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DECEMBER 2006, VOL.12, NO.8

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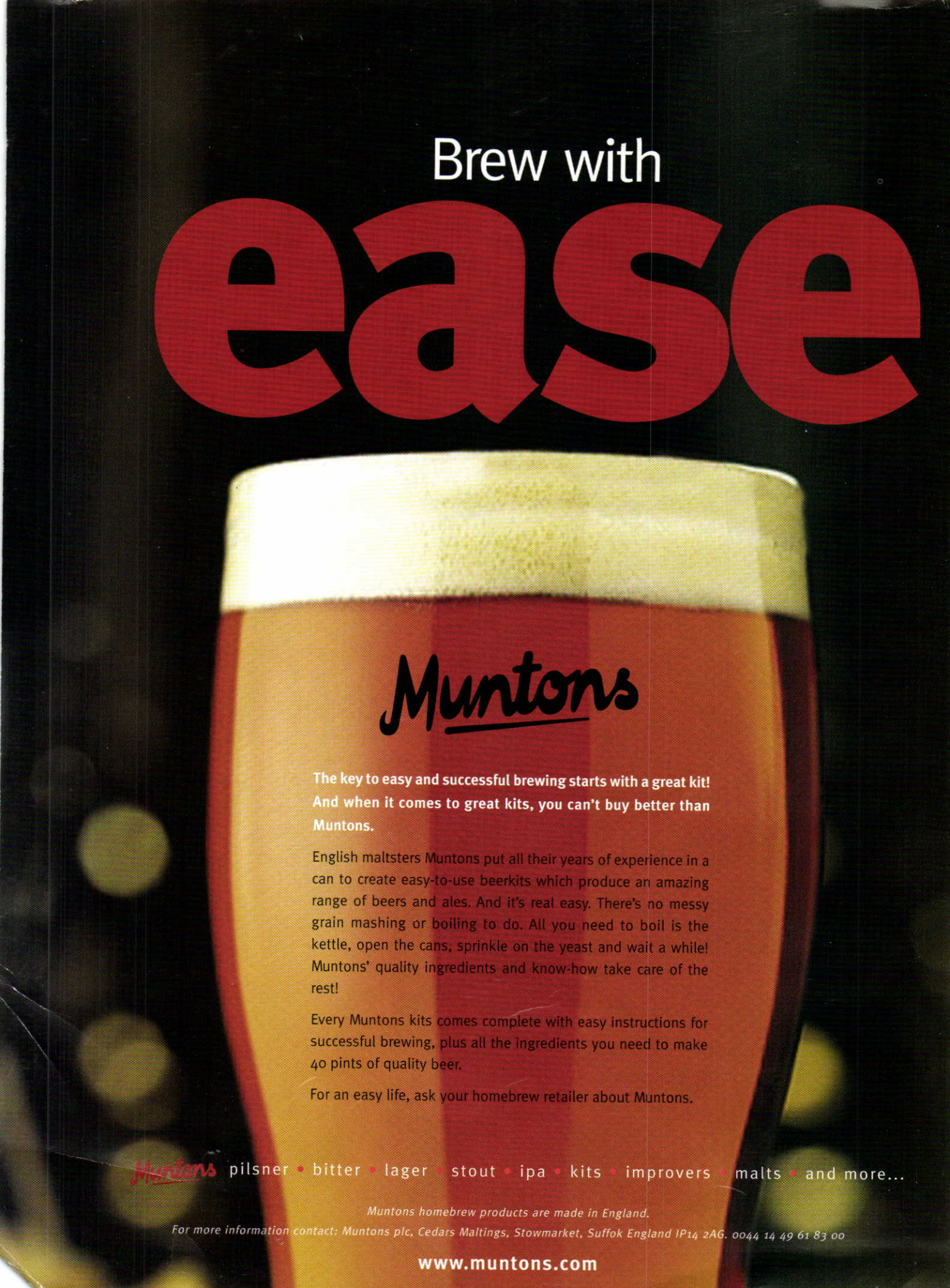
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DECEMBER 2006
Volume 12 Number 8

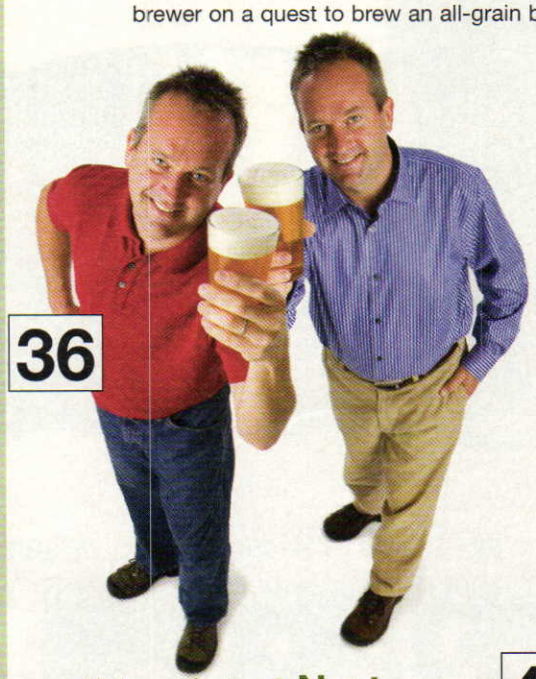
Brew Your Own

THE HOW-TO HOMEBREW BEER MAGAZINE

Departments

COVER PHOTO: CHARLES A. PARKER

Features



Where to find it

IN EARLY 1933, BEFORE PROHIBITION COULD BE OFFICIALLY REPEALED, PRESIDENT ROOSEVELT SIGNED EMERGENCY LEGISLATION ESSENTIALLY DECLARING LET THERE BE BEER. IT WASN'T UNTIL DECEMBER THAT WINE AND HARD LIQUOR LEGALLY RETURNED. AFTER BEING DEPRIVED OF LEGAL ALCOHOL FOR 13 MISERABLE YEARS, THIRSTY AMERICANS NEEDED A BEVERAGE OF MODERATION.

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Brew Your Own

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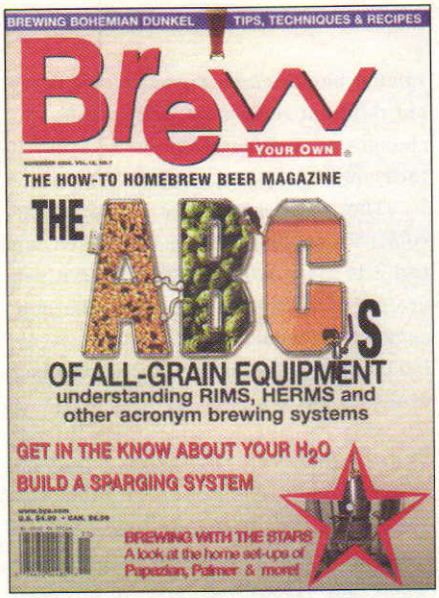
RIMS Response

I read Chris's story about RIMS vs. HERMS and I'm having a very tough time trying to figure out how anyone can write an "objective" comparison of RIMS vs. HERMS systems (including those commercially produced) without ever asking the commercial producers of such equipment, anything about them. We have not been asked for input or comment yet our system is displayed on the lead page. There is little discussion about brewer quality control but there is comment suggesting that the word 'repeatability' has never been tested. Everyone knows that these machines don't make beer by pushing a button and simply walking away. Brewer methodology as well as dependable equipment determine repeatability. One or the other is not enough. Professionals depend upon their ability and that of their equipment to deliver repeatable product. If small machines like those discussed did not have real value, then professional brewer Sam Calagione may not have decidedly developed recipes on his Brew-Magic RIMS pilot system. How can any brewer tweak a recipe if he does not control the variables that affect the final outcome of the product?

Temperature control and clear wort is just the beginning of this story. Certainly not the bottom line. All wort suffers the "roller coaster" ride of applied temperature as Chris suggests. However, controlling how it's applied in a dependable, 'repeatable' fashion helps to solidify "repeatable" results. Creating a great beer once is something anyone can do with a pot on a stove. Creating the same great beer every time is the result of controlling the variables, methodology, and ingredients. A "proud owner" using a well designed RIMS or HERMS, will not witness a miracle when a judge raises the sample glass. But a brewer with a smart, tested brewing system that can control the 'environment' of the brewing process, certainly has an edge over a brewer that does not have such equipment. What would happen to your 2 minute egg if it cooks for 3 minutes? Now, make the brewer as repeatable as the equipment



and you'll enjoy your favorite recipe brew forever! Does this require a test as suggested? I think common sense will do nicely, thank you (or you can simply ask our 1000+ "proud owners" around the world). Regarding the comment of commercial quality equipment "costing more", I ask... Cost more than what? Let's ask Chris to build an exact duplicate of our Brew-Magic System... I'll provide the blue print. Then let's see if his costs less and looks as good! You don't think that getting what you pay for has anything to do with this, do you. . . ?

Best Brew to You!

Bob Sulier
President, Sabco Industries, Inc.
(Manufacturer & proud owner of the Brew-Magic Brewing System)

Story author and BYO Editor Chris Colby responds:

"The effects of extremely clear pre-boil wort and tight temperature control during mashing on beer quality and repeatability has been the subject of arguments in the homebrewing community. We feel this story was an accurate reflection of this debate and wanted to point out that neither the positive or negative claims about this subject have been tested scientifically. When someone makes a claim regarding physical reality, there is only one way to usefully test that claim — with a scientific experiment. Historically, common sense has proven to be a poor test of scientific hypotheses.

"I strongly agree with your statement that 'Brewer methodology as well as dependable equipment determine repeatability.' I also agree that, in the hands of a skilled homebrewer, a RIMS can produce high-quality wort. However, I would also argue that, in the hands of a skilled homebrewer, a non-RIMS setup can produce equally high-quality wort. Of course, until that proposition is tested, it is just my opinion."

Countertop Partial Mashing 1

I picked up a Coleman 2-gallon container that looks like the one in the article on partial mashing ("Countertop Partial Mashing," October 2006), but I noticed in small print on the label it says that it's not to be used with hot liquids. Did I get the wrong one? Or should I ignore that?

Ed Adcock
Gilbert, Iowa

Countertop Partial Mashing 2

I am really excited about your countertop partial mashing article in the October issue of 2006. I also really appreciate that you posted it in full on the web site so that I could easily send it to new brewers who are not yet subscribed to *BYO*. I do have a question about the formulation of the recipes, though. What is the extract efficiency for the mash?

Todd Coffey
Albuquerque, New Mexico

Countertop Partial Mashing 3

I enjoyed your article on countertop partial mashing in the October 2006 issue. Can't wait to give it a try. My only question concerns converting my old extract-plus-grains recipes to this technique. Is there a formula for scaling down the amount of dried malt extract (DME)?

Dale Elster
Auburn, New York

Countertop Partial Mashing 4

In the October issue, you have an article on countertop partial mashing. I found this to be informative as well as the catalyst for an idea. If the cooler holds about 2 gallons, then why can't you use it to do small batches? I find that there are many recipes that I want to try, but don't want to make a full 5 gallons. So I make

RECIPE INDEX

BYO RECIPE STANDARDIZATION

Extract efficiency: 65%
(i.e. — 1 pound of 2-row malt, which has a potential extract value of 1.037 in one gallon of water, would yield a wort of 1.024.)

Extract values for malt extract:
liquid malt extract (LME) = 1.033–1.037
dried malt extract (DME) = 1.045

Potential extract for grains:
2-row base malts = 1.037–1.038
wheat malt = 1.037
6-row base malts = 1.035
Munich malt = 1.035
Vienna malt = 1.035
crystal malts = 1.033–1.035
chocolate malts = 1.034
dark roasted grains = 1.024–1.026
flaked maize and rice = 1.037–1.038

Hops:
We calculate IBUs based on 25% hop utilization for a one hour boil of hop pellets at specific gravities less than 1.050.

smaller batches and this allows me to try out different recipes as well as different changes to a given recipe to see how it turns out.

The other advantage to using the cooler for smaller batches is that you can use it to make wort for starters that you are going to can for later use. The only suggestion I would make is to use a 5-gallon paint strainer instead of the grain bag in the cooler.

Greg Dotson
Lake Station, Indiana

Author and BYO Editor Chris Colby responds: "We received a lot of letters about my countertop partial mashing story, and it sparked some discussion online as well. Here's my answer to the above letters and my response to some comments from other sources:

"First of all, I called Coleman and asked about the warning about hot liquids. The Coleman representative said the warning was issued because the liner could become unglued from the insulation if boiling hot liquids were poured into the cooler. At mashing temperatures, this isn't a problem.

"The extraction efficiency I used in calculating the recipes that appeared in the story is 65%. At this efficiency, a 4-lb. (1.8-kg) partial mash should yield roughly 3 gallons (11 L) of wort at 1.032 SG.

"The actual specific gravity you get may differ from this value due to grist composition, how well the grains are crushed, water chemistry or other factors — but it should be pretty close. The first time you try the technique, take a hydrometer reading after you've run off your first and second worts and adjusted the volume to 3 gallons (11 L) with water (but before you add any malt extract). If you are a little low or high, just add or subtract a little malt extract to compensate. Adding 3.5 oz. (99 g) of dried malt extract will add two "gravity points" to a 5-gallon (19-L) batch. Given the small volume of the mash, and the fact that it is not stirred, don't expect to get terrifically high levels of extraction.

"To convert existing extract recipes to this technique, subtract 2 lbs. 2 oz. (0.96 kg) of dried malt extract or 2 lbs. 13 oz. (1.3 kg) of liquid malt extract from your recipe to compensate for the 4.0 lbs.

(1.8 kg) of malt in the partial mash (assuming you're getting close to the assumed 65% extract efficiency).

"Some homebrewers who have tried the technique reported slow runoff rates. (I never experienced this in my tests.) If this is a problem for you, you can make a batch sparge manifold as seen in the story, "Cheap and Easy Batch Sparging," in the January-February 2004 issue. It's a project that only costs a few bucks and takes approximately 5 minutes to assemble. Some homebrewers have also reported success by placing a small folding strainer basket in the bottom of the cooler.

"BYO readers also made some good suggestions. One of the best was to leave the grain bag open and stir the grains directly rather than tie it off and poke at it with a spoon. (Why didn't I think of that?)

"Finally, yes, you can use the technique to make smaller batches of beer, if you want. Given the amount of wort yielded by the technique — around 2.5 gallons (9.5 L) — you could easily boil it down to make a 2-gallon (7.6-L) batch (with 1.048 coming from the grains). Or, you could add approximately a gallon (3.8 L) of water and boil it down for a 3-gallon (11-L) batch. Likewise, using a partial mash to make wort for yeast starters is possible, but it's a lot more work than simply boiling some extract."

Slipups in the "Stars"

In the October 2006 story, "Systems of the Stars," Rob Beck is called "Ron" once and his homebrew club affiliation is given as the Kansas City Brew Meisters, when the KC club is actually the Bier Meisters. In the profile of John Palmer, his copper ring manifold actually sits roughly ¼ inch (0.64 cm) off the bottom of his lauter tun, not the roughly ½ inch (1.3 cm) stated the text.

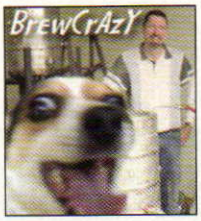
Horst Dornbusch was born in Germany in 1947 and has lived in North America since 1969. He arrived by boat as a Fulbright Scholar and earned a B.A. from Reed College and an M.A. from Brandeis University. Horst has written over 50 articles for *Brew Your Own* and, since the March-April 2002 issue, has been *BYO*'s Style Profile columnist.

This issue has a "double" theme and in it, Horst does double duty. On page 28, he writes about doppelbock - the dark, malty German lager — and explains how to brew this style of beer. In Style Profile, it's the season for saison, and he explains that the best way to get the right spiced character in a saison may be not to add any spices! Sadly, this is Horst's last planned installment of Style Profile as he has chosen to focus his full energies on building his new venture, Cerevisia Communications, a PR and consulting firm in the international beverage industry.

Reg "Gus" Pope caught the craft brew bug in Wyoming while working on Forest Service fire crews. He began homebrewing in 1994 and worked his way up from 5-gallon (19 L) extract batches to his current set-up — a custom fab, stainless, tiered, half barrel all-grain system housed in a converted garage designed specifically as a brewhouse in the blueprint stage of construction of his current home. In addition to the standard current brewing compliment, it contains a chemical/analytical test bench and a yeast bank.

Reg has helped *BYO* readers in the past with do-it-yourself projects including making a counter-pressure bottle filler (November 2005) and a counterflow wort chiller (January-February 2006). This issue on page 42 he shows us how everyday items can be used in home breweries to help make better beer.

Reg lives in the Boise, Idaho area with his "assistant brewer" wife.



John McKissack may be better known as Johnny Max from the brewing podcast Brew CrAzy. (Look for the podcast at www.brewcrazy.com.) McKissack co-hosts the show with Captain Ron, his dog. His first podcast episode aired in July 2006, and he has posted two shows per month since then.

In the November 2006 issue, John wrote the Last Call article, "1776 Porter," on his project to brew a beer using only the tools available to colonial Americans. In this issue, he contributes his first feature article - "21% Alcohol All-Grain Beer." After being told by a homebrew club member that there was no way he could brew an all-grain beer over 20% ABV, John set out to do that. He succeded in brewing a beer that he calls "Cause of Death," a 21.4% (calculated) ABV beer. Find out how he did it on 48.

John podcasts Brew CrAzy and brews his beer in Vidor, Texas.

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Hop PROFILE

CASCADE

Cascade is an American hop variety that is used primarily as a finishing hop. It was developed by Oregon State University's breeding program in 1956. It is a cross-breed from Fuggle and Serebrianker (a Russian hop).

It has a pleasant flowery, spicy, piney and citrusy flavor and aroma that is familiar in Pacific Nothwest hop varieties. Certain crops are also known to have a grapefruit flavor.

Cascade is one of the "three Cs" (Chinook, Centennial and Cascade are similar in flavor profile). Some substitutes for this hop could be Centennial, Amarillo or possibly Columbus.

It typically falls in the 4–6 % alpha acid range and the 5–7% beta acid range. Common beer styles where you will find this hop are pale ales, IPAs, porters and barleywines.

reader RECIPE

Jeff Atkins • Springfield, Illinois

Awesome Brown Buddy (Ale)

I started with Newcastle Brown as a target but the recipe has grown a little with each brewing. I've experimented with the grain bill and the yeast but kept Kent Goldings as my hops of choice. Perhaps I should play with the hops next time but for now, if you love browns, be they American or Northern English, this one will put a silly looking smile on your face after every pint.

Ingredients

8 lbs. (3.6 kg) Pale malt (Maris Otter or other British malt preferred)
1 lb. (0.45 kg) Crystal 60 °L
8 oz. (224 g) Biscuit malt
8 oz. (224 g) Belgian Aromatic malt
8 oz. (224 g) Carapils malt
3.5 oz. (98 g) Chocolate malt
1 oz. (28 g) Kent Goldings hops for 40 minutes of boil
1 ounce of Kent Goldings hops for 10 minutes of boil
1 pkg. Wyeast 1187 Ringwood or 1028 London Ale
A little more than 1 quart (~1 L) of water to each pound (0.45 kg) of grain

Step by Step

I did a step mash for this brew with a protein rest at 122 °F (50 °C) for 30 minutes. The temperature was then bumped to 156 °F (69 °C) for 60 minutes, then 168 °F (76 °C) for 5 minutes. Sparge with lots of 170 °F (77 °C) water then commence to boil. Boil for 60 minutes and add hops as described above. The beer fermented for one week in the primary and one week in the secondary. I keg carbonated at 2.4 volumes. Serve at cellar temperature (50–55 °F or ~11 °C) and you'll love it! – *Cheers!*

Homebrew CALENDAR

December 31

7th Annual Big Beers, Belgians & Barleywines Festival
Vail, Colorado

The 7th Annual Big Beers, Belgians & Barleywines Festival will be held January 5–6 in Vail, Colorado. Deadline for entries to the homebrew competition are due no later than December 31. The entry fee is $5 per entry. The accepted BJCP categories are 5 (Bock), 9E (Strong Scotch Ale), 12C (Baltic Porter), 13F (Russian Imperial Stout), 14C (Imperial IPA), 15C (Weizenbock), 16 (Belgian & French Ale), 17 (Sour Ale), 18 (Belgian Strong Ale), 19 (Strong Ale), 23 (Specialty Beer - minimum gravity of 1.050) and 26B (Braggot). For full information visit www.bigbeersfestival.com.

December 31

Wynkoop Brewing Company 2007 Beerdrinker of the Year
Denver, Colorado

Wynkoop Brewing Company is now conducting its search for the 2007 Beerdrinker of the Year. The brewery is now seeking "beer resumes" from the nation's most beer-minded men and women. Resumes must include each entrant's beer-drinking philosophy and details highlighting their passion for beer. Resumes should provide evidence of the entrant's understanding of beer, its history and its importance to civilization. Resumes are due no later than December 31. For full information visit www.wynkoop.com.

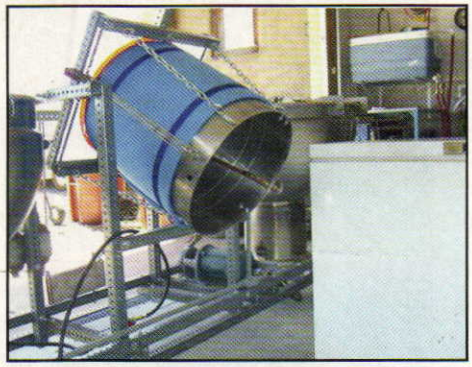
January 13

2007 Doug King Memorial Lager and Speciality/Experimental Beer Competition
Woodland Hills, California

Entries for this Maltose Falcon's sponsored competition will be accepted between January 2 and January 13. The fee is $5 per entry. New to this year's competition is Class 28 the Imperial ANYTHING! category. The only rule is the original gravity must be 1.080 or above. For full information please visit www.maltosefalcons.com/comps/2007DKM.

homebrew systems that make you DROOL

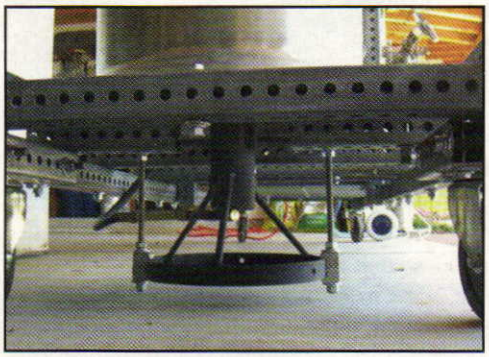
Tom Hart • Albuquerque, New Mexico



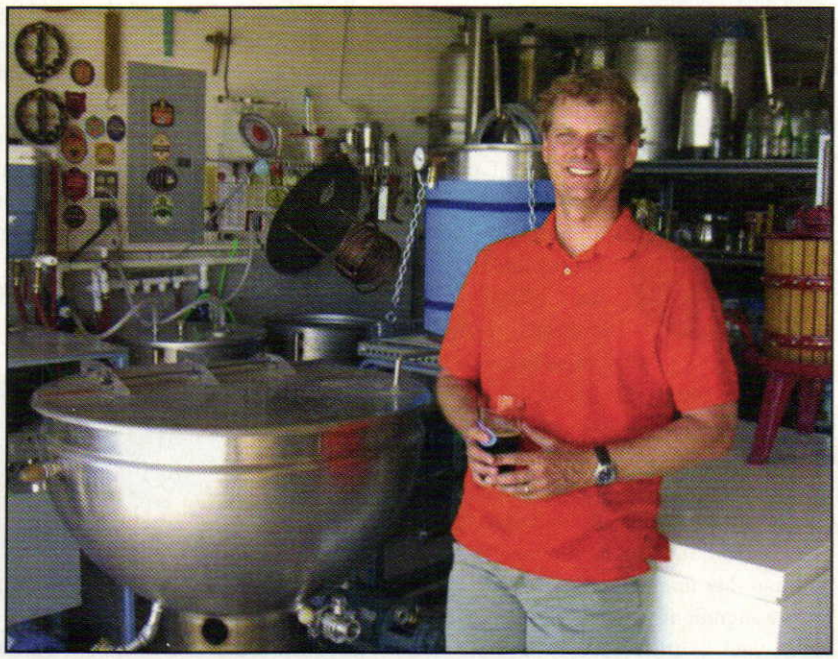
MASH/LAUTER TUN DUMPING –
The mash/lauter tun is set-up to dump its spent grain into a wheelbarrow for easy removal.

TWO ROLLER MILL –
The motorized two roller mill was inspired by a salvaged highway sign. The hopper holds 30 pounds (13.5 kg) of grain and the 4" diameter rollers are adjustable for control of the crush.

FULL RIG – The rolling brewery rig consists of two steam kettles: a 60-gallon (228-L) HLT and a 40-gallon (152-L) kettle/mash cooker. The 35-gallon (133-L) mash/lauter tun pivots to dump its spent grain and doubles as a whirlpool. Both gravity and a stainless steel centrifugal pump are utilized to transfer liquid.



ADJUSTABLE JET BURNER - The steam jacket of each kettle is heated with a 150,000-BTU liquid propane jet burner. These burners are suspended from the stand's frame on adjustable brackets to optimize their output.



FERMENTATION SET-UP – The temperature of the two 25-gallon conical fermenters is controlled by a glycol system. Glycol is recalculated, and held in an Igloo cooler at a specified temperature, by the Beer Line Chiller. This glycol is pumped out of the cooler and through copper, immersion coils suspended in each fermenter. The pumps that control this cooling loop are each regulated by a Ranco temperature controller that can be set to the desired fermentation temperature.

THE BREWPASTOR (above) –
Tom Hart was a co-founder and served for 7 years as the head brewer of the Rio Grande Brewing Company, where he earned two medals at the Great American Beer Festival. He built his home brewery after returning to his work as a Presbyterian minister.

THE SANCTUARY (left) –
When stored, everything fits in the front ⅔ of half a garage. The van gets the other third.

homebrew PROFILE

Event Brewing

Joe Gherlone • Fredericksburg, Virginia

Homebrewers tend to be invited to a lot of parties. After all, when you bring free, high quality, fresh beer, who in their right mind wouldn't want you around? As a homebrewer one can add a whole new level to both the craft of brewing and to a commemoration with family or friends. Brewing a beer (or making wine or mead, for that matter) specifically for an event is a great creative exercise, and is a very personal way to contribute to the party.

