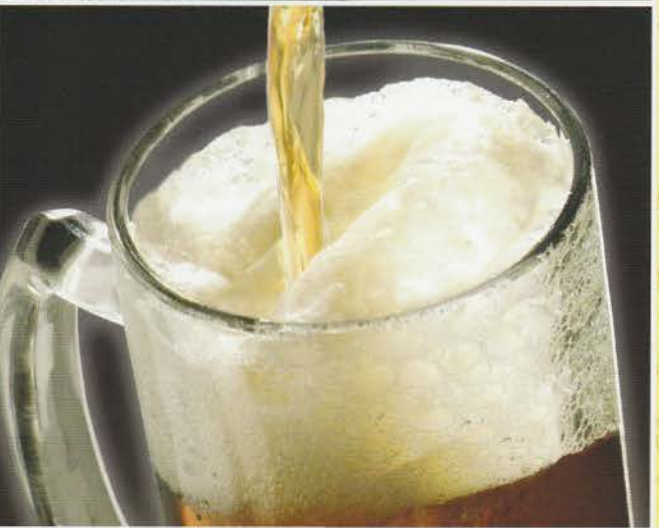

The ULTIMATE ALMANAC of WORLD BEER RECIPES

A Practical Guide for the Professional Brewer to the World's Classic Beer Styles from A to Z

by Horst Dornbusch

with Sponsorship & Technical Edits by

WEYERMANN® Specialty Malting Company since 1879

SCHULZ Brew Systems since 1677

BARTH-HAAS GROUP

March 21, 2010

ERRATA: The ULTIMATE ALMANAC of WORLD BEER RECIPES

The ULTIMATE ALMANAC of WORLD BEER RECIPES contains 92,300 words. Some 10,000 of these are pure numbers for such values as gravities, alcohol contents, beer colors, and malt and hop quantities. The math for these values was first executed on elaborate Excel spreadsheets. Then the results had to be transferred manually into the manuscript in Word. Though the author and technical editors took great care to proofread and double-check all numbers and facts before the books went to press, several errors are known to date to have slipped our collective attention. In addition, a regrettable mathematical error occurred in the hop calculations for several beers. Unfortunately, correcting even a minor error on a page requires reprinting that page and its opposite. A package of reprinted correction page will be available shortly upon request from Weyermann®, SCHULZ, and Barth-Haas. Meanwhile, please fix the values that were transposed in error from the list below and from the reverse side manually in your printed copy.

1. The grist percentages for Caraamber® and Carared® in the Amber English Ale on page 72 should be 10% each, not 15%. The malt quantities listed in pounds, ounces, kilograms, and grams, however, are correct.
2. The OG of Blond American Ale on p. 89 is 1.042 (10.5 °P); the FG is 1.012 (3 °P).
3. The OG for Southern English Brown Ale on p. 100 is 1.048 (12 °P); the FG is 1.012 (3 °P).
4. The color of the California Common on p. 101 is 11.3 SRM/28.8 EBC.
5. The AA-values for Taurus, Tradition, and Smaragd/Emerald on p. 112 are 8.5; 5.5; and 5, respectively.
6. The second malt In the Dunkelweizen on p. 122 is Pale Wheat; the EBC value is 37.8, not 38.8.
7. The BU-value In the Gruitbier on p. 133 is, of course, 0; the color should be 19.9 SRM/52.5 EBC.
8. The OG of Kölsch on p. 143 is 1.045 (11.25 °P).
9. The grist percentage for Pilsner malt in Maibock on p. 155 is 60%, not 42%. The malt quantities listed in pounds, ounces, kilograms, and grams, however, are correct. The color is 8.4 SRM/20.9 EBC.
10. The BU value for Modern Czech Pilsner ill on p. 175 is 20; the SRM value, 2.3.
11. The Pale Ale in the Baltic Porter on p. 176 is 65% of the grist; the smoked malt is 16%.
12. The FG of the Classic Porter on p. 177 is 3.25 °P, not 2.75 °P.
13. The grain bill for the London Porter on p. 181 is 33% each of Pale Ale, Carared®, and Caraamber®, and 1% of Carafa® I. The malt quantities listed in pounds, ounces, kilograms, and grams, however, are correct.
14. The color of the Robust Porter on p. 182 is 30.3 SRM/79.1 EBC.
15. The OG of Pumpkin Ale on p. 185 is 1.056 (14 °P); ABV/ABW should be 5.8% and 4.6%, respectively.
16. The OG and FG of Scottish Ale on p. 206 are 9.5 °P and 3 °P, respectively. In the style description on p. 205, the enzyme sequence is reversed in the sentence: *"All Scottish or Scotch ales are mashed in thick for a rest of 60 – 90 minutes at a relatively high 158 °F (70 °C) for a saccharification that favors beta- instead of alpha-amylase activity."* The sentence must read *"... that favors alpha- instead of beta-amylase activity."*
17. The FG of Sticke on p. 208 is 3.25°P; the ABW is 4.7%.
18. The bittering hop in the Irish Stout on p. 214 is Target; the aroma hop is none.
19. The OG of the Weissbier on p. 221 is 1.052; the color is 5.3 SRM/12.9 EBC.
20. The specifications for Zoiglbier on p. 228 are: OG 1.049 (12.25 °P); FG 1.013 (3.25 °P); 13.2 SRM/33.8 EBC; ABV 4.8%; ABW 3.8%.
21. The SRM for Zwickelbier on p. 230 is 24.25.

HOP CORRECTIONS:

Bockbier (p. 92)

HOPS	%AA	1 HL (oz)	1 HL (g)	1 BBL (oz)	1 BBL (g)	5 Gal (oz)	19 l (g)
Bittering: Taurus	8.5	2.73	77	3.2	91	0.5	15
Flavor: Tradition	5.5	1.28	36	1.5	42	0.2	7
Aroma: Smaragd	5	0.64	18	0.7	21	0.1	3
Dunkelweizen (p. 123)							
Bittering: Mittelfrüh	4.2	3.93	112	4.6	131	0.7	21
Aroma: Mittelfrüh	4.2	5.25	150	6.1	175	0.9	28
Ice Beer (p. 135)							
Bittering: Taurus	15.5	1.05	30	1.2	35	0.2	6
English IPA (p. 138)							
Bittering: Goldings	5	9.04	256	10.6	301	1.7	49
Flavor: Fuggles	4.3	3.93	111	4.6	131	0.7	21
Aroma: Goldings	5	3.93	111	4.6	131	0.7	21
Kellerbier (p. 141)							
Bittering: Hersbrucker	14.5	15.02	426	17.6	499	2.8	81
American Lager (p. 146)							
Bittering: Taurus	15.5	0.90	26	1.1	30	0.2	5
Aroma: Saaz	4.5	0.23	6	0.3	8	0.04	1
American Light Lager (p. 147)							
Bittering: Taurus	15.5	0.68	19	0.8	22	0.1	4
Aroma: Saaz	4.5	0.17	5	0.2	6	0.3	1
American Premium Lager (p. 148)							
Bittering: Taurus	15.5	1.50	43	1.8	50	0.3	8
European Light Lager (p. 150)							
Bittering: Spalter	4	5.31	151	6.2	177	1.0	28
Aroma: Saphir	3.25	2.66	75	3.1	88	0.5	14
Lambic (p. 153)							
Bittering: Fuggles	4.3	2.74	78	3.2	91	0.5	15
American Pub Wheat (p. 184)							
Bittering: Warrior®	15.5	1.64	47	1.9	55	0.3	9
Pumpkin Ale (p. 185)							
Bittering: Fuggles	4.3	5.97	169	7.0	199	1.1	32
Flavor: none	0	0	0	0	0	0	0
Aroma: Goldings	5	4.99	142	5.9	166	0.9	27
American Rye Ale (p. 194)							
Bittering: Warrior®	15.5	1.64	47	1.9	55	0.3	9
Foreign Export Stout (p. 212)							
Bittering: Target	11	4.12	117	4.8	137	0.8	22
Zoiglbier (p. 228)							
Bittering: Hersbrucker	2.75	9.44	268	11.1	314	1.8	51
Aroma: Mittelfrüh	4.25	3.78	107	4.4	126	0.7	20
Zwickelbier (p. 230)							
Bittering: Hersbrucker	2.75	10.73	304	12.6	357	2.0	58
Aroma: Mittelfrüh	4.25	6.44	182	7.6	214	1.2	35

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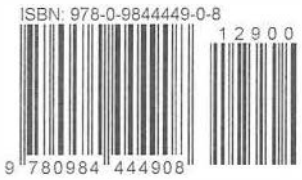

Disclaimer: The recipes in this book are based on the author's and technical editors' combined international brewing experience stretching over several decades. They have also benefited from the technical expertise and resources available within the three sponsor companies, the Barth-Haas Group, SCHULZ Brew Systems, and the Weyermann® Malting Company. The recipes are thoroughly researched to ensure their authenticity. However, because classic beer styles have evolved as part of the living brewing past, the author and technical editors freely and cheerfully admit that there may be other equally legitimate interpretations of the brew-historical record. Therefore, style specifications, appropriate ingredients, and brew-technical procedures are always subject to interpretation and debate. The recipes presented here are purposefully adapted for a modern brewery operation, that is, for technologically advanced SCHULZ systems as well as for top-quality Weyermann® malts and Barth-Haas hop products. They are intended for use by professional brewers, who understand the particular characteristics and capabilities of their brew equipment. Depending on specific local brewery setups, the recipe parameters may need to be adjusted to fit existing physical and technological conditions. Therefore, though the recipes have been designed with the outmost care, neither the author nor the technical editors can warrant the success of each and every recipe in each and every brew house and cellar configuration under all conditions.

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Acknowledgements

The idea for a collection of recipes for professional brewers, in book form, of *all* the world's beer styles has been kicking around in my head for almost two decades. One of these days, I always said, I will write this book, because somebody should and nobody has...and then I merrily kicked the can down the road, again, and again, and again. It's amazing how one can fill one's life to the brim with daily chores, while grandly procrastinating when it comes to doing the big things.

Whenever I mentioned this book idea to friends in the brew industry I received nothing but enthusiastic encouragement, especially from Sabine Weyermann and Thomas Kraus-Weyermann. They both felt that such a tome could be the perfect show-case for what brewers can do with Weyermann® malt. It was their contention that I would not be able to find a single beer style that could not be made with their malt, and that I would be welcome to brew anything I wanted to in the Company's pilot brewery, a dream of a 2.5-hectoliter SCHULZ system, which I knew well, because I had spent many a happy brew day there with Weyermann® brew master Oliver Honsel.

So I boldly suggested that, if Weyermann® sponsored the book, I would actually begin writing it. In fact, I proposed that SCHULZ, as a Bamberg neighbor and the world's oldest brew equipment manufacturer, might be interested in participating as well, and perhaps also Barth-Haas, the world's largest hop supplier, located just a quick swish down the Autobahn in Nuremberg. Combining the technical expertise of these three companies, each world leaders in their fields, I thought could only strengthen the final result.

Thus, over a beer in Bamberg, the foundation for this book was laid. Soon I found myself in negotiation about the details of the project with Johannes Schulz-Hess, the CEO of SCHULZ Brew Systems, Stephan Barth, the CEO of the Barth-Haas Group, and Sabine and Thomas. The final agreement was struck at the Drinktec in Munich in September 2009, and we settled on finishing the project ready for the brewing public at the Brewers Association Craft Brew Conference and BrewExpo America in Chicago, in April 2010.

With this august trio of Franconian companies covering my back, I spent much of the 2009/2010 New England winter selecting the 101 greatest beer styles in human history and nailing down their specifications, ingredients, and processes. For a passionate beer scribe, this was bliss! I thought of Ella Fitzgerald's line from *I got Rhythm*, "who could ask for anything more?"

I would like to give a special tip of the hat to Dr. Christina Schönberger of the Barth-Haas Group; Jürgen Buhrmann, Oliver Honsel, and Andreas Richter of the Weyermann® Malting Company, and the brew engineers of SCHULZ Brew Systems for the thoroughness of their technical reviews; and to Silke Thomas of the Weyermann® Malting Company for chaperoning the project through its physical production cycle.

I owe a special thank-you to my wife Elva for cheerfully suffering through weeks of neglect during my solitary writing marathon and for proofreading the entire manuscript before it went anywhere.

As I write these lines, the book is finally being readied for the printer in Germany. So there is nothing left for me to do on this project, but to express my profound gratitude to my sponsors. I thank them for their enthusiasm for the project, for their daring in undertaking it, and for their trust in me to pull it off. I am honored!

Horst Dornbusch
West Newbury
Massachusetts, USA
March 2010

Foreword

Munich-Gräfelfing
Bavaria, Germany
March 2010

Globalization is making the world one, impacting every field of human endeavor. Brewing is no exception. With beer, brewing ingredients, and brew systems shipped around the globe, with brew education offered on a global scale, and with our ability to "build" any type of brewing water anywhere in the world, beer styles that were once the province of distinct beer cultures within clear geographic boundaries, have now become universal. Today, a brewer in the United States, Italy, Norway, or Canada may brew a Belgian-style Abbey Ale just as likely as a brewer in Belgium may brew an Irish-style Stout or a German-style Bock. Beer styles that have evolved gradually over centuries are now taken as jumping-off points by innovative, modern brewers to create what is probably the greatest global beer variety ever, which is a glorious thing!

But all these new and exciting brews have their roots in what has come before them. "What's past is prologue," proclaims William Shakespeare's Antonio in the second act of *The Tempest*, and of course it is so. We all value the future, but, to know our way, we must also look into the past. Yet, there has been no work to date that puts all that tradition together in one volume for the professional brewer. What has been lacking so far is a definitive archive of the past that can serve as the authoritative basis for the brewing profession's own, unique "prologue." *The Ultimate Almanac of World Beer Recipes—A Practical Guide for the Professional Brewer to the World's Classic Beer Styles from A to Z*, therefore, goes a long way towards filling that gap. It is a long-overdue book, which provides a solid set of recipes, presented in a crisp, easy-to-use format, for replicating the world's greatest beer styles. Its pages represent the global heritage of brewing, to be revered in the present and to serve as an inspiration in the future. It is the product of a perfect synergy of a group of world experts in their fields: of the Barth-Haas Group, the world's leading hop merchant and processor; of SCHULZ Brew Systems, the world's oldest and most innovative brew equipment manufacturer; of the Weyermann® Malting Company, the world's leading specialty malting company; and of Horst Dornbusch, a multi-lingual and multi-cultural brew industry consultant and one of the world's leading beer journalists.

This book is *the* practical reference guide for the serious brewer, and an indispensible source book to be kept handy in any brew house anywhere in the world...as it will be in our library at Doemens Academy!

Dr. Wolfgang Stempfl
Managing Director and Dean
DOEMENS Academy

About this Book

As the subtitle states, ***The Ultimate Almanac of World Beer Recipes*** is a practical guide to the world's major beer styles from A to Z. It assumes that the reader is an accomplished brewer who knows how to apply the specifications and short-hand technical instructions in the recipes. How many beer styles there are exactly in the world is always a matter of debate among experts. The (American) Brewers Association Beer Style Guidelines recognize close to 150 styles and sub-styles; the European Beer Star recognizes about 40. Even the most detail-oriented classification may not exceed 200 styles. This book attempts to cover "all" beer styles in the world, past and present. It features 101 "major" beer styles with descriptions, recipes and brewing instructions. In addition, there are some five dozen "minor" beer style entries listed in an Appendix at the end of this book, with brief style descriptions or definitions.

Some styles, however, may still be considered "missing." This is because this book avoids, for the most part, the current and explosive trend of classifying styles prefixed with such attributes as "extreme," "imperial," "double," or "American" as separate styles. There are legitimate arguments for considering beers that are exaggerated in one or more aspects—in hop bitterness, in maltiness, in alcohol content, in choice of ingredients, or in spiciness—as new styles. Adding such beers to this book, however, could easily have multiplied the number of recipes to several hundreds. Suffice it to say that any one of the recipes in this book is perfectly suitable for experimentation and adaption by creative brewers in quest of truly new and unique brews. Nonetheless, given the book's comprehensive ambition, there is no comparable professional recipe collection available to date, in any language, anywhere.

The Ultimate Almanac of World Beer Recipes is deliberately constructed as a quick and easy reference guide for the practical brewer. As such, it may not satisfy all expectations of all brewers everywhere at all times. Here is what the book is not: It is not a collection of poetic style descriptions. There are already books that do that well. Nor is it primarily a list of style specifications and their ranges. Such lists exist already. The (American) Brewers Association Beer Style Guidelines, for instance, are an excellent resource for such information. This book does not purport to give comprehensive brewing instructions. There are libraries of technical brewing text books that take care of that. Instead, this book attempts to present a condensation of all the key characteristics of all major and some of the minor beer styles so that a professional brewer has enough information to start making the beer. This scope makes the book both a modest and an ambitious endeavor. It certainly makes it unique.

This book pools the combined resources and technical experience of three major companies in the international brew industry: The Barth-Haas Group of Nuremberg, which is the world's largest hop processor and hop trader; SCHULZ Brew Systems of Bamberg, founded in 1677 and now the world's oldest and most innovative brew

equipment manufacturer; and the Weyermann® Malting Company also of Bamberg, founded in 1879 and today the world's largest and most diverse specialty malt supplier.

All the recipes in this book are designed for use with the products of these three companies. However, they can be adapted by professionals for any brew system and any raw material. All quantities are listed for batch sizes of 1 U.S. barrel, 1 hectoliter, 5 U.S. gallons and 19 liters, for easy scaling up or down to suit any brew house size. They are also uniformly based on a near-perfect nominal extract efficiency of 80%, which is achievable in most modern brew houses for most beer styles. To apply the recipes to brew houses with different extract efficiencies, simply adjust all quantities proportionally.

For easy calculations, all quantities are provided in both metric units (decimal system) and U.S.-English units, where applicable. All brew-technical formulas have been selected for their ease of application by practical brewers in daily brew house operations. Simplicity with reasonable precision rather than unwieldy complexity with ultimate, laboratory-conform exactitude has been the criterion by which they were chosen. Some formulas have their roots in the metric system, others in the American/English system of measurements. All formulas, however, can be used in either system of measurement by simply plugging in the respective conversion factors from the Unit Conversion Table that can be found right before the recipe section.

The following pages contain a list of key terms and formulas they are applied in the recipes in this book, with definitions and explanations.

DID YOU KNOW ... ?

The first written description of the preserving and healthful effects of hops in beer is in a book entitled *Physica sacra* (Sacred world) by Hildegard von Bingen (1098 - 1179), a Benedictine abbess, brew nun, physician, natural scientist, and advisor to Emperor Frederick I (a.k.a. Barbarossa). Hildegard drank beer regularly and lived to be 81 years old, an incredible age for that time. It is not surprising that some people like to see a causal connection between her longevity and her dedication to beer.

About Malt

Malt is made only from grain, any grain. Taxonomically, all grains belong to the grass family (*Graminae*), and cereals are their edible seeds. Mankind's most important cereal grains are barley, wheat, rye, corn, sorghum, millet, and oats. Bamboo and reed, incidentally, are grasses, too. At least since the time of the ancient Egyptians, mankind has known that grains make better beer if they are malted.

Barley, of course, is the brewer's grain of choice, mostly because it has plenty of enzymes for the crucial conversions that need to take place in the malt house and in the brew house before beer can emerge. Barley also has relatively few lipids. (While corn oil is common and wheat germ oil is popular, barley oil is rare.) It is also relatively low in protein and has well-developed husks—two characteristics that are advantages for efficient lautering and filtering.

Literally dozens of barley varieties are suitable for making base and specialty malts. Most of them are bred nowadays specifically for brewing rather than for other uses. Wheat and rye varieties, on the other hand, tend to be multi-purpose grains that are bred not just for brewing but also for food processing and as animal feed. Millennia-old heirloom grains such as Dinkel (a spelt) are making a comeback in brewing, too.

Cereal adjuncts are grains that are added to the mash unmalted, usually in small quantities to supply extra body and mouthfeel, and sometimes color and flavor, to the finished beer. Barley and wheat can be used as adjuncts, as can rice, corn, sorghum, and millet, and, in fact, any other grain. If adjuncts are used in large amounts, as is common in many industrial pale lagers, they are usually boiled in adjunct cookers before being added to the mash.

Barley is planted either in the fall or in the spring. Fall plantings are invariably for six-row "winter" barley, while spring plantings are for two-row "spring" or "summer" barley. Both barleys are harvested in late summer. Compared to two-row barley, six-row barley tends to contain more husk material, proteins, and diastatic enzymes per amount of starch. Because of these qualities, six-row barley is the preferred base malt for beers with large portions of adjuncts, which are usually deficient in husks, protein content, and diastatic power.

Depending on the region of origin, two-row barley generally has between 8 and 11.5 percent protein content, rarely more; six-row barley, between 10 and 14 percent; and wheat, as much as 15 percent. Grain develops more protein on the stalk if grown in a continental climate (in North Dakota, for instance) than it does if grown in a maritime climate (on the British Isles, for instance).

Malt quality is determined essentially by two factors: the choice and quality of the grain, and the competence and equipment of the maltster. There are several variables that a brewer needs to understand when assessing malt quality. Quality maltsters tend to disclose these as specifications with their products. The units of

measurement for these variables are often derived from standard, laboratory-perfect mashes as reference norms. These mashes invariably produce higher yields than tend to be achievable in most production brew houses.

The procedures, ingredients, equipment, and quantities for these benchmark mashes are defined by various standard-making organizations. Most important among these are the American Society of Brewing Chemists (ASBC) and the European Brewing Convention (EBC). The units of measurement employed by these organizations are not always identical, but, because they are standardized, can be converted mathematically. One particularly prominent and internationally recognized standard mash is the so-called "Congress Mash," defined by the EBC.

The following are explanations of the key malt variables that are of importance to brewers.

Color (SRM, °L)

SRM is the acronym for Standard Research Method. SRM is usually applied to beer color, while grain color tends to be expressed in degrees of Lovibond (°L). Under standard laboratory conditions, 1 °L of grain color produces 1 SRM of beer color. In the European system, both grain and beer color is expressed by the same unit, EBC.

The formula used in this book for determining final beer color uses SRM-values. It is calculated from each malt's Lovibond-values (°L), the amount of each malt in a particular grain bill (in U.S. pounds), and the amount of green beer (in U.S. gallons) produced with that grain bill. This simple formula comes from American brew house practices, but it can be used in the metric system, too, by simply plugging equivalent metric values for weights and volumes into the formula.

Beer color formula:

(°L1*lb1+°L2*lb2+...+°Ln*lbn)/V

Whereby:
°L1, °L2 ... °Ln are the Lovibond values of the malts that make up the grain bill
lb1, lb2 ... lbn are the amounts of each malt in U.S. pounds
V is the amount of green beer in U.S. gallons made from this grain bill

Example for a one-hectoliter (26.41721 gal) batch of Altbier made from a grain bill of 25.05 lbs. of 6 °L Weyermann® Munich I plus 8.35 lbs. of 17.45 °L Weyermann® Carared®:

*SRM = (6*25.05+17.45*8.35)/26.41721*
SRM = (150.3+145.7075)/26.41721
SRM = 296.0075/26.41721
SRM = 11.2051= 11.2 (rounded)

To convert SRM color values into EBC color values, or vice versa, this book uses the following formulas:

y SRM = (y * 2.65) — 1.2 EBC
x EBC = (x * 0.375) + 0.46 SRM

Examples:

*11.2 SRM = (11.2*2.65) — 1.2 EBC*
11.2 SRM = 29.68 — 1.2 EBC
11.2 SRM = 28.48 EBC
11.2 SRM = 28.5 EBC (rounded)

or

*28.5 EBC = (28.5 * 0.375) + 0.46 SRM*
28.5 EBC = 10.6875 + 0.46 SRM
28.5 EBC = 11.147 SRM = 11.15 SRM (rounded)

Note: The difference between 11.2 SRM and 11.15 SRM is the result of cumulative rounding.

Moisture Content

The moisture content (MC) of barley at harvest time is usually around 12 to 17 percent. Once turned into malt, depending on the type of malt, the MC-value drops to about 1.5 to 4.5 percent. Malts with an MC exceeding 6 percent are poorly kilned and thus difficult to store without risking microbiological spoilage. Caramel malts, which are steeped to produce glassy sugars, tend to have higher MC-values than do fully dried pale malts or roasted malts.

Extract %DBFG/%DBCG

A malt's extract potential is expressed either as %DBFG (extract yield, dry basis, fine grind) or as %DBCG (extract yield, dry basis, coarse grind). Also important for the brewer is the difference between %DBFG and %DBCG.

The %DBFG is a measure of the maximum, theoretically possible, soluble content of the malt, by weight, extracted under laboratory conditions, relative to a zero-percent moisture content of the malt before mashing. A quality base malt should have a %DBFG-value of at least 78 percent. The top %DBFG limit is slightly below 85 percent, even for the best malts under laboratory conditions.

The %DBCG, by contrast, also generated under standardized laboratory conditions, gives the analogous extract value for a grind that more closely resembles a grist produced by a real-life brew house mill. Any difference between the mathematical %DBCG-value for a given grain bed and the actual extract result of a batch is an indication of the quality of the brew system, including the mill.

Factors that may influence the deviation between actual brew house extract values and %DBCG-values stated by the maltster are usually the performance of the mill, the completeness of malt hydration during mashing, the mash regimen (single infusion, multi-step infusion, decoction), the mash viscosity, the mash pH, and the physical construction of the lauter tun (in terms of false bottom design and height-

to-width ratio affecting grain bed depth). For a calculation of actual brew house efficiencies, see the formula presented later in this section.

The difference between the theoretical values for %DBFG and %DBCG is a measure of the malt's starch and protein degradation. In general, the lower the difference between the two grind values, the higher the degree of starch modification and the easier it is to extract carbohydrates from the mash. Top-quality base malts should have %DBFG/%DBCG differences in the range of 1 to 2 percentage points. Mashes with grain beds having a %DBFG/%DBCG difference that is greater than 2.5 percentage points indicate a slight under-modification of grain starch. Such malts may not perform well in a single-step infusion regimen.

Protein

Proteins are composed of nitrogen-based compounds such as amino acids. In a barley kernel, 1 percent of nitrogen equals 6.25 percent of protein. A malt specification sheet usually lists a total protein or total nitrogen value (TN). In either case, the value represents the entire quantity of nitrogenous matter in the malt, soluble and insoluble.

Malt with protein values exceeding 12% (1.9% TN) may cause lautering problems in the brew house and haze problems in the finished beer. Higher-protein malt is desirable, however, if protein-poor adjuncts such as rice or corn are used in the mash. A grain bill with a combined protein level below 10%, on the other hand, may be insufficient to provide the beer with a good body and a firm and stable head. Because proteins are essential yeast nutrients, low protein/nitrogen values may also lead to an incomplete fermentation.

Kolbach Index

This index indicates the ratio between soluble protein and total protein (soluble and insoluble combined), whereby the soluble protein is expressed as a portion of the total protein (measured as dry weight). Mathematically, the Kolbach Index is calculated by dividing the percentage value of soluble protein by the percentage value of total protein. Essentially, it tells the brewer how much of the entire protein content of the malt has already been modified in the malting plant.

There are no hard thresholds for the appropriate Kolbach Index, but it is generally accepted that top-quality base malt should have a Kolbach Index in a range of 36 to 44%. A higher index indicates over-modification, a lower index, under-modification. With severely undermodified malts, brew house extract yields may be unduly low. Malts with a Kolbach Index near or below the low end of the acceptability range, therefore, tend not to perform well in a single infusion mash and are likely to produce thin beers.

Homogeneity

Barley kernels are always sorted for size by means of screen separation. In malt, plump is better than thin, and the greater the amount of homogeneously plump kernels in a batch of barley or malt, the better the average modification of the batch,

the more uniform the crush, and the better the brew house yield from that batch. Any kernels below 2.2 millimeter in diameter are undesirable in a quality malt. As a general rule, at least 90% of the kernel diameters in a batch should be homogeneous, regardless of size. A malt with more than 95% of kernels at a diameter of 2.5 millimeters, for instance, is considered excellent.

Friability

This is the capacity of malt to be crumbled or crushed during milling. It is expressed as a percentage value. This variable is also referred to as mealiness, and it is the opposite of a malt's glassiness, the latter being the amount of sugar that has hardened or caramelized during the malting process. An acceptable base malt should be at least 75% friable; 85% is considered good; while 95% is considered excellent. Friability values above 95%, on the other hand, can be an indication of structural defects—not health—of the malt. Such excessive friability may be caused by pest infestations, such as *Fusarium graminearum,* which can cause the complete destruction of the endosperm. In this context, the glassiness value of a top-quality base malt may be between 0.5 and 3.0%.

Hartong Index (VZ 45 °C)

The Hartong Index is a measure of the extent of proteolytic and cytolytic enzyme activity at a reference temperature, which, in turn, is an indication of the amount of malt modification achieved by the maltster. The index is sometimes expressed as VZ 45 °C, whereby VZ stands for *"Verhältniszahl,"* the German word for "ratio number;" and 45 °C stands for the amount of that enzymatic conversion at a cool reference temperature of 45 °C (113 °F). A few maltsters use a Hartong index of VZ 65 °C. A Hartong Index of 40 ± 5 based on VZ 45 °C is considered excellent for modern base malt. A value of 32 to 34 is considered excellent in traditional, "undermodified" floor malt.

Diastatic Power

This index measures the strength of starch-reducing malt enzymes. A malt's diastatic power (DP) is often expressed in terms of °Lintner. Sometimes DP is also listed as IOB, which stands for the method of analysis developed by the UK Institute of Brewing. An extremely well-converted malt may have a DP-rating of as low as 35 °Lintner, which means it is well suited for single infusion mashing. A top-quality Pilsner base malt is likely to have DP-values in the vicinity of 100 °Lintner. A North American two-row ale base malt may have a °Lintner value of 125 or above, while some six-row malts may have °Lintner values exceeding 160. The EBC unit for diastatic power is °WK (which stands for degrees Windisch-Kolbach). The conversion between °WK and °Lintner is:

DP °Lintner = (°WK + 16)/3.5

Conversion Time

Conversion time is measured in minutes. It specifies the amount of time it takes, under standard conditions, for the enzymes in a base malt to convert starches to sugars. The conversion time is, of course, related to a malt's diastatic power. Malts

with high diastatic power have shorter conversion times than do malts with lower diastatic power. A good base malt for any mash application should have conversion times not exceeding 10 minutes. Extremely enzyme-rich six-row malts may have conversion times as short as 5 minutes.

Viscosity (Malt)

Viscosity is a fluid's resistance to flow, and poise (P) or PA s (Pascal-second) is the unit of measurement for the force required to overcome that resistance. In malt, viscosity indicates the extent to which beta-glucans in the endosperm cell walls have been broken down enzymatically during malting. Beta-glucans are viscous gums, and beta-glucanase enzymes exert breakdown forces, in centipoises "cP" (one hundredth of a poise) or "mPa s" (millipascal-second) during their degradation work. For conversions among these unites: 1 cP = 1 mPa s = 0.001 Pa s.

The better the degradation of beta-glucans in the malt house, the lower the subsequent viscosity of the wort in the brew house. Wort viscosity, therefore, is a malt spec, indirectly. It is measured under standard laboratory conditions. A value greater than 1.75 mPa s is considered high and is likely to cause lauter problems. The higher the value for mPa s is, the less the malt is suitable for simple infusion mashing. Base malt values in the range of 1.4 to 1.58 mPa s are considered excellent. Wheat malt, by comparison, has a viscosity of 1.60 – 2.10 m PA s.

DID YOU KNOW ... ?

- In the mash, calcium reacts with phosphates and amino acids from malt, which makes the mash more acidic.
- Magnesium, too, acidifies the mash.
- Bicarbonates make the mash more alkaline, but they precipitate when boiled, like scale in a household tea kettle.
- Sodium in moderate amounts adds fullness and sweetness to a beer, in large amounts, saltiness.
- Sulfate increases the perception of hop bitterness.
- Chloride decreases the perception of hop bitterness. Like sodium, it also adds fullness and mouthfeel to the finished beer.

About Mashing

Traditionally, as ideal types, most brewers have been using only two mash regimens, with a few variations on each theme: infusion and decoction. While infusion (single-step or multi-step) has been a staple of British-style ale-making, decoction (single, double, or triple) has been a staple of Continental-European lager-making. Nowadays, however, with the availability of modern, well-modified malts, decoction mashing is being abandoned more and more, even in the bastions of traditional lager-making. This is because decoction mashing is more time-, labor-, energy-, knowledge-, and equipment-intensive than infusion mashing. Regardless of the method by which a beer is presented in this book, however, it can be made by either method, though the results may not be identical in all instances.

One of the key differences between the typical British and the typical Continental-European mash method is the brew house configuration. While the traditional British brewing method relies broadly on a two-vessel system composed of a mash-lauter tun and a brew kettle (also known as a copper), the Continental-European brewing method relies broadly on a two-vessel system composed of a mash-kettle plus a lauter tun, or on a three-vessel system composed of a mash tun, a lauter tun, and a kettle. Some brew house configurations even feature a fourth vessel, a separate cooker, for boiling decoctions or for cooking cereals in recipes requiring large amounts of cereal adjuncts. The more single-function vessels are installed in a brew house, obviously, the more the more brew house processes can occur in parallel and the more brews can be put through the system in a day.

In the Continental-European system, the mash must be slurry-pumped (or ladled, in the old days) between vessels, while in a British system, the mash remains largely undisturbed once the mash-in is complete. A Continental-European brew system can easily be used for traditional British-type mashing, a British-type system, on the other hand, is rarely convenient or efficient for traditional Continental-European-style mashing, mostly because of mash-transfer limitations, mash-temperature control issues, and the relatively small volume of the mash-lauter tun compared to the kettle volume.

Mash Viscosity

In a British system, mash viscosity is usually rather high (a thick mash). Temperature increases from mash-in to mash-out are usually accomplished through sparging after the completion of the diastatic rest(s) instead of through heat application during the mash time itself. This has been true at least since the 1850s, when the first references to sparging began to appear in the Anglo-Saxon brew literature. Depending on a brewer's preferences, the conventional ratio of brewing liquor to malt in an infusion mash may range from one quart per pound of grist for a thick, high-viscosity mash to about 2.5 quarts per pound of grist for a thinner, lower-viscosity mash.

In a traditional Continental-European system, by contrast, temperature rises in the mash are usually accomplished by the application of external heat in jacketed

vessels, often in conjunction with thorough—and often lengthy—mash agitation to avoid hot spots. Mashes in Continental-European systems, therefore, tend to be much thinner (low viscosity) than in British-type systems. It is not uncommon for such mashes to contain as much as 80 percent of the kettle volume in mash liquor and, therefore, have the consistency more of a grain porridge than of a grain bed.

Also, while in a British-style system the grain bed remains covered with brewing liquor throughout the entire lautering period, in a Continental-European system, the grain bed is often allowed to run dry during lautering. It is then washed again with a second, third, or even fourth dose of mash liquor, the so-called "*Nachguss*" in German (literally: "after-pour"), which may amount to 30 to 50 percent of the kettle volume.

Though there are no set prescriptions for the "correct" water-to-grain ratio, you may wish to consider the following general rules:

A thinner mash with a reduced amount of sparge liquor tends to produce first runnings of relative higher gravities. It also may produce wort of lower pH values and fewer tannins extracted from the grain husks. A long sparge through a thicker grain bed, by contrast, has the opposite effect. Thinner mashes tend to produce better extract efficiencies (higher original gravity values per given grain bed) than do thicker mashes.

On the other hand, there is a traditional, mostly British, view that thicker mashes (made with, perhaps, 1 qt of water per 1 lb of malt) yield maltier beers. However, because wort quality is critically determined also by malt modification, not just by mash-tun geometry and grain bed thickness, much depends on the quality of the malt and on the barley strains from which it is made!

A mash with malts of high homogeneity and high friability values (both above 90%), for instance, should yield beers with exceptional maltiness under a great variation of mash viscosities. High friability values are an indication of good cell wall modification and proper cytolysis, which, in turn, allow for proper enzymatic access to all grain compounds in the mash that are relevant for obtaining complex malt flavors.

Enzymes and Temperatures

Enzymes are protein structure that work as organic catalysts, which means they cause a chemical reaction but are themselves not part of that reaction. They operate only in very specific temperature ranges. They kick in at one temperature, peak at a second, higher temperature, and become denatured and stop working at a third, even higher temperature. Once denatured, an enzyme is permanently destroyed. It cannot be regenerated by lowering the temperature.

Here is summary of the relationships between mash temperatures and enzyme activities:

Mash Enzyme Activity				
Temperature		*Enzyme*	*Function*	*Activity*
95 °F	35 °C	Beta-glucanase (cytolytic)	Gum conversion	Start
100 ± 5 °F	38 ± 2 °C	Phytase	Mash acidification	Start
104 °F	40 °C	Protease (proteolytic)	Protein conversion	Start
104 °F	40 °C	Beta-amylase (diastatic)	Starch to simple sugar conversion	Start
113 °F	45 °C	Beta-glucanase (cytolytic)	Gum conversion	Peak
113 °F – 131 °F	45 °C – 55°C	Phytase	Mash acidification	Peak
122 °F	50 °C	Protease (proteolytic)	Protein conversion	Peak
131 °F	55 °C	Beta-glucanase (cytolytic)	Gum conversion	Denatured
131 °F – 145 °F	56 °C – 63°C	Phytase	Mash acidification	Denatured
140 °F	60 °C	Protease (proteolytic)	Protein conversion	Weaken
140 °F	60 °C	Alpha-amylase (diastatic)	Starch to complex, unfermentable sugar conversion	Start
149 °F	65 °C	Beta-amylase (diastatic)	Starch to simple sugar conversion	Peak
158 °F	70 °C	Beta-amylase (diastatic)	Starch to simple sugar conversion	Denatured
162 °F	72 °C	Alpha-amylase (diastatic)	Starch to complex, unfermentable sugar conversion	Peak
176 °F	80 °C	Protease (proteolytic)	Protein conversion	Denatured
176 °F	80 °C	Alpha-amylase (diastatic)	Starch to complex, unfermentable sugar conversion	Denatured

Based on the above list, it is obvious why rests at approximately 100 °F (38 °C); 122 °F (50 °C); 149 °F (65 °C); and 162 °F (72 °C) have become classic benchmarks for a complex multi-step mash regimen, while rests at 122 °F (50 °C) and 152 °F (67 °C) have become the standard for two-step mashing.

For a single-step mash, a rest at 152 °F (67 °C) appears to be the best compromise.

One elegant alternative for the cautious brewer who wishes to ensure that all enzymes perform all their work at maximum efficiency, is to take the mash from a thick dough-in at about 95 °F (35 °C) or even lower, through a slow, continuous rise in temperature in about 90 minutes, to the mash-out at about 170 °F (77 °C). This method also ensures maximum hydration of the malt for improved extract yield.

There is also an inverse relationship between mash temperatures for peak enzyme activity and mash viscosity. Specifically, enzymes that become active at lower temperatures—such as beta-glucanase and protease—perform more efficiently in more viscous (thicker) mashes, while enzymes that become active at higher temperatures—such as beta and alpha amylase—perform more efficiently in less viscous (thinner) mashes. Under the correct viscosity and temperature conditions, enzymes usually perform the bulk of their work within the first 15 to 20 minutes of a rest; and longer rest times tend to produce only diminishing returns. Of course, conversion also occurs during the time it takes to ramp up a mash from one rest temperature to the next.

The brew house instructions in the recipes in this book are all variations of three standard brewing methods: single-step infusion, multi-step infusion, and decoction. All instructions are very brief and convey basic guidelines. Every brewer should feel free, however, to depart from these instructions and chart his or her own course. There is no room for dogmatism in the brew house!

Single-Step Infusion Mashing

Many traditional British/Irish-style beers can be made just fine by the single-step infusion method, which places the least amount of requirements on the brew equipment. This method dates from a time when mash tuns were invariably simple vessels, usually unclad, uninsulated, and unjacketed—even made of wood, in the old days. A fairly thick mash of about one hour at a fixed temperature of about 148 °F to 152 °F (64 °C to 67 °C) is the norm in this process, as is a slow sparge with water at about 180 °F (82 °C) plus or minus a few degrees, depending on the mash tun's thermal characteristics. The sparge water temperature is adjusted, once the grain bed reaches a mash-out temperature of about 170 °F (77 °C).

Thick, single-step infusion mashes may be simple, but unfortunately they are also the least extract-efficient ones, because much of the starch fails to get converted and much of the fermentable sugar fails to get washed out of the grain bed. In single-infusion mash tuns, therefore, the overall quality of the malts, especially with respect to modification and homogeneity, takes on heightened importance for brew house yields and beer flavor.

Multi-Step Infusion Mashing

Raising the mash temperature from low to high becomes easier the more versatile and sophisticated the brew system is. In a mash-lauter tun without a heat source, there is only one way to step-mash: After a thick mash-in at the first rest temperature, the next rest can be achieved solely through the addition of hot water, which can even be near the boiling point, depending on the required temperature

rise as well as the capacity and the thermal absorption characteristics of the mash-lauter tun. In a jacketed mash tun or mash-lauter tun, step-mashing is possible either by the hot-water infusion method, by heating the mash with the jacket, or by both. To avoid hot and cold spots, the mash needs to be agitated, mechanically or by hand, during temperature rises from one step to the next.

Decoction Mashing

This traditional Continental-European mash method requires a mash transfer system with a slurry pump as well as a kettle or cooker with a heat source for raising the temperature of the decoction and for boiling it. Decoction mashes, therefore, tend to be rather thin. Depending on the specific brew house configuration, the decoction can either be drawn into the cooking vessel and processed there, or the main mash minus the decoction can be removed from the mash-kettle—leaving the decoction to be processed there—and then re-introduced to the decoction after boiling.

Decoctions need to be taken through their different temperature rests, before the temperature is raised to the boil. A decoction boil usually lasts about 15 to 20 minutes. Then the hot decoction is returned to the main mash (or the main mash to the hot decoction) to raise the main-mash temperature.

In theory, a mash can be decocted as often as the brewer desires, between each rest, from the acid rest to the mash-out. Mash combinations are possible as well. For instance, a brewer could mash in at the acid rest temperature of 100 ± 5 °F (38 ± 2 °C); followed by a hot-water infusion in combination with steam heat from the mash-tun jacket to reach the protein rest temperature; followed by a decoction to raise the mash to a beta-saccharification temperature of perhaps 149 °F (65 °C) 152 °F (67 °C); followed by another infusion and jacket-heat step to 162 °F (72 °C); finally followed by a second decoction to achieve the mash-out temperature of 170 °F (77 °C). In practice, however, most decoctions nowadays are single-step, from the protein rest to a single saccharification rest; or they are double decoctions, from the protein rest to a single saccharification rest, and then to the mash out.

The amount of mash to be decocted at each step depends on the temperature increases required in the main mash. As a rule of thumb, brewers tend to decoct about one-third, but rarely more than one-half of the main mash at any one time. The following simplified formula (using liters and the Celsius scale) approximates the mash volume (V-dec) that should be decocted to move the main mash (V-main) from one specific rest temperature (T-main) to the next:

V-dec = T-diff * V-main)/(84 – T-main)

Whereby:
V-dec is the volume in liters of the mash that needs to be decocted
T-diff is the desired increase in temperature in the main mash, in °C
V-main is the volume in liters of the main mash
84 is a calculation constant
T-main is the starting temperature of the main mash before the decoction

Example for raising the temperature of a 100-liter (1 hl) mash from the protein rest temperature of 50 °C (122 °F) to a beta-amylase rest of 65 °C (149 °F):

*V-dec = (15 * 100)/(84 – 50) liters*
V-dec = 1500/34 liters
V-dec = 44 liters

The cooking process involved in decoction mashing tends to break down the cytolytic cell structures (mostly gums) of the malt more thoroughly than does infusion mashing. This makes the malt starches more accessible for gelatinization—which occurs under laboratory conditions at about 147 to 153 °F (64 to 67 °C)—and, subsequently, for enzymatic conversion into fermentable sugars. This is why decoction mashes tend to have higher yields than do infusion mashes, especially when compared to infusion mashes of the traditional, thick, British-style, single variety.

Historically, decoction developed probably for two mains reasons: First, the invention of the first practical thermometer happened only in 1714, by Gabriel Fahrenheit. Before that time, only volumes could be measured reliably, and bringing a given volume of mash to a boil was the safest method for controlling the mash heat. Second, medieval malts were often poorly modified and of rather inconsistent quality—two deficiencies that could be overcome by boiling the mash.

SCHULZ brew systems, for which the recipes in this book have been formulated, permit any type of mashing, from simple single-step infusions to multiple decoctions, thus allowing the brewer maximum freedom in handling the mash for any beer style.

Extract Efficiency

If all the compounds that ***can*** be converted in malt in a given grain bed (a hypothetical value) were ***actually*** being converted in a brew house, we would call that brew house 100 percent efficient. But such a brew house is pure fiction. It does not exist in practice because there is always a certain amount of soluble matter in the mash that fails to get extracted. The best brew houses have extract efficiencies close to 85 percent (a nominal value, averaged over many brews). Poor systems may have efficiencies of 55 percent or lower.

The amount of difference in extract efficiency between an actual brew house and an optimal brew house indicates the amount of grain that is being "wasted" in that brew house. In clear language, upgrading from a 60 percent efficient brew house, for instance, to one that is 80 percent efficient saves one-third of the total cost of grain per batch.

Such savings should be considered when calculating the amortization period of a brew house renovation or a new brew house purchase. In other words, a cheap brew house made from modified dairy or food-processing equipment can be more expensive in the long run than a well engineered and quality-fabricated—and admittedly more expensive—SCHULZ system.

A simple approximation of a brew house's percentage efficiency value (%E) can be obtained by applying the following simple formula:

%E = (°P * OG * Vol)/M

Whereby:
°P is the starting gravity before fermentation in °Plato (e.g., 12 °P)
OG is the original gravity before fermentation in English measure (e.g., 1.048)
Vol is the net kettle volume in liters (e.g., 100 liters)
M is the total mass in kilograms of the malt used in the grain bed (e.g., 15.5 kg)

Example for a 2.5-hectoliter batch at an OG of 1.0516 (12.9 °P) for 47.94 kilograms of grain:

*%E = (12.9 * 1.0516 * 250)/47.94*
%E = (3391.41)/47.94
%E = 70.742803
The extract efficiency for this batch is 71% rounded..

Grist Weight
The amount of grist required for a mash depends on four variables: The desired OG, the expected FG, the expected net green beer volume (the amount of wort that reaches the fermenter), as well as the nominal extract efficiency (a percentage value) of the specific mash-lauter system. To determine the total amount of malt required at the mash-in, this book uses the following simple formula from the metric world:

GW = OG(°P) * FG(°P) * V(net)/%E

Whereby:
GW (grist weight) is the total amount of grain in kilogram (kg)
OG(°P) is the target starting gravity in degrees Plato
FG(°P) is the target final or terminal gravity in degrees Plato
V(net) is the net green beer volume in liters that reaches the fermenter
%E is the nominal system extract efficiency expressed as a percentage

Example for a 100-liter beer with 12°P starting gravity, 3°P terminal gravity, and made in a brew house with 80% nominal extract efficiency:

*GW = 12*3*100/80 kg*
GW = 3,600/80 kg
GW = 45 kg

Gravities
In this book, the brew's starting gravity, that is, the gravity of the wort as it reaches the fermenter after all evaporation in the brew house is complete, is listed in both "English" OG and metric degree Plato (°P) values, whereby °P is identical to the German %-extract or %-*Stammwürze*.

To convert OG-values to °P and vice versa, we use the simplified formulas:

°P = (OG - 1)*250
OG = 1 + °P/250

Examples:

*°P = (1.048 - 1)*250*
*°P = 0.048*250*
°P = 12

or

OG = 1 + 12/250
OG = 1 + 0.048
OG = 1.048

There is also a laboratory-precise formula. It is:

°P = (-668.962) + (1262.45*OG) - 776.43*OG^2 + 182.94*OG^3

Example:

*°P = (-668.962) + (1262.45*1.048) - 776.43 * 1.048^2 + 182.94*1.048^3*
°P = 11.8974982605
°P = 11.9 rounded

In our example, the difference in the result between the simplified and the complex calculations is a mere one-tenth of a degree Plato (precisely: 0.102501739 °P) or the equivalent of 0.0004 gravity-points on the OG scale. If this miniscule gain in precision is important to you, obviously feel free to use the more complex formula.

The formulas for converting the final or terminal gravity (FG or the *"Endvergärungsgrad"* in German) into °P or vice versa are analogous to those for converting the starting gravity.

pH-Value

The abbreviation "pH" stands for "power of hydrogen" or "potential of hydrogen." Chemically, pH refers to the concentration of hydrogen ions in a solution; practically, it is a measure of a solution's acidity or alkalinity. Perhaps fittingly, the pH-scale was developed in a brewery, about a century ago, in 1909, by a Danish chemist named Søren Peder Lauritz Sørensen. Sørensen was the head of the Chemistry Department at the famous Carlsberg Laboratory in Copenhagen — the same lab, incidentally, where, in 1881, Emil Christian Hansen first isolated and cultured pure strains of ale and lager yeasts.

pH-values are measured on a scale with 7 as the neutral value. Distilled water is considered a neutral solution. It thus has a pH-value of 7. As solutions increase in acidity, their pH-value drops further and further below 7. As solutions increase in alkalinity, their pH-value rises further and further above 7.

The most acidic solutions can have a pH-value of as low as –5, while the most alkaline solutions, also known as base or caustic solutions, can have a pH-value as high as 14 or 15.

When reading pH-values from a strip or an instrument, it is important to understand that the pH-scale is not linear. Rather, it is a logarithmic scale, similar to the Richter scale for earthquakes, which means that a change of 1 increment represents a ten-fold change in actual acidity or alkalinity, and a change of 2 increments represents a 100-fold change!

For instance, a mash with a pH-value of 4 is ten times more acidic then a mash with a pH-value of 5; and it is a hundred times more acidic than a mash with a pH-value of 6. Therefore, even seemingly small changes in a pH-measurement can have significant effects on the finished beer.

In the mash, pH-values affect enzyme activity, because enzymes, though they can function in a fairly broad range of pH-values, usually reach their peak performance not only at precise mash temperatures, but also at a fairly narrow, acidic, pH-range around 5.5.

In the kettle, the wort's pH-value drops by about 0.2 or 0.3—which means the wort becomes more acidic. That drop is greater in lower-gravity worts than it is in higher-gravity worts. For best yeast performance, the wort should have a pH-value of 5 – 5.2.

In practice, brewers frequently encounter pH-values that are too high instead of too low (the mash and wort are not sufficiently acidic). The addition of acidified malt to the grain bill is the easiest way to solve such a problem:

If the mash and or wort pH is too high (i.e. not sufficiently acidic), replace 1 percent (by weight) of the base malt in the mash with Weyermann® Acidulated malt to drop the pH-Value by 0.1.

Alcohol

For the calculation of the amount of alcohol by volume (ABV), this book uses the simple formula:

(OG – FG)/0.00753 = ABV (%)

Example:

(1.048 – 1.012)/0.00753 = ABV (%)
0.036/0.00753 = ABV (%)
4.7808764 = ABV (%)
AVB = 4.8% (rounded)

For the conversion of ABV into alcohol by weight (ABW) and vice versa, this book uses the following simple formulas:

1% ABV = 0.789% ABW
1% ABW = 1.267% ABV

Examples:

*4.8% ABV = 4.8*0.789% ABW*
4.8% ABV = 3.7872% ABW
ABW = 3.8% (rounded)

or

*5% ABW = 5*1.267% ABV*
5% ABW = 6.335% ABV
ABV = 6.3% ABV (rounded)

Note: There are also more complex laboratory formulas for determining ABV and ABW, but these are well beyond the scope of this book.

Brewing with Sugar

Many beer styles, such as Belgian Abbey Ales or British Barley Wines recommend or require the addition of sugar to the wort. Others, such as Braggot, require the addition of honey. Sugars are either fermentable or not, depending on their molecular complexity. Brewers yeast (*Saccharomyces cerevisiae*) can ferment most monosaccharides and disaccharides (single and two molecule sugars).

Important, fully fermentable malt monosaccharides include glucose (AKA corn sugar or dextrose) and fructose. Fully fermentable disaccharides include sucrose (AKA table sugar, a compound of both glucose and fructose) and maltose (AKA malt sugar). Inverted sugar or invert sugar syrup, incidentally, is a mixture of glucose and fructose. It is obtained by splitting sucrose into its two constituent components. It, too, is fully fermentable. To calculate the contribution sugars make to wort gravity and to the production of alcohol, consider the following facts and mathematical relationships:

Sugar (for instance pure sucrose) in solution produces a specific gravity increase of 46.31 points (that is, of 0.046 or approx. 11.5 °P) per pound per gallon. If this sugar were dissolved in water (which has a SG of 1.000 (or 0 °), the resulting solution would have a gravity of OG 1.046 or 11.5 °P. In the metric system, this amounts to 386.5 points/kilogram/liter. For quantities that are more meaningful to professional brewers, this means:

1 lb pure sucrose (or equivalent) dissolved in 1 bbl wort increases OG by 1.493871 points (approx. 0.0015).

1 kg pure sucrose (or equivalent) dissolved in 1 hl wort increases OG by 3.863 points (approx. 0.0039).

Example:

*The addition of 4.5 lbs. of fully fermentable sugar to 1 bbl of wort raises the wort OG by (46.31 points * 4.5 lbs)/31 gal.*
*46.31 points * 4.5 lbs)/31 gal = 6.7224 points*
*46.31 points * 4.5 lbs)/31 gal* = approx. 7 gravity points (rounded)

For a Belgian Abbey Dubbel, for instance, with an OG just from just grain of 1.060 (15 °P), the combined wort gravity from both grain and from 4.5 lbs/bbl sugar, therefore, is 1.060 + 0.007 = 1.067 (16.75 °P).

Considering that—at a final gravity of 1.010—this beer's ABV, without the sugar, is 6.7 percent (rounded), it would be 7.6 percent with the sugar—calculated from an OG of 1.067 and the same FG of 1.010.

Note that the wort OG changes with the addition of sugar, but the wort FG does not, because the sugar is fully fermentable into alcohol and thus does not leave any residual, non-alcohol substances that would contribute to gravity in the finished beer.

Brewing with Honey
A typical sugar analysis of honey is as follows:

Honey Analysis (by weight in percent)			
Components	**%**		**%**
Fructose	**38.2**	**All Fermentable Sugars Combined**	**77.9**
Glucose	**31.3**		
Sucrose	**1.3**		
Maltose	**7.1**		
Higher Saccharides	**1.5**	**Water and All Non-Fermentables Combined**	**21.1**
Water	**17.2**		
Other Particulate	**3.4**		
TOTAL	**100**	**TOTAL**	**100**

The water content of individual batches of honey varies marginally, depending on the evaporation rate of the honey in the hive before harvesting. As a rule of thumb, however, we can use the following generalization:

Honey is about 20 percent water and 80% sugar, and virtually all of the sugars are fermentable. Therefore, for honey, we can use the same formula as for pure sugar above. However, the results need to be multiplied by 80 percent (or by 0.8, or by four-fifth). Therefore:

1 lb honey dissolved in 1 bbl wort increases OG by 1.1951 points (approx. 0.0012).

1 kg honey dissolved in 1 hl wort increases OG by 3.09 points (approx. 0.0031).

DID YOU KNOW ... ?

Mankind has been brewing beer for at least 8,000 years, but flavoring beer with hops, *Humulus lupulus* from the Latin for "wolf plant," is a fairly recent development. The first written evidence of hop cultivation comes from the medieval Benedictine brew monks of Weihenstephan outside Munich, in Bavaria. These friars made explicit mention of their hop gardens as early as 736, only a dozen years after the founding of their monastery by the Franconian missionary Corbinian. By 1040, Weihenstephan received from Bishop Engilbert of Freising the official brew privilege and the right to sell beer for profit. By that time, the place had grown into a substantial abbey and brewery. Since 1803, Weihenstephan has been owned by the State of Bavaria. At that time, Bavaria was occupied by Napoleon and, as part of his new Civil Code, he demanded the secularization of all church properties. Weihenstephan is now home to one of Germany's top three brew universities, the Technical University of Munich, and it is still a commercial brewery. This makes Weihenstephan the oldest continuously operating brewery in the world.

The first literary reference about hops comes from Hildegard von Bingen (1098–1179), a brew nun, botanist, physician, and advisor to Emperor Frederic I (a.k.a. Barbarossa). In her book *Physica sacra* (Sacred World), written in 1079, she pointed to the healthful properties of beer made with *Humulus lupulus*. The legendary abbess drank beer regularly and lived to be 81 years old, which was a rare age for that time. She maintained that there was a connection between her longevity and her dedication to beer. The French King Louis IX passed a law, in 1268, stipulating that, in his realm, only malt and hops may be used for beer making. We also know that hops were put into beer in the Netherlands as early as the 1300s. The German beer purity law (the Reinheitsgebot), too, makes hops one of the three required ingredients in beer (next to malted barley and water), which suggests that hops had become a common brew ingredient by then.

Hops were probably introduced to Britain by Belgian immigrant brewers in the 15th and 16th centuries. In fact, in those days, unlike today, the term ale denoted a beer brewed without hops, while the term beer denoted a brew made with hops. Once hops were introduced into beer toward the end of the Middle Ages, the brew that emerged was the original brown ale, the foundation style for all other British ales. The lighter browns eventually evolved into mild ales; the darker browns, into stouts; blends of stouts and browns, into porters; and the paler, hoppier browns, into IPAs, bitters, and pale ales. The introduction of hops in Britain, however, was apparently not without controversy. As we know from a 1440s-manuscript, the new—hopped—ale became known as "beer" to distinguish it from the traditional un-hopped "ales." In fact, while hops were being legislated *into* beer on the European continent, it seems that, at least initially, hops were being legislated *out of* beer in Britain. In the 1530s, King Henry VIII—obviously taking time out from his strenuous philandering—forbade the use of hops outright at his court. He considered hops an aphrodisiac that would drive the populace to sinful behavior. Such is the pious duplicity of a ruler who, after all, managed to go through countless mistresses—not to speak of six wives, two of whom lost their heads in the Tower!

About Hops

The best hops (*Humulus lupulus*) in the world grow only in two narrow bands around the globe, roughly between latitudes 35 to 50, north and south, because this is where the proper amount of sunlight per day reaches the earth during the hop-specific growing season, which, in the northern hemisphere, starts in late March to early April and ends with the harvest in late August to late September.

The hop vine is a member of the hemp family. Though it likes a bright and sunny climate, it also likes plenty of water from rain or irrigation, as well as soil types that drain well. This combination of requirements eliminates much of the land within the optimum latitude range as unsuitable for hop cultivation. Two core hop-growing regions stand out in importance, the German Hallertau region, slightly northeast of Munich, and the Pacific Northwest in the United States, each of which produce about one-third of the world's hop supply. China produces about one-tenth, and about a dozen other countries combined produce the rest.

There are hundreds of compounds in hops that contribute aroma, flavor, and preservative properties to beer. Importantly, these include resins and oils. The key resins, which are precursors to beer bitterness, are the three alpha-acids humolone, adhumulone, and cohumulone, as well as the three beta-acids lupolone, adlupulone, and colupulone. The key volatile oils in hops are linalool, geraniol, 4 mercapto-4-methylpentan-2-one, alpha-selinene, aromadendrene, beta-caryophyllene, beta-selinene, farnesene, and humulene. In addition, hops contain very valuable and bioactive substances, such as xanthohumol and desmethylxanthohumol, as well as 6- and 8-prenylnaringenin.

These compounds reside only in the hop's cone-shaped female flowers, specifically in the cluster of tiny, sticky, yellow globlets—the lupulins—on the inside of each leaf. When fresh, alpha-acid resins isomerize in the kettle and become wort-soluble. When exposed to air, alpha-acids oxidize fast and become wort-insoluble. Fresh beta-acid resins, on the other hand, such as lupulone, colupulone, and adlupulone, do not isomerize in the kettle and, therefore, contribute only negligible amounts to a beer's bitterness. Oxidized beta-acids, however, become wort-soluble.

Some hop varieties may have as little as 3 percent (by weight) of alpha-acids, while others may have as much as 18 to 20 percent. So-called "noble" hop varieties tend to contain relatively low amounts of alpha- and beta-acids. Rather, they have high amounts of hop oils, especially of humulene.

Hop flowers are also rich in tannins, which aid in the removal of excess protein from the wort. Tannins also serve as natural preservatives by inhibiting the development of pathogens in the beer. Finally, hops enhance the firmness and creaminess of a beer's head.

Numerically, the unit of measurement for bitterness is the same in the American/British and the EBC-system and is expressed as bitter unit (BU) or

international bittering unit (IBU). As a reference point, 1 BU equals 1 milligram of dissolved bittering compounds (isohumulones or equivalent) in 1 liter of liquid (wort or beer). The average human taste threshold for bitterness in beer is at about 4 BU, while the upper solubility limit for alpha-acids in beer is at about 100 BU.

Pellets

Fresh hops, when harvested, are extremely perishable and rarely last longer than a day or two. Therefore, all hops need to be processed immediately after harvesting to make them available throughout the entire brew year. This involves kiln-drying as well as pressing and baling, or pelletizing. Pellets are made from de-stemmed hop flowers that are deep-frozen (to eliminate the stickiness of the resins) and then hammer-milled. The frigid hop powder is then passed through a pellet die. Pellets are cylindrical in shape, approximately 15 mm long, and 6 mm in diameter.

They are packaged in laminated, plastic or aluminum foil pouches. Before sealing, the air in the pouches is evacuated to prevent oxidation of the hop resins and oils, which would give the hops an undesirable "cheesiness." Alternatively, they may be packed in soft pack containers that are back-flushed with carbon dioxide or nitrogen gas. Hop pellets are shipped in quantities of 5 kg (11 lbs.), 20 kg (44 lbs.), or 150 kg (330 lbs.). Unopened packs of pellets can be kept in cold storage for about a year without losing their bitterness and aroma properties; opened packs should be used in their entirety immediately or re-sealed and stored in a freezer.

In many breweries nowadays, the use of hop extracts for bittering has become popular, because, compared to dried hop flowers and pellets, they require much less storage space, they keep much better in storage, and their alpha-acid contribution to wort is much easier to calculate reliably. Hop extracts are produced from hop pellets that are "washed" under high pressure in liquefied carbon dioxide gas (CO_2) to dissolve the essential bittering and aroma substances. When the pressure is released, the CO_2 becomes gaseous, leaving behind pure hop extract.

T-90/T-45 Pellets

Pelletized hops come in two varieties, Type-90 and Type-45. T-90 pellets are made from the entire hop flower, while T-45 pellets are made after much of the vegetative matter has been removed from the flower, which concentrates the lupulin content in the pellets. Because T-90 pellets contain all the vegetative and lupulin material of the hop flower, they function as a full replacement for leaf hops in the kettle. Because of their greater surface area when dissolved in wort, however, they tend to give somewhat better hop utilization by weight than do comparable amounts of leaf hops.

T-45 hop pellets are made the same way as T-90 pellets, except that the hammer-milling occurs at a very low temperature of −31°F (− 35°C), which prevents the stickiness from the lupulin to affect further processing. The powder is then sieved to produce a resin-rich fraction which contains only about half the original vegetable matter, before the T-45 powder is sent to the pellet die and the packaging machine.

Hop Substitutions

Different hop varieties, of course, provide different characteristics to beer, in bitterness, flavor, and aroma.

POPULAR HOP VARIETIES (alphabetical)	
Aroma Hops	Aurora, Cascade, Citra, East Kent Goldings, First Gold, Fuggles, Goldings, Hallertauer Mittelfrüh, Hallertauer Tradition, Hersbrucker, Lublin, Mt. Hood, Opal, Perle, Saaz, Saphir, Select, Sladek, Smaragd (Emerald), Spalter, Strisselspalter, Styrian Goldings, Tettnanger, Willamette
Bittering Hops	Cluster, Galaxy, Marynka, Northern Brewer, Premiant, Pride of Ringwood, Target
High Alpha	Admiral, Chelan, Chinook, Galena, Herkules, Magnum, Millennium, Nugget, Super High Alpha, Super Pride, Taurus, Tillicum, Warrior®

As a general rule, the earlier a hop is added to the kettle, the easier it is to substitute, which is why many large breweries have switched to hop extracts for bittering.

