, clean malt flavor, for American hefeweizen.
Bavarian Weizen A50	S	YCK	Medium	High	64° to 66° F	Clove and banana esters blend w/ wheat malt.
Bavarian Weizen BRY 235	L	Siebel Inst.	None	High	61° to 72° F	A very estery beer with mild clove-like spiciness.
Bavarian Wheat 3638	L	Wyeast	Low	70% to 76%	64° to 75° F	Balance banana esters w/ apple and plum esters.
Forbidden Fruit Yeast 3463	L	Wyeast	Low	73% to 77%	63° to 76° F	Phenolic profile, subdued fruitiness.
Belgian Ardennes 3522	L	Wyeast	High	72% to 76%	65° to 85° F	Mild fruitiness with complex spicy character.
Belgian Wit A35	S	YCK	Medium	Low to Med.	65° to 70° F	Spicy, slight phenolic character.
Belgian Wit Ale WLP400	L	White Labs	Low/Med.	74% to 78%	67° to 74° F	Slightly phenolic and tart.

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WHEAT

Name and Number	Type	Lab	Floc.	Atten.	Temp.	Description
Belgian Wit II Ale WLP410	L	White Labs	Low/Med.	70% to 75%	67° to 74° F	Spicier, sweeter, and less phenolic than WLP400.
Belgian Wit Beer YTS004	L	YeastTech	Medium	72% to 75%	63° to 68° F	Good for light, Belgian-style ales.
Belgian Wheat 3942	L	Wyeast	Medium	72% to 76%	64° to 74° F	Apple- and plum-like nose with dry finish.
Belgian Wheat CL-900	S	BrewTek	Normal	72% to 74%	66° to 72° F	Soft, bread-like flavor that leaves a sweet finish.
Belgian Witbier 3944	L	Wyeast	Medium	72% to 76%	60° to 75° F	Alcohol tolerant, with tart, slight phenolic profile.
German Weiss CL-930	S	BrewTek	Normal	74% to 76%	66° to 72° F	Produces clove and phenol characters.
German Wheat 3333	L	Wyeast	High	70% to 76%	63° to 75° F	Sharp, tart crispness, fruity, sherry-like palate.
German Wheat CL-920	S	BrewTek	High	75% to 77%	66° to 72° F	Intensely spicy, clovey and phenolic.
Hefeweizen Ale WLP300	L	White Labs	Low	72% to 76%	68° to 72° F	Produces banana and clove nose.
Hefeweizen IV Ale WLP380	L	White Labs	Low	73% to 80%	66° to 70° F	Crisp, large clove and phenolic aroma and flavor.

TYPE = TYPE OF YEAST • S = SLANT • D = DRY • L = LIQUID • FLOC = FLOCCULATION
ATTEN = ATTENUATION • TEMP = IDEAL FERMENTATION TEMPERATURE • YCK = YEAST CULTURE KIT COMPANY



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LAMBIC CULTURES

Name and Number	Type	Lab	Floc.	Atten.	Temp.	Description
Hefeweizen Strain YTS001	L	YeastTech	Low	> 75%	63° to 68° F	Phenolic clove, banana, bubblegum flavor.
Weihenstephan Weizen 3068	L	Wyeast	Low	73% to 77%	64° to 70° F	A unique, rich and spicy weizen character.
Belgian Lambic Blend 3278	L	Wyeast	Low/Med.	65% to 75%	63° to 75° F	Rich, earthy aroma and acidic finish.
Brettan. Bruxellensis 3112	L	Wyeast	Medium	Low	60° to 70°	Produces classic lambic characteristics.
Brettan. Lambicus 3526	L	Wyeast	Medium	Low	60° to 75°	Ple cherry-like flavor and sourness.
Brettan. Lambicus CL-5200	S	BrewTek				
Brett/Ped Combo CL-5600	S	BrewTek				
Pediococc. Damnosus CL-5600	S	BrewTek				
Lactobac. Delbrückii 4335	L	Wyeast				Lactic acid bacteria.
Pediococcus Cerivisiae 4733	L	Wyeast				Lactic acid bacteria.