I had heard and thought about homebrew for years, but never tried it until I attended a Navy Hail and Farewell party (in which new officers are welcomed and departing officers are honored) shortly after reporting to a new ship in the service. It was at the house of Ron, the Executive Officer (second in command), and he provided his own homebrew for the wardroom's enjoyment.

What great beer. I didn't start brewing immediately, but the seeds were planted. My immediate supervisor in my next assignment, John, was a homebrewer as well. With his encouragement and advice, I took the plunge. I was surprised and flattered by how popular my beer turned out to be at these gatherings.

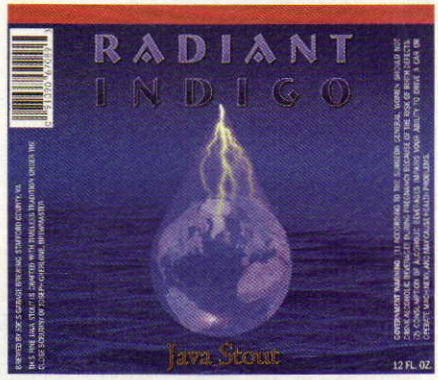
My "event brewing" started a year or two after I started brewing, when I worked for an organization called Navy TENCAP, doing research and development projects. During a break in a meeting for a project called "Radiant Copper," I was talking beer with the lead project engineer. He challenged me to brew a copper colored beer and offered to make a label so that we could distribute it to everyone on the project. That was the genesis of Radiant Copper India Pale Ale (see bottle picture), and we premiered the final product at a reception following a series of project review meetings. It was a big hit — so big that I brewed another batch for Dave, another of my TENCAP colleagues, for his retirement.

This led to Mike, another colleague, asking for a special effort for his retirement. Mike never does anything in a small way. Having worked on 6 different projects with Navy TENCAP, he wanted to be able to serve 6 different TENCAP project beers at his reception. I provided the beer and Chris designed a custom label for each beer. It was an interesting exercise in planning and execution: getting it all brewed in time, labeling 144 bottles and then carting six cases of beer to the Navy Memorial on the Friday before Memorial Day. I got numerous compliments on the beer and Mike got to enjoy maximum style points on his retirement. He even had posters made to show off the various beers. Our group presented Mike a handcrafted walnut display case with one of each of the bottles (empty, of course) as a retirement gift.

> "This sounds trivial, but the timeline is critical, especially when doing multiple batches."

A beer menu makes a great statement, but is also a necessary precaution when you label your bottles only with a batch number or a letter code. I always provide a short description of the brew, including alcohol content.

Not only does it help ensure folks can pick something they will like, but unknowingly quaffing down a barleywine as if it were a Bud Light is not conducive to driving (or even walking) safely home. It's also a good idea to add a notice that reminds the guests to recycle the bottles so that they can be refilled.



Aside from adding to the beverage menu, there are other good practices for event brewing. First, talk it through with the retiree, graduate or happy couple. If they like porters, your spectacular Kölsch may not be what they'd most like to enjoy at their event. Second, plan far enough ahead to have finished beer, properly packaged, available for the event.

This sounds trivial, but the timeline is critical, especially when doing multiple batches. A single batch of some beers can be completed in only three to four weeks, but many styles take much longer, so you need to think it through, especially if your family member or friend has expressed a preference for a certain style.

Finally, have a backup plan — I recently had the batch of IPA that I had promised for a party go bad, but had other homebrew to substitute, so luckily all was well.

The most important advice, I think, would be to enjoy yourself. Remember, this is for a celebration, and this is your very personal gift. Treat it as such, and celebrate the day.

replicator

by **Marc Martin**

Dear Replicator,

While most of the east coast homebrewers were in Orlando, Florida at the AHA conference, my wife and I spent that weekend in northern Virginia. Even though we are president and treasurer of the Star City Brewers Guild we chose to attend the 10th Old Dominion Beer Festival. While in the DC area, we visited the Sweet Water Tavern in Sterling, Va. and sampled many of brewmaster Nick Funnell's creations. My wife just loved the Giddyup Stout, a creamy, chocolaty, very coffee laden stout that is, I believe Sweet Water's signature dark brew. Any chance you could come up with a clone of Mr. Funnell's fine brew ?

Patrick Kennerly
Roanoke, Virginia

I brew a pretty good coffee porter myself so I was also very interested in this stout. My inquiry call was eagerly returned by Nick Funnell, Sweet Water's brewmaster. This is definitely a brewer with a colorful past and 20 years of experience. Originally from York, England he had brewed in London for the Orange Brewery. After moving to the States he attended the Institute for Brewing Studies and has now been at Sweet Water for the past 10 years. The extensive list of 33 different house beers is obvious testament to the fact that he is enjoying our U.S. tastes for variety.

Nick reports that his Giddyup Stout, brewed seasonally, is one of their more popular beers and he has been working to tweak this recipe for the past 5 years. His basic recipe started out as a dry stout but he wanted a flavor profile that was sweeter with more body, hence the late addition of lactose. The single addition of bittering hops allows the dark grains' roastiness to prevail.

Possibly the most interesting part of the recipe is Nick's procedure for handling the coffee. For brewers making flavored beers, this is always a point of great debate. He claims that after trying several methods he has found the "cold press" to be the most effective in producing a smooth, flavorful extract. One major problem in using coffee is the effect of the oils on head production and retention. By creating the extract over a longer period of time, and with cold water, he finds that oil production is very low allowing for excellent head qualities. You can bet I will be trying this for my next coffee beer. Thanks for the request. This should be a great stout to impress visiting holiday guests.

For further information visit their Website www.greatamericanrestaurants.com or call them at 703-449-1100.

Sweet Water Tavern Giddyup Stout

(5 gallons/ 19 L extract-with-grain)

OG = 1.046 FG = 1.012
IBU = 28 SRM = 32 ABV = 4.4 %

Ingredients

3.3 lbs. (1.5 kg) Briess unhopped light liquid malt extract
1 lb. 10 oz. (0.73 kg) light dried malt extract
11 oz. (0.31kg) crystal malt (60 °L)
6.0 oz. (0.17 kg) chocolate malt
6.0 oz. (0.17 kg) roast barley grain
3.0 oz. (85 g) Carafa® malt
5.0 oz. (0.14 kg) dark roast coffee (medium grind)
2.5 oz. (71g) lactose powder
½ tsp. yeast nutrient (15 min)
7.5 AAU Galena hops (60 min) (0.63 oz./18 g of 12.0% alpha acid)
White Labs WLP023 (Burton Ale) or Wyeast 1275 (Thames Valley Ale)
0.75 cup (150 g) of corn sugar for priming (if bottling)

Step by Step

Steep the crushed grain in 3 gallons (11.4 L) of water at 154 °F (68 °C) for 30 minutes. Remove grains from the wort, add the liquid extract and bring to a boil. Add the only addition of Galena hops and boil for 60 minutes. During the boil, use this time to thoroughly sanitize a fermenter. Add the yeast nutrient after 45 minutes of boiling. Dissolve in the lactose at the end of the boil. Now add the wort to 2 gallons (7.6 L) of cold water in the sanitized fermenter and top off with cold water up to 5 gallons (19 L).

Cool the wort to 75 °F (24 °C). Pitch your yeast and aerate the wort heavily. Allow the beer to cool to 68 °F (20° C). Hold at that temperature until fermentation is complete. Transfer to a carboy, avoiding any splashing to prevent aerating the beer. Let the beer condition for 1 week. One day prior to bottling or kegging make a coffee extract by steeping the ground dark roast coffee in 24 oz. (0.7 L) of cold water and refrigerate. Strain out the coffee grounds, add your extract and then bottle or keg. Allow to carbonate for 2 weeks and enjoy your Giddyup Stout!

All-grain option:

This is a single step infusion mash. Replace the malt syrup and dry malt extract with 8 lbs. (3.6 kg) 2-row pale malt. The other grains remain the same. Mix the crushed grain with 4 gallons (15.2 L) of 170 °F (77 °C) water to stabilize at 154 °F (68 °C) for 60 minutes. Sparge slowly with 175 °F (79 °C) water. Collect approximately 6 gallons (23 L) of wort runoff to boil for 60 minutes. The remainder of this recipe is the same as the extract-with-grain recipe.

Freshness and Aging Ales

Quality homebrew depends on timing

by Garrett Heaney

Some common questions beginning homebrewers have are: How well will my beer age? How long should I wait to drink it? How long is too long?

For most styles, beers are at their peak flavor for a few weeks or months, not years. The majority of ales that homebrewers make are ready to be consumed after just a few weeks and, if properly stored, will last for a few months before their flavor starts to decline.

However, there are others, such as certain high-alcohol barleywines, Scotch ales and Trappist ales, whose flavor profiles improve with extended aging — up to a couple years for some, longer for a very few. Initially, these beers may have big, rough flavor profiles — including harsh hop bitterness and a "hot" character from the alcohol — that take some time to round out. Lagers, too, typically require up to three months of aging at near-freezing temperatures (33 °F or 1 °C) in order to produce their desired flavor profile.

Contamination

Unwanted microbial growth will rob the aging potential of any beer. A tiny amount of contamination can mute a beer's flavors, making it seem dull. Larger amounts of contamination will produce off flavors or aromas that will often get progressively worse.

Carbonation

Most homebrewers carbonate their beers in one of two ways — bottle conditioning or force carbonating. For those who bottle condition your beer, you are automatically giving your beers 7–14 days of aging.

Force carbonation is a process in which brewers inject appropriate levels of CO_2 into kegged beer. While carbonation can be achieved rather quickly, your beer may still be green and you may want to give it a little more time to condition, in order to achieve other goals, such as clarification and maturation.

Clarification

After primary fermentation is complete, the bottom of your fermenter will have a layer of yeast and protein sediment known as trub. Trub can impart undesirable flavors to the beer, so some homebrewers use a practice known as "secondary fermentation," where the beer is racked off the sediment into a fresh container. This also gives the brew a chance to mature as a full batch, rather than being divided into 50+ bottles, in which certain flavor compounds would be unequally distributed. Secondary fermentation also leaves you with clearer beer, and clear beer has proven to be much more stable than hazy or cloudy beer.

Maturation

On the other hand, letting a beer sit on its yeast can also be beneficial. When yeast are in contact with green beer, they "clean it up," helping it mature into a conditioned beer. For ales, you need not rush to get a beer off it's yeast and trub. Let the beer sit for a few days after primary fermentation is done, then rack. (And if the beer clears adequately in your primary fermenter, consider skipping the secondary fermentation and just package it. Unnecessary transfers may simpy expose your beer to more oxygen than it would otherwise.)

Three molecules that yeast will take up during maturation are diacetyl, acetaldehyde and hydrogen sulfide. Each of these has its own, distinct flavor: Diacetyl has a butterscotch or buttery flavor, acetaldehyde has a green apple flavor and hydrogen sulfide (which is produced by some lager yeasts) has a rotten-egg aroma. Given adequate time and proper aging conditions, these flavors will naturally subside, and the proper flavors that you expect from each style of beer will be able to shine.

Exposure to oxygen and light

You should try to minimize a beer's exposure to oxygen as it conditions. Once fermentation slows or stops, don't open your bucket or pull out your airlock to take a look. Rack your beer the minimum amount of times you can get away with and do so "quietly" — with as little splashing or agitation as possible. If bulk aging a beer, make sure to keep your airlock filled with water. Light is damaging to beer, giving it a skunked character. Bottle your beer in brown bottles and keep it in the dark (for example, inside a case box).

Refrigeration

Temperature is one of the most important factors in determining how long a beer will remain at peak flavor. For the vast majority of homebrews, storing your beer refrigerated is the best option. (Storing a beer cold also accelerates clarification.) If that isn't an option, find the coolest feasible location.

Timing and tasting

As beer conditions, it goes from being green to properly aged (fresh, but fully conditioned) to over the hill. To gauge when your beer is at its peak, study the style you're brewing, focusing on what brewers before you have found as far as appropriate aging times, techniques and conditions and then leave it up to your taste buds. Implement a tasting schedule in which you open a beer every few days or weeks and let your palate tell you when it has come into its prime. Keep solid notes and adjust your aging practice until you have that style perfected. For more information, check out "Aging Gracefully" by Kirk Fleming in the July 1996 issue of *Brew Your Own*. Cheers!

Brewing Barleywine

Learn what it takes to brew this big beer at home

by Garrett Heaney

Barleywines are big beers boasting alcohol contents of 9–15 % by volume. That being said, there are certain techniques that brewers utilize in order to get that alcohol percentage up to the appropriate level. This high volume of alcohol requires more extensive aging to make the beer taste smooth, mellow and balanced. Some brewers even take this opportunity to age on oak, giving their barleywine unique character.

Darron Welch (left) is the Head Brewer and part owner of the Pelican Pub & Brewery in Pacific City, Oregon. Darron is a graduate of the American Brewers Guild and an active member of the Master Brewers Association of America and the American Society of Brewing Chemists. Pelican's Stormwatcher's Winterfest took Silver in the Barley Wine category at this year's GABF.

The hops we use are primarily Hersbrucker hops from Germany. Hersbruckers have a wonderful spicy and noble aroma that works nicely with the biscuity, toasted malt character. We use our own house ale yeast to ferment Stormwatcher's Winterfest, at 66 °F (19 °C).

To hit our extract targets, we mash twice and run-off short in order to fill up one of our small fermenters. We utilize very long boil times to both concentrate our extract and to develop flavor and color. Stormwatcher's Winterfest is first wort hopped, which is a little bit unusual, but it is a technique that we use quite a bit here at the Pelican Pub & Brewery, so it seems normal to us.

To conduct a proper fermentation for this big beer, we shoot for a pitching rate about 50% greater than normal. In our brewery, we use the industry standard of 1 million cells per milliliter per degree Plato. So for example, with our Kiwanda Cream Ale, a 12.2 °Plato wort (1.050 specific gravity), the target pitching rate is 12.2 million cells per milliliter of wort.

In the case of the Stormwatcher's Winterfest, the starting extract is very high, 31 °Plato (1.126 specific gravity), so the target pitch rate would normally be 31 million cells per milliliter, but in the case of very high gravity brews you want more than this rule of thumb, so the target is 50% higher, at 46 to 47 million cells per mL.

You are creating a stressful environment for your yeast when brewing a barleywine, so in addition to needing a heavy pitch rate, you want to give the yeast lots of oxygen. We dose purified oxygen inline during wort transfer at 45 cubic feet per hour (CFH) and 30 PSI for the entire wort transfer. It is really next to impossible to over oxygenate very high gravity worts such as a barleywine.

On a homebrew level, I'd consult with the yeast supplier to understand how many millions of cells there are in the yeast sample you are buying, and then either buy extra packages of yeast, or work out a timeline for progressively inoculating larger volumes of wort and building up your population of yeast cells. Invest in a sintered stainless stone and use it to really blast air or oxygen into your cooled and pitched wort.

We also try to maximize the apparent attenuation of Stormwatcher's Winterfest, not an easy task with a beer this big. The 2005 version had an apparent degree of fermentation (ADF) of about 72%, while the 2004 went a little further, with an ADF of 78%. In 2004 we used some locally sourced wildflower honey, which improved fermentability. In 2005 it wasn't available due to a wet spring previous.

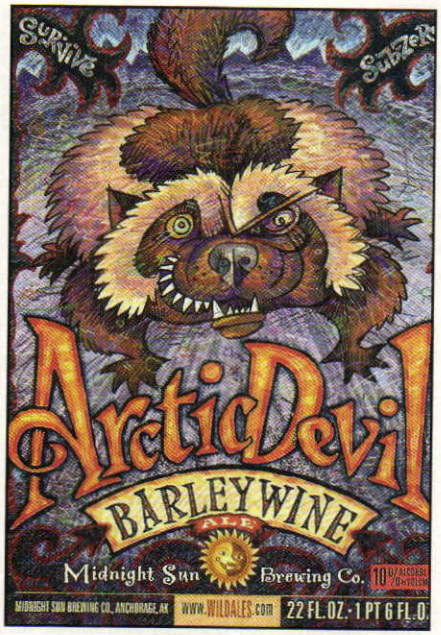
As for bitterness and color, Stormwatcher's Winterfest is about 35–40 IBUs and about 75 SRM. The beer clocks in at a hefty 12.5% ABV.

Stormwatcher's Winterfest is a very rich and balanced beer when it is fresh, but gains tremendous complexity and richness of aroma as it ages. The Stormwatcher's Winterfest that won a medal at this year's GABF was nearly a year old, and had been in the bottle for about eight months.

We target a CO_2 level similar to that of our other beers, around 2.5 to 2.6 volumes. Stormwatcher's Winterfest has a 7-day fermentation and a 6–7 day maturation at slightly elevated temperatures (68–69 °F). It is clarified with finings, cold conditioned for about two weeks and then gently filtered to brighten it up. The beer is held at about 12 PSI headspace pressure during cold conditioning, so it is mostly carbonated when filtered. We have carbonating stones in the bright beer and serving tanks to touch up the carbonation if need be.

For homebrewers wanting to brew barleywines, I would actually recommend starting with smaller beers that offer similar challenges and flavor profiles. You can practice mashing and running off twice to produce a high gravity wort, and you can improve your fermentation management skills incrementally. If you start with a 20 °Plato (1.083 SG) wort and ferment it successfully, you will have learned some good lessons along the way, which you can apply to later, stronger brews. Eventually, you can increase the wort strength into the barleywine range.

Barleywine is not a beer style for impatient brewers. But the satisfaction and rewards of brewing such a beer more than makes up for its challenges. Brewing barleywine pushes the limits of normal brewing techniques and a brewer's skill. You will be a better brewer after making a good barleywine.



Ben Johnson is a brewer at Midnight Sun Brewing Co. in Anchorage, Alaska. The Brewery won Bronze in the Barley Wine category at this year's GABF with its Arctic Devil Barleywine.

Our Arctic Devil Barleywine is truly an English-style barleywine. We use a high quality English 2-row malt for the base, a little bit of crystal malt and that's it. As for hops we use Challenger and Fuggles. For homebrewers, any English-style yeast that can tolerate high alcohol will work best.

When it comes to the numbers, our original gravity is 31 °Plato (1.134 SG) and we shoot to get it down to 8 °Plato (1.032 SG) for the final gravity. This leaves it somewhat sweet, but that really adds to the character of the beer. We actually keep the IBUs pretty low, at about 20. We shoot for 11% ABV, but last year's came in at 14%! It attenuated a little more than expected, but nobody seems to mind.

Arctic Devil is not Arctic Devil without a lot of age. The beer is a year old by the time it hits the bottle. The beer is pretty harsh when fresh and over the year's aging, it really mellows and comes into its own. For carbonation, we purposely keep it pretty low. The low carbonation really softens the beer and since it is best served aroud 50 °F (10 °C), we don't want too much CO_2 interfering with the flavor.

We age most of the beer in bourbon barrels. Right now we have Jack Daniels and Heavenly Hills barrels. This beer needs its time on oak — that's really what makes it unique. After 11 months on oak we put it back into the tank and blend in some Arctic Devil that we stored in stainless. This blending allows us to control the level of oakiness and adjust the flavor to exactly where we want it.

For homebrewers, if you can get a smaller barrel to replicate the aging, it would do wonders. Be patient and allow the beer to age for a long time. English styles are fairly sweet, and a little oxidized character is not a bad thing. We also do really long boils on the beer which is something you can easily do at home. It really helps to carmelize some of the sugars. Good luck!

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Turbo Conditioning

A mash out strategy and two Beano queries

"Help Me, Mr. Wizard"

by Ashton Lewis

Turbo time for conditioning

I have two questions for you. One deals with late additions of malt and the other with "turbo conditioning" — I've been reading *BYO* recently and I've noticed that a lot of recipes are calling for the late addition of malt extract. Is there a benefit to this? I always thought that extract went in after the grains and before the boil, for more efficiency of the malt. My next question has to do with the fact that recently, I've been conditioning my newly bottled beer upstairs because it's much too cold in the basement. I keep it next to the heater vent where the average temp is 72 °F (22 °C). My beer has been carbonated in about 3-4 days time, whereas in the summer it takes about 2 weeks in the basement. I know that good things come to those who wait, but am I doing my beer a disservice by this method of "turbo conditioning?"

Neil Herrick
via email

Like all techniques in brewing I suggest critically evaluating what is being done to brew beer. In the case of wort boiling the goal for all-grain brewers is to kill bacteria from malt, denature enzymes, precipitate proteins, adjust wort gravity, remove unwanted volatiles (such as DMS) and isomerize hop acids. The latter goal is actually hindered by high wort gravity.

Brewers who have small brew pots and are unable to boil the entire wort volume sometimes add dry and/or liquid malt extracts late in the boil. These partial-mash brewers boil the wort extracted from malt to do all the things that is required for wort boiling, then at the end of the boil add the remaining extract in liquid or dry form per their recipe. A short hold at high temperatures is sufficient to kill any bacteria these ingredients may carry since liquid and dry malt extracts have already been heat-treated during manufacture and do not have high bacterial loads. After the high-gravity wort has been cooled the gravity is adjusted with water.

The benefit to this method is that wort produced from grain is boiled at a normal gravity along with hops just like an all-grain, full wort volume brew and all of the requirements of boiling are met. Dry and liquid extracts do not need to be boiled because these ingredients were boiled when concentrated at the extract plant. Furthermore, boiling extracts has absolutely no affect on efficiency. So the simple answer is that this is a sound method and has no obscure pit-falls that may end up causing disappointment.

Your next question is about keeping your beer warm during conditioning. This is a real world problem for commercial breweries selling bottle-conditioned beers. As you point out, storing beer in the basement or an underground cellar reduces the air temperature to the average earth temperature of the location of the cellar. In most parts of the world the average earth temperature is about 55 °F (13 °C). This impairs the speed of bottle conditioning, and for many ale strains is really too cold to get much carbonation at all.

This is why bottle-conditioned beers are typically stored in warm cellars controlled to a comfortable temperature of about 75 °F (22 °C). This is plenty warm for the yeasties to do their work in a reasonable time frame and is not so warm that the beer starts to prematurely age because of high storage temperature. This practice is relatively common in Europe and the United States among brewers who bottle-condition their beers. Duvel in Belgium, Sierra Nevada in California and New Belgium in Colorado are three breweries I know who have warm cellars. I know that at Sierra Nevada beer is held for about a week before being released for sale.

So in the commercial world of brewing where time is money, warm conditioning reduces the number of cases that are sitting around waiting for carbonation to happen. Bean counters like to minimize this type of inventory and warm conditioning helps control inventory and the conditioning process. At home the economic drivers of inventory control are different, but why wait 2 weeks to sample your next tasty brew when you can cut down the time to 1 week? There is no reason whatsoever not to practice this method . . . I declare open season on "turbo-conditioning!"

Mash out methodology

I have a question regarding the mash out. I use single infusion mashing with a modified picnic cooler. When attempting to mash out I use a good deal of near-boiling water just to raise the temperature from the mash to 170 °F (77 °C). Not having the ability to apply direct heat to the mash tun, I was wondering if I could, like in decoction mashing, remove the thick portion of the mash, boil it and return it to raise the temperature to mash out, thus not having to add additional water. Would this extract tannins and "grainy" flavors since the beer was made via the infusion method? If this is feasible how much would I pull off of the main mash to boil in order to achieve the mash out temperature?

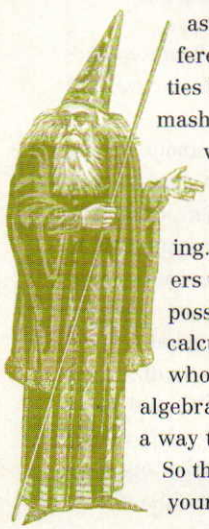
Paul Kempkes
Buffalo, New York

The easiest way to go about solving this problem is to not mash out. Breweries who have infusion mash tuns have no way of doing a decoction and do not add a bunch of hot water to the mash to increase its temperature. Instead, infusion mash brewers usually start collecting wort and sparge with water that is around 168 °F (76 °C) and allow the temperature to slowly rise during wort collection. While mashing out does stop enzyme activity and "fixes" the

carbohydrate profile of the wort, the main reason for mashing-out is to reduce wort viscosity and improve wort flow through the grain bed. This is more important when doing stirred, multi-temperature mashes because the mash bed becomes denser. Infusion mashes are usually easy to run-off and this is not so much of an issue.

You can do a single decoction to increase mash temperature if you really want to mash out. A little extra malty or grainy flavor is typically associated with beer made with decoction. How much mash to boil is a weighted average calculation. In this case you want 100% of the mash to be at 170°F and have (100 - x)% at 155 °F, for example, and (x)% at 212 °F. The equation to solve is: (1) x (170 °F) = [(1 – x) x 212 °F] + [(x) x 155 °F]. Solving this equation for x results in 0.74, meaning that 74% of the mash should be left in the mash tun and 26% of the mash should be boiled.

You probably will find that this will undershoot the desired temperature of 170 °F (77 °C) because some heat is lost when the two portions are mixed. This can be accounted for by deflating the decoction temperature used in the calculation based on empirical data. You can solve the equation in reverse to determine what temperature to use in the future. If the temperature only increased to 165 °F (74 °C), solving the equation (1) x (165 °F) = [(0.26) x (y °F)] + (0.74 x 155 °F) indicates that 193 °F (89 °C) was the effective decoction temperature. Using this value for future brews suggests boiling 39% of the mash.



For the sake of simplicity, I have assumed that there is no difference in the thermal properties between the thin and thick mashes because there is no easy way to measure the mash thickness in the portion of the mash removed for boiling. I apologize to those readers who wish to consider every possible variable in brewing calculation and am sure those who wish to make my simple algebra more complex will figure a way to do so!

So there you have the answer to your question. If you really want my opinion — you are getting it whether you want it or not! — I suggest keeping things simple and only adding levels of complexity to your routine if you have a real requirement. If you have a problem getting the mash easily flowing through your mash tun or have a flavor-related concern that this will address I give the added complexity two thumbs up, otherwise keep it simple!

Brewing gluten-free

One of my best friends has recently been diagnosed with Celiac's Disease (intolerance of products containing gluten) which of course includes malt. Now that he can no longer drink beer (the horror!) I would love to try and brew him some "gluten-free beer." I have found a few helpful Websites explaining the certain grains you can use such as sorghum, buckwheat and corn but nothing in great detail. I am especially interested in learning the malting process for these raw grains since I understand you have to obtain them from feed stores or health shops. Do you have any experience with this subject or can you point me in the right direction for good reference material?