However, should a hop specified in the recipes in this book be not available or not practical to obtain for any reason, the following chart contains a few possible substitution suggestions based on the different varieties' profiles:

HOP SUBSTITUTION TABLE (alphabetical)	
Brewers Gold-Like Hops	Brewers Gold, Chelan, Galena, Magnum, Merkur, Millennium, Nugget, Perle, Tillicum
Fuggles-Like Hops	Cascade, Centennial, Fuggles, Palisade, Southern Brewer, Styrian Goldings, Willamette
Goldings-Like Hops	Bramling Cross, Chinook, East Kent Goldings, First Gold, Horizon, Northern Brewer, Target
Hallertau-Like (Mittelfrüh) Hops	Crystal, Hallertauer, Liberty, Mount Hood, Opal, Saphir, Smaragd, Tradition, Ultra, Vanguard
Saaz-Like Hops	Backa, Lublin, Saaz, Santiam, Select, Spalter, Sterling, Tettnanger, Zhayi
Other, Difficult to Match Varieties	Amarillo, Ahtanum, Citra, Cluster, Galaxy, Glacier, Herkules, Hersbrucker, Nelson Sauvin, Simcoe, Summit, Taurus, Warrior®

Being a natural product, hop characteristics, of course, vary from one harvest year to the next. The following list shows the average values that brewers can expect from different varieties:

Variety	Alpha Acids[%]	Beta Acids[%]	Cohumulone [%]	Oil [ml/100g]	Aroma
Admiral	13 - 16	4.8 - 6.1	37 - 45	1.0 - 1.7	Typical English Aroma
Ahtanum	5.7 - 6.3	5.0 - 6.5	30 - 35	0.8 - 1.2	Citrus, Floral
Amarillo ®	8 – 11	6.0 - 7.0	21 - 24	1.5 - 1.9	Floral, Citrus
Apollo	15 - 19	5.5 - 8.0	24 - 28	1.5 - 2.5	Aromatic, Pleasant
Aurora	7.0 - 9.0	3.0 - 5.0	23 - 28	0.9 - 1.4	Intense, Pleasant
Bravo	14 – 17	3.0 - 4.0	29 - 34	1.6 - 2.4	Fruity, Floral
Brewer's Gold (UK)	5.5 - 6.5	2.5 - 3.5	40 - 48	1.8 - 2.2	Blackcurrant, Fruity, Spicy
Cascade	4.5 - 7.0	4.8 - 7.0	33 - 40	0.7 - 1.4	Floral, Citrus, Grapefruit
Centennial	9.5 - 11.5	3.5 - 4.5	29 - 30	1.5 - 2.3	Medium Intense Floral, Citrus
Challenger	6.5 - 8.5	4.0 - 4.5	20 - 25	1.0 - 1.7	Mild To Moderate, Spicy
Chelan	12 - 14.5	8.5 - 9.8	33 - 35	1.5 - 1.9	Pleasant Citrus Notes
Chinook	12 – 14	3.0 - 4.0	29 - 35	1.7 - 2.7	Spicy, Piney, Strong Grapefruit
Citra	11 - 13	3.5 - 4.5	22 - 24	2.2 - 2.8	Strong Citrus, Fruity
Cluster	5.5 - 8.5	4.5 - 5.5	37 - 43	0.4 - 0.8	Floral, Spicy
Columbus	14.5 - 16.5	4.0 - 5.0	28 - 32	2.0 - 3.0	Pungent
Crystal	3.5 - 5.5	4.5 - 6.5	20 - 26	1.0 - 1.5	Mild, Spicy, Floral
First Gold	5.6 - 9.3	2.3 - 4.1	32 - 34	0.7 - 1.5	Spicy, Similar To Goldings
Fuggles	3.0 - 5.6	2.0 - 3.0	25 - 30	0.7 - 1.4	UK:Mild/Pleasant;US:Woody/Fruity
Galaxy	13.5 – 15	5.8 - 6.0	~ 35	2.7 - 2.7	Intense, Pleasant, Unique
Galena	11.5 - 13.5	7.2 - 8.7	36 - 40	0.9 - 1.3	Citrus
Glacier	~ 5.5	~ 8.2	11 - 13	0.7 - 1.6	Pleasant Hoppiness
Goldings	4.0 - 6.0	2.0 - 3.0	23 - 28	0.7 - 1.0	Mild, Delicate, Classic English
Hallertau Merkur	10 - 14	3.5 - 7.0	17 - 22	1.4 - 1.9	Spicy, Floral
Hall. Mittelfrüh	3.0 - 5.5	3.0 - 5.0	18 - 28	0.7 - 1.3	Mild, Pleasant
Hallertau Taurus	12 – 17	4.0 - 6.0	20 - 25	0.9 - 1.4	Noble, Aromatic
Hallertau Tradition	4.0 - 7.0	3.0 - 6.0	24 - 30	0.5 - 1.0	Fine Noble
Herkules	12 - 17	4.0 - 5.5	32 - 38	1.6 - 2.4	Typical Spicy
Hersbrucker	1.5 - 4.0	2.5 - 6.0	17 - 25	0.5 - 1.0	Mild To Medium, Pleasant
Horizon	11 – 13	6.5 - 8.5	16 - 19	1.5 - 2.0	Floral, Spicy
Kent Goldings	4.0 - 6.5	1.9 - 2.8	28 - 32	0.4 - 0.8	Gentle, Fragrant, Pleasant
Liberty	3.0 - 5.0	3.0 - 4.0	24 - 30	0.6 - 1.2	Mild, Slightly Spicy
Lublin	3.0 - 4.5	3.0 - 4.0	25 - 28	0.5 - 1.1	Very Fine
Magnum	11 - 16	5.0 - 7.0	21 - 29	1.6 - 2.6	Hoppy, Fruity, Flowery
Marco Polo	14.5 - 16.5	4.5 - 5.5	28 - 32	2.0 - 3.0	Pungent
Marynka	6 – 12	10.2 – 13	26 - 33	1.8 - 2.2	Strong Hoppy
Millennium	14.5 - 16.5	4.3 - 5.3	28 - 32	1.8 - 2.2	Mild, Herbal, Similar To Nugget
Mount Hood	4.0 - 7.0	5.0 - 8.0	21 - 23	1.2 - 1.7	Mild, Somewhat Pungent
Nelson Sauvin	12 – 13	6.0 - 8.0	22 - 26	1.0 - 1.2	Unique Fruity, White Wine
Newport	13.5 – 17	7.2 - 9.1	36 - 38	1.6 - 3.4	Mild
NZ Hallertau	6.5 - 8.5	8.0 - 9.0	28 - 30	0.9 - 1.1	Slight Floral, Some Citrus
Northdown	7.5 - 9.5	5.0 - 5.5	24 - 30	1.5 - 2.5	Mild, Pleasant, Delicate
Northern Brewer	6 – 10	3.0 - 5.0	27 - 32	1.0 - 1.6	Medium To Strong

Variety	Alpha Acids [%]	Beta Acids [%]	Cohumulone [%]	Oil [ml/100g]	Aroma
Nugget	9 – 14	3.0 - 5.8	22 - 30	0.9 - 2.2	Pleasant Herbal
Opal	5.0 - 8.0	3.5 - 5.5	13 - 17	0.8 - 1.3	Fine, Spicy
Pacific Gem	13 – 15	7.0 - 9.0	37 - 40	1.1 - 1.3	Pleasant Blackberry
Pacifica	5.0 - 6.0	5.5 - 6.5	24 - 26	0.9 - 1.1	Citrus, Floral
Palisade ®	5.5 - 9.5	6.0 - 8.0	24 - 29	1.4 - 1.6	Good
Perle	4.0 - 9.0	2.5 - 4.5	29 - 35	0.5 - 1.5	Moderately Intense & Pleasant
Pilgrim	9 – 13	4.3 - 5.0	36 - 38	1.2 - 2.4	Distinctive, Strong
Premiant	7 – 11	3.5 - 6.0	18 - 23	0.9 - 1.3	Mild, Pleasant
Pride Of Ringwood	7 – 11	4.0 - 6.0	32 - 39	0.9 - 2.0	Strong, But Not Unpleasant
Progress	5.0 - 7.0	2.0 - 2.5	25 - 30	0.6 - 1.2	Moderately Strong, Good Aroma
Saaz	3.0 - 6.0	4.5 - 8.0	23 - 26	0.4 - 1.0	Intense, Pleasant
Santiam	5.5 - 7.0	7.0 - 8.5	20 - 22	1.3 - 1.7	Herbal, Noble Hop Aroma
Saphir	2.0 - 4.5	4.0 - 7.0	12 - 17	0.8 - 1.4	Spicy, Fruity, Floral
Simcoe ®	12 – 14	4.0 - 5.0	15 - 20	2.0 - 2.5	Unique Pine-Like Aroma
Sladek	5.0 - 9.0	8.0 - 11.0	22 - 28	0.8 - 1.0	Spicy
Smaragd (Emerald)	4.0 - 6.0	3.5 - 5.5	13 - 18	0.4 - 0.8	Very Fine Aroma
Southern Hallertau	5.0 - 6.0	3.8 - 5.4	22 - 26	0.6 - 0.7	Very Mild And Pleasant
Southern Saaz	4.0 - 7.0	3.0 - 5.0	23 - 28	0.5 - 1.1	Herbal, Spicy, Resinous
Sovereign	4.5 - 6.5	2.1 - 3.1	26 - 30	0.6 - 1.0	Fruity, Intense, Pleasant
Spalter	2.5 - 5.5	3.0 - 5.0	22 - 29	0.5 - 0.9	Mild, Pleasant, Slightly Spicy
Spalt Select	3.0 - 6.5	2.5 - 5.0	21 - 27	0.6 - 0.9	Very Fine, Spicy, Floral
Sterling	6.0 - 9.0	4.0 - 6.0	22 - 28	1.3 - 1.9	Herbal, Spicy, Floral, Citrus
Strisselspalt	3.0 - 5.0	3.0 - 5.5	22 - 25	0.6 - 0.9	Medium Intense And Pleasant
Styrian Goldings	4.5 - 6.0	2.0 - 3.5	25 - 30	0.5 - 1.0	Delicate, Slightly Spicy
Summer Saaz	4.0 - 7.0	4.0 - 6.0	22 - 25	1.0 - 1.3	Balanced, Sweet, Fruity
Summit	13.5 - 15.5	4.0 - 6.0	26 - 30	1.5 - 2.5	Strong Citrus, Grapefruit
Super Galena	13 - 16	8.0 - 10.0	35 - 40	1.5 - 2.5	Similar To Galena, Citrus
Super Pride	13 – 15	6.0 - 8.0	27 - 29	1.0 - 1.4	Pleasant
Target	9.5 - 12.5	4.3 - 5.7	35 - 40	1.2 - 1.4	Intense, Pleasant English Aroma
Tettnanger	2.5 - 5.5	3.0 - 5.0	22 - 28	0.5 - 0.9	Mild, Pleasant, Slightly Spicy
Tillicum	12 - 14.5	9.3 - 10.5	31 - 38	1.5 - 1.9	Good Aroma For Bitter Hop
Tomahawk ®	14.5 – 17	4.5 - 5.5	28 - 35	2.5 - 3.5	Pungent
Topaz	15 - 18	6.0 - 7.0	47 - 50	0.8 - 1.7	Strong, Fruity, Pleasant
Tsingdao Flower	6.0 - 8.0	3.0 - 4.2	~ 35	0.4 - 0.8	Floral, Spicy
Ultra	2.0 - 3.5	3.0 - 4.5	23 - 38	0.5 - 1.0	Mild, Pleasant, Saaz-Like
Vanguard	5.5 - 6.0	6.0 - 7.0	14 - 16	0.9 - 1.2	Similar To Hallertau Mittelfrüh
Warrior ®	14.5 - 16.5	4.3 - 5.3	22 - 26	1.3 - 1.7	Very Mild
Willamette	4.0 - 6.0	3.0 - 4.5	30 - 35	1.0 - 1.5	Mild, Pleasant, Slightly Spicy
Zeus	12 - 16.5	4.0 - 6.0	27 - 35	1.0 - 2.0	Aromatic, Pungent

Hop Utilization

The essential value for determining hop utilization of a hop addition with a known alpha-acid content (AA) is the length of time it is exposed to the heat of the wort in the kettle. Hop utilization values (as a percentage of total AA contained in a hop addition) for pellets are listed below. They are empirical averages for most brew systems. This book relies for all hop calculations exclusively on pellet values.

Approximate alpha-acid isomerization rates in % for pellets, relative to the number of minutes of the hop's exposure to hot wort

Minutes	*% Utilization*	*Decimal*
60+	30	0.30
55	29	0.29
50	28	0.28
45	27	0.27
40	25	0.25
35	23	0.23
30	21	0.21
25	19	0.19
20	17	0.17
15	14	0.14
10	10	0.10
5	6	0.06
0	0	0.00

Note that, in utilization formulas, percentage values for isomerization relative to time are often expressed as decimal values. For instance, 25 percent utilization is calculated as 0.25.

Bittering, Flavor, Aroma Hops: Definitions

The distinction between bittering, flavor, and aroma hops is perhaps analytically illegitimate, because virtually all hop additions contribute bitterness, flavor and aroma to the brew—but each to different degrees.

Also, the terms themselves are somewhat ambiguous, because there is no precise, scientific separation between bittering, flavor, and aroma. Clearly, bitterness is also a "flavor." And it is probably debatable, if a floral-hoppy note in a beer's finish is more aptly called an "aroma" than a "flavor." With these provisos, here are the concepts used in this book.

- Bittering hops: Hops used primarily for their alpha-acids. They are invariably added close to the beginning of the boil.

- Flavor hops: Hops added to the brew "in the middle" of the kettle time. There may be more than one flavor addition, or even none. The term "flavor" hops was selected merely to indicate that "middle" hop additions tend to lose many, though not all, of their delicate, volatile aromas through evaporation.

Depending on hop variety and length of heat exposure, flavor hops also contribute—next to aroma compounds—certain amounts of alpha-acids to the brew.

- Aroma hops: These are hops added very late in the kettle process—shortly before, at, or after shut-sown; often in the whirlpool; or in a hop back before the heat exchanger. In dry-hopping, brews are passed cold through a hop back during transfer. For all practical purposes, aroma hops make next to no contribution to a beer's bitterness, but many of their volatiles remain in the brew because of the short time (or no time) of their exposure to wort heat, or because they are added to the wort as it is cooling down.

This book relies on a simple formula for calculating the amount of bittering hops required to achieve a specified BU-target in a targeted amount of green beer. The amounts of flavor and aroma hops, on the other hand, are specified "free-hand" simply by weight, usually as a multiple or a percentage of the calculated weight of the bittering hops addition.

However, there is a feed-back relationship between the amounts of bittering, flavor, and aroma hops, because of the latter's' measurable contribution also to bitterness: Initially, the *nominally required* amount of bittering hops for a given BU target is calculated as if no other hops were used in the brew.

But if flavor and aroma hops are used in the brew and these hops, too, are exposed to kettle heat for any length of time, the *actual* amount of bittering hops is reduced to account for the amount of alpha-acids these other hop additions are allowed to contribute to the brew.

Bitter Unit Calculations

For the calculation of the weight of bittering hops (in U.S. ounces), based on the BU-values specified in the recipes, this book uses the following formula:

Amount of bittering hops (in U.S. oz) = (Vgal * BU)/(U * %AA * 7462)

Whereby:
Vgal is the target amount of green beer in U.S.-gallons
BU is the bittering value specified in the recipe
U is the percent hop utilization value (as a decimal value) per heat exposure time (from the table above)
%AA is the alpha-acid rating of the hop variety used (as a decimal value)
7462 is a computation constant

Example for 1 hectoliter of beer with a target BU of 40, bittered with a hop variety of 4.5% AA, exposed to high heat for 60 minutes:

*Amount of bittering hops = (26.41721*40)/(0.30*0.045*7462) oz*
Amount of bittering hops = 1056.6884/100.737 oz
Amount of bittering hops = 10.489575

Amount of bittering hops = 10.5 oz or 300 grams (rounded)

This formula yields the total amount of hops required to achieve the brew's target bitter value ***with just one (!) addition of bittering hops*** at a given AA-rating. If a brew also receives flavor and/or aroma hops additions, this amount is merely hypothetical, because it must be reduced in relationship to the bittering values contributed by these subsequent additions. In the recipes in this book, the specified amounts of bittering hops already take into account the alpha-acid contributions of the later flavor and/or aroma hops additions, if any.

For those brewers interested in making their own hops calculations, the formula for determining the "weight equivalent of bittering hops" that needs to be subtracted from the nominally required, hypothetical weight value of the first hop addition is as follows:

BU contribution from flavor or aroma hop = (oz * U * %AA * 7462)/Vgal

Whereby:
Vgal = target amount of green beer in U.S.-gallons
Oz = amount by weight (in U.S.-ounces) of flavor or aroma hops, respectively, as specified in the recipe
U = percent hop utilization value (as a decimal value) per heat exposure time (from the table on page 32)
%AA = alpha-acid rating of the hop variety used (as a decimal value)
7462 = a computation constant

Notes:

- As a general rule, leaf hops have slightly lower hop utilization values than do equivalent amounts of pellets at the same AA-rating. Unless better information is available, the following is a passable rule of thumb: To achieve the same extraction from leaf as opposed to pellet hops, simply increase the weight of the calculated hop pellet addition by about 20 to 25 percent.

- Also, utilization values depend on the hop variety, crop year, and the physical characteristics of the brew system.

- The small bittering values that come from hop beta-acids are ignored in all BU-calculations in the recipes in this book.

- Bitterness derived from other hop substances are also not considered in this book.

"Down-Stream" Hop Products

"Down-Stream" products are preparations that are extracted from natural hops. These products have several advantages for certain brew house applications: They are of laboratory-controlled consistency, they are highly shelf-stable, and they are very compact and thus require less storage space than pellets or baled leaf hops.

Barth-Haas down-stream products are intended for use in finished beer after fermentation and lagering or conditioning. Down-stream hop products are divided into bitter product known as Isohop and Tetrahop (Gold) as well as aroma products known as Pure Hop Aroma products (PHA). They are aqueous solutions of standardized concentrations that disperse easily in beer. The dosage is metered precisely by a dedicated pump that injects the solutions continuously into the beer stream during transfer, usually during or after filtration. The later the beer is inoculated with a down-stream product, the greater is that product's utilization, which generally ranges between 60 and 100 percent. Alternatively, down-stream products can be added to kegs during filling, which, however, results in reduced utilization rates.

Tetrahop Gold

Tetrahop Gold is a solution of 9 percent Tetrahydroiso alpha-acids. It is used not only for bittering, but also to enhance the finished beer's foam stability and its resistance to damage from ambient light. For bittering, it can be used as a partial substitute for bittering hops in any beer style in this book, replacing a hop equivalent of up to 8 BU. It is particularly suitable for all beer styles for which a sturdy head of foam is an essential characteristic, such as most lagers as well as Porters. For the correct dosage calculation for Tetrahop Gold, the following formula applies (metric):

Amount of Tetrahop Gold (g/hl) = BU*1.22 g/hl

Whereby
BU is the amount of bittering units that are to be replaced with Tetrahop Gold.
1.22 is a computation factor based on a solution of 9 percent Tetrahydroiso alpha-acids and 70 percent product utilization.

Example:
Assuming it takes 122 grams of Hallertauer Tradition with 5.5% AA (at 30% utilization) to supply 1 hl of beer with 20 BU (or it takes 5 oz/bbl). Replacing 6 BU with Tetrahop Gold, therefore, requires:

73 g/hl Hallertauer Tradition (= 30% less hops),

plus

*6*1.22 g/hl = 7.3 g/hl = 8.6 g/bbl = 0.3 oz/bbl Tetrahop Gold*

Isohop

Isohop, on the other hand, is a solution of 30 percent iso-alpha-acids and is used exclusively for bittering. It is suitable for the following beer styles featured in this book: Bitter, Extra Special; Brown Ale, American; California Common; Dark Ale American; Dunkelbock; Eisbock; Fruit Ale, American; Imperial IPA, American; IPA, English; IPA, American; Kellerbier; Old Ale; Lager, Amber European; Maibock; Pale Ale, American; Pale Ale, English; Pilsner, Northern German; Pilsner, American; Pilsner, Classic; Porter, Baltic; Porter, German; Porter, London; Porter Robust; Sticke; Stout, Belgian; Stout, Foreign Export; Stout, Irish; Stout, Oatmeal; Stout, Russian Imperial Stout.

Isohop can replace a hop equivalent of up to 40 BU. For the correct dosage calculation for Isohop, the following formula applies (metric):

Amount of Isohop (g/hl) = BU*0.42 g/hl

Whereby
BU is the amount of bittering units that are to be replaced with Isohop.
0.42 is a computation factor based on a solution of 30 percent iso-alpha-acids and 80 percent product utilization.

Example:
Assuming it takes 122 grams of Hallertauer Tradition with 5.5% AA (at 30% utilization) to supply 1 hl of beer with 20 BU (or it takes 5 oz/bbl). Replacing all 20 BU with Isohop, therefore, requires:

0 g/hl Hallertauer Tradition (= 100% less hops),

plus

*20*0.42 g/hl = 8.4 g/hl = 9.9 g/bbl = 0.35 oz/bbl Isohop*

PHAs
PHAs (down-stream aroma product) enhances, obviously, the beer's aroma. But, depending on the beer's composition also enhances other taste components such as the beer's sweetness indirectly. PHA is available for all hop varieties. They are divided into two types, PHA Varietal and PHA Topnote. PHA Varietals give beer a hop variety-specific late-hop character, while PHA Topnotes give it a variety-specific dry-hop character.

All PHAs can be used as partial or entire replacements for aroma hops. Various PHPs, both Varietals and Topnotes, can also be combined with each other to produce specific aroma profiles.

PHAs are dosed into the finished beer before or during filtration, or—for close to 100-percent utilization—after filtration. The dosage is metered by an in-line pump. They can also be added to the beer before kegging. Depending on beer style, PHAs are added at rate of 5 to 40 g/hl (approx. 6 to 47 g/bbl or 0.2 to 1.7 oz/bbl). A standard dosage recommendation is 10 g/hl beer (12 g/bbl or 0.30 oz/bbl). Belgian-style Abbey and Trappist ales, *Bière de saison*, and all variations of IPAs are excellent styles for PHAs.

About Water

The average beer is about 90 percent water, and traditionally brewers had to rely for their brewing liquor only on what was locally available. This meant using a liquid from the local municipal water works, a local river or reservoir, or a local well as is, without any control over the mineral content or the impurities it may contain. This fact has had a profound impact on beer styles and flavors.

Chemically, pure water consists of two parts hydrogen and one part oxygen, it is pH-neutral (pH 7), and it has no flavor. However, there are many trace elements that can be dissolved or suspended in water, including calcium, carbonate, chloride, magnesium, sodium, and sulfate, which influence the flavor profile of the finished beer, often by reacting with other beer compounds that are contributed by the yeast, the malt, and the hops. These trace elements and the compounds they form determine the two most crucial water variables for the practical brewer: hardness or softness and alkalinity or acidity.

Hardness/softness is determined mostly by the amount of calcium and magnesium in the water, or their absence; and by bicarbonate, or its absence. Water that is high in calcium and/or magnesium is acidic; water that is high in bicarbonate is alkaline.

Hardness comes in two varieties, permanent and temporary. Permanent hardness is usually slightly acidic, while temporary hardness is strongly alkaline. Permanent hardness is also referred to as sulfate or non-carbonate hardness, and is produced by calcium and magnesium ions, while temporary hardness is also known as carbonate hardness.

Water from aquifers surrounded by limestone tends to be fairly hard, because limestone is calcium carbonate. Carbonates in large amounts can contribute a harsh bitterness in beer which can negatively affect the flavor especially of a delicate, pale brew. As a broad generalization, water with fewer than 100 parts per million (ppm) of calcium carbonate is considered soft. Temporary (carbonate) hardness can be reduced by boiling the brewing liquor, which causes calcium carbonate ($CaCO_3$) to precipitate into scales, as it does in a household tea kettle. Permanent (sulfate or non-carbonate) hardness, on the other hand, remains in the liquor after a boil. It is much more difficult to reduce. Changing the amount of permanent hardness in brewing liquor requires specialized equipment, such as filters or reverse osmosis devices.

Brewing Liquor around the World

Among the world's famous traditional brewing centers, Pilsen has extremely soft water, which contains very low amounts of calcium, carbonate, chloride, magnesium, sodium, and sulfate. In most locations, therefore, it is advisable, when making a Pilsner (or a similar pale brew) to boil the brewing liquor before mashing with it. After the boil, rack the liquor, leaving about 10 percent of the liquid undisturbed behind at the bottom, or drain off the bottom 10 percent.

Not far from Pilsen, in Vienna, water is fairly hard. However, it has low levels of sodium and chloride, which makes it a good liquor for amber brews.

London water contains a modest to high amount of carbonate, sodium, and sulfate. It is an ideal brewing liquor, for instance, for Porter.

Munich water, on the other hand, is a more mixed bag. It contains relatively low amounts of sodium, sulfates and chloride; low to medium amounts of calcium and magnesium; but a fairly high amount of carbonates. Such water is well suited for the complex, mellow, malt-accented, yet relatively dry Munich Dunkel.

Dublin water, even more so than Munich water, is very high in carbonate content, and, not surprisingly, Dublin is a famous dark-beer center.

Burton-on-Trent water shows fairly high values for all elements, with calcium and sulfate values being exceptionally high. This gives Burton water plenty of permanent hardness. Burton's bicarbonate values are high as well and give it lots of temporary hardness, too. This composition makes Burton water the perfect liquor for IPAs.

Dortmund water is high in practically all mineral aspects, especially in carbonate and chloride (non-carbonate) hardness, which is why Dortmund-style Export lagers are perceived as very full-flavored and as both hoppier and maltier than similarly brewed Munich lagers, for instance.

In general, water with more temporary (carbonate) than permanent hardness—like Munich or London water—makes better dark beers; while water with more permanent (sulfate, non-carbonate) than temporary hardness—like Burton-on-Trent water—tends to make better pale beers.

Importantly, soft water, such as Pilsner water, dampens the perception of hop bitterness, while hard water, especially water that is high in sulfate, accentuates it. Therefore, a true Bohemian Pilsner of, say, 40 BUs can still taste predominantly malty, with a soft, rounded hoppiness, and without harsh astringencies, while a Burton Pale Ale made from the same grain-bed composition and with the same alpha-acid loading would have an overwhelmingly assertive, mouth-puckering, up-front bitterness and a dry aftertaste.

To achieve control over water quality and composition, several breweries now use modern techniques such as reverse osmosis to strip their water of all characteristics, good or bad, so that they can "build" their water from scratch to match the water characteristics of such famous traditional brewing centers as Burton-on-Trent, Dortmund, Dublin, London, Munich, or Pilsen.

The most common additives used to compose different water types are gypsum, which adds calcium and sulfate; Epsom salt, which adds magnesium and sulfate; non-iodized table salt, which adds sodium and chloride; chalk, which adds calcium and carbonate; baking soda, which adds sodium and bicarbonate; and slaked lime

(calcium hydroxide), which adds calcium; as well as calcium chloride; potassium chloride; sodium sulfate; and potassium metabisulfite. Gypsum and Epsom salts are also known as Burton salts because they add Burton-on-Trent-like hardness and sulfate levels to the brewing liquor.

DID YOU KNOW ... ?

The Danish botanist Emil Christian Hansen (1842 - 1909), a recognized authority on fungi (*myces*), was the first person to find a practical way to segregate the different yeast strains and breed them pure. From 1879, Hansen worked as head of the laboratory of the Carlsberg Brewing Company in Copenhagen. In 1881, he classified brewer's yeast into cold, bottom-fermenting lager strains (*Saccharomyces uvarum*) and warm, top fermenting ale strains (*Saccharomyces cerevisiae*). All other yeasts are called "wild" in beer making and produce nasty off-flavors. *Saccharomyces uvarum,* incidentally, is also known as *Saccharomyces Carlsbergensis*. It is not difficult to figure out where that name comes from.

Hansen also noted that, within the two broad classes of beer-friendly top and bottom fermenting yeasts, there are many variations, each with their own properties that affect the ultimate taste of the beer they ferment. Already in 1882, he demanded that yeast not only be free from bacteria, as Pasteur had insisted, but also free from "wild" yeast, if we want to make good beer. By 1890, he had developed a practical technique for the cultivation of pure yeast strains from a single cell. Pitching was never to be the same again.

About Yeast

The recipes in this book do not list specific yeast brands, only generic yeast types. There are many reputable yeast laboratories operating around the world, whose products—dried or liquid—are perfectly suitable for fermenting the beer styles in this book. For example, there are specialty yeast strains for Altbier, Kölsch, Hefeweizen, Bavarian Lagers, Czech Pilsners, Belgian Oud Bruin, Lambic, dry Stout, California Common, London-type ales, or high-alcohol ales and lagers.

Pitching rates are dependent on the cell count of the pitching slurry or starter as well as the gravity of the wort to be fermented. However, rates are not critical to a precise degree. Yet, severe under-pitching can cause a delay in the start of fermentation and lead to excessive levels of acetaldehyde, which gives the finished beer an aroma and flavor of green apples. A sluggish fermentation without vigorous CO_2 formation may also be insufficient to carry any remaining DMS out of the brew. Over-pitching, on the other hand, may cause a low ester profile that is atypical for certain beer styles, or the excess yeast cells may autolyze and impart an off-flavor similar to the smell of burnt rubber to the beer.

As a rough guideline, at a fermentation temperature of roughly 60 °F – 65 °F (roughly 15 °C – 18°C), ales require about 6 to 10 million cells per milliliter of wort per degree Plato, while lagers, which are usually fermented colder, require about 10 to 15 million cells per milliliter of wort per degree Plato. The following rule of thumb is a serviceable translation of these quantities for the practical brewer:

Pitch about 0.5 liters of thick, healthy yeast slurry per hectoliter (or about 0.6 quarts/bbl) of wort at about OG 1.048 (12 °P). Pitch up to twice as much for a brew with a gravity of OG 1.076 (19 °P); and pitch about 50 percent more slurry for a lager than you would for an ale.

DID YOU KNOW ... ?

Even though yeast, a single-cell organism, is the sole agent of alcoholic fermentation, it is not listed as a permissible beer ingredient in the original 1516 Bavarian Beer Purity Law. This is because, in those days, brewers (and their regulators) believed that yeast sediments were an impurity that was excreted from the brew during fermentation, a residue of putrefaction. To their minds, wort already contained alcohol, albeit in an adulterated form, and fermentation was a cleansing process, by which alcohol was liberated from its contaminants, including yeast. In the modern version of the German federal Beer Purity Law, (the *Reinheitsgebot*), yeast has been added as a legally permissible ingredient. However, only barley-based beers may be fermented with either bottom- or top-fermenting yeasts! Any beer containing rye, wheat, or other non-barley ingredients may be fermented with top-fermenting yeast only; otherwise it cannot be called "beer," by law! Consequently, like anywhere else, there are barley-only ales as well as lagers in Germany, but there are only rye or wheat ales, such as Roggenbier and Hefeweizen. This German law, of course, should not prevent any brewer outside Germany from brewing a "Weizenlager."

About Brew Systems

Brew systems can be categorized by their configuration and layout, by their capacity and versatility to brew different beer styles...and, of course, by their aesthetics.

Configuration and Layout

Brew systems are either modular, for any size brew house, or block-mounted as a pre-assembled unit—a configuration that has obvious size limitations. In either case, the system must perform all elementary functions of a brew house: mix the milled grain with water (mashing), produce wort (lautering), and heat up the wort. A brew system—modular or block-mounted—may range in complexity from traditional and simple to very sophisticated and high-tech.

The mash vessel must ensure:

1. Proper hydration of the milled grist.
2. Complete and homogeneous mixing of the milled grist.
3. Temperature control for all required enzymatic conversions.
4. The proper volume for grist and brewing liquor in relation to the overall size of the other equipment in the brewery, for any beer style.

The lauter vessel must ensure:

1. Temperature control throughout the lautering period.
2. Efficient and fast wort run-off.
3. Easy evacuation of spent grain.

The kettle process must ensure several functions that crucially affect the taste of the finished beer:

1. Wort sterilization and termination of all enzymatic degradation processes.
2. Isomerization of alpha-acids for bittering.
3. Formation of color, taste, and flavor elements through chemical processes such as the Maillard Reaction.
4. Coagulation and sedimentation of excess proteins into trub.
5. Evaporation of undesirable, volatile wort elements, including DMS and its precursors.
6. Wort gravity adjustments to specification.

In addition, ease of cleaning is or should be a crucial selection criterion, too, when choosing any brewing vessel.

Historically, making any beer at all—invariably from easily available local ingredients—was the primary brewing objective, and all other factors, such as raw material utilization and energy efficiency, were probably less of an issue. A simple system normally sufficed. A mash-lauter tun; a direct-fired kettle; an open, often wooden, fermenter; and a few casks were all that was needed as basic equipment to make beer. Classic British pub systems are typical representations of such a simple, traditional brew house model.

The Continental-European, mostly German, brew house configuration, on the other hand, evolved as a mash-kettle configuration, with the lauter tun—not the kettle—being the single-function unit. Such systems tend to be more versatile than British systems, because they allow more readily for multi-step mashing—traditionally by way of decoctions, but today usually by way of multi-step infusions with rest in between. For more through-put, some systems have a three-vessel configuration, with mash tun, kettle, and lauter tun each as stand-alone units. In the old days, the mash often had to be ladled from one vessel to the next. In early medieval systems, lautering often involved just ladling or skimming the wort from the mash tun into the kettle. Today, a "Continental" mash is transferred by means of positive head-pressure slurry pumps.

In either system, British or Continental, an extra vessel, the whirlpool as a wort clarifier, came into wide use during the second half of the 20th century. A very recent innovation that allows for an increase in the brew frequency is a so called "whirlpool kettle," tied to an external boiler.

Around the same time, steam generators for supplying jackets with heat became commonplace, even though the first practical use of steam for wort boiling dates back to the 1820s. Steam as a heat source, compared to direct firing, represents a great improvement in temperature control for hot liquor tanks, mash tuns, and kettles, which, in turn, results in better utilization of raw materials. Steam heating also improves energy efficiencies, compared to open flames, by aiming the energy primarily where it is needed. This reduces energy losses to ambient air.

Finally, with the arrival of automation in the brew house, efficiencies have increased even further, because it allows different recipes to be pre-programmed into the system so that all crucial temperatures, times, volumes, and flows can be reliably optimized.

Brew System Quality Variables

Apart from the efficiency and versatility of a brew system, sanitation and workmanship are perhaps the most crucial—and related—components of a quality brew house. Poorly ground welding seams, as well as nooks and crannies in vessels, transfer pipes, and other plumbing are notoriously difficult to keep clean and are obvious hideouts for spoilage microbes. The same is true for poorly designed or badly crafted valves and connectors, as well as ports for probes and gauges. A brew system that meets modern standards of sanitation and food safety, therefore, must be well designed for the unimpeded flow of slurries and liquids, including CIP solutions.

Many components of a brew system are also under constant stress from high heat, rapid temperature changes, and high pressure. All system components, therefore, must be made exclusively of strong, food-grade, quality metals (stainless steel) that can guarantee a brew system's long and trouble-free working life. This requires superior engineering at the design stage, diligent quality workmanship during fabrication, as well as intelligent site planning for the efficient material flow in the

brewery from the silos and grain lofts, through the hot brew house, the cold cellar, the temperate packaging area, to the loading ramp for packaged beer.

Finally, all brewing vessels must be properly insulated for maximum heat retention, which is essential for energy-efficient brewery operations.

Brew Systems for the Future

Most experts agree that the occurrence of the next energy crisis is not a question of "if" but "when," worldwide, because the amount of fossil fuels in the earth appears to be finite and their availability is always subject to political uncertainties. In response to these impending challenges, several brew equipment manufacturers are now working on new, energy-saving designs. Perhaps the most progressive approach is that of SCHULZ Brew Systems of Bamberg, which relies, among other innovations, on a revolutionary wort boiling method, which is available in two versions, the GentleCraftBoil system for small breweries with batch volumes smaller than 40 hectoliters (approx. 34 bbl), and the GentleBoil system for larger breweries with batch volumes exceeding 40 hectoliters. These systems are marketed in German speaking countries under the brand names of "SchoKolino" and "SchoKo." "SchoKo" is an acronym for "Schonkochen," which is German for "gentle boil."

Conventional wort boiling, which usually lasts 60 to 90 minutes, is, of course, the most energy-intensive process in the entire production of beer, traditionally consuming about 65 to 70 percent of the total energy requirements of a brewery. Improvements at the boil stage, therefore, offer the greatest energy-savings potential. The standard heat source nowadays for a full boil is steam circulated through internal or external kettle heating zones. By this process, heat-induced chemical changes in the wort, as well as wort evaporation, are achieved in a single step, the boil, without scorching the wort, as can occur in direct-fired kettles.

Whereas the expulsion of aromatic volatiles and the adjustment of wort concentrations definitely require evaporation temperatures, other reactions in the hot wort, such as hop isomerization, protein coagulation, and wort sterilization, can take place at temperatures below a full evaporation boil. Separating evaporation from other reactions in the wort, therefore, was a crucial conceptual starting point for the revolutionary SCHULZ GentleBoil wort treatment concept. In this new kettle concept, the wort is processed in three phases:

1. In a closed kettle, the wort is constantly recirculated for agitation at a temperature slightly below a full boil. This prevents the escape of thermal energy into the brew stack, while allowing alpha-acid isomerization; wort sterilization; color, taste, and flavor formation; protein coagulation; and partial evaporation of volatiles to take place in the wort.

2. The next step in the GentleBoil concept is a conventional whirlpool to clarify the wort.

3. Then, in a separate, innovative mushroom-shaped vessel, designed from scratch by SCHULZ developers as part of the GentleBoil system, the wort is put in-line through its final and major evaporation phase. A pump maintains a constant vacuum inside this vessel, and the whirlpooled wort enters the chamber through a tangential inlet. As the wort spins along the inside wall of the vessel in a thin film, it slowly descends and loses volatiles and some excess water. These evaporants are the same volatiles that, in a conventional full boil brew kettle, evaporate through the brew stack, along with plenty of thermal energy. The amount of evaporation inside the GentleBoil evaporation chamber is variable, but typically around 6 percent of wort volume. During evaporation in the vacuum, the wort cools off by roughly 30 °C (roughly 55 °F). A further decrease in wort temperature to the desired pitching temperature is then achieved the conventional way, through a cold-water heat-exchanger. The unit's vacuum pump, too, is connected to a separate cooler. The steam that is generated inside the vacuum unit during evaporation is water-cooled and liquefied in a condenser. This water exits the system at about 60 °C (140 °F). Therefore, the entire heat energy contained in the evaporated water is recovered—crucially, without generating excessive amounts of hot water.

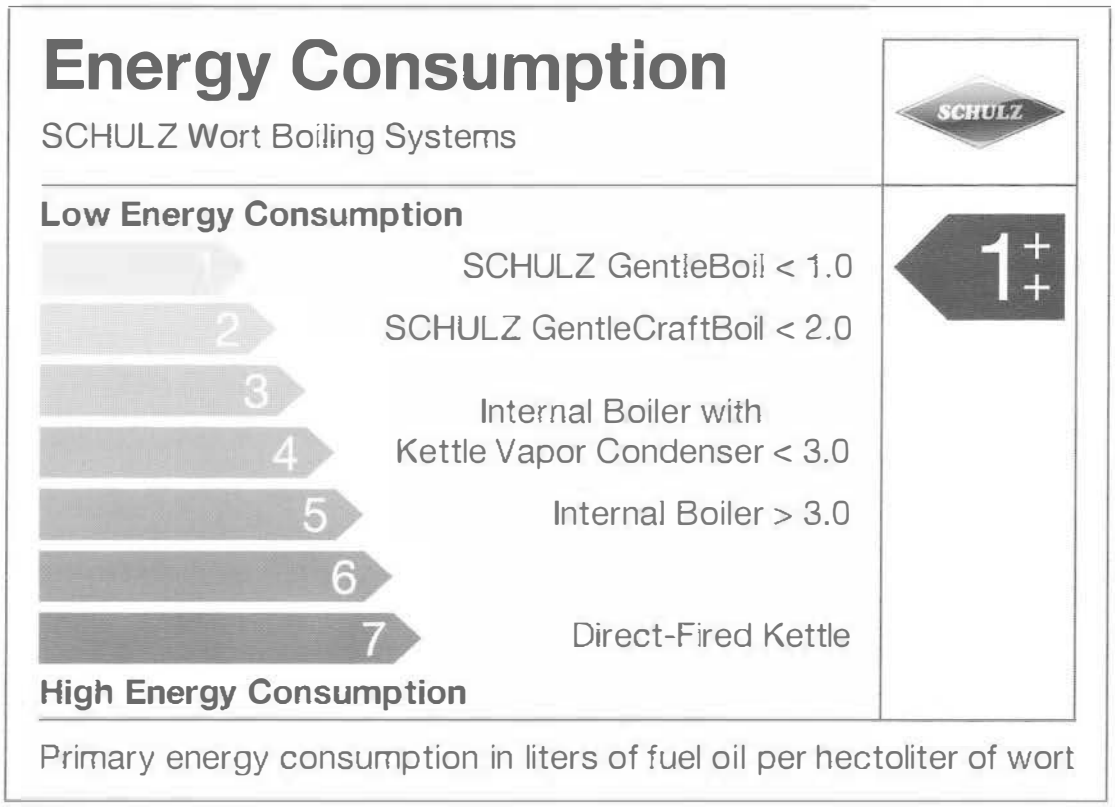
There are other advantages to the SCHULZ GentleBoil innovation: By not exposing the wort to the high temperatures of a full boil, there is less stress on the wort, but all traditional kettle effects are achieved: wort concentration, wort evaporation, a lowering of coagulable nitrogen content, and sufficient hop isomerization. Substances contributing to foam stability are preserved as well and their amounts can be calibrated by varying the duration of the wort's gentle "kettle time."

Implementing this technology in new brew systems or retrofitting existing systems with it does not limit a brewery's flexibility in terms of processes or beer styles. On the contrary, the brewery gains flexibility, because, with the new technology, the system can handle even very small charges—for specialty or contract brews, for instance. Minimum batch sizes, once dictated by external boiler configurations, are now a thing of the past.

In terms of amortization, this larger GentleBoil technology is economically viable only for batch sizes above 40 hectoliters. In the smaller GentleCraftBoil system, therefore, after the non-boil kettle process is complete and all kettle-related wort objectives are accomplished, the remaining dissipation of wort volatiles is achieved by a patented kettle-internal adjustable wort dispersion plate (AWDP) that operates under atmospheric instead of vacuum conditions.

Empirical energy measurements indicate substantial fuel savings of the new SCHULZ GentleBoil and GentleCraftBoil technologies over conventional, full-boil, brew systems. To produce one hectoliter (100 liters) of wort in a conventional brew system with an internal or external boiler consumes approx. 3.0 - 4.0 l/hl of oil (or equivalent) in primary energy. If the system is fired by a direct oil or gas burner the energy requirements even exceed 4.0 l/hl of oil (or equivalent)—often substantially!

The SCHULZ GentleBoil and GentleCraftBoil technologies, by comparison, require much less energy to prepare the same wort ready for fermentation. The GentleCraftBoil system requires less than 2.2 liters per hectoliter of finished wort, while energy consumption drops even below 1.0 l/hl for GentleBoil systems with the vacuum evaporation unit. This means the new SCHULZ technology yields up to 70 percent in energy savings compared to conventional systems.



A brewer with an annual output of 50,000 hectoliters (roughly 43,000 U.S. bbl), for instance, can save up to 125,000 liters (more than 32,500 U.S. gallons) of fuel oil (or equivalent) per year just by replacing or retrofitting an existing conventional with the new SCHULZ GentleBoil brew system. The savings are both economic and environmental: In the United States, as an example, at an assumed price of US$ 2.50 per U.S. gallon of fuel oil, the savings in a 43,000-bbl brewery add up to more than US$ 80,000 in annual operating cost as well as a reduction of 375 tons in annual CO_2 emissions.

The ECO-Burner

The latest SCHULZ eco-friendly energy-saving invention is the ECO-Burner, a fully automated, wood waste-consuming boiler that is connected to a closed-loop, hot-water kettle heating system. The ECO-Burner is fully integrated into the brew house process control software. Using shavings, pellets, or saw dust from the wood processing industry as an energy source takes the brew house carbon footprint down to zero. In addition to heating the brew equipment, this closed-loop hot-water system can also supply other areas of the brewery with heat by just tying it into building's heating system, thus generating the maximum in sustainability available for a modern brewery today.

What's a Style Anyway?

Beer styles are elusive concepts that seem next to impossible to define. It is rare that a majority, or even a plurality, of brewers or consumers agree on a particular beer style's exact parameters or numerical technical specifications. Some brewers might review a particular set of specifications presented in this book and argue that there might be too much caramel and not enough chocolate malt in the grain bill; that Warrior® or Ahtanum might have been a better choice of hops than Nugget; or that the final gravity of 2.5 °P (FG 1.1010) might be difficult to achieve in many fermentation cellars. Well...that's in the nature of the beast. A discussion of "style" will never be entirely "objective." We may use math to derive a certain set of numerical style specifications from assumption we make about a style, but the process by which we arrive at our assumptions in the first place has often more to do with subjective, creative intuition than with math.

Most beer styles have evolved over decades, even centuries, and many are still in flux today. In addition, creative brewers are constantly pushing the boundaries of their craft by inventing new interpretations of old styles; sometimes they even create new beers, especially in the New World, that defy all classifications heretofore known.

So, how many styles are there? That depends entirely on how you count. Is a Weizeneisbock, for instance, a separate style or just a sub-category of a broader classification called Hefeweizen, Weissbier, or wheat ale? Or is it a subcategory of Bock? Is a Baltic Porter a different style from a Robust Porter or a London Porter, or is it just one of many variations of the basic Porter theme? Is a beer already a style, if it's new, but is still just a one-of? Is a beer that is infused with grapes, figs, dates, or citrus fruit a new style, or is it merely a funky experiment? Is an American Pale Ale, which, only a few decades ago, was just a New World novelty, a style of its own or merely an adaptation of the classic English Pale Ale or Bitter? Likewise, are the Northern German Pils or Pilsener, the Bavarian Pils, the Scandinavian Pilsner, or, for that matter, the American mass-market "Premium Pilsner" just subcategories of the classic Czech Pilsner of 1842 from Bohemia? Or are there many Pilsner styles now? Considering that, today, perhaps nine out of 10 beers brewed in the world are—or claim to be—a variation of that revolutionary mid-19th-century brew, we have chosen to feature several Pilsner recipes here, without answering, whether or not each of them reflects a different "style."

Then there is the question of overlapping styles. For instance, when does a brew cease to be a Porter and become a Stout? At which color barrier does a pale ale become an amber, brown, or dark ale? Likewise, how deep golden may a Kölsch be, before we would rather call it an Altbier? What are the real distinguishing characteristics of a Vienna Lager, a Märzen, and an Oktoberfestbier; or what separates a Scottish ale from a Scotch ale? Perhaps because of this natural ambiguity, differences between brands *within* the same beer style are sometimes greater than the differences between adjacent beer styles. Just consider the vast variety of American pale ales on the market, on the one hand, and the often hard-to-

fathom difference between an American-style lager and American-style premium lager, on the other.

The term Trappist Ale is perhaps a typical example of the difficulty of aggregating various beers, or brands, into a style. Trappist ales hail from the seven monastic breweries that may legally call their beers Trappist—Achel, Chimay, De Koningshoeven, Orval, Rochefort, Westmalle, and Westvleteren—yet brew-technically they differ greatly from each other. For instance, Westvleteren does not use dark malts, the others do. Orval uses Brettanomyces and dry hopping as well as two different yeast strains for primary fermentation and bottle conditioning, the others do not. Chimay Premiere has a strong banana aspect, the others do not. Rochefort uses some coriander in its brews, the others do not. Perhaps the strongest characteristics that binds the Trappist together and separates them from such secular ales as Leffe Bruin, Affligem Tripel, or St. Bernadus Abt 12 is a non-brew-technical variable, namely...monks! Should a secular Abbey Ale really be considered a different style than a sacred Trappist Ale?

Finally, a beer's designation on the label is not always a reliable indication of what's inside the bottle either. Is it really OK to call a blond ale made with Pacific Northwest hops a Kölsch, or to call a wheat ale made with only 30 percent wheat malt, a Hefeweizen, when the German beer law defines the style as requiring at least 50 percent wheat malt? Stylistic mislabeling, deliberate or inadvertent, is not uncommon. In fact, in some jurisdictions, even the law is party to the obfuscation: In Texas, for instance, higher-alcohol brews such as Bocks and Doppelbocks must always be labeled as ales, even though they are technically lagers.

The quest for definition and precision in beer styles is undoubtedly vexing. Yet, in attempting to present beer style recipes, the team behind this book had to become specific. At the same time, we tried to avoid all dogmatism, high-minded or otherwise. More often than not, brewers know a style intuitively when they see or taste one, though they may not always agree on its technical definition. In trying to nail down the essence of a beer style, therefore, we sought to identify and to distill its core characteristics—brew-technical, socio-historical, and artistic-aesthetic, and translate each style into one plausible and practical rendition.

We constructed our specifications in all the obvious areas, including color ranges; bitterness ratings; original and final gravity ranges; mash temperatures; grain, hops, and yeast selections; and fermentation times and temperatures. For some of the truly classic styles, such as the Czech Pilsner, this task was relatively easier than it was for such highly variable styles as the Belgian *bière de saison,* for instance, which can be brewed equally authentically with and without spices!

The historical roots of a style were important to us as well. We took into account, if a style emerged at a particular point in time and within a particular culture. For us, a beer style acquired a much clearer definition, once it had longevity, that is, the style had been made by several generations of brewers, preferably in more than one

geographical location. In essence, when it comes to "style," most brewers know it when they see—or taste—it.

With all of these caveats, once again, this book is not intended as a set of dogmatic fixations of the different beer styles. Rather it is intended as a solid piece of research and a foundation for enlightened brewers, who may be interested in either copying our interpretations of a style or using them as take-off points for modifications according to their own predilections. With this book we hope to inspire, not to stifle, boundless individual experimentation.

Beer Styles Ingredients

Along with process, the basic tools for a creative brewer are, of course, water, malt, hops, and yeast. Given the vast variations of available ingredients today, even a simple calculation of their mathematically possible permutations should give us beer variations that number in the millions! There are many suppliers on the market that offer these ingredients as well as brew systems—some locally, others, like the three sponsors of this book, the Barth-Haas Group, SCHULZ Brew Systems, and the Weyermann® Malting Company, worldwide. These companies offer a vast range of products that enable a brewer to make just about any of the world's beer styles authentically. All recipes presented here are composed to work with the sponsors' products.

The Barth-Haas Group sources hops from all across the globe, from New Zealand, to China, the United States, Germany, Poland, Slovenia, and the Czech Republic. It supplies about one-third of the world's hops in the form of pellets, leaf hops, and "down-stream" products such as hop extracts.

SCHULZ is the world's oldest brew systems fabricator, since 1677, with installations in breweries all across the world, ranging in size from 2.5 to 400 hectoliters. The oldest, still operating SCHULZ brew house is over 150 years old! SCHULZ systems rank among the most versatile in the world and are suitable for making any beer style, from a no-boil Finnish Sahti, a single-infusion brown ale, a partigyle Stock or Old Ale in conjunction with a "small" ale, a Belgian Abbey Triple, to a triple-decoction Doppelbock.

Weyermann® has emerged, during the past quarter century, as the world's largest supplier of specialty malts as well as a top-quality supplier of German-, English-Belgian- and Czech-style base malts. In all, Weyermann® now produces more than 80 varieties of malt as well as malt extracts and the patented liquid roasted color malt SINAMAR®. There is a malt for every beer in that portfolio.

About the Sponsors

The BARTH-HAAS Group

BARTH-HAAS GROUP

The Barth-Haas Group is the leading, vertically-integrated, global player in the hop industry. The group maintains operations in every link in the hop supply chain, from growing hops on Barth-Haas Group-owned farms, purchasing third-party hops, hop processing, hop storage and logistics, to creating specialized hop applications for the brewing process and beyond. This involves hop R&D in agronomy, processing, brewing applications, pharma- and nutraceuticals, food processing, and several other areas.

Barth-Haas is active in every major hop growing area in the world and services both large and small brewing customers. For inquiries about the Barth-Haas Group, hop issues or hop purchases, contact:

http://www.barthhaasgroup.com
info@barthhaasgroup.com

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SCHULZ Brew Systems

SCHULZ has been fabricating brewery plants since 1677. Today, it designs and manufactures customized, top-quality brew and fermentation/maturation systems for any requirement—from simple, traditional, single-infusion systems to fully automated, versatile brewery facilities with the most advanced, economical, and eco-friendly technologies on the market.

SCHULZ systems range in size from 2.5 to approximately 300 hectoliters. For small breweries, SCHULZ manufactures complete breweries either in separate components or on a base frame, a block, ready for operation.

The SCHULZ spectrum of equipment ranges from individual tanks and vessels of all shapes and designs to complete turn-key breweries with custom designs, architectural plans, plant layouts, automation and control systems, heating and chilling peripheries, transfer infrastructure, energy recovery systems, spent-grain and effluent management systems, installation management, recipe assistance, and brewer training.

For pub breweries of any size, where aesthetics are often crucial, SCHULZ brew houses are available copper clad as well. With its long company history, SCHULZ has emerged as an international market leader in small-size and pub breweries, with an installed base of approximately 250 units, in addition to hundreds of mid- to large-size installations. The oldest SCHULZ brew house still in operation has been making beer for over 150 years.

See http://www.kaspar-schulz.de.
For inquiries in North America, contact:
Horst Dornbusch at schulzUSA@kaspar-schulz.com;
or by phone at 987-255-2009 or 978-255-1412.

WEYERMANN® SPECIALTY MALTING COMPANY

The Weyermann® Specialty Malting Company was founded by Johann Baptist Weyermann in Bamberg, Germany in 1879, as the MICH. WEYERMANN MALT COFFEE FACTORY, so-named after the founder's father. Today, Weyermann® is still a family- owned and family-operated company, managed by the fourth-generation descendants of the founder. From a small, local company, Weyermann® has grown to be the world's largest specialty malt producer to the beverage and food industries. It supplies about 3,000 customers in 115 countries, on every continent, except Antarctica. Its product spectrum includes more than 80 different malt products, from caramel, to chocolate, to roasted, to smoked—ranging in color from pale, to amber, to brown, to black. Weyermann® exports amount to about 60 percent of all shipments.

Weyermann® is a pioneer not only in malt product development, but also in trademarking malt brands. Already in 1903, Weyermann® trademarked its invention of a liquid color malt extract, called SINAMAR®, which is made from de-husked and thus de-bittered roasted malt. That trademark was granted by the German Imperial Patent Office in Berlin, in 1903. Today, it is protected internationally by the Madrid Protocol. In 1908, Weyermann® created the world's first-ever pale caramel malt, registered then in Germany under the trade name of Carapils®. This pale caramel malt was followed by other caramel malt innovations, including Carahell®, Caraaroma®, Caramunich®, Carafa®, and most recently, Carabohemian®, and Carabelge®.

Weyermann® employs one of the most rigid incoming inspection procedures in the malt industry. It purchases seeds for its raw materials and has them grown by select contract farmers in some of Germany's best growing locations, mostly in Bavaria, Saxony, and Thuringia. It insists on deep plowing for weed suppression, and is involved in all herbicide and pesticide decisions, as well as in timing decisions relating to both seeding and harvesting. All incoming trucks are sampled for kernel size, kernel homogeneity, cleanliness, and several other significant grain parameters.

All malt is batch-processed only at Weyermann®, whereby batch sizes range from 12 to 120 metric tons. This permits the complete traceability of all Weyermann® shipments from the customer's grain loft all the way back to the field where the original raw material was cultivated. All caramel and roasted malts are processed in drums rather than kilning boxes to ensure that every kernel is completely and evenly processed throughout each entire batch.

Weyermann® does not use genetically modified raw materials in any of its malts, malt extracts, and malt products for the food industry. All Weyermann® products are processed in accordance with DIN-ISO 9001-2000. In addition, they are made in accordance with the requirements of all applicable government food- and health regulations, including HACCP (Hazard Analyses of Critical Control Points), and contain less than the maximum allowable amounts of trace elements from pesticides, herbicides, mycotoxins, and nitrosamines. All analyses are carried out by independent, certified laboratories according to MEBAK standards (Methods of Brew-Technical Analyses).

All Weyermann® products are all-natural and conform to the requirement of the *Reinheitsgebot* (the German Beer Purity Law).

In addition, they are also available as internationally certified organic products. Organic certificates include the EU-BIO standard as well as the USDA-NOP.

See http://www.weyermannmalt.com

Weyermann® products are imported into the United States exclusively by
Crosby & Baker Ltd
http://www.crosby-baker.com.

They are imported into Canada exclusively by Gilbertson & Page (Canada) Inc.
http://www.gilbertsonandpage.com.

Unit Conversion Table

Mass

1 oz = 28.34952 grams
1 kg = 2.20462 lbs.
1 lb. = 0.4535924 kg

Volume

1 US fl. oz. = 29.57353 milliliter
1 US fl. oz. = 0.02957353 liter
1 ml = 0.03381402 U.S. fl. oz.
1 US pint = 0.4731765 liter
1 US quart = 0.9463529 liter
1 liter = 0.2641721 U.S. gallons
1 liter = 33.81402 fl. oz.
1 liter = 2.113376 US pints
1 liter = 1.056688 US quarts
1 US gallon = 3.7853 liters = 0.03226 barrels
1 bbl = 1.173 hl
1 hl = 0.852 bbl
For medieval German recipes: 1 Eimer (bucket) = 65 liters approx.

Grain Weight

1 US bushel (grain) = 35,238 liter = 0.35238 HL
1 US bushel barley = 48 lbs.
1 US bushel wheat = 60 lbs.
1 hl/kg barley= 61.7868766499 U.S. bushels

US bushel → ← "hectoliter-weight" and vice versa:
x hl-weight = y bushel weight*1.288393
x bushel weight = y hl weight*0.776855

Temperature

1 ° on the Celsius scale = 9/5 ° on the Fahrenheit scale
1 ° on the Fahrenheit scale = 5/9 ° on the Celsius scale
X °C = (9 * X °C/5) + 32 °F
Y °F = (5 * Y °F/9) – 32 °C

101 Recipes of the World's Classic Beer Styles A — Z

About "Major" Beer Styles

All hop and malt quantities for making a brew with the listed specifications are calculated for brew systems with a nominal, average system extract efficiency of 80 percent. This ensures easy standardization and comparison across brew systems of all types and sizes. Extract efficiency is essentially the amount of wort you get from a given amount of dry grist. An 80-percent performance is considered excellent. For most recipes, however, this top performance is achievable only with top-quality ingredients, such as Weyermann® malts; used in modern, well-engineered brew houses, such as those supplied by SCHULZ Brew Systems. Empirically, given the enormous variability of brew systems in use throughout the world, extract values may be marginally to substantially lower than presented here. In practice, commercial brew house efficiency values tend to vary between 55 and 80 percent. In rare cases, especially for certain recipes, and with the most meticulous attention to process control, they may even be higher—up to 83 to 85 percent.

Among the key factors influencing real-life brew house yields are process variables, brew house configurations, equipment heating methods, thermal characteristics of the brew system, vessel geometries, rake/agitator and false-bottom designs, and the chemical composition and pH-value of the local water. If your average brew house extract efficiency is known, use its difference from 80 percent for the proportional adjustment of all hop and malt quantities listed in the recipes here.

All beer color calculations, expressed in Standard Research Method (SRM) and European Brewing Convention (EBC) values, are based on average Lovibond ratings of the specified malts. Actual values, of course, vary from one harvest year to the next. Finished beer results, therefore, may differ slightly from those specified here.

Hop alpha-acid values, too, are based on assumed averages. The hop plant is very delicate and susceptible to local and seasonal weather conditions as well as the vagaries of pests and diseases, soil conditions, and cultivation techniques. If real alpha-acid values differ from those stated here, simply recalculate hop quantities accordingly.

All values in the recipes are rounded to no more than two decimal points.

The selected recipes are for beer styles that the author and technical editors judged to be among the most significant classic styles. Modern, experimental recipes were, for the most part, not included. For completeness, however, "minor" classic beer styles are discussed alphabetically in an Appendix, but without elaborate brewing recipes. The author and the technical editors freely acknowledge that the distinction between "major" and "minor" as well as between "classic" and "modern, experimental" beer styles is subjective and a judgment call. While the erstwhile experimental, muscular, in-your-face, high-alcohol hop bomb of an American Double or Imperial IPA is clearly sufficiently established to deserve recognition as a major beer style in its own right, perhaps an American Mandarin Orange Wheat Ale is not quite there yet.

Vague historical styles, too, for which it is very difficult to construct a recipe with a reasonable claim of authenticity, such the Brunswick Mumme from the days of the Hanseatic League, are generally just covered in the Appendix. Several perhaps "minor" recipes, on the other hand, which are still brewed today, such as the Finnish Sahti or the Flanders Kriek, have been included in the "major" recipe section.

The proper brewing method for a given style is another legitimate point of debate. How to brew a beer is not only a matter of theory, but also of the practical capabilities and limitations of the brew system, in which the recipe is to be put into action. Several recipes in this book may call for a continuous infusion, for instance, which is a simple "multi"-mash method that often produces very suitable and satisfactory, if not excellent, results. However, these beers can also to be brewed by the multi-step infusion or decoction method, or even by a single-temperature infusion. As a professional brewer you know how to take matters from here!

Cask-conditioning as a traditional cellaring technique has not been treated in this book, simply because—subject to the brewer's discretion and inclination—any beer included here can be cellared by this method—in new or used casks; in traditional English ale firkins; in Scotch, Bourbon, Cognac, or wine casks; in casks made of different woods; in casks lined with pitch; in casks toasted to various degrees; in untoasted casks...the variations are endless.

All non-alcoholic beers and most low-alcohol beers—though popular—have been omitted from this book, because such brews as German Malzbier and Alkoholfreies Weissbier or American mass-produced N-A beers tend to require special equipment and production techniques to eliminate alcohol produced by the yeast or to interrupt fermentation and keep the yeast from producing alcohol in the first place. Such beers are treated briefly in the Appendix.

Finally, most beer mixed drinks or blended beers, such as Radler, Russ or Russ'n, Black & Tan, and WeiPi, have been left out of the recipe section. They, too, are treated briefly in the Appendix.

For all the reasons enumerated above, none the style treatments in this book—not their specifications, not their ingredients, nor their brewing procedures—are intended as dogma. Instead, the recommendations listed here represent possible or typical interpretations of the featured styles. In the spirit of brew freedom, alternative interpretations of these styles may be just as valid. Therefore, you may use the recipes exactly as presented here, use them as a beacon for your orientation, or just consider them a platform from which to depart on your own trail of unlimited experimentation.

DID YOU KNOW ... ?

The Egyptian Queen Cleopatra and her Roman lover Marc Anthony invented the beer tax to finance a navy for their struggle with the Roman Empire led by Octavian, who later became Augustus, the first Roman Emperor. At the naval Battle of Actium (31 BC) Octavian completely routed the Egyptian fleet, and darling Cleo together with the philandering Marc Anthony committed suicide a year later. The Romans take-over of Egypt caused the decline of Egyptian brewing, because the grains that were once transformed into the brews of the Nile were now being transformed into the breads of the Tiber. Egypt remained under Roman influence until the so-called Arabic Conquest, which was completed by 642 AD, when Egypt became part of the Muslim world. This spelled the absolute end of Egyptian brewing, because the Koran demands that holy warriors practice sobriety.

Abbey/Trappist Dubbel

Beer culture of origin	Belgium
AKA	*Abdijbier, Bière d'Abbaye, Trappistenbier, Bière des Pères Trappistes*
Related Styles	Belgian Tripel/Triple Abbey Ale

Style Description

The brew-technical parameters of Belgian Abbey or Trappist Ales range so widely that it is virtually impossible to categorize them. Their alcohol by volume may vary from 4 to 12 percent; their original gravity, from 12.5 °P to 25 °P (OG 1.050 to 1.100); their final gravity, from 2.5 °P to 5 °P (FG 1.010 to 1.020); their color, from a pale-blond 3 SRM to a dark copper or tawny 20 SRM. The base malt for Abbey/Trappist brews is usually Pilsner or Pale Ale malt. The bitterness of a Dubbel may range from almost imperceptible at 20 BU to highly aromatic at 45 BU, and the hops can come from almost anywhere, including Germany (Tettnanger, Hallertauer Mittelfrüh, Spalt, or Perle), the Czech Republic (Saaz), and Slovenia (Styrian Goldings).

Even such terms as Dubbel (Flemish) or Double (French)—meaning double—as opposed to the usually pale to golden-colored Tripel (Flemish) or Triple (French)—meaning triple—are potentially misleading, because a Dubbel/Double from one brewery may actually be more potent than a Tripel/Triple from another. Dubbel/Double is usually deep amber to copper-colored, while a Tripel/Triple is usually pale to golden-colored.

*Perhaps the most salient definition of an Abbey or Trappist Ale appears to be a legal one: According to a 1962 Belgian court decision, only six monastic Belgian breweries—and one in neighboring Holland—may legally call their beers Trappist ales (*Trappistenbier *in Flemish and* Bière des Pères Trappistes *in French). These are alphabetically: Achel, Chimay, Orval, Rochefort, Westmalle, and Westvleteren, as well as the Brouwerij de Koningshoeven across the Dutch border. All other, secular, Abbey beers must be labeled* Abdijbier *(Flemish) or* Bière d'Abbaye *(French) to distinguish them from the ones made by monks.*

With these provisos, perhaps the only feature all Abbey/Trappist Ales have in common is bottle conditioning. In addition, these ales tend to have a big, dense, and creamy head; a complex, yeasty, fruity, and estery flavor and aroma; and sometimes a slightly sweet finish. Especially the stronger, well-aged variations often have notes of sour cherry and oak.

Abbey/Trappist ale brewers usually add rock candy, sugar syrup, or regular table sugar to the brew kettle to increase the brew's amount of fermentables and thus of alcohol. The sugars may be white or dark and are often a variable mixture of sucrose and glucose. The recipe below produces a brew of 15 °P (OG 1.060) kettle gravity before the addition of about 1.75 kg/hl (4.5 lbs./bbl) of white table sugar, which has virtually no influence on beer color. After the addition of sugar, the gravity is approx. 16.75 °P (OG 1.067).