KEY:

TYPE = TYPE OF YEAST • S = SLANT • D = DRY • L = LIQUID • FLOC = FLOCCULATION
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HOPS HOPS HOPS

So how the heck do I choose the right hops for my beer? With such a wide range of flavor and aroma characteristics, this chart can serve as a helpful guide to more than five dozen varieties. Whether you are trying to duplicate a style or are looking to experiment, the following list can help to get you started.

Comparing and Selecting Hops				
Name	Alpha Acid %	Typical Beer Styles	Possible Substitutions	Flavor Description
Admiral (U.K.)	13.5% to 16%	Ale	U.K. Target, U.K. Northdown, U.K. Challenger	Known for its bittering potential.
Ahtanum	4% to 6.3%			Floral, citrus, sharp, and piney.
Amarillo	8% to 9%	Ale, IPA	Cascade, Centennial	Citrusy, flowery.
Bramling Cross (U.K.)	5% to 7%	ESB, bitter, pale ale	U.K. Kent Golding, U.K. Progress, Whitbread Golding Variety	Quite mild, fruity currant aroma.
Brewer's Gold	7% to 8.5%	English ale	Bullion	Bittering hop with neutral aroma character.
Brewer's Gold (German)	6% to 7%	Ale, heavier German-style lagers	Northdown, Northern Brewer, Galena, Bullion	Black currant, fruity, spicy.
Bullion	6.5% to 9%	IPA, ESB, stout	Columbus, Northern Brewer, German Brewer's Gold	A rich hop primarily used for bittering. Intense black currant aroma.
Cascade	4.5% to 7%	Pale ale, IPA, porter, barleywine	Centennial, Amarillo, possibly Columbus	Pleasant, flowery, spicy, and citrusy. Can have a grapefruit flavor.
Centennial	8% to 11.5%	All ale styles, has been used with wheat beer	Cascade, possibly Columbus	Medium with floral and citrus tones.
Challenger (U.K.)	6.5% to 8.5%	English-style ales, porter, stout, ESB, bitter	U.S. or German Perle, Northern Brewer	Mild to moderate, quite spicy.
Chinook	10% to 14%	Pale ale, IPA, stout, porter, lager	Nugget, Columbus, Northern Brewer, U.K. Target	Mild to medium-heavy, spicy, piney, and grapefruity.
Cluster	5.5% to 8.5%	Ale and lager (good aroma for ale, good bittering for lager)	Galena	Medium and quite spicy.
Columbus	11% to 16%	IPA, pale ale, stout	Nugget, Chinook, U.K. Target, Northern Brewer	Pleasant, with pungent aroma.
Crystal	2% to 4.5%	Lager, pilsner, ESB	Mt. Hood, Hersbrucker, French Strisselspalt, Liberty, Hallertauer	Mild and pleasant, spicy and flowery.
Eroica	9% to 12%	Wheat	Galena, Nugget, Chinook	Strong but pleasant aroma.
First Gold (U.K.)	6.5% to 8.5%	Ale, ESB	U.K. Kent Golding, maybe Crystal	A little like Golding family; spicy.
Fuggle (U.S.)	4% to 5.5%	Any English-style beer or American ale	U.K. Fuggle, Willamette, Styrian Golding, U.S. Tettnanger	Mild and pleasant, earthy and fruity.
Fuggle (U.K.)	4% to 5.5%	All English-style ales, ESB, bitter, lager	U.S. Fuggle, Willamette, Styrian Golding	Mild, pleasant, hoppy, and robust.
Galena	10% to 14%	Ale, porter, stout, ESB, bitter	Nugget, Pride of Ringwood, Chinook	Medium but pleasant hoppiness, citrusy.
Golding (U.S.)	4% to 6%	Pale ale, ESB, all English-style beer	U.K. Golding, Whitbread Golding Variety, U.K. Progress, and possibly the Fuggle family	Mild, extremely pleasant, and gently hoppy.
Hallertauer (U.S.)	3.5% to 5.5%	Lager, pilsner, bock, wheat	Liberty, Ultra, Hallertauer Tradition	Very mild, pleasant, and slightly flowery, some spicy.
Hallertauer Gold	6% to 6.5%		Crystal, Mt. Hood	Known for its aromatic properties similar to Hallertauer.
Hallertauer Mittelfrüh	3% to 5.5%	Lager, bock, wheat, maybe pilsner	Liberty, German Tradition, Ultra	Mild and pleasant.
Hallertauer Tradition (Ger.)	3.5% to 5.5%	Mild-flavored beers	Crystal, Liberty	Known for its aromatic properties. A replacement for Hallertauer Mittelfrüh.
Hersbrucker (German)	3% to 5.5%	Lager, pilsner, bock, wheat	Mt. Hood, French Strisselspalt	Mild to semi-strong, pleasant, hoppy.
Horizon	11% to 14%	Ale, lager	Magnum or a high-alpha hop	Pleasantly hoppy.