Dominic Siewko
Los Angeles, California

I know enough about this topic to give some general information. People with Celiac's disease vary in the intensity with their reactions to gluten proteins. This disease can result in a drastic reduction of the small intestine's ability to absorb nutrients from food and can result in death. I suggest a pretty thorough review of the topic accompanied by a physician's advice to make sure whatever you brew for your friend is truly compatible with his dietary requirements.

The most common grains used to brew beer, barley, wheat and rye, are all off-limits for Celiacs. I am no expert here and am only reporting what I have read. Some papers indicate that oats may not be a problem for Celiacs, but the verdict appears to be out on that grain as well. Sorghum, rice and potatoes are some ingredients that Celiacs can safely consume that also can be used to brew beer. Buckwheat is considered safe by some Celiacs and unsafe by others, as is alcohol in general. This is not a very well documented disease and much of the information comes from the Celiac community.

Getting back to the question, any grain with a viable embryo can be malted by simply steeping the seeds in water to hydrate them and allowing them to germinate. Germination is halted by drying and kilning temperature and method influences malt color, flavor and enzymatic activity. Most malt used for brewing is lightly kilned because enzymes are required to convert malt starch into fermentable sugars during mashing. The higher kilned malts, such as crystal, Munich-types, chocolate and black malts, are used in relatively low proportions and enzymatic activity is not much of a consideration for specialty malt production.

There is a wealth of information available on malting in brewing textbooks and some good how-to stuff for home maltsters on the internet. *Malting & Brewing Science* by Hough, Stevens and Young is my favorite text written in English and can be found in the libraries of many colleges and universities. Sorghum malt is fairly common in Africa, where special steps are used to reduce polyphenol levels and their associated astringency. The equipment required for malting is pretty simple and easy to make and the process of malting is also pretty simple. However, producing consistent, high-quality malt requires attention to detail and skill, just like brewing good beer.

One domestic beer brewed specifically to offer beer to those with Celiac's disease is called Bard's Tale Beer. I know from talking to this brewery that one of the keys to brewing gluten-free beer is preventing contamination. For example, you may have gluten-free ingredients and introduce gluten proteins from your brewing equipment used to brew regular beer. It is important to sanitize everything, including the mill, to prevent cross-contamination. I recently was given a bottle of Bard's Tale Beer to taste by a co-worker who is a Celiac. I was really surprised by how beer-like this beer is. If I had not known that it was not made from malted barley, I would not have suspected other grains by tasting alone.

One of the challenges in your pursuit will be brewing a wide array of styles. I personally would experiment with

adjunct ingredients. Potatoes, rice, sugars, molasses, honey and maple syrup are some ingredients that you could use to add color and flavor to your base wort made from sorghum malt. Just like regular beer you can play around with different yeast strains, hop varieties and hopping methods to add variety to these beers. Please do your friend a favor and thoroughly research this topic and get your method down so that your gluten-free beer tastes great before offering him the gift of beer!

Carb cutting for diabetics

I have been just diagnosed with Type 2 Diabetes and my doctor wants me to stop drinking beer due to the carbohydrates. I have been homebrewing for over 13 years and I have a few follow-up questions on the responses that you have given on brewing with Beano over the last couple years. Can I use the Beano Brew process on any style of beer and will I get the reduction in carbohydrates of 53% approximately or 4.9 grams per 12 ounces that you achieved? Will I get the same results with the Beano Brew process using all-grain, partial-mash and extract brewing process? Are the temperatures critical during the brewing process and are they critical during fermentation and aging? I plan on making my Newcastle Brown recipe for my first Beano Brew; any problems or concerns about this style? Once again I'm worried about carbohydrates not calories!

Steven Solik
via email

Every time someone inquires about using Beano in brewing I ask myself what on earth I was thinking when I wrote my groundbreaking, tongue-in-cheek article! I never thought this would take off with homebrewers because most homebrew is the big macho stuff with lots of chutzpa. Beano contains de-branching enzymes that tend to make lighter bodied beers commonly lampooned by the beer snob crowd, like Stone's "yellow fizzy beer is for wussies" campaign. It's nice to hear that you have a possible way of brewing a flavorful beer that fits in with your low carbohydrate diet. I am not a physician, don't have diabetes and do not claim to know the intricacies of the diabetic diet. What I can tell you with certainty is that de-branching enzymes convert non-fermentable carbohydrates into fermentables, thereby reducing the carbohydrate level of finished beer.

I have not done extensive research into the Beano method and do not know what results to expect with other beer styles. In general, much of the color and flavor from special malts come from Maillard reaction products that arise during kilning from the reaction of reducing sugars and amino acids. Maillard reaction products are not carbohydrates and their contribution to flavor should be unaffected by using Beano. I do expect fuller styles, such as amber ales, to be negatively affected by Beano because residual sweetness is part of the flavor profile of these styles. A dry, toasty brown ale sounds pretty good to me and a worthy style for experimentation with

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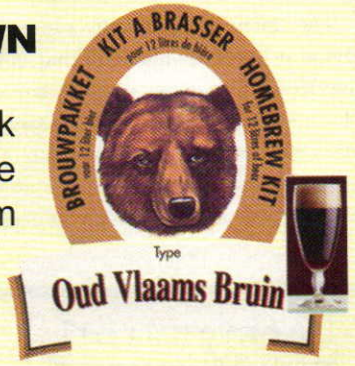

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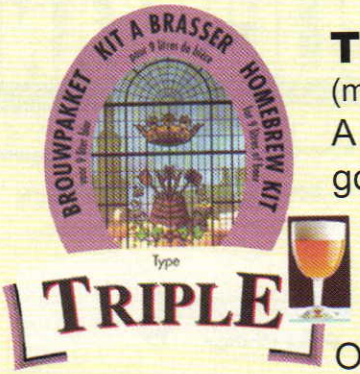

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Beano. I think other dry styles, such as Irish stouts and light beers would also do well.

When I conducted my Beano trial I added the enzyme to fermented beer. I did this because my test was conducted at a brewpub and I did not want to experiment with adding it to a 400-gallon (1500-L) mash. Commercially brewed light beers brewed using de-branching enzymes typically do all of the starch conversion in the brewhouse. De-branching enzymes used by brewers are industrially produced using the fungus *Aspergillus niger*, just like Beano. These enzymes are usually much more heat stable than malt-derived enzymes and are active up to about 176 °F (80 °C), meaning that they work just fine if added to the mash.

The nice thing about adding the enzyme in the brewhouse is that boiling denatures the enzymes and you can control over-attenuation. In your case, you probably want to blast up as much of the carbohydrates into fermentables as possible and you are not overly concerned about that possibility. Even so, you don't have to worry about enzyme activity in the bottle which could cause some very real problems with over-carbonation, possibly leading to little Beano grenades.

So in answer to your question about temperature, you don't have much to worry about with temperature if you use the Beano in the brewhouse. When added to beer the enzymes act slower since the temperature is cooler, but this is not a big deal because fermentation lasts days compared to the hour or so required for mashing. I don't think temperature is something to be overly concerned with. With that said, I would still recommend adding the de-branching enzymes to the mash.

The only way to know how this will work with an unknown beer style is to give it a try and make sure you collect good data. These notes will help you tweak things in the future if you find this method works with your diet. You want to be able to know how much Beano per pound of malt that you use so that you have a way of controlling the enzyme concentration.

If you want more enzyme activity, you can extend your mash duration or enzyme concentration in future brews. Extract brewers can also use Beano if the extract is heated to around 70 °C (158 °F) and the de-branching enzyme is allowed to chew on the dextrins for about an hour before boiling. Good luck with the Beano brown!

BYO Technical Editor Ashton Lewis has been answering homebrew questions as his alter ego Mr. Wizard for the last 12 years. Do you have a question for him? Send inquiries to *Brew Your Own*, 5053 Main Street, Suite A, Manchester Center, VT 05255 or send your e-mail to wiz@byo.com. If you submit your question by e-mail, please include your full name and hometown. In every issue, the Wizard will select a few questions for publication. Unfortunately, he can't respond personally. Sorry!

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Saison's Greetings

Belgian farmhouse ale for the holiday season

by Horst Dornbusch

In terms of specifications, there seem to be few beer styles in the world that are more all over the map than the bière de saison. Bière de saison is a farmhouse ale, brewed originally in Wallonia, the French-speaking part of Belgium. The range of alcohol by volume alone fluctuates wildly: In current commercial examples it easily varies between 5% and 8.5%. Also, bière de saison can be brewed with or without spices, flavored with English or German hops, dry-hopped or not, and fermented with any number of yeasts, as long as they are top-fermenting. The finished beer can be pale or dark amber, full-bodied or thin, sweet or dry. Its flavor profile can be dominated by cloves, pepper and some banana, or by maltiness. There may be spicy, hoppy, acidic and alcoholic notes upfront and vanilla or liquorish in the finish . . . or not!

Saison was originally brewed in Belgian farmhouses by homebrewers like you!

A bière born of homebrew freedom

Considering the bière de saison's genesis as a farmhouse brew, we should expect a natural amount of variation. Uniformity in ingredients and brewing practices across a wide geographical region is a phenomenon only of the modern age, and Belgium in particular has been loath, unlike its neighbor Germany, to abandon its idiosyncratic medieval beer-making habits. As farmer-brewers have done for eons all over the world, Wallonian country homebrewers have obviously relied mostly on ingredients they were able to raise themselves. Not surprisingly, their beers were more dependent on what they might have had at hand when the annual brew season was upon them than on broad brewing guidelines.

The Walloons usually brewed their saisons no later than in April or May, right before the hard labor started on the farm. Their beers were designed to be laid down. They had to be powerful enough to last through the summer, but still quaffable enough to serve as thirst quenchers during the harvest. The brews were unfiltered, of course, and chill hazes would have been normal on a crisp morning on the farm (as they will be when you take your saisons out of the refrigerator).

Many commercial bière de saisons are packaged in Champagne bottles. This presentation, however, is not as a sign of snobbish opulence but of solid farmers' frugality: The custom was born in the 19th Century, when poor farmer-brewers collected and recycled bubbly bottles that were carelessly discarded by the rich as trash. Once these bottles were stripped of their metal collars and were washed, filled, corked, and secured with wire cages, they made for excellent, cheap, sturdy and reusable beer containers.

It's all in the yeast!

In spite of the bière de saison's broad range of specifications along just about any brew-technical variable, all descriptions of the brew seem to agree more or less on one fact: The brew does exhibit a certain amount of spiciness. Once you mention "Belgian" and "spices" in one sentence, however, the knee-jerk reaction of most brewers is to empty their spice

BIÈRE DE SAISON by the numbers

OG	1.056–1.080 (14.5–19.5 °P)
FG	1.010–1.016 (2.5–4 °P)
SRM	8–12
IBUs	5–45
ABV	4.5–8.5%

RECIPE

Saison of the Season

(5 gallons/19 L, all-grain)

OG = 1.064 FG = 1.012

IBU = 20 SRM = 10 ABV = 6.8%

Ingredients

10.4 lbs. (4.7 kg) Dingemans pale malt (~2°L)

2.1 lbs. (0.95 kg) Briess flaked wheat (~2 °L)

0.50 lbs. (0.23 kg) Weyermann Munich Type I malt

0.50 lbs (0.23 kg) Hugh Baird Carastan malt (15 °L)

0.50 oz. (15 g) Briess roasted barley (300 °L)

6.0 AAU Tettnanger hops (45 min) (1.3 oz./38 g of 4.5% alpha acid)

1.0 oz. (28 g) Styrian Goldings hops (flavor/aroma)

1 package of White Labs WLP565 (Belgian Saison I) or Wyeast 3724 (Belgian Saison) yeast

1 cup light dried malt extract (for priming)

Step by Step

Bière de saison is a simple farmers' brew, so let's keep the mash process simple, too. Because modern homebrewers probably start out with much better grains than were available to the farmer-brewers of yonder, a simple infusion mash with two saccharification steps is probably sufficient. Mash in at about 144 °F (62 °C) for a 30-minute hydration and beta-amylase rest. Then raise the temperature to around 154 °F (68 °C) for a 30-minute alpha-amylase rest. Sparge with about 180 °F (82 °C) water until the grain bed reaches the mash-out temperature of 168 °F (76 °C).

Maintain that grain bed tem-

recipe continued on page 20

recipe continued from page 19

perature and keep on sparging until the kettle wort is about 1.058 (14.5 °P), that is, the wort is roughly 10% thinner than at the target OG at the end of the boil. Boil for about an hour. Add the bittering hops at the standard 15 minutes into the boil. If evaporation losses are greater than 10%, liquor the brew down in the kettle with some cold water. But note that precision is not crucial when brewing a bière de saison. Add the flavor/aroma hops after shut-down and create a gentle whirlpool in the kettle. Let the brew spin for about 30 minutes. Then siphon the wort off the trub. Heat-exchange to a pitching temperature of roughly 72 °F (22 °C) if you pitch the WLP565. Heat-exchange to roughly 80 °F (27 °C) if you pitch the Wyeast 3724. Aerate the brew thoroughly. Let primary fermentation run its full course. Fermentation may slow down once the brew approaches terminal gravity. Be patient. It may take up to three weeks before the brew comes to rest completely. Rack, prime and bottle all in one process. Of course, you can also rack the brew into a keg. In either case, allow for about three months of conditioning and maturation time at or above room temperature, preferably at 73 °F (23 °C).

Saison of the Season

(5 gallons/19 L, extract w/ grains)

OG = 1.064 FG = 1.012
IBU = 20 SRM = 10 ABV = 6.8%

Ingredients

8.0 lbs (3.6 kg) Pils liquid malt extract (such as Weyermann Bavarian Pilsner)
2.1 lbs. (0.95 kg) Briess flaked wheat (~2 °L)
0.50 lbs. (0.23 kg) Weyermann Munich Type I malt
0.50 lbs (0.23 kg) Hugh Baird Carastan malt (15 °L)
0.50 oz. (15 g) Briess roasted barley (300 °L)
6.0 AAU Tettnanger hops (45 min) (1.3 oz./38 g of 4.5% alpha acid)
1.0 oz. (28 g) Styrian Goldings hops (flavor/aroma)
1 package of White Labs WLP565 (Belgian Saison I) or Wyeast 3724 (Belgian Saison) yeast
1 cup light dried malt extract (for priming)

Step by Step

Mill the specialty grains and place into a steeping bag. Steep grains in about 3 gallons (11 L) of hot water (at about 160 °F or roughly 71 °C) for about an hour. Raise the bag and rinse with 2 or 3 cups of cold water. Do not squeeze the bag. Transfer the steeping liquid to the brew kettle and bring it to a boil. Turn off the heat. Stir in the LME. Bring to a boil again and add the bittering hops after 15 minutes. Boil for another 45 minutes and shut off. From here on, follow the equivalent instructions for the all-grain brew.

Saison of the Season

(5 gallons/19 L, extract only)

OG = 1.064 FG = 1.012
IBU = 20 SRM = 7.5–10 ABV = 6.8%

Ingredients

9.75 lbs (4.4 kg) Pils liquid malt extract (such as Weyermann Bavarian Pilsner)
0.50 fl. oz. (15 mL) of Weyermann SINAMAR® Color Malt Extract
6.0 AAU Tettnanger hops (45 min) (1.3 oz./38 g of 4.5% alpha acid)
1.0 oz. (28 g) Styrian Goldings hops (flavor/aroma)
1 package of White Labs WLP565 (Belgian Saison I) or Wyeast 3724 (Belgian Saison) yeast
1 cup dried malt extract (for priming)

Step by Step

Heat 3 gallons (11. 4 L) of brewing liquor to the boil. Shut off. Stir in the liquid malt extract and the SINAMAR®. Return to a boil and add the bittering hops immediately. Boil for another 45 minutes, shut off and adjust the gravity. From here on following the equivalent instructions for the all-grain brew.

racks into their brew kettles. How could one go wrong with cloves, coriander, ginger, passion fruit or orange peel? The saison is a Belgian after all!

Not so fast! A careful study of the different saisons reveals that some do and some do not contain spices. As far as I am concerned, there are essentially two ways of getting peppery spiciness into the brew — the bold, sure-fire, predictable way . . . and the subtle way. I prefer the subtle way. Let me explain: The sure-fire way involves indeed adding real spices to the brew. The more spices you add, and the stronger the spices, obviously, the more dominant will be the spice component in the finished beer (and the better you can cover up any brewing mistakes, too). To make a brew without spices, by contrast, involves finesse, and — given the ever-present risk of failure — mistakes will affect the flavor. The key to the subtle way of brewing a spicy saison is . . . the yeast!

In the old days, farmer-brewers of saison probably re-pitched their yeasts for decades, if not centuries. As a result, the yeasts that evolved over time in splendid isolation, must have taken on their own peculiarities. It is a fair guess that these house yeasts imbued the farm ales brewed with them with distinct, proprietary notes. Unique, yeast-derived flavors are not uncommon in the history of brewing and in the emergence of beer styles. The Hefeweizen yeast, for instance, is very important to a German Weissbier's phenolic and spicy clove, banana and bubblegum flavors. Wheat beers brewed without it do not really taste like Weissbier. For a bière de saison, just like for an authentic Hefeweizen, let the yeast be the source of the typical saison flavor, without the aid of spices. In a saison, I believe, you want to taste the beer, and the beer alone.

This approach is not shared by all craft brewers (or all commercial saison brewers in Belgium either). Especially brewers working in brewpubs are sometimes reluctant to maintain more than one or two yeast strains in parallel, so they use their standard ale yeasts to ferment their saisons, with or without spices. This pitching practice and my bias notwithstanding, there are some excellent renditions of both spiced and non-spiced saison-style beers on the market. One

excellent American spiced example is the 8% ABV Ommegang Hennepin from Brewery Ommegang in Cooperstown, New York. It is flavored with ginger and orange peel and is an excellently refreshing brew. A widely available bière de saison imported from Belgium is the 6.5% ABV, un-spiced, Vieille Provision Saison Dupont from Brasserie Dupont in the country village of Tourpe. Fermented with the brewery's house yeast, this bière de saison is a fairly blond, understated brew of profound maltiness with a faintly peppery note upfront, a smooth hop middle, and a tangy finish.

I consider the saison yeast, above all else, as the defining characteristic of a proper bière de saison. It is the one *sine qua non* of the style, the element that holds all its diverse interpretations together. High or low alcohol levels, a sweet or dry finish, acidity or not, mild or strong hop flavors and aromas . . . they do not matter as long as the yeast is right. To prove the point, divide your next standard pale or brown ale batch in two and pitch one half with a typical London ale yeast — such as Wyeast 1968 (London ESB) — and the other half with a saison-style yeast specialist such as White Labs WLP565 (Belgian Saison I) or Wyeast 3724 (Belgian Saison). I assure you, one batch will have spicy, peppery notes, the other will not. Also, the saison yeast, unlike the London yeast, keeps the diacetyl level well below the taste threshold of even an experienced palate.

White Labs describes its WLP565 (Belgian Saison I) yeast as a classic saison yeast from Wallonia. It produces earthy, peppery and spicy notes. This yeast shows medium flocculation and has a typically ale-like optimum fermentation temperature of 68–75 °F (20–24 °C). Bière de saison yeasts tend not to be strong and resilient attenuators and they may go dormant in higher-gravity brews before their job is done. Therefore, either expect some residual sweetness in the finished beer or add, as White Labs recommends, an optional "drying" yeast (perhaps an English ale or German Alt yeast) when fermentation is about 75% complete. Wyeast's saison offering is the 3724 (Belgian Saison) yeast . It produces a classic farmhouse ale with, according to the Wyeast website, spicy and complex aromatics including bubblegum. It finishes crisp and mildly acidic, with mild fruit, and produces a brew that is very tart and dry on the palate. Wyeast points out that this strain is slow to attenuate and benefits from a relatively high fermentation temperature of 70–85 °F (21–29 °C). The Wyeast Saison has low flocculation.

Bière de saison brewing tips

With a bière de saison grain bill, it seems, you simply cannot go wrong. While some saison grain bills are nothing but Pils malt, others may contain 5–15% caramel malts for added color and a bit of sweetness to balance any estery spiciness. You can also use small amounts of Vienna, Munich or aromatic malts for more breadiness and as a balance to the hops. Even raw grains, malted wheat, flaked barley or adjuncts would not be out of style. These lighten the body and add flavor

nuances. However, to avoid lautering issues and conversion problems for lack of enzymes, you might not want to use more than 40% adjuncts in the grain bill.

For malt sources, there really is no hard and fast rule. You can use Belgian malts from Dingemans, British malts from Muntons or Hugh Baird, German malts from Weyermann or American malts from Briess — or a combination of these. The grist composition suggested in our recipe, therefore, is just a guideline. It is for a light amber brew of about 10 SRM, with an OG of about 1.064 (14 °P). But, by all means, feel free to vary this recipe to your heart's content. Note that our total grain bill of 13.5 lbs. (6.1 kg), based on an extract efficiency of 65%. If your setup is better or worse, adjust the grain quantity accordingly, or just live with the result. After all, bière de saison is a flexible style.

For hops, you can use Tettnanger or Northern Brewer from Germany, Willamette from the U.S., East Kent Goldings from England, Styrian Goldings from Slovenia or even Saaz from the Czech Republic. I picked the citrusy Tettnanger as bittering hops and the floral Styrian Goldings as flavoring and aroma hops. Again, this is not dogma! Some commercial saisons are dry-hopped. In our recipe, we will simply add plenty of aroma hops to the whirlpool.

After primary fermentation, I suggest racking, priming and bottling the bière de saison in one process, and laying it down for three months of bottle-conditioning and maturation at a toasty room temperature of 73 °F (23 °C). However, serve the brew at a cool cellar temperature of roughly 50–55 °F (10–13 °C).

Extract-plus-grain brewers can replace the base malt with a European pale Pils liquid malt extract and obtain the additional color and flavor from the steeped specialty grains. Assuming no contribution to gravity from the specialty grains, the entire bière de saison grist can be replaced with roughly 8.8 lbs (4 kg) Pils liquid malt extract. Weyermann Bavarian Pilsner liquid malt extract is convenient for this purpose, because it comes in a 4-kg (8.8-lb.) plastic container. Because the sugar content of liquid malt extracts is not always constant even among consecutive batches from the same supplier, always use a hydrometer to verify your gravity.

Because there appears to be no prefab extract on the market that replicates the grain bill proposed here, the best solution for an all-extract bière de saison is to replace the entire grain bill with Pils liquid malt extract. At our original gravity, straight Pils liquid malt extract makes a brew of roughly 7.5 SRM. To darken the brew to our target beer color of 10 SRM, consider adding about 0.5 fl. oz. (15 mL) of Weyermann SINAMAR® Color Malt Extract to the kettle.

'Tis the season to be jolly . . . so try this spiceless spiced farmhouse brew from Wallonia as a neat holiday project. *Joyeux Noël and Santé!*

This is Horst Dornbusch's final "Style Profile" column for BYO. *Farewell!*

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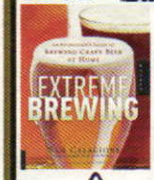

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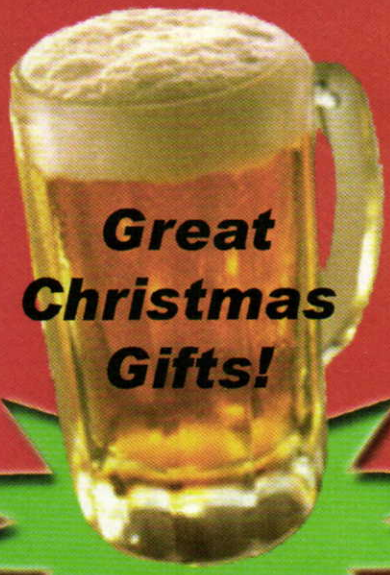

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by **Horst Dornbusch**

The word "bock" may come from a mangling of Einbeck, the name of the town where the style originated. But, "bock" also means billy goat in German and advertisements for bockbiers almost always feature a goat. Dopplebocks, or "double bock beers," begin with a long step mash — or a triple decoction mash, if you want to take the traditional route — of Munich malt and end with a long lagering period. However, if you brew one, your patience will eventually be rewarded with a dark, full-bodied, malty brew with a serious kick — just like a billy goat.

the SUSTAINING DOPPELBOCK

A MONK'S LIQUID BREAD

DOPPELBOCK by the numbers

OG	1.072 (18 °P)
FG	1.016 (4 °P)
SRM	18–22
IBU	28–32
ABV	7–8%, sometimes higher

Literally, doppelbock means "double bock." In Germany, all bock beers fall into the category of *starkbier* (strong beer), which is defined as any brew that is sent to the fermenter at an original gravity upwards of 1.064 (16 °P). Doppelbock is one of Germany's biggest beers, typically with an OG of 1.072 (18 °P) or more and exhibiting at least 7% alcohol by volume (ABV).

Doppelbocks are always heavy and malty, with little perceived hop bitterness. Their color ranges from a deep amber to light mahogany.

A Challenging Brew for the Patient and Contemplative Brewer

Brewing a beer this big from scratch is only for the most intrepid and patient of grainmeisters! Allow for a long brew day, because doppelbock requires a lengthy and laborious multi-step mashing process to allow for proper grain hydration and complete conversion of beta-glucans, proteins and all the starches. Also, with a grain bill of around 16 lbs. (7.3 kg) of grain for 5 gallons (19 L) of this, you will benefit from a correspondingly long sparge, perhaps for as long as 90 minutes. Next, malty doppelbocks benefit from a long, two-hour boil, which promotes the formation of melanoidins, the browning effect in wort that adds richness and some color to the finished brew. Worst of all, from the standpoint of an anxious and thirsty homebrewer, there is the beer's long, chilly lagering period to allow it to become mellow and drinkable.

Lagering should take a minimum of two months, but six months is much better — a wait that can test any brewer's patience and self-control. Lastly, for homebrewers who bottle condition their beer, this heavy lager is notoriously slow to respond to priming agents. So, after bottling, add another month of waiting before tasting, unless you have the means to force-carbonate the brew in a keg. You may also want to consider adding fresh yeast when you bottle.

In spite of all this heartache, this brew is worth the trouble. There are few beer experiences more satisfying than having a chewy, full-bodied, velvety-smooth doppelbock descend unhurriedly past your pallet.