The apparent attenuation of this brew at the end of fermentation is approx. 2.5 °P (FG 1.010). The sugar, therefore, raises the alcohol by volume (ABV) of the finished beer by approx. 0.8 percentage points from 6.7 to 7.6 percent (rounded values!).

Specifications (before the addition of sugar)

OG	1.060 (15 °P)		**BU**	20		**ABV**	6.7%
FG	1.010 (2.5 °P)		**Color**	11.8 SRM/30.1 EBC		**ABW**	5.2%

Specifications (after the addition of sugar; all values approx.)

OG	1.067 (16.75 °P)		**BU**	20		**ABV**	7.6%
FG	1.010 (2.5 °P)		**Color**	11.8 SRM/30.1 EBC		**ABW**	6%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	**%**	**1 HL (lbs)**	**1 HL (kg)**	**1 BBL (lbs)**	**1 BBL (kg)**	**5 Gal (lbs)**	**19 l (kg)**
Weyermann® Pale Ale	65	28.48	12.92	33.41	15.15	5.39	2.45
Weyermann® Abbey Malt®	20	8.76	3.97	10.28	4.66	1.66	0.76
Weyermann® Carabelge®	7.5	3.29	1.49	3.85	1.75	0.62	0.28
Weyermann® Munich I	7.5	3.29	1.49	3.85	1.75	0.62	0.28
Total Grain	100	43.82	19.87	51.40	23.31	8.29	3.77
White table sugar		3.85	1.75	4.52	2.05	0.728	0.33
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Magnum	13.5	0.60	17	0.7	20	0.1	3
Flavor: Barth-Haas Tettnanger	4	5.24	149	6.2	174	1.0	28
Aroma: Barth-Haas Styrian Goldings	5.25	3.50	99	4.1	116	0.7	19
Yeast	Belgian high-gravity ale yeast						

Brewing Process

Single infusion @ 152 °F (67 °C). Rest 90 min. Recirculate. Sparge 90 min. Boil 120 min. 1st hops @ 15 min; 2nd hops @ 100 min; 3rd hops @ 110 min. Add sugar 5 min before shut-down. Whirlpool 30 min. Primary fermentation 5 – 7 days @ 56 – 70 °F (15 – 21 °C), depending on yeast strain. Rack. Secondary fermentation 3 – 5 wks @ 46 – 50 °F (8 – 10 °C). Dissolve and sterilize about 250 grams/hectoliter of beer (roughly 10 oz./bbl) of white table sugar 2 liters (2 quarts) in hot water. Add to beer and re-inoculate it with fresh yeast. Conditioned in closed tank for a day. Package. Bottle-condition 3 wks @ about 70 °F (21 °C). Age beer in bottle for 3 – 4 months in dark cellar @ 46 – 56 °F (10 – 15 °C).

Abbey/Trappist Tripel/Triple

Beer culture of origin	Belgium
AKA	Abdijbier, Bière d'Abbaye, Trappistenbier, Bière des Pères Trappistes
Related Styles	Belgian Dubbel/Double Abbey Ale

Style Description

For a general style description of Abbey/Trappist Ale, see Abbey/Trappist Dubbel. The base malt for any Abbey/Trappist brew is usually Pilsner or Pale Ale malt. Traditionally, some of the brew's fermentables and thus alcohol come from rock candy, sugar syrup, or regular table sugar added to the kettle. The recipe below produces a brew of 15.5 °P (OG 1.062) kettle gravity before the addition of about 3.5 kg/hl (9 lbs./bbl) of white table sugar, which has virtually no influence on beer color. After the addition of sugar, the gravity is approx. 18.75 °P (OG 1.075). The apparent attenuation of this brew at the end of fermentation is approx. 2.5 °P (FG 1.010).The sugar, therefore, raises the alcohol by volume (ABV) of the finished beer by approx. 1.7 percentage points from 6.9 to 8.6 percent (rounded values!).

Specifications (before the addition of sugar)

OG	1.062 (15.5 °P)		**BU**	34		**ABV**	6.9%
FG	1.010 (2.5 °P)		**Color**	6.1 SRM/15 EBC		**ABW**	5.5%

Specifications (after the addition of sugar)

OG	1.075 (18.75 °P)		**BU**	34		**ABV**	8.6%
FG	1.010 (2.5 °P)		**Color**	6.1 SRM/15 EBC		**ABW**	6.8%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	96	43.55	19.75	51.08	23.17	8.24	3.75
Weyermann® Abbey Malt®	2.5	1.13	0.51	1.33	0.60	0.21	0.10
Weyermann® Carabelge®	1.5	0.68	0.31	0.80	0.36	0.13	0.06
Total Grain	100	45.36	20.58	53.21	24.14	8.58	3.91
White table sugar		7.70	3.49	9.03	4.10	1.46	0.66
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Magnum	13.5	1.01	29	1.2	34	0.2	5
Flavor: Barth-Haas Tettnanger	4	8.92	253	10.5	296	1.7	48
Aroma: Barth-Haas Styrian Goldings	5.25	5.94	169	7.0	198	1.1	32
Yeast	Belgian high-gravity ale yeast						

Brewing Process

Single infusion @ 152 °F (67 °C). Rest 90 min. Recirculate. Sparge 90 min. Boil 120 min. 1st hops @ 15 min; 2nd hops @ 100 min; 3rd hops @ 110 min. Add sugar 5 min before shut-down. Whirlpool 30 min. Primary fermentation 5 – 7 days @ 56 – 70 °F

(15 – 21 °C), depending on yeast strain. Rack. Secondary fermentation 3 – 5 wks @ 46 – 50 °F (8 – 10 °C). Dissolve and sterilize about 250 grams/hectoliter of beer (roughly 10 oz./bbl) of white table sugar 2 liters (2 quarts) of hot water. Add to beer and re-inoculate it with fresh yeast. Condition in closed tank for a day. Package. Bottle-condition 3 wks @ about 70 °F (21 °C). Age beer in bottle for 3 – 4 months in dark cellar @ 46 – 56 °F (10 – 15 °C).

DID YOU KNOW ... ?

The first modern kiln was developed less than 200 years ago, by British inventor Daniel Wheeler who patented it in 1817 as an "Improved Method of Drying and Preparing Malt." In doing so, he paved the way to the many beer styles we know today. In Wheeler's indirect-heat kiln, hot, clean air was blown by steam-engine driven fans into the grain bed.

The drying process in the Wheeler kiln could now be perfectly controlled, without imparting any nasty fuel flavors to the grain and without scorching it. If the maltster wanted to make dark grain for the black brews, he could now do so deliberately. And brewers could now mix pale malt with different amounts of dark or black, burnt malt to create different color and flavor effects in the beer.

Wheeler replaced the traditional direct-fired kiln with an iron, cylindrical drum, in which the grain is blow-dried by clean, hot air rather than penetrated by dirty, hot smoke. Thus the malt no longer picked up residues from coke or wood fuels, flavors that used to be passed on to the beer.

Apparently the idea for his kiln came to Wheeler while he was watching some coffee being roasted. With Wheeler's device maltsters could, for the first time, produce clean-tasting malt of predictable color.

It was Wheeler's invention that gave brewers the flexibility they needed to experiment with beer color and flavor in a way they had never been able to before. Thus, in the nineteenth century new beer styles came into existence, and older beers, even the black ones, were slightly altered by being made with pale foundation grists plus deliberately darkened grains.

The new lighter-colored beers that came on line in the nineteenth century and have dominated brewing ever since are the Oktoberfest, Pilsner, and Helles in the European continent and the pale ale, India pale, and bitters in the British Isles.

Altbier

Beer culture of origin	Germany (Düsseldorf region in the Rhineland)
AKA	Alt, Düssel
Related Styles	Sticke Alt; Latzen Alt; Doppelsticke

Style Description

Altbier is an unusual, cool-fermented, lagered ale. It is copper-colored, hop-accented (25–45 BU) and clean tasting. It should have virtually no roasted notes and is best made with plenty of Munich malt. The flavor profile of Altbier is greatly influenced by the yeast. While relatively warm-fermenting British ale yeast gives a brew plenty of fruity complexity, cool-fermenting specialty Altbier yeasts do exactly the opposite.

Spalt is ideally suited for this well-balanced bitter-sweet brew, for both bittering and aroma. Hallertauer, Tettnanger, Perle and Mt. Hood are good substitutes.

The mouthfeel ought to be light and clean, like that of a Dunkel lager, but with a touch more attenuation and a more hop-aromatic finish. The original gravity usually varies between 11.5 and 12.5°P (OG 1.046–1.050).

Specifications

OG	1.047 (12 °P)		**BU**	40		**ABV**	4.8%
FG	1.011 (2.75 °P)		**Color**	11.6 SRM/29.5 EBC		**ABW**	3.8%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pilsner	63	21.36	9.69	25.05	11.36	4.04	1.84
Weyermann® Munich I	30	10.17	4.61	11.93	5.41	1.92	0.88
Weyermann® Carared®	5	1.70	0.77	1.99	0.90	0.32	0.15
Weyermann® Carafa® Special I	2	0.68	0.31	0.80	0.36	0.13	0.06
Total Grain	100	33.90	15.38	39.77	18.04	6.41	2.92
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Spalter	4.5	8.04	228	9.4	267	1.5	43
Flavor: None	0	0	0	0	0	0	0
Aroma: Barth-Haas Spalter	4.5	5.24	149	6.2	174	1.0	28
Yeast	Düsseldorfer Altbier yeast						

Brewing Process

Step infusion at 122 °F (50 °C), 148 °F (64 °C), and 156 °F (69 °C), with a 10 min rest at each step; or single infusion @ 150 °F (66 °C), with a 30 min rest. Then raise temp to 170 °F (77 °C). Lauter. Boil 75 min. 1st hops after 15 min. 2nd hops after 65 min. Primary fermentation 7 days @ bottom edge of the yeast's preferred temp range. Rack. Reduce temp by 2 °F (1 °C) per day to 32 °F — 40 °F (0 °C — 4 °C). Rack after 2 wks. Lager 3 wks to 2 months. Rack and condition.

Altbier, Westphalian

Beer culture of origin	Germany
AKA	Münster Alt
Related Styles	Düsseldorf Altbier

Style Description

The City of Münster is deep in the heart of Westphalia, one of the two regions of the modern northwestern German State of North-Rhine-Westphalia—whose capital is Düsseldorf. Münster is also adjacent to the State of Lower-Saxony to the east. These two states as well as Holland and Belgium to the west are part of the vast, mountain-less Great European Plain that stretches from the Atlantic Ocean to the Ural Mountains in Russia. Beerologically, this region has always been ale country, and ales are still holding their own there, even though Bavarian and Czech lagers have by now conquered the rest of the world.

From the descriptions available to us today, the early medieval ales of the region, such as the Brunswick Mumme, were fairly heavy, darkish, syrupy ales—probably from smoky malts and low-attenuating yeasts.

In the late Middle Ages, these ales became a bit more drinkable through the addition of plenty of wheat malt. The brews that emerged became known as the Keutebier, forerunner of the modern Altbier and, in the 19th-century, of the Wiess of Cologne, which, in turn spawned the modern Kölsch.

While the copper Altbiers of Düsseldorf and their blond Kölsch cousins from Cologne have largely shed their wheaten heritage, in Münster and environs, the Keutebier metamorphosed into a type of Altbier that retained much of old wheaten creaminess. The Westphalian Altbier recipe below is a modern rendition of such an ale.

Specifications

OG	1.050 (12.5°P)		**BU**	20		**ABV**	5.2%
FG	1.011 (2.75°P)		**Color**	3.4 SRM/7.9 EBC		**ABW**	4.1%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Wheat Malt	40	14.47	6.56	16.97	7.70	2.74	1.25
Weyermann® Pilsner	30	10.85	4.92	12.73	5.77	2.05	0.94
Weyermann® Vienna	30	10.85	4.92	12.73	5.77	2.05	0.94
Total Grain	100	36.17	16.41	42.43	19.24	6.84	3.12
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Hallertauer Mittelfrüh	4.25	5.55	157	6.5	185	1.1	30
Flavor: None	0	0	0	0	0	0	0
Aroma: None	0	0	0	0	0	0	0
Yeast	Düsseldorfer Altbier yeast						

Brewing Process

Step infusion at 122 °F (50 °C), 148 °F (64 °C), and 156 °F (69 °C), with a 10 min rest at each step; or single infusion @ 150 °F (66 °C), with a 30 min rest. Then raise temp to 170 °F (77 °C). Lauter. Boil 60 min. Hops @ 5 min. Primary fermentation 7 days @ bottom edge of the yeast's preferred temp range. Rack. Reduce temp by 2 °F (1 °C) per day to 32 °F — 40 °F (0 °C — 4 °C). Rack after 2 wks. Lager 3 wks to 2 months. Rack and condition.

DID YOU KNOW ... ?

During the 14th century, the German North Sea port city of Hamburg was probably the world's largest brew center, mostly because its beers became one of *the* trading staples of the Hanseatic League. According to records still in existence, in 1376, Hamburg recorded 457 burgher-owned breweries, and by 1526 there were 531. Together, they brewed almost 25 million liters per year (more than 200,000 barrels) and employed almost half the city's wage earning population. Their most famous brew was *Keutebier*, a hopped, reddish to dark-brown wheat beer with an up-front sweetness and a viniferous aftertaste—a brew that was to become the forerunner of the modern Altbier and Kölsch.

DID YOU KNOW ... ?

The Bavarians are not the only ones with a Beer Purity Law. In 1706, Duke Johann Wilhelm, the ruler of the Rhineland, proclaimed that Düsseldorf Altbier, too, may be brewed only from barley, hops, and water; and three years later, he ordered in a police ordinance that "nobody may tap a cask [of Altbier] that is not at least several days old, bright, and well-sedimented."

Amber Ale, American

Beer culture of origin	United States
AKA	None
Related Styles	Pale Ale, Dark Ale

Style Description

On a scale from pale to black, this brew is akin to an American version of a red ale—somewhere between deep golden and dark. It has more malty notes than a pale ale, but next to no roasted notes of darker brews. Unlike many aggressively hopped American pales, this brew benefits from some restraint in the bittering department and a greater emphasis in the hop flavor and aroma departments. Any high-alpha American hops are suitable for bittering, while the selection of flavor and aroma hops should lean toward mild citrus notes rather than assertive spiciness. Unlike ales from the British Isles, this American Amber is low in diacetyl. It finishes with hops and malt in smooth balance. Plump, healthy, homogeneous two-row—rather than six-row—base malts, therefore, are important in this style.

Specifications

OG	1.053 (13.25 °P)		**BU**	32		**ABV**	5.2%
FG	1.014 (3.5 °P)		**Color**	17.75 SRM/45.8 EBC		**ABW**	4.1%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	74	28.45	12.91	33.37	15.14	5.38	2.45
Weyermann® Caraamber®	20	7.69	3.49	9.02	4.09	1.45	0.66
Weyermann® Carared®	5	1.92	0.87	2.26	1.02	0.36	0.17
Weyermann® Carafa® I	1	0.38	0.17	0.45	0.20	0.07	0.03
Total Grain	100	38.45	17.44	45.10	20.46	7.27	3.31
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Chinook	13	1.81	51	2.1	60	0.3	10
Flavor: Barth-Haas Willamette	5	15.02	426	17.6	500	2.8	81
Aroma: Centennial	10.5	3.00	85	3.5	100	0.6	16
Yeast	Various American-style ale yeasts						

Brewing Process

Single infusion. Depending on desired dryness in the finish, mash in @ 148°F – 154 °F (64°C – 68 °C); rest 60 min. Recirculate. Raise temp for mash-out @ 168 °F ± 2 °F (76 °C ± 1 °C) . Initially, sparge with 180°F (8 °C) brewing liquor; adjust sparge water temp, if needed. Boil 60 min. 1st hops @ 5 min; 2nd hops @ 55 min. Whirlpool 30 min. 3rd hops @ start of whirlpool. Primary fermentation @ 60 °F –70 °F (16 °C – 21 °C), depending on yeast, for about 7 days. Rack. Secondary fermentation about 14 days. Rack again, condition for a wk. Package.

Amber Ale, English

Beer culture of origin	Great Britain
AKA	None
Related Styles	Pale Ale , Dark Ale

Style Description

It is virtually impossible to define with certainty the color wave length at which a Pale Ale is too amber to still be called a Pale. Likewise, once an Amber Ale gets too coppery or darker, it should be called a Red, a Brown, or even a Dark Ale. Those brewers, therefore, who disagree with the color values in the specifications below, should feel free to adjust the grain bill in either direction.

An Amber Ale should show a good malt backbone, but without any chocolate or roast character, which is achieved in the interpretation below by a good portion of diastatically active Weyermann® Munich I malt in the grain bill. This lends the brew the required color without adding too much body.

The English character is assured by the floral notes of the East Kent Goldings for bittering. Flavor and aroma hop selections are noble-Continental, but any British hops would be suitable as well. Citrus accented Pacific Northwest hops, however, would be out of character.

A robust London-style yeast should give this brew the required touch of esters and diacetyl.

Specifications

OG	1.050 (12.5 °P)		**BU**	25		**ABV**	4.9%
FG	1.013 (3.25 °P)		**Color**	10.2 SRM/25.8 EBC		**ABW**	3.88%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	60	21.70	9.84	25.46	11.55	4.11	1.87
Weyermann® Munich I	20	7.23	3.28	8.49	3.85	1.37	0.62
Weyermann® Caraamber®	15	3.62	1.64	4.24	1.92	0.68	0.31
Weyermann® Carared®	15	3.62	1.64	4.24	1.92	0.68	0.31
Total Grain	100	36.17	16.41	42.43	19.24	6.84	3.12
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Goldings	5	5.20	147	6.1	173	1.0	28
Flavor: Barth-Haas Hallertauer Perle	6.5	3.36	95	3.9	112	0.6	18
Aroma: Barth-Haas Northern Brewer	8	6.10	173	7.2	203	1.2	33
Yeast	London-style ale yeasts						

Brewing Process

Single infusion. Mash 7 gal brewing liquor per 1 bbl of net kettle volume @ 154 °F (68 °C). Rest 45 min. Recirculate. Sparge with 180°F (8 °C) brewing liquor to raise mash temp to 168 °F ± 2 °F (76 °C ± 1 °C) for mash-out. Adjust sparge temp, if needed. Boil 70 min. 1st hops @ 55 min; 2nd hops @ 65 min. 3rd hops @ start of whirlpool. Whirlpool 30 min. Primary-ferment @ 60 °F –70 °F (16 °C – 21 °C), depending on yeast, for about 7 days. Rack. Secondary-ferment about 14 days. Rack again, condition for a wk. Package.

DID YOU KNOW ... ?

Archimedes (287-212 BC) apparently was already also familiar with the principles of the hydrometer, which is still one of the most efficient instruments for measuring the density of liquids, such as wort.

The oldest description of the hydrometer, however, dates to about 400 BC, in a letter by the Greek bishop Synesios of Cyrene (c. 373 - c. 414 AD) to his teacher Hypatia of Alexandria (370-415 AD), a scientist and daughter the Greek mathematician Theon of Alexandria (335 - c. 405 AD).

Galileo (1564-1642), too, mentioned the hydrometer, in 1612, in a letter to a friend.

In the second half of the 18th century and throughout the 19th century several inventors took out patents on hydrometer designs. The most practical hydrometers, similar to the ones still in use in breweries today, were developed by French chemist Antoine Baumé (1728-1804) and the English chemist and engineer William Nicholson (1753-1815).

Barley Wine, English & American

Beer culture of origin	England
AKA	None
Related Styles	None

Style Description

Barley wine is both an old and a young style. Its origins lie in the ancient British custom of partigyle-fermenting several runnings from the same mash separately. Its modern name, however, evolved only in the early 20th century, when the large commercial breweries in Britain started to move into big-ale brewing. The suffix "wine" is, of course a, misnomer, because barley wine has nothing to do with fermented fruit juice.

There is nothing definite about this style—except for its "bigness." It is usually blond to brown and fermented with alcohol-tolerant ale yeast. It can be hopped any which way. For a more "English" flavor, use East Kent Goldings or Fuggles throughout; for a more "American" flavor replace the Tettnanger with Liberty.

As a high-alcohol brew, barley wine wort requires plenty of fermentables from beta amylase, which become active at roughly 104°F (40°C) and peak at 149°F (65°C). Long mash rests at lower temperatures, therefore, are essential.

Barley wine reaches its full potential only after aging like a good grape wine. Six months in the bottle is considered a minimum; a quarter century, a maximum.

Specifications

OG	1.100 (25°P)		**BU**	95		**ABV**	8.1%
FG	1.039 (9.75°P)		**Color**	32.2 SRM/84.1 EBC		**ABW**	6.4%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Vienna	80	60.63	27.50	51.65	44.01	8.33	5.22
Weyermann® Pale Ale	11.5	8.72	3.95	7.43	3.37	1.20	0.75
Weyermann® Melanoidin	7	5.30	2.41	4.52	3.85	0.73	0.46
Weyermann® Carafa® II	1.5	1.14	0.52	0.97	0.83	0.16	0.10
Total Grain	100	75.78	34.37	64.57	52.05	10.41	6.53
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Aurora	8	10.31	292	12.1	343	2.0	55
Flavor: Barth-Haas Tettnanger	4	9.81	278	11.5	326	1.9	53
Aroma: Barth-Haas Cascade	5.75	9.81	278	11.5	326	1.9	53
Yeast	British, American, Belgian Abbey, Scottish, eau-de-vie, or other alcohol-tolerant ale yeast						

Brewing Process

Multi-step infusion: Mash in @ 99 °F (37 °C); raise temp to 122 °F (50 °C); rest 15 min; raise temp to 145 °F (63 °C); rest 45 min; raise temp to 154 °F (68 °C); rest 5 min; raise temp to 162 °F (72 °C); rest 20 min; raise temp to mash-out @ 171 °F (77 °C). Alternatively employ a single infusion @ 150 °F (66 °C), with a 60 min rest. Then raise temp to 171 °F (77 °C). Lauter. Boil 90 min. 1st hops after 30 min. 2nd hops after 75 min. 3nd hops after 85 min. Primary fermentation 14 days @ 66 – 70 °F (19 – 21 °F). Rack. Allow to sediment for 4 wks. Rack again. Condition. Package.

Sour Beer Process Advisory:

Sour beer-making is only for the bravest of the brave and demands a great deal of caution. Traditionally, and often still today, many sour beer styles are spontaneously fermented by airborne microbes. These may include Brettanomyces bruxellensis, Brettanomyces lambicus, lactobacillus delbrückii, pediococcus, and other assorted wild yeasts and bacteria.

Souring microbes are invariably considered defects in regular beers. As beer spoilers, they are kept in check by a host of cleaning, sanitizing, and disinfecting agents, especially on the cold-wort side of the brewery. Breweries attempting to make sour beers, therefore, need to ensure that there is no cross-contamination between their sour and their regular brews. That is why many breweries that produce both sour and regular beers have separate fermenters, transfer hose, pumps and even fillers just for sour beers. Brewers who wish to make sour beers, but prefer not to risk errant microbe infections, can replace some of the base malt with up to perhaps 10 percent Weyermann® Acidulated Malt, which contains biologically produced, Beer Purity Law-conforming, natural lactic acid.

Traditionally, souring microbes settle into brews during wort cooling in old-fashioned, flat, copper cool-ships that are placed in well vented rooms, where the green beer is exposed to a fresh breeze. The type or combination of microbes responsible for souring particular brews have often become proprietary micro-floras that are dominant only in a particular region or even brewery, thus giving a beer style—even a beer brand—its signature character. In many cases, this character is virtually impossible to imitate elsewhere. Specific mixtures of souring micro-flora are now commercially available from many yeast labs.

Berliner Weisse

Beer culture of origin	Germany
AKA	None
Related Styles	None

Style Description

Berliner Weisse is an extremely refreshing, effervescent, dry, tart, straw-colored, sour brew that is usually served "mit Schuss" (with a shot) of raspberry-flavored or woodruff-flavored syrup. In a sense, Berliner Weisse is the German equivalent of a Belgian Lambic.

Because of its fine-pearly, champagne-like effervescence, Napoleon referred to the brew as the Champagne of the North during his occupation of Berlin in 1809.

Brew-technically, Berliner Weisse is a sour wheat ale. It is best fermented with a clean-finishing German Altbier yeast as well as a special Berliner Weisse bacterium, lactobacillus delbrückii. German Hefeweizen/Weissbier yeasts, on the other hand, are wrong for this style!

The wheat portion of a Berliner Weisse is usually well below 50 percent (in a Bavarian Hefeweizen/Weissbier it must be at least 50 percent, by law). More than half the grist is usually regular, well modified, 2-row Pilsner malt.

Because of its sour characteristics, this brew benefits from a lengthy, even overnight, phytase acid rest at about 95 °F (35 °C) as well as an addition of some Weyermann® Acidulated Malt.

The bitter-hop loading in this brew is almost non-existent and hovers just above most people's taste threshold. The only dose of hops is generally added to the empty kettle right before lautering.

There are no flavor or aroma hops at all. The boil is extremely short, mostly to coagulate proteins and to sterilize the brew, not to extract many alpha-acids or to evaporate grain volatiles.

To prevent the lactobacillus delbrückii from become dominant at the start of fermentation, which would create too acidic an environment for the ale yeast to develop properly, the yeast should get a head start. This is best achieved by preparing a yeast starter ahead of time, but adding the bacteria to the starter only right before pitching.

Immediately before packaging, the beer is kräusened for bottle-conditioning. This produces the powerful effervescence already noted by Napoleon. Berliner Weisse has an unusually long shelf life for a German beer. If stored cool, in the dark, it may keep for up to 5 years.

Specifications

OG	1.030 (7.5 °P)		**BU**	5		**ABV**	3.2%
FG	1.006 (1.5 °P)		**Color**	2.3 SRM/4.9 EBC		**ABW**	2.5%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Well-Modified Pilsner	57	12.13	5.50	14.23	6.46	2.30	1.05
Weyermann® Pale Wheat Malt	30	6.39	2.90	7.49	3.40	1.21	0.55
Weyermann® Acidulated	10	2.13	0.97	2.50	1.13	0.40	0.18
Weyermann® Caraamber®	3	0.64	0.29	0.75	0.34	0.12	0.06
Total Grain	100	21.29	9.66	24.97	11.33	4.03	1.83
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Hallertauer Mittelfrüh	4.25	2.45	69	2.9	81	0.5	13
Flavor: none	0	0.00	0	0.0	0	0.0	0
Aroma: none	0	0.00	0	0.0	0	0.0	0
Yeast	German-style ale yeast (such as an Altbier yeast) plus Lactobacillus delbrückii						

Brewing Process

Three days before brew day, prepare a sterile, well-aerated starter for the German-style ale yeast from roughly 5 liters (5 quarts) of water per hectoliter of beer (approx. 6 quarts/bbl) plus approx. 500 grams (17 – 18 oz.) of pale liquid malt extract (LME) such as Weyermann® Pilsner LME. Alternatively use an equivalent amount of pale, preferably unhopped wort. On brew day, add the lactobacillus delbrückii to the starter.

Dough in with 40 liters of brewing liquor per expected hectoliter of finished beer (approx. 12 gallons/bbl) @ roughly 95 °F (35 °C). Acid and hydration rest of at least 2 hrs (longer is better; can be overnight). Infuse and heat to 122 °F (50 °C). Rest 30 min. Infuse and heat to 148 °F (64 °C). Rest 60 min. Infuse and heat to mash-out temp of 170 °F (77 °C). Recirculate 15 min. Add bittering hops to the empty kettle and lauter the wort into it. Boil about 20 min. Rest wort 15 – 20 min. After shut-down, check the gravity and restore any evaporation losses if necessary by liquoring the wort down to the target OG. Let the wort rest in the kettle for about 15 to 20 minutes to allow the trub to settle.

If possible, draw 10 liters/hectoliter or 2.5 gallons/bbl of sterile wort and refrigerate or freeze for kräusen and bottle-conditioning later.

Heat-exchange to 63 °F – 65°F (17 °C – 18°C). Add starter. Ferment about 4 days to approx. 3 °P or 1.012 or 3°P (approx. 75% attenuation). Rack and reduce temp to 50 °F (10 °C), which is below the lactobacillus' survival temperature. Keep at that temp for two days to ensure that all lactobacillus bacteria are dead. Rack again. Warm up kräusen to room temp and add to racked beer. Bottle immediately. Lager bottled beer @ 59 °F – 61 °F (15 °C – 16°C) for 2 wks, and @ 46 °F – 50 °F (8 °C – 10 °C) for another 2 wks to 3 months.

Bière de garde

Beer culture of origin	Northern France
AKA	French Farmhouse Ale
Related Styles	Belgian bière de saison

Style Description

Bière de garde, *as the name implies, is a "lagered" ale (*garder *is French for to keep, to watch, to care for, to reserve). In that respect, it resembles an Altbier.* Bière de garde *is at home in the northern French provinces of Nord-Pas de Calais, Artois and Picardie, right across the border from Belgium.*

Depending on the grain bed composition, the color of a bière de saison *may be blond (*blonde*), brown (*brune*) and amber (*ambrée*).*

It is brewed either from all barley malt or, in the Belgian fashion, with a small amount of sugar added to the brew kettle. The recipe below is an all-malt one. If you add sugar to the kettle, 1 lb raises the OG by approx. 1.5 gravity points (= 0.0015) per bbl; 1 kg by approx. 3.9 gravity points (= 0.0039) per hl. Note that the addition of fully fermentable sugar raises the OG, but not the FG.

Traditionally, a bière de garde *used to be brewed weak or strong at different times of the year, and the alcohol by volume of this farmhouse ale may range widely from a weak 3 to a mighty 8 percent. The stronger versions were usually brewed in the spring, before the start of the working season on the farm. Such a* bière de garde *of March was consumed until well into early fall. The last drop in a cask of* bière de garde*, therefore, might have aged for as much as eight months before it was drunk.*

Brewing on the farm usually resumed only after the harvest, with the season's new grain.

Specifications (rounded; without sugar)

OG	1.066 (16.5 °P)		**BU**	25		**ABV**	6.9%
FG	1.014 (3.5 °P)		**Color**	16.9 SRM/43.5 EBC		**ABW**	5.5%

Ingredients @ nominal 80% system extract efficiency

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pilsner	68.5	33.20	15.06	38.95	17.67	6.28	2.86
Weyermann® Vienna	10	4.85	2.20	5.69	2.58	0.92	0.42
Weyermann® Munich II	12.5	6.06	2.75	7.11	3.22	1.15	0.52
Weyermann® Caramunich® II	7.5	3.64	1.65	4.26	1.93	0.69	0.31
Weyermann® Caraaroma®	1.5	0.73	0.33	0.85	0.39	0.14	0.06
Total Grain	100	48.47	21.99	56.86	25.79	9.17	4.18
Optional brown sugar		2.20	1.00	2.58	1.17	0.42	0.19

HOPS	%AA	1 HL (oz)	1 HL (g)	1 BBL (oz)	1 BBL (g)	5 Gal (oz)	19 l (g)
Bittering: Barth-Haas Northern Brewer	8	1.65	47	1.9	55	0.3	9
Flavor: Barth-Haas Spalter	4	7.63	216	8.9	254	1.4	41
Aroma: Barth-Haas Saphir	3.25	3.81	108	4.5	127	0.7	20
Yeast	Saison- or Abbey-style yeast						

Brewing Process

Step-infusion. Mash in at about 150 °F – 154 °F (66 °C – 68 °C) with about one-fifth the net kettle volume. Rest 45 min. Raise temp to 168 °F ± 2 °F (76 °C ± 1 °C) for mash-out. Lauter for 90 min. Add optional brown sugar. Boil 60 min. 1st hops @ 5 min; 2nd hops @ 45 min. 3rd hops @ 5. Min. Whirlpool 30 min. Primary-ferment @ 60 °F – 65 °F (16 °C – 18 °C), depending on yeast, for about 7 days. Rack. Secondary-ferment about 14 days. Rack. Condition for a wk. Package.

DID YOU KNOW ... ?

It was only around at the beginning of the 19th century that brewers began to understand that fermentation had nothing to do with rot, that yeast played an important role, and—thanks to French chemist Antoine-Laurent Lavoisier (1743 – 1794)—who had discovered in 1789 that fermentation produces alcohol and CO_2. But someone still had to put it all together and to explain the mechanisms at work in fermentation in detail.

Along came the German physiologist and histologist Theodor Schwann (1810 – 1882). Schwann discovered that the cell is the building block of all plant and animal tissue. He was also the first to recognize, in 1837, that the yeast cell, which was first seen by the Dutch microscope-maker Antony van Leeuwenhoek in 1671, is a living organism. Noting that the little critter had a sweet tooth, Schwann called it "sugar fungus", hence the Latin name *Saccharomyces*. Schwann also discovered that the munching of sugars by *Saccharomyces*, which we call fermentation, occurs only when there is no air, i.e., that fermentation is an anaerobic process.

Bière de mars, Alsatian

Beer culture of origin	France (Alsace region)
AKA	*Bière de printemps* (beer of spring; usually refers to bottled *biere de mars*)
Related Styles	*Biere de saison* (but without spices), *biere de garde*

Style Description

Bière de mars *shares its name with a Belgian second-runnings Lambic, but the two beer styles have nothing in common. Think of the Alsatian* bière de mars *as an amalgam between a Bavarian Hefeweizen/Weissbier, a Bavarian Oktoberfest-Märzen (both* Märzen *and* mars *mean March in English), and a Belgian* bière de saison. *There are a few similarities to, and a few differences from, either style, though. While the Belgian* bière de saison *is brewed in March and lagered for months throughout the summer to be consumed through the fall, well into the harvest season, the Alsatian* biere de mars *is brewed in the fall, right after the hops harvest, and is lagered for months in brewery cellars throughout the winter for consumption in the spring.*

The proper hop for biere de mars from Alsace is, of course, the local, slightly floral Strisselspalt. If unavailable, the mildly spicy Tettnanger hops from just across the Rhine from Alsace, in Germany, is an excellent replacement.

Because there is plenty of time between brew day and consumption day, a biere de mars *is fermented very slowly at the low end of the yeast's temperature tolerance, which makes for a particularly clean-tasting beer with very few esters. It should not be fruity at all. Perhaps the best yeast for a traditional rendition of this brew is a Belgian saison specialty strain.*

Though biere de mars *is nowadays considered primarily an Alsatian seasonal specialty beer, its historical roots are in Arras, the capital of the Pas-de-Calais region in northern France, where its first mention dates to 1394.*

Modern Alsatian versions of this beer are brewed invariably as a lager without wheat, at a strength of 5.4 to 6.5 percent alcohol by volume. Some French sources indicate, however, that, in the old days, this brew was more likely an ale, and it may also have been made with a small portion of wheat.

An old-style biere des mars *should be light amber in color and at or above 5.5 percent alcohol by volume, which puts this beer's strength more in line with a Bavarian Märzen and a* bière de saison *than with a Bavarian Hefeweizen or its second-runnings Belgian namesake.*

The traditional versions—but no longer the modern mass-produced ones—are supposed to have a hefty biscuit malt aroma as well as a touch of smokiness. The recipe below is an attempt to recreate this relatively unknown, cold-matured, long-lagered, French March ale.

Specifications

OG	1.056 (14 °P)		**IBU**	20		**ABV**	5.8%
FG	1.012 (3 °P)		**Color**	11.8 SRM/30 EBC		**ABW**	4.6%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	65	26.48	12.01	31.06	14.09	5.01	2.28
Weyermann® Melanoidin	20	8.15	3.70	9.56	4.34	1.54	0.70
Weyermann® Pale Wheat Malt	10	4.07	1.85	4.78	2.17	0.77	0.35
Weyermann® Smoked Malt	5	2.04	0.92	2.39	1.08	0.39	0.17
Total Grain	100	40.74	18.48	47.79	21.68	7.71	3.51
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Tettnanger	4	2.83	80	3.3	94	0.5	15
Flavor: None	0	0.00	0	0.0	0	0.0	0
Aroma: Barth-Haas Strisselspalt	4	4.29	122	5.0	143	0.8	23
Yeast	Belgian biere des saison specialty yeast						

Brewing Process

Step-infusion. Mash in at about 144 °F (62 °C). Rest 30 min. Raise temp to 168 °F ± 2 °F (76 °C ± 1 °C) for mash-out. Recirculate. Lauter. Boil 60 min. 1st hops @ 5 min; 2nd hops @ 45 min. Whirlpool, for 30 min. Ferment at the low end of the temperature range of the selected yeast strain for up to 4 wks. Rack. Condition @ cellar temp of 40 °F – 44 °F (4 °C – 6 °C), or lower, for at least 3 months. Package unfiltered.

DID YOU KNOW ... ?

The thermometer was not invented until a mere 250 years ago. The first usable thermometers were developed by a German named Gabriel Daniel Fahrenheit, in 1714, by a Frenchman named René Antoine Ferchault de Réaumur, in 1731, and by a Swede named Anders Celsius, in 1742. This new little gadget finally allowed brewers to control the all-important mash temperature for the enzymatic conversion of starches into sugars and the equally important fermentation temperature for the yeast's conversion of these sugars into alcohol and carbon dioxide.

Bière de saison

Beer culture of origin	Belgium, Wallonia
AKA	Belgian Farmhouse Ale
Related Styles	French bière de garde

Style Description

Bière de saison *is a farmhouse ale from southern Belgian province of Wallonia. As a beer with homebrew roots, its range of specifications is fairly wide and it is often difficult to distinguish it from the other farmhouse ale brewed on the French side of the Franco-Belgian border, the* bière de garde *(see entry).*

A bière de saison *tends to be brewed with a pale malt base (often Pilsner malt) as well as some reddish color malt (Vienna is a good choice). In addition, it usually contains a good portion of malted or unmalted wheat. Just a touch of darker color malts often adds flavor complexity and depth of color.*

This brew may or may not be fortified with brew sugar, it may be dry-hopped or not, and, in typical Belgian fashion, it may be made with or without spices. If spices are used, these may be anise, coriander, cumin, ginger, grains of paradise, bitter orange Curacao peel, or some combination of these. The spices can be added to the kettle at the beginning of the boil or as late as the whirlpool; and their amounts may vary from a few grams to a few ounces per barrel or hectoliter.

*To create "*the*" recipe for a* bière de saison*, therefore, is practically impossible. The version presented below is a typical, middle-of-the-road interpretation of the style, without dry-hopping and without sugar. It can be brewed with or without an optional mixture of roughly 25 grams each of coriander and Curacao peel per hectoliter (approximately 2 oz per U.S. barrel) of finished beer, added to the hot wort at the start of whirlpooling.*

Specifications (for all-malt brew, without sugar)

OG	1.064 (16 °P)		**BU**	26		**ABV**	6.9%
FG	1.012 (3 °P)		**Color**	10.6 SRM/26.9 EBC		**ABW**	5.5%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	47.5	22.28	10.11	26.14	11.86	4.22	1.92
Weyermann® Vienna	22.5	10.56	4.79	12.38	5.62	2.00	0.91
Weyermann® Pale Wheat Malt	22.5	10.56	4.79	12.38	5.62	2.00	0.91
Weyermann® Carawheat®	7.5	3.52	1.60	4.13	1.87	0.67	0.30
Total Grain	100	46.91	21.28	55.03	24.96	8.88	4.04
Optional spices in whirlpool: 50/50 mix of ground coriander and bitter Curacao orange peel		0.1065	0.0483	0.1249	0.0567	0.0201	0.0092

HOPS	%AA	1 HL (oz)	1 HL (g)	1 BBL (oz)	1 BBL (g)	5 Gal (oz)	19 l (g)
Bittering: Barth-Haas Tettnanger	4	5.78	164	6.8	192	1.1	31
Flavor: None	0	0.00	0	0.0	0	0.0	0
Aroma: Barth-Haas Styrian Goldings	5.25	7.94	225	9.3	264	1.5	43
Yeast	Saison-style yeast						

Brewing Process

Step-infusion. Mash in at about 144 °F (62 °C). Rest 30 min. Raise temp to 168 °F ± 2 °F (76 °C ± 1 °C) for mash-out. Recirculate. Lauter. Boil 60 min. 1st hops @ 5 min; 2nd hops @ 45 min. Spices, if used, at start of whirlpool, for 30 min. Depending on selected yeast strain, ferment @ 72 °F – 80 °F (22 °C – 27 °C) for up to 2 wks. Rack, condition, package unfiltered. Brew improves if matured in package for about 3 months @ approx. 73 °F (23 °C).

DID YOU KNOW ... ?

In 1843, only one year after the first Pilsner Urquell was brewed, the Bohemian chemist Carl Joseph Napoleon Balling invented the modern hydrometer. His gravity spindle measured the amount of dissolved substances in the wort--mostly sugars, but also proteins, minerals, vitamins and aromatics--and thus allowed for the quantitative determination of extract strength and of the progress of fermentation (which brewers call attenuation).

Brewing science was advancing! The milky by-product of medieval putrefaction had by now become firmly established as a living, single-cell creature that converted sugars into alcohol and carbon dioxide and thus turns the brewer's wort into beer. Brewers could control the color of the grain that they fed the yeast, they could measure the yeast's temperature while it was at work in order to predict if they were producing a lager or an ale, and they could check the progress of the yeast's labors with a hydrometer. But if they wanted to tame the yeast, they had to find out what made it tick. The French chemist Louis Pasteur was the one to furnish that answer.

Bitter, Best

Beer culture of origin	England
AKA	None
Related Styles	(Ordinary) Bitter, Burton Ale, Pale Ale, ESB (Extra Special Bitter)

Style Description

Hops were introduced to England by Flemish immigrants as late as the 1400s, and they were slow to catch on. Perhaps the first truly hop-bitter English ale was the India Pale Ale (IPA), first brewed in the 1790s in London and later in Burton-on-Trent for the British colonies in what are now India, Pakistan, Bangladesh, and Sri Lanka.

In the 1830s, the large English breweries adopted the IPA style also for the domestic market, for which they reduced its hop loading, renamed it "Bitter," and offered it in three strengths: "Bitter" at roughly 9 °P (approx. mid-1.030s); "Best Bitter" at roughly 11 °P (approx. OG mid-1.040s); and "Extra Special Bitter" (ESB), a strong Bitter at roughly 13 °P - 14 °P (low to mid-1.050s).

Starting in the 1860s, bottled Bitters entered the British market, and they came to be called "Pale Ales" (without the prefix "India"), while only Bitters served in casks in pubs kept their traditional name.

Old-style Bitters are slightly fruity, mildly estery, single-infusion brews with mild British-style hop notes and a dry finish. They are fermented with fairly "dusty" (not very flocculent) yeast.

Specifications

OG	1.044 (11 °P)		**BU**	22		**ABV**	4.4%
FG	1.011 (2.75 °P)		**Color**	11.3 SRM/28.7 EBC		**ABW**	3.5%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	79	25.00	11.34	29.33	13.30	4.73	2.15
Weyermann® Carared®	10	3.16	1.44	3.71	1.68	0.60	0.27
Weyermann® Carahell®	10	3.16	1.44	3.71	1.68	0.60	0.27
Weyermann® Carafa® II	1	0.32	0.14	0.37	0.17	0.06	0.03
Total Grain	100	31.65	14.35	37.12	16.84	5.99	2.73
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Goldings	5	3.19	90	3.7	106	0.6	17
Flavor: Barth-Haas Fuggles	4.3	5.19	147	6.1	173	1.0	28
Aroma: Barth-Haas Goldings	5	5.19	147	6.1	173	1.0	28
Yeast	London-style ale yeast						

Brewing Process

Single infusion. Mash in with 7 gal of brewing liquor per a 1 bbl of expected net kettle volume (or 1 qt/1 lb of grist, dry weight) @ 148 °F – 150 °F (64 °C – 66 °C); rest 60 min. Recirculate. Sparge with 180°F (8 °C) brewing liquor to raise mash temp to 168 °F ± 2 °F (76 °C ± 1 °C) for mash-out. Hold mash temp at that level. Adjust sparge water temp, if needed. Boil 60 min. 1st hops @ 5 min; 2nd hops @ 55 min. Whirlpool 30 min. 3rd hops @ start of whirlpool. Primary fermentation @ 60 °F – 70 °F (16 °C – 21 °C), depending on yeast, for about 7 days. Rack. Secondary fermentation about 14 days. Rack again, condition for a wk. Package.

DID YOU KNOW ... ?

The world's oldest known piece of literature—the Sumerian epic of King Gilgamesh— mentions beer. It was written and rewritten by priests over centuries, and stored in temple vaults for scholarly reference. Only one rendition of about half the work, copied about 3,200 years ago on twelve tablets, has been preserved. It was found in the library of the Assyrian capital of Nineveh on the banks of the river Tigris, and is now in the Louvre in Paris. On the ninth tablet, incidentally, the epic tells about a deluge, which is probably the earliest historical reference to the great flood of the Old Testament.

The Gilgamesh epic talks about the origin of man—as a descendent of a mythical beast called Enkidu—and about the role that beer and its transformative powers have played in that genesis. Enkidu was an unkempt and unruly creature, half man, half bull. He often wandered the plains of Mesopotamia like prehistoric nomads—not in search of food, but of the key to immortality. He ate grass with the gazelles and when he found a hunter's trap, he would destroy it, thus acting as protector of his animal friends. He shared the gazelles' watering holes, but Enkidu also drank ... beer!

One day, Ninkasi, the Sumerian goddess of fertility and beer, decided to play a trick on Enkidu. She sent one of her temple maidens out to the plains with the mission to seduce the wandering and searching Enkidu. When she found him, she did, indeed, seduce him as she had been ordered, and afterwards offered him a meal of bread and beer. "Enkidu knows not how to eat bread," she said, "nor how to drink beer." She then entreated him: "Eat bread, Enkidu, as it is part of life! Drink beer as it is the custom of the land." Then the epic continued: "The wild beast Enkidu ate bread until he was sated. He then drank beer, seven crocks full. His spirit relaxed and became free. He started to talk in a loud voice. Well-being filled his body and his face turned bright. He washed his matted fleece with water and rubbed his body with oil, and Enkidu became human." In short, the two sides to Enkidu's nature seem to be a metaphor for the dual nature of man, but it is beer that makes us animated, it is beer that propels us to civilization, it is beer that makes us human. By gentling Enkidu's animal nature, beer helped to define who we are.

Bitter, Extra Special

Beer culture of origin	England
AKA	ESB
Related Styles	(Ordinary) Bitter, Best Bitter, Burton Ale, Pale Ale

Style Description

Extra Special Bitter (ESB), though called "bitter" is not all that bitter by modern standards. Rather it is a very balanced brew with a good malt base and a typical English citrus hop aroma of tangerine and orange in the finish. Traditionally, all Bitters—from Ordinary Bitter, to Best Bitter, to ESB—are just single-infusion-mashed in a mash-lauter tun. The mosh is fairly thick and the rise from the mash temperature to the mash-out temperature occurs through sparging, usually with just the hot sparge liquor as the heat source. Classic Bitters tend to be fermented with fairly "dusty" (not very flocculent) yeast strains. ESB is a very complex ale with slightly fruity flavors as well as some buttery diacetyl notes. ESB emerged in the 19th century and was one of the styles favored for serving as cask-conditioned ales drawn by beer engines. Authentic ESBs, therefore, are relatively low in effervescence.

Specifications

OG	1.056 (14 °P)		**BU**	34		**ABV**	5.8%
FG	1.012 (3 °P)		**Color**	11.7 SRM/29.8 EBC		**ABW**	4.6%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	80	32.59	14.78	38.23	17.34	6.17	2.81
Weyermann® Carared®	10	4.07	1.85	4.78	2.17	0.77	0.35
Weyermann® Caramunich® I	10	4.07	1.85	4.78	2.17	0.77	0.35
Total Grain	100	40.74	18.48	47.79	21.68	7.71	3.51
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Goldings	5	7.44	211	8.7	247	1.4	40
Flavor: Barth-Haas Goldings	5	4.15	118	4.9	138	0.8	22
Aroma: Barth-Haas Goldings	5	8.30	235	9.7	276	1.6	45
Yeast	London-style ale yeast						

Brewing Process

Single infusion. Mash in with 7 gal of brewing liquor per a 1 bbl of expected net kettle volume (or 1 qt/1 lb of grist, dry weight) @ 148 °F – 150 °F (64 °C – 66 °C); rest 60 min. Recirculate. Sparge with 180°F (8 °C) brewing liquor to raise mash temp to 168 °F ± 2 °F (76 °C ± 1 °C) for mash-out. Hold mash temp at that level. Adjust sparge water temp, if needed. Boil 60 min. 1st hops @ 5 min; 2nd hops @ 55 min. 3rd hops @ start of whirlpool. Whirlpool 30 min. Primary-ferment @ 60 °F –70 °F (16 °C – 21 °C), depending on yeast, for about 7 days. Rack. Secondary-ferment about 14 days. Rack again, condition for a wk. Package.

DID YOU KNOW ... ?

Until the late Middle Ages, the understanding of yeast as a living organism being responsible for alcoholic fermentation was completely unknown. Instead, the residue of spent yeast was considered of putrefaction rather than fermentation. The full scientific explanation of the yeast's metabolism had to wait for Pasteur in the 19th century. But even Pasteur would not have been able to do his work, had he not been able to see yeast...and for that he need a microscope.

Although Antony van Leeuwenhoek (1632-1723) appears to have had no interest in fermentation, he was, without realizing it, the instrument for the research that would ultimately solve its mystery. Van Leeuwenhoek was a draper-turned-natural-scientist-and-microscope-maker. As a draper apprentice in Amsterdam, in 1648, young Antony often had to check the quality of cloth under a lens. This helped spark his interest in optics. By 1871, he had constructed his first microscope. He assembled at least 242 of them in his lifetime, some with a magnification of as great as 270 times.

We know that Zacharias Janssen, a Dutch spectacle maker, had theorized about magnification before van Leeuwenhoek and had made a primitive model of the microscope around 1590 (as had Galileo in 1610), but van Leeuwenhoek's was the first truly usable device. In 1674, it helped him to see yeast cells, bacteria, and other protozoa (single-cell animals) as well as red blood cells for the very first time. He also described the reproduction of microorganisms and thus refuted the theory of spontaneous generation, which, thus far, had furnished the accepted explanation for the cause of fermentation and putrefaction.

Finally, there was the yeast!

Bitter, Ordinary

Beer culture of origin	England
AKA	None
Related Styles	(Ordinary) Bitter, Burton Ale, Pale Ale, ESB (Extra Special Bitter)

Style Description

Ordinary "Bitter" is the lowest-strength English Bitter. It has a gravity of roughly 9 °P (approx. OG mid-1.030s). "Best Bitter" is slightly stronger and hoppier at roughly 11 °P (approx. OG mid-1.040s). "Extra Special Bitter" (ESB) is the strongest and happiest Bitter at roughly 13 °P - 14 °P (low to mid-1.050s). Bitters are slightly fruity and mildly estery, with mild British-style hop notes and a dry finish. They are invariably single-infusion brewed and fermented with fairly "dusty" (not very flocculent) yeast.

Specifications

OG	1.036 (9 °P)		**BU**	20		**ABV**	3.5%
FG	1.010 (2.5 °P)		**Color**	8.1 SRM/20.3 EBC		**ABW**	2.7%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	59.75	15.35	6.96	18.01	8.17	2.90	1.32
Weyermann® Carared®	20	5.14	2.33	6.03	2.73	0.97	0.44
Weyermann® Carahell®	20	5.14	2.33	6.03	2.73	0.97	0.44
Weyermann® Carafa® II	0.25	0.06	0.03	0.08	0.03	0.01	0.01
Total Grain	100	25.69	11.65	30.14	13.67	4.86	2.21
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Goldings	5	4.88	138	5.7	162	0.9	26
Flavor: Barth-Haas Fuggles	4.3	4.72	134	5.5	157	0.9	25
Aroma: Barth-Haas Goldings	5	4.72	134	5.5	157	0.9	25
Yeast	London-style ale yeast						

Brewing Process

Single infusion. Mash in with 7 gal of brewing liquor per a 1 bbl of net kettle volume (or 1 qt/1 lb of grist, dry weight) @ 148 °F – 150 °F (64 °C – 66 °C); rest 60 min. Recirculate. Sparge with 180°F (8 °C) brewing liquor to raise mash temp to 168 °F ± 2 °F (76 °C ± 1 °C) for mash-out. Hold mash temp at that level. Adjust sparge water temp, if needed. Boil 60 min. 1st hops @ 5 min; 2nd hops @ 55 min. 3rd hops @ start of whirlpool. Whirlpool 30 min. Primary-ferment @ 60 °F –70 °F (16 °C – 21 °C), depending on yeast, for about 7 days. Rack. Secondary-ferment about 14 days. Rack again, condition for a wk. Package.

Blond Ale, American

Beer culture of origin	United States
AKA	None
Related Styles	Pale Ale (English), IPA, Imperial or Double Pale Ale

Style Description

Perhaps the best way to characterize an American Blond Ale is by calling it an ale version of the American Standard Lager, akin to a Kölsch, but with clearly American accents in the hop and malt department. It is often brewed as an easy-drinking summer seasonal. The grain bill is simple and of good diastatic strength. Some wheat (used below) and a few adjuncts (not used below) are acceptable. The beer is often brilliantly straw blond, like a Munich Helles. Unlike many British pale to blond ales, though, the American version tends to be low in diacetyl, with only a hint of mild, fruity esters. The hopping is American, but restrained. Any American yeast is acceptable, but a clean-fermenting Kölsch or Altbier yeast gives excellent results, too.

Specifications

OG	1.042 (11.5 °P)		**BU**	20		**ABV**	4%
FG	1.010 (2.5 °P)		**Color**	3.3 SRM/7.5 EBC		**ABW**	3.1%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	75	22.61	10.26	26.53	12.03	4.28	1.95
Weyermann® Diastatic Barley Malt	20	6.03	2.74	7.07	3.21	1.14	0.52
Weyermann® Pale Wheat Malt	5	1.51	0.68	1.77	0.80	0.29	0.13
Total Grain	100	30.15	13.68	35.37	16.04	5.70	2.60
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Warrior®	15.5	1.48	42	1.7	49	0.3	8
Flavor: none	0	0.00	0	0.0	0	0.0	0
Aroma: Crystal	4.5	1.58	45	1.8	52	0.3	8
Yeast	Any American-style ale yeast; or Kölsch or Altbier yeast						

Brewing Process

Single infusion. Mash in with 7 gal of brewing liquor per a 1 bbl of expected net kettle volume (or 1 qt/1 lb of grist, dry weight) @ 152 °F (67 °C); rest 60 min. Recirculate. Sparge with 180°F (8 °C) brewing liquor to raise mash temp to 168 °F ± 2 °F (76 °C ± 1 °C) for mash-out. Hold mash temp at that level. Adjust sparge water temp, if needed. Boil 60 min. 1st hops @ 5 min; 2nd hops @ 55 min. 3rd hops @ start of whirlpool. Whirlpool 30 min. Primary fermentation @ 60 °F –70 °F (16 °C – 21 °C), depending on yeast, for about 7 days. Rack. Secondary fermentation about 14 days. Rack again, condition for a wk. Package.

Blond Ale, Belgian

Beer culture of origin	Belgium
AKA	*Blonde* (French)
Related Styles	Belgian Golden Ale

Style Description

The Belgian Blond Ale is a more restrained version of the stronger Belgian Golden Ale, and it is generally brewed by a similar, or the same, process. You can use a multi-step infusion, a single decoction, or, as suggested below, a continuous infusion. The Belgian Blond has a bit more malt aroma from the complex grain bill, but much less hop aroma. For a straw-blond version, replace it with Weyermann® Extra Pale Pilsner. Because of the long maturation period during which the brew mellows in the conditioning tank on the yeast, it finishes fairly dry and clean, almost like an Altbier or a German blond lager.

Specifications (before the addition of LME)

OG	1.048 (12 °P)		**BU**	24		**ABV**	4.9%
FG	1.011 (2.75 °P)		**Color**	8.2 SRM/20.6 EBC		**ABW**	3.9%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pilsner	74	25.65	11.63	30.08	13.65	4.85	2.21
Weyermann® Vienna	15	5.20	2.36	6.10	2.77	0.98	0.45
Weyermann® Carabelge®	9	3.12	1.41	3.66	1.66	0.59	0.27
Weyermann® Caraaroma®	2	0.69	0.31	0.81	0.37	0.13	0.06
Total Grain	100	34.66	15.72	40.65	18.44	6.56	2.99
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Saaz	4.5	6.29	178	7.4	209	1.2	34
Flavor: None	0	0	0	0	0	0	0
Aroma: None	0	0	0	0	0	0	0
Yeast	Belgian Abbey-style ale yeast						

Brewing Process

Continuous infusion. Dough in as thick as possible @ 90 °F (32 °C) or lower. Then ramp up temp slowly and continuously over 3 – 4 hrs to a mash-out temp of about 170 °F (77 °C). Lauter slowly for 3 hrs. Boil for 90 minutes. Hops @ 15 min. Whirlpool 30 min. Ferment for 1 wk. @ 64 °F – 70 °F (18 ° - 21 °C), depending on yeast strain. Rack and ferment for another 10 days. Reduce temp to approx. 34°F (1°C); lager for 12 wks. Rack, condition, package.

DID YOU KNOW ... ?

By February-March, with winter dragging on in Bavaria and Ash Wednesday putting a somber stop to all the merriment of Mardi Gras, it's time for some serious consolation:

Out comes the Doppelbock, a beer that was first brewed by Paulaner monks at Cloister Neudeck ob der Au in Munich. The Benedictine order of Paulaners had arrived in Munich from Italy in 1627. No sooner had they settled in their new home, they started to fire up their brew kettles, making beer just for their own consumption. Depending on which documents you trust, the year of the Paulaners' inaugural brew was 1630, 1651 or 1670.

The strong brew that these austere Paulaners concocted apparently had such delightful qualities that it gave them no small amount of guilt pangs. They felt, their beer might be just a bit too much of an indulgence, especially for Lent, a 46-day time of fasting between Ash Wednesday and Easter Sunday. To calm their worried souls, they decided to ask the Holy Father in Rome for a special dispensation so that they could continue to brew with a clear conscience. So they send a cask of Lenten beer to Rome for the pope to try and to pass judgment. During its transport across the Alps, however, and along the burning-hot highways of Italy, unfortunately—or fortunately—the cask tossed and turned, and got "cooked" for several weeks—a classic condition for beer ruin. So when the Holy Father tasted the much-praised quaff from Munich, he found it (appropriately) disgusting. His decision: Because the brew was so vile, making and drinking as much of it as the Munich monks could was probably beneficial for their souls. Therefore, he willingly gave the brewing of this new, allegedly rotten, beer style his blessing. Little did he know...!

Traditionally, the Paulaner monks brewed their "liquid bread" only for themselves for the Lenten season, when next to no solid food was allowed to pass their lips. It was not until the spring of 1780 that Elector Duke Karl-Theodor of Bavaria finally granted the Paulaners to their official permit to disburse their brew to the public. The name of that first commercial Doppelbock was Salvator, which is Latin for Savior.

The brew soon found its imitators, and, in a clever marketing ploy, each and every one of these strong brews ended on "ator," as in Animator, Celebrator, Kulminator, Maximator, Sympator, and Triumphator.

As an escape from the rigors of the Lenten season, it seems, thousands of Munich residents nowadays gather annually in the Paulaner Beer Hall in the Nockherberg district, around St. Joseph's Day (March 19), to kick off two weeks of official Bockbier drinking.

Bockbier

Beer culture of origin	Germany
AKA	Bock
Related Styles	Doppelbock, Maibock, Eisbock, Weizenbock

Style Description

Bockbiers are Bavaria's traditional strong lagers. They rank among the heaviest and maltiest, yet smoothest, brews in the world. The bitterness of a Bockbier is very gentle, usually within a range of 20 – 25 IBU, and there is next to no hop aroma in the nose or in the finish. Most Bockbiers (though not all!) are slightly dark in appearance, somewhere between dark copper and burnt amber. Depending on Bockbier type, however, the color can vary greatly, from amber pale to fairly dark.

Specifications

OG	1.066 (16.5 °P)		**BU**	23		**ABV**	7%
FG	1.013 (3.25 °P)		**Color**	18 SRM/46.6 EBC		**ABW**	5.6%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pilsner	30	14.54	6.60	17.06	7.74	2.75	1.25
Weyermann® Munich II	27.5	13.33	6.05	15.64	7.09	2.52	1.15
Weyermann® Carafoam®	25	12.12	5.50	14.21	6.45	2.29	1.04
Weyermann® Melanoidin	12.5	6.06	2.75	7.11	3.22	1.15	0.52
Weyermann® Caramunich® III	5	2.42	1.10	2.84	1.29	0.46	0.21
Total Grain	100	48.47	21.99	56.86	25.79	9.17	4.18
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Taurus	8.5	77	3.2	91	0.5	15	2.73
Flavor: Barth-Haas Tradition	5.5	36	1.5	42	0.2	7	1.28
Aroma: Barth-Haas Smaragd/Emerald	5	18	0.7	21	0.1	3	0.64
Yeast	Bavarian-style lager yeast						

Brewing Process (Continuous Infusion)

Dough in for a very thick mash @ approx. 90 °F (32 °C). Rest 30 min. Infuse and raise temp continuously over 2 – 3 hrs to the mash-out temp of 170 °F (77 °C). Lauter for at least 90 min. Boil 90 min. 1st hops @ 30 min. 2nd hops @ 75 min. 3rd hops @ 85 min. Whirlpool 30 min. Ferment @ 50 °F (10 °C) for 3 wks. Rack. Lager close to freezing point for at least 5 wks. Rack again, condition, package.

Brewing Process (Double Decoction)

Mash in main mash at @ 100 °F (38 °C); rest 30 minutes for proper grist hydration and activation of phytase for some mash acidification.

Draw 1st decoction (one-third of main mash). Heat decoction (10 – 15 min). Rest decoction @ 149 °F (65 °C) for 30 min. Heat decoction (10 min). Rest decoction @ 162 °F (72 °C) for 10 min. Heat decoction (10 min). Boil decoction @ 212 °F (100 °C) for 10 min. Reintroduce decoction to main mash. Rest main mash @ 149 °F (65 °C) for 10 min.

Draw 2nd decoction (one-third of main mash). Heat decoction (5 – 10 min). Rest decoction @ 162 °F (72 °C) for 10 min. Heat decoction (10 min). Boil decoction @ 212 °F (100 °C) for 10 min. Reintroduce decoction to main mash. Rest main mash @ 162 °F (72 °C) for 10 min.

Raise temp of main mash to 171 °F (77 °C). Rest 15 min. Recirculate (5 min). Start lautering and sparging slowly (!) for about 3 hrs until kettle full. Boil 90 min. 1st hops @ 30 min. 2nd hops @ 75 min. 3rd hops @ 85 min. Whirlpool 30 min.

Ferment @ 50 °F (10 °C) for 3 wks. Rack. Lager close to freezing point for at least 5 wks. Rack again, condition, package.

DID YOU KNOW ... ?

Bockbier season in Bavaria runs roughly from December to May. As the temperature drops, the Bocks get darker, and vice versa. While Christmas Bocks and Doppelbocks are the most opaque of the Bocks, Maibocks are the blondest. Here is the varied nomenclature of Bavarian Bocks, in alphabetical order:

Doppelbock: Literally "double bock," it is a favored of the Lenten season. All Doppelbock names end on the suffix "ator."
Dunkelbock: A regular Bockbier, but brewed with plenty of roasted malts for extra color.
Eisbock: A Doppelbock that is frozen in the tank until much of the water becomes slush. The beer drained off the slush is Eisbock, literally "ice" Bock.
Fastenbock: "Lenten bock" is another name for the Doppelbocks of Lent.
Frühlingsbock: "Springtime bock" is another name for a "Maibock."
G'frornes: Franconian vernacular for "Frozen thing" in Franconian dialect. An Eisbock from the city of Kulmbach.
Heller Bock/Helles Bock: Another name for "Maibock."
Maibock: The blond Bock of late spring.
Urbock: A non-Bavarian Bock form the northern German city of Einbeck.
Weizenbock: A Bockbier brewed as an ale with at least 50% malted wheat.
Weizendoppelbock: A Doppelbock brewed as an ale with at least 50% malted wheat.
Weizeneisbock: A Weizendoppelbock brewed as an ale and treated like a barley-based Eisbock.
Weihnachtsbock: "Christmas Bock," a dark Bock brewed for Christmas.
Winterbock: A winter special often brewed at Doppelbock strength.

Braggot

Beer culture of origin	Scotland
AKA	Honey Ale
Related Styles	Mead

Style Description

Braggot is an ancient Scottish ale that allegedly dates back to the times between the Roman invasion of the British Isles under Caesar a little over 2,000 years ago and the Viking conquest of Scotland about 1,000 years ago.

Not much is known for sure about this brew, except that it was apparently very strong from being fortified with plenty of honey...and it obviously had no hops.

Many modern craft-brewers nowadays make brews they call Braggot, but they cannot lay claim to any measure of authenticity, nor can the recipe presented below.

All Braggot recipes are of necessity fanciful—but nonetheless inspirational—interpretations of the antique original—as is the recipe below, which contains a small, anachronistic amount of bittering hops.

The average honey is about 80 percent fermentable sugars and 20 percent water. The addition of 1 pound of honey, therefore, to 1 barrel of wort increases the OG by 1.1951 points (approx. 0.0012). In the metric system, the addition of 1 kilogram of honey to 1 hectoliter of wort increases the OG by 3.09 points (approx. 0.0031).