Comparing and Selecting Hops

Name	Alpha Acid %	Typical Beer Styles	Possible Substitutions	Flavor Description
Kent Golding (U.K.)	4% to 5.5%	All English-style ales, ESB, bitter	U.S. Golding, Whitbread Golding Variety, U.K. Progress	Gentle, fragrant, and pleasant.
Liberty	3% to 6%	Lager, pilsner, bock, wheat	Hallertauer Tradition, Hallertauer, Mt. Hood	Mild and clean aroma, slightly spicy character.
Magnum	13% to 15%	All beers, particularly lager, pilsner, stout	Northern Brewer	Known for bittering value and quality.
Mt. Hood	3% to 6%	Lager, pilsner, bock, wheat	Crystal, French Strisselspalt, Hersbrucker	Mild, pleasant, and clean, somewhat pungent and resinous.
Northdown (U.K.)	7.5% to 9.5%	All ales, porter		Fruity with some spiciness.
Northern Brewer (U.S.)	6% to 10%	ESB, bitter, English pale ale, porter, California (steam) beer	Nugget, Chinook	Medium-strong with some wild tones.
Northern Brewer (German)	7% to 10%	ESB, bitter, English pale ale, porter	Chinook, U.S. Northern Brewer	Medium-strong with some wild tones.
Northwest Golding	4% to 5%	Ale, porter, stout, ESB, bitter		Known for aromatic properties.
Nugget	11% to 14.5%	Light lager	Columbus, Chinook, U.K. Target, Galena	Quite heavy and herbal.
Olympic	11% to 13%		Chinook	Mild to medium, citrusy aroma, spicy.
Perle (U.S.)	6% to 9.5%	Pale ale, porter, German styles	Northern Brewer, Cluster, Galena, Chinook	Known for its aromatic and bittering properties, pleasant and slightly spicy.
Perle (German)	6% to 8.5%	Pale ale, porter, lager	U.S. Perle, Northern Brewer	Moderately intense, good and hoppy, fruity and a little spicy.
Phoenix (U.K.)	4.2% to 5.5%	All ales	U.K. Northdown, U.K. Kent Golding, U.K. Challenger	Similar to U.K. Challenger.



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Comparing and Selecting Hops