With that much patience and self-restraint — nay denial — involved in brewing a doppelbock, it is small wonder that the people who first came up with this brew were pious monks! The first doppelbock was brewed by the Paulaner friars of Munich, a Benedictine order named after its Italian patron saint, Francis of Paula. It seems that you've got to be wholly immersed in the contemplative lifestyle of a cloistered recluse to conceive of a brew this trying. (For additional detail about the origins of doppelbock, see the historical sidebar on p. 32.)

Defining Doppelbock

There are many varieties of strong beer in Munich. Next to the doppelbock, there are regular bocks, Christmas bocks, win-

countinued on page 31

DOPPELBOCK RECIPES

Terminator Doppelbock

(5 gallons/19 L, all-grain)
OG = 1.072 FG = 1.016
IBU = 30 SRM = 21 ABV = 7.2%

Ingredients

9.5 lbs. (4.3 kg) Weyermann Munich Type I malt (6.2 °L)
6.0 lb. 2.7 kg) Weyermann Munich Type II malt (10 °L)
0.45 lbs. (0.2 kg) Weyermann Caramunich® Type I malt (35 °L)
7.75 AAU Hallertauer Mittelfrüh, Hersbrücker, Perle or Mt. Hood hops (75 mins)
(1.7 oz./49 g of 4.5% alpha acid)
0.5 oz. (14 g) Hallertauer Mittelfrüh, Hersbrucker, Perle or Mt. Hood hops (5 mins)
Wyeast 2206 (Bavarian Lager), Wyeast 2308 (Munich Lager), White Labs WLP838 (Southern German Lager) or White Labs WLP920 (Old Bavarian Lager) yeast
1 cup corn sugar (for priming)

Step by Step

Mash the grain using the lengthy process described in the main text. Before sparging, recirculate the run-off until it is clear. Sparge with near-boiling water making sure the grain bed temperature does not exceed the mash-out temperature of about 170–172°F (77–78°C). Boil the wort for about two hours. Add the bittering hops 45 minutes into the boil and the flavor/aroma hops about 5 minutes before shutdown. Let the hot wort rest for 30 to 45 minutes to allow the trub to sediment well. Then heat-exchange the brew to the optimum fermentation temperature recommended for your chosen yeast; 48 °F (8.8 °C) tends to be a perfect target pitching temperature for most Bavarian lager yeasts.

For a faster start of fermentation, aerate very thoroughly! Pitch the yeast or starter. The brew should reach its terminal gravity of approximately FG 1.016 (4 °P) within 10 days to two weeks. Let the spent yeast settle for a few days. This will improve the clean taste of the finished Doppelbock. Then rack the brew and give it an optional diacetyl rest at room temperature for about two to three days, at which point it is time to rack it into a lagering vessel. For lagering, pull the brew's temperature down gradually in increments of 2–3 °F (1–1.5 °C) per day for about a week to 10 days. The optimum lagering temperature is approximately 28 °F (-2 °C). The longer the brew is lagered, the mellower it will taste. Eight weeks is the recommended minimum, half a year or longer is better.

Now the beer is finally ready for packaging, but, after such a long lagering period, the beer will contain very few viable yeast cells for metabolizing any priming agent. Thus building carbonation through bottle priming may take about four weeks at room temperature. By far the best way to serve this brew, therefore, is to dispense it force-carbonated out of a Cornelius keg. After conditioning in bottles or a keg, reduce the beer's temperature to a cellar temperature of about 50 °F (10 °C) for storage. This is also the temperature at which you should serve it.

Terminator Doppelbock

(5 gallons/19 L, extract with grains)
OG = 1.072 FG = 1.016
IBU = 30 SRM = 21 ABV = 7.2%

Ingredients

7 lb. 10 oz. (3.5 kg) Weyermann Munich Amber liquid malt extract
4.4 lb. (2.0 kg) Weyermann Munich Type II malt (10 °L)
0.45 lbs. (0.2 kg) Weyermann Caramunich® Type I malt (35 °L)
8.0 AAU Hallertauer Mittelfrüh, Hersbrücker, Perle or Mt. Hood hops (60 mins)
(1.8 oz./50 g of 4.5% alpha acid)
0.5 oz. (14 g) Hallertauer Mittelfrüh, Hersbrucker, Perle or Mt. Hood hops (5 mins)
Wyeast 2206 (Bavarian Lager), Wyeast 2308 (Munich Lager), White Labs WLP838 (Southern German Lager) or White Labs WLP920 (Old Bavarian Lager) yeast
1 cup corn sugar (for priming)

Step by Step

Divide the mixed cracked specialty grains in two muslin bags and place these into about 1.8 gallons (6.9 L) of cold water. Raise the temperature of the steeping liquid over half an hour to 162 °F (72 °C). Turn off the heat and leave the bags in the liquor for another half an hour. Lift the bags out of the liquid, rinse them with several cups of cold water and discard. Stir in the malt extract, adjust the kettle volume and bring to a boil. Because the extract has already been boiled once, there is no need for the long two-hour boil of the wort from the all-grain version. Add the bittering hops after 15 minutes and the flavor hops after 55 minutes. Shut-down after a total boil time of 75 minutes. Then follow the steps outlined in the all-grain recipe.

Terminator Doppelbock

(5 gallons/19 L, extract only)
OG = 1.072 FG = 1.016
IBU = 30 SRM = 21 ABV = 7.3%

Ingredients

6.75 lbs. (3.0 kg) Weyermann Munich Amber liquid malt extract
4.0 lbs. (1.8 kg) Weyermann Bavarian Dunkel liquid malt extract
8.0 AAU Hallertauer Mittelfrüh, Hersbrücker, Perle or Mt. Hood hops (60 mins)
(1.8 oz./50 g of 4.5% alpha acid)
0.5 oz. (14 g) Hallertauer Mittelfrüh, Hersbrucker, Perle or Mt. Hood hops (5 mins)
Wyeast 2206 (Bavarian Lager), Wyeast 2308 (Munich Lager), White Labs WLP838 (Southern German Lager) or White Labs WLP920 (Old Bavarian Lager) yeast
1 cup corn sugar (for priming)

Step by Step

Mix the two liquid malt extracts with hot brewing liquor in the kettle, stir well, and bring to a boil. Add the bittering hops after 15 minutes and the flavor hops after 55 minutes. Shut-down after a total boil time of 75 minutes. Then follow the steps outlined in the all-grain recipe.

Terminator Doppelbock

(5 gallons/19 L, countertop partial mash)
OG = 1.072 FG = 1.016
IBU = 30 SRM = 20 ABV = 7.3%

Ingredients

8.25 lbs. (3.7 kg) Weyermann Munich Amber liquid malt extract
3.55 lb. (1.6 kg) Weyermann Munich Type II malt (10 °L)
0.45 lbs. (0.2 kg) Weyermann Caramunich® Type I malt (35 °L)
8.0 AAU Hallertauer Mittelfrüh, Hersbrücker, Perle or Mt. Hood hops (60 mins)
(1.8 oz./50 g of 4.5% alpha acid)
0.5 oz. (14 g) Hallertauer Mittelfrüh, Hersbrucker, Perle or Mt. Hood hops (5 mins)
Wyeast 2206 (Bavarian Lager), Wyeast 2308 (Munich Lager), White Labs WLP838 (Southern German Lager) or White Labs WLP920 (Old Bavarian Lager) yeast
1 cup corn sugar (for priming)

Step by Step

Heat 5.5 quarts (5.2 L) of water to 165 °F (74 °C) and pour it into a 2-gallon (7.6-L) insulated beverage cooler. Place crushed grains in a nylon steeping bag and submerge grains in cooler. Open bag and stir grains thoroughly, then close bag and cooler and let mash for 45 minutes, starting at 154 °F (68 °C). While grains are mashing, heat 3.0 quarts (2.8 L) of water to a boil in your brewpot. Also, heat 5.0 quarts of water to 180 °F (82 °C) in a separate pot. After the grains have mashed, recirculate a couple quarts (liters) of wort until it is fairly clear, then run off first wort and add it to the boiling water in your kettle. Add 180 °F (82 °C) water to cooler, stir grains and let sit for 5 minutes. Then recirculate and draw off second wort, adding it to the wort in your kettle. Add about 3.0 lbs. (1.4 kg) of the liquid malt extract (not all of it) to your brewpot and bring wort to a boil. Boil wort for 60 minutes, adding hops at times indicated in the ingredient list. With 15 minutes left in the boil, stir in about half of the remaining liquid malt extract. (Keep the boil clock running.) At the end of the boil, stir in the rest of the malt extract and cover your brewpot. Let it sit for 15 minutes before you cool. Cool wort. Transfer chilled wort to fermenter and top up to 5 gallons (19 L) with cold water. Pitch yeast and follow the fermentation instructions in the all-grain recipe.

terbocks, eisbocks and Maibocks. Unfortunately for the modern, scientifically inspired brewer, the numerical separators between these brews are not quite as discrete as might be desirable. In fact, the brewers of Munich, both secular and religious, brew their beers on a seamless continuum of strength — from the featherweight *schankbiers* of a mere 2.5% ABV, to the serious heavyweights that push the envelope at 12 to 13% ABV. Thus it is difficult to tell with certainty the original gravity or alcohol level at which an ordinary bockbier — already a potent brew! — should end and a doppelbock should start. Likewise, in the upper reaches of weightiness, there is no clear demarcation line between the strength of a doppelbock and its even more exulted cousin, the eisbock — except by process, of course. The eisbock, unlike the doppelbock, needs to be frozen and drained off its slush to concentrate its flavors and alcohol, while the doppelbock must reach similar heights by relying entirely on the good works of its yeast.

Doppelbocks are always heavy, starting at 7% ABV, but with some examples reaching 13%. Thus, they are sipping rather than quaffing beers. Their smoothness is very deceptive and can easily lead the unsuspecting imbiber to overindulge.

Doppelbocks, like most Bavarian beers, have very little perceived upfront bitterness, in spite of a respectable hop loading of about 30 IBU. This is barely enough to balance the dominance of the residual sweetness from all that Munich malt. In color, a doppelbock is always dark-ish, roughly between very deep amber and light mahogany, somewhere around 20 SRM.

All-Grain Doppelbock Mashing

The optimum foundation grist for a proper doppelbock grain bill is Bavarian-grown Munich malt, often called Type I. Munich Type 1 malt is kilned to no more than 6 to 8 degrees Lovibond (° L). This is a color rating at which diastatic enzymes are still active enough to convert their own starches. Unlike most other, paler base malts, Munich malts do not have the enzymatic power to convert much extra starch. (Of course, since starchy adjuncts are never used in doppelbocks, this is not a practical concern).

With modern malting techniques, which allow the maltster to make controlled batches of malt with Lovibond ratings ranging between roughly 1.5 °L and 500 °L, we can now make dopplebocks at just about any color we want to. For instance, we could make a doppelbock from nothing but Pils malt and obtain a finished beer with a light, golden color. However, before the 19th Century, such pale malts were not available and the more grain the brewer put into the mash, the darker the beer was likely to be. Therefore, if tradition is your guide — as it still is in Bavaria — you want to aim for a color value of around 20 SRM.

When formulating a doppelbock, begin with about 50 to 60% of Munich Type I malt. Next, to add extra color and maltiness, add the more strongly kilned

countinued on page 33

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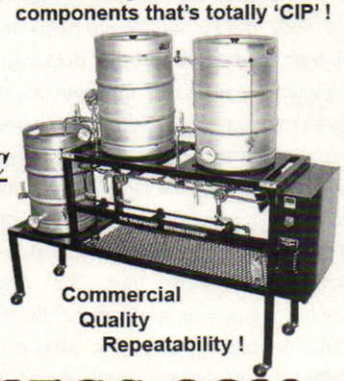

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DOPPELBOCK: FROM BEER OF THE FAST TO BEER OF THE FEST

As best we know, the first Lenten strong beer was 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 — a difference of little consequence, though, from our perspective in the 21st Century. 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 sent 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. Because the monks believed that liquids not only cleansed the body but also the soul, they would patiently make plenty of liquid instead of solid bread from their grain, and then drink it in copious quantities as the rules of their order commanded them to. It is a fair guess that the Paulaners' Lenten "liquid bread" got stronger over the years. Eventually, the Paulaners must have let some of their beer leak out for cash, to the general population. Under stringent feudal rules (and under the modern rules of post-Prohibition North America, incidentally) such sales were of course patently illegal without a license. Thus the Paulaners often found themselves in trouble because of their beer. We know so from many civil complaints that were on record about public rowdiness and drunkenness in the streets around the monastery.

It was not until the spring of 1780 that Elector Duke Karl-Theodor of Bavaria finally granted the Paulaners their official permit to disburse their brew to the public. The name of that first commercial doppelbock was Salvator, which is Latin for Savior. (Today, most brewers give their their doppelbocks names ending in "-or," referencing the original doppelbock.) The Paulaners' joy in being legal, however, was to last only 19 years, because, in 1799, a French fellow named Napoleon Bonaparte conquered Bavaria and proclaimed a new policy, in which he declared that, in all the lands he had conquered in Europe, all religious orders had to be dissolved and dispossessed. Napoleon's secularization edict was inspired by the Enlightenment movement, which called for a strict separation between church and state. Unlike in Europe's feudal past, in the new order, governed by Napoleon's law, the Code Civil, the church was no longer allowed to own property, levy taxes, or engage in business . . . no more pursuits of earthly riches, just the shepherding of man's immortal soul.

For the Paulaners, that meant that the Bavarian state had to confiscate their monastery and its brewery. The brewery lay in disuse until 1806, when the state rented it to Franz Xaver Zacherl, owner of the Münchener Hellerbräu brewery. Franz Xaver swiftly ended the "Salvatorless" period. By 1813, he was able to purchase his rented premises . . . and, like the monks before him, he promptly got himself into trouble with the law. There were countless court challenges to his beer license, because the public was once again ready to "disturb the peace." In small-minded fashion, always fearful that their subjects might have too good a time, the civic authorities simply tried to shut Franz Xaver down.

It is in a transcript of testimony given in support of brew master Zacherl during one of those hearings that, on November 10, 1835, Zacherl's brew was called Salvator. Though the name had been in use for many decades before, this is the oldest documentary reference to the name Salvator for the original doppelbock.

But things soon improved for Herr Zacherl. His Majesty himself, King Ludwig I of Bavaria, issued an ordinance of favor of the Paulaner brewer on March 25, 1837. "As long as I do not decree otherwise," the King proclaimed, "the authorities are herewith empowered to grant an annual permit for the dispensing of Salvator beer. Regular closing hours, however, must be observed, but no taxes may be levied, because this beer is to be considered a luxury item." Having found a friend for his brew in the highest place in the land, Zacherl continued to pour his Salvator Doppelbock every Lent until his death in 1846. His heirs and successors did so as well. By the mid-1860s however, a beer hall, the Salvatorkeller at the Nockherberg, was erected for the festivities. This hall — albeit completely renovated after a fire on November 27, 1999 — is where still today, every year, the first Salvator cask of the season is tapped.

Munich malt called Type II. Munich Type II malt is kilned to about 10 °L. Type II malt should occupy about one-third of the grain bill. Finally, for extra body and mouthfeel, use CaraMunich® Type I, a caramel/crystal-type malt that is kilned to about 35 °L. It makes up the remaining roughly one-tenth of the grain bill.

Note that these Lovibond values refer to Bavarian-grown malts (and the recipes on page 30 are based on these), while malts of the same names that come from North American maltsters are frequently slightly or substantially darker. When purchasing your grains, therefore, be sure to inquire about their color values.

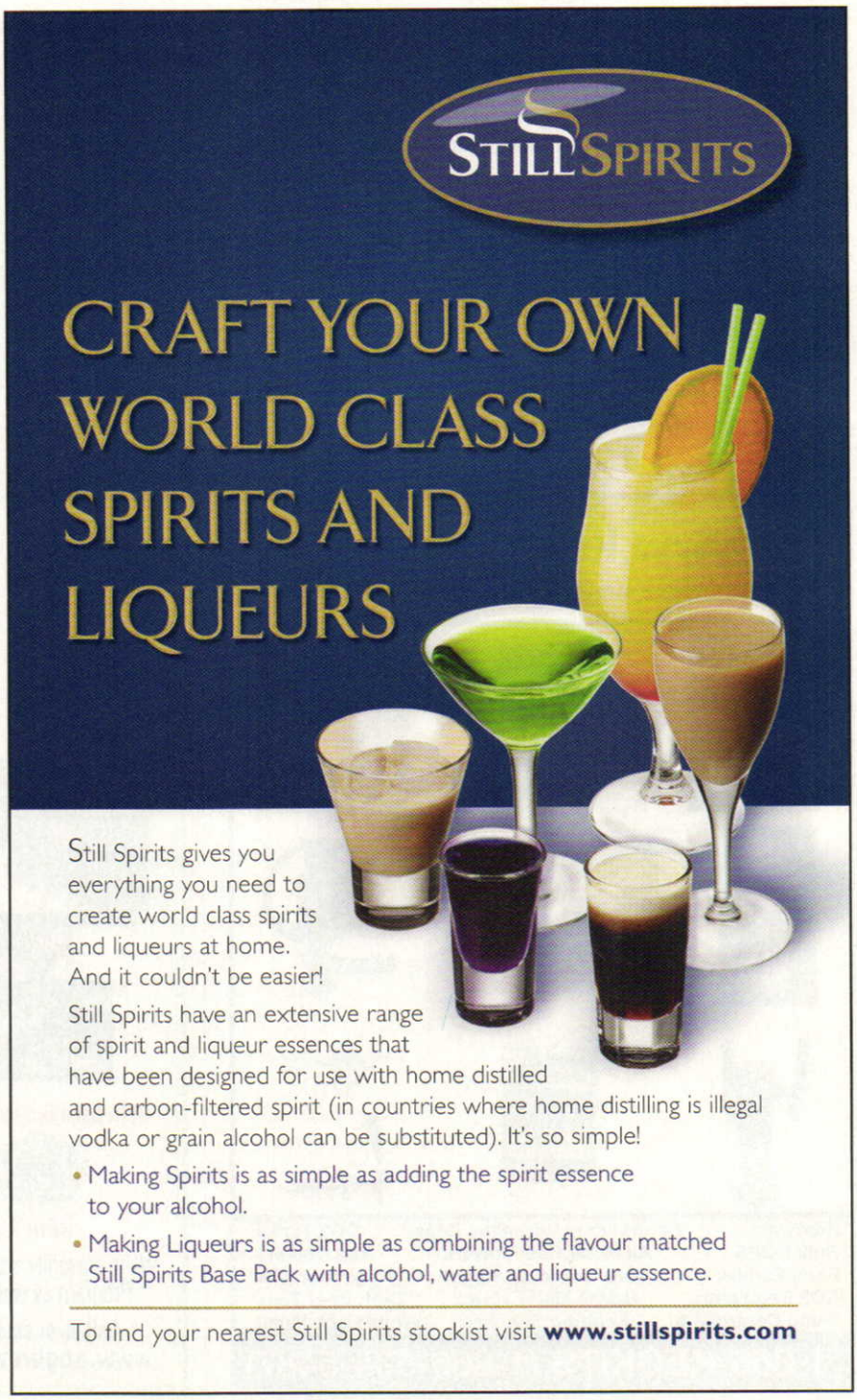
Following the practice of many German breweries, dough-in a doppelbock mash as thick as possible, aiming for a starting mash temperature of roughly 95 °F (35 °C). At a liquor-to-grist ratio of 1:1 (1 L/kg or 0.5 quarts/lb.), our 5-gallon (19-L) recipes call for roughly 2.0 gallons (7.6 liters) of liquor at a temperature of 122 °F (50 °C). This is a very thick mash, much thicker than that of a single infusion mash. However you will be adding water to the mash for subsequent rests and this will progressively thin it out.

Let the mash rest for at least an hour for proper hydration. This improves extract efficiency and lautering speed — important variables in a grain bed as big as a doppelbock's. Proper hydration also accentuates the finished beer's malt flavor. Lastly, an enzyme called phytase becomes active at this temperature. It produces small amounts of phytic acid, which helps to ensure a proper mash-pH (5.1 to 5.4 is considered optimal for amylase activity during subsequent saccharification rests). Some German breweries even dough-in the evening before brew day to let the mash hydrate overnight.

The next rest of about 30 minutes comes at a temperature of 113 °F (45 °C). To get there, infuse the hydrated mash very slowly with near-boiling water, while stirring constantly to avoid hot spots in the grain bed. This is an optional, but beneficial rest for a heavy doppelbock, because, at this temperature, high-molecular gums, mostly beta glucans, are enzymatically degraded by specialized enzymes, mostly endo-beta-glucanase. The degradation of gums reduces mash and wort viscosity, improves lautering, cuts down on beer hazes and has a positive effect on head stability and mouthfeel in the finished beer.

Next in line is the protein rest at about 122 °F (50 °C). Again infuse the mash with near-boiling water. Let the mash rest for about 30 minutes. The objective here is to activate proteases, the group of enzymes that breaks down large-molecular proteins into smaller-molecular ones — going to work on the remaining large proteins that have not already been degraded during malting. Like the degradation of gums, eliminating large-molecular proteins aids in lautering efficiency and reduces the possibility of chill hazes in the finished beer.

Now raise the mash temperature to the peak beta-amylase activity level of about 149 °F (65 °C). Beta amylase enzymes change starches into simple,



fermentable sugars, the source of all the alcohol we want in a doppelbock. By this point, your mash thickness will be somewhere within the range that allows for starch degredation to proceed without a problem. Rest the mash here for 30 minutes. Then infuse it again to reach the peak alpha amylase temperature of roughly 162 °F (72 °C) for another 30-minute rest. At this temperature, any leftover starches will be converted by alpha amylase into unfermentable, complex sugars which will add body to the finished beer.

Finally, it is time for the mash-out at about 170–172 °F (77–78 °C). First recirculate the wort until it runs clear, and then start sparging with approximately 180 °F (82 °C) water. Reduce the sparge water temperature as soon as the grain bed reaches the mash-out temperature.

Traditionally, of course, like all Bavarian beers, doppelbock was decocted — principally because the enzymatic properties of brewing grains were unpredictable in the old days, and because adequate modification at the malting plant was not a sure bet either. Many modern brewers maintain that decoction mashing enhances the beer's maltiness, though most commercial breweries — even in Bavaria — use an infusion process these days. If you wish to try a traditional decoction mash, see the Techniques column on page 55.

Extract and Extract-Plus-Grain Doppelbocks

Extract-plus-grain as well as all-extract brewers will have a much easier time with this brew than do all-grainers, provided they can find the right specialty malt extracts at their local homebrew supply shop. Extract-plus-grain brewers can replace the Munich Type I malt from the all-grain version with Weyermann Munich Amber liquid malt extract. This golden-brown, unhopped malt extract is the perfect substitute, because it happens to be made entirely from a double-decoction mash of Weyermann Munich Type I malt. Use a mix of the other malts, including Munich Type II and Caramunich® Type I, steeping.

For all-extract brewers, a good malt extract approximation of the Munich Type II and Caramunich® Type I malts from the all-grain recipe is Weyermann Bavarian Dunkel liquid malt extract. This product is an unhopped malt extract made from a double-decoction mash of Weyermann Munich Type I , Weyermann Caramunich® Type II, and Weyermann Pilsner Malt. According to Weyermann's specifications, the amber extract alone produces a nominal color rating of 8.8 to 11 °L in a wort of OG 1.050 (13 °P), while the dunkel extract does the same at a nominal color rating of 25 to 29 °L. Mixed at an amber-to-dunkel ratio of 60:40, therefore, the resulting wort color should be about 15 °L for the reference OG of 1.050 (13°P), and close to our target color of 21 °L at our target OG of 1.072 (18°P).

Hops and Yeast

Because doppelbocks are very Bavarian, their hop bitterness is

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restrained and more apparent on the finish than upfront. They rely only on the mildest and most aromatic noble hops. Hallertauer Mittelfrüh, Hersbrücker, Perle or the American Hallertauer-derivative Mt. Hood are fine. Spalter, Tettnanger and Northern Brewer can also be used.

Because high-gravity worts sometimes do not take off as quickly and vigorously as is desirable, it is helpful to provide the brew with plenty of viable yeast cells at pitching time. You can either make a yeast starter or simply pitch multiple packets of yeast. For a 5-gallon (19-L) batch of beer, a 4–6 qt. (~4–6 L) yeast starter would be optimal.

Proven Bavarian lager yeasts are best for doppelbock. These include Wyeast 2206 (Bavarian Lager), Wyeast 2308 (Munich Lager), White Labs WLP838 (Southern German Lager) and White Labs WLP920 (Old Bavarian Lager) yeast. Be sure to aerate the wort well at pitching time, because a lack of sufficient oxygen will delay the start of fermentation and cause the yeast to produce solvent-tasting esters, which could ruin the clean, smooth taste of your doppelbock.

Priming and Conditioning

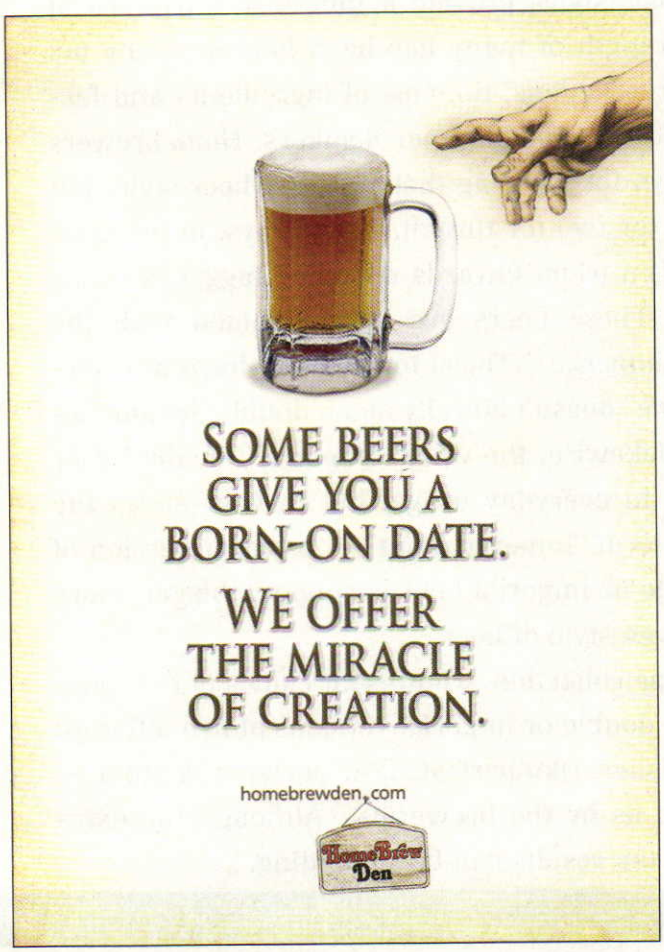
Because a doppelbock requires from two to six months of lagering time to mellow out, it will contain fewer viable yeast cells for metabolizing any priming agent at packaging time than an ale. Thus building carbonation through bottle priming may take about four weeks at room temperature. Adding some fresh bottling yeast — about a teaspoon of yeast solids per 5 gallons (19 L) — should let you bottle condition in the normal amount of time. By far the best way to serve this brew is to dispense it force-carbonated out of a Cornelius keg.