The recipe below features a hefty dose of about 50 lbs. of honey per barrel (about 19.33 kg/hl). This should add approx. 59.75 gravity points (= 0.060 or 15 °P), which raises the alcohol content by volume from 5.1 to a whopping 13 percent!

Specifications (from grain bill only, without addition of honey)

OG	1.052 (13 °P)		**BU**	10		**ABV**	5.1%
FG	1.014 (3.5 °P)		**Color**	48.3 SRM/126.8 EBC		**ABW**	4%

Specifications(from grain bill plus addition of honey combined)

OG	1.112 (28 °P)		**BU**	10		**ABV**	13%
FG	1.014 (3.5 °P)		**Color (est.)**	55 SRM/140 EBC		**ABW**	10.3%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	75	28.27	12.82	33.16	15.04	5.35	2.44
Weyermann® Cararye®	15	5.65	2.56	6.63	3.01	1.07	0.49
Weyermann® Roasted Barley (unmalted)	5	1.88	0.85	2.21	1.00	0.36	0.16
Weyermann® Smoked Malt	5	1.88	0.85	2.21	1.00	0.36	0.16
Total Grain	100	37.69	17.09	44.21	20.05	7.13	3.25
Honey		42.63	19.33	50.00	22.68	8.06	3.67

HOPS	%AA	1 HL (oz)	1 HL (g)	1 BBL (oz)	1 BBL (g)	5 Gal (oz)	19 l (g)
Bittering: Barth-Haas Northern Brewer	5	2.36	67	2.8	78	0.4	13
Flavor: None	0	0	0	0	0	0	0
Aroma: None	0	0	0	0	0	0	0
Yeast	Alcohol-tolerant Scottish/Scotch-Style yeast, mead yeast, or champagne yeast						

Brewing Process

Single-step infusion: Mash in @ 158 °F (70 °C); rest 90 min. Recirculate. Sparge slowly with 180°F (8 °C) liquor to raise mash temp to 172 °F (78 °C) for mash-out. Adjust sparge temp if needed. Boil 60 min. Add honey to kettle @ 30 min. Periodically skim scum off wort surface. Hops @ 5 min. Whirlpool 30 min. Ferment @ 60 °F (16 °C), for about 1 month. Rack. Condition. Package. Age in package for 1 wk.

DID YOU KNOW ... ?

The original Braggot brewers are believed to have been the Picts, a rough, shadowy people that inhabited what is now Scotland around the beginning of the first millennium BC. They seem to have moved there from the northern parts of the European Continent or from the Iberian Peninsula (nobody is quite sure). They were a ferocious tribe with a mystical culture, and, after their migration to the island home, they suppressed the native Scots there and effectively ruled Scotland until the ninth century AD.

When the Romans under Julius Caesar arrived in the British Isles in 54 BC, they encountered the warriors from the north, but were never able to defeat them. The Romans gave the Picts their name. They called these people *pictii*, or "the painted ones," probably because the ancient Pict warriors tattooed their bodies before they went into battle. In subsequent centuries, after the Romans had left, the Picts kept themselves busy in perpetual strife with new invaders from the south. However, neither the Celts nor the Angles and Saxons could dislodge them. But then came the raiding Vikings from Scandinavia...

For centuries, the Picts had stood their ground, but in one of those great mysteries of the ancient world, they suddenly disappeared around the tenth century, without leaving much of a trace. And when they were vanished by the Vikings, they took their beer knowledge with them, which is why the true composition of their Braggot is as much of a mystery as is the rest of the murky part that Picts played on the stage of world history.

Brown Ale, American

Beer culture of origin	United States
AKA	None
Related Styles	Brown Ale (English), Dark Ale, Blond Ale, Pale Ale

Style Description

This Brown Ale is an Americanized version of the British original. It is strongly malty, with a good caramel base, some chocolate and toasty overtones, but no smokiness whatsoever. The brewer is free to choose the hop selection from any number of citrus, floral, herbal, pungent, resiny, or spicy hops. The yeast should be clean-fermenting with relatively little diacetyl or ester. This beer originated in the late 20th century, when Cascade was the *American hop to use. In the recipe below, Cascade is used for bittering, flavor, and aroma.*

Specifications

OG	1.051 (12.75 °P)		**BU**	30		**ABV**	5.1%
FG	1.013 (3.25 °P)		**Color**	33.8 SRM/88.4 EBC		**ABW**	4%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	65	24.00	10.89	28.16	12.77	4.54	2.07
Weyermann® Caramunich® III	20	7.39	3.35	8.66	3.93	1.40	0.64
Weyermann® Carared®	13	4.80	2.18	5.63	2.55	0.91	0.41
Weyermann® Carafa® Special II	2	0.74	0.34	0.87	0.39	0.14	0.06
Total Grain	100	36.93	16.75	43.32	19.65	6.99	3.18
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Cascade	5.75	8.24	234	9.7	274	1.6	44
Flavor: Barth-Haas Cascade	5.75	3.18	90	3.7	106	0.6	17
Aroma: Barth-Haas Cascade	5.75	6.37	181	7.5	212	1.2	34
Yeast	Any American-style yeast						

Brewing Process

Single infusion. Mash in with 7 gal of brewing liquor per a 1 bbl of expected net kettle volume (or 1 qt/1 lb of grist, dry weight) @ 152 °F (67 °C); rest 45 min. Recirculate. Sparge with 180°F (8 °C) brewing liquor to raise mash temp to 168 °F ± 2 °F (76 °C ± 1 °C) for mash-out. Hold mash temp at that level. Adjust sparge water temp, if needed. Boil 60 min. 1st hops @ 5 min; 2nd hops @ 40 min. Whirlpool 30 min. 3rd hops @ start of whirlpool. Primary fermentation @ 60 °F – 70 °F (16 °C – 21 °C), depending on yeast, for about 7 days. Rack. Secondary fermentation about 14 days. Rack again, condition for a wk. Package.

Brown Ale, Belgian

Beer culture of origin	Belgian
AKA	Oud Bruin, Flanders Brown Ale
Related Styles	Flanders Red Ale, Lambic

Style Description

*Flanders Brown Ale or Oud Bruin, which is Flemish for Old Brown, is one of Belgium's classic sour ales. Flanders (*Vlaanderen *in Flemish or* Flandre *in French), the mostly Flemish-speaking region around Brussels, is the center of Belgian sour beer-making. This region has also spawned such styles as Flanders Red Ale as well as Lambic in all its variations—including Gueuze, Faro, Mars, and the fruit Lambics (Kriek, Pêche, Framboise, and Cassis).*

The brews of Flanders are generally golden to reddish-brown, rarely darker, not unlike an English Brown Ale, Irish Red Ale, or Düsseldorf Altbier. Roasted notes are not acceptable. In typical Belgian free-style brewing fashion, Flanders beers are strong or mild, and they are drunk young or well aged. Sometimes they are even blended from young and old beer, reminiscent of the fabled "threads" that allegedly composed the original London Porter. Sometimes they are flavored with sour fruit.

The Oud Bruin has a rich caramel malt base and plenty of fruitiness and esters, with complex overtones of phenol and sherry-like oxidation products, but relatively little hop flavor. The hops are noble and restrained. The finish is tart.

Specifications

OG	1.056 (14 °P)		**BU**	20		**ABV**	5.6%
FG	1.014 (3.5 °P)		**Color**	17.1 SRM/44.1 EBC		**ABW**	4.4%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	30	12.22	5.54	14.34	6.50	2.31	1.05
Weyermann® Pilsner (well modified)	30	12.22	5.54	14.34	6.50	2.31	1.05
Weyermann® Vienna	20	8.15	3.70	9.56	4.34	1.54	0.70
Weyermann® Carabelge®	20	8.15	3.70	9.56	4.34	1.54	0.70
Total Grain	100	40.74	18.48	47.79	21.68	7.71	3.51
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Hallertauer Mittelfrüh	4.25	2.81	80	3.3	93	0.5	15
Flavor: none	0	0.00	0	0.0	0	0.0	0
Aroma: Barth-Haas Saaz	4.5	5.55	157	6.5	185	1.1	30
Yeast	Belgian ale yeast plus Belgian Lactobacillus bacteria						

Brewing Process

Mash in @ about 125 °F (52 °C); 20-min hydration, beta-glucan and protein rest. Raise temp to 144 °F (62 °C); 40-min beta-amylase rest. Raise temp to 162 °F (72 °C); 40-min alpha-amylase rest. Recirculate 15 – 20 min. Lautering. Boil 90 min. Bittering hops @ 15 min; aroma hops @ 75 min. After shut-down, rest brew for 30 min before whirlpooling for another 30 min. Primary fermentation temp @ about 68°F (20°C). Pitch equal amounts of yeast and bacteria. Because bacteria have longer lag time, yeast will metabolize most of the sugars before bacteria become active. Rack after 2 wks, then again after 4 wks. Condition for 6 wks. Package.

Sour Beer Process Advisory:

Sour beer-making is only for the bravest of the brave and demands a great deal of caution. Traditionally, and often still today, many sour beer styles are spontaneously fermented by airborne microbes. These may include Brettanomyces bruxellensis, Brettanomyces lambicus, lactobacillus delbrückii, pediococcus, and other assorted wild yeasts and bacteria.

Souring microbes are invariably considered defects in regular beers. As beer spoilers, they are kept in check by a host of cleaning, sanitizing, and disinfecting agents, especially on the cold-wort side of the brewery. Breweries attempting to make sour beers, therefore, need to ensure that there is no cross-contamination between their sour and their regular brews. That is why many breweries that produce both sour and regular beers have separate fermenters, transfer hose, pumps and even fillers just for sour beers. Brewers who wish to make sour beers, but prefer not to risk errant microbe infections, can replace some of the base malt with up to perhaps 10 percent Weyermann® Acidulated Malt, which contains biologically produced, Beer Purity Law-conform, natural lactic acid.

Traditionally, souring microbes settle into brews during wort cooling in old-fashioned, flat, copper cool-ships that are placed in well vented rooms, where the green beer is exposed to a fresh breeze. The type or combination of microbes responsible for souring particular brews have often become proprietary micro-floras that are dominant only in a particular region or even brewery, thus giving a beer style—even a beer brand—its signature character. In many cases, this character is virtually impossible to imitate elsewhere. Specific mixtures of souring micro-flora are now commercially available from many yeast labs.

Brown Ale, Northern English

Beer culture of origin	Northern England
AKA	Nut Brown Ale
Related Styles	Bitter, Pale Ale, ESB (Extra Special Bitter)

Style Description

Perhaps the best-known interpretations of the traditional Northern English Brown Ale are the hallowed, but now mass-produced Newcastle Brown Ale and the craft-brewed Samuel Smith's Nut Brown Ale. Northern Browns are flavorful, malt-accented ales with subtle notes of nuttiness, biscuit, and caramel. Like southern English Browns, they range in color from dark amber to a reddish-brown, but they are brewed slightly stronger and have a little bit more residual sweetness in the finish, with a very restrained hop bitterness and only mild hop flavors and aromas. The classic hop profile of the Northern Brown is decidedly "English," calling for Fuggles or East Kent Goldings. While the southern rendition may have a slight chocolate malt note, even a touch of roastiness and smokiness, the northern edition does not.

Specifications

OG	1.051 (12.75 °P)		**BU**	24		**ABV**	5.1%
FG	1.013 (3.25 °P)		**Color**	15.8 SRM/40.6 EBC		**ABW**	4.0%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	85	31.39	14.24	36.82	16.70	5.94	2.71
Weyermann® Caramunich® III	5	1.85	0.84	2.17	0.98	0.35	0.16
Weyermann® Caraamber®	4	1.48	0.67	1.73	0.79	0.28	0.13
Weyermann® Caramunich® II	4	1.48	0.67	1.73	0.79	0.28	0.13
Weyermann® Caraaroma® II	2	0.74	0.34	0.87	0.39	0.14	0.06
Total Grain	100	36.93	16.75	43.32	19.65	6.99	3.18
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Fuggles	4.3	6.81	193	8.0	227	1.3	37
Flavor: none	0	0.00	0	0.0	0	0.0	0
Aroma: none	0	0.00	0	0.0	0	0.0	0
Yeast	London-style ale yeast						

Brewing Process

Single infusion. Mash in with 7 gal of brewing liquor per a 1 bbl of expected net kettle volume (or 1 qt/1 lb of grist, dry weight) @ 150 °F – 154 °F (66 °C – 68 °C); rest 45 min. Recirculate. Sparge with 180°F (8 °C) brewing liquor to raise mash temp to 168 °F ± 2 °F (76 °C ± 1 °C) for mash-out. Hold mash temp at that level. Adjust sparge water temp, if needed. Boil 60 min. 1st hops @ 5 min; 2nd hops @ 55 min. Whirlpool 30 min. Primary fermentation @ 60 °F –65 °F (16 °C – 18 °C), depending on yeast, for about 7 days. Rack. Secondary fermentation about 14 days. Rack again, condition for a wk. Package.

Brown Ale, Southern English

Beer culture of origin	England
AKA	None
Related Styles	Bitter, Pale Ale, Northern English Brown Ale, ESB

Style Description

The original English brown ale dates from the Middle Ages or earlier. Its "brownness" was the direct result of unpredictable malting techniques. In the old days, the malted grist was kiln-dried over open coal or wood fires, which caused all brewing groins to be somewhat dark, smoky, and roasted. That is the reason for the complex grain bill with modern malts. Pale malt was simply not available then. The color of beer made from such medieval malt would invariably be some shade of brown. Initially, this beer was made without hops, which was introduced to the British Isles by Flemish immigrants only in the 15th century. The hopped British everyday ale became what we now know as brown ale—brewed a bit stronger in the north than in the south of England. The lower-gravity Browns eventually evolved into Milds; the darker ones, into Stouts and Porters; and the hoppier ones, into IPAs, Bitters, and Pale Ales. Today, the typical southern English Brown is dark-amber, with a copper hue or ruby tinge.

Specifications

OG	1.048 (11 °P)		**BU**	24		**ABV**	4.8%
FG	1.012 (2.5 °P)		**Color**	23.2 SRM/60.3 EBC		**ABW**	3.8%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	60	20.79	9.43	24.39	11.06	3.93	1.79
Weyermann® Caraamber®	15	5.20	2.36	6.10	2.77	0.98	0.45
Weyermann® Caramunich® II	14	4.85	2.20	5.69	2.58	0.92	0.42
Weyermann® Smoked Malt	10	3.47	1.57	4.07	1.84	0.66	0.30
Weyermann® Carafa® III	1	0.35	0.16	0.41	0.18	0.07	0.03
Total Grain	100	34.66	15.72	40.65	18.44	6.56	2.99
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Fuggles	4.3	6.81	193	8.0	227	1.3	37
Flavor: none	0	0	0	0	0	0	0
Aroma: none	0	0	0	0	0	0	0
Yeast	London-style ale yeast						

Brewing Process

Single infusion. Mash in with 7 gal per 1 bbl net kettle volume @ 154 °F (68 °C). Rest 45 min. Recirculate. Sparge with 180°F (8 °C) brewing liquor to raise mash temp to approx. 168 °F (76 °C) for mash-out. Hold temp at that level. Boil 60 min. 1st hops @ 5 min; 2nd hops @ 55 min. 3rd hops @ start of whirlpool. Whirlpool 30 min. Primary-ferment @ 60 °F – 70 °F (16 °C – 21 °C), depending on yeast, for about 7 days. Rack. Secondary-ferment about 2 wks. Rack, condition for 1 wk. Package.

California Common

Beer culture of origin	USA
AKA	Steambeer®
Related Styles	None

Style Description

California Common is one of very few indigenous traditional American beer styles. It is a quaffing brew for the common man and woman that dates back to the rough and tumble days of the Alaska Gold Rush of the 1890s, when many of the mostly male inhabitants of San Francisco lined up on the docks waiting to be transported to the riches of the northern frontier.

Given its frontier history, this beer style has a fairly broad range of specifications. The beer was a lager, made, in those days, mostly by German immigrants.

The beer was also known as steam beer, a name, which—according to one theory—was given to it by a brewery that owned one of the first steam engines at the time. The Anchor Brewing Company of San Francisco has since trademarked that name.

The early brewers of California Commons obviously brewed with whatever ingredients were handy and fermentation was invariably fairly warm for a lager, which is why this brew requires a warm-tolerant specialty lager yeast for authenticity. The beer finishes dry, with a slight fruitiness and an assertive, lingering hoppiness from traditional (not modern, citrus) American hops.

Specifications

OG	1.052 (13 °P)		**BU**	35		**ABV**	5.3%
FG	1.012 (3 °P)		**Color**	28.8 SRM/35 EBC		**ABW**	4.2%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	79	29.77	13.51	34.92	15.84	5.63	2.57
Weyermann® Carared®	12.5	4.71	2.14	5.53	2.51	0.89	0.41
Weyermann® Caramunich® III	7.5	1.28	0.58	1.50	0.68	0.24	0.11
Weyermann® Carafa® I	1	0.38	0.17	0.44	0.20	0.07	0.03
Total Grain	100	36.14	16.39	42.40	19.23	6.84	3.11
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Northern Brewer	8	4.26	121	5.0	142	0.8	23
Flavor: None	0	0.00	0	0.0	0	0.0	0
Aroma: Barth-Haas Cluster	7	5.16	146	6.1	172	1.0	28
Yeast	California lager or San Francisco lager yeast						

Brewing Process

Multi-step infusion. Mash in @ 148 – 150 °F (64 – 66 °C). Rest 60 min. Raise temp to 168 °F (76 °C) for mash-out. Recirculate. Lauter. Boil 75 min. 1st hops @ 15 min; 2nd hops @ 70 min. Whirlpool. Ferment for 10 days @ 58 °F – 72 °F (14 °C – 22 °C), depending on yeast selection. Rack. Rest for 1 wk. to 10 days. Rack again. Condition for a few days and package.

DID YOU KNOW ... ?

It is widely known that the framers of American Independence were men of vision, courage, and wisdom. Less well known is the fact that they were also great imbibers of beer. Patrick Henry, Thomas Jefferson, Samuel Adams, and James Madison vigorously promoted the brewing industry in the colonies. George Washington operated a small brewery at his home at Mount Vernon. His handwritten recipe for beer--said by his peers to be superb--is still on display at the New York Public Library. And during the Revolutionary War, he made sure his troops received a quart of beer each day. In their fondness for beer, these great men were only following an American tradition that was already well established. No sooner had the colonies of Pennsylvania, Vermont and New York been founded, than their governors established breweries to provide their subjects with refreshment. Since the first of these was built in 1623, it can be seen that the practice of enjoying beer in America is older than America itself.

Cream Ale

Beer culture of origin	USA
AKA	None
Related Styles	None

Style Description

Cream Ale is one of very few indigenous traditional American beer styles. It can be fermented as an ale, a lager, or a hybrid of the two. The recipe below uses a 50/50 mixture of San Francisco-style lager yeast and Chico-style ale yeast. Cream Ales are pale-golden, highly attenuated, well carbonated, pre-Prohibition American brews, generally made at the frontier with whatever grain was at hand, which more likely than not included corn adjuncts. It is low in diacetyl, esters, hop bitterness, and maltiness. Often made with six-row malt, it has some grainy sweetness. For a two-row mash use some biscuit Belgian malt, such as Weyermann® Carabelge, for color and mouthfeel. In the Cream Ale recipe below, about 0.9 percent of the alcohol is derived from 4.95 lbs. of white table sugar per barrel (1.75 kg per hectoliter).

Specifications (before the addition of sugar)

OG	1.045 (11.25 °P)		**BU**	18		**ABV**	4.7%
FG	1.010 (2.5 °P)		**Color**	3.7 SRM/9.1 EBC		**ABW**	3.7%

Specifications (after the addition of sugar)

OG	1.052 (13 °P)		**BU**	18		**ABV**	5.6%
FG	1.010 (2.5 °P)		**Color**	3.7 SRM/9.1 EBC		**ABW**	4.4%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	98.5	31.91	14.47	37.43	16.98	6.04	2.75
Weyermann® Carabelge®	1.5	0.49	0.22	0.57	0.26	0.09	0.04
Total Grain	100	32.40	14.70	38.00	17.24	6.13	2.79
White table sugar		3.85	1.75	4.52	2.05	0.73	0.33
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Cluster	7	2.43	69	2.8	81	0.5	13
Flavor: None	0	0	0	0	0	0	0
Aroma: Barth-Haas Cluster	7	3.03	86	3.6	101	0.6	16
Yeast	50/50 mix of San Francisco-style lager yeast and dry "Chico"-style ale yeast						

Brewing Process

Multi-step infusion. Mash in @ 148 – 150 °F (64 – 66 °C); rest 60 min. Raise temp to 168 °F ± 2 °F (76 °C ± 1 °C) for mash-out. Recirculate 15 – 20 min. Lauter. Boil 75 min. 1st hops @ 15 min; 2nd hops and sugar @ 70 min. Whirlpool. Ferment @ 70 °F (21 °C) or slightly below. Brew should reach terminal gravity of 2.5 °P (1.010) in 3 to 4 days. Rest 2 days for sedimentation. Rack and condition @ approx. 40 °F (5 °C) for 10 days. Rack again and package.

Dampfbier

Beer culture of origin	Bavaria, Germany
AKA	None
Related Styles	None

Style Description

Dampfbier is German for steam beer. Though now rarely brewed, it was quite common towards the end of the 19th century in the Bavarian Forest—then an economically depressed region—near the Czech border. The breweries were fairly antiquated and still without refrigeration yet. It was brewed mostly in the summer as a medium-bodied, very gently hopped (only about 14 IBU), low-effervescence, all-barley ale. It was fairly warm-fermented, by German standards, at roughly 70°F (21°C), with top-fermenting yeast scrounged from better-to-do Weissbier breweries. But German or English ale yeasts work, too. Apparently, the brew's name comes from the copious amounts of bubbles produced during a fast and vigorous primary fermentation without temperature control. As these surface bubbles burst, they give the appearance—at least to the uninitiated—of a ferment boiling and giving off "steam." Originally, Dampfbier was a dark brew, like a Munich Dunkel. Today, it is generally deep golden to light amber in color. It may be filtered or not.

Specifications

OG	1.048 (12 °P)		**BU**	14		**ABV**	5.1%
FG	1.010 (2.5 °P)		**Color**	4.2 SRM/10.1 EBC		**ABW**	4%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pilsner	70	24.26	11.00	28.46	12.91	4.59	2.09
Weyermann® Munich I	30	10.40	4.72	12.20	5.53	1.97	0.90
Total Grain	100	34.66	15.72	40.65	18.44	6.56	2.99
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Hallertauer Mittelfrüh	4.25	4.08	116	4.8	136	0.8	22
Flavor: none	0	0	0	0	0	0	0
Aroma: Barth-Haas Hallertauer Mittelfrüh	4.25	2.33	66	2.7	78	0.4	13
Yeast	Bavarian Hefeweizen/Weissbier yeast; also Kölsch yeast or English ale yeast						

Brewing Process

Thin single infusion mash @ 152°F (67°C). Rest 60 min. Sparge 60 min, letting grain-bed temp rise to 168 °F (76 °C). Boil 60 min. 1st hops at 15 min. 2nd hop in whirlpool. After shut-down, siphon off about 5 liter/hl (approx 2 gal/bbl) of hot wort into a sterile, sealable container, and refrigerate or freeze as kräusening until bottling. Pitch @ 70°F (21°C). Rack after 4 days. Add kräusen. Maintain pressure at 7 – 8 psi for 2 wks. Rack and age for 4 wks. Package.

Dark Ale, American

Beer culture of origin	United States
AKA	None
Related Styles	Amber Ale, Porter,

Style Description

American Dark Ale is a vaguely defined style and there is little consensus as to its identifying criteria. It is perhaps best explained by what it is not. American Dark Ale, unlike its adjacent styles on the color and flavor scale, Porter and Amber, sets itself apart by having a background of biscuity notes that—in the view of the author and technical editors—are best achieved through the addition of a small amount of unmalted roasted barley to the grist. Chocolate notes, too, should be present, but not dominant.

The hop component should be noticeable and non-noble, unlike in a dark European lager such as Munich or Bohemian Dunkel. Perhaps a combination of Galena and Willamette, rather than the grapefruity Northwest standby Cascade, give a more balanced result. The finish should have some residual sweetness, unlike that of a dry Irish Stout, for instance. The single-infusion temperature should favor alpha-amylase, not just beta-amylase. A mash-in temperature of 154 °F (68 °C) should achieve this goal. For yeast, virtually any American-style yeast appears suitable.

The recipe below is only one possible interpretation of this style.

Specifications

OG	1.050 (12.5 °P)		**BU**	30		**ABV**	4.9%
FG	1.013 (3.25 °P)		**Color**	37.4 SRM/98 EBC		**ABW**	3.9%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	80	28.94	13.12	33.94	28.92	5.47	2.49
Weyermann® Caraamber®	15	5.43	2.46	6.36	5.42	1.03	0.47
Weyermann® unmalted roasted barley	4	1.45	0.66	1.70	1.45	0.27	0.12
Weyermann® Carafa® I	1	0.36	0.16	0.42	0.36	0.07	0.03
Total Grain	100	36.17	16.41	42.43	36.15	6.84	3.12
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Galena	13	2.59	74	3.0	86	0.5	14
Flavor: none	0	0	0	0	0	0	0
Aroma: Barth-Haas Willamette	5	2.82	80	3.3	94	0.5	15
Yeast	Various American-style ale yeasts						

Brewing Process

Single infusion. Depending on desired dryness in the finish, mash in @ 154 °F (68 °C); rest 60 min. Recirculate. Raise temp for mash-out @ 168 °F ± 2 °F (76 °C ± 1 °C). Initially, sparge with 180°F (8 °C) brewing liquor; adjust sparge water temp, if needed. Boil 60 min. 1st hops @ 5 min; 2nd hops @ 55 min. Whirlpool 30 min. Primary fermentation @ 60 °F –70 °F (16 °C – 21 °C), depending on yeast, for about 7 days. Rack. Secondary fermentation about 14 days. Rack again, condition for a wk. Package.

DID YOU KNOW ... ?

In the twentieth century, alcoholic beverages, including beer, became the topic of two of the only 27 amendments to the American constitution. The 18th Amendment ushered in Prohibition in 1919, the 21st Amendment ended it in 1933. This puts alcoholic beverages at a statistical par with such weighty matters as, for instance, the succession to the presidency in case of incapacitation or death of the incumbent, which also takes up two amendments, the 20th of 1933 and the 25th of 1967.

And even after the repeal of Prohibition, the simple joy of homebrewing remained illegal—and this in spite of the fact that two American presidents, George Washington and Thomas Jefferson, were homebrewers. President Jimmy Carter finally decriminalized homebrewing as late as 1978!

Dark Ale, Belgian

Beer culture of origin	Belgium
AKA	Dark Strong Ale
Related Styles	None

Style Description

The Belgian Dark Ale belongs to the category of Belgian "strong" ales—those with an alcohol by volume content starting at around 6 percent and seemingly having no top limit as long as the yeast is cooperative. The base malt is usually a Pilsner malt. The beer also needs plenty of aromatic malts as well as some color malts. However, strongly roasted, British-style, dark malts are not part of this style.

The hops in a Belgian Dark, as in many Belgian beers, are noble and Pilsner-like—Styrian Goldings and Saaz are suitable for bittering and flavor, respectively. Because the Belgian Dark needs to be brewed to a high alcohol content of at least 8 percent (usually much more!), it requires a slow and extensive mash regimen that ensures both proper hydration of the grain bed as well as the extraction of anything that is fermentable. One effective method—chosen below—is to dough in at a low 90 °F (32 °C) and ramp the temperature up gradually through a continuous infusion process over a three- to four-hour period to the mash-out temperature of about 170 °F (77 °C). This ensures the proper breakdown of proteins and beta-glucans as well as the conversion of starches mostly to mono- and disaccharides for plenty of alcohol and a dry finish.

For the extra alcohol, a proper Belgian Strong Dark Ale also needs a dose of dark sugar in the kettle for additional, clean-tasting fermentables and additional alcohol. Roughly 1.75 kg of pure sugar per hectoliter (roughly 4.5 lbs./bbl) of finished beer bumps up the amount of alcohol by volume by about 0.9 percent. A more flavorful alternative to dark sugar is the sugar-equivalent amount of an unhopped, pale, liquid malt extract (LME). Added to the kettle, LME instead of sugar gives the brew an enhanced malt intensity.

Our choice below is roughly 3 kg per hectoliter (approx. 3.66 lbs./bbl) of dark brown, smooth Weyermann® Bavarian Dunkel LME, which is made entirely from a two-step decoction of Weyermann® Munich I, Weyermann® Caramunich®, and Weyermann® Pilsner. This LME has 72 to 79 percent of fermentable sugars by weight and gives the brew a well balanced slightly sweet, malt-aromatic finish. Mathematically, therefore, the LME raises the alcohol content by volume (ABV) by about 1.3 percent.

The recipe below produces a brew of 21 °P (OG 1.084) kettle gravity before the addition of LME, and of 23.5 °P (OG 1.094) kettle gravity after the addition of LME. The apparent attenuation of this brew at the end of fermentation is approx. 3.5 °P (FG 1.014). At that attenuation level, the malt alone is responsible for about 9.3 percent ABV, and the mash and LME combined generate about 10.6 percent. The estimated color value of the finished beer is approx. 14.5 SRM (37.2 EBC).

Specifications (before the addition of LME)

OG	1.084 (21 °P)		**BU**	22		**ABV**	9.3%
FG	1.014 (3.5 °P)		**Color**	15.1 SRM/38.9 EBC		**ABW**	7.3%

Specifications (after the addition of LME)

OG	1.094 (23.5 °P)		**BU**	22		**ABV**	10.4%
FG	Approx. 1.016 (4 °P)		**Color (est.)**	16 SRM/41.2 EBC		**ABW**	8.2%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	61	38.27	17.36	44.89	20.36	7.240	3.298
Weyermann® Munich II	20	12.55	5.69	14.72	6.68	2.374	1.081
Weyermann® Abbey Malt®	10	6.27	2.85	7.36	3.34	1.187	0.541
Weyermann® Carabelge®	6	3.76	1.71	4.42	2.00	0.712	0.323
Weyermann® Caraaroma®	3	1.88	0.85	2.21	1.00	0.356	0.162
Total Grain	100	62.73	28.45	73.59	33.38	11.869	5.40
Weyermann® Bavarian Dunkel LME		6.66	3.02	7.81	3.54	1.26	0.57
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Styrian Goldings	5.5	3.32	94	3.9	110	0.6	18
Flavor: Barth-Haas Hallertauer Mittelfrüh	4.25	2.47	70	2.9	82	0.5	13
Aroma: Barth-Haas Hallertauer Mittelfrüh	4.25	2.47	70	2.9	82	0.5	13
Yeast	Belgian Abbey-style ale yeast						

Brewing Process

Continuous infusion. Dough in as thick as possible @ 90 °F (32 °C) or lower. Then ramp up temp slowly and continuously over 3 – 4 hrs to a mash-out temp of about 170 °F (77 °C). Lauter slowly for 3 hrs. Boil for 90 minutes. 1st hops @ 15 min; 2nd hops @ 60 min; 3rd hops @ 85 min. Whirlpool 30 min. Ferment for 1 wk. @ 64 °F – 70 °F (18 ° - 21 °C), depending on yeast strain. Rack and ferment for another 10 days. Reduce temp to approx. 34°F (1°C). Lager for 12 wks. Rack, condition, package.

Dark Ale, English

Beer culture of origin	England
AKA	None
Related Styles	Brown Ale, Scottish Ale, Old Ale, Porter, Stout

Style Description

"Dark" is by definition a vague term, and it is truly debatable where exactly one should place the borders for Dark Ale specifications vis-a-vis Brown Ale, Scottish Ale, Porter, or Stout. There appears to be only one guideline this brew: Given the rough malting techniques of the Middle Ages, during which many kernels probably failed to sprout and many other kernels got inadvertently roasted in the smoky kiln, part of the dark ale grist was probably more akin to roasted barley than malt. Perhaps the traditional Dark Ale reflects this aspect of medieval British beer-making more so than any other style. Therefore, the author and technical editors consider the Dark Ale primarily a darker version of the classic British Brown Ale, but based on a very uneven grist, with both a slightly toastier flavor and a chewier texture than the Brown.

Specifications

OG	1.050 (12.5 °P)		**BU**	28		**ABV**	4.8%
FG	1.014 (3.5 °P)		**Color**	42 SRM/110.1 EBC		**ABW**	3.8%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	60	21.70	9.84	25.46	11.55	4.11	1.87
Weyermann® Caraamber®	15	5.43	2.46	6.36	2.89	1.03	0.47
Weyermann® Caramunich® II	10	3.62	1.64	4.24	1.92	0.68	0.31
Weyermann® Smoked Malt	10	3.62	1.64	4.24	1.92	0.68	0.31
Weyermann® Carafa® III	3	0.36	0.16	0.42	0.19	0.07	0.03
Weyermann® Roasted Barley (unmalted)	1	1.09	0.49	1.27	0.58	0.21	0.09
Total Grain	100	35.81	16.24	42.00	19.05	6.77	3.09
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Goldings	5	6.84	194	8.0	227	1.3	37
Flavor: none	0	0	0	0	0	0	0
Aroma: none	0	0	0	0	0	0	0
Yeast	London-style ale yeast						

Brewing Process

Single infusion. Mash in with 7 gal brewing liquor per a 1 bbl of net kettle volume @ 154 °F (68 °C). Rest 45 min. Recirculate. Sparge with 180 °F (8 °C) brewing liquor to raise mash temp to 168 °F (76 °C) for mash-out. Boil 60 min. 1st hops @ 5 min; 2nd hops @ 55 min. 3rd hops @ start of whirlpool. Whirlpool 30 min. Primary-ferment @ 60 °F –70 °F (16 °C – 21 °C), depending on yeast, for about 7 days. Rack. Secondary-ferment about 14 days. Rack. Condition for 1 wk. Package.

Dinkelbier

Beer culture of origin	Germany
AKA	Speltbier
Related Styles	Hefeweizen/Weissbier, Emmerbier, Einkornbier

Style Description

Dinkel (Triticum spelta) *is German for spelt. It is a hard-grained heirloom wheat, with genes going back to cultivars planted in Neolithic times in the Fertile Crescent of the Middle East, where beer brewing originated. The Sumerians almost certainly made beer from Dinkel.*

*Dinkel is the result of a cross between Emmer (*Triticum dicoccum*) and wild grasses in Mesopotamia some 10,000 years ago. Emmer, in turn, is a cross between Einkorn (*Triticum monococcum*), which is an even older wheat variety, and also wild grasses.*

In Europe, Dinkel is known to have been cultivated at least since the late Bronze Age, some 3,000 years ago, mostly in the regions inhabited by the Alemans, a Germanic tribe in what is now the German State of Baden-Wurttemberg and the German-speaking part of Switzerland.

In the Middle Ages, Dinkel was also known as Schwabenkorn *(Swabia grain), because the southwestern German region of Swabia (part of Baden-Wurttemberg) was then the center of Dinkel cultivation. Spelt places few demands on soil quality and climate, which means that it can grow where modern wheat (*Triticum aestivum*) cannot.*

Malt from this cereal is about 1.9 °L to 2.8 °L in color. Dinkel is fairly high in protein content (up to 17% compared to modern wheat, which has about 12.5% to 14.5%). Therefore, the Dinkel portion of the mash seldom exceeds 50 percent. In addition, Dinkel kernels are best de-husked in the malt house. Otherwise, Dinkelbier would taste very rough and astringent.

The recipe below is based on 68 percent well modified Weyermann® Pilsner malt and about 30 percent Weyermann® Spelt malt. It also contains an optional, small amount of Weyermann® Chocolate Spelt malt for additional color, which you can omit.

After fermentation, Dinkelbier needs to mellow out during a maturation period of several months around the freezing point.

Because beer foam is mostly protein, Dinkelbier throws a very thick head when it is poured into a glass. Its alcohol content by volume tends to be about 4.5%.

When brewing a Dinkelbier think of it as making an heirloom Hefeweizen.

Specifications

OG	1.050 (12.5 °P)		**IBU**	15		**ABV**	4.5%
FG	1.016 (4 °P)		**Color**	8.5 SRM/21.4 EBC		**ABW**	3.6%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pilsner	68	24.60	11.16	28.85	13.09	4.65	2.12
Weyermann® Spelt Malt	30	10.85	4.92	12.73	5.77	2.05	0.94
Weyermann® Chocolate Spelt Malt	2	0.72	0.33	0.85	0.38	0.14	0.06
Total Grain	100	36.17	16.41	42.43	19.24	6.84	3.12
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Hallertauer Mittelfrüh or equivalent	4.2	4.21	119	4.9	140	0.8	23
Flavor: None	0	0	0	0	0	0	0
Aroma: Barth-Haas Hallertauer Mittelfrüh or equivalent	4.2	4.20	150	6.1	175	0.9	28
Yeast	Bavarian Hefeweizen/Weissbier Yeast						

Brewing Process

Multi-step infusion. Mash in with approx. 65% of expected net kettle volume of brewing liquor @ 99 °F (37 °C); raise temp to 113 °F (45 °C); rest for 10 min; raise temp to 126 °F (52 °C); rest 10 min; raise temp to 144 °F (62 °C); rest 30 min; raise temp to 162 °F (72 °C); rest 30 min; raise temp to mash-out @ 172°F (78°C). Sparge/lauter 100 min. Boil 60 min. Bittering hops after 15 min. Aroma hops in whirlpool. Ferment in open fermenter @ 64 – 75 °F (18 – 24 °C), depending on selected yeast strain. Rack after about 2 wks and again after 4 wks. Pull the temp down to the freezing point and mature for 3 – 2 months. Rack, condition, package.

DID YOU KNOW ... ?

The very first freight carried by a German train was two casks of beer. They were brewed by the Lederer Brewery of Nuremberg! The casks traveled from Nuremberg to Fürth on July 11, 1836, on the first German rail link, a mere seven months after it had been opened.

Doppelbock

Beer culture of origin	Germany
AKA	None
Related Styles	Bock, Maibock, Eisbock, Weizenbock

Style Description

Doppelbock is the strong version of the already strong Bockbier. Doppel is double in German. It is made essentially the same way as a Bockbier with virtually the same ingredients., except with a bit of de-husked Weyermann® Carafa® I for additional color.

The wort's starting gravity seems to be limited only by the geometry of the mash tun; and the alcohol level, only by the yeast's ability to metabolize all that is fermentable in this brew. The starting gravity is usually above 18 °P (OG 1.070) and may even approach 25 °P (OG 1.100); the alcohol by volume level may exceed 10 percent. Hop dosage, however, is restrained.

Specifications

OG	1.092 (23 °P)		**BU**	23		**ABV**	9.8%
FG	1.018 (4.5 °P)		**Color**	23.3 SRM/60.6 EBC		**ABW**	7.75%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pilsner	32	22.15	10.05	25.98	11.78	4.19	1.91
Weyermann® Munich II	30	20.76	9.42	24.36	11.05	3.93	1.79
Weyermann® Carafoam®	27.5	19.03	8.63	22.33	10.13	3.60	1.64
Weyermann® Melanoidin	8	5.54	2.51	6.50	2.95	1.05	0.48
Weyermann® Caramunich® III	2	1.38	0.63	1.62	0.74	0.26	0.12
Weyermann® Carafa® I Special	0.5	0.35	0.16	0.41	0.18	0.07	0.03
Total Grain	100	69.21	31.39	81.19	36.83	13.09	5.97
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Taurus	2.73	2.46	70	2.9	82	0.5	13
Flavor: Barth-Haas Tradition	1.28	1.92	54	2.2	64	0.4	10
Aroma: Barth-Haas Smaragd/Emerald	0.64	1.28	36	1.5	42	0.2	7
Yeast	Bavarian-style lager yeast						

Brewing Process (Continuous Infusion)

Dough in for thick mash @ approx. 90 °F (32 °C). Rest 30 min. Infuse and raise temp continuously over 2 – 3 hrs to mash-out temp of 170 °F (77 °C). Lauter for at least 90 min. Boil 90 min. 1st hops @ 30 min. 2nd hops @ 75 min. 3rd hops @ 85 min. Whirlpool 30 min. Ferment @ 50 °F (10 °C) for 3 wks. Rack. Lager close to freezing point for at least 5 wks. Rack again, condition, package.

Brewing Process (Double Decoction)
Mash in main mash at @ 100 °F (38 °C); rest 30 minutes for proper grist hydration and activation of phytase for some mash acidification.

Draw 1st decoction (one-third of main mash). Heat decoction (10 – 15 min). Rest decoction @ 149 °F (65 °C) for 30 min. Heat decoction (10 min). Rest decoction @ 162 °F (72 °C) for 10 min. Heat decoction (10 min). Boil decoction @ 212 °F (100 °C) for 10 min. Reintroduce decoction to main mash. Rest main mash @ 149 °F (65 °C) for 10 min.

Draw 2nd decoction (one-third of main mash). Heat decoction (5 – 10 min). Rest decoction @ 162 °F (72 °C) for 10 min. Heat decoction (10 min). Boil decoction @ 212 °F (100 °C) for 10 min. Reintroduce decoction to main mash. Rest main mash @ 162 °F (72 °C) for 10 min.

Raise temp of main mash to 171 °F (77 °C). Rest 15 min. Recirculate (5 min). Start lautering and sparging slowly (!) for about 3 hrs until kettle full. Boil 90 min. 1st hops @ 30 min. 2nd hops @ 75 min. 3rd hops @ 85 min. Whirlpool 30 min.

Ferment @ 50 °F (10 °C) for 3 wks. Rack. Lager close to freezing point for at least 5 wks. Rack again, condition, package.

DID YOU KNOW ... ?
The oldest depiction of beer-making in the world comes from Mesopotamia (in what is now southern Iraq). It is more than four thousand years old and shows the threshing of emmer (a primitive wheat variety) for a sacrificial beer made by Sumerian brewsters specifically in honor of the goddess Ninkasi, whom the Sumerians worshipped as the great mother of creation. Ninkasi is also known by the names of Ningiirsu, Ninurta, Nidaba, Astarte, or Ishtar. She was revered as the goddess offertility. Her emblem was an ear of emmer or barley. In the spring she caused the grain to ripen. Grain was the center of Sumerian culture and Ninkasi, its goddess, the center of Sumerian ritual. Ninkasi was born of sparkling-fresh water. In the world above, her job was to brew all the beer for all the gods. On earth, she was in charge of the harvest, beer and brewing, drunkenness and seduction, the passionate art of carnal love, and the cruel art of war. Her name meant "the lady who fills the mouth."

Dortmunder Export

Beer culture of origin	Germany
AKA	None
Related Styles	Bavarian Helles, European Pilsner

Style Description

Dortmund is the largest city in what was once the coal-mining and steel-making Ruhr District, Germany's industrial heartland, in the northwest of the country. Dortmund has been an ale-brewing center ever since 1293, when the German King Adolf of Nassau conferred the brew right upon its burghers. The beers made in Dortmund throughout the Middle Ages were mostly Altbier-like brews, called Keutebier, mashed from a mixture of barley and wheat malts.

The modern Dortmunder Export, by contrast, is a blond lager that evolved in the latter part of the 19th century, during the heyday of the Industrial Revolution, as an adaptation of the Bohemian Pilsner. In Germany, beers called "Export" generally have an alcohol by volume content in the five-percent range. The Dortmunder is no exception.

Dortmund water is exceptionally high in both carbonate and non-carbonate hardness. If need be, adjust your brewing liquor accordingly. A traditional Dortmunder Export is a deep golden brew with a solid malt backbone, a substantial mouthfeel, a complex happiness, a crisp, medium-dry finish, and next to no esters or diacetyl. The yeast, therefore, must be very clean-fermenting, such as a Danish-type.

Specifications

OG	1.052 (13 °P)		**BU**	25		**ABV**	5.3%
FG	1.012 (3 °P)		**Color**	4.3 SRM/10.3 EBC		**ABW**	4.2%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pilsner	75	28.27	12.82	33.16	15.04	5.35	2.44
Weyermann® Carafoam®	12.5	4.71	2.14	5.53	2.51	0.89	0.41
Weyermann® Carahell®	12.5	4.71	2.14	5.53	2.51	0.89	0.41
Total Grain	100	37.69	17.09	44.21	20.05	7.13	3.25
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Tettnanger	4	5.26	149	6.2	175	1.0	28
Flavor: Barth-Haas Hallertauer Mittelfrüh	4.25	2.95	84	3.5	98	0.6	16
Aroma: Barth-Haas Saaz	4.5	7.38	209	8.7	245	1.4	40
Yeast	German or Danish dry-fermenting lager yeast						

Brewing Process

Multi-step infusion. Mash in @ 122 °F (50 °C); rest 30 minutes; raise temp to 148 °F (64 °C); rest 20 min. Raise temp to mash-out @ 172 °F (78 °C). Lauter 90 min. Boil for 75 minutes. 1st hops @ 15 min; 2nd hops @ 60 min; 3rd hops in whirlpool. Ferment @ 48 °F (9 °C) for 1 wk. Rack and fermentation for another 10 days. Reduce temp to 34°F (1°C); lager for 4 wks. Rack, condition, package.

DID YOU KNOW ... ?

Today, it's possible to enjoy beers from breweries all over the world. But 800 years ago, the brewers' market was confined to only their local area. It simply was not possible to physically move the beer long-distance and keep it fresh. All this changed when momentous technological advances were made in transportation... especially in animal traction and harness!

Improvements in these fields were first reported in the ninth century, but came into wider use only around the 13th century. Before that time, a horse was hitched to its dray by traces fastened to a yoke on its withers and anchored by a strap around the breast. The harder the horse pulled, the more the strap choked it. The rigid collar changed all that. It put the strain on the horse's shoulders instead on its windpipe, thus increasing the animal's "horsepower" almost fivefold. Only then did the transport of heavy casks of beer over rutty roads become possible.

Horses employed in freight hauling were also susceptible to slipping, hoof breakage and foot injuries. Because of frequent breakdowns of the hay burners, delivery schedules for trading goods were notoriously unreliable. It was not until the arrival of the nailed-on, iron horseshoe, which kept the animals sound and sure-footed, that trade, especially in semi-perishable goods, could be conducted on anything resembling a timetable.

Dunkel, Bavarian

Beer culture of origin	Germany
AKA	Munich Dunkel
Related Styles	Bohemian Dunkel, Schwarzbier

Style Description

Dunkel is malt-accented dark lager from Bavaria. It is a difficult beer to make well, because—just as in the even darker Schwarzbier—the requirements of color and flavor in this brew are at odds. The beer must be opaque, but it must not have any of the roasted notes that are so typical of the dark ales of the British Isles. Chocolate and roasted malts, therefore, are not appropriate.

The Dunkel is also arguable the world's first and oldest true beer style. It emerged after two feudal decrees changed Bavarian brew practices. The Bavarian Beer Purity Law of 1516 mandated that, in Bavaria, beers could be made, henceforth, only from barley, hops and water—the existence of yeast was still unknown then.

The Bavarian summer brewing prohibition of 1553—unknown to the medieval brewers—caused all Bavarian beers to be lagers, because ale yeasts simply went dormant during the brewing season in the cold Bavarian winters.

The darkish lager that everybody started to make after these two decrees had been passed quickly became the *staple beer of Bavarians. Initially called red beer, it acquired the name Dunkel in the 19th century.*

Nowadays, the Dunkel grain bill is composed primarily of Munich malt, sometimes with a portion of Pilsner malt, as well as a few darker specialty malts for color and flavor. Always decocted in the old days, it is now usually just multi-step infusion-mashed.

Hops in the Dunkel are always noble. They are gentle up front, with lingering aromas in the finish.

Specifications

OG	1.052 (13 °P)		**BU**	24		**ABV**	5.2%
FG	1.013 (3.25 °P)		**Color**	16.9 SRM/43.4 EBC		**ABW**	4.1%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Munich I	55	20.73	9.40	24.31	11.03	3.92	1.79
Weyermann® Munich II	30	11.31	5.13	13.26	6.02	2.14	0.97
Weyermann® Caramunich® III	10	3.77	1.71	4.42	2.01	0.71	0.32
Weyermann® Carafoam®	5	1.88	0.85	2.21	1.00	0.36	0.16
Total Grain	100	37.69	17.09	44.21	20.05	7.13	3.25

HOPS	%AA	1 HL (oz)	1 HL (g)	1 BBL (oz)	1 BBL (g)	5 Gal (oz)	19 l (g)
Bittering: Barth-Haas Tradition	5.5	4.49	127	5.3	149	0.8	24
Flavor: Barth-Haas Hallertauer Mittelfrüh	4.25	1.72	49	2.0	57	0.3	9
Aroma: Barth-Haas Hallertauer Mittelfrüh	4.25	1.07	30	1.3	36	0.2	6
Yeast	Bavarian-style lager yeast						

Brewing Process

Multi-step infusion. Dough in thick for an optional 15–30 min. acid rest @ at 100 ± 5 °F (38 ± 2 °C). Raise temp to 122 °F (50 °C). Rest 30 min. Raise temp to 146 ± 2 °F (63 ± 1 °C). Rest 30 min. Raise temp to 156 ± 2 °F (69 ± 1 °C). Rest 30 min. Raise temp to mash-out temp @ 170 °F (77 °C). Recirculate. Lauter for about 90–120 minutes. Boil 90 min. 1st hops @ 15 min. 2nd hops @ 70 min. 3rd hops in whirlpool. Ferment @ 50 °F – 59 °F (10 °C – 15 °C). After 7 ± 2 days Primary fermentation, rack. Secondary fermentation for 2 wks. Lager @ -2 °C (28 °F), if possible, for 4 – 6 wks. Rack, condition, package.

DID YOU KNOW ... ?

We consider the dawn of man's recorded history to be the dawn of Sumerian culture some 10,000 years ago, and there is sound reason to think that beer and human civilization began at roughly the same time. The Sumerians were a Stone Age people of hunters and gatherers, who wandered the mountain regions of Persia (present-day Iran) and Anatolia (part of present-day Turkey), when Europe was still recovering from the last Ice Age. For their daily survival, they were engaged in a roving game of chance in pursuit of food that came with swift and nimble feet, wings, and fins designed for a quick getaway, or it grew somewhat haphazardly as wild fruits, grains, and vegetables in scattered places. Eventually, perhaps by accident, these prehistoric nomads strayed into the fertile flood plains below, between the rivers Tigris and Euphrates in what is now Iraq, into a region that the Greeks would one day call Mesopotamia, which means "land between the rivers." There the hunting was good and the living seemed easy—and they evolved into a sedentary farming culture—the first ever—that lasted at least five thousand years. With this step, they left behind not only the mist of the mountains, but also the fog of prehistory. Among the grains they cultivated was a form of wild barley (*Hordeum spontaneum*) with six rows of kernels, which, by 7000 BC, they had evolved into an advanced type of barley, *Hordeum distichium*, with two rows of big, plump kernels, the oldest cultivated plants in the world and a forerunner of most modern brewing barley. The Sumerians did the same with emmer or spelt (*Triticum dicoccum*), which they evolved into wheat (*Triticum aestivum*), and we know from Sumerian records that, by the fourth millennium BC, they used half their annual grain harvest for bread, the other half for wheat and barley beer.

Dunkel, Bohemian

Beer culture of origin	Czech Republic
AKA	Böhmisch Dunkel, Czech Dark Lager
Related Styles	Czech Pilsner; Bavarian Dunkel

Style Description

Perhaps the most famous Bohemian dark lager is the brew served at the U Fleků pub and microbrewery in Prague, Czech Republic.

The roots of Bohemian beer can be traced back to 1295, when King Wenceslas II of Bohemia convinced Pope Boniface VIII in distant Rome to revoke a papal ban on secular beer-making in Wenceslas' kingdom. After this reversal of papal policy, the king granted 260 burgher families in Pilsen the right to make their own beer. And the beer they made was dark und possibly an ale, a forerunner of the modern Bohemian Dunkel lager. It is generally referred to nowadays as Bohemian Dunkel or Böhmisch Dunkel.

The German designation comes from a time when Bohemia was part of the German-speaking Austro-Hungarian Empire.

The Bohemian Dunkel is to Czech Pilsner what Bavarian Dunkel is to Bavarian Helles. It is rich and dark, and, like the blond Pilsner, it requires a very malt-aromatic grain bill as well as aromatic Saaz hops. The brew has a slight residual sweetness, which is offset by some roastiness from a small addition of chocolate-flavored caramel malt.

Specifications

OG	1.048 (12 °P)		**BU**	21		**ABV**	4.8%
FG	1.012 (3 °P)		**Color**	32.4 SRM/84.5 EBC		**ABW**	3.8%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Floor-Malted Bohemian Pilsner	40	13.86	6.29	16.26	7.38	2.62	1.19
Weyermann® Munich II	40	13.86	6.29	16.26	7.38	2.62	1.19
Weyermann® Carabohemian®	18	6.24	2.83	7.32	3.32	1.18	0.54
Weyermann® Carafa® Special I	2	0.69	0.31	0.81	0.37	0.13	0.06
Total Grain	100	34.66	15.72	40.65	18.44	6.56	2.99
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Saaz	4.5	2.94	83	3.4	98	0.6	16
Flavor: None	0	0	0	0	0	0	0
Aroma: Barth-Haas Saaz	4.5	5.51	156	6.5	183	1.0	30
Yeast	Czech Pilsner yeast						

Brewing Process

Multi-step infusion. Mash in @ 122 °F (50 °C); rest 30 minutes; raise temp to 144 °F (62 °C); rest 20 min. Raise temp to 162 °F (72 °C); rest 20 min. Raise temp to mash-out @ 172 °F (78 °C). Lauter 90 min. Boil for 75 minutes. 1st hops @ 15 min; 2nd hops @ 60 min. Fermentation temp @ 54°F (12°C). Rack when gravity @ about 4.5 °P (1.018). Reduce temp to 34°F (1°C); lager for 3 – 4 wks. Rack and condition for 2 days.

DID YOU KNOW ... ?

The oldest continually operating brewpub in the world is arguably U Flecků in Prague in the Czech Republic. Established in 1499, this large and magnificently designed tavern closed for only for a few months in 1620 after the Battle of the White Mountain which took place on a hillside just outside the city. Today it is a bustling establishment frequented by locals and tourists alike. Only one beer is brewed— Flekovský tmavý ležák 13°, a dark, almost black lager (4.5% ABV, OG 1.052).

Dunkelbock

Beer culture of origin	Germany
AKA	Dunkler Bock, Dunkles Bock
Related Styles	Doppelbock, Maibock, Eisbock, Weizenbock

Style Description

Most Bockbiers (though not all!) are slightly dark in appearance, somewhere between dark copper and burnt amber. Some Bockbiers, however, are mashed with a particularly large portion of chocolate and roasted caramel malt, which makes them more akin to a super-strong Schwarzbier than a Bockbier. For a basic Bockbier description, see entry.

Specifications

OG	1.066 (16.5 °P)		**BU**	35		**ABV**	7%
FG	1.013 (3.25 °P)		**Color**	43.8 SRM/114.8 EBC		**ABW**	5.6%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pilsner	30	14.54	6.60	17.06	7.74	2.75	1.25
Weyermann® Munich II	27.5	13.33	6.05	15.64	7.09	2.52	1.15
Weyermann® Carafoam®	25	12.12	5.50	14.21	6.45	2.29	1.04
Weyermann® Melanoidin	12.5	6.06	2.75	7.11	3.22	1.15	0.52
Weyermann® Carafa® I Special	5	2.42	1.10	2.84	1.29	0.46	0.21
Total Grain	100	48.47	21.99	56.86	25.79	9.17	4.18
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Taurus	8.5	4.16	118	4.9	138	0.8	22
Flavor: Barth-Haas Tradition	5.5	1.94	55	2.3	65	0.4	10
Aroma: Barth-Haas Smaragd/Emerald	5	0.97	28	1.1	32	0.2	5
Yeast	Bavarian-style lager yeast						

Brewing Process (Continuous Infusion)

Dough in for thick mash @ approx. 90 °F (32 °C). Rest 30 min. Infuse and raise temp continuously over 2 – 3 hrs to mash-out temp of 170 °F (77 °C). Lauter for at least 90 min. Boil 90 min. 1st hops @ 30 min. 2nd hops @ 75 min. 3rd hops @ 85 min. Whirlpool 30 min. Ferment @ 50 °F (10 °C) for 3 wks. Rack. Lager close to freezing point for at least 5 wks. Rack again, condition, package.

Brewing Process (Double Decoction)

Mash in main mash at @ 100 °F (38 °C); rest 30 minutes for proper grist hydration and activation of phytase for some mash acidification.

Draw 1st decoction (one-third of main mash). Heat decoction (10 – 15 min). Rest decoction @ 149 °F (65 °C) for 30 min. Heat decoction (10 min). Rest decoction @ 162 °F (72 °C) for 10 min. Heat decoction (10 min). Boil decoction @ 212 °F (100 °C) for 10 min. Reintroduce decoction to main mash. Rest main mash @ 149 °F (65 °C) for 10 min.

Draw 2nd decoction (one-third of main mash). Heat decoction (5 – 10 min). Rest decoction @ 162 °F (72 °C) for 10 min. Heat decoction (10 min). Boil decoction @ 212 °F (100 °C) for 10 min. Reintroduce decoction to main mash. Rest main mash @ 162 °F (72 °C) for 10 min.

Raise temp of main mash to 171 °F (77 °C). Rest 15 min. Recirculate (5 min). Start lautering and sparging slowly (!) for about 3 hrs until kettle full. Boil 90 min. 1st hops @ 30 min. 2nd hops @ 75 min. 3rd hops @ 85 min. Whirlpool 30 min.

Ferment @ 50 °F (10 °C) for 3 wks. Rack. Lager close to freezing point for at least 5 wks. Rack again, condition, package.

DID YOU KNOW ... ?

By far the biggest monastery brewery of the Middle Ages, which does not exist any longer, was the Benedictine Monastery of Sankt Gallen (St. Gall) in Switzerland. It flourished around the turn of the 1st to the 2nd millennium. This monastery had three breweries, which were spread over 40 buildings. They yielded about 300 gallons of beer a day. In 895, it took more than 100 monks, about 200 serfs, and an even larger number of pupils from the monastery's school to tend to the oats and barley fields and to run the breweries.

In 1060, St. Gall's then-Abbot, Ekkehard IV, chronicled his *Casus Sancti Galli*, the history of St. Gall, in which he wrote that each monk was entitled to seven meals a day with all the bread he could eat. Evenings were reserved for the round table at which the monks indulged in happy conversation over tankards of brew. Each monk was allotted five *Mass* of beer a day. The term *Mass* is still used in Bavaria today to denote a liter mug. In those days, a *Mass* was any measure roughly between a US quart and half a gallon. A single monk at Sankt Gallen, therefore, might have drained as much as one standard U.S. keg of beer a week!

St. Gall, with its splendor and opulence, epitomized the greatness of medieval monastic brewing—an achievement that had been almost five centuries in the making. Economically, monastic breweries were much like secular businesses, but with several competitive advantages: Cheap or free raw materials, cheap or free labor, and an exemption from all taxes. Monastery beer was good (or as good as it could get then) and it was cheap. After 1204, the abbots of St. Gall would even serve as powerful secular princes, too, of the Holy Roman Empire of the German Nation, as the medieval central European empire was then called!

Dunkelweizen

Beer culture of origin	Germany (Bavaria)
AKA	Dunkles Weissbier, Dunkles Weizen
Related Styles	Hefeweizen/Weissbier, Weizenbock, Weizendoppelbock

Style Description

Dunkelweizen is the dark version of the pale creamy Bavarian Hefeweizen, Weizenbier, or Weissbier. For a basic description, see Weissbier. Dunkelweizen has pronounced clove, vanilla, banana, apple, bubble-gum, and sometimes nutmeg flavors.

Dunkel means dark in German (as opposed to weiss, which means white) and Weizen means wheat. In Germany, the modern Beer Purity Law stipulates that any brew called wheat beer must contain at least 50 percent wheat malt. It must also be an ale. Because wheat has a relatively high glucan and protein content and very little husk material, which makes for difficult lautering, German wheat beer mashes rarely contain more than 70 percent wheat malt.

They are always malt-accented, with hop notes remaining in the background. A delicate noble hop, such as Hallertauer Mittelfrüh, therefore, is ideal for both bittering and aroma.

Authentic German wheat ales are usually fermented in open vessels for easy yeast cropping. They are also unfiltered and bottle- or keg-conditioned. For this, the fully fermented brew is inoculated, just before packaging, with Speise (fresh wort for priming) and fresh yeast. The yeast can be pitched into the Speise. If no Speise is available, an amber liquid malt extract (LME) can be used as a substitute priming agent.

Specifications (All values before the addition of Speise/priming agent)

OG	1.054 (13.5 °P)		**IBU**	14		**ABV**	5.4%
FG	1.013 (3.25 °P)		**Color**	14.7 SRM/38.8 EBC		**ABW**	4.3%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Dark Wheat Malt	25	9.80	4.45	11.50	5.22	1.85	0.84
Weyermann®	15	5.88	2.67	6.90	3.13	1.11	0.51
Weyermann® Pilsner	35	13.72	6.23	16.10	7.30	2.60	1.18
Weyermann® Carawheat®	15	5.88	2.67	6.90	3.13	1.11	0.51
Weyermann® Munich II	7	2.74	1.25	3.22	1.46	0.52	0.24
Weyermann® Acidulated	3	1.18	0.53	1.38	0.63	0.22	0.10
Total Grain	100	37.69	17.09	44.21	20.05	7.13	3.25
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**

Bittering: Barth-Haas Hallertauer Mittelfrüh or equivalent	4.2	0	0	0	0	0	0
Flavor: None	0	0	0	0	0	0	0
Aroma: Barth-Haas Hallertauer Mittelfrüh or equivalent	4.2	0.0	0.0	0.0	0.0	0.0	0.0
Yeast	Bavarian Hefeweizen Yeast						

Brewing Process

Multi-step infusion. Mash in with approx. 65% of expected net kettle volume of brewing liquor @ 99 °F (37 °C); raise temp to 113 °F (45 °C); rest for 10 min; raise temp to 126 °F (52 °C); rest 10 min; raise temp to 144 °F (62 °C); rest 30 min; raise temp to 162 °F (72 °C); rest 30 min; raise temp to mash-out @ 172°F (78°C). Sparge/lauter 100 min. Boil 75 min. Bittering hops after 15 min. Aroma hops in whirlpool. Ferment in open fermenter @ 64 – 75 °F (18 – 24 °C), depending on selected yeast strain. Speise/priming: @ apparent gravity of 2.85 °P (1.011) pitch fresh Bavarian Hefeweizen yeast and add enough fresh Dunkelweizen wort or Weyermann® Munich Amber Liquid Malt Extract (approx. 4.28 lbs LME/bbl; 3.65 lbs LME/hl; 1.66 kg LME/hl; or 0.14 lbs LME/gal) to raise gravity to 4 °P (1.016). Package primed brew immediately into kegs, bottles, or serving tank. Warm-condition packaged beer 7 – 8 days @ approx. 68 °F (20 °C). Pressure should not exceed 2.6 bar (37.7 psi). Finally, cold-condition packaged beer @ 41 °F (5 °C) for another 2 wks.

DID YOU KNOW ... ?

The oldest evidence of beer-making in Central Europe is of a type of Dunkelweizen. In 1935, a broken crock was discovered in the burial site of a well-to-do Celtic tribesman who had died about 800 BC. The site is near the Franconian village of Kasendorf, some seven miles from Kulmbach, in northern Bavaria. The grave belongs to the so-called Hallstatt culture, a subgroup of the Celtic family of peoples. Not only did it contain the remains of the deceased gentleman, but buried with him were also the provisions that his clan had so generously contributed for his trip into the realm of the spirits, including the large crock. When archaeologists pieced the shards back together, they took on the shape of an elegant amphora. But there was a faint residue in its bottom, and when that residue was analyzed, almost 3,000 years later the amphora was sealed in that grave, it was identified as dried-up traces of black wheat beer, made from moist, half-baked loaves of bread—the standard raw material for the mashes of ancient times—soaked in water, and flavored with oak leaves. The crock, which is now in the Beer Museum in Kulmbach, ranks as the oldest evidence of beer-making in Europe.

Eisbock

Beer culture of origin	Germany
AKA	None
Related Styles	Doppelbock, Bock, Maibock, Weizenbock

Style Description

Eisbock is the strong version of the Doppelbock, which is the strong version of the already strong Bockbier. To make this beer, brew as strong a Doppelbock as your equipment allows and let it ferment to the finish. Then freeze the brew in the tank to at least 24.4 °F (-4 °C) and drain the still-liquid portion of the slush that forms at this temperature. Note, not all breweries have the equipment to make this beer!

Separating the ice from the liquid has a similar effect as distilling: The more ice you remove, the greater becomes the alcohol concentration in the beer that's left behind. The key taste difference between distillation and freezing is in the amount of flavor that remains in the finished beverage. In distillation for Scotch Whiskey, for instance, you leave not only water but also some of the malt aroma behind, and you drink what you take out of the brew. In freezing, on the other hand, you discard what you take out (water) and drink what is left behind, and that includes most of the malt flavors.

Because freezing also creates a cold break of proteins and tannins, which clings to the ice crystals, a beer produced by this method is not just stronger but also very smooth. Therefore, the malt aroma in this beer is extremely pronounced and often sweet. The color deepens as well, while virtually all hop perception fades away. The alcoholic level may reach as much as 14 to 15 percent. Because this beer is not strictly "brewed" but freeze-processed, the specifications below are merely approximate.