Name	Alpha Acid %	Typical Beer Styles	Possible Substitutions	Flavor Description
Pioneer (U.K.)	8% to 10%	Ale, ESB	U.K. Kent Golding	A mild, typical English aroma.
Polish Lublin	3% to 4.5%	Pilsner	U.S. Saaz, Czech Saaz, U.S. Tettnanger	Mild and typical of noble aroma types; spicy, herbal.
Pride of Ringwood (Australia)	7% to 10%	Australian lager	Galena, Cluster	Quite pronounced, woody, earthy, herbal.
Progress (U.K.)	5% to 7.5%	Ale, bitter, ESB, porter	U.K. Kent Golding, Fuggle	Moderately strong, good aroma.
Saaz (Czech)	3% to 4.5%	Pilsner	U.S. Saaz, Polish Lublin	Very mild with pleasant hoppy notes, earthy, spicy, and herbal.
Saaz (U.S.)	3% to 5%	Pilsner, lager, wheat	Czech Saaz, Polish Lublin	Mild and pleasant, earthy and spicy.
Santiam	5% to 7.9%	Lager, American ale, pilsner	German Tettnanger, German Spalt, German Spalt Select	Noble characteristics.
Satus	12.5% to 14%		Galena	Known for its bittering and aromatic properties.
Simcoe	12% to 14%			A bittering and aromatic hop.
Spalt (German)	4% to 5.5%	Lager	U.S. Saaz, U.S. Tettnanger, German Spalt Select	Mild and pleasant, slightly spicy.
Spalt Select (German)	4% to 6%	Lager, and any beer where noble aroma is wanted	U.S. Saaz, U.S. Tettnanger, German Spalt	Very fine Spalter-type aroma.
Spalt Select (U.S.)	3% to 5%	German lagers	Tettnanger, Saaz	Medium intensity and pleasant hoppy qualities. Medium-strong aroma with wild American tones.
Sterling	6% to 9%	Lager, ale, pilsner	Saaz, Polish Lublin	Herbal, spicy, pleasant aroma, hint of floral and citrus.
Strisselspalt (France)	3% to 5%	Pilsner, lager, wheat	Mt. Hood, Crystal, Hersbrucker	Medium intensity, pleasant, hoppy.
Styrian Golding (Slovenia)	4.5% to 6%	All English-style ales, ESB, bitter, lager	U.S. Fuggle, U.K. Fuggle, Willamette	Delicate, slightly spicy.



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Comparing and Selecting Hops

Name	Alpha Acid %	Typical Beer Styles	Possible Substitutions	Flavor Description
Target (U.K.)	9.5% to 12.5%	All ale and lager	Fuggle, Willamette	Pleasant English hop aroma, quite intense.
Tettnanger (U.S.)	3.4% to 5.2%	German ales and lagers, American lagers, wheat	German Spalt, Czech Saaz, Santiam	An aromatic hop, mild and slightly spicy.
Tettnanger (German)	3.5% to 5.5%	Lager, ale	German Spalt, German Spalt Select, U.S. Tettnanger, Saaz	Mild and pleasant, slightly spicy, herbal.
Tomahawk	15% to 17%	Ale	Columbus	Primarily a bittering hop.
Tradition (German)	5% to 7%	Lager, pilsner	Hersbrucker, Hallertauer Mittelfrüh	Very fine and similar to Hallertauer Mittelfrüh.
Ultra	2% to 4.1%	Lager, pilsner, wheat, finish hop in ales	Liberty, Hallertauer Tradition, Saaz	Very good to outstanding, some Saaz-like qualities. Aromatic properties similar to Hallertauer.
Vanguard	4% to 5.67%		Saaz, Hallertauer Mittelfrüh	Aroma similar to continental European types.
Warrior	15% to 17%	Ale, stout	Nugget	A bittering and aromatic hop.
WGV (Whitbread Golding Variety) (U.K.)	5% to 7%	Ale	U.K. Kent Golding, U.K. Progress	Quite pleasant and hoppy, moderately intense.
Willamette	3.5% to 6%	Pale ale, ESB, bitter, English-style ale, porter, stout	U.S. Fuggle, U.S. Tettnanger, Styrian Golding	Mild and pleasant, slightly spicy, fruity, floral, a little earthy.
Yakima Cluster	6% to 8.5%			Used as a kettle hop for bittering.
Zeus	13% to 17%		Columbus	Aromatic and pleasant.