Alternatively, on the day before packaging your doppelbock, brew a pale lager and divert about one quart (~1 L) of it — at high kräusen — to a sanitized container. Use this as fermenting wort to inoculate the doppelbock right before packaging. The fermenting wort will add both priming sugars and fresh, active yeast to consume these sugars.

Alternatively, you could also, on the evening before packaging day, use about 0.75 lbs. (0.34 kg) milled pale malt to make a single-infusion mini-mash at 149 °F (65 °C), the optimum temperature for beta-amylase. Draw about 1 quart (~1 L) of wort for priming your beer. Boil this wort for 20 minutes for trub coagulation and sterilizing, but you do not need to hop it. You can also make your quart (liter) of wort from about 0.5 lb. (0.25 kg) of pale liquid malt extract or about 6.0 oz. (0.17 kg) of dried malt extract. Cool the wort and inoculate it with a package of lager yeast. The following day, when the wort is at high kräusen, add it to the finished doppelbock as a primer.

Once you endure the long lagering period, without sneaking samples, your period of self-denial will be over and you will be free to enjoy your liquid bread.

Horst Dornbusch is a frequent contributor to Brew Your Own.



TASTING DOUBLE

BIG BEER TREND MEANS BIG BREWING SESSIONS

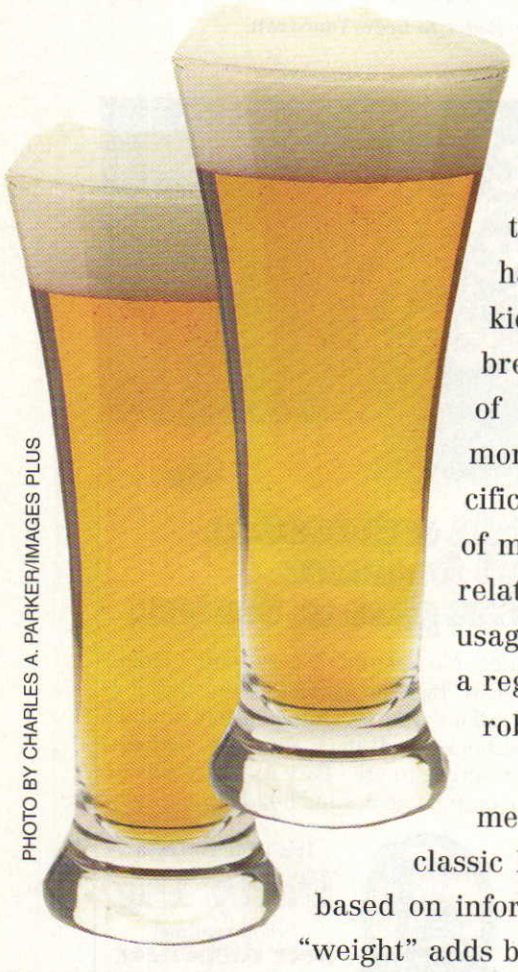


PHOTO BY CHARLES A. PARKER/IMAGES PLUS

There are many classic beer styles that are WELL-KNOWN AND ENJOYED BY BEER LOVERS THE WORLD OVER. However, although classic beer styles provide a time-tested balance of ingredients, the strength of many has been held down by tax laws, government restrictions, the cost of ingredients and factors other than the preference of beer drinkers. Homebrewers have long been known for brewing their favorite beer style, but kicking it up a notch (or two (or three)). These days, in the craft brew industry, there is a trend towards releasing bigger versions of many beer styles. These beers are often denoted with the moniker "double" or "imperial." These terms don't have any specific definition — "double" doesn't literally mean double the amount of malt in most cases. Likewise, the word "imperial" means "of or relating to an empire" in everyday usage, but in beer styles the usage follows from the term "imperial stout" — a bigger version of a regular stout. A double or imperial beer is simply a bigger, more robust version of a given style of beer.

In this recipe collection, we present clones of five commercial beers that are double or imperial versions of five different classic beer styles — a Pilsner, Oktoberfest, IPA, porter and stout — based on information provided to us by the breweries. Although the extra "weight" adds brewing challenges, the results can be rewarding.

By **GLENN BURNSILVER**

IT'S IN "DUBBLY"

If you are interested in making your own double or imperial beer, there are a few rules that can help you make good decisions during recipe formulation. First, as mentioned earlier, a double or imperial beer is not simply created by doubling a recipe. Usually the amount of grain required is less than twice that of the beer being doubled (or "imperialized"). Left Hand Brewery, for example, uses 800 kilos of grain to make a 22-barrel batch of their Twin Sisters Double IPA, while their Warrior ("regular") IPA uses 500 kilos.

In any case, the biggest challenge is balancing the flavor characteristics representative of the base style with the increased alcohol levels caused by a larger malt bill. When striving for a balance of flavors, the percentage of specialty malts needs to be considered. Specialty malts (and dark roasted grains) may be scaled up at the same rate as the recipe as a whole, but usually the more intensely-flavored specialty grains are scaled up less than proportionally. This avoids having the more darkly-kilned malts come to dominate the flavor profile of the beer and not represent the flavor profile of the base beer style. There is no simple formula to follow when scaling up specialty grains for an imperial version of a regular beer style. You will just need to use your judgement and experiment to get the right balance of flavors appropriate to the base style and increased alcohol due to the "doubling."

As with the malt, hopping rates should be increased to balance the bigger malt presence and higher alcoholic strength. Similar to specialty malts, there's no magic formula for how much you need to increase your hopping rate. Keep in mind also that the amount of grain in your recipe affects your hop utilization — the higher the gravity you boil your wort at, the lower your hop utilization. Getting the right balance can be tricky, so plan to brew at least one test batch before settling on your recipe. And of course, consulting existing double or imperial recipes may help guide your own recipe formulation decisions.

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MASHING MATTERS

For all-grain brewers, making a double or imperial beer may require some changes to their procedures. At a minimum, more grain will be mashed, so before you start, be sure you have enough space in your mash tun to avoid any nasty surprises on brewday. As a rough guide, for every 10 pounds of grain in your recipe, you will need at least 4 gallons of space in your mash tun (~3.33 L/kg). In the case of very

big beers, you may need to employ more than one mash tun (or to mash and lauter in shifts). For very big beers, you will also need to collect more wort and boil it for a longer time, or your extract efficiency will suffer. As a rule of thumb, expect to collect a little over a gallon of wort for every 2.0 pounds of grain in the recipe (~4.2 L/kg). With a propane burner, at a homebrew scale, it is easy to boil off a gallon (3.8 L) of wort an hour and not overly darken the wort. For very big beers, you may need more than one kettle.

Of course, you can also skip the long, huge boil by simply collecting enough wort for a normal-length boil, then adding malt extract to reach your target specific gravity. You can also add a great excess of malt and make your beer from only first runnings.

Extract brewers simply need to add the required amount of malt extract to reach their target specific gravity. The biggest challenge for extract brewers, when making any big beer, is to get adequate hop bitterness and to keep color pickup in the boil to a reasonable range. The solution in both cases is to increase the boil volume to minimize the effect of boiling a highly concentrated wort. The most preferable option is to do a full-wort boil. If that isn't possible, boil the largest volume you can.

PITCH PERFECT

For optimal yeast performance when pitching to a high-gravity wort, it is important to give the yeast everything possible so it has a fighting chance. Make sure the yeast strain is designed to handle high-gravity beers. Most beer strains will do fine up to 10–12%, but if you're brewing a real monster, check the yeast descriptions carefully.

Make a large yeast starter or pitch an adequate amount of yeast harvested from a previous fermentation. As a rough rule of thumb, a yeast starter for 5 gallons (19 L) of "normal-strength" ale (around 12 °Plato/SG 1.048) should be 1.5–2 quarts (~1.5–2 L). The size of the starter should scale proportionally with the gravity of the beer. If you don't make a starter, you should pitch two (or more) packages of yeast.

The next step is to oxygenate. Yeast needs oxygen too, and in this case one heck of a lot to stay alive long enough to breakdown all that sugar. If you have an oxygen tank, get the tube in the carboy and really bubble away for a couple minutes. If you are like me, shake shake shake the carboy until you think your arm might fall off. Rest a couple minutes, and repeat. This should be done at least four or five times — really!

PATIENCE, GRASSHOPPER

Because of the high gravity of these beers, fermentation usually takes a few extra days. Give the beer time to finish fermenting and to condition and don't rush it into the bottle. It can be hard to wait, but it will be worth it.

Glenn Burnsilver is a frequent contributor to Brew Your Own.

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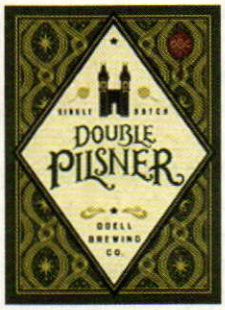
DOUBLE/IMPERIAL clones

Odell Double Pilsner clone



(5 gallons/ 19 L, all-grain)
OG = 1.076
FG = 1.016
IBU = 37
SRM = 8
ABV = 7.8%

Ingredients

15 lbs. (6.8 kg) German Pilsner malt
1.0 lb. (0.45 kg) Weyermann Carafoam® malt (or other very low color caramalt)
4 oz. (0.11 kg) Munich malt (10 °L)
10 AAU Saaz hops (60 mins) (2.9 oz./81 g of 3.5% alpha acids)
1.5 oz. (43 g) Tettnang hops (1 min)
1.5 oz. (43 g) Tettnang hops (0 min)
1 tsp Irish moss (15 mins)
Wyeast 2206 (Bavarian Lager) or White Labs 820 (Octoberfest/ Märzen) yeast (4 qt./~4 L starter)
0.75 cups corn sugar (for priming)

Step by Step

Use water with a low mineral content. Mash crushed grains with 5.1 gallons (19 L) of mash water, heated to ~162 °F (72 °C). Mash at 150-152 °F (66-67 °C) for 45 minutes. Recirculate wort until it is quite clear. Collect wort, sparging with 168 °F (76 °C) water to collect 6.5 gallons (25 L) of wort. (Your SG here should be 1.058. If it's lower than this, add dried malt to reach 1.058 or collect more wort — up to 8 gallons/30 L — and boil longer). Boil wort for 90 minutes. Cool wort, transfer to fermenter and aerate well. Pitch yeast sediment from yeast starter. Ferment beer at 55 °F (13 °C). Hold fermentation temperature until beer is finished fermenting. Chill to 34 °F (1.1 °C) and hold for at least a month. Prime bottles with sugar or keg.

Odell Double Pilsner clone

(5 gallons/19 L, extract with grains)
OG = 1.076 FG = 1.016
IBU = 37 SRM = 9 ABV = 7.7%

Ingredients

3.5 lbs. (1.6 kg) Briess Light dried malt extract
5.25 lbs. (2.4 kg) Briess Pilsen malt extract (late addition)
0.75 lbs. (0.34 kg) German Pilsner malt
1.0 lb. (0.45 kg) Weyermann Carafoam® malt (or other very low color caramalt)
4 oz. (0.11 kg) Munich malt (10 °L)
10 AAU Saaz hops (60 mins) (2.9 oz./81 g of 3.5% alpha acids)
1.5 oz. (43 g) Tettnang hops (1 min)
1.5 oz. (43 g) Tettnang hops (0 min)
1 tsp Irish moss (15 mins)
Wyeast 2206 (Bavarian Lager) or White Labs 820 (Octoberfest/ Märzen) yeast (4 qt./~4 L yeast starter)
0.75 cups corn sugar (for priming)

Step by Step

Put crushed grains in a nylon steeping bag. In a large soup pot, heat 3 qts. (2.8 L) of water to 162 °F (72 °C) and submerge bag. Steep grains at 150–152 °F (66–67 °C) for 45 minutes. While grains are steeping, bring 2.5 gallons (9.5 L) of water to a boil in your brewpot. After steep, put colander over brewpot and place grain bag in it. Pour "grain tea" through grain bag (to filter out the "floaties"), then rinse grains with 1.5 quarts (1.4 L) of water at 170 °F (77 °C). Add dried malt extract and boil wort for 60 minutes, adding hops at times indicated. Add liquid malt extract at the end of the boil and let it steep for 15 minutes before cooling. Chill wort, then transfer to fermenter. Add water to make 5 gallons (19 L) and aerate well. Pitch yeast sediment from starter and follow the fermentation and lagering instructions in the all-grain recipe. Prime bottles with sugar or keg.

Avery The Kaiser (Imperial Oktoberfest) clone

(5 gallons/19 L, all-grain)
OG = 1.085 FG = 1.019
IBU = 23 SRM = 16 ABV = 8.6%

Ingredients

13.75 lbs. (6.24 kg) pale 2-row malt
1 lb. 6 oz. (0.62 kg) Weyermann Vienna malt
1 lb. 6 oz. (0.62 kg) Weyermann Munich Type I malt (7 °L)
15.3 oz. (0.43 kg) Gambrinus dark Munich malt (20 °L)
8.5 oz. (0.24 kg) Dingemans aromatic malt
4.75 AAU Hallertau Tradition hops (60 mins) (0.79 oz./22 g of 6% alpha acids)
2.5 AAU Sterling hops (30 mins) (0.33 oz./9.5 g of 7.5% alpha acids)
0.6 oz. (17 g) Tettnang hops (0 mins)
0.6 oz. (17 g) Hallertau Hersbrücker hops (0 mins)
Wyeast 2206 (Bavarian Lager) or White Labs 820 (Octoberfest/ Märzen) yeast (4 qt./~4 L yeast starter)
0.75 cups corn sugar (for priming)

Step by Step

Single temperature infusion mash at 152 °F (67 °C), using 5.6 gallons (21 L) of mash liquor heated to 163 °F (73 °C). Mash in, mix for 20 minutes, then rest for 20 minutes. Vorlauf (recirculate) for 15 minutes. Collect 7 gallons (26 L) of wort and check specific gravity (SG). If SG is below 1.061, you can either add dried malt extract to make it 1.061 or collect more wort — up to 9 gallons (34 L) — and extend the boil time accordingly. Boil for 120 minutes, with 3 hop additions. Ferment at 55 °F (13 °C) for the first 24 hours, then drop the temperature to 50 °F (10 °C). When gravity hits 1.030-1.035, let temperature rise to wherever it can for diacetyl rest. Prime beer with corn sugar, or keg.

Avery The Kaiser (Imperial Oktoberfest) clone

(5 gallons/19 L, countertop partial mash)

OG = 1.085 FG = 1.019,
IBU = 23 SRM = 16 ABV = 8.5%

Ingredients

1 lb. 4.2 oz. (0.57 kg) Weyermann Vienna malt
1 lb. 4.2 oz. (0.57 kg) Weyerman Munich Type I malt (7 °L)
15.3 oz. (0.43 kg) Gambrinus dark Munich malt (20 °L)
8.5 oz. (0.24 kg) Dingemans aromatic malt
3.0 lbs. (1.4 kg) Coopers Light dried malt extract
6.0 lbs. (2.7 kg) Coopers Light liquid malt extract
(late addition)
4.75 AAU Hallertau Tradition hops (60 mins)
(0.79 oz./22 g of 6% alpha acids)
2.5 AAU Sterling hops (30 mins)
(0.33 oz./9.5 g of 7.5% alpha acids)
0.60 oz. (17 g) Tettnang hops (0 mins)
0.60 oz. (17 g) Hallertau Hersbrücker hops (0 mins)
Wyeast 2206 (Bavarian Lager) or White Labs 820 (Octoberfest/Märzen) yeast
(4 qt./~4 L yeast starter)
0.75 cups corn sugar (for priming)

Step by Step

Heat 5.5 quarts (5.2 L) of water to 166 °F (74 °C) and pour into 2-gallon (7.6-L) beverage cooler. Place crushed grains in a nylon steeping bag and submerge. Stir grains well, tie off bag lightly and seal cooler. Let partial mash rest, starting at 155 °F (68 °C), for 45 minutes. (It will most likely drop to around 150 °F (66 °C) by the end of the mash. This is fine.) While partial mash is resting, heat 0.75 gallons (2.8 L) of water to a boil in your brewpot and 5.0 qts. (4.7 L) of water to 180 °F (82 °C) in a large kitchen pot. Run off first wort and add to boiling water in brewpot. Add the 5.0 qts. (4.7 L) of 180 °F (82 °C) water to the cooler, untie bag, stir grains and let sit for 5 minutes. Run off second wort and add to brewpot. Add dried malt extract and bring to a boil. Add first charge of hops and boil for 60 minutes, adding other hops at times indicated in the ingredient list. With 15 minutes left in boil, stir in half of the liquid malt extract; add the remaining half at the end of the boil. (Keep the boil clock running when adding extract.) Let wort sit 15 minutes before cooling. Cool wort and transfer to fermenter. Add water to make 5 gallons (19 L), aerate well and pitch yeast. Follow fermentation and lagering instructions in all-grain recipe.

Left Hand Twin Sisters (Double IPA) clone

(5 gallons/19 L, all-grain)
OG = 1.085 FG = 1.016
IBU = 87 SRM = 15 ABV = 9.0%

Ingredients

15.5 lbs. (7.0 kg) Castle pale malt
1.5 lbs. (0.68 kg) rye malt
0.5 lbs. (0.23 kg) biscuit malt
0.5 lbs. (0.23 kg) crystal malt (40 °L)
13.75 AAU Tomahawk hops (60 mins)
(0.92 oz./26 g of 15% alpha acids)
7.5 AAU Glacier hops (45 mins)
(0.63 oz./18 g of 12% alpha acids)
3.75 AAU Cascade hops (30 mins)
(0.75 oz./21 g of 5% alpha acids)
3.75 AAU Liberty hops (15 mins)
(0.94 oz./27 g of 4% alpha acids)
3.0 AAU Liberty hops (5 mins)
(0.75 oz./21 g of 4% alpha acids)
1.25 oz. (35 g) Crystal hops (dry hops)
Wyeast 1272 (American II) or White Labs WLP005 (California V) yeast
(3 qt./~3 L yeast starter)
0.75 cups corn sugar (for priming)

Step by Step

Mash at 152 °F (67 °C). Boil for 90 minutes. Ferment at 68 °F (20 °C).

Left Hand Twin Sisters (Double IPA) clone

(5 gallons/19 L, extract with grains)
OG = 1.085 FG = 1.016
IBU = 87 SRM = 15 ABV = 9.0%

Ingredients

3.5 lbs. (1.6 kg) Muntons Light dried malt extract
6.5 lbs. (3.0 kg) Muntons Light liquid malt extract
(late addition)
1.5 lbs. (0.68 kg) rye malt
0.5 lbs. (0.23 kg) biscuit malt
0.5 lbs. (0.23 kg) crystal malt (40 °L)
13.75 AAU Tomahawk hops (60 mins)
(0.92 oz./26 g of 15% alpha acids)
7.5 AAU Glacier hops (45 mins)
(0.63 oz./18 g of 12% alpha acids)
3.75 AAU Cascade hops (30 mins)
(0.75 oz./21 g of 5% alpha acids)
3.75 AAU Liberty hops (15 mins)
(0.94 oz./27 g of 4% alpha acids)
3.0 AAU Liberty hops (5 mins)
(0.75 oz./21 g of 4% alpha acids)
1.25 oz. (35 g) Crystal hops (dry hops)
Wyeast 1272 (American II) or White Labs WLP005 (California V) yeast
(3 qt./~3 L yeast starter)
0.75 cups corn sugar (for priming)

Step by Step

In your brewpot, heat 3.5 quarts (3.3 L) of water to 163 °F (73 °C). Add crushed grains to a nylon steeping bag and steep for 45 minutes at 152 °F (67 °C). While grains are steeping, heat 1.5 quarts (1.4 L) of rinse (sparge) water to 170 °F (77 °C). After steep, put a colander over your brewpot and put the grain bag in it. Rinse grains with 170 °F (77 °C) sparge water. Add water to brewpot to make 4.0 gallons (15 L). (If you boil a smaller volume, you will not be able to extract the proper amount of bitterness from the hops.) Bring "grain tea" and water to a boil and add dried malt extract. Boil for 60 minutes, adding hops at times indicated in the ingredient list. Keep a smaller pot of boiling water handy, and keep the boil volume topped up to 4.0 gallons (15 L). Stir in the liquid malt extract at the end of the boil and let it steep for 15 minutes before cooling. Cool wort and transfer to fermenter. Top up to 5 gallons (19 L) with cool water and aerate thoroughly. Pitch yeast and follow

fermentation instructions in all-grain recipe.

Flying Dog Gonzo Porter (Imperial Porter) clone

(5 gallons/19 L, all-grain)
OG = 1.088 FG = 1.025
IBU = 75 SRM = 83
ABV = 8.2%

Ingredients

15 lbs. (6.8 kg) 2-row pale malt
2.5 lbs. (1.1 kg) crystal malt (120 °L)
1.0 lb. (0.45 kg) black malt
0.5 lb. (0.23 kg) chocolate malt
5.5 AAU Warrior hops (90 mins) (0.34 oz./9.7 g of 16% alpha acids)
9.4 AAU Northern Brewer hops (60 mins) (1.0 oz./30 g of 9% alpha acids)
9.4 AAU Northern Brewer hops (30 mins) (1.0 oz./30 g of 9% alpha acids)
3.0 oz. (85 g) Cascade hops (0 mins)
4.0 oz. (114 g) Cascade hops (dry hops)
Wyeast 1056 (American Ale) or White Labs WLP001 (California Ale) yeast (3 qt./~3 L yeast starter)
0.75 cups corn sugar (for priming)

Step by Step

Mash at 152 °F (67 °C). Lauter slowly to allow maximum sugar collection. Two hour boil. Ferment at 70 °F (21 °C).

Flying Dog Gonzo Porter (Imperial Porter) clone

(5 gallons/19 L, extract with grains)
OG = 1.088 FG = 1.025
IBU = 75 SRM = 84 ABV = 8.1%

Ingredients

3.0 lbs. (1.4 kg) Briess Light dried malt extract
6.75 lbs. (3.1 kg) Alexander's Pale liquid malt extract (late addition)
2.5 lbs. (1.1 kg) crystal malt (120 °L)
1.0 lb. (0.45 kg) black malt
0.5 lb. (0.23 kg) chocolate malt
5.5 AAU Warrior hops (90 mins) (0.34 oz./9.7 g of 16% alpha acids)
9.4 AAU Northern Brewer hops (60 mins) (1.0 oz./30 g of 9% alpha acids)
9.4 AAU Northern Brewer hops (30 mins) (1.0 oz./30 g of 9% alpha acids)
3.0 oz. (85 g) Cascade hops (0 mins)
4.0 oz. (114 g) Cascade hops (dry hops)
Wyeast 1056 (American Ale) or White Labs WLP001 (California Ale) yeast (3 qt./~3 L yeast starter)
0.75 cups corn sugar (for priming)

Step by Step

Heat 5.5 quarts (5.2 L) of water to 166 °F (74 °C) and pour into 2-gallon (7.6-L) beverage cooler. Place crushed specialty grains in a nylon steeping bag and submerge. Stir grains well, tie off bag lightly and seal cooler. Let grains steep, starting at 155 °F (68 °C), for 30 minutes. While grains are steeping, heat 2.0 gallons (7.6 L) of water to a boil in your brewpot and 2.5 qts. (2.4 L) of water to 180 °F (82 °C) in a large kitchen pot. Run off "grain tea" and add to boiling water in brewpot. Add the 2.5 qts. (2.4 L) of 180 °F (82 °C) water to the cooler, untie bag, stir grains and let sit for 5 minutes. Run off remaining "grain tea" and add to brewpot. Add dried malt extract and bring to a boil. Add first charge of hops and boil for 60 minutes, adding other hops at times indicated in the ingredient list. With 15 minutes left in boil, stir in half of the liquid malt extract; add the remaining half at the end of the boil. (Keep the boil clock running when adding extract.) Let wort sit 15 minutes before cooling. Cool wort and transfer to fermenter. Add water to make 5 gallons (19 L), aerate well and pitch yeast. Follow fermentation instructions in all-grain recipe.

Great Divide Yeti Imperial Stout clone

(5 gallon/19 L, all-grain)
O.G. = 1.090 F.G. = 1.018
IBU = 75 SRM = 98 ABV = 9.3%

Ingredients

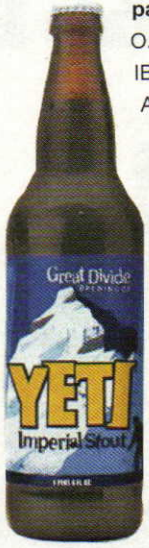
15.25 lbs (6.9 kg) American 2-row malt
1.0 lb (0.45 kg) crystal malt (120 °L)
12 oz. (0.34 kg) chocolate malt
12 oz. (0.34 kg) black patent malt
10 oz. (0.28 kg) roasted barley
8.0 oz. (0.23 kg) flaked wheat
8.0 oz. (0.23 kg) flaked rye
14.3 AAU Chinook hops (60 min) (1.1 oz./31 g of 13% alpha acids)
7.2 AAU Chinook hops (30 min) (0.55 oz./16 g of 13% alpha acids)
5.3 AAU Centennial hops (15 min) (0.50 oz./14 g of 10.5% alpha acids)
0.5 oz. (14 g) Centennial hops (5 min)
Wyeast 1056 (American Ale) or White Labs WLP001 (California Ale) yeast (3 qt./~3 L yeast starter)
0.75 cups corn sugar (for priming)

Step by Step

Mash at 150 °F (66 °C). Boil for 60 minutes, adding hops as indicated above. Ferment at 70 °F (21 °C).

