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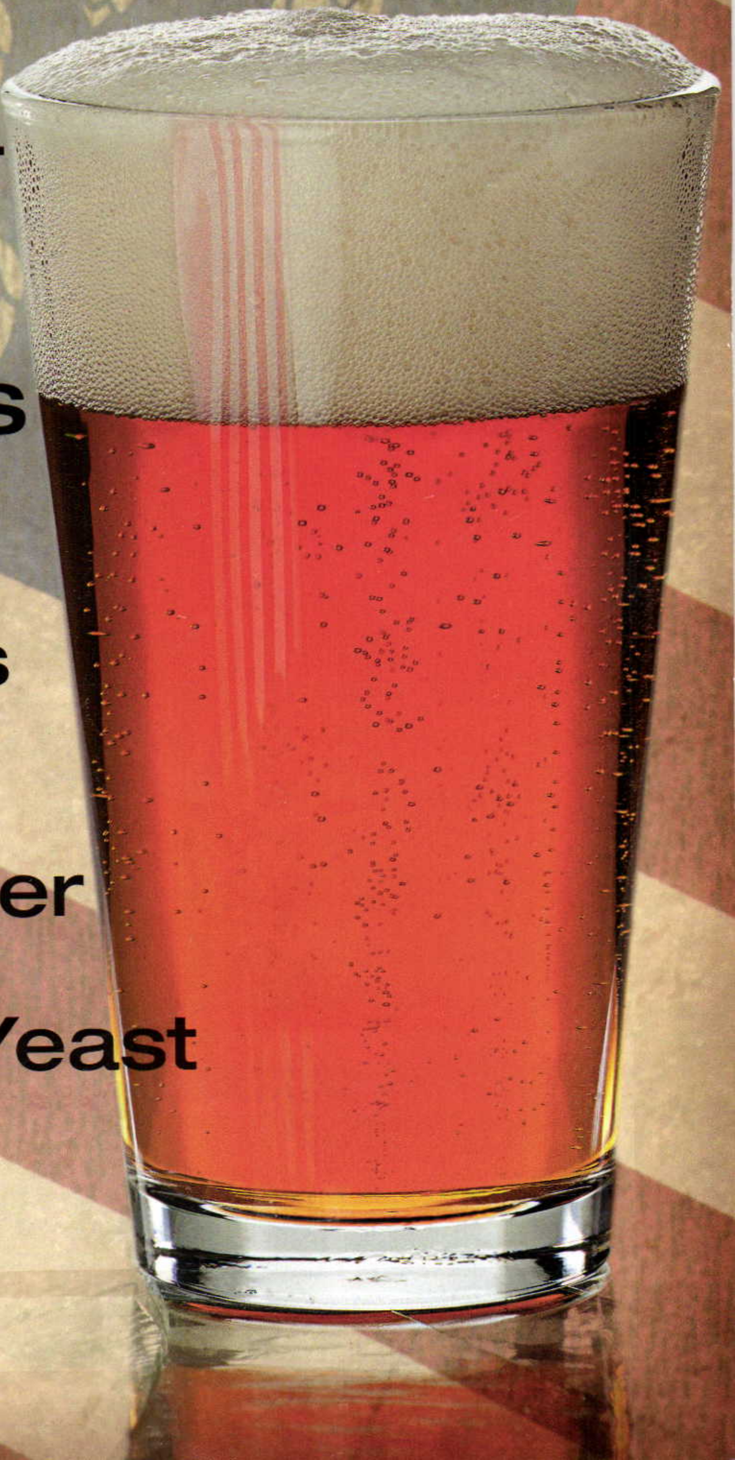
JULY-AUGUST 2012, VOL.18, NO.4