Specifications

OG	Approx. 1.100 (25 °P)		**BU**	Up to 35		**ABV**	Up to 14.5%
FG	Not applicable		**Color**	Up to 50 SRM/100 EBC		**ABW**	Up to 11.2%

Ingredients: Same as for Doppelbock. See entry.

Brewing Process

Brew and ferment a Doppelbock. See entry.

After the final racking, freeze the tank content until the water in the brew begins to crystallize, which occurs at a temperature of below 24.4 °F (-4 °C). It is OK to set the temp even lower. However, the lower the temp, the more ice crystals will form, and faster. Depending on the chilling system's thermal capacity, this may take several days. Not all breweries may have this capability. The unfrozen beer and alcohol can now be drained or filtered off the slush. This creates a highly concentrated full-flavored brew, as if it had been made from a wort up to 25 °P (OG 1,100), even more. Condition this concentrate for a very mild effervescence. Package. Age the packaged Eisbock for up to 9 months in a cool, dark cellar.

DID YOU KNOW ... ?

It is not entirely clear, however, where and when the first batch of Eisbock was made, but there is one persistent legend that places the origin of Eisbock in the city of Kulmbach, at around 1890.

According to that (tall?) tale, a brewery lad—after a long day of toil in front of the mash tun—was too tired in the evening to roll the casks of finished Bockbier from the brewery yard back into the cellar, as the brew master had told him to. He figured that there would be no harm in leaving them outside until morning. That night, however, turned out to be bitter cold, and the beer inside the casks froze solid.

By the time the brew crew returned the following morning, the staves of the casks had burst open. It appeared to all that the entire lot of wonderful Bockbier had been ruined. As the brewers inspected the frozen brew more closely, they discovered that, at the very center of each cask, a small pool of murky, brownish liquid had collected.

The brewers were unaware that alcohol has a much lower freezing point than water, and that it became concentrated as the beer froze in the casks from the outside in. As the water froze, the alcohol also transported with it all the essence of the Bockbier's malty flavor to the center.

The irate brew master, bent on meting out severe punishment, ordered the hapless lad to crack open the icy casks and drink the awful brownish stuff. The frightened lad, of course, did as he was told, taking mere tentative sips at first, but then imbibing with ever increasing gusto. In the center of each cask-size lump of ice was the most delicious, malty-sweet, and heavy beer imaginable. Punishment, indeed! The lad, being a kind and generous sort of chap, let the others share in his "punishment."

Subsequently, the Kulmbach brewers made it a practice, during severe cold spells, to roll out into the open a few casks of Bockbier or Doppelbock, leave them overnight, and collect the cold nectar in the center, the essence of Bock, as a heart-warming sipping beer.

Thus was born, allegedly, the Eisbock, a beer style that is still made today, but now in modern fermenters, according to the principles that operated on that bitter cold wintry night in Kulmbach.

Next to barley-based Eisbock, there is also a Weizeneisbock, which is based on a Weizendoppelbock. To make it, make a Weizenbock, as strong as possible, ferment it to the finish, and freeze and drain it as you would a barley-based Doppelbock.

Fruit Ale, American

Beer culture of origin	United States
AKA	Cherry Ale, Blueberry Ale, etc.
Related Styles	Pale Ale (English), IPA, Imperial IPA

Style Description

American fruit ales may be made with any number of fruit. The recipe below is an example made with about 50 lbs/bbl (approx. 25 kg/hl) of very ripe, dark, sour cherries, macerated, placed with the pits into a heat-resistant hop bag, then lowered first briefly into the hot kettle for sterilizing, then into the primary fermenter for flavoring.

Cherries (and most fruit) contain pectin (carboxymethyl cellulose), which is a flavorless starch that starts to gel at around 145–155°F (63–68°C). Fining the hot wort with 8 grams of Irish Moss per hectoliter (0.33 oz./bbl), therefore, is highly recommended.

There are no firm rules for making fruit ales, except that they are vaguely built on American pale to dark ales and are best fermented with a clean-finishing yeast. Note that all numerical specifications here are without taking into account the effects of the fruit on the wort or finished brew. They are thus approximate.

Specifications (without considering the addition of fruit)

OG	1.064 (16 °P)		**BU**	55		**ABV**	6.4%
FG	1.016 (4 °P)		**Color**	91 SRM/240 EBC		**ABW**	5%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	80	37.53	17.02	44.02	19.97	7.10	3.23
Weyermann® Carahell®	10	4.69	2.13	5.50	2.50	0.89	0.40
Weyermann® Carafa® Special III	5	2.35	1.06	2.75	1.25	0.44	0.20
Weyermann® Roasted Unmalted Barley	5	2.35	1.06	2.75	1.25	0.44	0.20
Total Grain	100	46.91	21.28	55.03	24.96	8.88	4.04
Very ripe, sour, preferable dark cherries		50.00	22.68	58.65	26.60	9.46	4.31
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Chinook	13	5.55	157	6.5	184	1	30
Flavor: none	0	0	0	0	0	0	0
Aroma: Barth-Haas Tettnanger	4	1.55	44	1.8	52	0.3	8
Yeast	Irish ale yeast						

Brewing Process

Mash in @ 122 °F (50°C). Rest 30 min. Raise temp to 154 °F (68 °C). Rest 20 min. Sparge to reach mash-out @ 168 °F ± 2 °F (76 °C ± 1 °C). Boil 60 min. 1st hops @ 15 min.

Meanwhile, wash cherries in cold water and remove all stems and leaves. Macerate fruit in bowl with a masher. Stuff cherry pulp, including pits, into steeping bags. Collect cherry juices oozing out of bags in bowls.

After shut-down, siphon off about 5 liter/hl (approx 2 gal/bbl) of hot wort into a sterile, sealable container, and refrigerate or freeze as kräusening until bottling. This is optional. The brew can also be conditioned the conventional way.

Add Irish moss, if used, to kettle. Lower bags of cherries into hot wort to sterilize for about 15 min. Pour in any collected juice as well. Remove sterile bags and place them in sanitized bowls to collect juices again. Add aroma hops to kettle. Rest 5 min.

Heat-exchange into open fermenter. Add fruit bags and collected juices. Pitch yeast @ 66 °F (19 °C). Once a day, skim scum off top of fermenting brew. Remove fruit bags after 7 days. Do not squeeze bags, to keep pectin trapped in the bags from getting into the brew, where it would cause hazes later on!

Rack into closed fermenter. Condition conventionally under pressure as for Pale Ale, or add warmed-up kräusening and condition. Conditioning time is 7 days. Package.

DID YOU KNOW ... ?

The word "Kölsch" has three meanings in the local dialect of the city of Köln (Cologne) in the Rhineland of Germany. As an adjective, it means "of Cologne." As a noun it is the name for both the local dialect itself and for the local beer. That's why patrons in the pubs around that famous cathedral joke that Kölsch is the only language in the world that you can also drink.

Golden Ale, Belgian

Beer culture of origin	Belgium
AKA	Belgian Strong Ale
Related Styles	None

Style Description

The Belgian Golden Ale evolved in the late 19th century as the Belgian brewers' answer to the golden Pilsner lager from Bohemia, which was gaining market share against Belgium's local brews at the time. In appearance, maltiness and hoppiness, the Belgian Golden was designed to resemble the foreign competitor from Bohemia, but, in typical Belgian fashion, it was brewed as an ale, not a lager and almost twice as strong as a Pilsner—hence the brew's other name of Belgian Strong Ale.

The hops in a Belgian Golden are noble and Pilsner-like—Styrian Goldings and Saaz are suitable for bittering and flavor, respectively. The malt for this brew is the rich and aromatic Weyermann® Extra Pale Pilsner Malt.

Because the Belgian Golden is brewed to a high alcohol content of 8 – 10 percent (or more), it requires a slow and extensive mash regimen that ensures both proper hydration of the grain bed as well as the extraction of anything that is fermentable. One effective method—chosen below—is to dough in at a low 90 °F (32 °C) and romp the temperature up gradually through a continuous infusion process over a three- to four-hour period to the mash-out temperature of about 170 °F (77 °C). This ensures the proper breakdown of proteins and beta-glucans as well as the conversion of starches mostly to mono- and disaccharides for plenty of alcohol and a dry finish.

For the extra alcohol, a proper Belgian Golden Ale also needs a dose of sugar in the kettle for additional, clean-tasting fermentables. Roughly 1.75 kg of pure sugar per hectoliter (roughly 4.5 lbs./bbl) of finished beer bumps up the amount of alcohol by volume by about 0.9 percent, without contributing much flavor.

An alternative to relatively flavorless sugar is a sugar-equivalent amount of unhopped, pale, liquid malt extract (LME). Added to the kettle, LME instead of sugar gives the brew an enhanced malt intensity. Our choice below is roughly 3 kg per hectoliter (approx. 3.66 lbs./bbl) of Weyermann® Bavarian Pilsner LME, which is made entirely from a decoction mash of Weyermann® Pilsner Malt and Weyermann® Carafoam®. This LME has 72 to 79 percent of fermentable sugars by weight. Mathematically, therefore, the LME raises the alcohol content by volume (ABV) by about 1.3 percent.

The recipe below produces a brew of 17.25 °P (OG 1.069) kettle gravity before the addition of LME, and of 19.75 °P (OG 1.079) kettle gravity after the addition of LME. The apparent attenuation of this brew at the end of fermentation is approx. 12.5 °P (FG 1.014). At that attenuation level, the malt alone is responsible for about 7.3 percent ABV, and the mash and LME combined generate about 8.5 percent. The estimated color value of the finished beer is approx. 5.7 to 5.8 SRM (14 EBC).

Specifications (before the addition of LME)

OG	1.069 (17.25 °P)		**BU**	25		**ABV**	7.3%
FG	---		**Color**	4.4 SRM/10.4 EBC		**ABW**	5.8%

Specifications (after the addition of LME)

OG	1.079 (19.75 °P)		**BU**	25		**ABV**	8.6%
FG	1.014 (3.5 °P)		**Color (est.)**	5.5 SRM/13.3 EBC		**ABW**	6.8%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Extra Pale Pilsner	95	48.28	21.90	56.63	25.69	9.13	4.16
Weyermann® Abbey Malt®	2.5	1.27	0.58	1.49	0.68	0.24	0.11
Weyermann® Carabelge®	2.5	1.27	0.58	1.49	0.68	0.24	0.11
Total Grain	100	50.82	23.05	59.61	27.04	9.61	4.38
Weyermann® Bavarian Pilsner LME		6.66	3.02	7.81	3.54	1.26	0.57
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Styrian Goldings	5.5	3.77	107	4.4	125	0.7	20
Flavor: Barth-Haas Hallertauer Mittelfrüh	4.25	2.81	80	3.3	93	0.5	15
Aroma: Barth-Haas Hallertauer Mittelfrüh	4.25	2.81	80	3.3	93	0.5	15
Yeast	Belgian Abbey-style ale yeast						

Brewing Process

Continuous infusion. Dough in as thick as possible @ 90 °F (32 °C) or lower. Then ramp up temp slowly and continuously over 3 – 4 hrs to a mash-out temp of about 170 °F (77 °C). Lauter slowly for 3 hrs. Boil for 90 minutes. 1st hops @ 15 min; 2nd hops @ 60 min; 3rd hops @ 85 min. Whirlpool 30 min. Ferment for 1 wk. @ 64 °F – 70 °F (18 ° - 21 °C), depending on yeast strain. Rack and ferment for another 10 days. Reduce temp to approx. 34°F (1°C); lager for 12 wks. Rack, condition, package.

Gose, Leipziger

Beer culture of origin	Germany, Saxony
AKA	None
Related Styles	None

Style Description

Leipziger Gose is a mostly malted wheat-based brew of medieval origin that flourished in the early 20th century in and around the Saxon capital of Leipzig. But it faded from consciousness after the Second World War, when Saxony became part of Communist East Germany. However, it has seen a revival after the Fall of the Berlin Wall on November 9, 1989. It is a rare German brew, because it contains salt as well as spices, which are technical violations of the German Beer Purity Law. However, that law, in its modern version, also allows for exceptions in the case of traditional, indigenous, heirloom brews that predate the first proclamation of the Purity Law in Bavarian, in 1516. Gose apparently takes its name from the river Gose which flows through the town of Goslor in the German State of Lower Saxony, about 100 miles west of Leipzig. Goslar rose to prominence in the 11th century not only as one of the wealthiest and most important copper, lead, zinc, salt, and silver mining towns in the German Empire, but also as a brew center. It is likely that the original source of saltiness in Gose was the naturally saline water from some of the mineral-rich aquifers in and around Goslar, which supplied much of the liquor for the old Goslor brew houses. The coriander helps diffuse some of that saltiness on the palate.

Specifications

OG	1.046 (11.5 °P)		**BU**	13		**ABV**	4.7%
FG	1.011 (2.75 °P)		**Color**	3.9 SRM/9.2 EBC		**ABW**	3.7%

Ingredients @ nominal 80% system extract efficiency

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Wheat Malt	60	19.89	9.02	23.33	10.58	3.76	1.71
Weyermann® Pilsner	17.5	5.80	2.63	6.80	3.09	1.10	0.50
Weyermann® Munich II	15	4.97	2.26	5.83	2.65	0.94	0.43
Weyermann® Acidulated	7.5	2.49	1.13	2.92	1.32	0.47	0.21
Total Grain	100	**33.15**	**15.04**	**38.88**	**17.64**	**6.27**	**2.86**
ground coriander		0.1065	0.0483	0.1249	0.0567	0.0201	0.0092
Sea or kosher salt		0.1200	0.0544	0.1408	0.0638	0.0227	0.0103
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Hallertauer Mittelfrüh	4.25	2.55	72	3.0	85	0.5	14
Flavor: None	0	0	0	0	0	0	0
Aroma: Barth-Haas Hallertauer Perle	6.5	3.73	106	4.4	124	0.7	20
Yeast	German Hefeweizen/Weissbier yeast						

Brewing Process

Place ground coriander seeds in a steeping bag on a string for easy immersion in and removal from kettle. Step-infusion. Mash in at about 148 °F– 150 °F (64 °C – 66 °C). Rest 120 min (or longer). Raise temp to 160 °F (71 °C) for mash-out. Add sea or kosher salt to the kettle. Boil 60 min. 1st hops @ 5 min; 2nd hops and coriander @ 55 min. Shut down. Remove coriander. Recirculate. Lauter. Whirlpool 45 min. Ferment @ 63 °F – 75 °F (17 °C – 24 °C), depending on yeast strain, for approx. 7 days. Rack. Mature for 3 wks. Rack. Condition for 2 wks. Package.

DID YOU KNOW ... ?

Louis Pasteur (1822 - 1895) became interested in the fermentation of wine, vinegar and beer while he was a professor at universities in Dijon, Strasbourg and Lille. By 1862, we find him at the *École normale* in Paris, where he is poised to finish off the myth of spontaneous fermentation for good. He discovered that heating liquids to about 145°F for 30 minutes kills any bacteria or other organisms that it may contain (pasteurization), and that, if the liquid is left hermetically sealed, no microbial activity--spontaneous or otherwise--recurs. Always eager to increase the shelf life of their beers, breweries were among the first industries to pasteurize their products.

Since infectants cannot suddenly appear in a sterile environment, but must be introduced from the outside, Pasteur also admonished brewers to examine yeast cells under the microscope before adding them to the beer (pitching) in order to determine whether the yeast was infected or healthy.

In 1868, Pasteur moved to the Sorbonne. Two years later, he was commissioned by the French government to investigate how French brewers could make a beer that could compete effectively against the rising flood of imports from Germany. Eight years later, he spelled out his findings in his study *Études sur la bière*, which did not rescue the French beer market from domination by the neighboring Teutonic brew, but did provide the most comprehensive explanation yet of the fermentation processes and the products that result from the yeast's metabolism.

He discovered that yeast metabolizes glucose under the presence of oxygen and that it uses energy gained from the sugar to grow and reproduce furiously. Under anaerobic conditions, yeast does not grow much, but, as Schwann had already observed, commences vigorous fermentation. This rule is now known as the Pasteur effect: Oxygen suppresses fermentation, its absence stimulates it.

Since Pasteur, we can manage the metabolic life of yeast through wort aeration after pitching and through subsequent oxygen starvation. We also know that, if we start out with sterile wort and control the microbes we pitch into the brew, we can control the result and make good beer. Thanks to Pasteur, hygiene has become one of the most important tools in the brewer's repertoire.

Gruitbier

Beer culture of origin	Medieval Continental Europe and British Isles
AKA	Herb Ale
Related Styles	Scottish Heather Ale, Froagh

Style Description

Gruitbier is a medieval beer made before the universal acceptance of hops as a beer flavoring. It was made both on the British Isles and on the Continent. Gruit is old-Germanic for herb. The modern German wort Kraut (also meaning herb) is derived from this etymological root, as is the word Sauerkraut, "sour herb," which is bacterially fermented cabbage.

Common herbs used in Gruitbier included, among many others, bog myrtle, gale, heather flowers (in Scotland), juniper berries (still used in Finnish Sahti today), mugwort, rosemary, woodruff (especially popular in Germany), and yarrow. In fact, the name mugwort is derived from the use of this herb in beer: It turns an ordinary ale into one that's truly a mug's worth.

Before the introduction to England of hops by Flemish immigrants in the 15th century, who settled in Kent, where they grew East Kent Goldings, all beer was called "ale" there. As hops began to conquer ale brewing, however, the new, hopped ale was given the name "beer," to distinguish it from the older unhopped ale. Today, of course, beer is the umbrella category, with ale and lager, both hopped, as its subcategories.

The base brew of Gruitbier may have contained any number of grains, next to barley, including wheat, oats, rye and spelt. Given uncertain malting methods at the time, the brew would likely have been somewhat brownish or darker, but rarely pale.

A Gruitbier's strength may have varied greatly, too, especially considering the then popular partigyle method of brewing several threads from the same mash. There were probably Gruit Stock Ales from the first runnings and Gruit Mild Ales from the final runnings. Given this vague definition of a Gruitbier, the modern brewer has great freedom in composing one.

The indeterminate nature of the Gruitbier's specifications, however, ought not to be a reason not to brew one. Below is one possible interpretation, brewed a bit on the strong side, as a variation of a classic English brown ale. Note that there appear to be no Gruit-flavored lagers in brewing history, probably because, in the cradle of lager-making, such potions would violate the Beer Purity Law.

Depending on your taste preferences, the combined weight of herbs should not exceed 50 to 100 grams (1.75 to 3.5 oz.) per barrel or hectoliter, added to the kettle and best suspended in a steeping bag from a string for no more than 15 minutes before shut-down. For a stronger herb flavor, increase the amount of herbs and/or the length of time they are exposed to the hot wort.

Specifications

OG	1.064 (16 °P)		**BU**	26		**ABV**	6.9%
FG	1.012 (3 °P)		**Color**	10.6 SRM/26.9 EBC		**ABW**	5.5%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pilsner	47.5	22.28	10.11	26.14	11.86	4.22	1.92
Weyermann® Vienna	22.5	10.56	4.79	12.38	5.62	2.00	0.91
Weyermann® Pale Wheat Malt	22.5	10.56	4.79	12.38	5.62	2.00	0.91
Weyermann® Carawheat®	7.5	3.52	1.60	4.13	1.87	0.67	0.30
Total Grain	100	**46.91**	**21.28**	**55.03**	**24.96**	**8.88**	**4.04**
A mixed "bouquet garni" of juniper berries, mugwort, woodruff, and rosemary		0.1500	0.0680	0.1760	0.0798	0.0284	0.0129
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: None	0	0	0	0	0	0	0
Flavor: None	0	0	0	0	0	0	0
Aroma: None	0	0	0	0	0	0	0
Yeast	Any English-style ale yeast						

Brewing Process

Single infusion. Mash in with 7 gal of brewing liquor per a 1 bbl of expected net kettle volume (or 1 qt/1 lb of grist, dry weight) @ 150 °F – 154 °F (66 °C – 68 °C). Rest 45 min. Recirculate. Sparge with 180°F (8 °C) brewing liquor to raise mash temp to 168 °F ± 2 °F (76 °C ± 1 °C) for mash-out. Hold mash temp at that level. Adjust sparge water temp, if needed. Boil 60 min. Add spices in steeping bag on a string in kettle @ 45 min. Shut down, Remove spices. Whirlpool 30 min. Primary fermentation @ 60 °F – 65 °F (16 °C – 18 °C), depending on yeast, for about 7 days. Rack. Secondary fermentation about 14 days. Rack again, condition for 1 wk. Package.

DID YOU KNOW ... ?

When Germany stretched its colonial ambitions in the nineteenth century, its emissaries opened breweries in almost every land they conquered. Even today the breweries of Togo (known as German West Africa in colonial times) produce great blonde lagers. Tsingtao was a German colony between 1897 and 1914, and still today the Tsingtao brewery—established in 1903 and now the biggest brewery in China— makes a Munich-style lager, which is a staple offering of Chinese restaurants throughout the globe.

Helles

Beer culture of origin	Germany
AKA	Hell, Münchener Helles, Munich Helles
Related Styles	Export Hell, Dortmunder Export, European Pilsner

Style Description

The first cask of Helles ever was released on March 21, 1894, by the style's inventor, the Spaten Brewery of Munich as a Bavarian competitor to the Pilsner from neighboring Bohemia. Hell or Helles is German for "light," in color, not in calories or alcohol. Helles has an ABV of 4.7 to 5.4 percent, with versions above 5 percent usually called Export Helles. If a brewery calls a Helles "Urhell" or "Urtyp," it tries to emphasize the brew's authenticity ("urtyp" means original type in German). A "Spezial Helles" is a seasonal Helles, while an "Edel-Hell" is often a brew of special quality ("edel" means noble).

Specifications

OG	1.047 (11.75 °P)		**BU**	20		**ABV**	4.8%
FG	1.011 (2.75 °P)		**Color**	4.1 SRM/9.6 EBC		**ABW**	3.8%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pilsner	50	16.95	7.69	19.88	9.02	3.21	1.46
Weyermann® Extra Pale Premium Pilsner	42	14.24	6.46	16.70	7.58	2.69	1.23
Weyermann® Carahell®	5	1.70	0.77	1.99	0.90	0.32	0.15
Weyermann® Carafoam®	3	1.02	0.46	1.19	0.54	0.19	0.09
Total Grain	100	33.90	15.38	39.77	18.04	6.41	2.92
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Hass Hallertauer Tradition	5.5	4.49	127	5.3	149	0.8	24
Flavor: Barth-Haas Hallertauer Mittelfrüh	4.25	1.72	49	2.0	57	0.3	9
Aroma: Barth-Haas Hallertauer Mittelfrüh	4.25	1.07	30	1.3	36	0.2	6
Yeast	Bavarian-style lager yeast						

Brewing Process

Multi-step infusion. Mash in @ 122 °F (50 °C). Rest 30 min. Raise temp to 148 °F (64 °C). Rest 20 min. Raise temp to mash-out @ 172 °F (78 °C). Lauter 90 min. Boil 75 min. 1st hops @ 15 min; 2nd hops @ 60 min; 3rd hops in whirlpool. Ferment @ 48 °F (9 °C) for 1 wk. Rack. Ferment another 10 days. Reduce temp to 34°F (1°C). Lager for 4 wks. Rack, condition, package.

Ice Beer

Beer culture of origin	Canada
AKA	Ice Lager
Related Styles	American Premium Lager/Pilsner, American Light Lager

Style Description

Ice beer was first introduced by Labatt of Canada in 1993. Like Bavarian Eisbock, it is fully fermented and then chilled to at least 24.4 °F (-4 °C), when ice crystals form. Removing the slush increases the beer's alcoholic strength by perhaps as much as 0.5 percent ABV. Freezing also removes some of the proteins and tannins in the beer, making its flavor fairly subdued. Because of the effects of freezing on the brew, all specifications below are approximate.

Specifications

OG	1.054 (13.5 °P)		**BU**	14		**ABV**	6.2%
FG	1.012 (3 °P)		**Color**	3.4 SRM/7.8 EBC		**ABW**	4.9%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Extra Pale Premium Pilsner	82.5	32.35	14.67	37.95	17.21	6.12	2.79
Weyermann® Pale Ale	7.5	2.94	1.33	3.45	1.56	0.56	0.25
Weyermann® Acidulated	5	1.96	0.89	2.30	1.04	0.37	0.17
Weyermann® Munich II	5	1.96	0.89	2.30	1.04	0.37	0.17
Total Grain	100	39.22	17.79	46.00	20.86	7.42	3.38
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Taurus	15.5	3.62	103	4.2	120	0.7	19
Flavor: none	0	0	0	0	0	0	0
Aroma: Barth-Haas Saaz	4.5	0.27	8	0.3	9	0.1	1
Yeast	American lager yeast						

Brewing Process

Multi-step infusion. Mash in @ 122 °F (50 °C); rest 30 minutes; raise temp to 144 °F (62 °C); rest 20 min. Raise temp to 162 °F (72 °C); rest 20 min. Raise temp to mash-out @ 172 °F (78 °C). Lauter 90 min. Boil for 75 minutes. 1st hops @ 15 min; 2nd hops @ 70 min. Fermentation temp @ 54°F (12°C). Rack when gravity @ about 4.5 °P (1.018). Reduce temp to 34°F (1°C). After the final racking, freeze the tank content until the water in the brew begins to crystallize, which occurs at a temperature of below 24.4 °F (-4 °C). It is OK to set the temp even lower. The lower the temp, the more ice crystals will form, and faster. Separate the crystals from the unfrozen beer and alcohol. Bring temp back to just above the freezing point. Lager for 4 wks. Condition and package.

India Pale Ale, American

Beer culture of origin	United States
AKA	IPA
Related Styles	English IPA, American Double or Imperial IPA

Style Description

American India Pale Ale (IPA) is an adaptation of the original British IPA. While the classic British version often had an original gravity of 1.070 or greater, American versions tend to be just a tad less strong. But like the Old World model, New World IPAs are aggressively hopped, often with in-your-face bittering values from floral-citrus Pacific Northwest hops including the signature Cascade with notes of grapefruit peel. One interesting hop combination is Simcoe® for bittering, Amarillo® for flavor, and a half-and-half mixture of Cascade and Crystal for aroma. The pungent Columbus, Tomahawk® and Zeus, and the citrus Galena and Summit are also good choices for this style. For balance, this hop-accented brew needs a solid malt backbone with good underpinnings of pale caramel malts for body and mouthfeel and melanoidin malt for depth of flavor. A single infusion mash is quite sufficient for this brew.

Specifications

OG	1.060 (15 °P)		**BU**	56		**ABV**	6.1%
FG	1.014 (3.5 °P)		**Color**	17 SRM/43.9 EBC		**ABW**	4.8%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	55	24.10	10.93	28.27	12.82	4.56	2.08
Weyermann® Melanoidin	20	8.76	3.97	10.28	4.66	1.66	0.76
Weyermann® Carared®	17.5	7.67	3.48	8.99	4.08	1.45	0.66
Weyermann® Carafoam®	7.5	3.29	1.49	3.85	1.75	0.62	0.28
Total Grain	100	43.82	19.87	51.40	23.31	8.29	3.78
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Simcoe®	13	4.71	134	5.5	157	0.9	25
Flavor: Barth-Haas Amarillo®	9.5	2.54	72	3.0	85	0.5	14
Aroma: Barth-Haas Cascade	5.75	2.54	72	3.0	85	0.5	14
Aroma: Barth-Haas Crystal	4.5	2.54	72	3.0	85	0.5	14
Yeast	American "Chico"-Style ale yeast						

Brewing Process

Mash in with 7 gal of brewing liquor per a 1 bbl of net kettle volume @ 148 °F – 150 °F (64 °C – 66 °C). Rest 60 min. Recirculate. Sparge with 180°F (8 °C) brewing liquor to raise mash temp to 168 °F ± 2 °F (76 °C ± 1 °C) for mash-out. Hold mash temp at that level. Adjust sparge water temp, if needed. Boil 75 min. 1st hops @ 15 min; 2nd

hops @ 70 min. Whirlpool 30 min. 3rd hops @ start of whirlpool. Primary fermentation @ 60 °F–70 °F (16 °C – 21 °C), depending on yeast, for about 7 days. Rack. Secondary fermentation about 14 days. Rack again, condition for 1 wk. Package.

DID YOU KNOW ... ?

Beer-making in colonial North America was not just an English way of life, but a French one as well, up north in Quebec, along the banks of the Saint Lawrence River. Founded as a fur trading outpost by Samuel de Champlain in 1608, Quebec was the first permanent French settlement in North America. By 1615, the first Jesuit missionaries of the Recollet order had arrived—sent into the wilderness by King Louis XIV to convert heathen Indians to the faith of the king. These pious friars, however, had obviously more on their minds than just the salvation of savage souls, because by 1620, they were already setting up a brewery.

This was the same year, incidentally, when a group of Pilgrims set off from Plymouth, England, in a ship called the Mayflower to start a colony in Virginia, but ended up in what is now Massachusetts. The Pilgrims had to cut their voyage short for lack of victuals and ale. And after they landed and built their "Plimouth Plantation," one of the first structures they erected after a church was...a brewery.

By 1646, the Quebec missionaries got really serious about their thirst: They moved their brewery to the outskirts of Quebec, to a place known as Sillery. However, they kept all the beer they produced just for themselves. Preaching charity and brotherly love was one thing, but sharing your brew was clearly quite another. The ordinary colonists had to be content with mere cognac imported from France!

By 1670, the population of Quebec had grown to about 5,000, and it became ever more difficult and expensive for the authorities at the court in Paris to keep that many bodies in cognac. Jean Talon, the Intendant who ran the province of New France for the king in Old France, therefore, decided to give himself a secular brew monopoly, plant hops, brew beer for the people, and sell it at a controlled price. His official justification for the money-making scheme was to cut public drunkenness. His brewery was on what is now St. Vallier Street in Quebec City. There, according to old documents, he made some 4,000 casks of beer a year, aged in cellars made of eight-foot thick walls.

Talon left office in 1672, and his brewery closed three years later, but strangely the same site became a brewery again, 180 years later. The now-defunct Boswell Brewery of Quebec operated on that site between 1852 and 1971. The brewery vaults of Jean Talon's original brewery, however, are still preserved to this day. They now house a museum of 17th-century guns and furniture.

India Pale Ale, English

Beer culture of origin	England
AKA	IPA
Related Styles	American IPA, Burton Ale, ESB, Pale Ale

Style Description

India Pale Ale (IPA) is the original British pale ale. It was first brewed in the 1790s just for export to the British colonies run by the East India Company, hence its name. Initially a brew from London, it was soon brewed primarily in Burton-on-Trent, where the water from deep aquifers is rich in gypsum, which enhances the perceived bitterness of hops and produces a drink of thirst-quenching dryness. Casks of IPA, preserved by plenty of alcohol and hop-bitterness, were loaded into the holds of sailing ships on their six-week voyages, twice across the equator, to the Far East.

These original IPAs often had an original gravity of 17.5 °P (OG 1.070) or greater, they finished at about 3.75 °P (FG 1.015), and contained at least 7% ABV. By the 20th century, after steamships and the Suez and Panama canals had made the voyage to the Far East shorter and more predictable, and after the conquest of almost every beer market in the world by the golden Pilsner Lager and its imitations, the original IPA faded almost into oblivion.

Today, however, this classic style has been rediscovered, principally by North American craft brewers, who are inclined to bitter their IPAs with a vengeance, usually with Pacific Northwest hops.

Specifications

OG	1.070 (17.5 °P)		**BU**	45		**ABV**	7.2%
FG	1.016 (4 °P)		**Color**	13.2 SRM/34 EBC		**ABW**	5.7%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	89	46.18	20.95	54.17	24.57	8.74	3.98
Weyermann® Carared®	5	2.58	1.17	3.03	1.37	0.49	0.22
Weyermann® Carahell®	5	2.58	1.17	3.03	1.37	0.49	0.22
Weyermann® Carafa® II	0.5	0.26	0.12	0.30	0.14	0.05	0.02
Total Grain	100	51.60	23.41	60.53	27.46	9.76	4.45
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Goldings	5	6.78	192	8.0	226	1.3	36
Flavor: Barth-Haas Fuggles	4.3	2.81	80	3.3	93	0.5	15
Aroma: Barth-Haas Goldings	5	2.81	80	3.3	93	0.5	15
Yeast	London-style ale yeast						

Brewing Process

Single infusion. Mash in with 7 gal of brewing liquor per a 1 bbl of expected net kettle volume @ 148 °F – 150 °F (64 °C – 66 °C). Rest 60 min. Recirculate. Sparge with 180°F (8 °C) brewing liquor to raise mash temp to 168 °F ± 2 °F (76 °C ± 1 °C) for mash-out. Hold mash temp at that level. Adjust sparge water temp, if needed. Boil 75 min. 1st hops @ 5 min; 2nd hops @ 65 min. Whirlpool 30 min. 3rd hops @ start of whirlpool. Primary fermentation @ 60 °F –70 °F (16 °C – 21 °C), depending on yeast, for about 7 days. Rack. Secondary fermentation about 14 days. Rack again, condition for a wk. Package.

DID YOU KNOW ... ?

As the name implies, the key market for India Pale Ale was the British colony of India, which in those days included what are now the countries of Pakistan, Bangladesh and Sri Lanka.

Casks of IPA were loaded into the holds of sailing ships of the East India Company, which had a trade monopoly for goods from the Subcontinent. Outbound, these trading vessels were filled with the amenities of British life for the distant merchants.

On their return voyage, they brought back the treasures of the orient, from spices, to cloth, to tea. In the 18th century, the East India Company was the effective ruler of the British possessions in the Far East, not only economically, but politically, too. Its monopoly, however, ended with the institution of the Raj, in 1858, when the company was dissolved and the Crown itself took over the administration and defense of the colony.

The opening of a domestic British market for the bitter IPA occurred apparently by accident, when, in 1827, a ship bound for India foundered off Liverpool and its cargo, which included casks of IPA, was salvaged and sold locally.

Because the bitter export ale disappeared quickly down the Liverpudlian hatches, the Burton brewers realized they had a home market, too, for their "bitter," as the beer became soon known.

Imperial IPA, American

Beer culture of origin	United States
AKA	Double IPA
Related Styles	English IPA, American Double or Imperial IPA

Style Description

Imperial IPA is one of America's signature "extreme" brews. Also known as Double or Extra IPA, it pushes the limits of brewing specifications—and sometimes of the tolerance of a drinker's palate as well. The recipe below pushes these limits in both gravity and the solubility of alpha-acids in wort. To secure the requisite amount of fermentables for a high alcohol content, the malt base for this brew needs to be highly attentuative (therefore, the large amount of diastatic barley malt), and the mash temperature must favor beta amylase. The hop bittering is often aggressive and mouth-puckering, and the hop flavor reverberations, long lasting. The brew is pale, but its precise color value is almost irrelevant. Subtleties are not a hallmark of this brew! Note that the ABV-value of 10.9 percent is based on a nominal *80 percent extract efficiency, which may not be achievable with the grain loading for this brew!*

Specifications

OG	1.100 (25 °P)		**BU**	95		**ABV**	10.9%
FG	1.018 (4.5 °P)		**Color**	7.8 SRM/19.4 EBC		**ABW**	8.6%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	55	41.68	18.91	48.89	22.18	7.89	3.59
Weyermann® Diastatic Barley Malt	45	34.10	15.47	40.00	18.14	6.45	2.94
Total Grain	100	75.78	34.37	88.89	40.32	14.34	6.53
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Columbus	15.5	6.70	190	7.9	223	1.3	36
Flavor: Barth-Haas Cascade	5.75	7.23	205	8.5	241	1.4	39
Aroma: Barth-Haas Amarillo®	9.5	7.23	205	8.5	241	1.4	39
Yeast	American "Chico"-Style ale yeast						

Brewing Process

Mash in with 7 gal of brewing liquor per a 1 bbl of expected net kettle volume @ 148 °F – 150 °F (64 °C – 66 °C)Rest 90 min for proper hydration. Recirculate. Sparge with 180°F (8 °C) brewing liquor to raise mash temp to 168 °F ± 2 °F (76 °C ± 1 °C) for mash-out. Hold mash temp at that level. Adjust sparge water temp, if needed. Boil 75 min. 1st hops @ 15 min; 2nd hops @ 60 min. 3rd hops @ start of whirlpool. Whirlpool 30 min. Primary-ferment @ 60 °F –70 °F (16 °C – 21 °C), depending on yeast, for about 7 to 10 days. Rack. Secondary-ferment about 14 to 21 days. Rack again. Condition for 1 wk. Package.

Kellerbier

Beer culture of origin	Germany
AKA	None
Related Styles	Zwickelbier, Zoiglbier

Style Description

Kellerbier, literally "cellar beer," ranks among the most popular summer beer garden brews in its region of origin, in Franconia, in northeastern Bavaria. It is closely related to two other beer styles from region, Zwickelbier and Zoiglbier (see entry).

Traditionally, Kellerbier is a low-effervescent, unfiltered, cask-conditioned (but un-fined) lager that requires slow, cool maturation in oak, at atmospheric pressure, at a cellar temperature of perhaps 50 °F – 55 °F (10 °C – 13° C), for months. The tank pressure for a modern Kellerbier should not exceed 3 psi. When served on tap, Kellerbier is usually just gravity-poured. It is brewed to classic Märzen strength (5.0 – 5.5 percent ABV) and has a pronounced, lingering hop aroma from Hallertauer or Hersbrucker. The grain bill and color are Märzen-like, too, with plenty of Munich malt. The color is light to deep amber with a reddish or orange tinge.

Specifications

OG	1.055 (13.75 °P)		**BU**	35		**ABV**	5.4%
FG	1.014 (3.5 °P)		**Color**	12.7 SRM/32.4 EBC		**ABW**	4.3%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pilsner	64	25.58	11.60	30.01	13.61	4.84	2.20
Weyermann® Munich II	28	11.19	5.08	13.13	5.96	2.12	0.96
Weyermann® Caramunich® III	8	3.20	1.45	3.75	1.70	0.61	0.28
Total Grain	100	39.98	18.13	46.89	21.27	7.56	3.45
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Hersbrucker	14.5	2.85	81	3.3	95	0.5	15
Flavor: None	0	0.00	0	0.0	0	0.0	0
Aroma: Barth-Haas Hallertauer Mittelfrüh	4.25	2.85	81	3.3	95	0.5	15
Yeast	Bavarian lager yeast						

Brewing Process

Multi-step infusion. Mash in @ 122 °F (50 °C). Rest 30 min. Raise temp to 148 °F (64 °C). Rest 15 min. Raise temp to 156 °F (69 °C). Rest 15 min. Raise temp to 170 °F (77 °C). Recirculate. Lauter. Boil 90 min. 1st hops @ 30 min. 2nd hops in whirlpool. Ferment @ 48 °F (9 °C) in unpressurised tank. Ferment to finish for about 3 wks. Warm up to room temp for 2-day diacetyl rest. Rack.

Condition, keeping pressure @ 3 psi. Traditionally, brew should be transferred to oaken (often un-toasted) casks and aged at cellar temp of about 50 – 55 °F (10 – 13 °C) for 2 months. If kept in tank instead, do not rack again. Package yeast-turbid.

Brewers who prefer not to cask-condition this beer can imitate the barrique-ing by making an oak-chip tea as follows:

The day before brew day, using a quart- or liter-size size kitchen measuring container, take three scoops (about 3 quarts or liters) of oak chips per barrel or hectoliter of beer and mix the chips with about 5 gallons (19 liters) of roughly 180 °F (80 °C) water. Cover the container and let it cool off overnight. For greater (optional) depth of flavor, before steeping, lightly toast the oak chips in an oven at 250°F (approx. 120°C) for about an hour, until the chips are slightly brownish, but not charred. On brew day, strain the liquid off the oak chips and add to the wort at the start of whirlpooling. The combination of noble hop aroma, oak flavor and Weyermann® Munich malt makes for a surprisingly complex, but refreshing summer brew.

DID YOU KNOW ... ?

In the Bavarian regions north of the River Danube, the right to brew came automatically with the deed to a parcel of land. These brew-privileged medieval home- and landowners often brewed their beers, such as Kellerbier, Zwickelbier, and Zoiglbier, in communal brew houses, with open brew kettles and a powerful wooden fire underneath. The brew houses often doubled as bake houses, too, taking advantage of the fire under the kettle to heat both the brew and the oven; and the yeasts that took care of fermentation in usually open fermenters also took care of the leavening of the bread. Communal brew and bake houses were set up by many city administrations as a public safety measure, because they reduced the incidents of fire, an ever-present danger in cramped medieval cities. Eventually, as tradesmen guilds became common, brewers and bakers often joined to form a single guild for both professions.

Kölsch

Beer culture of origin	Germany (Cologne region in the Rhineland)
AKA	None
Related Styles	Altbier

Style Description

Kölsch, like Altbier is an unusual, cool-fermented, lagered ale. The specialty Kölsch yeast ferments cleanest at around 59 °F – 65 °F (15 °C – 18 °C). This ale is brilliantly straw-blond like a Munich Helles, mildly noble-hop-accented at 20 – 30 BU from Tettnanger or Spalter, for instance, and clean tasting. Traditionally, it is step-mashed with just Pilsner base malt and no specialty malts. In a sense, Kölsch is to Altbier what Pale Ale is to Brown Ale. The Kölsch is a fairly recent stylistic development. Like the Altbier from Düsseldorf, 25 miles (45 km) down the River Rhine from Cologne, the Kölsch derives from a medieval northern German brew called Keutebier, which was made form a mixture of often dark (Dunkel) barley and wheat malts. In the early 20th century, the wheat was dropped, the malt became pale, and the Kölsch style was fixed in its modern interpretation.

Specifications

OG	1.048 (12 °P)		**BU**	26		**ABV**	4.7%
FG	1.010 (2.5 °P)		**Color**	1.9 SRM/3.9 EBC		**ABW**	3.7%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Extra Pale Pilsner	77	24.95	11.32	29.26	13.27	4.72	2.15
Weyermann® Pale Wheat Malt	15	4.86	2.20	5.70	2.59	0.92	0.42
Weyermann® Carafoam®	5	1.62	0.73	1.90	0.86	0.31	0.14
Weyermann® Acidulated	3	0.97	0.44	1.14	0.52	0.18	0.08
Total Grain	100	32.40	14.70	38.00	17.24	6.13	2.79
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Tettnanger	4	5.75	163	6.7	191	1.1	31
Flavor: Barth-Haas Tettnanger	4	5.75	163	6.7	191	1.1	31
Aroma: None	0	0	0	0	0	0	0
Yeast	Kölsch yeast						

Brewing Process

Mash in thick @ 110 °F (43 °C). Infuse and raise temp by about 1 °F (0.5 °C) per min. to 146 °F (66 °C). Rest 30 min. Infuse and raise temp to 158 °F (70 °C). Rest 15 min. Infuse and raise temp to mash-out @ 170° F (78° C). Sparge 45 – 60 min. Boil 70 min. 1st hops @ 10 min. 2nd hops @ 60 min. Whirlpool 30 min. Ferment for 2 wks @ 59 °F – 65 °F (15 °C – 18 °C). Rack. Lager 6 – 8 wks. Rack, condition, package.

Kriek

Beer culture of origin	Belgian, Flanders
AKA	None
Related Styles	Lambic, Pêche, Framboise, Cassis

Style Description

Kriek is a Lambic (see entry) that is re-fermented with fresh sour cherries. It is a sour specialty beer from the Senne River valley in the Pajottenland, which is part of Flanders, outside Brussels. Traditionally, the cherries for this brew were uniquely local. They are an extremely sour variety called Schaarbeek cherries they are indigenous to only a very limited area around village of Schaarbeek. Nowadays Schaarbeek cherries are also grown in a few other parts of Europe, especially in Poland. If unavailable, other sour cherry varieties, such as Moreno, may serve as substitutes. Cherries are added to Lambic after the main fermentation is finished, during the aging period. The amount of fruit is entirely up to the brewer's preference. A good rule of thumb is 20 kilogram (44 lbs.) of fruit per 1 hectoliter (26.42 gal.) of finished beer (or approx. 50 lbs./bbl). The fruit can be added macerated or crushed. Traditionally, cherries are added with the pits. The dormant yeast and bacteria in the Lambic ferment the fruit sugars for some effervescence. Once secondary fruit fermentation starts, the brew should be racked off the pulp and packaged for conditioning in bottles or kegs.

Cherries can be replaced by other fruit to make other forms of fruit Lambic called Framboise (raspberry Lambic), Pêche (peach Lambic), or Cassis (black currant Lambic).The process for making these beers is analogous to making Kriek. Modern brewers, especially in the New World, have experimented with additional, less traditional Lambic fruits, including cranberries, blueberries, even grapes.

For specifications and ingredients, other than fruit, see the entry for Lambic.

Brewing Process (Applies also to Cassis, Framboise, and Pêche)

Make a regular Lambic as described in the Lambic entry and allow the beer to ferment entirely to the finish (after perhaps 4 – 6 wks). Now you have two choices for adding the fruit: Follow tradition, which may not be practical in every brewery operation, or go for a modern improvisation. Traditionally, the Lambic is aged for at least a year, before the fruit is introduced to the matured brew. The fruit is left there for a few months to a year, before the beer is racked and packaged.

A practical, though not authentic, compromise may be more suitable for a modern brewery or brewpub operation with no cask cellaring possibility and an economically-drive tank utilization requirement, which prevents a single brew to block a tank for a year or two. Let the Lambic ferment to the finish. Then place the macerated fruit, including the pits, into a clean tank and rack the still brew over the fruit. A fresh dose of yeast and Lambic microbes may help at this point as well. Rack the brew off the fruit after about 6 – 8 wks, condition mildly and package into bottles, kegs, or a serving tank.

DID YOU KNOW ... ?

The Alsatian *Bière de mars* ought not to be confused with the Belgian brew of the same name. A Belgian *Bière de mars* is a "small" Lambic made from the second, low-gravity runnings of the mash (Lambic is the stronger of the two, made from the first, high-gravity runnings, at about 12.5 °P/OG 1.050). Lambic and/or *bière de mars* is made from a mash of roughly 40% unmalted pale wheat and 60% pale barley malt, whereby Lambic receives about twice as much bittering hops (12 – 22 BU) as does *bière de mars*. The hops are usually English, such as Fuggles.

DID YOU KNOW ... ?

All Lambics originate from the Senne River valley in the Pajottenland, part of Flanders, outside Brussels. A beer made from blending Lambic and Biere de mars half-and-half, incidentally, is called Faro; and a blend of one-third young Lambic and two-thirds old Lambic, Gueuze. Lambic re-fermented, before bottling, with fresh fruit, are called Kriek (cherry Lambic fermented with sour Schaarbeek cherries, indigenous to the village of Schaarbeek outside Brussels); Framboise (raspberry Lambic), Pêche (peach Lambic), or Cassis (black currant Lambic). All Lambics are sour, spontaneously fermented ales with such airborne micro-flora as Brettanomyces bruxellensis and Brettanomyces lambicus ("wild" yeast strains) contributing to the fermentation process, next to ale yeasts (Saccharomyces cerevisiae). Traditionally, the beer-souring micro-flora reached the wort after the boil, when it rested in large, shallow, copper coolships exposed to a fresh breeze. Nowadays, brewers can purchase Lambic microbe mixes from commercial yeast labs.

Lager, American

Beer culture of origin	United States
AKA	None
Related Styles	American Light Lager, American Premium Lager, German Pils or Pilsener, Czech Pilsner, Bavarian Helles, European Pilsner

Style Description

American Lager is the classic American adaptation of the original Czech Pilsner and its global variations. It may be brewed as an all-malt beer, with two-row or six-row barley, as well as with or without such adjuncts as rice and/or corn as flakes, torrified, or unprocessed. The recipe below is for a top-quality all-malt version. Feel free to substitute the two-row base malt with six-row base malt and/or with up to 40 percent adjuncts. The bittering and aroma values should be kept very low, just above the taste threshold.

Specifications

OG	1.045 (11.25 °P)		**BU**	12		**ABV**	4.8%
FG	1.009 (2.75 °P)		**Color**	2.7 SRM/5.8 EBC		**ABW**	3.8%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Well-Modified Pilsner	85	27.54	12.49	32.30	14.65	5.21	2.37
Weyermann® Pale Ale	10	3.24	1.47	3.80	1.72	0.61	0.28
Weyermann® Acidulated	5	1.62	0.73	1.90	0.86	0.31	0.14
Total Grain	100	32.40	14.70	38.00	17.24	6.13	2.79
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Taurus	15.5	3.10	88	3.6	103	0.6	17
Flavor: none	0	0.00	0	0.0	0	0.0	0
Aroma: Barth-Haas Saaz	4.5	0.23	6	0.3	8	0.0	1
Yeast	American lager yeast						

Brewing Process

Multi-step infusion. Mash in @ 122 °F (50 °C); rest 30 minutes; raise temp to 144 °F (62 °C); rest 20 min. Raise temp to 162 °F (72 °C); rest 20 min. Raise temp to mash-out @ 172 °F (78 °C). Lauter 90 min. Boil for 75 minutes. 1st hops @ 15 min; 2nd hops @ 70 min. Fermentation temp @ 54°F (12°C). Rack when gravity @ about 4.5 °P (1.018). Reduce temp to 34°F (1°C); lager for 3 – 4 wks. Rack and condition for 2 days. Note: If adjuncts are used, they need to be cooked separately and added to the mash at mash-in.

Lager, American Light

Beer culture of origin	United States
AKA	None
Related Styles	American Lager, American Premium Lager, German Pils or Pilsener, Czech Pilsner, Bavarian Helles, European Pilsner

Style Description

American Light Lager is a low-calorie and often low-carbohydrate adaptation of the standard American Lager. It has a very light body, a straw-yellow color, and very little flavor or aroma—either from malt or hops—but can be refreshing and thirst-quenching. It is high in adjuncts and may have notes of acetaldehyde (green apples) and DMS, but not of diacetyl. It is usually severely filtered and may have a slight residual sweetness. The recipe below is for an all-malt version. Substitute the malt with up to 40 percent rice and/or corn adjuncts, if desired.

Specifications

OG	1.032 (8 °P)		**BU**	9		**ABV**	3.3%
FG	1.007 (1.75 °P)		**Color**	1.6 SRM/3.1 EBC		**ABW**	2.6%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Extra Pale Premium Pilsner	90	20.48	9.29	24.02	10.89	3.87	1.76
Weyermann® Pale Ale	5	1.14	0.52	1.33	0.61	0.22	0.10
Weyermann® Acidulated	5	1.14	0.52	1.33	0.61	0.22	0.10
Total Grain	100	22.75	10.32	26.69	12.11	4.30	1.96
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Taurus	15.5	2.33	66	2.7	77	0.4	12
Flavor: none	0	0.00	0	0.0	0	0.0	0
Aroma: Barth-Haas Saaz	4.5	0.17	5	0.2	6	0.0	1
Yeast	American lager yeast						

Brewing Process

Multi-step infusion. Mash in @ 122 °F (50 °C); rest 30 minutes; raise temp to 144 °F (62 °C); rest 20 min. Raise temp to 162 °F (72 °C); rest 20 min. Raise temp to mash-out @ 172 °F (78 °C). Lauter 90 min. Boil for 75 minutes. 1st hops @ 15 min; 2nd hops @ 70 min. Fermentation temp @ 54°F (12°C). Rack when gravity @ about 4.5 °P (1.018). Reduce temp to 34°F (1°C); lager for 3 – 4 wks. Rack and condition for 2 days. Note: If adjuncts are used, they need to be cooked separately and added to the mash at mash-in.

Lager, American Premium

Beer culture of origin	United States
AKA	None
Related Styles	American Lager, American Light Lager, German Pils or Pilsener, Czech Pilsner, Bavarian Helles, European Pilsner

Style Description

American Premium Lager is very similar in flavor, aroma, mouthfeel, and appearance to American standard or light lagers, except the hops is more noticeable, there are fewer adjuncts (if used) in the mash, and the alcohol by volume is higher—reaching as much as 6 percent. The American Premium is more likely to be made from an all-malt base than the other two American lagers. If adjuncts are desired, substitute up to 25 percent of the base malt with rice and/corn.

Specifications

OG	1.054 (13.5 °P)		**BU**	20		**ABV**	5.6%
FG	1.012 (3 °P)		**Color**	3.4 SRM/7.8 EBC		**ABW**	4.4%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Extra Pale Premium Pilsner	82.5	32.35	14.67	37.95	17.21	6.12	2.79
Weyermann® Pale Ale	7.5	2.94	1.33	3.45	1.56	0.56	0.25
Weyermann® Acidulated	5	1.96	0.89	2.30	1.04	0.37	0.17
Weyermann® Munich II	5	1.96	0.89	2.30	1.04	0.37	0.17
Total Grain	100	39.22	17.79	46.00	20.86	7.42	3.38
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Taurus	15.5	5.17	147	6.1	172	1.0	28
Flavor: none	0	0.00	0	0.0	0	0.0	0
Aroma: Barth-Haas Saaz	4.5	0.38	11	0.4	13	0.1	2
Yeast	American lager yeast						

Brewing Process

Multi-step infusion. Mash in @ 122 °F (50 °C); rest 30 minutes; raise temp to 144 °F (62 °C); rest 20 min. Raise temp to 162 °F (72 °C); rest 20 min. Raise temp to mash-out @ 172 °F (78 °C). Lauter 90 min. Boil for 75 minutes. 1st hops @ 15 min; 2nd hops @ 70 min. Fermentation temp @ 54°F (12°C). Rack when gravity @ about 4.5 °P (1.018). Reduce temp to 34°F (1°C); lager for 3 – 4 wks. Rack and condition for 2 days. Note: If adjuncts are used, they need to be cooked separately and added to the mash at mash-in.

Lager, European Amber

Beer culture of origin	Universal
AKA	None
Related Styles	Dortmunder Export, Vienna Lager, European Red Lager

Style Description

This is a very simple, single-infusion-mashed, deep amber, German-style lager of Export strength (> 5 percent ABV) with a medium, but noticeable, fine, spicy, and floral hop bitterness and hop aroma. It is just a shade darker than an English Brown Ale and a shade lighter than an English Dark Ale. It finishes with a touch of residual sweetness. The yeast should be a clean-fermenting variety that produces next to no esters or diacetyl. This beer is an ideal choice for a generic fall or mid-spring brew-pub lager.

Specifications

OG	1.056 (14 °P)		**BU**	30		**ABV**	5.6%
FG	1.014 (3.5 °P)		**Color**	9.8 SRM/24.7 EBC		**ABW**	4.4%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Vienna	80	32.59	14.78	38.23	17.34	6.17	2.81
Weyermann® Carared®	20	8.15	3.70	9.56	4.34	1.54	0.70
Total Grain	100	40.74	18.48	47.79	21.68	7.71	3.51
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Spalter	4	8.85	251	10.4	294	1.7	47
Flavor: None	0	0	0	0	0	0	0
Aroma: Barth-Haas Saphir	3.25	8.85	251	10.4	294	1.7	47
Yeast	German, Bavarian, or Danish dry-fermenting lager yeast						

Brewing Process

Single-step infusion. Mash in @ 154 °F (68 °C); rest 45 minutes; raise temp to mash-out @ 172 °F (78 °C). Lauter 90 min. Boil for 90 minutes. 1st hops @ 30 min; 2nd hops in whirlpool. Ferment @ 48 °F (9 °C) for 1 wk. Rack and ferment for another 10 days. Reduce temp to 34°F (1°C); lager for 4 wks. Rack, condition, package.

Lager, European Light

Beer culture of origin	Universal
AKA	Leichtbier, Low-Alcoholic Lager
Related Styles	Helles

Style Description

This is a very simple, single-infusion-mashed, brilliantly blond, German-style, low-alcohol lager with and a very delicate fine, spicy, and floral hop bitterness and a gentle hop aroma. It is roughly in the color range of a Munich Helles. It finishes fairly dry. The yeast should be a clean-fermenting variety that produces next to no esters or diacetyl. This beer is an ideal choice for a generic, mid-summer, brew-pub, quaffing lager for "starter" patrons generally accustomed to mass-produced industrial brews.

Specifications

OG	1.031 (7.75 °P)		**BU**	18		**ABV**	2.7%
FG	1.011 (2.75 °P)		**Color**	2.2 SRM/4.6 EBC		**ABW**	2.1%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Extra Pale Premium Pilsner	77	16.95	7.69	19.89	9.02	3.21	1.46
Weyermann® Carafoam®	15	3.30	1.50	3.87	1.76	0.62	0.28
Weyermann® Carared®	5	1.10	0.50	1.29	0.59	0.21	0.09
Weyermann® Acidulated	3	0.66	0.30	0.77	0.35	0.12	0.06
Total Grain	100	22.02	9.99	25.83	11.72	4.17	1.90
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Spalter	5.31	151	6.2	177	1.0	28	5.31
Flavor: None	0	0	0	0	0	0	0
Aroma: Barth-Haas Saphir	2.66	75	3.1	88	0.5	14	2.66
Yeast	Danish dry-fermenting lager yeast						

Brewing Process

Single-step infusion. Mash in @ 154 °F (68 °C); rest 45 minutes; raise temp to mash-out @ 172 °F (78 °C). Lauter 90 min. Boil for 90 minutes. 1st hops @ 30 min; 2nd hops in whirlpool. Ferment @ 48 °F (9 °C) for 1 wk. Rack and ferment for another 10 days. Reduce temp to 34°F (1°C); lager for 4 wks. Rack, condition, package.

Lager, European Red

Beer culture of origin	Universal
AKA	None
Related Styles	Dortmunder Export, Vienna Lager, European Red Lager

Style Description

This is a very simple, single-infusion-mashed, German-style lager of with a reddish hue, and a delicate fine, spicy, and floral hop bitterness and hop aroma. It is roughly in the color range of a Vienna Lager. It finishes with a touch of residual sweetness. The yeast should be a clean-fermenting variety that produces next to no esters or diacetyl. This beer is an ideal choice for a generic early-fall or late-spring brew-pub lager.

Specifications

OG	1.046 (11.5 °P)		**BU**	22		**ABV**	4.7%
FG	1.011 (2.75 °P)		**Color**	14.7 SRM/37.8 EBC		**ABW**	3.7%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Vienna	75	24.86	11.28	29.16	13.23	4.70	2.14
Weyermann® Caramunich® II	15	4.97	2.26	5.83	2.65	0.94	0.43
Weyermann® Carared®	5	1.66	0.75	1.94	0.88	0.31	0.14
Weyermann® Melanoidin	5	1.66	0.75	1.94	0.88	0.31	0.14
Total Grain	100	33.15	15.04	38.88	17.64	6.27	2.86
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Spalter	4	6.49	184	7.6	216	1.2	35
Flavor: None	0	0	0	0	0	0	0
Aroma: Barth-Haas Saphir	3.25	6.49	184	7.6	216	1.2	35
Yeast	German, Bavarian, or Danish dry-fermenting lager yeast						

Brewing Process

Single-step infusion. Mash in @ 154 °F (68 °C); rest 45 minutes; raise temp to mash-out @ 172 °F (78 °C). Lauter 90 min. Boil for 90 minutes. 1st hops @ 30 min; 2nd hops in whirlpool. Ferment @ 48 °F (9 °C) for 1 wk. Rack and ferment for another 10 days. Reduce temp to 34°F (1°C); lager for 4 wks. Rack, condition, package.

Lambic

Beer culture of origin	Belgian, Flanders
AKA	None
Related Styles	Flanders Brown Ale/Oud Bruin, Flanders Red Ale, Faro, Gueuze, Kriek, Pêche, Framboise, Cassis, *Bière de mars*

Planning a Lambic Brew Day

A traditional Lambic is a partigyle brew, whereby only the first runnings of a mash become true Lambic—at a kettle gravity of about 12.5 °P/OG 1.050—while the second runnings become a "small" Lambic of indeterminate kettle gravity, called bière de mars. *The low-gravity* bière de mars *receives only about half as much bittering hops as does the full-blown first-runnings Lambic. Use the recipe below to compose your Lambic mash and then lauter it until the desired kettle gravity is reached. Then you have a choice: Follow the partigyle tradition and continue lautering for a* bière de mars *into a separate holding vessel, or just drain the remaining weak wort away.*

If you chose to make a bière de mars *consider the extra vessel requirements: Because you need to boil and ferment two gyles from the same mash separately, you need a receiving vessel for the second runnings, while the first runnings are boiling. You also need two fermenters, one for the Lambic and one for the* bière de mars. *If no* bière de mars *holding vessel is available in the brew house, you can use the fermenter that will ultimately receive the* bière de mars *for fermentation. In this case, make sure you shut off that tank's glycol system before filling it with hot wort. Turn it back on to cool the tank while the* bière de mars *is boiling. Depending on the relative size of your brew house and your tanks, using the partigyle method may fill two fermenters only half way each. In this case, consider making two Lambic batches on two consecutive days, which results in complete capacity utilization of the occupied tankage.*

Style Description

Lambics are sour Belgian ales that are drunk young or old, blended or not, pure or re-fermented with fruit. They are related to Flanders Oud Bruin and Flanders Red Ale. Lambics originate from the Senne River valley in the Pajottenland, part of Flanders, outside Brussels. Traditional Lambics are made from a mash of up to 40 percent unmalted pale wheat and 60 percent pale—often a very pale—barley malt.

Hops for Lambics are usually aged for three years before they are added to the brew. By that time, they have lost all volatile aroma. Much of their alpha-acids content, too, has become oxidized and thus wort-insoluble. A good calculated bittering target is about 10 BU, however, because the true state of the hops is difficult to judge, precise dosage calculations are not feasible (and not necessary) for Lambic. Mild, low-alpha hops such as Fuggles from England or a German noble variety are traditional for this brew.

A beer made from blending Lambic and Biere de mars *half-and-half is called Faro. Some Faro interpretations are re-fermented with Belgian dark and/or light brewing*

sugar. A blend of one-third young Lambic and two-thirds old Lambic (at least 6 months old) is called Gueuze.

Lambics that are re-fermented with fresh fruit are called Kriek (cherry Lambic), Framboise (raspberry Lambic), Pêche (peach Lambic), or Cassis (black currant Lambic).

In their home environment, all Lambics are spontaneously fermented with a veritable cocktail of airborne micro-flora which usually include Brettanomyces bruxellensis and Brettanomyces lambicus as well other brewer's and wild yeasts, including Saccharomyces cerevisiae. Nowadays, brewers can purchase Lambic microbe mixes from commercial yeast labs.

Classic Lambics are fermented in open wooden vats and aged in oak casks, which impart strong flavors to the sour beer as well as allow it to partially oxidize. The result of aging is often a kind of barnyard flavor reminiscent of goats, hay, and sweaty horse blankets, with a background of raw cereal, citrus, apple, rhubarb, and honey aromas, as well as a slight maltiness. Hop flavors, however, are completely lacking, as is hop aroma. Because Lambic is fermented completely to the finish by yeasts and bacteria, there is no residual sweetness left, and the finish is exceptionally tart and of mouth-puckering dryness. Lambics have next to no effervescence and no head.

Specifications (for a first-runnings Lambic, not a *bière de mars*)

OG	1.051 (12.75 °P)		**BU**	10		**ABV**	5.6%
FG	1.009 (2.25 °P)		**Color**	2.2 SRM/4.7 EBC		**ABW**	4.4%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Extra Pale Premium Pilsner	60	22.16	10.05	25.99	11.79	4.19	1.91
Unmalted wheat	40	14.77	6.70	17.33	7.86	2.79	1.27
Total Grain	100	36.93	16.75	43.32	19.65	6.99	3.18
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Fuggles	4.3	1.97	56	2.3	65	0.4	11
Flavor: none	0	0	0	0	0	0	0
Aroma: none	0	0	0	0	0	0	0
Yeast	Belgian ale yeast plus one to all of the following: Brettanomyces bruxellensis, Brettanomyces lambicus, lactobacillus bacteria, and pediococcus bacteria						

Brewing Process

Mash in @ about 125 °F (52 °C); 20-min hydration, beta-glucan and protein rest. Raise temp to 144 °F (62 °C); 40-min beta-amylase rest. Raise temp to 162 °F (72 °C); 40-min alpha-amylase rest. Recirculate 15 – 20 min. Lauter. Boil 90 min. Bittering hops @ 30 min. After shut-down, rest brew for 30 min before whirlpooling for another 30 min. Primary fermentation temp @ about 68°F (20°C). Pitch equal amounts of very healthy ale yeast and a commercial Lambic blend (or a mixture of custom-selected souring microbes). Because bacteria have a longer lag time than do

yeasts, the latter will metabolize most of the small-molecular sugars before the bacteria become active. Rack after 2 wks, then again after 4 wks. Condition for at least 8 wks, preferably much longer. Best aged for 6 months up to 6 years in oak. Used casks that previously contained Port, Sherry, or wine can be used. Package.

Sour Beer Process Advisory:

Sour beer-making is only for the bravest of the brave and demands a great deal of caution. Traditionally, and often still today, many sour beer styles are spontaneously fermented by airborne microbes. These may include Brettanomyces bruxellensis, Brettanomyces lambicus, lactobacillus delbrückii, pediococcus, and other assorted wild yeasts and bacteria.

Souring microbes are invariably considered defects in regular beers. As beer spoilers, they are kept in check by a host of cleaning, sanitizing, and disinfecting agents, especially on the cold-wort side of the brewery. Breweries attempting to make sour beers, therefore, need to ensure that there is no cross-contamination between their sour and their regular brews. That is why many breweries that produce both sour and regular beers have separate fermenters, transfer hose, pumps and even fillers just for sour beers. Brewers who wish to make sour beers, but prefer not to risk errant microbe infections, can replace some of the base malt with up to perhaps 10 percent Weyermann® Acidulated Malt, which contains biologically produced, Beer Purity Law-conform, natural lactic acid. Acidulated malt can also be used in addition to souring microbe preparations.