Great Divide Yeti Imperial Stout clone

(5 gallon/19 L, partial mash)
O.G. = 1.090 F.G. = 1.018
IBU = 75 SRM = 98
ABV = 9.3%



Step by Step

Reduce the amount of 2-row pale malt to 2.0 lbs. (0.91 kg). Add 9.0 lbs. (4.1 kg) of Muntons Light liquid malt extract to the recipe. Heat 2.3 gallons (8.7 L) of water to 161 °F (72 °C). Submerge grain bag(s) and partial mash at 150 °F (66 °C) for 30–45 minutes. (Note: this is just over 6 lbs. (~ 3 kg) of grains, you may need more than one grain bag, depending on size. Putting your brewpot in your oven on its lowest heat setting may help you maintain partial mash temperature.) Remove grains, rinse grain bag(s) slowly with 1.0 gallon (3.8 L) of water at 170 °F (77 °C). Add water to brewpot to make 4.0 gallons (15 L) of wort; stir in roughly two-thirds of the malt extract. Bring to a boil. Boil for 60 minutes, adding hops at the times indicated in the ingredient list. Add remaining malt extract with 15 minutes left in boil. Cool wort, transfer to fermenter, top up to 5 gallons (19 L), aerate and pitch yeast. Ferment at 70 °F (21 °C).

by **REG POPE**

10 everyday ITEMS you can USE for BREWING

A homebrewer in a homebrew shop is like a kid in a candy store. In addition to all the different types of malt, hops and yeast, homebrew shops offer a multitude of items that make brewing easier, cleaner and more fun.

However, useful homebrewing items can also be found almost anywhere if you just look. Hardware stores, home improvement stores and cooking specialty stores all carry useful or adaptable items. Even stores that are a little off the beaten path — like an aquarium store — may have something to aid you in your homebrewing.

Here is a collection of everyday items that are useful in brewing, but aren't usually found in homebrew shops. Some are easy to find; others a little harder. Some are relatively big ticket items, while others are cheap — or free! All will help you toward the end of brewing the highest quality beer possible, the goal that drives us all.

STUFF YOU CAN USE IN YOUR HOME BREWERY CAN BE FOUND ANYWHERE — WE'LL SHOW YOU WHERE TO LOOK.

CHEST FREEZER OR REFRIGERATOR

A chest freezer or refrigerator is one of the handiest appliances available to the homebrewer. Fitted with an external thermostat, like the one manufactured by Johnson Controls, it can be set to run at any temperature between ambient temperature and freezing. It can be used as a lagering chamber, or it can be fitted with taps and used as a serving cooler. It can be used to maintain the optimal fermentation temperature, keeping your fermenting wort cool in the hot months or — with the help of a drug store heating pad — warm in a cold garage or basement during the winter. Keep in mind that newer models use less energy — often much less energy — than older types. That avocado-colored beauty you found at a local garage sale might not seem like a bargain when your electricity bill comes.

DAMP RID

Whatever type of fermentation enclosure you use, condensation can be a problem. It makes things sweaty and slippery and can be a haven for odor-causing bacteria, mold and mildew — and other microorganisms that could potentially contaminate your beer. Damp Rid is a mineral salt (probably anhydrous calcium chloride) that absorbs excess moisture from the air. Simply place a tub or sachet in your fermentation chamber, and that's it. A similar product is called Drierite (anhydrous calcium sulfate). The blue version of Drierite turns red when it has absorbed moisture. Both products can be reconstituted by driving off the water of hydration. For small amounts (around 12 oz./0.34 kg), an hour in an oven at 425 °F (220 °C) should do it.

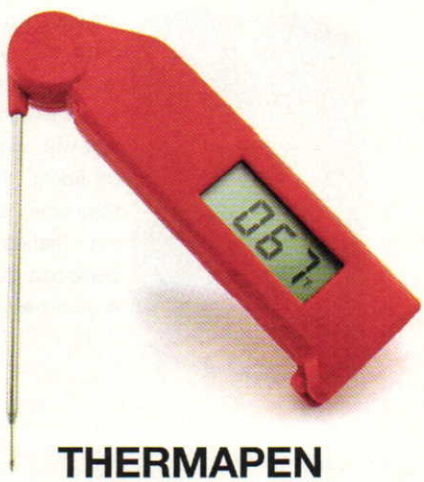
THERMAPEN

The Thermapen is a very worthwhile upgrade from the common glass thermometer we all began with. The commercial version is heavy duty, reads temperature in less than 4 seconds and is accurate to within 1 °F (0.5 °C). In contrast, manual and low-end electronic thermometers can take as long as 30 seconds to settle in on a reading. Look for it at cooking stores or online at www.thermoworks.com.

Another cool option is an infrared "thermometer gun." These devices — which can be found at many hardware stores and some homebrew shops — read temperature from a beam of infrared light bounced off the target. Want to know the temperature of the top of your mash? Just point and shoot.

CHEST FREEZER

DAMP RID

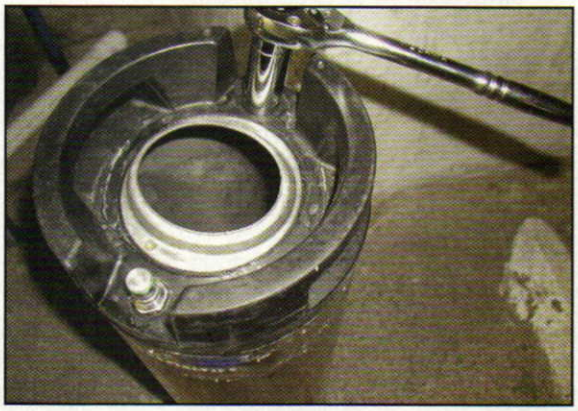


THERMAPEN

IGLOO "ICE CUBE" COOLER

These handy coolers, which come in 48-quart and 60-quart versions, have multiple uses in the home brewery. An "ice cube" can make an economical first mash tun, if you plan on batch sparging. (See "Cheap and Easy Batch Sparging" in the Jan-Feb 2004 issue for construction.) The 60-quart size is also the perfect size to hold one carboy for an evaporative cooling "swamp cooler" setup. Just put a T-shirt over the carboy, add a little water to the cooler and you can shave 5–10 °F (2.8–5.6 °C) off of your fermentation temperature. Some versions even come with rollers, making it easy to move a full carboy.

KEG SOCKET/WRENCHES



Wrenches, appropriately sized, for instance 13/16" for a pin lock fitting, or sockets for ball locks, enable the removal of the posts from Corny kegs for cleaning, without subjecting them to trauma that can damage the pins or strip the threads or hex construction of the fitting. For pin-lock kegs, there are sockets available that have indents cut into them so that they pass over the pins to grip the bottom of the fitting, but a decent quality crescent wrench will accomplish the same thing. It can be worked in under the pins to grip the fitting or from the top at an angle, depending on the available access around the top of the keg. If possible, take the post (or whole keg) to the hardware store with you so you're sure to get the right size socket.

HAND SANITIZER
(SUCH AS PURELL OR DIAL)

Hand sanitizer is a handy thing to have in a home brewery, because it may prevent you from undoing all of the hard work you put into sanitizing spoons, racking canes, siphons and transfer equipment. You can't wash your hands every time you touch something that is potentially unclean, but it takes only seconds to use this before you touch anything that has been sanitized and may come in contact with wort. Don't get overconfident, though. Hand sanitizer won't completely sterilize your hands, and it contains perfumes that you don't want in your beer.

WATER FILTRATION DEVICE

Good beer starts with good water. The quality of municipal water varies based on the method of treatment and may contain any number of naturally-occurring or added components that can affect taste, mash efficiencies or yeast health. Standard undersink models usually consist of two filter housings, which can hold your choice of replaceable filters. A standard setup includes a sediment filter and a carbon filter connected in series. These remove particulate matter and many chemical residues and need to be changed every once in awhile, based on use.

The top shelf option for water treatment would be a reverse osmosis (RO) filtration system. These systems work by forcing water through a membrane with holes that are a fraction of a micron in size, approaching the size of the water molecule itself. The membrane allows the water to pass through, leaving behind most other dissolved matter. The result is water that is almost as pure as distilled water — a blank slate that allows you to add only the minerals you want.

RO filters are surprisingly affordable these days, but their output is very slow. Most affordable home models have a 3-gallon (11 L) reserve tank to hold filtered water. Thus, you'll have to plan ahead and start collecting your water a few days ahead of brewday.

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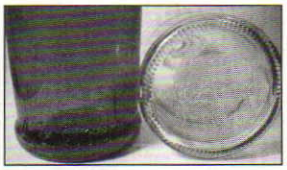

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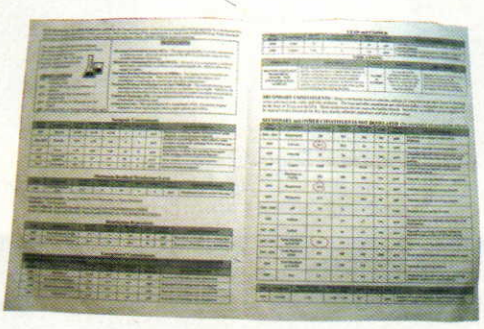
CHLORAMINE TEST STRIPS

Chloramines are a combination of ammonia and chlorine and are among the compounds approved by the FDA for use in the treatment of municipal water supplies. Although safe for human consumption, they can cause phenolic off-flavors in beer. Both carbon and reverse osmosis (RO) filtration can potentially remove chloramines. Campden tablets can definitely do so. However, to assess the effectiveness of your water treatment program, a tester of some sort is a useful tool. Since most fish and amphibians are particularly susceptible to chloramines, most pet shops carry test strips that will give you a quantitative measure of it. Take a sample of your water before and after treatment and see if your method of treatment was effective. (**Note:** most pet stores also sell drops to rid water of chloramines. Although great for fish and frogs, the effect of these drops on beer hasn't been tested as far as we know. So, save the pet store drops for your fish tank and use another method to get rid of chloramines in your brewing water.)



YOUR MUNICIPALITY'S WATER QUALITY REPORT

They say the best things in life are free. This is definitely the case for one piece of information that is valuable to every homebrewer — his or her local water report. This report, by statute, is produced annually and should be mailed to you with equal frequency. If not, call or visit your local water department and request it. Your water report will tell you the concentrations of key brewing ions, but keep in mind that your city may switch between different wells and your report may present an average analysis.

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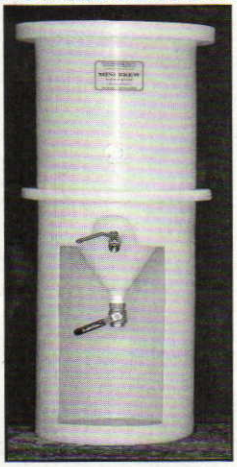

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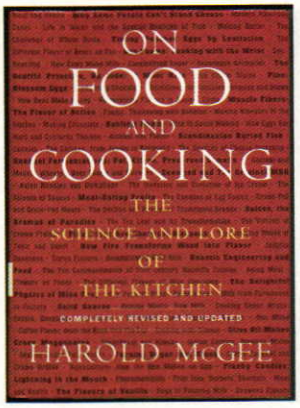

"ON FOOD AND COOKING" BY HAROLD MCGEE

This widely acclaimed volume celebrates all things food and food science. It describes, in easy to understand language, the ingredients and the chemical and physical properties that make our foods taste the way they do. Understanding your ingredients is essential for getting the best expression from them and this book covers the culture, history and lore of all kinds of foods — including fermented beverages. Besides being a really cool and entertaining reference on foods, there is plenty of information on barley and wheat — and rye, oats, corn, rice, millet, sorghum, buckwheat, triticale and almost every other grain known to man. It also contains information on such useful brewing subjects as starch gelation, tannins and Maillard reactions. Plus, for experimental homebrewers, there is a wealth of information on fruits, spices, coffee, chocolate, the chemistry of wood smoke and many other things you might want to brew with.

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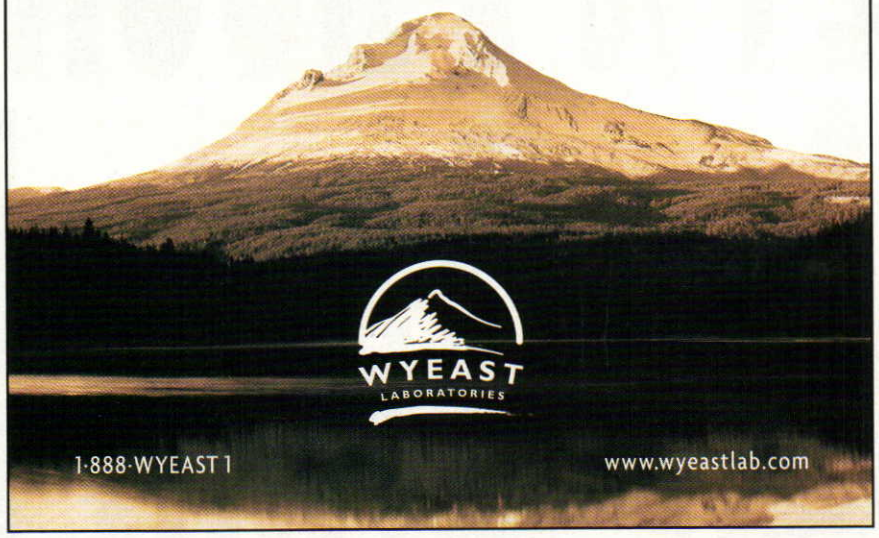

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by **John McKissack**

21% Alcohol All-Grain Beer

BREWING A REALLY BIG BEER

I am sure many of us have tried some of the extreme beers such as Dogfish Head's 120 Minute IPA, at 21% alcohol by volume (ABV). A few of us may have even tasted Samuel Adams Utopia with an outrageous alcohol level of 25% ABV. At over $100 per bottle, none has yet to cross my lips. These beers are super high gravity beers, but they are not all-grain beers. Both are brewed with a fairly large amount of sugars or syrups to raise the alcohol level. So, what is the highest alcohol level a homebrewer can expect to reach brewing an all-grain beer?

Have you ever tried to do something, just because somebody told you it could not be done? A friend in my local homebrew club — Golden Triangle Homebrewers Club in Southeast Texas — told me it was impossible to brew an all-grain beer over 20% ABV. He then went on to say that he had read 16% was the highest I could ever expect to achieve as a homebrewer. EVER. Well, that night I could not fall asleep because I was thinking about how to brew a 20% ABV all-grain beer. I woke up thinking about it and over the next several weeks, reading and researching big-beer brewing took most of my spare time. The result was an extreme homebrewed all-grain old ale.

My challenge was to pass 20% ABV with all-grain procedures, so without beating around the bush any more, here is my recipe and brewing procedures.

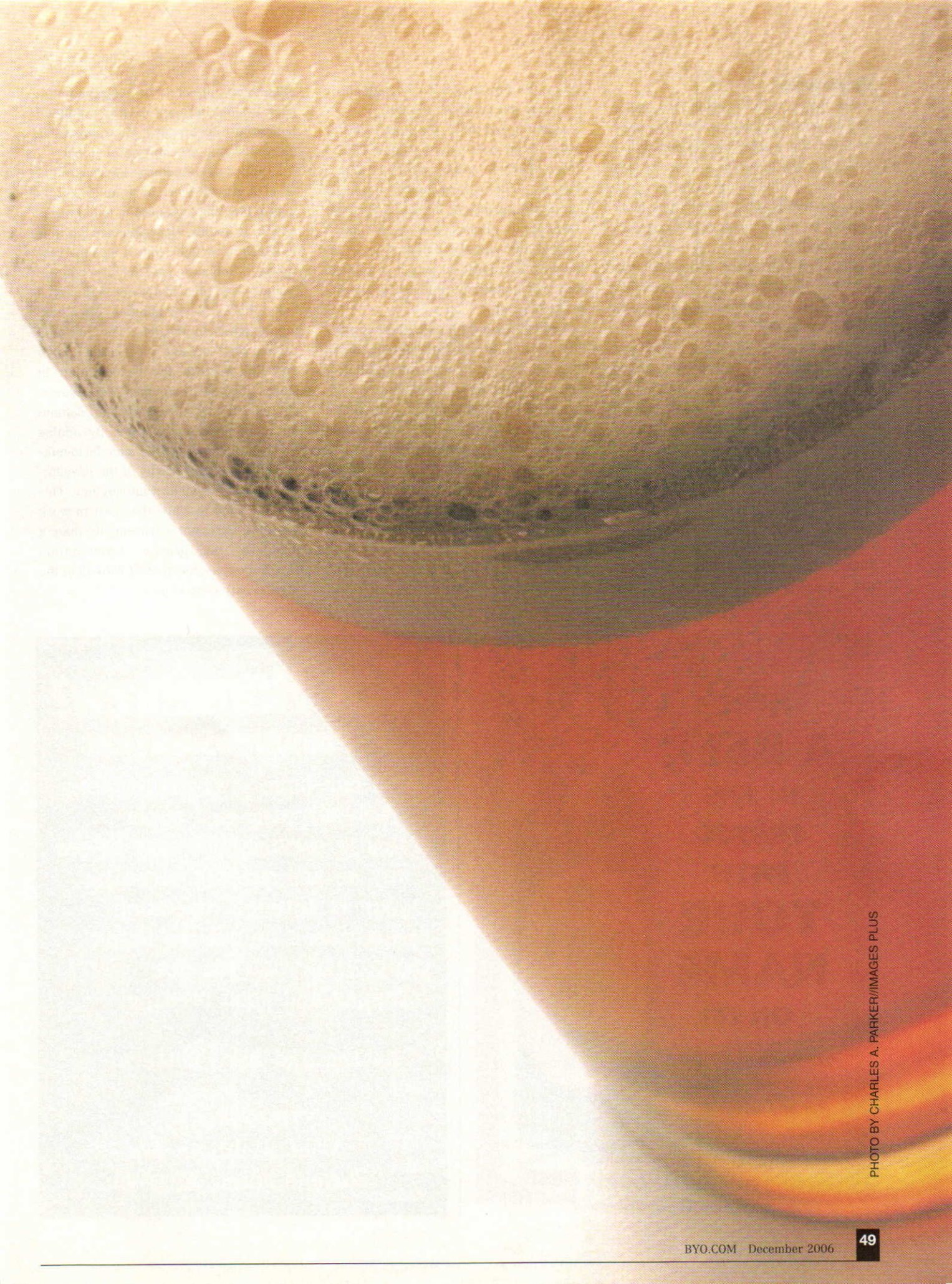


PHOTO BY CHARLES A. PARKER//IMAGES PLUS

Procedures

To begin with, I made a 1-gallon (3.8-L) yeast starter at a specific gravity of 1.066. The starter was fermented in a 6.5-gallon (25 L) carboy. (If you try this, keep track of the volume and gravity of your starter, as you will need this information to calculate your wort gravity accurately).

I pitched the starter with White Labs WLP099 (High Gravity) yeast. According to the White Labs website, it can ferment beers to 25% ABV.

I mashed 31 lbs. (14 kg) of Maris Otter malt at 146 °F (63 °C) overnight. (If you try this, you only need to mash until conversion is complete). You'll need at least 9.5 gallons (37 L) of mash liquor for a mash thickness of 1.25 quarts per pound (2.6 L/kg). At this thickness, the whole mash will fit comfortably in a converted keg (or keggle, as they're sometimes called).

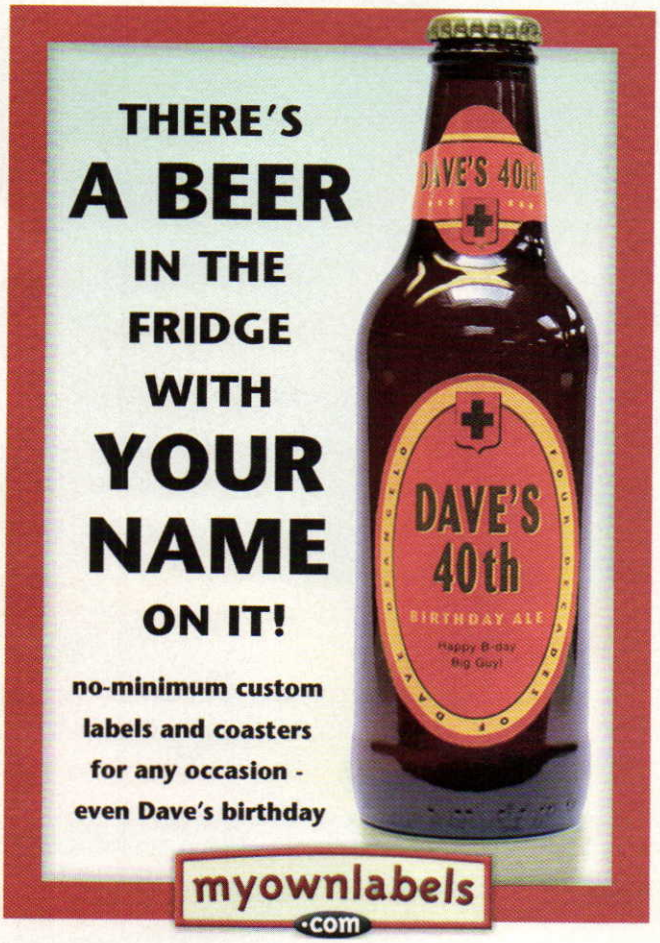
I sparged very slowly until all the sugar was extracted. I ended up collecting 18 gallons (68 L) of wort in two kettles. Be sure to plan far enough ahead that your sparge water is ready.

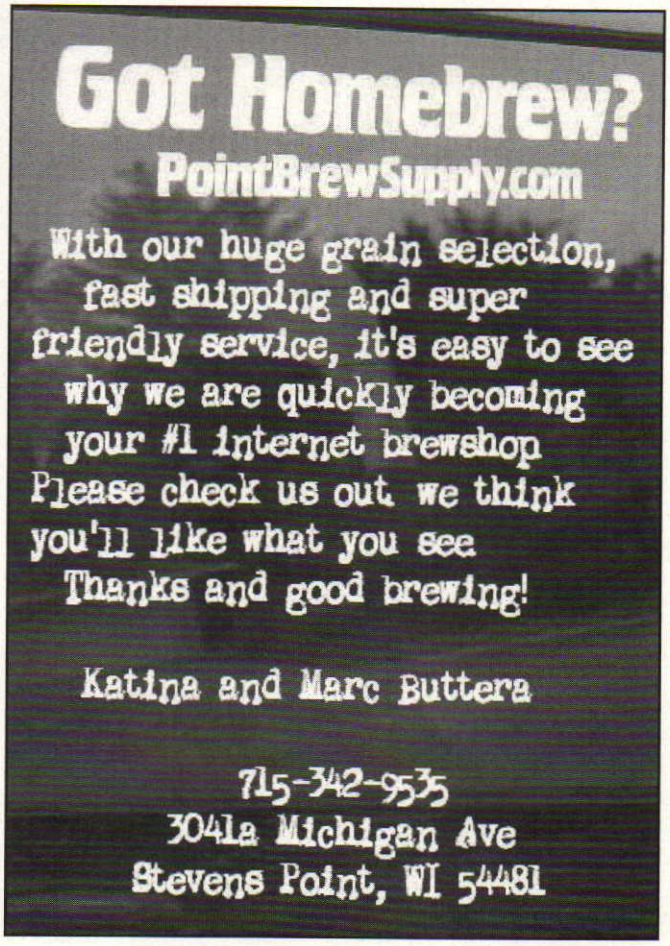
I then boiled down the wort — in the two separate pots — to 4 gallons (15 L). I boiled slowly to reduce caramelization. I also put a clip-on fan on each pot, blowing on the surface of the wort. This was intended to prevent boil overs and it worked. (It really did, I don't brew without one now.) I also suspect it caused the wort to boil down much faster by blowing the steam away.

I added my hops for the final 60 minutes of boil. In a normal gravity wort, they would yield a calculated value of over 100 IBUs. Given the extremely high gravity of the wort, I am not sure what a reasonable calculated IBU value would be. The final 4.0 gallons (15 L) wort had an original gravity (OG) of 1.246. Combined with the 1-gallon (3.8-L) starter, I calculated an OG of 1.210.

I then added only 1.0 gallon (3.8 L) of OG 1.246 wort to the 1-gallon (3.8-L) starter. I oxygenated the combined wort for 15 minutes with oxygen (O_2) and affixed an airlock. For oxygenation, I used a small welding oxygen cylinder I bought just for brewing. If you are using air, you should probably aerate longer.

I canned the remaining 3 gallons (11 L) of high-gravity wort in 1 quart (~1 L) mason jars, the kind used in food preservation. To do this, I just siphoned the wort — which is so thick that it siphons very slowly — into jars. I set the lids on loosely and placed them in a water bath, which I then boiled for 15 minutes. After boiling, I tightened the lids. The reason I canned the wort and set it aside was to add the wort to the fermentation in stages. (See the September 2006 issue of *BYO* and the October 2006 Mail column for more on canning wort.) By adding fresh wort every time the main fermentation subsides, the gravity of the fermenting wort will remain relatively low. This was intended to allow the yeast to work in a less stressful environment than a standard high-gravity fermentation (when the yeast has to deal with all of the high-gravity wort at once).





Cause of Death

(5 gallons/19 L, all-grain)

Virtual OG = 1.210 FG = 1.044
IBU = ?? SRM = ?? ABV = 21%

Ingredients

31 lbs. (14 kg) Maris Otter pale ale malt
32 AAU Warrior hops (60 min) (2.0 oz. /57 g of 16% alpha acids)
18 AAU Amarillo hops (60 min) (2.0 oz./57 g of 9% alpha acids)
13 tablets Beano
White Labs WLP099 (Super High Gravity Ale) yeast

Step by Step

Make a 1-gallon (3.8-L) yeast starter with an original gravity of 1.066. Put wort in 6.5-gallon (25-L) carboy and pitch yeast.

Heat 9.7 gallons (37 L) of water to 157 °F (69 °C) and stir in crushed grains. You will need at least 14 gallons/56 quarts (53 L) of mash tun space to do this. Let mash rest for at least 90 minutes at 146 °F (63 °C) or until an iodine test indicates conversion is complete. (I mashed overnight). You are shooting for a very fermentable wort. Recirculate until the wort is clear and then begin the runoff. Sparge with 180 °F (82 °C) until grain bed temperature reaches 170 °F (77 °C), then sparge with 170 °F (77 °C) water. Collect 18 gallons (68 L) of wort and boil to reduce volume to 4.0 gallons (15 L). While boiling, attempt to minimize the amount of color pickup. Cool wort and transfer 1.0 gallon (3.8 L) of wort to your carboy. Aerate well. Can the remaining 3 gallons (11 L) of wort in 1 qt. (~1 L) canning jars. When the main fermentation slows, add more high gravity wort and aerate. Repeat. When all wort has fermented, add 8 tablets of Beano. Add 5 more Beano tablets when fermentation slows again. After beer conditions, keg and force carbonate.