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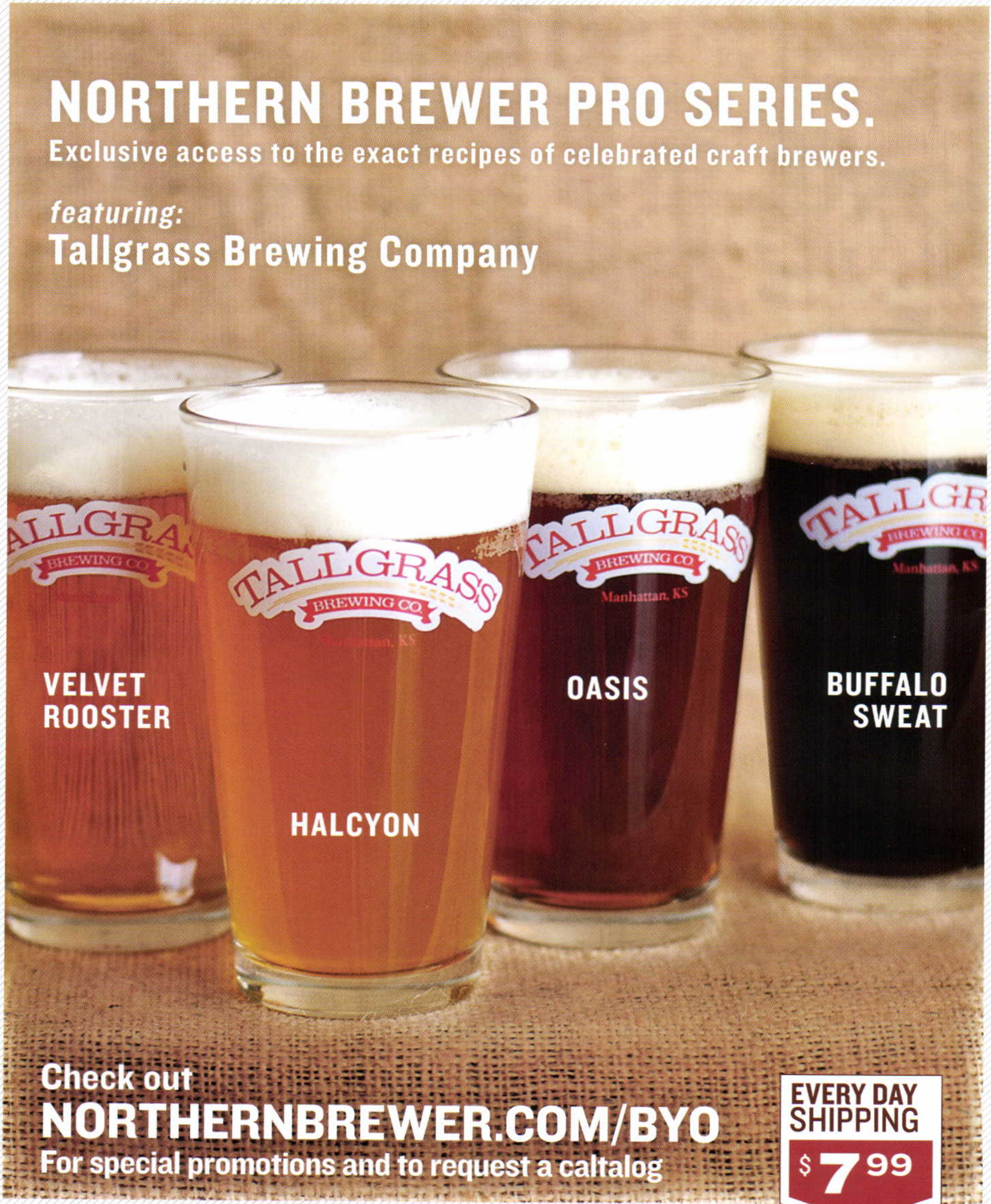
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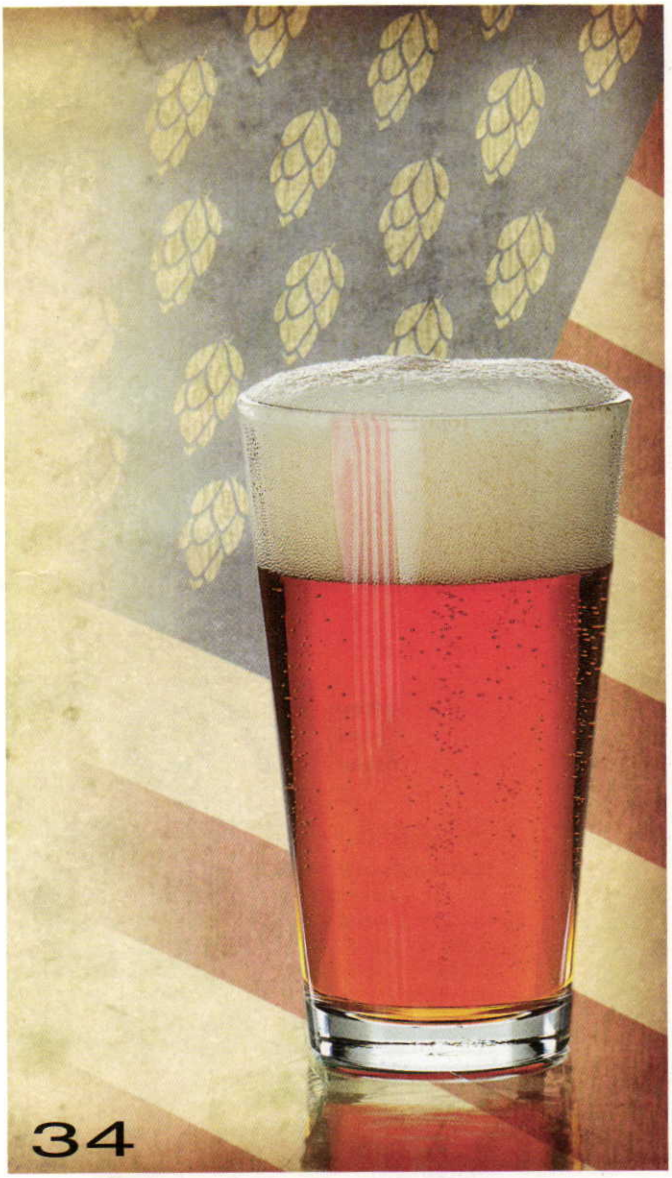