Hops chart from BYO November 1999



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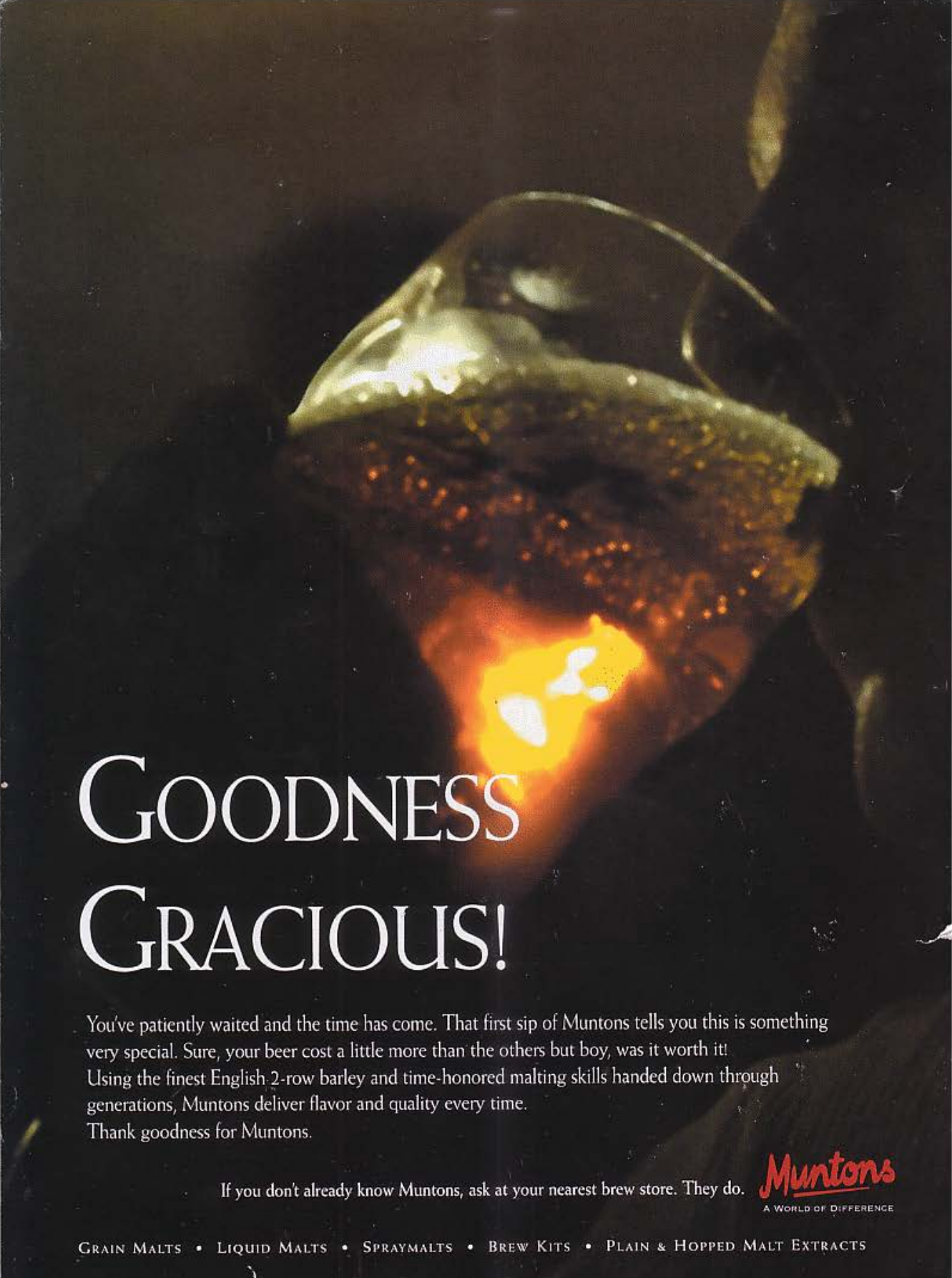
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30°	1.75	1.82	1.92	2.03	2.14	2.23	2.36	2.48	2.60	2.70	2.82	2.93	3.02																		
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42°	1.45						1.83	1.93	2.02	2.12	2.21	2.30	2.39	2.47	2.56	2.65	2.74	2.82	2.91	3.00											
43°	1.43						1.80	1.90	1.99	2.08	2.17	2.25	2.34	2.43	2.52	2.60	2.69	2.78	2.86	2.95											
44°	1.40							1.86	1.95	2.04	2.13	2.21	2.30	2.39	2.47	2.56	2.64	2.73	2.81	2.90	2.99										
45°	1.38							1.82	1.91	2.00	2.08	2.17	2.26	2.34	2.42	2.51	2.60	2.68	2.77	2.85	2.94	3.02									
46°	1.35							1.88	1.96	2.04	2.13	2.22	2.30	2.38	2.47	2.55	2.63	2.72	2.80	2.89	2.98										
47°	1.33							1.84	1.92	2.00	2.09	2.18	2.25	2.34	2.42	2.50	2.59	2.67	2.75	2.84	2.93	3.02									
48°	1.30							1.80	1.88	1.96	2.05	2.14	2.21	2.30	2.38	2.46	2.55	2.62	2.70	2.79	2.87	2.96									
49°	1.28								1.85	1.93	2.01	2.10	2.18	2.25	2.34	2.42	2.50	2.58	2.66	2.75	2.83	2.91	2.99								
50°	1.25								1.82	1.90	1.98	2.06	2.14	2.21	2.30	2.38	2.45	2.54	2.62	2.70	2.78	2.86	2.94	3.02							
51°	1.23									1.87	1.95	2.02	2.10	2.18	2.25	2.34	2.41	2.49	2.57	2.65	2.73	2.81	2.89	2.97							
52°	1.20									1.84	1.91	1.99	2.06	2.14	2.22	2.30	2.37	2.45	2.54	2.61	2.69	2.76	2.84	2.93	3.00						