Traditionally, souring microbes settle into brews during wort cooling in old-fashioned, flat, copper cool-ships that are placed in well vented rooms, where the green beer is exposed to a fresh breeze. The type or combination of microbes responsible for souring particular brews have often become proprietary micro-floras that are dominant only in a particular region or even brewery, thus giving a beer style—even a beer brand—its signature character. In many cases, this character is virtually impossible to imitate elsewhere. Specific mixtures of souring micro-flora are now commercially available from many yeast labs.

Maibock

Beer culture of origin	Germany
AKA	Heller Bock, Helles Bock; Frühlingsbock
Related Styles	Bockbier, Doppelbock, Eisbock, Weizenbock

Style Description

Mai *is German for the month of May, the time of year when, in Bavaria, it is still too cool to sit out in the open air in a beer garden and already too bright and spring-like to hide indoors in the beer halls. This is when Bavarians turn to Maibock, a real Bockbier, but brewed almost as golden-yellow as a Helles, the Bavarians' summer quaffing lager. Because of its blond color, the Maibock is also often called a Heller or Helles Bock (*hell *is German for light in color, not in strength). Brewing a Maibock is almost identical to brewing any other Bockbier; except that the Maibock requires a different grain bill and much more hops.*

Specifications

OG	1.068 (17 °P)		**BU**	33		**ABV**	7.3%
FG	1.013 (3.25 °P)		**Color**	7.9 SRM/19.8 EBC		**ABW**	5.8%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pilsner	42	30.02	13.62	35.21	15.97	5.68	2.59
Weyermann® Carahell®	15	7.51	3.40	8.80	3.99	1.42	0.65
Weyermann® Carafoam®	10	5.00	2.27	5.87	2.66	0.95	0.43
Weyermann® Munich I	10	5.00	2.27	5.87	2.66	0.95	0.43
Weyermann® Melanoidin	3	1.50	0.68	1.76	0.80	0.28	0.13
Weyermann® Vienna	2	1.00	0.45	1.17	0.53	0.19	0.09
Total Grain	100	50.03	22.69	58.69	26.62	9.47	4.31
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Taurus	8.5	3.92	111	4.6	130	0.7	21
Flavor: Barth-Haas Hallertauer Tradition	5.5	1.83	52	2.1	61	0.3	10
Aroma: Barth-Haas Smaragd/Emerald	5	0.92	26	1.1	30	0.2	5
Yeast	Bavarian-style lager yeast						

Brewing Process (Continuous Infusion)

Dough in for thick mash @ approx. 90 °F (32 °C). Rest 30 min. Infuse and raise temp continuously over 2 – 3 hrs to mash-out temp of 170 °F (77 °C). Lauter for at least 90 min. Boil 90 min. 1st hops @ 30 min. 2nd hops @ 75 min. 3rd hops @ 85 min. Whirlpool 30 min. Ferment @ 50 °F (10 °C) for 3 wks. Rack. Lager close to freezing point for at least 5 wks. Rack again, condition, package.

Brewing Process (Double Decoction)
Mash in main mash at @ 100 °F (38 °C); rest 30 minutes for proper grist hydration and activation of phytase for some mash acidification.

Draw 1st decoction (one-third of main mash). Heat decoction (10 – 15 min). Rest decoction @ 149 °F (65 °C) for 30 min. Heat decoction (10 min). Rest decoction @ 162 °F (72 °C) for 10 min. Heat decoction (10 min). Boil decoction @ 212 °F (100 °C) for 10 min. Reintroduce decoction to main mash. Rest main mash @ 149 °F (65 °C) for 10 min.

Draw 2nd decoction (one-third of main mash). Heat decoction (5 – 10 min). Rest decoction @ 162 °F (72 °C) for 10 min. Heat decoction (10 min). Boil decoction @ 212 °F (100 °C) for 10 min. Reintroduce decoction to main mash. Rest main mash @ 162 °F (72 °C) for 10 min.

Raise temp of main mash to 171 °F (77 °C). Rest 15 min. Recirculate (5 min). Start lautering and sparging slowly (!) for about 3 hrs until kettle full. Boil 90 min. 1st hops @ 30 min. 2nd hops @ 75 min. 3rd hops @ 85 min. Whirlpool 30 min. Ferment @ 50 °F (10 °C) for 3 wks. Rack. Lager close to freezing point for at least 5 wks. Rack again, condition, package.

DID YOU KNOW ... ?
Maibock is also known as Heller Bock or Helles Bock, meaning pale Bock. But why the different endings in Heller and Helles? The reason is a matter of grammar:

In German, adjectives have case and gender endings, whereby the form of the gender ending is determined by the gender of the noun. Heller is masculine, Helles is neuter. Helle would be feminine. It is obvious that the Germans cannot make up their minds, if Bock is masculine or neuter: Is it "der Bock" or "das Bock?"

Bock coincidentally also means ram or Billy goat in German, which is a creature of masculine gender. However, Bock is also a beer, and "das Bier" (the beer) is neuter in German. So, if you think of Bock more as a beer, you are more likely to call the Maibock Helles Bock. If you are more concerned with its goat-like kick, you are more likely to call it Heller Bock.

Malt Liquor

Beer culture of origin	United States
AKA	None
Related Styles	American Lager

Style Description

American Malt Liquor is a unique brew. It is not intended as an elegant beer, but more as a generic, robust, slightly harsh, usually high-alcohol working man's drink. Made with next to no hops and usually just six-row brew malt and plenty of adjuncts (usually corn), this brew is a hefty, single-step infusion affair designed to be low-price in terms of both ingredients for the brewer and finished beer for the consumer.

At 10 BU, bittering is kept just above the taste threshold. The adjuncts should not exceed 40 percent of the grain bill by weight. Corn is added to the mash, but it has no enzymes and relies on barley enzymes for conversion. It adds alcohol to the brew while lightening its color and contributing no flavor, except for some residual sweetness.

Raw, milled corn needs to be decoction-cooked before it can be added to the mash. If you do not wish to mill your own corn, purchase pre-ground corn meal. Milled corn or corn meal should be cooked (or heated to above 190 °F or 88 °C) for about an hour to ensure for proper starch gelatinization. Starch that has not gelatinized will not convert enzymatically to sugar.

Alternatively, you can purchase conveniently pre-processed corn adjuncts in the form of pre-gelatinized (which means pre-cooked and dried) brewers flaked corn. These can be added to the mash without any ado. There is also torrified corn, which is corn treated like popcorn, but without the oil. Torrifying causes the moisture in the fresh corn to turn into steam, which, in turn, gelatinizes the starches.

The recipe below features two different mashes. One is a classic malt liquor mash made with six-row barley malt and about 28 percent pre-gelatinized flaked corn.

The other mash is a "gentrified" grain bill that may be more appealing to brewpub patrons. It is made with a single grist base of top-quality Weyermann® Pale Ale malt, without adjuncts.

For either version, Cluster (4.5 – 8.5 %AA) is a good bittering hop choice and a California-type lager yeast strain provides the right kind of fruitiness for this brew.

Specifications (with corn adjuncts)

OG	1.072 (18 °P)		**BU**	10		**ABV**	8.2%
FG	1.010 (2.5 °P)		**Color**	4.4 SRM/10.4 EBC		**ABW**	6.5%

Ingredients @ nominal 80% system extract efficiency, with corn adjuncts (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
6-row brew malt	72	38.29	17.37	44.91	20.37	7.24	3.30
pre-gelatinized brewers flaked corn	28	14.89	6.75	17.46	7.92	2.82	1.28
Total Grain	100	53.18	24.12	62.37	28.29	10.06	4.58
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Cluster	7	1.69	48	2.0	56	0.3	9
Flavor: None	0	0	0	0	0	0	0
Aroma: None	0	0	0	0	0	0	0
Yeast	California-type lager yeast						

Specifications (all malt)

OG	1.072 (18 °P)		**BU**	10		**ABV**	8.1%
FG	1.011 (2.75 °P)		**Color**	6 SRM/14.8 EBC		**ABW**	6.4%

Ingredients @ nominal 80% system extract efficiency, all malt (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	100	53.18	24.12	62.37	28.29	10.06	4.58
Total Grain	100	53.18	24.12	62.37	28.29	10.06	4.58
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Cluster	7	1.69	48	2.0	56	0.3	9
Flavor: None	0	0	0	0	0	0	0
Aroma: None	0	0	0	0	0	0	0
Yeast	California-type lager yeast						

Brewing Process

Single-step infusion. If raw corn adjuncts are used, decoct them @ 190 °F – 212 °F (88 °C – 100 °C) 60 min and transfer to mash tun. Add cool water to reduce adjunct temp to mash-in temp of approx. 154 °F (64 °C). Rest 30 minutes; Raise temp to mash-out @ 172 °F (78 °C). Recirculate. Lauter. Boil 75 min. Hops @ start of boil. Primary-ferment @ 65°F (18°C) for 2 wks. Rack. Secondary-ferment @ 65°F (18°C) for 2 wks. Rack. Condition for 1 wk. Rack. Package.

DID YOU KNOW ... ?

In 1878, Lorenz Enzinger, a Bavarian living in Worms, on the banks of the Rhine River, put a filtration device on the market that took yeast and other suspended solids out of the beer before it was packaged. This gave beer clarity and a longer shelf life. Two years later, the first patented machine for dispensing beer with CO_2 instead of air appeared. Now even draft beer stayed fresh to the last drop.

Mild Ale, English

Beer culture of origin	England
AKA	None
Related Styles	(Ordinary) Bitter, Burton Ale, Pale Ale, ESB (Extra Special Bitter)

Style Description

"Mild ale" was the beverage of choice of the rough necks of British heavy industry, a real working man's drink, consumed in copious quantities by the steel workers and coal miners of the Midlands and Wales. The roots of mild ale, however, date back to well before the Industrial Revolution of the 19th century, perhaps to as early as the 16th century, when milder, weaker versions of the regular brown ale was the drink of the "fairer" sex and of the servants. Brew-technically, mild ale was often made from the final runnings of a partigyle brew.

Specifications

OG	1.036 (9 °P)		**BU**	12		**ABV**	3.3%
FG	1.011 (2.75 °P)		**Color**	11.9 SRM/30.1 EBC		**ABW**	2.6%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	88	22.61	10.26	26.52	12.03	4.28	1.95
Weyermann® Munich II	10	2.57	1.17	3.01	1.37	0.49	0.22
Weyermann® Carafa® II	2	0.51	0.23	0.60	0.27	0.10	0.04
Total Grain	100	25.69	11.65	30.14	13.67	4.86	2.21
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Goldings	4.3	3.41	97	4.0	113	0.6	18
Flavor: none	0	0	0	0	0	0	0
Aroma: none	0	0	0	0	0	0	0
Yeast	London-style ale yeast						

Brewing Process

Single infusion. Mash in with 7 gal of brewing liquor per a 1 bbl of net kettle volume @ 154 °F (68 °C). Rest 30 min. Recirculate. Sparge with 180°F (8 °C) brewing liquor to raise mash temp to 168 °F ± 2 °F (76 °C ± 1 °C) for mash-out. Hold mash temp at that level. Adjust sparge water temp, if needed. Boil 60 min. Hops @ 5 min. Whirlpool 30 min. Primary fermentation @ 60 °F – 70 °F (16 °C – 21 °C), depending on yeast, for about 4 - 7 days. Rack. Secondary fermentation about 10 - 14 days. Rack again, condition for a wk. Package.

Oktoberfest/Märzen

Beer culture of origin	Germany
AKA	None
Related Styles	Vienna Lager

Style Description

The Märzen was developed in 1842 by the Spaten Brewery of Munich, the year that the Dreher Brewery near Vienna released a similar style, the Vienna Lager. Märzen means March in German. Before the invention of refrigeration, the beer was originally brewed, in late spring as a strong lager, aged in wooden casks in cellars and caves for the hot summer months, when ambient-temperature lager-making was not possible in Bavaria. In 1871, the Spaten brewery introduced its Märzen for the first time at that year's Munich Oktoberfest. This is how the brew acquired its long double name.

The beer is very malty, based on a grain bill of mostly Vienna and Munich malts. Pilsner and light caramel malts may also be used, with a small quantity crustal for depth of flavor and some color. Many breweries still believe in decocting this beer for additional malt aroma. If decoction is used, as below, dough in as thick as possible at the acid rest temperature. Then gradually raise the temperature to the mash-out while reducing mash viscosity simultaneously. The hops take a second seat to the malt in this beer, and hop aroma predominates over hop bitterness. The recipe below uses a few recently developed hop races to good aromatic effect.

Specifications

OG	1.056 (14 °P)		**BU**	23		**ABV**	5.6%
FG	1.014 (3.5 °P)		**Color**	9.5 SRM/23.9 EBC		**ABW**	4.4%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Vienna	70	28.52	12.94	33.45	15.17	5.40	2.46
Weyermann® Munich II	20	8.15	3.70	9.56	4.34	1.54	0.70
Weyermann® Carahell®	5	2.04	0.92	2.39	1.08	0.39	0.18
Weyermann® Melanoidin	5	2.04	0.92	2.39	1.08	0.39	0.18
Total Grain	100	40.74	18.48	47.79	21.68	7.71	3.51
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Taurus	8.5	2.73	77	3.2	91	0.5	15
Flavor: Barth-Haas Hallertauer Tradition	5.5	1.28	36	1.5	42	0.2	7
Aroma: Barth-Haas Smaragd/Emerald	5	0.64	18	0.7	21	0.1	3
Yeast	Bavarian-style lager yeast						

Brewing Process
Dough in for a thick mash @ approx. 90 °F (32 °C). Rest 30 min. Infuse and raise temp continuously over 2 – 3 hrs to mash-out temp of 170 °F (77 °C). Lauter for at least 90 min. Boil 90 min. 1st hops @ 30 min. 2nd hops @ 75 min. 3rd hops @ 85 min. Whirlpool 30 min. Ferment @ 50 °F (10 °C) for 3 wks. Rack. Lager close to freezing point for at least 5 wks. Rack again, condition, package.

DID YOU KNOW ... ?
Until the late 19th century, breweries used natural ice, harvested in winter to keep their fermentation and storage cellars cold during the summer. For this they used to cut ice from frozen lakes or sprayed water on so-called ice gallows to make icicles. If you brewed in a climate where freezing was no common, you had to make warm-fermenting ales and drink them fast.

It was the invention of a German engineer, Carl von Linde, that finally allowed brewers to replace the traditional ice houses with mechanical refrigeration. The breakthrough came in 1873, when Linde, with the financial backing of Gabriel Sedlmayr, brew master at the Munich Spaten Brewery, completed his first working model of what was then called an ammonia cold machine.

Linde recognized that a compressed gas, when it is permitted to expand, or a solid when it is liquefied, absorbs heat from its surroundings. Ammonia, CO_2, Freon, or several other volatile chemicals can be used as refrigerants, as long as they lend themselves to alternating condensation and evaporation in a closed system. Linde used an electromotor to compress gaseous ammonia into a liquid. He then released it into the coils of a refrigeration compartment. There the ammonia reverted to its gaseous form and, in the process, drew heat from its environment. The motor then repeated the cycle by converting the ammonia gas back into a liquid, and so on and so on. Compression is best done away from the refrigerated area, because compression gives off heat.

Depending on the sources, different people, including Linde, have been credited with the invention of refrigeration, but it was Linde's work with the new technology and the enthusiastic support of brew master Sedlmayr that led to the universal embrace of refrigeration by the brewing industry. To this day, the compressors and evaporators in a modern brewery still work according to the same principles that Linde used in his first cold machine.

Old Ale

Beer culture of origin	England
AKA	Stock Ale, Strong Ale, Winter Warmer
Related Styles	Wee Heavy, Scotch Ale, Barley Wine, Belgian Strong Ale

Style Description

Like Barley Wine, Old Ale (AKA Stock Ale or Strong Ale) is traditionally fermented from the first, high-gravity runnings from the same mash in a partigyle brewing process, with plenty of grain insolubles in the wort. Stock Ale was one of the tree threads from which Porter was allegedly composed. A long recirculation time and a slow sparge usually improve the flavor quality and extract value of the wort.

An Old Ale usually improves with four to six months of aging, in wooden casks in the old days. It tends to be less dry in the finish than the equally alcoholic Barley Wine. Therefore, the saccharification rest should favor alpha-amylase for the production of a good amount of unfermentable sugars. The addition of brewing sugar is optional. The flavor of an Old Ale should be earthy and complex, perhaps reminiscent of an old Port. Hopping rates can vary from very mild to very bitter—from 20 to 60 BU, with very little hop aroma. For base malt, a portion of floor malt makes the brew more authentic. Interesting flavor variation: Age in toasted Port, Scotch, or Bourbon casks.

Specifications

OG	1.082 (20.5°P)		**BU**	50		**ABV**	8.2%
FG	1.020 (5°P)		**Color**	47.3 SRM/125 EBC		**ABW**	6.5%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	40	24.45	11.09	28.68	13.01	4.63	2.11
Weyermann® Bohemian Pilsner Floor Malt	40	24.45	11.09	28.68	13.01	4.63	2.11
Weyermann® Carabelge®	8	4.89	2.22	5.74	2.60	0.93	0.42
Weyermann® Smoked Malt	8	4.89	2.22	5.74	2.60	0.93	0.42
Weyermann® Roasted Barley (unmalted)	3	1.83	0.83	2.15	0.98	0.35	0.16
Weyermann® Carafa® II	1	0.61	0.28	0.72	0.33	0.12	0.05
Total Grain	100	61.13	27.73	71.70	32.52	11.56	5.27
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Goldings	5	11.80	335	13.8	392	2.2	63
Flavor: none	0	0	0	0	0	0	0
Aroma: Barth-Haas Goldings	5	5.90	167	6.9	196	1.1	32
Yeast	London-Style yeast						

Brewing Process

Multi-step infusion: Mash in @ 154 °F (68 °C); rest 60 min. Recirculate. Sparge with 180°F (8 °C) brewing liquor to raise mash temp to 168 °F ± 2 °F (76 °C ± 1 °C) for mash-out. Hold mash temp at that level. Adjust sparge water temp, if needed. Boil 90 min. 1st hops @ 30 min. 2nd hop at start of whirlpool. Whirlpool 30 min. Primary fermentation @ 60 °F –70 °F (16 °C – 21 °C), depending on yeast, for about 7 - 10 days. Rack. Secondary fermentation about 14 – 21 days. Rack again, condition for a wk. Package and age for 4 – 6 months.

DID YOU KNOW ... ?

The Germans have their Beer Purity Law, which was first decreed in 1516, in Bavaria. But, when it comes to beer law-making, the Brits are no slouches either. In fact, the first legal code in any Germanic language was written in Britain, by King Ethelbert, ruler of Kent, in his capital city of Canterbury, in 616 A.D. Ethelbert's laws not only contained a code of moral conduct that expressed his vision of a just social order, it also specified which behavior was not permitted in alehouses. One such stipulation listed the payments troublemakers had to make in restitution, if they caused anybody an injury while intoxicated. Likewise, King Ine of Wessex issued a code of laws in 694 in which he tried to contain the rampant spread of ale booths serving up inferior ales. Ine decreed that an alewife, pouring where she shouldn't, was to be punished by being dunked publicly into a trough of water, and her ale was to be given to the poor, free of charge.

DID YOU KNOW ... ?

Samuel Johnson, wrote most of his seminal *Dictionary of the English Language*, in 1775, in an alehouse along the Thames called *The Anchor Inn*. This inn is still at Bankside, on Park Street, in the Southwark District, a stone's throw from the London Bridge and the old London Hop Exchange. There, Johnson boozed it up with his friend Boswell. In *The Anchor Inn*, there is still a "Johnson's Bar," where this scribe once wrote: "A tavern chair is the throne of human felicity." But Boswell had a thoroughly antiquated understanding of the terms beer and ale. In his *Dictionary* he states that beer is a "liquor made from malt and hops," while ale is a "liquor made by infusing malt in hot water and fermenting the liquor." By 1775, however, all British ales were already made with hops!

Pale Ale, American

Beer culture of origin	United States
AKA	None
Related Styles	Pale Ale (English), IPA, Imperial or Double Pale Ale

Style Description

One of the key distinctions between English and American pale ales is the types of hops used for bittering and aroma. While Old World Pale Ale relies on such English stalwarts as East Kent Goldings and Fuggles, New World Pale Ales rely on Pacific Northwest hops. At the start of the American craft brew movement, that meant invariably Cascade. But Ahtanum, Amarillo®, Chinook, Cluster, Columbus, Galena, Warrior®, and Willamette, among others, are suitable, too, in either their bittering or aroma capacities.

A particularly interesting variation of an American session Pale Ale is the recipe below brewed with Galena for bittering and Willamette for aroma.

The American Pale Ale is a popular take-off platform for experimentation in malt and hop flavors as well as alcoholic strength. Frequently, it is also the basis for seasonal specials, including spiced ales and fruit ales.

Specifications

OG	1.046 (11.5 °P)		**BU**	34		**ABV**	4.8%
FG	1.010 (2.5 °P)		**Color**	7 SRM/17.4 EBC		**ABW**	3.8%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	70	23.20	10.53	27.22	12.35	4.39	2.00
Weyermann® Munich I	10	3.31	1.50	3.89	1.76	0.63	0.29
Weyermann® Diastatic Barley Malt	10	3.31	1.50	3.89	1.76	0.63	0.29
Weyermann® Caraamber®	10	3.31	1.50	3.89	1.76	0.63	0.29
Total Grain	100	33.15	15.04	38.88	17.64	6.27	2.86
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Cascade	5.75	4.75	135	5.6	158	0.9	25
Flavor: none	0	0.00	0	0.0	0	0.0	0
Aroma: Barth-Haas Amarillo®	9.5	7.22	205	8.5	240	1.4	39
Yeast	American "Chico"-Style ale yeast						

Brewing Process

Single infusion. Mash in with 7 gal of brewing liquor per a 1 bbl of expected net kettle volume (or 1 qt/1 lb of grist, dry weight) @ 154 °F (68 °C); rest 60 min . Recirculate. Sparge with 180°F (8 °C) brewing liquor to raise mash temp to 168 °F ± 2 °F (76 °C ± 1 °C) for mash-out. Hold mash temp at that level. Adjust sparge water

temp, if needed. Boil 60 min. 1st hops @ 5 min; 2nd hops @ 55 min. Whirlpool 30 min. 3rd hops @ start of whirlpool. Primary fermentation @ 60 °F –70 °F (16 °C – 21 °C), depending on yeast, for about 7 days. Rack. Secondary fermentation about 14 days. Rack again, condition for a wk. Package.

DID YOU KNOW ... ?

The struggle for the place of alcohol in American society pitched the breweries against crusading teetotalers. Here are the milestones of the struggle:

1826: Founding of the American Temperance Society
1873: Founding of the Women's Christian Temperance Union
1881: Kansas is the first state to go dry
1893: Founding of the Anti-Saloon League
Late 1800s: Almost 4,000 breweries in America
Right before Prohibition: Barely 500 breweries in America
1920: On January 17, passage of the 18th Amendment mandates Prohibition and forces the nation to be dry, by law. Alcohol production and distribution goes underground and become the province of the mob.
1933: On December, 5, repeal of the 18th by the 21st Amendment makes alcohol legal again.
After Prohibition: Fewer than 200 breweries left in America
1935: Passage of the Federal Alcohol Administration Act institutes the three-tier system and many states enact their own "blue laws"
1935 to 1975: Progressive consolidation of brew industry
1978: 42 breweries left in America
1980s: Start of the craft brew movement in America
2010: Approx. 1,500 mostly small, independent breweries (1,000 of those are brewpubs)

Pale Ale, English

Beer culture of origin	England
AKA	None
Related Styles	(Ordinary) Bitter, Burton Ale, Pale Ale, ESB (Extra Special Bitter)

Style Description

Hops were introduced to England by Flemish immigrants only in the 1400s, while on the Continent, hops had been in use as a beer flavoring for several centuries. The British were slow to catch on to the marvels and potential of hops. Perhaps the first truly hop-bitter English ale was the India Pale Ale (IPA), first brewed in the 1790s in London and later in Burton-on-Trent for the British colonies in what are now India, Pakistan, Bangladesh, and Sri Lanka.

In the 1830s, the large English breweries adopted this style also for the domestic market, for which they reduced its hop loading, renamed it "Bitter," and offered it in three strengths: "Bitter" at roughly 9 °P (approx. OG mid-1.030s); "Best Bitter" at roughly 11 °P (approx. OG mid-1.040s); and "Extra Special Bitter" (ESB), a strong Bitter at roughly 13 °P – 14 °P (OG low to mid-1.050s). Starting in the 1860s, bottled beer entered the British market, and bottled Bitters came to be called "Pale Ales" (without "India" prefix), while only Bitters served in casks in pubs kept their traditional name.

English Pale Ales are slightly fruity, mildly estery, single-infusion brews with delicate British-style hop notes and a dry finish. They are fermented with fairly "dusty" (not very flocculent) yeast.

Specifications

OG	1.052 (13 °P)		**BU**	40		**ABV**	5.3%
FG	1.013 (3.25 °P)		**Color**	7 SRM/17.4 EBC		**ABW**	4.2%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	92.5	34.67	15.73	40.67	18.45	6.56	2.99
Weyermann® Caraamber®	7.5	3.02	1.37	3.54	1.60	0.57	0.26
Total Grain	100	37.69	17.09	44.21	20.05	7.13	3.25
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Goldings	5	8.65	245	10.2	288	1.6	46
Flavor: none	0	0	0	0	0	0	0
Aroma: Barth-Haas Goldings	5	5.37	152	6.3	179	1.0	29
Yeast	London-style ale yeast						

Brewing Process

Single infusion. Mash in with 7 gal of brewing liquor per a 1 bbl of net kettle volume @ 154 °F (68 °C). Rest 45 min. Recirculate. Sparge with 180°F (8 °C) brewing liquor to

raise temp o 168 °F ± 2 °F (76 °C ± 1 °C) for mash-out. Hold mash temp at that level. Adjust sparge water temp, if needed. Boil 60 min. 1st hops @ 5 min; 2nd hops @ 55 min. 3rd hops @ start of whirlpool. Whirlpool 30 min. Primary fermentation @ 60 °F –70 °F (16 °C – 21 °C), depending on yeast, for about 7 days. Rack. Secondary fermentation about 14 days. Rack again. Condition for 1 wk. Package.

DID YOU KNOW ... ?

The English epic Beowulf, composed by an Anglican bard in the early 8th century, tells how serious boozing was considered an integral part of life—almost a religious ritual—during the Middle Ages, when ale booths lined the old Roman roads of Britain, and the Christian kings passed pious legal codes in a vain attempt to regulate the hearty drinking of their subjects.

By the end of the first millennium, drunkenness had become so rampant that King Edgar (he reigned between 959 and 975) decreed, on the advice of Archbishop Dunstan of Canterbury, that any village or town was limited to only one alehouse. He also ordered that ale may be served only in drinking horns with pins fastened on the inside at prescribed intervals so that, the law read, "whoever should drink beyond these marks at one draught should be obnoxious to a severe punishment."

With the Norman Conquest of Britain, in 1066, by the wine-drinking French, things did not change much. True, wine became the poison of choice for the nobles, but beer remained the favored quaff of the toiling lower orders, the now-subjugated Anglo-Saxons. A telling quote from the scholarly William of Malmesbury, written in the early 1100s, laments the deplorable lack of sobriety among the commoners: "Drinking in particular was a universal practice, in which they [the Britons] passed entire nights as well as days. They consumed their whole substance in mean and despicable houses, unlike the Normans and French, who in noble and splendid mansions lived with frugality ... They (the Britons) became accustomed to eat until they became surfeited, and to drink until they were sick."

Pils/Pilsener, Northern German

Beer culture of origin	Germany
AKA	Edelpils
Related Styles	Czech Pilsner, Dortmund Export, Bavarian Helles, European Pilsner, American Lager

Style Description

A northern German Pils is mostly characterized by its straw-blond appearance—a beer simply could not get much paler without the use of adjuncts. The classic version has an assertive citrus-like, up-front, noble-hop kick from as many as 40 BU. Many mass-produced modern versions, on the other hand, now have a much reduced bitterness (most between 28 and 36 BU, with some as low as 23 BU).

A Pils is well-attenuated and has a very dry, crisp and refreshing finish, with a spritzy effervescence and next to no fruitiness, esters or diacetyl. It has a sturdy, long-lasting head. The Northern German Pils is an adaptation of the original Czech Pilsner Urquell of 1842.

The first Pilsner-style beer in Germany was brewed in 1872, by the Aktienbrauerei Zum Bierkeller of Radeberg near Dresden, the capital of the German State of Saxony, which borders the Czech Republic. This brewery has since been renamed Radeberger. In line with German grammar, the adjective "Pilsner"—without the middle "e"—refers to anything made in Pilsen, whereas "Pilsener"—with the middle "e"—denotes anything that is like a thing from Pilsen but not made there. Not all German breweries, however, label their Pilseners (or Pils) in line with this etymological distinction.

Specifications

OG	1.048 (12 °P)		**BU**	44		**ABV**	5%
FG	1.010 (2.5 °P)		**Color**	2 SRM/4.2 EBC		**ABW**	4%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Extra Pale Premium Pilsner	90	31.19	14.15	36.59	16.60	5.90	2.69
Weyermann® Carafoam®	10	3.47	1.57	4.07	1.84	0.66	0.30
Total Grain	100	34.66	15.72	40.65	18.44	6.56	2.99
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Tettnanger	4	4.64	132	5.4	154	0.9	25
Flavor: Barth-Haas Tettnanger	4	6.49	184	7.6	216	1.2	35
Aroma: Barth-Haas Hallertauer Mittelfrüh	4.25	6.49	184	7.6	216	1.2	35
Yeast	German or Danish dry-fermenting lager yeast						

Brewing Process

Multi-step infusion. Mash in @ 122 °F (50 °C); rest 30 min. Raise temp to 144 °F (62 °C). Rest 20 min. Raise temp to 162 °F (72 °C). Rest 20 min. Raise temp to mash-out @ 172 °F (78 °C). Lauter 90 min. Boil for 90 min. 1st hops @ 10 min; 2nd hops @ 30 min; 3rd hops @ 75 min. Fermentation temp @ 50 °F – 59 °F (10 °C – 15 °C), depending on yeast strain. Rack @ terminal gravity. Reduce temp to 34°F (1°C). Lager for 12 wks. Rack. Condition. Package.

DID YOU KNOW ... ?

Until the 16th century, government regulations like the *Reinheitsgebot* and the summer brewing prohibition were the driving forces behind the changes in brewing practices, particularly in Bavaria. But even after 1516, when only barley, hops and water were used, the result of the brewing process was still a matter of luck. Fermentation was commonly regarded as a mystical and spontaneous process, a form of putrefaction. The milky substance that settled out at the bottom of the fermenter or formed a flocculent layer at the top of the brew was not recognized for what it was (yeast). Instead, it was considered an impurity, a by-product of putrefaction that better be discarded. It was not known that this very "by-product" made alcoholic fermentation happen.

As any brewers can guess, in practice, any number of airborne yeast strains, from lager yeasts (*Saccharomyces uvarum*) to ale yeasts (*Saccharomyces cerevisiae*) to wild yeasts, could be—and probably were present in any given brew and, most likely, all were infected with bacteria. Which yeast became dominant and defined the character of the beer depended largely on the ambient temperature. The warmer the cellar, the more likely the beer would be an ale. Off-flavors in beer and a short shelf life were probably the rule rather than the exception, especially for beers brewed during the hot summer months.

A theoretical understanding of the metabolism of yeast, of the differences between warm and cold fermenting yeasts--and of the differences between the beers they produce--had to wait until the late 19th century. It was the German physician and chemist Andreas Libau, a.k.a. Libavius (around 1560 - 1616), who was the first to point out that fermentation and putrefaction were different processes. He knew about carbon dioxide (CO_2) and was the first to describe a method of distilling alcohol. It is doubtful that any brewer of Libavius' time read his heavy tome, *Alchymia* (published in Latin, in 1606), which was the first systematic text book of chemistry, but later scientists did. Libavius laid the conceptual foundation for all subsequent discoveries about the true nature of fermentation.

Pilsner, American

Beer culture of origin	United States
AKA	None
Related Styles	American Lager, American Light Lager, German Pils or Pilsener, Czech Pilsner, Bavarian Helles, European Pilsner

Style Description

American Pilsner is similar to a European Pilsner, except it is often made with about 30 percent adjuncts (corn and/or rice). The recipe below is for an all-malt version. If adjuncts are desired, replace a portion of the base malts accordingly. Hop bitterness is noticeable and usually noble. Aroma hops is sometimes added to whirlpool.

Specifications

OG	1.054 (13.5 °P)		**BU**	35		**ABV**	5.6%
FG	1.012 (3 °P)		**Color**	3 SRM/6.7 EBC		**ABW**	4.4%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Extra Pale Premium Pilsner	80	31.37	14.23	36.80	16.69	5.93	2.70
Weyermann® Pale Ale	15	5.88	2.67	6.90	3.13	1.11	0.51
Weyermann® Acidulated	5	1.96	0.89	2.30	1.04	0.37	0.17
Total Grain	100	39.22	17.79	46.00	20.86	7.42	3.38
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Hallertauer Barth-Haas Taurus	15.5	9.18	260	10.8	305	1.7	49
Flavor: none	0	0	0	0	0	0	0
Aroma: Barth-Haas Tettnanger	4.5	2.00	57	2.3	66	0.4	11
Yeast	American lager yeast						

Brewing Process

Multi-step infusion. Mash in @ 122 °F (50 °C).Rest 30 minutes. Raise temp to 144 °F (62 °C). Rest 20 min. Raise temp to 162 °F (72 °C). Rest 20 min. Raise temp to mash-out @ 172 °F (78 °C). Lauter 90 min. Boil for 75 minutes. 1st hops @ 15 min. 2nd hops in whirlpool. Fermentation temp @ 54°F (12°C). Rack when gravity @ about 4.5 °P (1.018). Reduce temp to 34°F (1°C); lager for 3 – 4 wks. Rack and condition for 2 days. Note: If adjuncts are used, they need to be cooked separately and added to the mash at mash-in.

Pilsner, Classic

Beer culture of origin	Czech Republic, Bohemia
AKA	None
Related Styles	Modern Czech Pilsner, German Pils or Pilsener, Dortmund Export, Bavarian Helles, European Pilsner, American Lager

Style Description

The original Bohemian Pilsner was brewed by Josef Groll, Bavarian brew master, in 1842. Groll was then in the employ of the Měšťanský Pivovar (Burgher Brewery) in Plzeň (Pilsen), Bohemia. The new beer, the world's first blond lager, was called Plzeňský Prazdroj, or, more commonly, by its German name of Pilsner Urquell, because Bohemia was then part of the German-speaking Austro-Hungarian Empire (it is now part of the Czech Republic). "Ur" is German for "original," and "Quell," for "source," "spring," or "well."

This "original source" has since become the foundation brew not only for the modern Czech Pilsner, but also for many adaptations throughout the world, including the Bavarian Helles, the Northern German Pils or Pilsener, the Dortmund Export, the Scandinavian and Dutch blond lagers, even the mass-produced American lagers. In fact, Pilsners in one form or another are the most common beers in the world, probably with a global market share of about 90 percent. The first Pilsner—here called "Classic"—differed slightly but significantly from all modern Czech and global Pilsners in four respects:

The entire grist was floor malted and made only from indigenous, two-row, Czech Haná spring barley. Today, the Haná barley of the mid-19th century is no longer available in its pure form. However, Haná has given its genes to many of the best modern brewing barleys, including Bojos and Tolar, two Czech varieties used to hand-make Weyermann® Bohemian Pilsner Floor Malt in a 19th-century floor maltery with an 1890s, two-tier, indirect-fired kiln. Given the likely uneven composition of the malt used by Groll, the grain bill in this recipe includes about 3.5 percent of Weyermann® Carabohemian®. Because of the extremely soft, low-pH, low-carbonate, low-sulfate Pilsner water, it also contains about five percent of Weyermann® Acidulated Malt.

The yeast in that original brew was Bavarian. The Bavarian yeast of Groll's days has since mutated in its new home into a distinct Czech strain that ferments at a slightly higher temperature and produces slightly more diacetyl than its Bavarian progenitor strain. A modern Czech Pilsner yeast, therefore, would be an anachronism in an authentic classic Czech Pilsner recipe.

The Groll mash was a triple decoction, a method that is now rarely employed. Yet, the authentic recipe below is formulated for a triple decoction mash.

The 1842 beer was brewed with more Saaz hops for bittering and aroma than is now common. The bittering in the recipe below, therefore, is a substantial 40 BU.

Specifications

OG	1.052 (13 °P)		**BU**	40		**ABV**	5.3%
FG	1.012 (3 °P)		**Color**	6.3 SRM/15.5 EBC		**ABW**	4.2%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Bohemian Pilsner Floor Malt	91.5	34.48	15.64	40.45	18.35	6.52	2.97
Weyermann® Acidulated	5	1.88	0.85	2.21	1.00	0.36	0.16
Weyermann® Carabohemian®	3.5	1.32	0.60	1.55	0.70	0.25	0.11
Total Grain	100	37.69	17.09	44.21	20.05	7.13	3.25
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Saaz	4.5	1.92	55	2.3	64	0.4	10
Flavor: Barth-Haas Saaz	4.5	6.98	198	8.2	232	1.3	37
Aroma: Barth-Haas Saaz	4.5	3.41	97	4.0	113	0.6	18
Yeast	Bavarian lager yeast						

Brewing Process

Triple decoction. Depending on the composition of the local water, boil the brewing liquor to precipitate some carbonate hardness. Rack the liquor, leaving about 10 percent of the water behind. This imitates the soft, low-pH, low-carbonate, low-sulfate water of the Pilsner region. Mash in the main mash at @ 100 °F (38 °C); rest 30 minutes for proper grist hydration and activation of phytase for some mash acidification.

Draw 1st decoction (one-third of main mash). Heat decoction (10 – 15 min). Rest decoction @ 149 °F (65 °C) for 30 min. Heat decoction (10 min). Rest decoction @ 162 °F (72 °C) for 10 min. Heat decoction (10 min). Boil decoction @ 212 °F (100 °C) for 10 min. Reintroduce decoction to main mash. Rest main mash @ 149 °F (65 °C) for 10 min.

Draw 2nd decoction (one-third of main mash). Heat decoction (5 – 10 min). Rest decoction @ 162 °F (72 °C) for 10 min. Heat decoction (10 min). Boil decoction @ 212 °F (100 °C) for 10 min. Reintroduce decoction to main mash. Rest main mash @ 162 °F (72 °C) for 10 min.

Draw 3rd decoction (one-third of main mash). Heat decoction (10 min). Boil decoction @ 212 °F (100 °C) for 10 min. Reintroduce decoction to main mash. Rest main mash @ 171 °F (77 °C) for 15 min. Recirculate (5 min). Start lautering and sparging slowly (!) for about 3 hrs until kettle full. Kettle time: 90 min. Bitter hops after 10 min; flavor hops after 30 min; aroma hops after 75. Whirlpool 30 min. Primary fermentation in open fermenter for 4 days @ approx. 55 °F (13 °C). Transfer to closed tank for pressure build-up for 3 to 5 days. Rack into horizontal tank on day 7 or 8. Lager for 4 wks @ 30.5 °F (-0.8 °C). Package.

Pilsner, Czech, Modern (I)

Beer culture of origin	Czech Republic, Bohemia
AKA	None
Related Styles	German Pils or Pilsener, Dortmund Export, Bavarian Helles, European Pilsner, American Lager

Style Description

The original Bohemian Pilsner, brewed in 1842 in the Bohemian City of Plzeň (Pilsen), now in the Czech Republic, was the world's first blond lager. About nine out of 10 beers today are derived from this revolutionary brew. The recipe below is a simple modern adaptation of this brew, with a small addition of Weyermann® Acidulated Malt in the grist to simulate the soft, acidic brewing liquor of Pilsen.

Specifications

OG	1.047 (11.75 °P)		**BU**	27		**ABV**	4.8%
FG	1.011 (2.75 °P)		**Color**	2.35 SRM/5 EBC		**ABW**	3.8%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Bohemian Pilsner	95	32.21	14.61	37.78	17.14	6.09	2.78
Weyermann® Acidulated	5	1.70	0.77	1.99	0.90	0.32	0.15
Total Grain	100	33.90	15.38	39.77	18.04	6.41	2.92
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Saaz	4.5	5.43	154	6.4	181	1.0	29
Flavor: none	0	0	0	0	0	0	0
Aroma: Barth-Haas Saaz	4.5	3.54	100	4.2	118	0.7	19
Yeast	Czech lager yeast						

Brewing Process

Multi-step infusion. Mash in @ 122 °F (50 °C); rest 30 min. Raise temp to 144 °F (62 °C); rest 20 min. Raise temp to 162 °F (72 °C); rest 20 min. Raise temp to mash-out @ 172 °F (78 °C). Lauter 90 min. Boil for 75 minutes. 1st hops @ 15 min; 2nd hops @ 60 min. Fermentation temp @ 54°F (12°C). Rack when gravity @ about 4.5 °P (1.018). Reduce temp to 34°F (1°C); lager for 3 – 4 wks. Rack and condition for 2 days.

DID YOU KNOW ... ?

The British chemist Cornelius O'Sullivan was the first to figure out how enzymes work. As biochemical catalysts, enzymes convert, under the influence of moisture and warmth, unfermentable starches into fermentable sugars. O'Sullivan published his findings in 1890 and, thus, demystified the riddle of the mash. He supplied us with the last missing link in our understanding of the carbon chain from the carbon dioxide in the air, to the starch in the grain, to the sugar in the wort, to the alcohol in the fermented beer

Pilsner, Czech, Modern (II)

Beer culture of origin	Czech Republic, Bohemia
AKA	None
Related Styles	German Pils or Pilsener, Dortmund Export, Bavarian Helles, European Pilsner, American Lager

Style Description

The original Bohemian Pilsner, brewed in 1842 in the Bohemian City of Plzeň (Pilsen), now in the Czech Republic, was the world's first blond lager. About nine out of 10 beers today are derived from this revolutionary brew. The recipe below is a modern adaptation of this brew, with a few specialty grains for a deep-golden hue as well as a small addition of Weyermann® Acidulated Malt to simulate the soft, acidic brewing liquor of Pilsen.

Specifications

OG	1.047 (11.75 °P)		**BU**	24		**ABV**	4.8%
FG	1.011 (2.75 °P)		**Color**	3.3 SRM/7.6 EBC		**ABW**	3.8%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Bohemian Pilsner Malt	60	20.34	9.23	23.86	10.82	3.85	1.75
Weyermann® Carafoam®	20	6.78	3.08	7.95	3.61	1.28	0.58
Weyermann® Munich I	15	5.09	2.31	5.97	2.71	0.96	0.44
Weyermann® Acidulated	5	1.70	0.77	1.99	0.90	0.32	0.15
Total Grain	100	33.90	15.38	39.77	18.04	6.41	2.92
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Saaz	4.5	4.83	137	5.7	160	0.9	26
Flavor: none	0	0	0	0	0	0	0
Aroma: Barth-Haas Saaz	4.5	3.15	89	3.7	105	0.6	17
Yeast	Czech lager yeast						

Brewing Process

Multi-step infusion. Mash in @ 122 °F (50 °C); rest 30 min. Raise temp to 144 °F (62 °C); rest 20 min. Raise temp to 162 °F (72 °C); rest 20 min. Raise temp to mash-out @ 172 °F (78 °C). Lauter 90 min. Boil for 75 minutes. 1st hops @ 15 min; 2nd hops @ 60 min. Fermentation temp @ 54°F (12°C). Rack when gravity @ about 4.5 °P (1.018). Reduce temp to 34°F (1°C); lager for 3 – 4 wks. Rack and condition for 2 days.

Pilsner, Czech, Modern (III)

Beer culture of origin	Czech Republic, Bohemia
AKA	None
Related Styles	German Pils or Pilsener, Dortmund Export, Bavarian Helles, European Pilsner, American Lager

Style Description

The original Bohemian Pilsner, brewed in 1842 in the Bohemian City of Plzeň (Pilsen), now in the Czech Republic, was the world's first blond lager. About nine out of 10 beers today are derived from this revolutionary brew. The recipe below is a modern adaptation similar to several mass-produced Czech Pilsners available worldwide today. The grain bill is made up just of base malt and the hop bitterness and aroma are very restrained for an easy quaffing brew. Instead of Weyermann® Bohemian Pilsner Floor Malt you can also use Weyermann® Bohemian Pilsner Malt, Weyermann® Well-Modified Pilsner Malt, or, for a straw-blond brew, Weyermann® Extra Pale Premium Pilsner Malt.

Specifications

OG	1.047 (11.75 °P)		**BU**	24		**ABV**	4.8%
FG	1.011 (2.75 °P)		**Color**	2 SRM/4.1 EBC		**ABW**	3.8%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Bohemian Pilsner Floor Malt	100	33.90	15.38	39.77	18.04	6.41	2.92
Total Grain	100	33.90	15.38	39.77	18.04	6.41	2.92
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Saaz	4.5	4.02	114	4.7	134	0.8	22
Flavor: none	0	0	0	0	0	0	0
Aroma: Barth-Haas Saaz	4.5	2.62	74	3.1	87	0.5	14
Yeast	Czech lager yeast						

Brewing Process

Multi-step infusion. Mash in @ 122 °F (50 °C); rest 30 min. Raise temp to 144 °F (62 °C); rest 20 min. Raise temp to 162 °F (72 °C). Rest 20 min. Raise temp to mash-out @ 172 °F (78 °C). Lauter 90 min. Boil for 75 minutes. 1st hops @ 15 min; 2nd hops @ 60 min. Fermentation temp @ 54°F (12°C). Rack when gravity @ about 4.5 °P (1.018). Reduce temp to 34°F (1°C); lager for 3 – 4 wks. Rack and condition for 2 days.

Porter, Baltic

Beer culture of origin	England
AKA	None
Related Styles	Robust Porter, Russian Imperial Stout

Style Description

The Baltic Porter is one of two British brews developed specifically for trade with Scandinavia; Poland; the Baltic states of Latvia, Lithuania, and Estonia; and the Russian Empire of the Czar. The other northern trading brew is the Russian Imperial Stout. Baltic Porter was brewed a bit stronger than a Brown Porters destined for British home consumption—usually between 5.5 and 7.5 percent alcohol by volume. It is also a bit hoppier and a bit toastier to better survive the long, rough ocean voyage. For bittering and flavor, the recipe below uses East Kent Goldings; for aroma, Styrian Goldings.

Specifications

OG	1.069 (17.25 °P)		**BU**	35		**ABV**	7.2%
FG	1.015 (3.75 °P)		**Color**	62.7 SRM/164.9 EBC		**ABW**	5.7%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	60	33.03	14.98	38.75	17.57	6.25	2.85
Weyermann® Caramunich® III	15	7.62	3.46	8.94	4.06	1.44	0.66
Weyermann® Carabohemian®	10	5.08	2.31	5.96	2.70	0.96	0.44
Weyermann® Carared®	6	3.05	1.38	3.58	1.62	0.58	0.26
Weyermann® Carafa® I	4	2.03	0.92	2.38	1.08	0.38	0.18
Total Grain	100	50.82	23.05	59.61	27.04	9.61	4.38
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Goldings	5	3.06	87	3.6	102	0.6	16
Flavor: Barth-Haas Goldings	5	9.18	260	10.8	305	1.7	49
Aroma: Barth-Haas Styrian Goldings	5.25	9.18	260	10.8	305	1.7	49
Yeast	London-style ale yeast						

Brewing Process

Single infusion. Mash in with 7 gal of brewing liquor per a 1 bbl of net kettle volume @ 154 °F (68 °C). Rest 45 min. Recirculate. Sparge with 180°F (8 °C) brewing liquor to raise mash temp to 168 °F ± 2 °F (76 °C ± 1 °C) for mash-out. Hold mash temp at that level. Adjust sparge water temp, if needed. Boil 60 min. 1st hops @ 5 min; 2nd hops @ 55 min. 3rd hops @ start of whirlpool. Whirlpool 30 min. Primary-ferment @ 60 °F – 70 °F (16 °C – 21 °C), depending on yeast, for about 7 days. Rack. Secondary-ferment about 14 days. Rack again, condition for 1 wk. Package.

Porter, Classic

Beer culture of origin	England
AKA	Entire Butt, Historical/Original Porter
Related Styles	Brown/London Porter, Robust Porter, Baltic Porter

Style Description

Porter emerged in England in the early 1720s, allegedly as a "three-thread" blend of three ales from different casks, in the pub. The threads were usually a strong, "two-penny" Old or Stock Ale; a well-hopped ale; and a "small," usually low-hopped ale from the final runnings of a partigyle brew. When brewery made this brew as a single unblended ale, it was referred to as an entire butt, meaning that it could be served in a pub entirely from one cask. The brew was very popular among London dock workers and porters, who gave the brew its name. At the beginning, this rough-neck Porter was much stronger than the London Porters made today. The original gravity was probably between 15 °P and 17.5 °P (OG 1.060 and 1.070). They are also somewhat rough and smoky, because they were made from the standard brown malt of the day, also known as "blown" malt, which was kilned over an open wooden fire, imparting the some burnt roastiness to the grain and the beer. A modern grain bill that attempts to replicate this classic Porter, therefore, ought to contain some roasted malt, such a Weyermann® Carafa III as well as some smoked malt.

Specifications

OG	1.068 (17 °P)		**BU**	24		**ABV**	7.3%
FG	1.013 (2.75 °P)		**Color**	45 SRM/118.1 EBC		**ABW**	5.8%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	80	40.03	18.16	46.95	21.30	7.57	3.45
Weyermann® Smoked Malt	15	8.01	3.63	9.39	4.26	1.51	0.69
Weyermann® Carafa® III	4	2.00	0.91	2.35	1.06	0.38	0.17
Total Grain	100	50.03	22.69	58.69	26.62	9.47	4.31
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Fuggles	4.3	6.81	193	8.0	227	1.3	37
Flavor: none	0	0	0	0	0	0	0
Aroma: none	0	0	0	0	0	0	0
Yeast	London-style ale yeast						

Brewing Process

Single infusion. Mash in @ 154 °F (68 °C). Rest 45 min. Recirculate. Sparge with 180°F (8 °C) brewing liquor to raise mash temp to 168 °F ± 2 °F (76 °C ± 1 °C) for mash-out. Hold mash temp at that level. Boil 60 min. Hops @ 15 min. Whirlpool 30 min. Primary fermentation @ 60 °F – 70 °F (16 °C – 21 °C), depending on yeast, for about 7 days. Rack. Secondary-ferment at same temp about 14 days. Rack again, condition for a wk. Package.

Porter, Dry

Beer culture of origin	Ireland
AKA	Irish Porter
Related Styles	London/Brown Porter, Robust Porter, Irish Stout

Style Description

Which came first, the chicken or the egg? The Stout or the Porter? While the answer to the chicken-and-egg riddle sends most people into metaphysical nirvana, the Stout vs. Porter issue is clear-cut answer: The English Porter came first. It was then made "stouter," which is how the Stout got its name. But in another adaptation, it became both leaner and drier instead of stouter—which is how it is presented below. Dry Porter is essentially a very simple English Porter from the start of the Industrial Revolution, with clean notes of chocolate and roasted malt, but less alcohol.

Specifications

OG	1.044 (11 °P)		**BU**	24		**ABV**	4.4%
FG	1.011 (2.75 °P)		**Color**	32 SRM/83.7 EBC		**ABW**	3.5%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	82	25.95	11.77	30.44	13.81	4.91	2.24
Weyermann® Carabohemian®	15	4.75	2.15	5.57	2.53	0.90	0.41
Weyermann® Carafa® II	3	0.95	0.43	1.11	0.51	0.18	0.08
Total Grain	100	31.65	14.35	37.12	16.84	5.99	2.73
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Fuggles	4.3	6.59	187	7.7	219	1.2	35
Flavor: None	0	0	0	0	0	0	0
Aroma: None	0	0	0	0	0	0	0
Yeast	Irish-style dry-finishing ale yeast						

Brewing Process

Single infusion. Mash in @ a liquor-to-grist ratio of about 3:1 by dry weight @ 153 °F (67 °C); rest 90 min. Recirculate. Raise temp to 168 °F (76 °C). Sparge slowly with 170 °F (77 °C) water until kettle full. Boil 90 min. Hops @ 30 min. Whirlpool 30 min. Fermentation @ roughly 66 °F (19 °C) for about10 days. Rack and condition for about 14 days. Rack. Package.

DID YOU KNOW ... ?

... it was during the Viking period in Britain and Ireland that the Celtic term for beer, *cwrw*, began to be replaced by the Norse term *öl*, from which derives the modern English term *"ale?"*

Porter, German

Beer culture of origin	Germany
AKA	None
Related Styles	Schwarzbier

Style Description

Yes, there is such a brew as a German Porter, but it is extremely rare. It originated in the early 20th century, when a few German brewers tried to create an indigenous competitor to the London Porter which was then gaining friends on the Continent. After the Second World War, the brew survived mostly in what became East Germany, where many breweries let the beer undergo a secondary fermentation with Brettanomyces. In West Germany, on the other hand, Porter was fermented with yeast only.

The original English Porter is, of course, a dark ale that was first created in London in the 18th century. It is fairly dry, slightly acrid, and made in part from roasted malts. The German version, by contrast, is decidedly "Germanified." Instead of an ale, it is a lager. In both flavor and brewing process, it resembles more a Schwarzbier than the English model. The German Porter should have between 5.8 and 7.2 percent alcohol by volume, which is stronger than virtually all English Porters. For bittering, flavor, and aroma, the German version relies on zesty noble instead of instead of floral English hops. The recipe below uses Herkules (12 – 17 %AA) for bittering, Northern Brewer (6 – 10 %AA) for flavor, and Tettnanger (2.5 – 5.5 %AA) for aroma. Liberty (3 – 5 %AA) would be suitable, too. Finally, unlike the English Porter, which is a fast turn-around ale, the German Porter is, of course, lagered for six weeks in a cool cellar. The result is an interesting, but very rare combination of British-ale complexity and German-lager drinkability.

Specifications

OG	1.057 (14.25 °P)		**BU**	30		**ABV**	5.8%
FG	1.013 (3.25 °P)		**Color**	57 SRM/150 EBC		**ABW**	4.6%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pilsner	54	22.41	10.17	26.29	11.93	4.24	1.93
Weyermann® Munich II	40	16.60	7.53	19.48	8.83	3.14	1.43
Weyermann® Carafa® III Special	6	2.49	1.13	2.92	1.33	0.47	0.21
Total Grain	100	41.51	18.83	48.69	22.08	7.85	3.58
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Herkules	9.5	2.68	76	3.1	89	0.5	14
Flavor: Barth-Haas Northern Brewer	8	1.86	53	2.2	62	0.4	10
Aroma: Barth-Haas Tettnanger	4	3.73	106	4.4	124	0.7	20
Yeast	Bavarian-style lager yeast						

Brewing Process

Multi-step infusion. Mash in @ 122 °F (50 °C). Rest 20 min. Raise temp to 147 °F (64°C). Rest 100 min. Raise temp to 162 °F (72°C) Rest 30 min. Raise to 169 °F (76°C). Rest 5 min. Lautering for 2 hrs. Boil 2 hrs. 1st hops @ 60 min. 2nd hops @ 105 min. 3rd hops @ 115 min. Pitch @ 48 °F (9°C). Total primary fermentation 6 – 7 days. At 1.026 (6.5 °P), close tank, raise tank temp to 52 °F (11 °C), and maintain pressure @ 0.6 bar (8 psi). At 1.018 (<5 °P), raise tank to diacetyl rest temp of 55 °F (13°C) for 3 days. Rack. Crash temp in 24 hrs to 30 °F (-1 °C). Cold-condition for 10 days. Package on day 28.

DID YOU KNOW ... ?

In the early 19th century, Porter became so popular in England that brewers had a hard time keeping up with demand. Not surprisingly, their solution was to expand and to construct ever bigger brew houses and fermenters to cash in on the seemingly unquenchable thirst of this nourishing brew.

In those days, fermenters were invariably made of wood. And as the demand for Porter grew so did the size of the vats. The Meux Brewery in central London, at Tottenham Court Road and Oxford Street, established in 1764, famously owned a marvel of construction at the time, the world's biggest beer fermenter with a reported capacity of 860,000 gallons (more than 27,000 bbl or 32,500 hl). These vats were so huge that breweries held dinners for their patrons inside them, when they were empty between brews.

On October 16, 1814, the unthinkable, yet probably inevitable, happened: The metal hoops holding one of the Meux Brewery vats with 3,555 barrels of 10-month old Porter together snapped. The escaping beer caused the other vats in the building to rupture, too, and a tidal wave of rushing Porter flooded the streets in the neighborhood. The flood of brew crushed everything in its path, sweeping along houses, horses, wagons, and people. Once the flow had spent itself, eight people were found dead. Seven had drowned in beer, while one died from alcohol poisoning as he heedlessly drank without limit from the river of precious libation.

The brewery was torn down in 1922, and today, a theater is on the site where the brewery once was.

Porter, London

Beer culture of origin	England
AKA	Brown Porter
Related Styles	Brown Ale, Scottish Ale, Old Ale, Porter, Stout

Style Description

Porter emerged in England in the early 1720s, just before the Industrial Revolution. It rose to become the biggest selling English beer style at the height of the British Empire near the end of the 19th century. But by the 1930s, it had all but disappeared. It was only revived by the North American craft brew movement in the late 20th century. Thus is the rise, and fall, and rise again, of the Porter through a turbulent three centuries, during which its character changed dramatically, as brewing ingredients, malting and brewing technology, and consumer tastes evolved. To speak of Porter in the singular, therefore, is not meaningful. Rather there are several clearly distinguishable variations on the Porter theme, known under such names as Brown, London, Irish, Robust, Double, Baltic, Imperial, and Dry, not to mention its North American Double, Imperial and Double Imperial interpretations. Below is a Porter which was popular around the turn of the 18th to the 19th century.

Specifications

OG	1.054 (13.5 °P)		**BU**	32		**ABV**	5.6%
FG	1.012 (3 °P)		**Color**	28.1 SRM/73.3 EBC		**ABW**	4.4%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	60	12.94	5.87	15.18	6.88	2.45	1.12
Weyermann® Carared®	15	12.94	5.87	15.18	6.88	2.45	1.12
Weyermann® Caraamber®	10	12.94	5.87	15.18	6.88	2.45	1.12
Weyermann® Carafa® I	10	0.39	0.18	0.46	0.21	0.07	0.03
Total Grain	100	39.21	17.79	46.00	20.86	7.42	3.38
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Goldings	5	6.20	176	7.3	206	1.2	33
Flavor: None	0	0	0	0	0	0	0
Aroma: Barth-Haas Goldings	5	7.81	221	9.2	260	1.5	42
Yeast	London-style ale yeast						

Brewing Process

Single infusion. Mash in with 7 gal of brewing liquor per a 1 bbl of net kettle volume @ 154 °F (68 °C)Rest 45 min. Recirculate. Sparge with 180°F (8 °C) brewing liquor to raise mash temp to 168 °F ± 2 °F (76 °C ± 1 °C) for mash-out. Hold mash temp at that level. Adjust sparge water temp, if needed. Boil 70 min. 1st hops @ 15 min; 2nd hops @ 65 min. Whirlpool 30 min. Primary fermentation @ 60 °F –70 °F (16 °C – 21 °C), depending on yeast, for about 7 days. Rack. Secondary fermentation about 14 days. Rack again, condition for a wk. Package.

Porter, Robust

Beer culture of origin	England
AKA	None
Related Styles	Brown Porter, Stout

Style Description

Near the end of Queen Victoria's long reign, as the 19th century was coming to a close, the Robust Porter split off from the standard London or Brown Porter. The Porter, long a brew of working class lineage and favored by the rough, hearty, and robust strand of the British social fabric, seemed to be just a touch too rough for the more gentile denizens of refined Victorian society. A gentleman might want his dark ale, but it had to be a bit more upscale. Strange then that the upper-crust Porter that evolved came to be known as "robust," a term more workman- than gentleman-like!

The Robust Porter is rich and coffee-accented. Its finish is slightly sweet, not dry. In spite of the dark malts in the mash, this beer should never finish like an Irish stout. A single infusion is sufficient, but the saccharification rest temperature should be closer to 155°F (68°C) than, say, to 148 °F – 152 °F (64 °C –67 °C), at which most British ales are mashed. For bittering, the recipe below uses the high-alpha Magnum. But a traditional, lower-alpha English hop variety would be suitable as well. For flavor, Santiam adds a slight note of citrus to the brew. It can be substituted with Tettnanger or Fuggles. For aroma, the recipe below uses Glacier in the whirlpool. It can be replaced it with Fuggles, Styrian Goldings, or Willamette.

Specifications

OG	1.058 (14.5 °P)		**BU**	32		**ABV**	5.8%
FG	1.014 (3.5 °P)		**Color**	34.4 SRM/90 EBC		**ABW**	4.6%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	73	30.86	14.00	36.20	16.42	5.84	2.66
Weyermann® Caraamber®	9	3.80	1.73	4.46	2.02	0.72	0.33
Weyermann® Caramunich® II	8	3.38	1.53	3.97	1.80	0.64	0.29
Weyermann® Smoked Malt	8	3.38	1.53	3.97	1.80	0.64	0.29
Weyermann® Carafa® III	2	0.85	0.38	0.99	0.45	0.16	0.07
Total Grain	100	42.28	19.18	49.59	22.49	8.00	3.64
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Magnum	13.5	1.98	56	2.3	66	0.4	11
Flavor: Barth-Haas Santiam	6.25	3.11	88	3.6	103	0.6	17
Aroma: Barth-Haas Glacier	5.5	3.11	88	3.6	103	0.6	17
Yeast	London-style ale yeast						

Brewing Process

Single infusion. Mash in @ 155 °F (68 °C); rest 45 min. Recirculate. Sparge with hot liquor to raise temp to the mash-out @ 168 °F (76 °C). Boil 75 min. 1st hops @ 15 min; 2nd hops @ 55 min. 3rd hops @ start of whirlpool. Whirlpool 30 min. Primary fermentation @ 60 °F –70 °F (16 °C – 21 °C) for about 7 days. Rack. Secondary fermentation about 21 days without pressure. Rack, condition, package.

DID YOU KNOW ... ?

In the old days, beer bottles were closed like champagne bottles, with corks and a wire or string cage. But an invention in 1875 by Nicolai Fritzner, in Germany, change all that. He came up with a wire-bale bottle closure, the flip-top. It not only solved the problem of containing the high pressure in beer bottles, it also made it easy to re-close a bottle, once opened. The flip-top remained the standard beer bottle closure worldwide, until it was replaced by the crown cap.

Crown caps or crown corks as bottle stoppers were invented by William Painter in Baltimore, Maryland, in 1892, originally with natural cork lining. The success of this new closure soon allowed Painter to start his tarts the Crown Cork & Seal Company of Baltimore. A scarcity of cork in the mid-1950s caused a switch from cork to polyvinyl chloride (PVC) liners.

The beer can is another American invention. The very first beer sold in a can was the Krueger Cream Ale (see entry for Cream Ale). It went on sale in Richmond, Virginia, on January 24, 1935, —exactly 13 months and 19 days after the ratification of the 21st Amendment to the U.S. Constitution, which repealed the 18th Amendment and thus ended Prohibition. The Gottfried Krueger Brewing Company was founded in 1899 by a German immigrant in Newark, New Jersey. Krueger decided to test-market its revolutionary canned Cream Ale in far-away Richmond, in the south of the United States, just in case the new container flopped, which could have affected Krueger's reputation in its key northeast market.

Pub Wheat, American

Beer culture of origin	United States
AKA	Wheat Ale
Related Styles	Hefeweizen/Weissbier

Style Description

American Pub Wheat is an ale with perhaps 10 to 30 percent—usually but not always entirely pale—wheat malt, compared to German Hefeweizen/Weissbier, which must contain at least 50 percent wheat malt by law. The non-wheat portion of the mash can be Pilsner or Pale Ale malt as well as a few specialty malts. The recipe below contains about 20% pale wheat malt, 2 percent caramel wheat for a bit of color, and pale ale malt as the diastatic base. The hop profile in the recipe below is kept deliberately mild and noble for a spritzy-spicy and refreshing taste experience. For a more robust Northwest character, use, for instance, Cascade and/or Cluster instead. Filtration is optional.

Specifications

OG	1.052 (13 °P)		**BU**	25		**ABV**	5.3%
FG	1.012 (3 °P)		**Color**	5.2 SRM/12.5 EBC		**ABW**	4.2%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	78	29.40	13.33	34.48	15.64	5.56	2.53
Weyermann® Pale Wheat Malt	20	7.54	3.42	8.84	4.01	1.43	0.65
Weyermann® Carawheat®	2	0.75	0.34	0.88	0.40	0.14	0.06
Total Grain	100	37.69	17.09	44.21	20.05	7.13	3.25
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Warrior®	15.5	9.25	262	10.9	308	1.8	50
Flavor: Barth-Haas Mount Hood	5.5	0.95	27	1.1	32	0.2	5
Aroma: Barth-Haas Amarillo®	8.5	0.95	27	1.1	32	0.2	5
Yeast	American wheat yeast, Kölsch yeast, Altbier yeast						

Brewing Process

Multi-step infusion. Dough in @ approx. 113 °F (44 °C). Rest 20 min. Infuse and raise temp to 122 °F (50 °C). Rest 20 min. Infuse and Raise temp to 149 °F (65 °C). Rest 45 min. Infuse and raise temp to 158 °F (70 °C). Rest 20 min. Infuse and raise temp to mash-out @ 170 °F (77 °C). Recirculate. Lauter. Boil 90 min. 1st hops @ 30 min. 2nd hops @ 75 min. 3rd hops @ 85 min. Whirlpool 30 min. Ferment @ low temp range of selected yeast for 7 days. Pull temp down over 2 days to 45 °F (7 °C). Rack and keep @ that temp for 3 wks. Rack, condition, package.