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At each stage, I let the beer ferment until fermentation activity subsided noticeably. I waited until the rate of bubbling in the airlock was less than one bubble every 30 seconds.

After the fermentation slowed, I added one quart (~1 L) of high-gravity wort and oxygenated the beer for 5 minutes minimum with O_2. The oxygenation is essential to keep the yeast population healthy and able to pass 20% ABV. I added fresh wort every time fermentation slowed and aerated after each addition. After the final addition of wort, I let the whole thing ferment out.

When the yeast had consumed all the sugars it could from my wort, I added 8 crushed Beano tablets. The idea was to break down unfermentable sugars in the wort into fermentable ones.

After mashing, 20% or more of the mash carbohydrates are sugars (or other carbohydrates) that brewers yeast cannot utilize. In a huge beer like this, some of these need to be degraded into simpler sugars to increase the alcohol level and to prevent the beer from being too "thick." (Doing a step mash with a long rest around 140 °F (60 °C) is also an option to make a very fermentable initial wort.) Again I let the fermentation proceed until it was done, then I added 5 more crushed Beano tablets. When this fermentation ended, I let the beer sit about a month. Bottle conditioning was out of the question due to the high alcohol level, so I kegged it and force carbonated.

Flavor

The beer is thick and a little sweet, but the hop bitterness is right there with it for balance. A rich caramel flavor blends nicely and a faint flavor of oak comes through. I'm not sure where the oak came from. I think this beer would go great with a slice of Grandma's pecan pie.

Alcohol Level

From the drop in specific gravity, I calculated the alcohol level as 21.4% ABV. Of course, as a homebrewer, I don't have the equipment to test the actual level to know how accurate that is. But, the beer is very alcoholic.

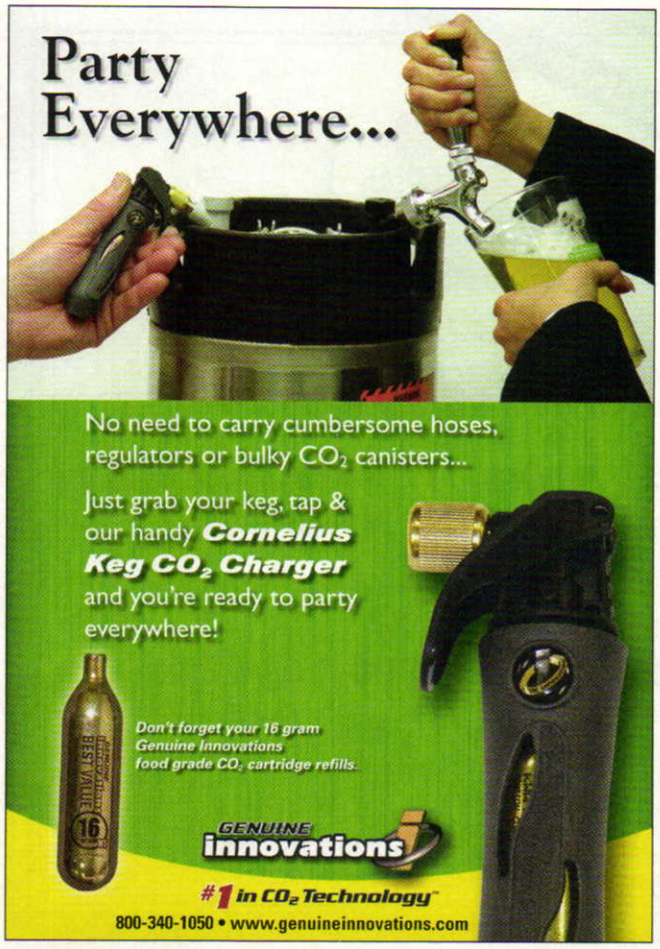
Originally I was going to call this beer the "Old Fat Otter" since the only grain I used was Maris Otter malt. After my first taste, I was surprised that the alcohol was almost hidden. My first thought was, "If you didn't know how much alcohol was in this beer, it would be a real killer." For this reason, I named the beer "Cause of Death."

Next Time

If — or should I say when? — I brew an extreme all-grain beer again, I will change a few things.

Next time, I will add the Beano much sooner, probably when I pitch my yeast. I think this will shorten the overall fermentation time and may allow more nonfermentables to be converted before the alcohol level gets too high. I may also add Beano to my mash tun, to start the conversion of non-fermentables sooner.

Another option for aeration would be to only aerate the quarts (liters) of high-



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If — or should I say when? — I brew an extreme all-grain beer again, I will change a few things.

gravity wort and pitch them with fresh yeast. After 20 minutes or so, you could add the pitched wort to the beer.

The idea behind this is that you would not aerate beer that has partially fermented, as this can cause problems in the finished beer (including the production of excessive amounts of diacetyl, although this didn't happen in my beer). The yeast should quickly take up any oxygen in the aerated, high-gravity wort. When that is then pitched to the main fermentation, the wort addition will contain yeast that has been energized by oxygen, but the fermenting beer itself won't be exposed to oxygen. It may be worth a try.

On the recipe side, I would also like to add some grains that are a little more roasty. They said it couldn't be done — so I went ahead and did it. If you brew "Cause of Death," or something similar, keep your yeast happy and you will have cause to celebrate.

John McKissack (Johhny Max) produces the BrewCrAzY.com podcasts. He is a member of the Golden Triangle Homebrewers club in Texas.

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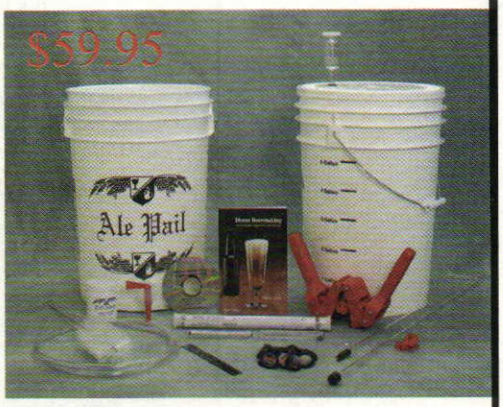

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Decoction Mashing

From undermodified malt to maximum maltiness

by Chris Colby

As we all know, mashing is the process in which crushed malts are soaked in hot water, resulting in the conversion of the starch in the malt to simpler sugars. The idea is conceptually simple, but in practice there are a variety of ways to go about it. Historically, new methods of mashing have arisen to deal with new technologies, new ingredients and increases in malt quality.

Common types of mashing

Today, most malts are well modified and respond well to a single infusion mash when an all-malt beer is being brewed. The mash temperature of a single infusion mash is almost always in the 148–162 °F (64–72 °C) range. Step infusion mashes, in which the mash is rested at two or more temperatures, may be accomplished by heating the mash directly or adding infusions of boiling water to raise the temperature between rests. A common single step mash is one with a rest in the beta-glucanase range (113–122 °F/45–50 °C) followed by a rest in the saccharification range (148–162 °F/64–72 °C).

If adjuncts such as corn grits or rice are used, a double or cereal mash is employed. In essence, the cereal adjunct is cooked separately to rupture the starch granules in the grains. Then the cereal mash is returned to the main mash, which is composed of barley malt with high enzymatic content. (The type of malt used in conjunction with large amounts of adjunct is usually 6-row malt. Purified amylase enzymes may also be added to aid with starch conversion.) Because the cereals are added to the main mash at near-boiling temperatures, the temperature of the combined mash increases and double mashes are thus stepped mashes. (Flaked or torrefied grains are adjuncts that can simply be stirred into a mash.)

A decoction mash is a step mash that is performed by removing a portion of the mash, boiling it and returning it to the main mash. Traditionally, decoction mashing was used to get the most out of malt that was not produced to today's levels of modification. In the past, malt was both less modified and more variable with respect to degree of modification.

> "In the past, malt was both less modified and more variable with respect to degree of modification."

Decoction mashes may involve more than one cycle of separating (or pulling) a decoction, boiling it and returning to the mash. The traditional type of decoction mashing is a triple decoction mash, in which decoctions are boiled and returned to the main mash three times. As such there are four temperature rests, one at the temperature the grains are mashed in at and one after each decoction. Decoction mashing was developed before the advent of thermometers, and the standard triple decoction mash may owe many of its features to this fact.

Pros and cons

Some brewers argue that a decoction mash yields a desirable malt characteristic in beer, particularly German and Czech-style lagers, — such as Pilsners, bocks, doppelbocks and Oktoberfests — that other mashing methods cannot duplicate. Pilsner Urquell is an example of a beer that is decoction mashed.

Other brewers see decoction mashing as a huge waste of time and energy (as in BTUs), and some dispute the contention that decoction mashing produces a character that cannot be obtained any other way. A triple decoction mash is very time and energy consuming and most commercial breweries that once performed this type of mash have either shortened their mashes to double decoction or single decoction mashes, or have begun infusion mashing. Most brewers, however, will agree on the following points.

Decoction mashing results in some melanoidin production. Melanoidins are red-brown, aromatic compounds formed by reactions between amino acids and sugars. They are formed at temperatures over 194 °F (90 °C). Both Munich malts and — big surprise — melanoidin malts are rich in melanoidins, and some brewers argue you can mimic the effects of a decoction mash by adding a portion of these malts to your grist. In pale beers, brewers attempt to minimize melanoidin production. In darker beers, they look for ways to increase it. Since parts of the mash are boiled in a decoction mash, and wort boils at around around 215 °F (102 °C), melanoidins are produced. The degree to which they are produced depends on how intensely the decoctions are boiled and the levels of protein modification (and hence the availability of amino acids) in the malt.

Decoction mashing extracts more tannins than an infusion mash. Along with gelating the starch, boiling the mash extracts husk compounds, including polyphenols (tannins). The level of tannin extraction, however, is fairly low and some maintain that this low level actually benefits the flavor of the beer. If a low,

pleasing amount of tannin extraction is a piece of "decoction mash character," then simply adding Munich or melanoidin malt would not capture that character exactly.

Homebrewers used to infusion mashing may wonder how a decoction could be boiled without extracting a large amount of tannins and yielding a very astringent beer. After all, when lautering, they are repeatedly told that their grain bed temperature should never exceed 170 °C (77 °C). The key to understanding this apparent discrepancy is understanding when tannins are soluble in wort. Increased heat and increased pH both favor tannin extraction. At lower pH values, such as those found in a thick mash, tannin extraction from grain husks is minimal even at boiling temperatures. At higher pH values — such as those in a grain bed that has been extensively sparged — excess tannin extraction occurs at a much lower temperature.

Decoction mashing inactivates some of the enzymes in a mash. Enzymes are proteins (strings of amino acids) that are folded into a specific three-dimensional shape. The shape of the enzyme determines its function. When heated, enzymes unravel (or denature, in the lingo). Different enzymes denature at different temperatures because they assume different shapes and some are "cross-linked" by sulphur bridges that stabilize their structure. Boiling temperatures are sufficient to denature almost all enzymes and thus boiling the mash inactivates any enzymes that are useful in brewing. In decoction mashing, only roughly a third of the mash is boiled at each decoction and enzymes from the unboiled mash compensate for those denatured in the decoction boil.

Besides boiling of a portion of the mash, decoction mashing involves a lot of stirring and can result in an increased yield for many brewers. In a home brewery, a decoction mash is likely to give the brewer a better yield compared to an unstirred single infusion mash. My efficiency typically jumps by around 5% when I decoct.

Decoction mashing also results in increased removal of dimethyl sulfide (DMS), more intensive gelation of starch and less protein breakdown in the boiled portion of the mash. (Fewer proteins are degraded because the mash temperature of the decoction moves more quickly through the rests where proteinases are active than in the mash as a whole.)

Triple decoction mash

Although it takes some time and planning, it is certainly very possible to perform a triple decoction mash in a homebrewery. It does help, however, to have a brewing partner as you need to monitor what is going on in two mashes at the same time and the boiled mash needs nearly constant stirring.

Some maltsters sell less modified (or "undermodified") malts, and these are a good malt choice when doing a triple decoction mash. You can triple decoct using modern, well modified malts, but you may want to consider shortening some of the rests. At a minimum, it will save you time.

A triple decoction mash begins with a mash in at around 99 °F (37 °C). The mash thickness for pale beers is usually around 2.3–2.6 quarts of water per pound of grain (4.8–5.4 L/kg). For darker beers, a stiffer mash — around 1.4–1.9 qts./lb. (3.0–4.0 L/kg) — is used. Infusion mashes are generally thicker than both of these. As an option, the decoction mash can be mashed in very thickly at ambient temperature, then brought to the correct mash temperature and thickness with an infusion of hot water. I mash in my kettle as this makes it easy to apply direct heat if I need to make a slight temperature correction.

These days the explanation for this temperature is often that it activates the enzyme phytase, which lowers mash pH. Of course, decoction mashing was pioneered long before enzymes were discovered. (In fact, it was before things like cells and molecules — things you would need to understand before you could fathom the idea of an enzyme — were discovered. The choice of this temperature may be because it is easy to judge. At human body temperature — which varies, but hovers around 99 °F (37 °C) — water feels neither hot nor cold. Mashing in at this temperature may have been an adaptation to the lack of thermometers. (Another pre-thermometer way to achieve reasonably consistent water temperatures is to mix a fixed ratio of boiled water — which must be around 212 °F (100 °C), depending on elevation — and well water — which hovers around 54 °F (12 °C) at most locations.

Next, the brewer "pulls a decoction." In other words, he scoops out the thickest one-third of the mash and heats it in a separate pot. You can do this after a short rest, around 15 minutes, or you can let the rest sit at 99 °F (37 °C) for (literally) hours. (If you want phytase to produce a noticeable change in mash pH, you may indeed need to rest here for hours.) Heat the decoction to 150 °F (66 °C) and let this rest for 15–20 minutes. This allows some starch conversion to occur before the decoction is boiled and the enzymes destroyed. In a modern, well-modified malt, the decoction portion of the mash may completely convert, or nearly so, at this step. Next, the decoction is heated to a boil. For pale beers, the decoction is boiled for 15 minutes. Dark beers, in which more melanoidin production is desired, are boiled longer — up to 40 minutes. I usually boil my decoctions on my kitchen stove, as I worry that I will heat the mash too quickly and scorch it if I use one of my propane burners.

While any of the decoctions are being boiled, you must stir nearly constantly to prevent scorching. Although not traditional practice, I almost always add a pinch of calcium — either gypsum or calcium chloride — to the boiled decoction, to help the boiled mash achieve a desirably low pH.

After the first decoction is boiled, it is returned to the main mash, establishing a mash temperature around 125 °F (52 °C). (These days, we'd describe this rest as activating beta-glucanase. Older sources would likely call it a protein rest. With well modified malt, you may choose to proceed directly to the next decoction.) After a variable amount of time — from roughly 15–30 minutes — a second decoction is pulled and boiled. Like the first decoction, this should be the thickest one-third of the mash. This decoction is boiled for 15–30 minutes and returned to the mash.

Once the second decoction is returned, the mash temperature should settle to around 149 °F (65 °C). Traditionally, the mash was allowed to rest for about an hour at this point. At

this temperature, of course, starch is being converted into maltose and other sugars. If you are using a modern, well-modified malt, you can shorten this rest to 30 minutes (or shorter, if you confirm conversion with an iodine test).

After your conversion rest, a final decoction is pulled, boiled for 15–30 minutes and returned to the main mash for a mash out temperature around 170 °F (77 °C). A mash-out makes lautering easier — and lautering would likely have been more variable with historical malts. These days, we also know it brings most enzyme activity to a halt, "fixing" your carbohydrate profile. Now, what may be six hours later, you are ready to begin recirculation and lautering.

Other decoction programs

Shorter decoction mashes exist, both double and single. By varying the size of the decoction you pull and your mash-in temperature, you can come up with just about any set of rests you would like. If you mash in your kettle, you can also combine direct heat for steps or ramps within your decoction mash.

Schmitz process

One interesting single decoction program is the Schmitz process. This combines directly heated steps with one decoction to complete a step mash.

For a single decoction mash using the Schmitz process, mash in at 122 °F (50 °C), then begin heating the mash to 150 °F (66 °C). Stir the mash as you heat.

If you are making a dark beer, a long rest at ambient temperature — in German, a *vormaischverfahren* — may proceed heating the mash to mash-in temperature.

When you reach 150 °F (66 °C), let the mash solids settle. Once they are settled, carefully scoop out the liquid part of the mash — the part with the dissolved enzymes — and put it in another kettle. Keep this liquid at 150 °F (66 °C).

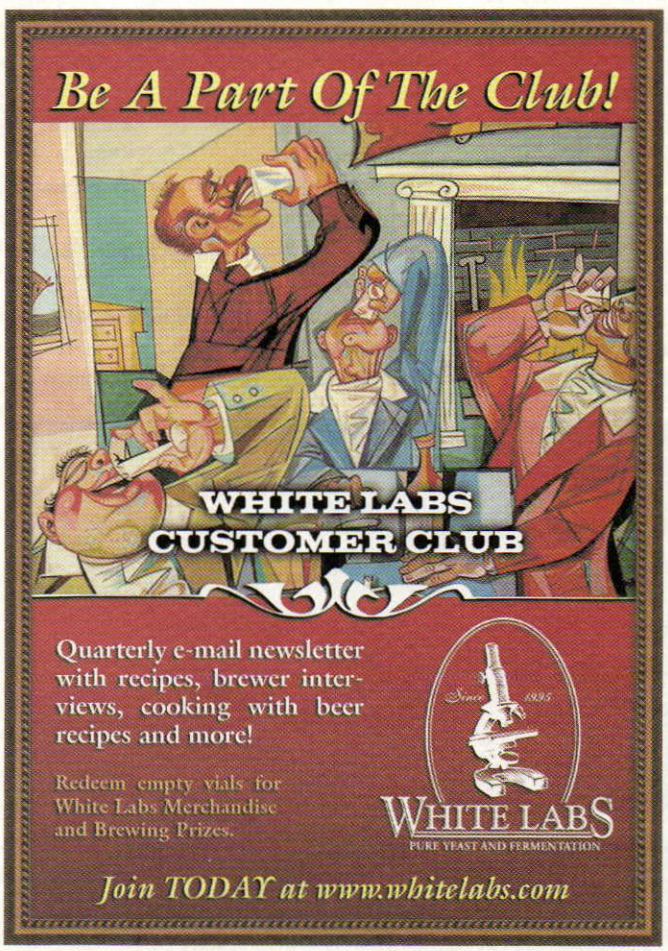
Boil the mash solids (and surrounding liquid) that were left behind for 15–30 minutes. Next, cool the mash back down to the point that, when you combine it with the liquids you are reserving, your temperature comes to rest within the saccharification range.

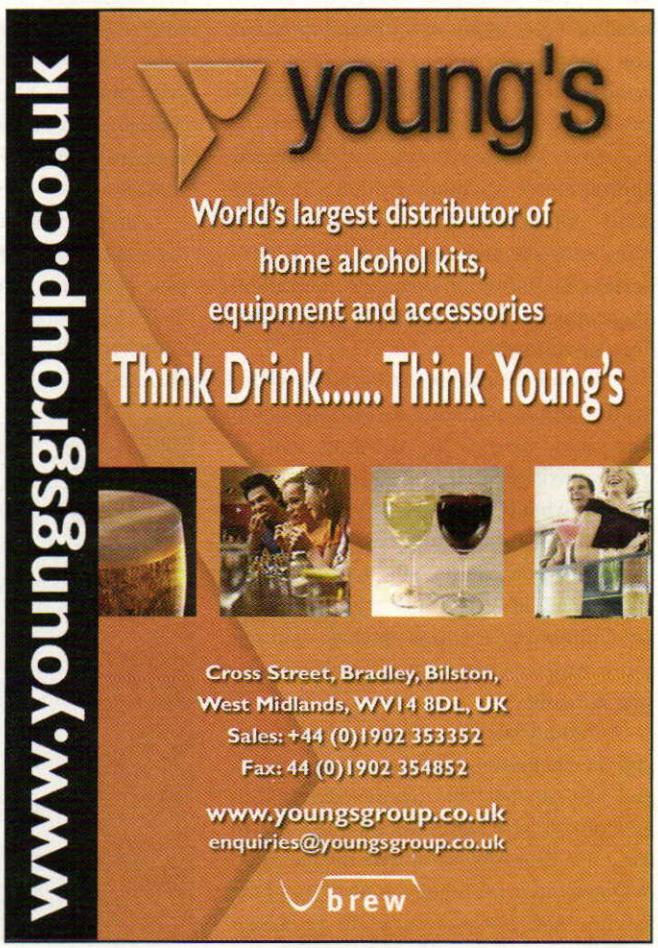
Obviously, you would cool the grains down to 150 °F (66 °C) if you wanted the recombined mash temperature to be 150 °F (6 °C). If you wanted a higher temperature, cool the grains less. The exact amount depends on the proportion of water you scooped out to the proportion of grain left behind.

To cool your decoction, use a copper coil immersion chiller. Once you've added back the liquid part of the mash, you can use either direct heat or your immersion cooler to correct your temperature, if needed.

The first time you try a decoction mash, take good notes regarding the volumes of the decoctions you pull and the temperatures your recombined mashes settle in to. Use this information to tweak your plans for subsequent brewdays.

Chris Colby is Editor of BYO.





In-line Thermometer

Cool your wort to the right temperature

Story and photos by Forrest Whitesides

So you've got a great new counterflow chiller to knock down your boiling wort to yeast pitching temperatures but you aren't sure how high of a cooling water flow rate you need to do the job? You need an in-line thermometer to give you hands-free and real time feedback on the temperature of the wort as it leaves the chiller.

This type of thermometer is positioned after the "wort out" connection on a counterflow chiller and is connected on either end by vinyl tubing. The wort flows out of the chiller, through the in-line thermometer and then into a fermentation vessel (carboy, bucket, etc). The in-line thermometer shows you temperature changes in the wort as it happens. This allows you to adjust the flow rate of cooling water going into the chiller to get the target pitching temperature you need for whatever type of yeast you might be using.

Sure, you can do this with a normal thermometer by dipping it in the wort that's already in the carboy, but this can be messy and poses a potential bacterial contamination risk. Also, an in-line thermometer allows hands-free temperature monitoring.

If you have cool or cold ground water, using such a thermometer will also help you save money by allowing you to reduce excess water usage during cooling. Brewing is a water-intensive process, and if you can dial in the exact flow rate you need, you can potentially save several gallons of water per brew session. In addition to the cost savings, cutting your water usage is also environmentally friendly.

Commercially available in-line brewing thermometers run about $40 at retail, but you can put one together yourself in just minutes for about $10. A quick trip to your local hardware store and pet shop will get you everything you need. We'll be using a common self-adhesive aquarium thermometer (very similar to the stick-on thermometers often used on carboys) with a temperature range from 64 °F to 86 °F (18 °C to 30 °C) as the workhorse of this project. This temperature range coincides with the recommended pitching temperatures for the vast majority of yeast strains.

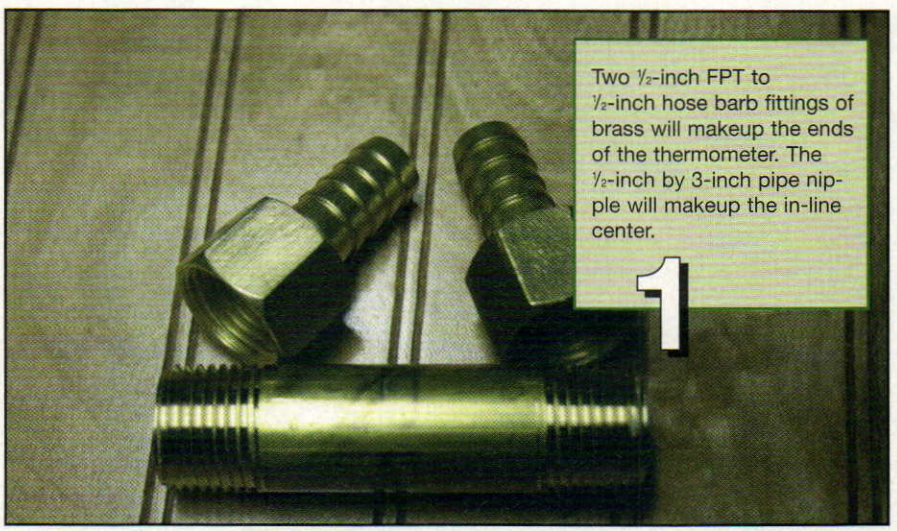
An in-line thermometer can work hand-in-hand with a counterflow chiller to help you determine the proper flow rate of cool water.

There are two basic materials options for this project, depending on your personal preferences: metal or clear PVC. Metal conducts heat better and allows the thermometer to adjust to temperature changes quickly. Clear PVC is lighter and cheaper and allows you to see the wort as it flows through. For some people, being able to see the wort is important, so if you fall into this category, the PVC is your best option.

Metal mania

For the metal thermometer, you'll need the following parts:

- ½-inch x 3-inch pipe nipple, brass [Fig. 1]
- Two ½-inch FPT to ½-inch hose barb fitting, brass [Fig. 1]
- LCD self-adhesive aquarium thermome-



Two ½-inch FPT to ½-inch hose barb fittings of brass will makeup the ends of the thermometer. The ½-inch by 3-inch pipe nipple will makeup the in-line center.

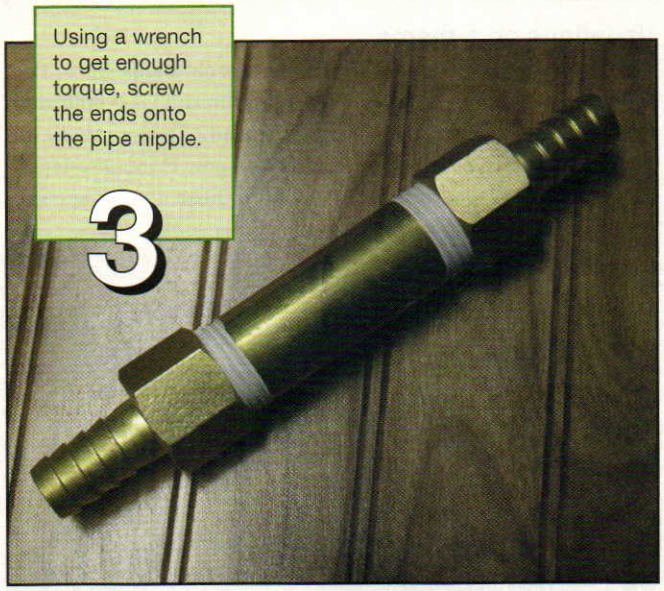
1

2

Wrapping the threads of the pipe nipple will ensure a tight, leak-proof seal.