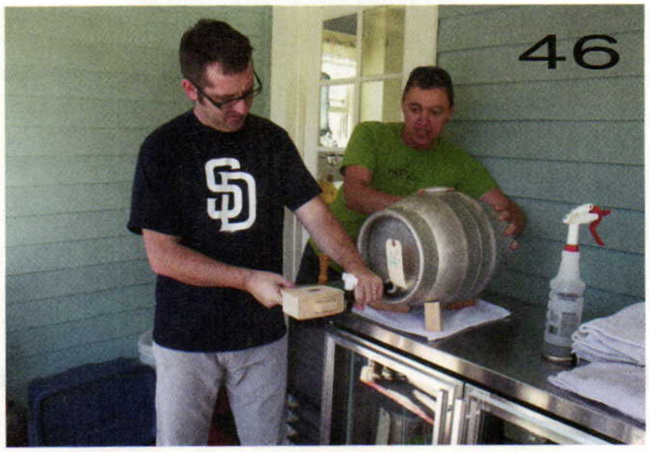

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BYO RECIPE STANDARDIZATION

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.

what's happening at BYO.COM

Try Dry Hopping

If you love homebrewing with "C" hops (Cascade, Chinook, etc.), learn how to get the most out of their aroma by dry hopping. Check out more information about what dry hopping is and how it's done.
www.byo.com/component/resource/article/573

More On Hops

Hops aren't just for bittering. Learn about the versatility of hops in *BYO*'s online video series with *BYO* contributor and *Basic Brewing Radio* host James Spencer.
www.byo.com/videos/24-videos/1794-videos

Label Love

Do you love homebrew labels? We do too! We love them so much, in fact, that we collected all of our favorites in one place. If you want to see more labels, check out our online gallery of all our past *BYO* Label Contest winners.
www.byo.com/photos/category/1

Brew 1776-Style

Homebrewer John McKissack went back in time to come up with a recipe for "1776 Independence Porter," which required roasting his own grains. Check out his recipe for an authentic Independence Day homebrew.
www.byo.com/component/resource/article/25

Cover Photo: **Charles A. Parker**

Brew Your Own — THE HOW-TO HOMEBREW BEER MAGAZINE

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Volume 18, Number 4: July-August 2012

Omigosh, it's Ommegang!