Pumpkin Ale

Beer culture of origin	England & United States
AKA	None
Related Styles	None

Style Description

Pumpkin Ale is an old brew with great variations in ingredients and processes. The recipe here uses both Old World and New World hops: Fuggles and East Kent Goldings for bittering and American Willamette for aroma. Feel free to use other hop combinations, English or American. The color of pumpkin ale is orange to amber; it has a biscuit malt aroma and a warming pumpkin aroma. If properly conditioned, it has a dry and very effervescent finish. It is flavored not just with hops, but also with spices. For about a barrel or hectoliter, use a spice mixture of about 2 teaspoons each of ground cloves and allspice, 3 crushed cinnamon sticks, and about 50 grams of fresh, peeled, and finely diced ginger root.

Pumpkin preparation for brewing varies greatly: Most brewers bake their pumpkins before adding them to the brew; but some use them raw. Some use the seeds, others don't. Some press the pumpkins like apples and just add the juice to the kettle or the fermenter. Some cut the pumpkins into 2-inch cubes, others macerate them like mashed potatoes. Some add the pumpkins to the mash (which creates less turbidity and allows the mash enzymes to convert the pumpkin starches), others, to the kettle. Some add the spices only briefly into the kettle or whirlpool, others to the fermenter, which creates as rougher flavor. Some even steep the spices in vodka and add the strained vodka at the end of fermentation in the fermenter. The recipe below uses about 13.87 lbs/bbl (5.375 kg/hl) of fresh, baked, mashed pumpkin meat without the peel and the seeds, added to the mash.

Specifications

OG	1.100 (25°P)		**BU**	26		**ABV**	5.4%
FG	1.012 (3°P)		**Color**	6.7 SRM/16.6 EBC		**ABW**	6.4%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	80	32.59	14.78	27.77	23.66	4.48	2.81
Weyermann® Carafoam®	10	4.07	1.85	3.47	1.57	0.56	0.35
Weyermann® Carared®	10	4.07	1.85	3.47	2.96	0.56	0.35
Total Grain	100	40.7414	18.48	34.71	28.19	5.60	3.51
Fresh pumpkin flesh, seeded, baked, peeled, mashed		11.850	5.375	10.096	8.602	1.628	1.021
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Fuggles	8	10.31	292	12.1	343	2.0	55
Flavor: none	4	9.81	278	11.5	326	1.9	53
Aroma: Barth-Haas Willamette	5.75	9.81	278	11.5	326	1.9	53
Yeast	American "Chico"-style yeast or equivalent						

Pumpkin Preparation

Remove pumpkin stems and cut each pumpkin into 2 – 3 pieces. Remove seeds. Place on cookie sheets skin-side up. Bake for about 90 min in 375 °F (190 °C) oven (until pumpkin is mush). Let cool off and scrape flesh from peel. Using a potato masher, macerate pumpkin flesh thoroughly until smooth.

Brewing Process

Multi-step infusion: Mash in @ 140 °F (60 °C). Add and mix in all pumpkin. Rest 60 min. Raise temp to 165 °F (74 °C). Rest 10 min. Raise temp to mash-out @ 169 °F (76 °C). Recirculate. Lauter. Boil 75 min. 1st hops @ 15 min. Wrap spices in cheese cloth suspended from a string and drop into kettle @ 60 min (hold on to sting!). 2nd hops and Irish Moss (3 tablespoons/hl or bbl) @ 70 min. Pull out spice @ shut-down. Whirlpool at least 30 min. Ferment @ 70 °F (21 °C) for 10 – 15 days. Rack, condition, package unfiltered. Beer improves if allowed to mature in package for about 2 – 4 wks.

DID YOU KNOW ... ?

- Pumpkins originated in Central America.
- They belong to the family of cucumbers and melons, the *Cucurbitaceae*.
- Pumpkins are rich in starches and sugars, which make them ideal for brewing. The old-English word for pumpkin is *pumpion* or *pompion*.
- The oldest written mention of *pompion* dates from 1547.
- Pumpkin Ale was invented by English colonists in America.
- Early brewers in the New World, just as medieval brewers in the Old World—including Bavarians before the Beer Purity Law of 1516—brewed with anything that was available and fermentable.
- After the introduction of pumpkins from the New World to England pumpkin was used there as well for brewing beer.
- The oldest, anonymous recipe for pure pumpkin ale, that is, an ale without grain, was published in February 1771 by the *American Philosophical Society*, founded in Philadelphia by Ben Franklin. The "Receipt for Pompion Ale" read as follows:

  "Let the Pompion be beaten in a Trough and pressed as Apples. The expressed Juice is to be boiled in a Copper a considerable Time and carefully skimmed that there may be no Remains of the fibrous Part of the Pulp. After that Intention is answered let the Liquor be hopped cooled fermented &c. as Malt Beer."

Rauchbier

Beer culture of origin	Germany (Bamberg region of Franconia, Bavaria)
AKA	Smoked Märzen
Related Styles	None

Style Description

Rauchbier is German for "smoked beer," a smoky-tasting, barley-based, opaque, usually unfiltered lager that is brewed and aged similar to a Märzen/Oktoberfest beer. Modern Rauchbier is particularly common in the City of Bamberg in Bavaria. In the days of indirect-fired malt kilns, many beers had a smoky flavor. Today, this style is made from various unsmoked base malts plus about 25% two-row Smoked Malt that is kiln-dried over aged local beech wood logs, similar to the way Scotch Whiskey is dried over peat moss. The smokiness from the beech wood imparts a bacony flavor to the beer. A Rauchbier's color usually ranges between 20 and 30 SRM (approx 51 – 78 EBC). Because of the strong smoke-flavor, the beer does not require aroma hops, just a dose of bittering hops. Bitter values, however, may range widely—from 15 to more than 30 BU. Bavarian noble hops is traditional.

Specifications

OG	1.051 (12.75°P)		**BU**	20		**ABV**	5.2%
FG	1.011 (2.75°P)		**Color**	26.3 SRM/68.4 EBC		**ABW**	4.1%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Munich II	57	21.05	9.55	2469	11.20	3.98	1.81
Weyermann® Smoked Malt	27	9.97	4.52	11.70	5.30	1.89	0.86
Weyermann® Caramunich® II	10	3.69	1.68	4.33	1.96	0.70	0.32
Weyermann® Carafa® Special Type I	3	1.11	0.50	1.30	0.59	0.21	0.10
Weyermann® Acidulated	3	1.11	0.50	1.30	0.59	0.21	0.10
Total Grain	100	36.93	16.75	43.32	19.65	6.99	3.18
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Tradition	5.5	4.29	122	5.0	143	0.8	23
Flavor: None	0	0	0	0	0	0	0
Aroma: None	0	0	0	0	0	0	0
Yeast	Bavarian/Munich-Style Lager Yeast						

Brewing Process

Multi-step infusion. Mash in with approx. 65% of expected net kettle volume of brewing liquor @ 140 °F (60 °C); rest 20 min; raise temp to 147 °F (64 °C); rest for 20 min; raise temp to 162 °F (72 °C); rest 30 min; raise temp to mash-out @ 172 °F (78 °C). Sparge 90 min. Boil 60 min; bittering hops after 15 min. Fermentation in unitank 14 days @ 50 °F – 54 °F (10 °C – 12 °C); tank capped @ 4.5 °P (1.018); transfer to horizontal; lager at least 2 wks @ approx. 34 °F (1 °C).

DID YOU KNOW ... ?

The oldest "modern" brewery with all the facilities for malting and brewing is...of ancient Roman origin. It was excavated in 1978 on the banks of the River Danube, inconspicuously tucked away between two family homes on a little street named Kornweg, in a quiet residential suburb of the Bavarian city of Regensburg, called Grossprüfening. It's a puzzling archaeological find. The sign at the dig merely identifies it enigmatically as a Wirtschaftsgebäude (an "economic building"). A 30-foot walkway leads from the sign to a locked pavilion, approximately 26 by 43 feet (8 by 13 meters), erected in 1983, with glass walls on three sides, through which visitors can view the excavations.

The building contains an oblong set of stone foundations in which are arranged a deep well, a water-tight basin at ground level, a kiln with a flue, and a stone-ringed fire place, about three feet in diameter. The probable date of the site's construction is 179 AD. At that time, Regensburg was the largest Roman military camp in what is now Bavaria, housing Emperor Marcus Aurelius' Third Italian Legion of some 5,500 to 6,400 heavily armed Roman elite troupes, as well as the same number of Germanic tribal servants, tradesmen, merchants, artisans, and — most importantly— innkeepers and ladies of easy virtue, who supplied the Roman military machine with all the necessities—and frivolities—of life.

But why would the wine-loving Romans build a brewery? Out of necessity! The grape had not yet been introduced to central Europe, and given the paucity of roads across the Alps in those days, it was simply not possible to keep that many thirsty legionnaires in imported drink from down south. There nothing but temperance—not the Roman way!—or making the booze on location. They Romans had watched the Germans make an "adulterated wine from grain," from half-baked bread loaves stirred into crocks of water for fermentation, a drink that they detested. So, with Roman ingenuity and architectural skill, the civilized wine-drinkers set out to work on a method of improved beer-making. The result: A brew made from malted and mashed grain rather than soggy bread.

Thus, strangely, we must credit the Romans with the invention of the basic brew systems configuration that started what we now consider the sublime Bavarian beer culture.

Red Ale, Flanders

Beer culture of origin	Belgium, Flanders
AKA	Flanders Sour Ale
Related Styles	Flanders Brown Ale/Oud Bruin, Lambic

Style Description

A Flanders Red Ale has many characteristics of the Flanders Oud Bruin...only more so. Like the Oud Bruin, the Red is very tart and sour, but its other flavor components are even more complex. There is a strong black cherry-like fruitiness with notes of currants, red grapes, and plums, with mild phenol, vanilla, and chocolate undercurrents. These complex flavors are balanced by a noticeable residual sweetness. Hop flavors are very subdued. While the Oud Bruin relies on central European noble hops, the signature hops for the fruitier Red is more British, such as Brewers' Gold. Fermentation is by Belgian ale yeast strains as well as lactobacillus and Brettanomyces—and occasionally even by vinegar-making acetobacter, which uses oxygen dissolved in the brew to convert ethanol into acetic acid (not used here).

Specifications

OG	1.052 (13 °P)		**BU**	20		**ABV**	5.2%
FG	1.013 (3.25 °P)		**Color**	13.4 SRM/34.3 EBC		**ABW**	4.1%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Abbey Malt®	25	9.42	4.27	11.05	5.01	1.78	0.81
Weyermann® Vienna	25	9.42	4.27	11.05	5.01	1.78	0.81
Weyermann® Munich I	20	7.54	3.42	8.84	4.01	1.43	0.65
Weyermann® Carabelge®	20	7.54	3.42	8.84	4.01	1.43	0.65
Weyermann® Acidulated	10	3.77	1.71	4.42	2.01	0.71	0.32
Total Grain	100	37.69	17.09	44.21	20.05	7.13	3.25
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Brewer's Gold	6	2.10	59	2.5	70	0.4	11
Flavor: none	0	0	0	0	0	0	0
Aroma: Barth-Haas Brewer's Gold	6	3.93	112	4.6	131	0.7	21
Yeast	Belgian ale yeast plus Brettanomyces bruxellensis and Belgian lactobacillus bacteria						

Brewing Process

Mash in @ about 125 °F (52 °C); 20-min hydration, beta-glucan and protein rest. Raise temp to 144 °F (62 °C); 40-min beta-amylase rest. Raise temp to 162 °F (72 °C); 40-min alpha-amylase rest. Recirculate 15 – 20 min. Lautering. Boil 90 min. Bittering hops @ 15 min; aroma hops @ 75 min. After shut-down, rest brew for 30 min before whirlpooling for another 30 min. Primary fermentation temp @ about 68°F (20°C). Pitch equal amounts of ale yeast, Bettanomyces and lactobacillus. Because bacteria

have longer lag time, yeast will metabolize most of the sugars before bacteria become active. Rack after 2 wks, then again after 4 wks. Condition for 6 wks or longer. Package.

Sour Beer Process Advisory:

Sour beer-making is only for the bravest of the brave and demands a great deal of caution. Traditionally, and often still today, many sour beer styles are spontaneously fermented by airborne microbes. These may include Brettanomyces bruxellensis, Brettanomyces lambicus, lactobacillus delbrückii, pediococcus, and other assorted wild yeasts and bacteria.

Souring microbes are invariably considered defects in regular beers. As beer spoilers, they are kept in check by a host of cleaning, sanitizing, and disinfecting agents, especially on the cold-wort side of the brewery. Breweries attempting to make sour beers, therefore, need to ensure that there is no cross-contamination between their sour and their regular brews. That is why many breweries that produce both sour and regular beers have separate fermenters, transfer hose, pumps and even fillers just for sour beers. Brewers who wish to make sour beers, but prefer not to risk errant microbe infections, can replace some of the base malt with up to perhaps 10 percent Weyermann® Acidulated Malt, which contains biologically produced, Beer Purity Law-conform, natural lactic acid. Acidulated malt can also be used in addition to souring microbe preparations.

Traditionally, souring microbes settle into brews during wort cooling in old-fashioned, flat, copper cool-ships that are placed in well vented rooms, where the green beer is exposed to a fresh breeze. The type or combination of microbes responsible for souring particular brews have often become proprietary micro-floras that are dominant only in a particular region or even brewery, thus giving a beer style—even a beer brand—its signature character. In many cases, this character is virtually impossible to imitate elsewhere. Specific mixtures of souring micro-flora are now commercially available from many yeast labs.

Red Ale, Irish

Beer culture of origin	Ireland
AKA	None
Related Styles	Brown Ale, Amber Ale

Style Description

The Irish Red Ale, similar to the English Brown Ale, is an outgrowth of the late-medieval ale tradition of the British Isles, but, much like the Vienna Lager of central Europe, it has almost disappeared. There is even some debate as to its true characteristics, and some mass-produced commercial versions of this ale are even fermented as lagers. Its ABV may vary between perhaps 4.2 and 5.2 percent, it finishes dry, has next to no fruitiness, and relatively little hops. It has a few roasted notes, which are reminiscent of the old direct-fired kilns that invariably scorched a few grains and probably also steeped rather than just dried a few of the grains, giving them a slightly crystalline acrospire. Finally, during the hand-worked floor-malting process of yore, some kernels may not have been able to sprout and they thus turned into unmalted roasted barley rather than malt. These historical roots are the basis for the ingredients and process selection below.

Specifications

OG	1.044 (11 °P)		**BU**	24		**ABV**	4.4%
FG	1.011 (2.75 °P)		**Color**	17.6 SRM/45.5 EBC		**ABW**	3.5%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	50	15.82	7.18	18.56	8.42	2.99	1.36
Weyermann® Vienna	30	9.49	4.31	11.14	5.05	1.80	0.82
Weyermann® Melanoidin	10	3.16	1.44	3.71	1.68	0.60	0.27
Weyermann® Caramunich® III	9	2.85	1.29	3.34	1.52	0.54	0.25
Weyermann® Roasted Barley	1	0.32	0.14	0.37	0.17	0.06	0.03
Total Grain	100	31.65	14.35	37.12	16.84	5.99	2.73
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Fuggles	4.3	6.40	182	7.5	213	1.2	34
Flavor: none	0	0	0	0	0	0	0
Aroma: Barth-Haas Fuggles	4.3	1.70	48	2.0	57	0.3	9
Yeast	Irish-style dry-finishing ale yeast						

Brewing Process

Single infusion. Mash in @ a liquor-to-grist ratio of about 3:1 by dry weight @ 153 °F (67 °C). Rest 45 min. Recirculate. Raise temp to 168 °F (76 °C). Sparge slowly with 170 °F (77 °C) water until kettle full. Boil 65 min. 1st hops @ 5 min; 2nd hops @ 60 min. Whirlpool 30 min. Fermentation @ roughly 66 °F (19 °C) for about 7 days. Rack and condition for about 14 days. Package.

Roggenbier

Beer culture of origin	Germany
AKA	German Rye Ale
Related Styles	American Rye Ale

Style Description

Rye (Secale cereale), or Roggen in German, was much more common as a malt source in the Middle Ages than it is today, especially in the German-speaking world. This is in part, because the Bavarian Beer Purity Law of 1516, which has hence become a law in all of Germany, restricted beer ingredients to just water, hops, and barley. All other cereals were "out," reserved for the people's solid rather than liquid bread. Rye malt is very hard and has smaller kernels than barley. Therefore, it should be milled separately with a narrower gap setting. Its protein content is roughly between that of barley and wheat. Like wheat and unlike barley, rye has no husks and thus absorbs water comparatively quickly, which means the maltster must take extra care not to over-steep the rye at the beginning of the malting process. The elongated shape of rye kernels, compared to the rounder shape of barley kernels, results in poorer flow characteristics and greater compaction in the germination chamber. This turns aeration into a challenge and can lower the germination rate.

For these reasons, it is virtually impossible to make an all-rye beer, because the mash would be difficult to lauter. Also, rye has a relatively high beta-glucan content, which can make the run-off agonizingly slow. Rye beers, therefore, commonly contain a large amount of barley malt (Pilsner), and often some wheat malt and a few specialty malts (dark Munich and acidulated malts) as well. The share of rye in a commercial mash varies between roughly 30 and 60 percent for a Roggenbier and between roughly 10 and 30 percent for a North American Rye Ale.

Always employ a multi-step mash that allows for the enzymatic degradation of as many of the unconverted beta-glucans and proteins as possible. Beta-glucanase reach their peak activity at roughly 113°F (45°C); protease, at roughly 122°F (50°C).

Rye beers are nowadays almost always ales—even in Bavaria, the cradle of lager brewing. In Europe, they are usually fermented with a strain of wheat beer yeast. The addition of rye gives the brew a noticeable crispness and dryness on the palate. So as not to conflict with the rye's slight spiciness, select hops that are relatively low in cohumulone, such as Hallertauer Mittelfrüh, Hersbrucker, Magnum, Opal, Premiant, Smaragd (Emerald), Santiam, Saphir, Spalt, or Tettnanger.

Rye ales show mild up-front fruitiness, some yeastiness and breadiness in the middle, and an almost smoky, spicy, faintly sour, even tangy-tart finish. Similar to a Hefeweizen, a Roggenbier is usually left unfiltered. Roggenbier as an old style from before the invention of beer filtration in 1878, it is more authentic to package the beer in its yeast-turbid state. Roggenbier can be a pleasing and refreshing summer quaffing beer.

Specifications

OG	1.048 (12 °P)		**BU**	18		**ABV**	5.3%
FG	1.008 (2 °P)		**Color**	16.4 SRM/42.3 EBC		**ABW**	4.2%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pilsner	45	15.60	7.07	18.29	8.30	2.95	1.34
Weyermann® Rye	30	10.40	4.72	12.20	5.53	1.97	0.90
Weyermann® Vienna	20	6.93	3.14	8.13	3.69	1.31	0.60
Weyermann® Carafa ® I Special	2.5	0.87	0.39	1.02	0.46	0.16	0.07
Weyermann® Cararye®	2.5	0.87	0.39	1.02	0.46	0.16	0.07
Total Grain	100	34.66	15.72	40.65	18.44	6.56	2.99
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Hersbrucker	2.75	4.92	139	5.8	163	0.9	26
Flavor: None	0	0	0	0	0	0	0
Aroma: Barth-Haas Smaragd/Emerald	5	7.72	219	9.1	257	1.5	41
Yeast	Bavarian-style Hefeweizen/Weissbier yeast						

Brewing Process

Multi-step infusion. Dough in @ approx. 113 °F (44 °C). Rest 20 min. Infuse and raise temp to 122 °F (50 °C). Rest 20 min. Infuse and Raise temp to 149 °F (65 °C). Rest 45 min. Infuse and raise temp to 158 °F (70 °C). Rest 20 min. Infuse and raise temp to mash-out @ 170 °F (77 °C). Recirculate. Lauter. Boil 90 min. 1st hops @ 30 min. 2nd hops @ 85 min. Whirlpool 30 min. Ferment @ 68°F (20°C) for 7 days. Pull temp down over 2 days to 45 °F (7 °C) and rest for 3 days. Rack and warm up to room temp, and condition for 1 wk. Rack and package.

DID YOU KNOW ... ?

Buckwheat is not a grain but an herb, the *Fagopyrum* family, which originated in Asia. It has small, off-white and edible, triangular fruits, which, when ground up, can be used as a flour substitute. Buckwheat seeds are high in protein and may be added as a non-grain adjunct to the mash. It produced a slightly nutty flavor to beer.

Rye Ale, American

Beer culture of origin	United States
AKA	None
Related Styles	Roggenbier

Style Description

American Rye Ales contain perhaps 10 to 30 percent rye malt, compared to German Roggenbiers, which may contain as much as 60 percent. Rye malt is very hard and has smaller kernels than barley. Therefore, it should be milled separately with a narrower gap setting. Its protein content is roughly between that of barley and wheat. Like wheat and unlike barley, rye has no husks, which would make it next to impossible to lauter an all-rye beer. The non-rye portion of the mash can be Pilsner or Pale Ale malt as well as some wheat and a few specialty malts. Because rye has a large amount of beta-glucans, it is best to employ a multi-step mash. The addition of rye gives the brew a noticeable crispness and dryness on the palate, which is why it is preferable to use only hops low in cohumulone. Suitable hop varieties are, for instance, Amarillo®, Mount Hood, and Warrior®. Cluster and Cascade, on the other hand, would be less ideal.

Specifications

OG	1.048 (12 °P)		**BU**	25		**ABV**	5.3%
FG	1.008 (2 °P)		**Color**	4.9 SRM/11.7 EBC		**ABW**	4.2%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	77.25	26.77	12.14	31.40	14.24	5.07	2.31
Weyermann® Rye	12.50	4.33	1.96	5.08	2.30	0.82	0.37
Weyermann® Pale Wheat Malt	10	3.47	1.57	4.07	1.84	0.66	0.30
Weyermann® Carafa® I Special	0.25	0.09	0.04	0.10	0.05	0.02	0.01
Total Grain	100	34.66	15.72	40.65	18.44	6.56	2.99
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Warrior®	15.5	9.25	262	10.9	308	1.8	50
Flavor: Barth-Haas Mount Hood	5.5	0.95	27	1.1	32	0.2	5
Aroma: Barth-Haas Amarillo®	8.5	0.95	27	1.1	32	0.2	5
Yeast	American wheat yeast, Kölsch yeast, Altbier yeast						

Brewing Process

Multi-step infusion. Dough in @ approx. 113 °F (44 °C). Rest 20 min. Infuse and raise temp to 122 °F (50 °C). Rest 20 min. Infuse and Raise temp to 149 °F (65 °C). Rest 45 min. Infuse and raise temp to 158 °F (70 °C). Rest 20 min. Infuse and raise temp to mash-out @ 170 °F (77 °C). Recirculate. Lauter. Boil 90 min. 1st hops @ 30 min. 2nd hops @ 75 min. 3rd hops @ 85 min. Whirlpool 30 min. Ferment @ low temp range of selected yeast for 7 days. Pull temp down over 2 days to 45 °F (7 °C). Rack and keep @ that temp for 3 wks. Rack, condition, package.

Sahti

Beer culture of origin	Finland
AKA	None
Related Styles	None

Style Description

Strangely, the Finnish word Sahti appears to derive from the German word Saft, meaning juice, even the though the modern Finnish word for beer is olut, a derivative of ale. Sahti brewing instructions are enshrined in about 400 stanzas of the 22,795 stanzas of the Kalevala, the ancient Finnish national epic, which, incidentally, devotes only about 200 stanzas to the creation of the universe—obviously a subject of lesser importance than beer. The Kalevala emerged at least 2,000 years ago and was orally transmitted. Because Sahti is still brewed today, largely according to ancient methods, by several Finnish specialty breweries, Sahti is one of the oldest, if not the oldest, continuously brewed beer style in the world. For this reason, though a "minor" style by some standards, it is included here with a complete recipe. The Kalevala, incidentally, was first written down by a Finnish physician, Elias Lönnrot, in 1836.

This traditional Finnish "juice" comes in two partigyle strengths from separate runnings of the same mash. "Tupulisahti" means "strong Sahti" from the first runnings, while the brew from the weak runnings is called "Jälkijuoma," literally "nose drops." In the recipe below are specifications for both full-strength Tupulisahti and weak Jälkijuoma. Traditionally, Sahti was made from malted barley, steeped in sacks in a cold stream, spread out to germinate, and then "kiln-dried" in a smoky sauna. Sahti may also contain some rye and/or oats. Traditional Sahti mashing—usually in an elongated wooden tun carved from a tree trunk— involves the gradual heating of the mash for several hours with hot water and stones made red-hot over a sauna fire. The effect is similar to that of a modern continuous infusion mash. Juniper twigs with or without berries as well as whole, old (!) hops are placed at the bottom of the mash to impart bitter flavors to the wort during lautering.

The modern adaptation of the Sahti recipe below, therefore, includes some rye malt, Smoked Malt, and roasted caramel malt. Once the grain bed has run dry, if you chose to make a Jälkijuoma as well, wash it again with fresh hot water and ferment these runnings separately. Sahti wort, unlike modern wort, is not boiled, but fermented directly after lautering. Modern brewers, however, would be well advised to raise the wort temperature in the kettle to about 180 °F (82 °C) to sterilize it.

Traditional Sahti fermentation was in open wooden vats, by bread yeast, as is still done today in Finland. Bread yeast is a poor attenuator that quits long before modern brewers yeast does. Once fully attenuated, traditional Sahti was stored in wooden casks in root cellars at about 40 °F (4 °C) for quick consumption. The result was a hazy coppery ale of around 8 percent alcohol by volume (Tupulisahti) with a buttery to tangy aroma and a refreshing winey to spicy palate. Jälkijuoma had about 3 percent ABV, unless it was fortified with honey during fermentation. Nowadays, commercial Sahtis tend to be weaker than their traditional forbearers, having an ABV of about 5 –

6.5 percent, half way between traditional Tupulisahti" and Jälkijuoma. The recipe below is for a Sahti of traditional strength.

Note that, because of the murky origins of Sahti, the specifications for our reconstruction of this style with modern ingredients and equipment reflect necessarily more educated guesswork than firm brew-historical certainty! Nonetheless, this could be an interesting and unusual summer brew to attempt in a brewpub.

Specifications—Tupulisahti

OG	1.080 (20 °P)		**BU (est.)**	16		**ABV**	8%
FG	1.020 (5 °P)		**Color (est.)**	8.5 SRM/21 EBC		**ABW**	6.3%

Specifications—Jälkijuoma (est.)

OG	1.030 (7.5 °P)		**BU**	?		**ABV**	2.8%
FG	1.009 (2.25 °P)		**Color**	? SRM/? EBC		**ABW**	2.2%

Ingredients—Tupulisahti @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	84	50.00	22.68	58.65	26.60	9.46	4.31
Weyermann® Rye	10	5.95	2.70	6.98	3.17	1.13	0.51
Weyermann® Smoked Malt	5.75	3.42	1.55	4.01	1.82	0.65	0.29
Weyermann® Carafa ® I Special	0.25	0.15	0.07	0.17	0.08	0.03	0.01
Total Grain	100	59.52	27.00	69.82	31.67	11.26	5.13
Crushed dried juniper berries		0.30	0.14	0.35	0.16	0.06	0.03
Juniper (or cedar) boughs		Enough to cover false bottom of lauter tun					
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Tettnanger flowers in the mash	4	7	198	8.2	232	1.3	37
Flavor: None	0	0	0	0	0	0	0
Aroma: None	0	0	0	0	0	0	0
Yeast	Bakers bread yeast						

Brewing Process

Continuous infusion. Place juniper boughs (or cedar boughs) over false bottom of mash tun. Lay base liquor. Mash in at about 120 °F (49 °C) using milled grains, juniper berries and leaf hops mixed together. Note that rye malt needs to be milled separately at narrower gap setting. Rest mash 30 min. Raise temp over 90 min to 160 °F (71 °C) for mash-out. Recirculate. Lauter. Raise wort temp to 180 °F (82 °C) to sterilize it. Make bread yeast starter with wort from a previous batch or a water solution with sugar, DME, or LME. Heat-exchange wort to room temp into (optionally open) fermenter. Pitch yeast. Ferment to finish. Rack into pressure tank. Condition lightly. Package unfiltered into bottles, kegs, or serving tank. Brew has only short shelf life; consume within a few weeks.

DID YOU KNOW ... ?

For centuries in Europe—from antiquity to the Middle Ages—juniper (*Juniperus communis*) was a favorite beer flavoring. Today, we know juniper mostly from gin, which is essentially nothing but juniper-flavored vodka. Juniper is a coniferous shrub or columnar tree that grows well throughout most of the Northern Hemisphere. It can be found beyond the tree limit, from Alaska to Newfoundland, Greenland, and Iceland. It ranges south through New England to the Carolinas and west through northeastern Illinois, Indiana, northern Ohio, Minnesota, and Nebraska to the western mountains of Washington, California, Arizona, and New Mexico. While the role of juniper in beer making was once indispensible, it has now been marginalized by the ubiquitous use of hops.

Sahti in Literature:

She, the maid who beer concocted,
Gathered six of grains of barley,
Seven hop tassels next she gathered,
And eight ladles of water,
Then upon the fire she placed it,
And allowed it there to simmer,
And she boiled the ale of barley,
Through the fleeting days of summer,
Poured it then in wooden barrels,
And in tubs of birch wood stored it.

From *Kalevala*, the ancient Finnish national epic

German translation: *Kalevala, Das finnische Epos des Elias Lönnrot*, Marix Verlag GmbH, Wiesbaden 2005. English translation: Bosley, Keith, *Kalevala.* Oxford University Press, Oxford 1989.

Sahti was made for centuries as part of the natural way of rural life (in Finland).

Roger Protz, *The Ultimate Encyclopedia of Beer*, 1995.

The only "primitive" beer to survive in Western Europe is the Sahti of Finland.

Michael Jackson, *The New World Guide to Beer*, 1988

Schwarzbier, Franconian

Beer culture of origin	Germany, Bavaria
AKA	Kulmbacher Schwarzbier
Related Styles	Thuringian/Köstritzer Schwarzbier, Dunkel

Style Description

Schwarz means black in German. Schwarzbiers are opaque, very dark mahogany lagers, almost like "Über"-Dunkels. There is a Thuringian version, with very slight chocolate-toasty notes, as well as a Franconian version from northern Bavarian, with absolutely no toasty or astringent notes at all. Both versions finish fairly dry, but the Bavarian version may have some residual sweetness. In both versions, hop bitterness, flavor, and aroma are restrained and noble. In a Schwarzbier—just as in a Dunkel—the requirements of color and flavor are brew-technically opposed to each other. The beer gets its darkness from dark malt, but the malt must not be too roasted. A good way to achieve this is through small additions of Weyermann® de-husked Carafa® I, II, or III Special malts. The base malts for both versions are Pilsner and Munich.

For a milder flavor, you can replace the roasted malt with more Pilsner malt and some SINAMAR® Liquid Malt Color added to the kettle. For quantities, use about 1.5 ounces (by weight) or 1.25 fluid ounces of SINAMAR® to darken 1 barrel of wort by 1 SRM. In the metric system, the equivalent values are 14 grams or 11.9 milliliters of SINAMAR® to darken 1 hectoliter of wort by 1 EBC.

Specifications

OG	1.048 (12 °P)		**BU**	24		**ABV**	4.8%
FG	1.012 (3 °P)		**Color**	40.7 SRM/106.7 EBC		**ABW**	3.8%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 Hl (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pilsner	43	14.56	6.60	17.07	7.74	2.75	1.25
Weyermann® Munich I	20	6.93	3.14	8.13	3.69	1.31	0.60
Weyermann® Munich II	20	6.93	3.14	8.13	3.69	1.31	0.60
Weyermann® Carafoam®	10	3.47	1.57	4.07	1.84	0.66	0.30
Weyermann® Carafa® I Special	8	2.77	1.26	3.25	1.48	0.52	0.24
Total Grain	100	34.66	15.72	40.65	18.44	6.56	2.99
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Herkules	15.5	1.75	50	2.0	58	0.3	9
Flavor: Barth-Haas Tradition	5.5	0.37	10	0.4	12	0.1	2
Aroma: Barth-Haas Hallertauer Mittelfrüh	4.25	0.37	10	0.4	12	0.1	2
Yeast	Bavarian-style lager yeast						

Brewing Process

Multi-step infusion. Dough in thick for an optional 15–30 min. acid rest @ at 100 ± 5 °F (38 ± 2 °C). Raise temp to 122 °F (50 °C). Rest 30 min. Raise temp to 146 ± 2 °F (63 ± 1 °C). Rest 30 min. Raise temp to 156 ± 2 °F (69 ± 1 °C). Rest 30 min. Raise temp to mash-out temp @ 170 °F (77 °C). Recirculate. Lauter for about 90 – 120 minutes. Boil 90 min. 1st hops @ 15 min. 2nd hops @ 65 min. 3rd hops @ 5 min. Whirlpool. Pitch @ 48 °F (9°C). Total primary fermentation 10 - 14 days. Rack @ terminal gravity. Lager @ 30 °F (-1 °C) for 3 wks. Rack, condition, package.

DID YOU KNOW ... ?

... how the Bockbier acquired its name? The story of Bockbier starts not in Bavaria but in the northern German town of Einbeck, in the middle of the 13th century. Einbeck was then an important member city of the Hanseatic League, an international trading empire run by hundreds of powerful medieval merchants. Einbeck's specialty export was a strong dark ale made from wheat and barley. Almost every inhabitant of Einbeck was directly or indirectly engaged in the brewing trade ... and, much to the chagrin of Munich's brewers, one of the greatest customers of Einbeck beer was the House of Wittelsbach, the ruling dynasty of Bavaria. Eventually, the Bavarian Dukes and their entourage quaffed so much of the Einbeck ale that their drinking habits started to impact Bavaria's balance of payments. Beer imports had become a matter of Bavarian fiscal policy.

In 1590, to salvage the Bavarian money supply from leaking north, the ruler of the day, Duke Wilhelm V, had an Einbeck-like, strong, brown to red beer brewed in his own brew house in Landshut (50 miles northeast of Munich), which he hoped would recapture the market lost to the northern brewers. A year later, he completed brew house for the new beer in the center of Munich, on the site of the now-famous Hofbräuhaus. Initially, Wilhelm's Einbeck beer replacement was intended only for the nobility, but, starting in 1610, the local innkeepers had to buy it, too ... and the Bock stated to make money for the state coffers.

Wilhelm V's successor, Duke Maximilian I, went one step further. In 1612, he enticed an Einbeck brew master, Elias Pichler, to come to Munich. Under Elias' guidance, and in accordance with prevailing Munich brewing practices, the famous Einbecker strong ale metamorphosed into a strong lager, the kind of Bockbier we know today. The first strong Munich lager brewed the "Einbeck way" was dispensed at the Hofbräuhaus in 1614. The Bavarian dialect soon mangled the name Einbeck to "ayn pock" and, eventually, to "ein Bock" (one Bock). And that's how the Bock got to Bavaria.

Because the word Bock also means ram or Billy goat in German, many Bockbiers now feature that creature on their labels...which is strangely fitting, because, at 7 percent alcohol by volume, the beer, like the animal, has a kick!

Schwarzbier, Thuringian

Beer culture of origin	Germany
AKA	None
Related Styles	Franconian/Bavarian/Kulmbacher Schwarzbier, Dunkel

Style Description

Schwarz means black in German. Schwarzbiers are opaque, very dark mahogany lagers, almost like "Über"-Dunkels. There is a Thuringian version, with very slight chocolate-toasty notes, os well as a Franconian version from northern Bavarian, with absolutely no toasty or astringent notes at all. Both versions finish fairly dry, but the Bavarian version may have some residual sweetness. Hop bitterness, flavor, and aroma are restrained and noble.

In a Schwarzbier—just as in a Dunkel—the requirements of color and flavor are brew-technically opposed to each other. The beer gets its darkness from dark malt, but the malt must not be too roasted. A good way to achieve this is through small additions of Weyermann® de-husked Carafa® I, II, or III Special malts. The base malts for both versions are Pilsner and Munich.

For a milder flavor, you can replace the roasted malt with more Pilsner malt and some SINAMAR® Liquid Malt Color added to the kettle. For quantities, use about 1.5 ounces (by weight) or 1.25 fluid ounces of SINAMAR® to darken 1 barrel of wort by 1 SRM. In the metric system, the equivalent values are 14 grams or 11.9 milliliters of SINAMAR® to darken 1 hectoliter of wort by 1 EBC.

Specifications

OG	1.047 (11.75 °P)		**BU**	26		**ABV**	4.5%
FG	1.013 (3.25 °P)		**Color**	40.7 SRM/106.5 EBC		**ABW**	3.7%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pilsner	45	15.26	6.92	17.90	8.12	2.89	1.31
Weyermann® Munich II	50	16.95	7.69	19.88	9.02	3.21	1.46
Weyermann® Carafa® III Special	5	1.70	0.77	1.99	0.90	0.32	0.15
Total Grain	100	33.90	15.38	39.77	18.04	6.41	2.92
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Magnum	13.5	6.28	178	7.4	209	1.2	34
Flavor: Barth-Haas Northern Brewer	8	0.45	13	0.5	15	0.1	2
Aroma: Barth-Haas Northern Brewer	8	0.45	13	0.5	15	0.1	2
Yeast	Bavarian-style lager yeast						

Brewing Process

Multi-step infusion. Mash in @ 122 °F (50 °C). Rest 20 min. Raise temp to 147 °F (64°C). Rest 100 min. Raise temp to 162 °F (72°C) Rest 30 min. Raise to 169 °F (76°C). Rest 5 min. Lautering for 2 hrs. Boil 2 hrs. 1st hops @ 60 min. 2nd hops @ 105. 3rd hops @ 115 min. Pitch @ 48 °F (9°C). Total primary fermentation 6 – 7 days. At 1.026 (6.5 °P), close tank, raise tank temp to 52 °F (11 °C), and maintain pressure @ 0.6 bar (8 psi). At 1.018 (<5 °P), raise tank to diacetyl rest temp of 55 °F (13°C) for 3 days. Rack. Crash temp in 24 hrs to 30 °F (-1 °C). Cold-condition for 10 days. Package on day 28.

DID YOU KNOW ... ?

In the mash, calcium reacts with phosphates and amino acids from malt, which makes the mash more acidic.

Magnesium, too, acidifies the mash.

Bicarbonates make the mash more alkaline, but they precipitate when boiled, like scale in a household tea kettle.

Sodium in moderate amounts adds fullness and sweetness to a beer, in large amounts, saltiness.

Sulfate increases the perception of hop bitterness.

Chloride decreases the perception of hop bitterness. Like sodium, it also adds fullness and mouthfeel to the finished beer.

Scotch Ale

Beer culture of origin	Scotland
AKA	120/-
Related Styles	90/-, 140/-, Export, Wee Heavy, Scottish Ale

Style Description

Scotch Ales are the strong versions of Scottish Ales. They come in strengths of 90- to 140-shillings. A typical 90-shilling Scotch Ale has a gravity of 13.75 °P – 19.25 °P (1.055 – 1.075); a 120-shilling, of 19.25 °P – 23.75 °P (1.075 – 1.095); and a 140-shilling, of 23.75 °P – 32.5 °P (1.095 - 1.130).

The base malt for Scotch Ale is Pale Ale malt with varying amounts of pale caramel malt and unmalted roasted barely. The recipe below contains a small amount of Weyermann® Smoked Malt to imitate the flavor that peat-fired kilns might have imparted to the brew. The base malt for all Scottish/Scotch ales is Pale Ale malt with varying amounts of pale caramel malt and unmalted roasted barley.

The recipe below also contains a small amount of Weyermann® Smoked Malt to imitate the peat flavor that peat-fired kilns have traditionally imparted to the brew. For a more modern version of a Scottish or Scotch Ale, you can replace the grain bill presented here with the following grain bed composition, adjusted for the desired gravities: Weyermann® Pale Ale Malt (50%), Weyermann® Vienna Malt (20%), Weyermann® Carared® (10%); Weyermann® Caramunich® I (10%), Weyermann® Caraaroma® (9.8%), plus Weyermann® Carafa® I (0.2%).

Scotch Ale is mashed in thick for a rest of 60 – 90 minutes at a relatively high 158 °F (70 °C) for a saccharification that favors beta- instead of alpha-amylase activity. Traditionally, the mash-out temperature is achieved through sparging with hot brewing liquor at 180 °F (82 °C). The sparge temperature is reduced, once the mash reaches 172 °F (78 °C).

Scotch Ales were usually made only from the first runnings of two consecutive batches, whereby the weak runnings of the two batches were fermented separately for a lower-gravity and lower-alcohol ale (often called a Two-Penny Ale). The recipe below is for a 120-shilling ale. Higher or lower gravities can be achieved by simply increasing or decreasing all grain amounts proportionally. For the heaviest Scotch Ale, though, it may be convenient to add some unhopped liquid malt extract (LME) to the kettle rather than risking an overflowing mash tun or a stuck mash.

BU-levels generally range from approximately 30 to 40 BU, though some Scotch Ales may be brewed to a bitter-value of 60 BU. Boiling time is at least 90 minutes, and there are two hop additions in Scotch ales, at 60 minutes and 45 minutes into the boil. The yeast should be a Scottish strain or ale yeasts that yield low levels of esters and fusel alcohols.

Specifications

OG	1.090 (22.5 °P)		**BU**	36		**ABV**	9.3%
FG	1.022 (5.5 °P)		**Color**	23.5 SRM/61.1 EBC		**ABW**	7.1%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	75	50.69	22.99	59.46	26.97	9.59	4.37
Weyermann® Carafoam®	11.5	7.77	3.53	9.12	4.14	1.47	0.67
Weyermann® Roasted Barley (unmalted)	1.5	1.01	0.46	1.19	0.54	0.19	0.09
Weyermann® Smoked Malt	10	6.76	3.07	7.93	3.60	1.28	0.58
Total Grain	100	67.59	30.66	79.28	35.96	12.79	5.82
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Golding	5	4.67	132	5.5	155	0.9	25
Flavor: none	0	0	0	0	0	0	0
Aroma: Golding	5	4.25	120	5.0	141	0.8	23
Yeast	Scottish/Scotch-Style yeast (Imperfect substitutes: Belgian Strong Ale or Altbier yeast)						

Brewing Process

Single-step infusion: Mash in as thick as possible @ 158 °F (70 °C). Rest 90 min. Recirculate. Sparge with 180°F (8 °C) brewing liquor to raise mash temp to 172 °F (78 °C) for mash-out. Hold mash temp at that level. Adjust sparge water temp. Boil 90 min. 1st hops @ 30 min. 2nd hop @ 45 min. Whirlpool 30 min. Primary fermentation @ 60 °F (16 °C), for about 12 days. Rack. Secondary fermentation about 21 days @ 40 ° F – 50 °F (4 °4 – 10 °C). Rack again, condition for 1 wk. Package.

DID YOU KNOW ... ?

The first New World brewer probably stirred the mash in the English colony of Jamestown, established in Virginia in 1607. It became the first *lasting* English settlement in North America. We know that there wasn't a single brewer among the first group of settlers, but within two years, the Jamestown folk did something about that. They planted a field of barley and simultaneously put an ad in a London newspaper asking for two brewers to come over. By the time the brewers arrived, barley was already waiting for them to be turned into beer.

This fixes the beginning of brewing in North America to the year 1609, at Jamestown!

DID YOU KNOW ... ?

Today, people think of Scotch mostly as whiskey, not beer. But Scotch whiskey became popular only in the nineteenth century. Before that time, it was beer that was the Scotsman's national beverage. And what is Scotch anyway? It's made from barley, and it is a distilled spirit. In other words, Scotch is nothing but distilled beer. Traditionally, ales in Scotland were strong and dark or very strong and dark. The darkness came, as it did elsewhere, from the kilning of malted barley over open fires. It is likely that much of the barley for beer making was kilned over peat moss, which gave the grist a unique smoky flavor.

Hops came to Scotland only relatively late, in the early to mid-1800s. In Scotland, the growing season is simply too short to support hops cultivation and importing hops was simply too expensive for regular production. Because of the lack of hops, Scottish ales tended to be brewed either just with malt, water, and yeast—often with the addition of honey or molasses for extra alcoholic strength. Sometimes they were flavored with heather flowers. But the lack of hops had a detrimental effect on the lower-alcohol, everyday brews. As the central Europeans had figured out centuries earlier, hops is not only a great beer flavoring, but it also helps to preserve the brew and give it better keeping qualities. So Scottish ales that were not made from very heavy, sugar-rich, malt extracts that yielded fairly high-alcohol brews, tended to go off relatively fast. Until only about two hundred years ago, therefore, everyday Scottish quaffing beers had a fairly awful reputation.

But interestingly, the very strong ales from Scotland, those that flirt with an alcohol by volume level of nine to ten percent, have always been regarded as belonging to a class by themselves. Unlike the ordinary Scottish brews, the heavies always found much favor among the discriminating beer connoisseurs. To set them apart from ordinary ales made in Scotland, these "wee heavies" are usually referred as Scotch ales, rather than Scottish ales.

Scottish Ale

Beer culture of origin	Scotland
AKA	70/-
Related Styles	60/-, 80/-, 90/-, Export, Wee Heavy, Scotch Ale

Style Description

Scottish Ale comes in three basic strengths (with a few variations): 60-, 70-, and 80-shillings. Stronger Scottish Ales are usually called Scotch Ales or Wee Heavy Ales. These come in strengths of 90- to 140-shillings.

A typical 60-shilling ale from Scotland has a gravity of 7.5 °P – 8.75 °P (1.030 – 1.035); a 70- shilling, of 8.75 °P – 10 °P (1.035 – 1.040); an 80-shilling, of 10 °P – 13.75 °P (1.040 – 1.055); a 90-shilling, of 13.75 °P – 19.25 °P (1.055 – 1.075); a 120-shilling, of 19.25 °P – 23.75 °P (1.075 – 1.095); and a 140-shilling, of 23.75 °P – 32.5 °P (1.095 - 1.130).

The base malt for all Scottish/Scotch ales is Pale Ale malt with varying amounts of pale caramel malt and unmalted roasted barely. The recipe below also contains a small amount of Weyermann® Smocked Malt to imitate the peat flavor that peat-fired kilns have traditional imparted to the brew. For a more modern version of a Scottish or Scotch Ale, you can replace the grain bill presented here with the following grain bed composition, adjusted for the desired gravities: Weyermann® Pale Ale Malt (50%), Weyermann® Vienna Malt (20%), Weyermann® Carared® (10%); Weyermann® Caramunich® I (10%), Weyermann® Caraaroma® (9.8%), plus Weyermann® Carafa® I (0.2%).

All Scottish or Scotch ales are mashed in thick for a rest of 60 – 90 minutes at a relatively high 158 °F (70 °C) for a saccharification that favors beta- instead of alpha-amylase activity. Traditionally, the mash-out temperature is achieved through sparging with hot brewing liquor at 180 °F (82 °C). The sparge temperature is reduced, once the mash reaches 172 °F (78 °C). Ales in Scotland—especially the stronger ones—were often made only from the first runnings of two consecutive batches, whereby the weak runnings of the two batches were used to produce a weak ale, called a Two-Penny Ale. The recipe below is for a 70-shilling ale. Higher or lower gravities can be achieved by simply increasing or decreasing all grain amounts proportionally. For the heaviest Scotch Ale, though, it may be convenient to use the addition of an unhopped liquid malt extract (LME) in the kettle, rather than risking an overflowing mash tun or a stuck mash.

BU-levels range from approximately 25 for the weaker Scottish Ales to 40 BU for the heavier ones. Some Scotch Ales were brewed to a bitter-value of 60 BU. Boiling time is at least 90 minutes, and there are two hop additions in Scottish/Scotch ales: 60 minutes and 45 minutes into the boil.

The yeast should be a Scottish strain or ale yeasts that yield low levels of esters and fusel alcohols.

Specifications

OG	1.038 (20.5°P)		**BU**	27		**ABV**	3.5%
FG	1.012 (5°P)		**Color**	9.5 SRM/24 EBC		**ABW**	2.7%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	77	20.92	9.49	24.54	11.13	3.96	1.80
Weyermann® Carafoam®	11.5	3.13	1.42	3.67	1.66	0.59	0.27
Weyermann® Roasted Barley (unmalted)	1.5	0.41	0.18	0.48	0.22	0.08	0.04
Weyermann® Smoked Malt	10	2.72	1.23	3.19	1.45	0.51	0.23
Total Grain	100	27.17	12.33	31.88	14.46	5.14	2.34
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Goldings	5	3.50	99	4.1	117	0.7	19
Flavor: none	0	0	0	0	0	0	0
Aroma: Barth-Haas Goldings	5	3.19	90	3.7	106	0.6	17
Yeast	Scottish/Scotch-Style yeast (Imperfect substitutes: Belgian Strong Ale or Altbier yeast)						

Brewing Process

Single-step infusion: Mash in as thick as possible @ 158 °F (70 °C). Rest 90 min. Recirculate. Sparge with 180°F (8 °C) brewing liquor to raise mash temp to 172 °F (78 °C) for mash-out. Hold mash temp at that level. Adjust sparge water temp. Boil 90 min. 1st hops @ 30 min. 2nd hop @ 45 min. Whirlpool 30 min. Primary fermentation @ 60 °F (16 °C), for about 4 - 5 days. Rack. Secondary fermentation about 21 days @ 40 ° F – 50 °F (4 °4 – 10 °C). Rack again, condition for a wk. Package.

DID YOU KNOW ... where hops come from?

The hop plant is a clinging vine that has been grown virtually wherever beers have been made ... and that means: everywhere. Its origins are not entirely certain, but most reference works maintain that the hop plant is likely to have originated in central Asia, spreading gradually to Europe and North America. There is evidence that hops grew in Britain at least 5,000 years ago. Though hops can grow virtually anywhere, certain regions offer more favorable conditions for the vine than do others. The leading hop-growing countries are, in alphabetical order, Australia, Belgium, China, the Czech Republic, Germany, New Zealand, Poland, Slovenia, South Africa, Ukraine, and the United States. Hops do well in soft, sandy, porous soil deposits with plenty of drainage, such as the yellowish lime deposits accumulated by winds during the ice age in southern Germany. The hop vine also needs ample rainfall during the initial growing phase, followed by a prolonged dry spell during the maturation phase, conditions that characterize the climate in the Pacific Northwest of the United States. In the Northern Hemisphere, the hops harvest occurs usually between late summer and early fall. After the harvest, the hops' rhizomes stay in the ground. From these, new shoots emerge the following spring. It is not uncommon for the same rhizome to produce hops for 70 to 100 years before they need to be replaced with a fresh plant.

Smoked Ale, American

Beer culture of origin	United States
AKA	None
Related Styles	Rauchbier

Style Description

This is a simple, smoked quaffing beer reminiscent of a Franconian Märzen-strength Rauchbier (see entry), but with less alcohol. It has a distinctly American flavor and aroma balance of Pacific Northwest hops, slightly roasted malts, and smoke. As an ale, it also has a slight fruitiness from the yeast, which is completely absent from the German Rauchbier, the latter being made with a very clean fermenting, low-temperature lager yeast. The color of this ale is deep red to copper.

Specifications

OG	1.048 (12 °P)		**BU**	20		**ABV**	4.8%
FG	1.012 (3 °P)		**Color**	34.3 SRM/89.7 EBC		**ABW**	3.8%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Munich I	63	21.83	9.90	25.61	11.62	4.13	1.88
Weyermann® Smoked Malt	25	8.66	3.93	10.16	4.61	1.64	0.75
Weyermann® Caramunich III	8	2.77	1.26	3.25	1.48	0.52	0.24
Weyermann® Carafa II	4	1.39	0.63	1.63	0.74	0.26	0.12
Total Grain	100	34.66	15.72	40.65	18.44	6.56	2.99
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Galena	12.5	1.51	43	1.8	50	0.3	8
Flavor: None	0	0	0	0	0	0	0
Aroma: Barth-Haas Willamette	5	2.83	80	3.3	94	0.5	15
Yeast	American ale yeast, such as "Chico"-style						

Brewing Process

Single-step infusion. Mash in @ approx. 150 °F (66 °C). Rest 60 min. Raise temp to mash-out @ 172 °F (78 °C). Recirculate. Lauter. Boil 70 min. 1st hops @ 10 min. 2nd hops @60 min. Whirlpool. Ferment @ 58 °F (20 °C) for 10 days. Rack. Condition for 14 days. Rack. Package unfiltered.

Sticke

Beer culture of origin	Germany (Düsseldorf region in the Rhineland)
AKA	Latzenbier
Related Styles	Altbier, Doppelsticke

Style Description

Sticke is to Altbier (see entry) what Bockbier is to Helles, or Imperial Stout is to Stout. It is the strongest and scarcest Altbier. Its strange name derives from a mangled version of the low-German word "stickum," meaning secret in English.

The brew evolved at the Zum Uerige, one of the four traditional Düsseldorf Altbier brewpubs. It is brewed only twice a year, ready for tapping on the third Tuesday in January and the third Tuesday in October, respectively.

Several other Altbier makers, too, produce a version of Sticke, also just a few times a year. In the past, some of them even kept the brew dates secret and announced the availability of the specialty beer as a surprise.

Sticke is essentially brewed like a regular Altbier, only its gravity and bitter values are much higher, as is its alcohol content by volume. The Sticke is a much under-appreciated but easy-to-make beer that would make a perfect addition on any brewpub winter beer menu.

Specifications

OG	1.058 (14.5°P)		**BU**	60		**ABV**	6%
FG	1.013 (.25°P)		**Color**	16.8 SRM/43.1 EBC		**ABW**	4.2%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pilsner	54.25	22.93	10.40	26.90	12.20	4.34	1.98
Weyermann® Munich II	20	8.46	3.84	9.92	4.50	1.60	0.73
Weyermann® Carared®	20	8.46	3.84	9.92	4.50	1.60	0.73
Weyermann® Pale Wheat Malt	5	2.11	0.96	2.48	1.12	0.40	0.18
Weyermann® Carafa® III Special	0.75	0.32	0.14	0.37	0.17	0.06	0.03
Total Grain	100	42.2763	19.18	49.59	22.49	8.00	3.64
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Spalter	4.5	12.06	342	14.1	401	2.3	65
Flavor: None	0	0	0	0	0	0	0
Aroma: Barth-Haas Spalter	4.5	7.87	223	9.2	262	1.5	42
Yeast	Düsseldorfer Altbier yeast						

Brewing Process

Step infusion at 122 °F (50 °C), 148 °F (64 °C), and 156 °F (69 °C), with a 10 min rest at each step; or single infusion @ 150 °F (66 °C), with a 30 min rest. Then raise temp to 170 °F (77 °C). Lauter. Boil 75 min. 1st hops after 15 min. 2nd hops after 65 min. Primary fermentation 7 days @ bottom edge of the yeast's preferred temp range. Rack. Reduce temp by 2 °F (1 °C) per day to 32 °F — 40 °F (0 °C — 4 °C). Rack after 2 wks. Lager 3 wks to 2 months. Rack and condition.

DID YOU KNOW ... ?

The origin of Sticke, according to local lore, dates from a time when beer ingredients were still measured rather haphazardly by the bucket-fulls. If the brew master made a "mistake" and mashed in too generous an amount of malt (for an OG of perhaps 1.056 or 14°P), he also had to add an extra dose of hops. The finished beer from such a batch would be a strong and substantial beverage—one not to be missed by the Altbier stalwarts. Because the Sticke started out as a mistake, it was rarely brewed the same way twice. The news of a brew master's mistake, of course, normally would get around quickly among the initiated, who would pass the secret by word of mouth, behind cupped hands, in a "stickum" or "sticke" way to their friends. To be in on the secret was quite a privilege. It is said that this "stickum" hot tip, shared among the aficionados, then became the origin of the beer's name.

In the Schumacher brewpub in Düsseldorf, a similar specialty Altbier is seasonally available. There, the Sticke brew is called Latzenbier. It, too, is usually brewed only twice a year. Apparently, the name Latztenbier dates from a time when monasteries still dominated the brewing trade and ordinary folk were served only thin beer, known then as "convent beer." But the real stuff, the strong beer, was stored high up on "Latten" or "Latzen" (wooden slats) out of sight of the impecunious commoners. This top-shelf brew, or Latzenbier, would be reserved only for the brew monks themselves or sold secretly, or "sticke," to only to the deserving folk, that is, those with ample cash.

Stout, Belgian

Beer culture of origin	Belgium
AKA	Black Belgian Stout
Related Styles	English/Irish stouts

Style Description

Belgium has always been at the crossroads of two great brew cultures, the German culture across its eastern border and the Anglo-Saxon culture across the Channel to the west. As a result, Belgian beers have absorbed influences from both and then mixed these with indigenous brewing concepts.

The Belgian Stout is no exception. It is about as opaque as any Stout from the British Isles, yet without any harsh, burnt, or acrid notes that are invariable associated with British black patent malts. The beer finishes almost as clean as a German Schwarzbier, almost lager-like.

The yeast for this brew must be a high attenuator, giving the brew a typically Belgian high alcohol content of 7 to 8 percent by volume, but without the fruity, estery, or high molecular alcohol underpinnings of many British strong ales. In spite of its strength, a Belgian Stout should have no syrupiness or heaviness. Instead, it should be of a medium body. To achieve an easy-drinking brew in spite of the seeming contradiction of blackness and crispness, the interpretation of this style below relies on de-husked Weyermann® Carafa® III, mostly for color, as well as Weyermann® Carawheat® for both color and smoothness. The diastatic power in the mash comes from Weyermann Pilsner malt. Some extra body is supplied by Weyermann® Abbey and Carabelge® malts.

The brew is formulated for an ABV of 7.3 percent, which is similar in strength to a Golden Belgian Ale.

Those who wish to bump up the ABV even further can add some Belgian dark sugar.

Specifications

OG	1.069 (17.25 °P)		**BU**	30		**ABV**	7.3%
FG	1.014 (3.5 °P)		**Color**	51.2 SRM/134.6 EBC		**ABW**	5.8%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pilsner	50	25.41	11.53	29.80	13.52	4.81	2.19
Weyermann® Carabelge®	25	12.70	5.76	14.90	6.76	2.40	1.09
Weyermann® Abbey Malt®	12	6.10	2.77	7.15	3.24	1.15	0.52
Weyermann® Carawheat®	10	5.08	2.31	5.96	2.70	0.96	0.44
Weyermann® Carafa III Special	3	1.52	0.69	1.79	0.81	0.29	0.13
Total Grain	100	50.82	23.05	59.61	27.04	9.61	4.37

HOPS	%AA	1 HL (oz)	1 HL (g)	1 BBL (oz)	1 BBL (g)	5 Gal (oz)	19 l (g)
Bittering: Barth-Haas Goldings	5.5	5.81	165	6.8	193	1.1	31
Flavor: None	4.25	0	0	0	0	0	0
Aroma: Barth-Haas Saaz	4.25	7.08	201	8.3	235	1.3	38
Yeast	Belgian Abbey-style ale yeast						

Brewing Process

Continuous infusion. Dough in as thick as possible @ 90 °F (32 °C) or lower. Then ramp up temp slowly and continuously over 3 – 4 hrs to a mash-out temp of about 170 °F (77 °C). Lauter slowly for 3 hrs. Boil for 90 minutes. 1st hops @ 15 min; 2nd hops @ 85 min. Whirlpool 30 min. Ferment for 1 wk @ 64 °F – 70 °F (18 ° - 21 °C), depending on yeast strain. Rack and ferment for another 10 days. Reduce temp to approx. 34°F (1°C); lager for 12 wks. Rack, condition, package.

DID YOU KNOW ... ?

What is Belgium? Where does the name come from? Those who had to study Latin in school may recall the first line in Caesar's Gallic Wars: "*Gallia est omnis divisa in partes tres, quarum unam incolunt Belgae, aliam Aquitani, tertiam...Galli.*" (All of Gaul is divided into three parts, one inhabited by the Belgians, another by the Aquitains, the third...by the Gauls.) To Caesar, everybody who lived north the river Seine and west of the river Rhine, was a Belgian—and it is that Roman designation of the locals that is at the root of the name of the modern country of Belgium. Thus we can ultimately blame a Roman emperor for the prefix of the many beer styles that the *Belgae* have spawned.

Subsequently in the Dark Ages, as the Roman Empire was being replaced by the Germanic medieval feudal system, Caesar's land of the *Belgae*, disappeared completely from the map, both in name and in fact. For about a thousand years, the lands that were eventually to become the country of Belgium were ruled by other countries, first, in the 8th century as part of Charlemagne's empire, and, by the by the 15th century, as part of Burgundy. In 1477, Mary of Burgundy married the Austrian emperor Maximilian I, and Caesar's erstwhile land of the *Belgae* became part of Austria. In 1555, Charles V, King of Austria and Emperor of Germany, turned these lands over to his son, Philip II of Spain, and the Belgians found themselves living in the now-Spanish Netherlands, which became French, when Napoleon Bonaparte's *Grand Armée* overran Europe in the early 19th century. At the Vienna Congress, in 1815, made Belgium part of the Netherlands.

In 1830, the Belgians finally had enough. They started an uprising against their Dutch king, William I, and simply declared their independence, and found themselves a king, a German blue-blood, Prince Leopold of Saxe-Coburg-Gotha. At the London Conference of 1831, the European powers finally gave their blessing to the formation of the new state. Thus was created between The Netherlands and France the current country of Belgium, under a label dating back to antiquity, to a Roman chronicler, general, and emperor named Julius Caesar.

Stout, Foreign Export

Beer culture of origin	Ireland
AKA	FES
Related Styles	English Stout

Style Description

This is a Stout that dates from the beginnings of the style in the late 18th century, in London and Dublin, when a Stout was still a "stout" Porter, and the study of microbiology had not been invented yet. It was a strong brew with plenty of dark, unmalted adjuncts, fermented by a yeast culture, the composition of which we can only guess today.

Apparently, the beer had certain sour, horse-blanket notes on the palate, which suggests the presence of Bettanomyces in the fermentation vats. In fact, there is speculation that the agents of fermentation for that brew may have included some lager yeast strains as well.

The recipe below is a "conservative" interpretation of the style, formulated entirely for fermentation by a pure Irish dry ale yeast strain.

The more adventurous brewers, however, may wish to pitch this brew with a mélange of ale and lager strains as well as a Brettanomyces preparation.

Barrique-ing a brew thus fermented in a whiskey barrel, could add even more interesting notes to the finished beer.

Specifications

OG	1.073 (18.25°P)		**BU**	65		**ABV**	7.3%
FG	1.018 (4.5°P)		**Color**	75.7 SRM/200 EBC		**ABW**	5.8%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	75	40.47	18.36	47.48	21.53	7.66	3.49
Weyermann® Roasted Barley (unmalted)	17	9.17	4.16	10.76	4.88	1.74	0.79
Weyermann® Caraaroma®	8	4.32	1.96	5.06	2.30	0.82	0.37
Total Grain	100	53.96	24.48	63.30	28.71	10.21	4.65
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Goldings	11	5.92	168	6.9	197	1.1	32
Flavor: none	0	0	0	0	0	0	0
Aroma: Barth-Haas Goldings	5	6.97	198	8.2	232	1.3	37
Yeast	Irish ale yeast						

Brewing Process

Single-step infusion: Mash in as thick as possible @ 151 °F (66 °C). Rest 90 min. Recirculate. Sparge with 180°F (8 °C) brewing liquor to raise mash temp to 172 °F (78 °C) for mash-out. Hold mash temp at that level. Adjust sparge water temp. Boil 90 min. 1st hops @ 30 min. 2nd hops @ 80 min. Whirlpool 30 min. Primary fermentation @ 65 °F (18 °C) for about 1 wk. Rack. Secondary fermentation about 3 wks @ same temp. Rack again, condition for a wk. Package.

DID YOU KNOW ... ?

Though beer styles are a fairly recent development, historically, because it has been only about 200 years since brewers have been able to fix their brews in terms of scientific parameters and repeatable processes. But the origins of beer styles have their roots in much earlier practices, especially among the medieval brew monks and brew nuns, often educated people and the only ones in their communities who could read and write. In the feudal culture of the Middle Ages, just about everything and every activity in life was linked to a person's place in the static social hierarchy of society. It was no different with monastery beer.

For the monastery's abbot and his inner circle as well as for distinguished guests the brew monks made a beer they called *celia*. It was a strong brew usually made from barley, sometimes from wheat or, frequently, from both. It is probable that *celia* was one of the first beers to be flavored with hops, when it started to be used in monastery breweries in the 8th century. Though the ordinary monks had to brew *celia*, they rarely got to taste it.

Slightly below the lofty rank of *celia* was a brew called *cervisa*, It was a beer of often milky-sour taste, usually made from oats, and flavored with herbs and sometimes with honey, in which case it was called *cervisa mellita*. Technically, therefore, this was a Gruitbier (see entry). It was the everyday beer of the monks and pilgrims and was consumed almost incessantly throughout the day.