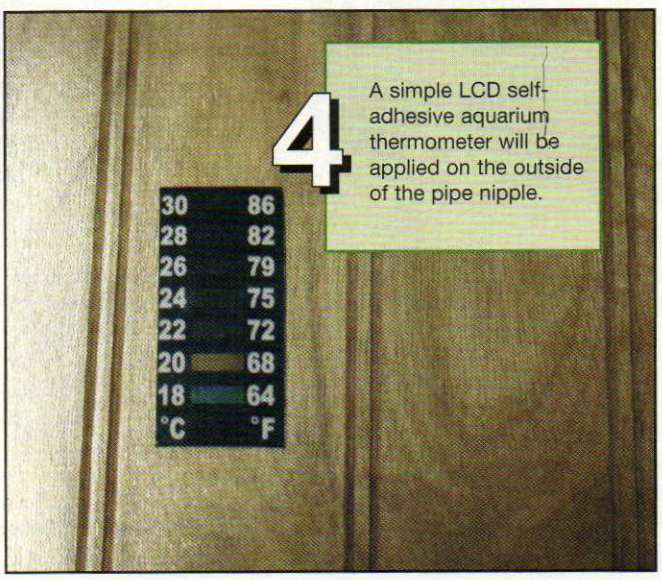
ter, small vertical style [Fig. 4]
- Teflon pipe tape
- Clear plastic packing tape

Before assembling this project, the brass parts should be washed with warm water and mild soap to remove any dirt and oil and then dried. The first step is to give the threads on both ends of the pipe nipple a liberal wrapping of teflon tape [Fig. 2]. It is very difficult to get a good seal with threaded metal fittings without using pipe tape. Now screw in the hose barb connections to either end of the pipe nipple [Fig. 3]. Hand-tightening may be enough to get a good seal, but you should give each connection a little extra torque with a wrench just to be safe. Even the smallest leak in your thermometer will give you a headache on brew day by adding to overall cleanup time. (Over time, temperature fluctuations can cause the metal to expand and contract, which can loosen the fittings. You should check the tightness of the fittings after every third or fourth usage).



Using a wrench to get enough torque, screw the ends onto the pipe nipple.

3



4

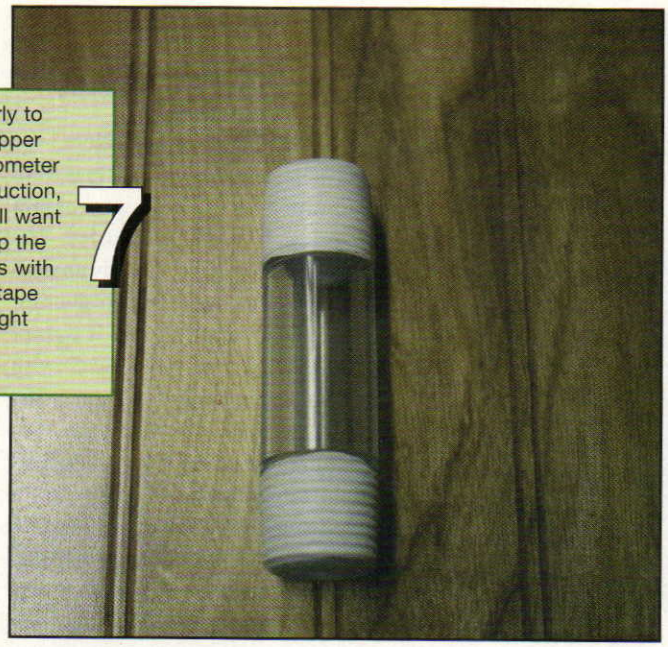
A simple LCD self-adhesive aquarium thermometer will be applied on the outside of the pipe nipple.

While the LCD-thermometer is 3 inches in length, you may have to trim it slightly at the top and bottom to make it fit on the 3-inch pipe nipple.

5

6

For the PVC version, you can purchase a clear ½-inch by 4-inch PVC pipe nipple at your hardware store or online.



Similarly to the copper thermometer construction, you will want to wrap the threads with teflon tape for a tight seal.

Now that all the fittings are snugly connected, affix the LCD thermometer to the pipe nipple as shown in Fig. 5. The small vertical LCD thermometers commonly available in pet stores are generally about three inches high, which is a tight fit on our 3-inch pipe nipple. You may have to trim a little off the bottom of the thermometer strip. When I assembled this project, I needed to trim off the name of the manufacturer in order to get it to fit on the pipe nipple. Trimming will not in any way impair the operation of the thermometer, so don't be shy about customizing it to fit your project. Since they retail for about $2 at most pet stores, go ahead and buy two of them in case you trim a little too much.

To finish off the in-line thermometer, give the pipe nipple a turn or two of plastic packing tape. The stick-on strip thermometer was designed to be used on flat glass rather than concave metal, so the clear tape will help keep it in place long after the adhesive backing wears out.

Plastic voyeurism

If you want to go the clear plastic route, here's what you'll need:

- ½-inch x 4-inch* pipe nipple, clear PVC [Fig. 6]
- Two ½-inch FPT to ½-inch hose barb, PVC or polypropylene [Fig. 6]
- LCD self-adhesive aquarium thermometer, small vertical style [Fig. 4]
- Teflon pipe tape
- Clear plastic packing tape

* You may have difficulty finding clear PVC at your local hardware store. If so, you can order it online from U.S. Plastics (www.usplastics.com) using part number 34349. *Note: The 3-inch clear PVC pipe nipple that U.S. Plastics stocks has less non-threaded surface than the equivalent brass part, so I recommend that you get the 4-inch part. For the hose barb fittings, you can use any available plastic material that is safe for potable water.

Putting together a see-through thermometer is nearly identical to the steps involved with the metal version: Wrap the threads with pipe tape [Fig. 7], screw in the hose barb fittings [Fig. 8], and affix the LCD thermometer strip and wrap it with packing tape [Fig. 9].

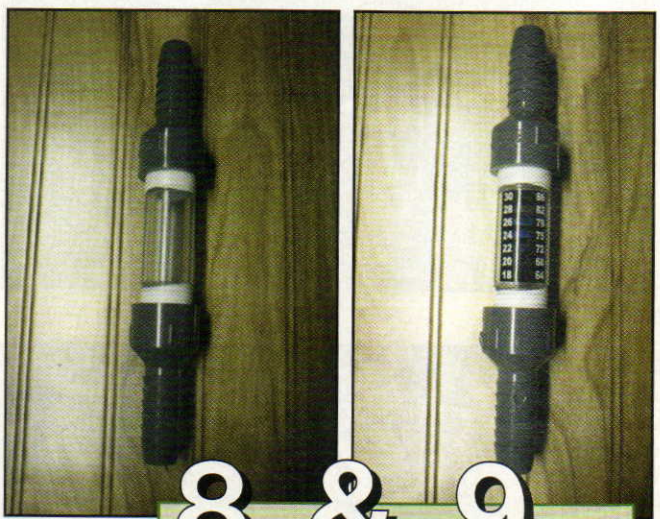
Performance: Metal Versus PVC

The strip thermometer used in this project reacts to temperature changes surprisingly fast considering its low price. I tested both a metal and clear PVC version of this project to get a rough idea of how it would perform in a situation of quickly changing flow temperatures.

Starting off with warm tap water (approximately 90 °F or 32 °C) flowing through the thermometer, I quickly shifted to much cooler water (approximately 60 °F or 16 °C) and noted how long it took the thermometer to register the change. The metal thermometer took about 8 seconds to adjust to the change, while the PVC thermometer took about 15 seconds. I did not test under "laboratory conditions," so take the above results as rough estimates of performance.

Variations on a theme

The above parts and methods are merely suggestions. Feel free to substitute larger or smaller fittings to suit your individual brewing setup or use stainless steel instead of brass. Above all, don't be afraid to be creative. And let us know if you develop an improvement on the design. We'd love to hear about your success and innovations.



8 & 9

The rest of the construction is also simple and identical to the copper thermometer's procedure. Screw the hose barb fittings onto each end of the pipe nipple, tighten with enough torque to form a tight seal and then affix your LCD self-adhesive thermometer.

Forrest Whitesides writes the Projects column in each issue of Brew Your Own *magazine.*

Analyze This!

An analysis can tell you "a lot" about your malt

by Bill Pierce

Just as no two batches of beer are exactly alike, neither are lots of malt. A major reason is the barley itself. Variations in rainfall, soil nutrients and temperature during the growing season, along with storage and handling conditions, all affect the crop from year to year, region to region and even from field to field. This impacts such values as kernel size, starch, protein and moisture content. And despite strict modern quality control procedures, there are also subtle variations from lot to lot even at the same facility.

Of course, maltsters know this and therefore blend barleys before malting and blend lots of the same kind of malt after malting. And, some differences — most notably kernel size — can be tightly controlled by screening.

The remaining differences, however, can be significant enough to affect the gravity and color of the beer. For example, an increase of one percent in the moisture content of the base malt, along with a corresponding decrease in the extract potential, will lower the original gravity (OG) by more than one point. And the color of black roasted malt among different lots from the same maltster can vary by 40 degrees Lovibond (°L).

None of this, though, should be cause for despair among brewers who seek the highest levels of consistency. This is because maltsters analyze the malt they produce and release the results in the form of a malt lot analysis. A malt spec sheet allows brewers to determine the characteristics and quality of the malt we use, select between different malts and also allow us to alter the amount of malt in a recipe or the procedures we use for handling it. Malt spec sheets are available from virtually every malt producer to anyone who requests it. Some sheets give an average analysis, others are reported on a lot by lot basis. Even those brewers who are more of the "relax, don't worry, etc." school of homebrewing can benefit from this information.

Making malt

Before discussing malt lot analyses, it may help to briefly review the basics of malting. In malting, barley kernels are steeped in water, until the root sheath just penetrates the husk. The barley is then removed from the water and allowed to germinate. Once the rootlets have grown sufficiently, the wet malt is heated (kilned) to dry the malt. After kilning, the rootlets attached to the barley kernels are removed.

Readers are leaders

To create a malt lot analysis, a sample of the finished malt is carefully analyzed in a laboratory. Standardized testing procedures are used to test specific qualities that are significant to brewers. Most commercial breweries require that a lot analysis accompany each malt shipment they receive. Homebrewers and small craft brewers can request one from their malt supplier.

If you buy malt in quantities of less than a full bag, it's possible to obtain the lot number (printed on each bag) from your local homebrew shop and contact the maltster directly, who will be happy to provide the information via telephone, fax or e-mail. A couple of them have a feature on their web sites for viewing lot numbers online.

As you might expect, the vocabulary of malt lot analysis is technical, but it's not that hard to learn to interpret. Come along with us as we examine a typical lot analysis and explain the various entries. It's a lot less personal than going on the couch with Dr. Freud, and we predict you will enjoy your beer more than the doctor did his cigar.

The terms for the values reported in each malt lot analysis vary slightly, depending on the maltster. These values can be grouped into several categories, including color, moisture, extract, modification, proteins and physical characteristics. For base malts, there is also data on diastatic (enzymatic) power.

In living color

In North America, color is measured in SRM (Standard Reference Method) units or degrees Lovibond, an older visual method that is essentially the same scale. The palest Pilsner malt has a value of 2 SRM, while the blackest roast malt can be more than 600 SRM. Europeans use a corresponding but different scale known as EBC (European Brewers Convention). The two systems can be converted using the following formulas:

EBC = (L * 2.65) + 1.2

L = (EBC - 1.2) / 2.65

It should be noted that the resulting beer will have a color darker than the malt, due to boiling and other reactions that occur during the brewing process.

Make mine dry

Moisture in malt contributes to mold and accelerates spoilage. Brewers pay for convertible starches and extractable sugars in their malt rather than water, which they add at mashing time. However, it's not possible for malt to be bone dry, and a small amount of moisture is inevitable and even desirable. British pale malts typically have the lowest moisture content, on the order of 3–4% by weight, while Continental and North American base malts are in the area of 4–5%. Caramel and crystal malts have the highest moisture content, up to 6%, resulting in a slightly gummy character in mashes with high percentages of these. In any case, malts with a moisture content much above 6% are best avoided, as this is an indication of problems during malting.

Sugar, sugar

Brewers speak of sugars as "extract;" this is, what results in food for the yeast (fermentable sugars) and body for the beer (unfermentable dextrins). Accordingly, it is not surprising that a malt lot analysis contains an entire group of values for reporting extract. The first two are Extract Yield Dry Basis Fine

Grind (DBFG) and Extract Yield Dry Basis Coarse Grind (DBCG). These are derived from a laboratory mash conducted with a small quantity of the malt. The method is rather different from actual brewery conditions, but the fine-grind results represent the maximum possible laboratory yield from the malt. For base malts, a DBFG value of less than 78 percent indicates poor quality. As a result of how they are produced, specialty malts will have lower yields, but this is not a problem because they are generally not significant contributors of extract to beer.

The coarse-grind results are intended to demonstrate to the brewer the maximum that can be achieved using a crush that approximates that used by most breweries. This value is still higher, however, than most real breweries (including homebreweries) achieve because the mash is "oversparged" compared to normal brewery procedures. In practice, mashing conditions at a brewery typically result in a yield 5–15% lower than the DBCG value. It should be noted that both of these values are reported on a "dry basis," that is, as if the moisture content of the malt was zero. This makes it easier to compare different lots and eliminates factoring in the varying moisture content. Of course we know that all malt contains some moisture, and occasionally you may see a malt analysis that expresses the extract values on an "as-is" basis (AIFG and AICG).

Often brewers refer to a malt's "extract potential." This is typically expressed as specific gravity that can be achieved with 1.00 pound (455 g) of malt mashed in 1.00 gallon (3.78 L) of water.

The following formula can be used to calculate extract potential:

Extract potential (S.G.) = 1 + (DBFG / 100) * 0.04621

The 0.4621 multiplier in the formula is the extract potential of sucrose (1.04621), against which all extract is measured. For example, a malt with a DBFG value of 80.5% results in a calculated extract potential of 1.0372.

Another important value is the Extract Fine Grind/Coarse Grind Difference (FG/CG). Sometimes a malt analysis will list this rather than the DBCG value. If so, it's a simple matter to calculate the DBCG by subtracting the FG/CG from the DBFG value. The FG/CG value is an indication of the modification of the malt and its suitability for single infusion mashing. A FG/CG difference of 0.5–1.0 percent is well suited to a single step infusion, while a value greater than 1.5 percent indicates that a protein rest may be advisable.

Maltsters in other parts of the world may use different units of measurements. British malt analyses sometimes report "hot water extract" (HWE). HWE is based on how many liters of wort a kilogram of malt will yield with a specific gravity of 1.001 in water at a temperature of 20 °C (68 °F) using a 7M (0.7 mm) mill gap for coarse grind and a 2M (0.2 mm) gap for fine grind. Divide the HWE values by 3.86 to convert to DBCG and DBFG, respectively. The British equivalent of FG/CG is "cold water extract" (CWE) and represents the percentage of extract soluble in cold (20 °C/68 °F) water. Malts with a CWE of 19–23 percent are good candidates for single temperature infusions, while lower values may require additional lower temperature rests.

Continental maltsters sometimes provide FG/CG data in the form of the Hartong or VZ 45 degree index. This is similar to CWE except that water at 45 °C (113 °F) is used. The resulting value is about twice as high as the CWE.

Eat your protein

Protein values in malt are related to the total nitrogen content (proteins are comprised of nitrogen-rich amino acids). Sometimes a malt analysis will list the total nitrogen (TN) value in percent. In general, brewers want minimal protein in their malt because it has little brewing value except for enzymes and foam.

One percent TN equals 6.25% protein; to convert protein to TN divide the value by 6.25. British and Continental base malts are normally below 10 percent protein (1.6% TN). All-malt beers brewed with malt having a protein value above 12% may exhibit haze problems, which is why North American six-row malt (with protein as high as 14%) is best used with adjuncts that have far less protein. (The situation is actually a little more complex as the kinds of proteins present in a malt also play a role.)

The percentage of protein (or nitrogen) that is soluble in water is expressed as a SP (soluble protein) or SN (soluble nitrogen) value. This is used to calculate the S/T (soluble/total) or SN/TN (soluble nitrogen/total nitrogen) rations, also called the Kolbach Index. The three ratios are equivalent to each other and also can be expressed as the soluble nitrogen ratio (SNR). In all cases, the value results from dividing the soluble protein (or nitrogen) value by the percent protein (or total nitrogen).

The S/T is important because it is the best indicator of malt modification, the degree to which germination was allowed to proceed during the malting process. S/T values above 35% indicate highly modified malts suitable for infusion mashing, while values above 45% can result in thin-bodied beer. Undermodified malt (with an S/T of 30–35%) requires multiple temperature rests or decoction.

The power of enzymes

Related to extract and protein values is the "diastatic power" (DP), the ability of the enzymes in the malt to convert starches to sugars. This is important when base malt is used in conjunction with other starch-containing, but enzyme-poor malts, and unmalted adjunct grains. For North American and British malt, diastatic power is measured in degrees Lintner. Well-modified British pale ale malt, for example, may have a DP value in the range of 35–40, indicating that it can convert its own starches and a small proportion of adjuncts, up to 3–4% of the total grain bill. North American six-row malt, with its higher protein content, can have a DP as high as 160, demonstrating its ability to convert a large percentage of adjuncts.

Malt analysis sheets may also list dextrinizing units (DU) as another measure of enzymatic power.

The Continental European equivalent unit of measure for DP is degrees WK (Windisch-Kolbach). The two units can be converted using the following formulas:

Degrees WK = (degrees L * 3.5) - 16

Degrees L = (degrees WK + 16) / 3.5

Some malt analyses list the starch conversion time in minutes, in addition to or instead of the DP values. In no case

should this be more than 20 minutes for base malt; for North American two-row and six-row pale malts it should be on the order of 5 minutes.

Let's get physical

A section of the lot analysis concerns the physical characteristics of the malt. Among these is the kernel size, typically expressed in terms of screen separation, that is, the fraction of kernels that do not pass through screens of various sizes. In general, larger kernels will exhibit higher extract yields. Kernels smaller than 2 mm (0.079 in.) can be indications of poor or nonexistent modification. Sometimes the size value is given only in terms of the percentage of kernels that are "plump" or "thin." Malt that is more than 2% thin can cause problems when it is milled; a relatively uniform kernel size is desirable from this standpoint.

Malt is also classified in terms of hardness. By convention, it is described as "mealy," "half-glassy" and "glassy." Mealy kernels have an endosperm (the partially geminated portion at the heart of the kernel that contains the starches) that is 25% or less glassy (hard). Glassy kernels have an endosperm that is more than 75% hard. The remaining kernels (26–75% hard) are said to be half-glassy.

Mealiness is an indication of how well a malt will crush and how accessible the endosperm is to the water and the malt enzymes during mashing. Base malt used for single infusion mashing should be at least 95% mealy. Values of 90–95% mealy suggest multi-temperature infusions or decoction, and in all cases the base malt should be a minimum of 90% mealy.

The opposite of mealiness is "vitreosity," which is sometimes used as an alternative measurement. A value of 1 is assigned to glassy (vitreous) kernels, 0.5 to half-glassy and 0 to mealy kernels. The percentages of each are summed and averaged; a vitreosity value of 0.25 or less is considered desirable. Friability is the relative ease of crumbling when a malt is milled. It is related to mealiness, and may be reported in its place. All malt should be at least 80% friable, and at least 85% friable for infusion mashing.

The analyses for caramel and crystal malts may list the degree of crystallization. These malts are relatively steely (glassy), and the degree of crystallization should be 85% or higher for caramel malts and at least 95% for crystal malts.

Viscosity measures the breakdown during malting of the beta glucans that comprise the endosperm cell walls. Expressed in centipose units (cP), a value greater than 1.75 cP indicates that a mash with this malt will be gummy and pose potential sparge problems. In this case a beta glucan rest at 95–100° F (35–38 °C) or decoction mash is advisable.

Mashers of the universe

Obtaining and studying a lot analysis can teach you a great deal about one of the most important brewing ingredients and bring you great rewards in terms of the consistency and quality of your beer. It may or may not overcome your deepest fears and complexes, but it just might let you brew the stuff of your dreams.

Bill Pierce writes "Advanced Brewing" in each issue of BYO.

Typical Malt Analyses

Typical North American 2-Row Pale Malt Analysis

Variable	Typical Value
Color °Lovibond	1.8
Moisture %	4.0
Extract Dry Basis Fine Grind (DBFG) %	80.5
Extract Dry Basis Coarse Grind (DBCG) %	9.5
Fine Grind/Coarse Grind Difference (FG/CG) %	1.0
Total Protein (TP) %	12.0
Soluble Protein (SP) %	5.0
Soluble Nitrogen Ratio (SNR) %	42.0
Diastatic Power (DP) °Lintner	140
Glassy/Half-Glassy/Mealy %	0/2/98
Plump %	80

Typical British Pale Ale Malt Analysis

Variable	Typical Value
Color °Lovibond	3.0
Moisture %	3.2
Hot Water Extract (HWE) L°/kg 7M	310
Cold Water Extract (CWE) %	20.1
Total Nitrogen (TN) %	1.5
Soluble Nitrogen Ratio (SNR) %	40
Diastatic Power (DP) °Lintner	50
Screenings < 2.2 mm %	0.45
Friability %	90

Typical Continental Pilsner Malt Analysis

Variable	Typical Value
Color EBC	3.2
Moisture %	4.2
Extract Dry Basis Fine Grind (DBFG) %	81.0
Fine Grind/Coarse Grind Difference (FG/CG) %	1.0
Total Protein (TP) %	10.75
Soluble Nitrogen Ratio (SNR) %	39.5
Diastatic Power (DP) °WK	211
Friability %	87
Glassiness %	1.2
Viscosity cP	1.56

The author wishes to acknowledge and thank craft brewer and author Greg Noonan for his work that has appeared online and in several other publications.

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Last Call

Super Cooler

One man's trash is a homebrewer's treasure

by Rick Oftel • Edina, Minnesota

I like most homebrewers, it took a few years to transition from extract to all grain and from bottles to cornies. Cornelius kegs were cooled in a modified chest freezer until moisture buildup rusted the evaporator coils. After 6 short years, my cooler was junk.

A few months later, we acquired my

photos courtesy of rick oftel

The Garden View Brewing keg cooler was salvaged from the parking lot of a laundry mat and holds 30 kegs!

One, two, three, four, five, six taps are mounted to the side of the cooler. Now that's homebrew variety.

Cocker Spaniel "Chaser" who loves to walk me about two miles each day. During an extended evening adventure, a large Pepsi sign was noticed outside a commercial laundry and we crossed the road to investigate. It was a very dirty two door Beverage Air cooler waiting for the recycling truck. Upon closer inspection, the old cooler had a newer compressor.

The next evening, returning with paper, tape measure, brewery door sizes and wild ideas, I determined the cooler would fit through our walk-out basement door and into the brewery. I also discovered that my wife had gone to school with the shop manager.

The next day, our negotiations were simple; I offered to haul away their junk for free. Lacking a pickup truck, I was unsure how to accomplish this task but "in the true spirit of homebrewing," knew that this cooler was moving.

On Wednesday afternoon, rush hour traffic was slightly inconvenienced as a 1967 Wheel Horse lawn tractor and miniature tilt-bed trailer embarked on a 3-mile cooler retrieval mission. The rig, top speed of 6.5 mph, arrived safely at the scene. After loading the cooler and cinching it down, the slow moving convoy pointed home. The trailer lifted the 7-foot cooler about a foot so you can imagine this narrow Pepsi sign mixing with rush-hour traffic. The 3-mile trip took about 90 minutes. Some creative driving skills (e.g., drive on the center line) " were used to facilitate two left turns. You can take liberties when driving slow moving vehicles equipped with red reflective triangles.

After arriving in the garage, it was temporarily energized and made some noise and cold air. After a thorough cleaning, the shelves were discarded and the doors were temporarily removed. Condensate lines were replaced and the unit was re-wired so the evaporator fans only operate when the compressor cycles. High quality spray paint changed the cabinet color from black to white.

Having cold beer is great but you need to dispense it correctly. From the mess in the old chest freezer, I knew that picnic taps and open doors were out. My Christmas present was a set of 6 valve forward faucets and stainless steel shanks. Silicone caulk sealed the insulation to prevent moisture collection. Each shank was fed with a six-foot length of $\frac{3}{16}$-inch tubing. A gas valve manifold with check valves was reused from the old chest cooler. All that remained was to move the 350-pound monster into the modest 11 x 13-foot brewery.

One of my inquisitive friends with an abundant share of dry wit mentioned, "If you ever need help, I am more than willing" but before he was able to finish, I asked, "What are you doing next Saturday?"

The move was easy. We loaded the cooler onto the trailer and drove it to the basement door. We lowered the unit onto two 4-wheel moving dollies and rolled it into the basement brewery. A sharp corner at the base of the stairwell was negotiated with the lifting ability of a motorcycle jack stand, allowing the big box to clear three stairs. After righting the box into the brewery, Paul asked, "What do you do, stay awake nights dreaming up crazy projects like this?"

The cooler included a functional fluorescent ballast so brewery signage was required. The font was discovered in a computer, enlarged on a copier and transferred to cheap pine board. Letters were hand carved about half way through the pine and the cavities filled with casting resin. The name, "Garden View Brewing" describes my view through the brewery windows of my wife's rose garden.

The cooler is now fully functional and can hold 30 cornies plus a 5-pound CO_2 tank. Liquid temperature stays close to 38 °F (3 °C). Although it is a few degrees too warm, it lagers very nicely. The cooler usually cycles on each hour for about 5 minutes.

Most beers are brewed towards the middle of style guidelines but on occasion, I have been known to brew with heavy handed hops. My favorites include traditional beers like Pilsners, German wheat, Kölsch, IPA, Irish red, pale ales, Scotch ale, porter and dry stouts. I truly enjoy being able to refrigerate all the beer I brew in an actual refrigerator!

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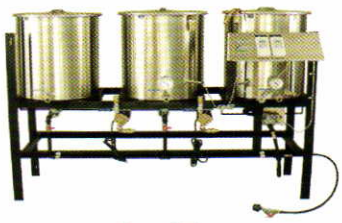

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to Rachel and Brian Turner!

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