53°	1.18									1.80	1.88	1.96	2.03	2.10	2.18	2.26	2.33	2.41	2.48	2.57	2.64	2.72	2.80	2.88	2.95	3.03					
54°	1.15											1.85	1.93	2.00	2.07	2.15	2.22	2.29	2.37	2.44	2.52	2.60	2.67	2.75	2.83	2.90	2.98				
55°	1.13											1.82	1.89	1.97	2.04	2.11	2.19	2.25	2.33	2.40	2.47	2.55	2.63	2.70	2.78	2.85	2.93	3.01			
56°	1.10												1.86	1.93	2.00	2.07	2.15	2.21	2.29	2.36	2.43	2.50	2.58	2.65	2.73	2.80	2.88	2.96			
57°	1.08												1.83	1.90	1.97	2.04	2.11	2.18	2.25	2.33	2.40	2.47	2.54	2.61	2.69	2.76	2.84	2.91	2.99		
58°	1.05												1.80	1.86	1.94	2.00	2.07	2.14	2.21	2.29	2.36	2.43	2.50	2.57	2.64	2.72	2.80	2.86	2.94	3.01	
59°	1.03													1.83	1.90	1.97	2.04	2.11	2.18	2.25	2.32	2.39	2.46	2.53	2.60	2.67	2.75	2.81	2.89	2.96	3.03
60°	1.00													1.80	1.87	1.94	2.01	2.08	2.14	2.21	2.28	2.35	2.42	2.49	2.56	2.63	2.70	2.77	2.84		

Temperature of Beer (Degrees Fahrenheit)

BREW YOUR OWN REFERENCE GUIDE 2000



GOODNESS GRACIOUS!

You've patiently waited and the time has come. That first sip of Muntons tells you this is something very special. Sure, your beer cost a little more than the others but boy, was it worth it! Using the finest English 2-row barley and time-honored malting skills handed down through generations, Muntons deliver flavor and quality every time. Thank goodness for Muntons.

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