The third beer was called *conventus*, a thin beer made of the final runnings from the stronger beers and mixed with fresh extract from malted oats. It was brewed specifically for the lower ranks, the abbey's workers, and for beggars.

And below that was, of course, always...water. But that was often contaminated and thus bad for your health!

Stout, Irish

Beer culture of origin	Ireland
AKA	Dry Stout
Related Styles	English Stout

Style Description

If there is one outstanding characteristic of an Irish Stout, it is its dryness. The key to making a dry stout —or a dry beer in general, ale or a lager —is the mash temperature, which should favor beta- over alpha-amylase.

A dry Stout, therefore, is best mashed in at a single infusion temperature of about 150 °F (66 °C). Stout is a delicate beer, in spite of its dark appearance. The base malt should not be too rough. In the recipe below, the solution is about 15 percent of Weyermann® Extra Pale Pilsner malt.

For a bit of body the balance an Irish Stout's dryness, the brew requires a small portion of dark unmalted adjuncts, such as Weyermann® roasted barley. The Caraaroma® contributes a smooth chocolate character for a well-rounded taste.

There is only one hop addition, for bittering. Too complex a hop regiment with strong flavors and aromas would conflict with the predominance of dark malt flavors. Therefore, Target with its 9.5 to 12.5 percent alpha-acids—which are relatively high bittering values for a British-style hop—is a good choice, but the old standbys of Fuggles and East Kent Goldings are suitable as well.

Specifications

OG	1.040 (10°P)		**BU**	35		**ABV**	4.3%
FG	1.008 (2°P)		**Color**	57.5 SRM/151.2 EBC		**ABW**	3.4%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	70	20.06	9.10	23.53	10.67	3.80	1.73
Weyermann® Extra Pale Pilsner	15	4.30	1.95	5.04	2.29	0.81	0.37
Weyermann® Roasted Barley (unmalted)	10	2.87	1.30	3.36	1.52	0.54	0.25
Weyermann® Caraaroma®	5	1.43	0.65	1.68	0.76	0.27	0.12
Total Grain	100	28.66	13.00	33.62	15.25	5.42	2.47
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Goldings	11	3.75	106	4.4	125	0.7	20
Flavor: none	0	0	0	0	0	0	0
Aroma: Barth-Haas Goldings	0	0	0	0	0	0	0
Yeast	Irish ale yeast						

Brewing Process

Single-step infusion: Mash in as thick as possible @ 151 °F (66 °C). Rest 90 min. Recirculate. Sparge with 180°F (8 °C) brewing liquor to raise mash temp to 172 °F (78 °C) for mash-out. Hold mash temp at that level. Adjust sparge water temp. Boil 90 min. Hops @ 30 min. Whirlpool 30 min. Primary fermentation @ 65 °F (18 °C) for about 1 wk. Rack. Secondary fermentation about 3 wks @ same temp. Rack again, condition for a wk. Package.

DID YOU KNOW ... ?

Today, we consider monastery brewing a strictly Continental European way of beer-making. Few people, however, know that the pious brew monks and nuns got their start in the brewing trade from Irish missionaries in the Dark Ages. Here is how that happened:

The Irish were among the first European outside Italy to be Christianized. It all started around 385 AD, when a young Scottish lad named Patricius (now St. Patrick, the patron saint of the Emerald Isle) was born as the son of Calpurnius, the local tax collector for the Romans. When he was about 30 years old, he claimed to have been instructed by a divine voice to go to Ireland and make it Christian, which he did so successfully that, by the beginning of the 6th century, there wasn't a soul left for his missionary spiritual heirs to Christianize. So, they reached for their shepherd's staff, laced up their sandals, crossed the Irish Sea and the English Channel, and set out with zeal and ardor to wrestle Continental lost souls from the clutches of eternal damnation. As soon as they reached the shores of mainland Europe, they set up a string of small monasteries—the first ever on the Continent—as hubs from which they spread the gospel into the vast, heathen forests.

One of the most consequential founders of Irish monasteries on the Continent was a chap by the name of Columban (c. 540–615). He was a monk from the Benedictine Abbey of Bangor in Ireland. Around 585, he took leave of his homeland in the company of 12 disciples. It is not clear if Columban knew how to brew when he left Ireland, but he clearly learned about it once he started living among ale-swigging Germans. Initially, life in these Dark-Age monasteries was harsh and sparse, for austere Columban had laid out strict rules from them: For monks who forgot to say *Amen* or sang out of tune, he prescribed six lashes; and ten lashes for notching a table with a knife. He decreed that meals be simple and never large, because food and drink should sustain, not harm, life. Though every monk was allotted his daily measure of beer, he forbade drunkenness, and any monk who spilled beer had to stand upright and still for an entire night. The monks' labors were centered on good deeds for others, not for themselves, and they shared not just their counsel but also their produce with all comers. But as the flow of pilgrims and other traveling folk increased on the highways and byways of the feudal realm, so did the monasteries' operations. The food, drink, and shelter the monks once shared out of charity with anyone who came, soon became a commodity offered to the dusty travelers for profit, and the hooded fishermen of souls, with hostels and breweries in all the right places, went into the hospitality business with abandon, and they turned their cloisters and into first truly large-scale brewing operation in Europe.

Stout, Oatmeal

Beer culture of origin	England
AKA	None
Related Styles	English Stout, Sweet Stout, Milk Stout

Style Description

Along most specification variables, Oatmeal Stout ranges roughly between dry and sweet stouts, though it often has a bit more alcoholic strength. It is very low in diacetyl and hop flavor and aroma, which leaves room for the almost oily silkiness and smoothness of oats to have their effect on the palate. The simplest source for oats is your local grocery store. Quick oats are fine, instant oats are better because they are more thoroughly pre-gelatinized.

Specifications

OG	1.054 (13.5 °P)		**BU**	35		**ABV**	5.3%
FG	1.014 (3.5 °P)		**Color**	105.9 SRM/279.5 EBC		**ABW**	4.2%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	55	21.57	9.78	25.30	11.47	4.08	1.86
Weyermann® Caramunich® III	15	5.88	2.67	6.90	3.13	1.11	0.51
Weyermann® Caraaroma®	15	5.88	2.67	6.90	3.13	1.11	0.51
Weyermann® Carafa® I	5	1.96	0.89	2.30	1.04	0.37	0.17
Quick or instant oats from grocery store	5	1.96	0.89	2.30	1.04	0.37	0.17
Weyermann® Roasted Barley (unmalted)	5	1.96	0.89	2.30	1.04	0.37	0.17
Total Grain	100	39.21	17.79	46.00	20.86	7.42	3.38
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Target	11	3.61	102	4.2	120	0.7	19
Flavor: None	0	0	0	0	0	0	0
Aroma: Barth-Haas Goldings	5	0.94	27	1.1	31	0.2	5
Yeast	English- or Scottish-style yeast						

Brewing Process

Single-step infusion: Mash in as thick as possible @ 151 °F (66 °C). Rest 90 min. Recirculate. Sparge with 180°F (8 °C) brewing liquor to raise mash temp to 172 °F (78 °C) for mash-out. Hold mash temp at that level. Adjust sparge water temp. Boil 90 min. 1st hops @ 30 min. 2nd hops @ 80 min. Whirlpool 30 min. Ferment @ 60 °F (16 °C) for about 4 wks to keep the diacetyl level in check. Rack. Condition about 3 wks @ same temp. Rack. Mature for 3 – 4 months. Package.

Stout, Russian Imperial

Beer culture of origin	England
AKA	Extra Double Stout
Related Styles	English Stout

Style Description

In the late 19th century the British Isles produced a plethora of Stouts, ranging in gravities from perhaps 10°P (OG 1.040) for both the dry and sweet Stouts, to about 16 °P (OG 1.064) for the single Stouts all the way to about 25 °P (OG 1.100) or more for the crown of them all, the Russian Imperial Stout—mature, inscrutably black, strong, weighty, rich, and awesome—the basso in the matrix of Stouts. This super-Stout for the Baltic export trade was brewed to an extraordinary strength of 8 to 11 percent alcohol by volume, and conditioned for months, even years. It was mashed from a grain bill of pale ale, Pilsner, amber and black malts and preserved with often four times the hops of a regular ale. Favored even at the banquets of the Czar's Imperial Winter Palace in Saint Petersburg—hence it imperial name—this stout is a harmonious marriage between the incredible finesse of British dark-ale brewing and the somber melancholy of the Russian soul. Its grain bill is so hefty that it may push the capacity limits of most mash tuns. Depending on the size of your mash tun, it might be necessary to divide the massive grain bill into two portions, mash each of them separately, and fill the fermenter on two consecutive brew days. To ensure proper attenuation, the yeast pitch must be healthy and plentiful.

An English-style yeast may deliver the correct flavor, but it may not be able to go the distance to full attenuation. Also suitable is a Scottish-style yeast, which may be more robust. A Belgian Abbey-style yeast may be the safest bet, because of its high alcohol tolerance. Perhaps the best pitch is a combination of all three yeasts.

Specifications

OG	1.110 (27.5°P)		**BU**	80		**ABV**	11.7%
FG	1.022 (5.5°P)		**Color**	206 SRM/545 EBC		**ABW**	9.22%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	43	36.17	16.41	42.43	19.25	6.84	3.12
Weyermann® Pilsner	12.5	10.52	4.77	12.33	5.59	1.99	0.91
Weyermann® Caramunich® III	12.5	10.52	4.77	12.33	5.59	1.99	0.91
Weyermann® Caraaroma®	12.5	10.52	4.77	12.33	5.59	1.99	0.91
Weyermann® Caraamber®	12.5	10.52	4.77	12.33	5.59	1.99	0.91
Weyermann® Carafa® III	4	3.36	1.53	3.95	1.79	0.64	0.29
Weyermann® Roasted Barley (unmalted)	3	2.52	1.14	2.96	1.34	0.48	0.22
Total Grain	100	84.12	38.16	98.67	44.76	15.91	7.25

HOPS	%AA	1 HL (oz)	1 HL (g)	1 BBL (oz)	1 BBL (g)	5 Gal (oz)	19 l (g)
Bittering: Barth-Haas Target	11	7.28	206	8.5	242	1.4	39
Flavor: None	0	0	0	0	0	0	0
Aroma: Barth-Haas Goldings	5	8.58	243	10.1	285	1.6	46
Yeast	English-, Scottish-, and Abbey-style yeast						

Brewing Process

Single-step infusion: Mash in as thick as possible @ 151 °F (66 °C). Rest 90 min. Recirculate. Sparge with 180°F (8 °C) brewing liquor to raise mash temp to 172 °F (78 °C) for mash-out. Hold mash temp at that level. Adjust sparge water temp. Boil 90 min. 1st hops @ 30 min. 2nd hops @ 80 min. Whirlpool 30 min. Ferment @ 60 °F (16 °C) for about 4 wks to keep the diacetyl level in check. Rack. Condition about 3 wks @ same temp. Rack. Mature for 3 – 4 months. Package.

DID YOU KNOW ... ?

Oats are usually added to the mash unmalted, at no more than 10 percent of the total grain bill. Oats give the finished beer added body, mouth feel, and head retention, but can also create chill hazes, which is one reason why they are used mostly in dark beers. Oats must always be mashed with other grains, because they have no diastatic power— for lack of amylase enzymes). Their relevant specifications are:

Color: 1 °L/1.45 EBC
Diastatic Power: 0.0 °Lindner
Maximum portion in grain bed: 10.0%
%DBFG/%DBCG Diff: 1.5 %
Total Protein: 9.0 %

DID YOU KNOW ... ?

The origin of the name Oyster Stout for Sweet or Milk Stout does not come from the practice of putting raw oysters into a cask or adding oyster juice to it as a flavoring. Rather, nourishing Sweet Stout has long been a favorite beverage to drink with oysters, especially in British pubs. Placing in Stout was first tried not in England, but in New Zealand in 1929.

Stout, Sweet

Beer culture of origin	England, Ireland
AKA	Export Stout, Milk Stout, Oyster Stout
Related Styles	English Stout

Style Description

While the classic Irish Stout excels in dryness and a complete lack of residual sweetness, the fruity-creamy Sweet Stout—also known as Export Stout or Milk Stout—excels in residual sweetness and a full-bodied finish. The term Milk Stout derives from the fact that some varieties achieve their sweetness from the addition of unfermentable lactose, the sugar found in milk. In the recipe below, the sweetness is achieved through the addition of a substantial amount of chocolate and caramel malts to the grain bill. The alcohol content may vary between a low of 3 and a high of 4.6 percent by volume. The interpretation below is formulated for a lower-alcohol version. On the British Isles, this Stout was once considered beneficial for lactating ladies and thus frequently prescribed for young mothers.

Specifications

OG	1.041 (10.25°P)		**BU**	26		**ABV**	3.3%
FG	1.016 (4°P)		**Color**	92.4 SRM/243.7 EBC		**ABW**	2.6%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Ale	50	14.70	6.67	17.25	7.82	2.78	1.27
Weyermann® Caraaroma®	20	5.88	2.67	6.90	3.13	1.11	0.51
Weyermann® Caramunich® III	10	2.94	1.33	3.45	1.56	0.56	0.25
Weyermann® Caraamber®	10	2.94	1.33	3.45	1.56	0.56	0.25
Weyermann® Roasted Barley (unmalted)	10	2.94	1.33	3.45	1.56	0.56	0.25
Total Grain	100	29.40	13.34	34.49	15.65	5.56	2.53
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Target	11	2.79	79	3.3	93	0.5	15
Flavor: None	0	0	0	0	0	0	0
Aroma: None	0	0	0	0	0	0	0
Yeast	London ale yeast						

Brewing Process

Single-step infusion: Mash in as thick as possible @ 151 °F (66 °C). Rest 90 min. Recirculate. Sparge with 180°F (8 °C) brewing liquor to raise mash temp to 172 °F (78 °C) for mash-out. Hold mash temp at that level. Adjust sparge water temp. Boil 90 min. Hops @ 30 min. Whirlpool 30 min. Primary fermentation @ 65 °F (18 °C) for about 1 wk. Rack. Secondary fermentation about 3 wks @ same temp. Rack again, condition for a wk. Package.

Vienna Lager

Beer culture of origin	Germany
AKA	None
Related Styles	Oktoberfest/Märzen

Style Description

In many respects, the Vienna Lager, which is now rarely brewed, resembles the Märzen-Oktoberfest, a close stylistic relative. It was first introduced in 1841 by the Dreher Brewery in Schwechat, near Vienna. The Vienna's body is medium and malty; its finish is slightly, but not cloyingly, sweet. Its hop loading, like that of a Märzen-Oktoberfest, emphasizes aroma more so than bitterness, and its alcohol by volume is usually around 5 percent—more in line with what Munich brewers call an Export than with a Märzen-Oktoberfest, which tends to have an alcohol by volume level closer to 6%. Finally, the Vienna lager is a touch more reddish in color than the more golden-amber typical Märzen-Oktoberfest.

Specifications

OG	1.050 (12.5 °P)		**BU**	25		**ABV**	4.9%
FG	1.013 (3.25 °P)		**Color**	13.1 SRM/33.5 EBC		**ABW**	3.9%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Vienna	50	18.08	8.20	21.21	9.62	3.42	1.56
Weyermann® Munich II	40	14.47	6.56	16.97	7.70	2.74	1.25
Weyermann® Caramunich® I	5	1.81	0.82	2.12	0.96	0.34	0.16
Weyermann® Melanoidin	5	1.81	0.82	2.12	0.96	0.34	0.16
Total Grain	100	36.17	16.41	42.43	19.24	6.84	3.12
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Tradition	5.5	5.31	151	6.2	177	1.0	29
Flavor: Barth-Haas Hallertauer Mittelfrüh	4.25	3.49	99	4.1	116	0.7	19
Aroma: None	0	0	0	0	0	0	0
Yeast	Bavarian-style lager yeast						

Brewing Process

Dough in for a thick mash @ 122°F (50°C). Rest 30 min. Infuse and raise temp to 151 °F (66 °C). Raise mash temperature to 170 °F (77 °C). Lauter for 90 min. Boil 90 min. 1st hops @ 15 min. 2nd hops @ 75 min. Whirlpool 30 min. Ferment @ 50 °F (10 °C) for 2 wks. Rack. Lager close to freezing point for at least 4 wks. Rack again, condition, package.

Weissbier

Beer culture of origin	Germany (Bavaria)
AKA	Weizenbier, Weizen, Hefeweizen
Related Styles	Kristallweizen (filtered), Dunkelweizen, Weizenbock, Weizendoppelbock

Style Description

Weissbier or Hefeweizen evolved in Bavaria in the 16th century. Its signature flavor—often described as phenolic, spicy, tart, and fruity, with notes of clove, banana, nutmeg, vanilla, apple, even bubblegum—comes exclusively from special Weissbier yeast strains.

A mash-in temperature of 99 °F (37 °C) is particularly favorable to the formation of ferulic acid, a precursor compound in malt for 4-vinyl guaiacol, a type of phenol, which is largely responsible for the clove-banana Weissbier flavor. In Germany, the modern Beer Purity Law stipulates that any beer called Weissbier on the label must contain at least 50 percent wheat malt. It must also be an ale. Because wheat has a relatively high glucan and protein content and very little husk material, which makes for difficult lautering, Weissbier mashes rarely contain more than 70 percent wheat malt.

Weissbiers are always malt-accented, with hop notes remaining in the background. A delicate noble hop, such as Hallertauer Mittelfrüh, therefore, is ideal for both bittering and aroma. Weissbiers are usually fermented in open vessels for easy yeast cropping.

Weissbier is always unfiltered (the filtered version is called Kristallweizen), and usually bottle-conditioned. For this, a fully fermented Weissbier is inoculated, just before bottling, with Speise (fresh wort for priming) and fresh yeast. The yeast can be pitched into the Speise. If no Speise is available, an amber liquid malt extract (LME) can be used as a substitute priming agent.

Specifications (All values before the addition of Speise as a priming agent.)

OG	1.050 (12.5 °P)		**IBU**	14		**ABV**	5.2%
FG	1.012 (3 °P)		**Color**	4.3 SRM/10.15 EBC		**ABW**	4.1%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Wheat Malt	55	20.73	9.40	24.31	11.03	3.92	1.79
Weyermann® Pilsner	20	7.54	3.42	8.84	4.01	1.43	0.65
Weyermann® Carahell®	15	5.65	2.56	6.63	3.01	1.07	0.49
Weyermann® Munich II	7	1.13	0.51	1.33	0.60	0.21	0.10
Weyermann® Acidulated	3	2.64	1.20	3.09	1.40	0.50	0.23
Total Grain	100	37.69	17.09	44.21	20.05	7.13	3.25

HOPS	%AA	1 HL (oz)	1 HL (g)	1 BBL (oz)	1 BBL (g)	5 Gal (oz)	19 l (g)
Bittering: Barth-Haas Hallertauer Mittelfrüh or equivalent	4.2	3.93	112	4.6	131	0.7	21
Flavor: None	0	0	0	0	0	0	0
Aroma: Barth-Haas Hallertauer Mittelfrüh or equivalent	4.2	5.25	150	6.13	175	0.93	28
Yeast	Bavarian Hefeweizen Yeast						

Brewing Process

Multi-step infusion. Mash in with approx. 65% of net kettle volume of brewing liquor @ 99 °F (37 °C); raise temp to 113 °F (45 °C); rest for 10 min; raise temp to 126 °F (52 °C); rest 10 min; raise temp to 144 °F (62 °C); rest 30 min; raise temp to 162 °F (72 °C); rest 30 min; raise temp to mash-out @ 172°F (78°C). Sparge/lauter 100 min. Boil 60 min. Bittering hops after 15 min. Aroma hops in whirlpool. Ferment in open fermenter @ 64 – 75 °F (18 – 24 °C), depending on selected yeast strain.

Speise/priming: At terminal gravity, which is likely to occur around 2.85 °P (1.011), pitch fresh Bavarian Hefeweizen yeast and add enough fresh Weissbier wort (approx. 8% – 9% of finished beer volume) to raise gravity to approx. 4 °P (1.016). Alternatively, add Weyermann® Munich Amber Liquid Malt Extract to prime the brew. The approximate quantities of LME are: 4.28 lbs LME/bbl of finished beer; 3.65 lbs LME/hl of finished beer; 1.66 kg LME/hl of finished beer; or 0.14 lbs LME/gal of finished beer.

Package primed brew immediately into kegs, bottles, or serving tank. Warm-condition packaged beer 7 – 8 days @ approx. 68 °F (20 °C). Pressure should not exceed 2.6 bar (37.7 psi). Finally, cold-condition packaged beer @ 41 °F (5 °C) for another 2 wks.

DID YOU KNOW ... ?

On its home turf in Bavaria, a properly brewed wheat ale is usually referred to as Weissbier (German for "white beer) or Weizenbier ("wheat beer"), while in North America this beer is called by its now less common German name of Hefeweizen (literally "yeast wheat"). The modern German Beer Purity Law defines Weizenbier as any top-fermented brew that is made with at least 50 percent wheat. A few breweries mash their Weissbiers with as much as 75 percent wheat.

Weizenbock

Beer culture of origin	Germany
AKA	None
Related Styles	Weissbier/Hefeweizen, Bockbier

Style Description

While Bockbier is a barley-only strong Bavarian lager, Weizenbock is a wheat-and-barely strong Bavarian ale. Brew-technically, Weizenbock can be infusion-mashed like a Hefeweizen/Weissbier or decoction-mashed like a barley-based Bockbier. The recipe below contains instructions for either method. Compared to the pale Hefeweizen/Weissbier grain bill, the Weizenbock grain bill is slanted slightly towards darker malts.

Like a Hefeweizen/Weissbier, a Weizenbock is usually bottle-conditioned. For this, a fully fermented Weizenbock is inoculation, just before bottling, with Speise (fresh wort for priming) and fresh yeast. The yeast can be pitched into the Speise. If no Speise is available, an amber liquid malt extract (LME) can be used as a substitute priming agent. For a Weizendoppelbock, simply increase the grain bill proportionally to your heart's content. For a Weizeneisbock, make a Weizendoppelbock, then follow the analogous instructions for a barley-based Eisbock (see entry).

Specifications

OG	1.066 (16.5 °P)		**BU**	23		**ABV**	7%
FG	1.013 (3.25 °P)		**Color**	11.2 SRM/28.5 EBC		**ABW**	5.6%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pale Wheat Malt	55	26.66	12.09	31.27	14.18	5.04	2.30
Weyermann® Pilsner	20	9.69	4.40	11.37	5.16	1.83	0.84
Weyermann® Carahell®	7.5	3.64	1.65	4.26	1.93	0.69	0.31
Weyermann® Dark Wheat	7.5	3.64	1.65	4.26	1.93	0.69	0.31
Weyermann® Carawheat®	7.5	3.64	1.65	4.26	1.93	0.69	0.31
Weyermann® Acidulated	2.5	1.21	0.55	1.42	0.64	0.23	0.10
Total Grain	100	48.47	21.99	56.86	25.79	9.17	4.18
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Hallertauer Mittelfrüh or equivalent	4.2	6.46	183	7.6	215	1.2	35
Flavor: None	0	0	0	0	0	0	0
Aroma: Barth-Haas Hallertauer Mittelfrüh or equivalent	4.2	5.25	150	6.1	175	0.9	28
Yeast	Bavarian Hefeweizen Yeast						

Brewing Process (Infusion)
Mash in with approx. 65% of expected net kettle volume of brewing liquor @ 99 °F (37 °C); raise temp to 113 °F (45 °C); rest for 10 min; raise temp to 126 °F (52 °C); rest 10 min; raise temp to 144 °F (62 °C); rest 30 min; raise temp to 162 °F (72 °C); rest 30 min; raise temp to mash-out @ 172°F (78°C). Sparge/lauter 100 min. Boil 60 min. Bittering hops after 15 min. Aroma hops in whirlpool. Ferment in open fermenter @ 64 – 75 °F (18 – 24 °C), depending on selected yeast strain.

Speise/priming: At terminal gravity, pitch fresh Bavarian Hefeweizen yeast and add enough fresh Weissbier wort (approx. 8% – 9% of finished beer volume) to raise gravity to approx. 4 °P (1.016). Alternatively, add Weyermann® Munich Amber Liquid Malt Extract to prime the brew. The approximate quantities of LME are: 4.28 lbs LME/bbl of finished beer; 3.65 lbs LME/hl of finished beer; 1.66 kg LME/hl of finished beer; or 0.14 lbs LME/gal of finished beer.

Package primed brew immediately into kegs, bottles, or serving tank. Warm-condition packaged beer 7 – 8 days @ approx. 68 °F (20 °C). Pressure should not exceed 2.6 bar (37.7 psi). Finally, cold-condition packaged beer @ 41 °F (5 °C) for another 2 wks.

Brewing Process (Double Decoction)
Mash in main mash at 99 °F (37 °C); rest 30 minutes for proper grist hydration and activation of phytase for some mash acidification.

Draw 1st decoction (one-third of main mash). Heat decoction (10 – 15 min). Rest decoction @ 149 °F (65 °C) for 30 min. Heat decoction (10 min). Rest decoction @ 162 °F (72 °C) for 10 min. Heat decoction (10 min). Boil decoction @ 212 °F (100 °C) for 10 min. Reintroduce decoction to main mash. Rest main mash @ 149 °F (65 °C) for 10 min. Draw 2nd decoction (one-third of main mash). Heat decoction (5 – 10 min). Rest decoction @ 162 °F (72 °C) for 10 min. Heat decoction (10 min). Boil decoction @ 212 °F (100 °C) for 10 min. Reintroduce decoction to main mash. Rest main mash @ 162 °F (72 °C) for 10 min. Raise temp of main mash to 171 °F (77 °C). Rest 15 min. Recirculate (5 min). Start lautering and sparging slowly (!) for about 3 hrs until kettle full. Bittering hops after 15 min. Aroma hops in whirlpool. Ferment in open fermenter @ 64 – 75 °F (18 – 24 °C), depending on selected yeast strain.

Speise/priming: At terminal gravity, pitch fresh Bavarian Hefeweizen yeast and add enough fresh Weissbier wort (approx. 8% – 9% of finished beer volume) to raise gravity to approx. 4 °P (1.016). Alternatively, add Weyermann® Munich Amber Liquid Malt Extract to prime the brew. The approximate quantities of LME are: 4.28 lbs LME/bbl of finished beer; 3.65 lbs LME/hl of finished beer; 1.66 kg LME/hl of finished beer; or 0.14 lbs LME/gal of finished beer.

Package primed brew immediately into kegs, bottles, or serving tank. Warm-condition packaged beer 7 – 8 days @ approx. 68 °F (20 °C). Pressure should not exceed 2.6 bar (37.7 psi). Finally, cold-condition packaged beer @ 41 °F (5 °C) for another 2 wks.

Wiess

Beer culture of origin	Germany (Cologne region in the Rhineland)
AKA	None
Related Styles	Kölsch, Altbier, as well as medieval Keutebier and Mumme

Style Description

Wiess—meaning "white" in the Lower Rhineland German dialect—is a type of unfiltered Kölsch that was once common in Cologne, especially in the late 19th century. The style became practically extinct, however, at the beginning of the 20th century, when the easy-drinking, brilliantly blond, and severely filtered modern Kölsch completely replaced it as the default quaffing and session beer of the locals. While the Kölsch is an all-barley based ale, the Wiess was an unfiltered ale, made from a base of pale barley malt and up to 20 percent (rarely more) pale wheat malt.

Historically, the Wiess is an evolutionary link between the modern Kölsch and the medieval Keutebier, a wheat-and-barley ale that evolved from the Mumme, a strong, brown, low-attenuation, high-gravity trading ale from the City of Brunswick (Braunschweig in German). The Mumme was once the most common beer in the world, because, between the 13th and 16th centuries, it was transported in ketches of the Hanseatic League to all the far corners on the then-known world. Keutebier is the common ancestor of the modern Altbier and, through the Wiess, of the modern Kölsch as well.

With the resurgent interest in heirloom beer styles, Wiess is now being revived, especially in brewpubs. The recipe below is based on a regular Kölsch brewing process, with a continuous infusion mash and a 90-minute boil.

Specifications

OG	1.046 (11.5 °P)		**BU**	22		**ABV**	4.8%
FG	1.010 (2.5 °P)		**Color**	2.1 SRM/4.25 EBC		**ABW**	3.8%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pilsner	80	26.52	12.03	31.11	14.11	5.02	2.29
Weyermann® Pale Wheat Malt	20	6.63	3.01	7.78	3.53	1.25	0.57
Total Grain	100	33.15	15.04	38.88	17.64	6.27	2.86
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Hallertauer Perle	6.5	2.02	57	2.4	67	0.4	11
Flavor: Barth-Haas Spalter	4	3.00	85	3.5	100	0.6	16
Aroma: Barth-Haas Hersbrucker	2.25	1.80	51	2.1	60	0.3	10
Yeast	Kölsch yeast						

Brewing Process

Mash in thick @ 110 °F (43 °C). Infuse and raise temp by about 1 °F (0.5 °C) per min. to 146 °F (66 °C). Rest 30 min. Infuse and raise temp to 158 °F (70 °C). Rest 15 min. Infuse and raise temp to mash-out @ 170° F (78° C). Sparge 45 – 60 min. Boil 90 min. 1st hops @ 5 min. 2nd hops @ 40 min. 3rd hops @ 80 min. Whirlpool 30 min. Ferment for 2 wks. @ 59 °F – 65 °F (15 °C – 18 °C). Rack. Lager 6 – 8 wks. Rack, condition, package.

DID YOU KNOW ... ?

Wheat beer has apparently been brewed in Bavaria (and probably in Bohemia, too) since the Bronze Age. Proof of this is a 2,800-year old earthenware fermentation amphora discovered in 1934 in a Celtic tribal burial mound near the small village of Kasendorf, outside Kulmbach, in northern Bavaria. The amphora can now be seen in the Kulmbach Beer Museum. Scientists have determined that the residues in the amphora are from dark wheat beer flavored with oak leaves.

In 1520, the feudal ruler of Bavaria, Duke Wilhelm IV of the Wittelsbach dynasty, rewarded one of his vassals, Duke Hans VI of Degenberg from the village of Schwarzach in the Bavarian Forest, with the exclusive privilege, in perpetuity, to brew and sell "white beer" (Weissbier) in this hinterland region. Perhaps unexpectedly, the Degenbergs were able to make quite a profit from their new monopoly. They thus aroused the jealousy of their erstwhile benefactor. Under feudal law, however, a privilege once given could not be revoked. In 1602, however, Duke Sigismund of Degenberg died without leaving an heir. Now that the Degenberg clan had become extinct, all the clan's hereditary privileges, including their Weissbier monopoly, reverted back to the Wittelsbach ruler of the day, Duke Maximilian I.

Maximilian promptly continued the Weissbier monopoly, now owned by him, and insisted that all pubs in his realm had to serve Weissbier purchased from the Duke's breweries. He also built a "white" brewery in downtown Munich, which opened in 1605 on the location of the current landmark Hofbräuhaus. The Wittelsbach Weissbier monopoly lasted until the middle of the 19th century, when "white beer" gradually fell out of fashion and the traditional Bavarian brown lager started to make a comeback. In 1856, the Wittelsbachs sold the Weissbier brew rights to a brewer named George Schneider I, whose descendants still make Weissbier today.

Witbier/Bière blanche

Beer culture of origin	Belgium
AKA	Belgian White Ale
Related Styles	*Bière de saison*; French *bière de mars*

Style Description

Witbier or biere blanche *in French is the Belgian equivalent of a German Hefeweizen/Weissbier, but without the clove, banana, and bubblegum notes that come from the Hefeweizen yeast. It also has a kinship with an Alsatian bière de mars. This brew is fermented cleanly with a Belgian Witbier yeast and then spiced with coriander and bitter orange Curacao peel, both ground before being immersed in a steeping bag in the hot kettle wort. The beer is nicely effervescent and makes a refreshing summer quaffing ale, especially when served chilled at a cellar temperature of about 54 °F (12 °C).*

Specifications

OG	1.048 (12 °P)		**BU**	15		**ABV**	4.8%
FG	1.012 (3 °P)		**Color**	2.7 SRM/5.9 EBC		**ABW**	3.8%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pilsner	55	19.06	8.65	22.36	10.14	3.61	1.64
Weyermann® Pale Wheat Malt	45	15.6	7.07	18.29	8.30	2.95	1.34
Total Grain	100	34.66	15.72	40.65	18.44	6.56	2.99
ground coriander		0.17	0.077	0.199	0.091	0.032	0.015
bitter Curacao orange peel		0.083	0.038	0.097	0.044	0.016	0.007
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Styrian Golding	5	1.23	35	1.4	41	0.2	7
Flavor: Barth-Haas Saaz	4.5	3.66	104	4.3	122	0.7	20
Aroma: None	0	0	0	0	0	0	0
Yeast	Belgian Witbier yeast						

Brewing Process

Step-infusion. Mash in at about 144 °F (62 °C). Rest 30 min. Raise temp to 164 °F (73 °C) for mash-out. Recirculate. Lauter. Boil 75 min. 1st hops @ 15 min; 2nd hops @ 30 min. Spices in steeping bag on a string @ 60 min. Depending on selected yeast strain, ferment @ 70 °F (21 °C) for up to 2 wks. Rack. Condition for 2 wks @ 54 °F (12 °C). Package unfiltered.

Zoiglbier

Beer culture of origin	Germany, Bavarian
AKA	None
Related Styles	Zwickelbier, Kellerbier

Style Description

Zoiglbier is very similar to Kellerbier and Zwickelbier (see entries), but it is traditionally more effervescent than Kellerbier and less than Zwickelbier. Near the end of its maturotion with active yeast in casks (or, today, modern tanks) the brew is bunged or capped ("gespundet" in German). Zoiglbier, like Zwickelbier, has an alcohol content below 5 percent by volume. Its color is also roughly half-way between Kellerbier and Zwickelbier. It is the least hoppy of the three brews, and nowadays is brewed exclusively with Hallertauer Mittelfrüh. While Kellerbier is aged for months, Zoiglbier is usually aged for only a few weeks.

Zoiglbier has its origin in medieval Franconian homebrews. "Zoigl" is the Franconian vernacular for "sign." In Franconian medieval home- and farm-brewing, a Zoigl was a six-pointed white-and-blue star, made from two triangles of wooden slats and assembled into a shape that is similar to the Star of David. Inside the star was usually a cutout of a beer mug or a pine branch.

Burghers and farmers used to hang a Zoigl in front of their doors whenever they had homebrew ready to drink. It was an invitation to the neighbors to come over and have a few. One triangle of a Zoigl symbolized the three elements involved in brewing: fire, water, and air. The other triangle symbolized the three ingredients of brewing: malt, hops and water.

Specifications

OG	1.055 (13.75 °P)		**BU**	22		**ABV**	5.4%
FG	1.014 (3.5 °P)		**Color**	12.7 SRM/32.4 EBC		**ABW**	4.3%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pilsner	46.75	16.56	7.51	19.42	8.81	3.13	1.43
Weyermann® Munich II	52	18.41	8.35	21.60	9.80	3.48	1.59
Weyermann® Carafa® I	1.25	0.44	0.20	0.52	0.24	0.08	0.04
Total Grain	100	35.50	16.10	41.64	18.89	6.72	3.06
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Hersbrucker	14.5	1.79	51	2.1	60	0.3	10
Flavor: None	0	0	0	0	0	0	0
Aroma: Barth-Haas Hallertauer Mittelfrüh	4.25	0.72	20	0.8	24	0.1	4
Yeast	Bavarian lager yeast						

Brewing Process

Multi-step infusion. Mash in @ 122 °F (50 °C). Rest 30 min. Raise temp to 148 °F (64 °C). Rest 15 min. Raise temp to 156 °F (69 °C). Rest 15 min. Raise temp to 170 °F (77 °C). Recirculate. Lauter. Boil 90 min. 1st hops @ 30 min. 2nd hops in whirlpool. Ferment @ 48 °F (9 °C) to the finish for about 3 wks. Warm up to room temp for 2-day diacetyl rest. Rack, condition, and package yeast-turbid.

DID YOU KNOW ... ?

The German Beer Tax Law levies dues on brewers based on the kettle gravity of their beers, before they are fermented. There are four such categories:

Einfachbier: The word literally means "simple" or "plain" beer. It is defined as any brew, regardless of color or composition, with a taxable extract value of 2 – 5.5%, which usually produces an alcohol by volume content of 0.5 to 1.5%, slightly above non-alcoholic beers and slightly below Leichtbiers. Only very few breweries make Einfachbier nowadays, and the category holds no more than 0.1% market share in Germany.

Schankbier: The word literally means "tap" or "draft" beer. Only very few styles and brands fall into the category. Schankbiers have only a 0.2% market share. They have an extract value in the 7 to 8% range, and their alcohol by volume level tends to be between 0.5 and 2.6%. Berliner Weisse falls into this category.

Vollbier: The word literally means "full" or "entire" beer. It contains 11 to 14% extract. This beer category holds about 99% market share in Germany. A completely fermented Vollbier usually has between 3 and 5.3% alcohol by volume. Pils, Helles and Weissbier (Hefeweizen) belong in this category.

Starkbier: The word literally means "strong" beer. All beers with an extract value exceeding 16% are Starkbiers. Their alcohol level is invariably above 5% and rarely more than 10%. Though many beer styles fall into this category, all Starkbiers combined hold only a 0.7% market share. All Bockbiers, Doppelbocks, and Eisbocks are Starkbiers.

Zwickelbier

Beer culture of origin	Germany, Bavarian
AKA	None
Related Styles	Kellerbier, Zoiglbier

Style Description

Zwickelbier is very similar to Kellerbier (see entry), but it is traditionally more effervescent because, unlike Kellerbier, during its maturation with active yeast in casks (or, today, modern tanks) the brew is bunged or capped ("gespundet" in German). This allows for just enough carbon dioxide to build up, giving the Zwickelbier a nice creamy head when poured into a glass. Zwickelbier is also less hop-accented than Kellerbier, as well as a bit darker than Kellerbier because of a small addition of highly kilned caramel malts. Milder versions of Zwickelbier are sometimes brewed with de-husked malt, as is featured in the recipe below. With an alcohol content of usually below 5 percent by volume, it is slightly weaker that the Märzen-strength Kellerbier. Finally, while Kellerbier is aged for months, Zwickelbier does not have any barrique characteristics, because it tends to be served as soon as its fermentation is finished. Hence its name: Zwickel means sampling cock in German.

Specifications

OG	1.049 (12.25 °P)		**BU**	25		**ABV**	4.8%
FG	1.013 (3.25 °P)		**Color**	14.25 SRM/63.1 EBC		**ABW**	3.8%

Ingredients @ nominal 80% system extract efficiency (rounded)

MALT	%	1 HL (lbs)	1 HL (kg)	1 BBL (lbs)	1 BBL (kg)	5 Gal (lbs)	19 l (kg)
Weyermann® Pilsner	58	20.54	9.32	24.09	10.93	3.89	1.77
Weyermann® Munich II	38	13.46	6.10	15.78	7.16	2.55	1.16
Weyermann® Carafa® I	4	1.42	0.64	1.66	0.75	0.27	0.12
Total Grain	100	35.41	16.06	41.54	18.84	6.70	3.05
HOPS	**%AA**	**1 HL (oz)**	**1 HL (g)**	**1 BBL (oz)**	**1 BBL (g)**	**5 Gal (oz)**	**19 l (g)**
Bittering: Barth-Haas Hersbrucker	14.5	2.03	58	2.4	68	0.4	11
Flavor: None	0	0	0	0	0	0	0
Aroma: Barth-Haas Hallertauer Mittelfrüh	4.25	1.22	35	1.4	41	0.2	7
Yeast	Bavarian lager yeast						

Brewing Process

Multi-step infusion. Mash in @ 122 °F (50 °C). Rest 30 min. Raise temp to 148 °F (64 °C). Rest 15 min. Raise temp to 156 °F (69 °C). Rest 15 min. Raise temp to 170 °F (77 °C). Recirculate. Lauter. Boil 90 min. 1st hops @ 30 min. 2nd hops in whirlpool. Ferment @ 48 °F (9 °C) to the finish for about 3 wks. Warm up to room temp for 2-day diacetyl rest. Rack, condition, and package yeast-turbid.

Appendix: The World's "Minor" Beer Styles A — Z

Selection Criteria for "Minor" Beer Styles

The beer styles selected for this appendix are those, which the author and technical editors judged to be of interest, historically or otherwise, but did not merit a place among the 101 "major" styles featured in this book with a full-blown recipe. They are listed in this Appendix with brief descriptions or definitions mostly because, to paraphrase Sir Edmund Hillary, the first climber of Mount Everest, "they are there."

Here is an explanation of the groups of styles you can find in the Appendix:

- Styles about which not much is known, except that they once existed. These include La Blonde van Vlaanderen and Louvain Peeterman Wit, for instance. Constructing recipes for these brews with any claim of authenticity would be difficult if not futile.

- Several other historical styles are included here even though plenty of information is available about them. However, these beers are hardly made today. Typical examples of this group are Mumme, Keutebier, and Broyhan Bier, which were truly ubiquitous beer styles at their time, when Northern Europe as well as international beer commerce was dominated by the Hanseatic League, a private merchant trading empire that was founded in Lübeck in 1241 and formally dissolved in 1669.

- Then there are styles whose key ingredients are difficult to impossible to find or their processes are so obscure that few brewers would venture to make them. Including such styles with a full-blown recipe in this book would have shifted the focus from a practical guide to an encyclopedic collection. Styles in this group include, for instance, Chicha, Quinoa Beer, and Steinbier.

- Other beer designations, though in use today, such as Landbier, Erntebier, or Kräusenbier, are really more marketing terms than *bona fide* beer styles. Their definitions are included in this Appendix.

- Several beer mix drinks such as Radler or Shandy are listed in the Appendix, as are Black&Tan and WeiPi, two beer blends mixed from beer that are covered in the recipe section.

- Finally, for terminological completeness, there are a few very brief references to fermented beverages that technically are not "beers" at all, such as Koumiss or Kefir.

Alster or Alsterwasser
Northern German version of Bavarian Radler or Radlermass (see entry).

American Wild Ale
Inspired by Belgian Lambics and Flemish Red Ales, American Wild Ale is emerging as a category of American Ales (any ale) fermented with *Brettanomyces* for the characteristic sour notes reminiscent of horse sweat.

Bière des mars, Belgian
See Kriek, Lambic.

Biobier
One of two German terms for organic beer. The other term is Ökobier. See organic beer.

Black&Tan
A mixture of pale beer (usually ale) and stout, also known as half and half. The two beers are poured carefully and separately into the same glass so that they remain layered. The brew with the higher gravity, usually the pale brew, needs to be poured first so that the brew with the lower gravity can float on top. Some breweries now package a pre-mixed Black&Tan, which, when poured is, of course, not layered.

La Blonde van Vlaanderen
An obscure Belgian beer made with oatmeal.

Broyhan Beer
Named after Hanoverian brew master Cord Broyhan, who lived in the early part of the 16th century. His beer was a form of Mumme (see entry), a well-hopped light brown ale mashed from one-third wheat and two-thirds barley.

Canadian Ale
A beer that is difficult to define. Generally it refers to an ale made in Canada, with relatively little hops and relatively more alcohol (perhaps 5 ABV). It has a flavor profile somewhere between an English Pale Ale and the North American Lager.

Cassis
See Kriek, Lambic.

Champagne Ale
Usually a Belgian blond, strong ale that is finished like champagne. In the *méthode champenoise*, the brew undergoes three separate fermentations, each being best served by a different yeast strain.

Primary fermentation is usually by a clean-fermenting Belgian ale yeast. Secondary fermentation is by an alcohol-tolerant champagne yeast. Tertiary fermentation called the *prise de mousse* (literally: "absorption of foam") occurs in a champagne bottle, for almost four months, with the bottle kept neck down, on the lees (*sur lie*),

usually with a resilient *eau de vie* yeast with a clean profile and an alcohol tolerance of perhaps 21 percent.

Two months into the *prise de mousse*, the brew undergoes a *remuage* (riddling). This involves twisting each bottle sharply one-quarter turn with the flick of the wrist. It helps to firmly lodge all sediment in the bottle neck. This should be done once a day for two weeks. Then the brew rests undisturbed for another month to completely clarify.

Next comes the *dégorgement*, the removal of the sediment. For this the bottle neck must be frozen until the debris becomes an icy plug. The bottle is open upside down until the pressure in the bottle forces the plug to be disgorged. At this point the bottle must be rightened immediately, the lost liquid replenished with fresh brew, the so-called *dosage*; and then the bottle should be re-sealed with a champagne cork and plug and a new wire cage.

Chicha
A South American pale ale prepared from corn. Because corn has no amylase, traditional Chicha-makers used to chew the corn, thus exposing it to ptyalin, a type of amylase in human saliva. They then spat the chewed corn into a communal trough. The ptyalin performs the same function as amylase in grain: It converts starches to maltose sugar and thus makes the starches accessible for yeast metabolism. Chicha made by this method contains about 1 – 3 percent ABV.

Chocolate Ale/Lager
A recent American experimental brew, involving the aging of beer on cocoa chits.

Christmas Beer
A specialty beer often brewed with spices for the winter holiday season. One of the classic Christmas beers is called Winter Warmer.

Diätbier
Literally "diet beer," this is the German designation of a beer type brewed specifically for people suffering from diabetes, a condition that is characterized by the body's inability to process glucose, a type of sugar. Diätbier is fermented completely to the finish, without any residual sugars left. It is thus extremely dry. Because of the way diet beer is made, even though it has nearly no residual sugar, it has approximately the same alcohol content as a comparable regular beer.

Diesel
A German beer mix usually of lager and a cola-type soft drink. The mixture has the color of Diesel fuel, which explains the name. There are variations on the Diesel-theme: A lager-cola mix is also known as a *Colabier* or *Gespritzter*. A Hefeweizen-cola mix is a *Colaweizen*, *Flieger* ("Aviator"), or "Turbo." Pilsner-cola or Altbier-cola is a *Krefelder*. A *Greifswalder* is a Schwarzbier-cola, a *Brummbär* ("Brown Bear"), a Stout-cola or a Porter-cola.

Diest
An obscure dark and heavy Belgian brew. Not much is known about it.

Dünnbier
Literally "thin beer," this is a German designation for a relatively low-alcohol beer (about 4.5 to 5.5% extract value and roughly 2 — 3% alcohol by volume). It falls into the Einfachbier tax category (see entry). Traditionally, Dünnbier was brewed in the industrial north of Germany for the coal and steel workers, where they drank it all day long. The beer was provided free of charge in unlimited quantities by their employers. Dünnbier tastes similar to Erntebier (see entry), which it resembles brew-technically. Perhaps the closest popular relative to Dünnbier is Leichtbier or Light Bier.

Eblulum
A black elderberry ale, apparently introduced to Scotland by Welsh druids in the 9th century AD to be drunk at Celtic autumn festivals. It probably had about 6.5 percent ABV and may have been made from a mash of barley malt and unmalted roasted oats and barley.

Emmerbier
See Dinkelbier.

Erntebier
Literally "harvest beer" in German, this is a thin, relatively low-alcohol beer (about 4.5 – 5.5% extract value and roughly 2 – 3 percent alcohol by volume, rarely stronger). Traditionally, Erntebier falls into the Einfachbier tax category (see entry). It started as a seasonal brew made by farmers to be drunk at lunchtime in the fields during the harvest. It was customary for the farmers' children to take earthenware crocks of Erntebier to their elders at noon. Several breweries, especially in Bavaria, still make a commercial Erntebier today, though such modern versions tend to be slightly higher in alcohol than the original homebrewed Erntebiers. A typical Erntebier is mildly hopped with a fairly weak body. It is only moderately effervescent and does not keep its head very well because of its lack of body. Most Erntebiers are brewed to a very pale color.

Faro
See Lambic.

Festbier
A German specialty brew, usually a Bock or Doppelbock, often dark. More often than not, it is like an Oktoberfestbier (see entry). In most locations, Festbier is timed for fall consumption, especially in the south of Germany. In some locations, however, Festbier may also be brewed as a springtime specialty.

Framboise
See Kriek, Lambic.

Froagh
Scottish heather ale. See Gruitbier.

G'frorns
Literary "something frozen," a term in the Franconian vernacular for Eisbock. The spelling in High German would be "Gefrorenes."

Ginger Beer
Not a beer, but a soft drink originally from Jamaica. English Shandy (see entry) is conventionally a mixture of pale beer (often an ale) and ginger beer.

Gluten-Free Beer
Beers brewed primarily from sorghum (see Appendix entry) and/or buckwheat as well as millet, quinoa, or rice, for instance, which do not contain gluten—unlike barley, wheat, rye, spelt, oats, and kamut. Gluten is a type of grain protein that causes damage to the intestines of people diagnosed with Celiac Disease. Such Celiac sufferers, therefore, cannot drink regular beer.

Grätzer Bier
Grätz is the German name for the Polish town of Grodzisk, the origin of a low-gravity, pale, highly-hopped ale made mostly from smoked wheat malt.

Grozet
A form of Gruitbier (see entry). The term comes from the Gaelic "Groseid," a brew made by Scottish monks and alewives from barley and wheat malt and flavored with bog myrtle, hops, and meadowsweet. It was secondary-fermented, almost like a Kriek (see entry), with ripe Scottish gooseberries.

Grünkernbier
Grünkernbier is made from unripe Dinkel (see Dinkelbier) with the starch not fully developed.

Gueuze
See Lambic.

Heather Ale
See Gruitbier.

Honey Beer
See Braggot.

Jopenbier
A highly hopped type of Mumme (see entry), originally from Hamburg. This beer was particular popular in the 16th and 17th centuries. Danziger Jopenbier from what is now the Polish City of Gdansk, was also well known at the time.

Kamut Beer
Kamut is scientifically known as QK-77. It is an ancient strain of wheat that contains about 30 percent more protein than wheat. Related to durum wheat, it was allegedly cultivated in Egypt during the reign of the Pharaohs. An individual grain of Kamut looks like regular wheat only the individual grain seed is more than twice the length of regular wheat. Like wheat, it can be used for both bread- and beer-making.

Kefir
Often listed in publications about beer, Kefir is strictly speaking not a beer, because it is not made from grain but from camel's milk. It is fermented like beer, whereby the carbohydrate source is lactose, the sugar found in milk, which can give it up to 2.5 percent ABV. Kefir comes from the Caucasus, a mountain range between the Caspian and Black seas.

Kelpie
An ale made from malted barley that is fertilized in the field with seaweed. Apparently of medieval Scottish origin, this ale used to be served in alehouses there. The flavor can be slightly imitated by adding a small amount of fresh seaweed into the mash.

Keutebier
A northern German, medieval precursor to Altbier and Kölsch, this ale was mashed from an uncertain mixture of barley and wheat malt, usually kilned over smoky, direct-fired kilns, originally flavored with herbs (see Gruitbier), later with hops. One interesting statistic: In 1494, there were 64 breweries in Cologne, producing a combined total of 65,000 hectoliters (about 55,000 bbl) of Keutebier per year.

Koumiss
Really not a beer, because not made from grain, Koumiss, like Kefir, is a fermented milk drink, fermented from mare's or camel's milk.

Kräusenbier
A rarely used German term for a beer secondary-fermented by the addition of "Speise" for "Kräusen," that is, the addition of fresh wort as a priming agent to a fully fermented brew.

Kvass
A Russian beer style made partially from stale rye bread, just as beer used to be made from half-baked loaves of bread in ancient Mesopotamia and in Central Europe by Celtic and Germanic tribes before the arrival of the Romans north of the Alps. The brew is traditionally with fruit or herbs, including mint, raisins, apples, berries, even birch sap collected like maple sap in early spring. For additional strength, kvass may be fortified with sugar. The name comes from the Russian word for "leaven." The bread for Kvass can be made not just from rye, but also from wheat or barley. Traditionally, the fermentation agent for Kvass is ordinary baker's bread yeast.

Landbier
Literally "country beer," this is a generic German term denoting a simple every-day session or quaffing brew. As an easy-drinking beer, it is usually not too hoppy. Its other characteristics, however, are undefined. A Landbier is usually golden-yellow, but it may also be dark; it may be filtered or not, and its alcohol by volume level may range between 4.8% and 5.3%. For many breweries, the term Landbier has more to do with branding a particular line of beer than with brewing a beer according to a style definition.

Leichtbier
The German term for light beer. In Germany, Leichtbier is just a lighter version, in terms of alcoholic strength and calories, of a regular beer. Most, though not all, Leichtbiers tend to have an alcohol content by volume of approximately 2% to 3.2%, which places them in the Schankbier category, that is, above the alkoholfrei (non-alcoholic) category of less than 0.5% alcohol by volume and below the Vollbier (entire beer) category, which usually falls into the 4.5% to 5% alcohol-by-volume range. America's best-selling beer brand, Bud Light, by comparison, has an alcohol by volume level of 3.6%.

Liége Saison
A low-gravity, highly hopped Belgian brew with a small amount of spelt as part of the grain bill.

Louvain Peeterman Wit/*bière blanche*
The low-gravity (OG 1.025 – OG 1.030; 6 °P – 7 °P), Belgian Peeterman beer from Leuwen/Louvain outside Brussels is a white ale made from three-quarters air-dried malt and one-quarter unmalted wheat or three-quarters air-dried malt and one-quarter unmalted oats. In the fermenter, unboiled Speise with live microbes including Lactobacillus is added as kräusen.

Malzbier
Literally "malt beer," this German designation is for a type of non-alcoholic beer, which, by law, must have an alcohol-by-volume content of no more than 0.5%. It is unrelated to the similar-sounding American "malt liquor," which is a high-alcohol brew. Malzbier is generally dark and sweet. It is produced by brewing a regular, low-hopped, dark beer that could have evolved into a normal dark beer with about 4.8% alcohol.

More often than not, Malzbier is brewed as an ale, not a lager. It becomes a Malzbier simply because the brewer chills the brew down to the freezing point before adding the yeast. At this temperature, the yeast remains virtually dormant and fermentation is very slow and sparse, even though there is plenty of sugar for the yeast to metabolize. Thus, the sugars remain largely unfermented—hence the brew's incredibly malty sweetness.

Before bottling, Malzbier needs to be filtered or pasteurized to remove or kill all the yeast. Malzbier is usually made from malted barley, but it may also be brewed like a

wheat beer from a combination of malted wheat and barley, in which case it is called Weizenmalzbier ("wheat malt beer"). Because this brew is also popular as an energy drink it is also called Kraftbier ("strength bier") or Nährbier ("nourishment beer"). A particularly sweet version of Malzbier is Karamelbier and Doppelkaramelbier, two low-hop Malzbier versions brewed with caramel malts and often enriched with glucose or sucrose syrup.

Mead
A brew made from honey, usually diluted with water or wort, and fermented like a beer. If it is a fermented mixture of malt wort and honey, it is typically called Braggot (see recipe).

Millet Beer
This brew is an alcoholic beverage of African origin. It is also known as Chibuku made from malted millet, a true grain. Similar African beers are sorghum beer and maize beer. The latter is also known as maize liquor or Kisasho.

Molasses Beer
Molasses, the extract of sugar cane, is highly fermentable and has been used as an adjunct in beer in the New World (as has maple syrup). George Washington, the United States' first president was a molasses ale homebrewer. Here is the recipe, with the old-style spelling and punctuation in original form. This recipe is now in the Precious Book Department of the New York Public Library. It makes a brew of roughly 11 percent alcohol by volume.

"To Make Small Beer: Take a large siffer full of bran hops to your taste—boil these 3 hours. Then strain our 30 galln into a cooler put in 3 galln molasses while the beer is scalding hot or rather draw the molasses into the cooler. Strain the beer on it while boiling hot, let this stand till it is little more than blood warm. Then put in a quart of yest if the weather is very cold cover it over with a blank let it work in the cask— Leave the bung open till it is almost done working—Bottle it that day week it was brewed."

Mumme
This medieval ale was once the most popular beer in the world. It was the main trading beer of the Hanseatic League for about three centuries. The brew takes its name from Christian Mumme, a brewer master in the City of Brunswick (Braunschweig in German), who is on record as having concocted a thickish, hopped barley beer in 1492, the year, incidentally, of Christopher Columbus' first voyage to America. Apparently, Mumme was a darkish, heavy ale brewed to a fairly high original gravity but also to a fairly high terminal gravity, perhaps in the 9 °P (FG 1,030) range.

We can surmise that the lack of complete fermentations was the result of poorly attenuating yeast strains, because, in the Middle Ages, many tradesmen were combination baker-brewers, who made both the people's solid and liquid bread in the same facility, using the same microbes for leavening and fermentation. Mumme

eventually evolved into a style called Keutebier, which was made from a mixture of malted barley and wheat and, apparently, more attenuative. Keutebier, in turn, evolved into the 19th-centure Wiess of Cologne as well as the modern Kölsch and Altbier.

Musa Beer
This brew from Central and East Africa is technically not a beer. It is the fermented juice of a ripe fruit known as "beer banana." Musa beer is relatively low in alcohol, but can be distilled to make a liquor called waragi.

Near-Beer
Another term for a low-alcohol beer (with an ABV < 0.5%). The term became particularly popular during the American Prohibition (1919 – 1933), when many breweries switched to making near-beer to stay in business. Near-beers are usually lagers.

Ökobier
One of two German terms for organic beer. The other is Biobier. See Organic Beer.

Organic Beer
In order for beers to be called "Organic," they must be certified by a government agency as meeting clearly defined organic standards. In the United States, these standards are spelled out by the National Organic Program (NOP). Certified organic beers must be brewed entirely from organically grown and processed raw materials.

L'Orge d'Anvers
An obscure dark and heavy, barley-based Belgian brew. *Orge* is barley in French.

Pêche
See Kriek, Lambic.

Peeterman Beer
See Louvain Peeterman Beer.

Potato Beer
Beer from this tuber, too, ought not to be called beer. However, the potato, just like the grains we use in our mash tuns, contains starch and some enzymes. Especially if mixed with amylase-rich diastatic grains, potatoes can increase the alcoholic strength of the drink that results from it. If distilled, it is called vodka—though today most vodka is wheat-based.

Potsdamer Stangen-Bier
A type of highly effervescent, kegged-only, German Kräusenbier (see Appendix entry) from the region around Berlin. It was very popular in the 1930s but has since fallen out of favor. Originally, Potsdamer Stangen-Bier was a blend of fresh wort inoculated with yeast and beer dregs collected from returned kegs. It was available in both ale and lager versions.

Quinoa Beer
Quinoa beer is usually mashed from a base of Pilsner malt, with some Munich, Carafoam®, and acidulated malts as well as up to 20 percent quinoa. Quinoa grains are high in proteins and have more fat content than barley or wheat, which gives it a silky smooth, almost oily effect, similar to that of rye in the grist. In beer, quinoa is usually treated like an adjunct and cooked separately before being introduced to the mash. This beer can be brewed as an ale or a lager.

Radler or Radlermass
This is a Bavarian beer mixed drink made in the glass of half Helles or a similar blond lager and half lemonade. Nowadays, many breweries premix Radler pre-packed. In the north of Germany, Radler is called Alster or Alsterwasser after the small river that empties into the Elbe River at Hamburg.

Rice Wine
Technically neither Chinese Rice wine nor Japanese Sake are wines. Because they are both made from grains, not from fruit juice, they are true beers. Both are fermented by molds rather than by yeasts or bacteria like *Lactobacillus*.

Russ or Russ'n
Similar to Radler (see entry), this Bavarian beer mixed drink consists of half Hefeweizen/Weissbier and half Lemonade. For a clear Russ'n use filtered Hefeweizen, called Kristallweizen. Russ'n means Russians in the Bavarian-German dialect. The mix apparently got its name in the 1920s, when it became popular among members of the Munich Communist Party during political beer hall meetings. Stretching the precious Hefeweizen with lemonade was a way to also stretch the party's meager financial resources. Russ'n can be mixed in the glass or, nowadays, purchased ready-mixed, pre-packaged.

Sake
Japanese rice-based fermented beverage. Sake is technically a beer, because it is made from grain, and is not distilled. The conversion of rice starch to fermentable sugars occurs by the action of a particular mold called *kopi-kin* or *Aspergillums oryzae*. See also Rice Wine.

Schlehenbier
Literally "sloe beer," an old-style German brew flavored with sloe berries, the fruit of the blackthorn. It was a summer beer.

Shandy
English Shandy is a mixture of pale beer (often an ale) and ginger beer, which is a soft-drink originally from Jamaica.

Sorghum Beer
This beer of African origin is made from sorghum, a member of the grass family. Beer made from malted sorghum is slightly opaque compared to an identical beer made from malted barley instead. Sorghum, unlike barley, can be cultivated in arid as well

as tropical regions Sorghum is a gluten-free grain. Beer made from it is, therefore, not harmful to people with celiac disease.

Sour Beer
Any number of brews, usually from Belgium or based on Belgian-style brewing methods, fermented with bacteria in addition to yeast.

Spiced Beer
Any type of beer, ale or lager, flavored with spices in addition to or instead of hops.

Steinbier
Literally "stone beer" in German, this brew gets it its name from the medieval technique of boiling wort in the brew kettle by dropping super-heated stones into it. This was necessary when brew kettles were made of wood and obviously could not be direct-fired. Beer boiled this way tastes different from regular beer, because the rocks, when dropped into the brew, scorch and caramelize some of the malt sugars. The result is a smoky-tasting deposit that literally sugar-coated the rocks. Once the beer is in the fermenter, the coated rocks are placed there so that the yeast can metabolize the sugar coating. This adds a pleasantly smoky flavor and a slightly sweet, malt-candy-like finish to a Steinbier.

Texas Bock
A strong, Bockbier-like ale that originates in the State of Texas, where State law demands that any beer with an ABV exceeding 6 percent must be labeled "ale" even if it is brew-technically a lager.

Triple Bock
Triple Bock is a term coined by the Boston Beer Company for a brew stronger than a "mere" Doppelbock ("double" Bock). The first Triple Bock was released in 1994. It had an ABV of 17.5 percent, which was achieved by the addition of maple syrup as an adjunct. Triple Bock was the "forerunner" of two and even stronger brews, the Samuel Adams Millennium at 21 percent ABV, released in 1999, and the Utopias at 24 – 27 percent, first released in 2002.

Urbock
The prefix "ur" means "original" in German. Strictly speaking, the original Bockbier is an ancient northern German, not a Bavarian, beer, though many Bavarian brews nowadays also use the designation Urbock. Originally, Urbock was brewed as an ale, not, as is now common, as a lager.

Utopias
See Triple Bock.

Uytzet des Flandres
An obscure historical dark and heavy Belgian brew.

Wee Heavy
Another name for a strong Scotch Ale

Weihnachtsbier
German for Christmas Beer

WeiPi
The abbreviation stands for "Weissbierpils." It was first introduced in Germany in 2005. It is a beer blended in the lagering tank at a ratio of 53% Weissbier and 47% Pils. The resulting beer has about 5.2% alcohol by volume.

Zoeg of Tirlemont
An obscure, historical, low-gravity, very sweet Belgian brew.

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Horst Dornbusch, Author

Horst Dornbusch was born and raised in Düsseldorf, Germany. He holds degrees in sociology and politics from Reed College in Oregon and Brandeis University in Massachusetts. After a 20-year career as a journalist and editor, he founded a craft brewery in Massachusetts. Since 2001, he has been a consultant in the international brew industry. He is a former Fulbright Scholar, an award-winning brewer, and an author of several books and hundreds of articles about beer, published in European and North American trade journals.

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Christina Schönberger is an engineer in brewing and beverage technology. She graduated from the Technical University of Munich-Weihenstephan in 1999. She completed her internship at the Suntory Brewing Company, Japan, in 2000. In 2003, she obtained her PhD from Weihenstephan and became a consultant to the German Brewers Association. She has been with the Barth-Haas Group since 2005, as Manager of Technical Services. In her role, she also manages research projects and writes hop-related professional articles.

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Johannes Schulz-Hess is the 10th-generation CEO of SCHULZ Brew Systems, a company dating from 1677. SCHULZ is not only Bamberg's oldest continuously operating industrial enterprise; it is also the world's oldest manufacturer of brew equipment. Known as a leading innovator in its field, SCHULZ fabricates a full range of brew house and cellar installations from single vessels to complete turn-key breweries. Johannes Schulz-Hess is an architect with a graduate degree in engineering from the University of Stuttgart. In 2007, he joined the family business and, a year later, assumed the role of CEO.

Sabine Weyermann, Thomas Kraus-Weyermann, Co-CEOs, Weyermann® Malting Company

Sabine Weyermann together with her husband Thomas Kraus-Weyermann are the Co-CEOs of the Weyermann® Malting Company in Bamberg, Germany. The company was started by Sabine's great-great-grandfather Johann Baptist Weyermann in 1879. Sabine is the fourth-generation Weyermann in the malting business. Both Sabine and Thomas hold engineering degrees in brewing and beverage technology from the Technical University of Munich-Weihenstephan. In addition, Thomas has a Masters Degree in economics from the Ludwig-Maximilian-University in Munich. He apprenticed as a brewer at about a dozen European lager and Weissbier breweries. Starting in 1986, he worked for the Dortmunder Kronen Brauerei, first as Head Brew Master and eventually as Technical Director of the brewery and the brewery's malting facility. In 1990, he joined his wife Sabine in her family business in Bamberg. Since then Weyermann® has tripled its capacity and now ships more than 80 malt varieties to some 3,000 brewery customers in almost 120 countries.

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