I enjoyed Chris Colby's "Tripel" article in your current issue until the part about carbonating to 4 volumes of CO_2 in a keg. Without specialized equipment, pouring draught beer at this carbonation level is pretty much impossible . . . you just get a glass of foam. Also, although kegs are rated for slightly higher pressures advising people to pressurize a keg to close to 30 PSI to achieve this carbonation level is dangerous at the least.

Phil Leinhart
Brewmaster
Brewery Ommegang

Author and BYO *Editor Chris Colby responds: "Glad you liked the article, minus the part about keg carbonation. I love Ommegang beer.*

"Cornelius kegs are rated to 130 PSI, so an operating pressure of around 30 PSI should not be dangerous with any properly maintained keg. It may, however, cause problems with dispensing that, in retrospect, I should have addressed in the article.

"Any homebrew draft system should be balanced. (See the January-February 2006 issue of BYO *for the details.) Long story short, for more highly-carbonated beers, you should have corresponding longer serving lines. For pouring a highly carbonated tripel, doubling the length of your serving line would be a good place to start. With a 'regular' length serving line, the beer is going to come shooting out of the tap. Also, the 'usual' things that brewers do to keep foaming down should be reviewed. Open the tap quickly and fully; a half-open tap will just squirt foam that, once it collapses, will yield flat beer. Keep the lines clean. Residue inside serving lines serves as nucleation sites for CO_2 bubbles. Try pouring two or more glasses worth into a pitcher. Sometimes, a beer may foam initially, but then settle down fairly quickly. And, finally, if you are serving with cobra taps, try holding the tap as high above the keg as is feasible.*

"Draft systems can be tricky. If nothing seems to work, the last resort would be to vent the keg numerous times and let it equilibrate at a lower level of CO_2 pressure."

contributors

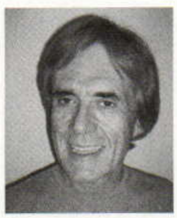
Justin Burnsed made the journey from homebrewer to professional brewer and blogged about his time enrolled in the UC Davis Master Brewers program and out in the real world at byo.com. He is currently Partner and Brewmaster at Prospectors Brewing Company in Mariposa, California (near Yosemite National Park), which is opening in late July/early August 2012.

Justin has written about roasty beers (foreign export stout in the January-February 2011 issue of *BYO*) and sour beers (gose, in the May-June 2011 issue). In this issue, for our cover story, he tackles the subject of hoppy, American-style ales — and provides a trio of recipes. His story starts on page 34.

Another homebrewer turned commercial brewer, Jamil Zainasheff, is the owner of Heretic Brewing Company, in Pittsburg, California. Jamil also blogs about his experiences at byo.com.

Despite having gone commercial, he still maintains a high profile in the homebrewing world, hosting the show *Can You Brew It?* on the Brewing Network (www.brewingnetwork.com) and maintaining the popular website, Mr. Malty (www.mrmalty.com).

In this issue of *BYO*, he does triple duty, writing his usual "Style Profile" column on Belgian dark strong ale (p. 19), being featured in "Tips from the Pros" (p. 13) and quoted in Mr. Wizard's column (p. 15).



Bill Pierce has earned the Craft Brewers Certificate from Siebel Institute in Chicago, Illinois and briefly worked as a brewpub brewer. Bill is a long-time participant in the HBD (Homebrew Digest, hbd.org), a BJCP judge and is *BYO*'s former "Advanced Brewing" columnist.

In the May-June 2010 issue of *BYO*, Bill wrote about the Ballantine Brewing Company. Then, in the January-February 2012 issue, he discussed the long rise and eventual collapse of another American brewery — Falstaff.

In this issue, on page 26, he takes a look at another American brewer that started small, but made it big, only to have external circumstances intervene. Learn about Heileman Brewing and also kräusening, a technique the company touted in its ads.

Anhydrous equivalents?

After reviewing your resource page on your website and under the carbonation chart, I am wondering if anhydrous glucose (anhydrous dextrose) is the same as dried malt extract? Also, do you have a chart that includes the volumes of CO_2 for bottle conditioning when it comes to using unfermented wort to carbonate?

Brent Brewer
via email

The resource guide gives the amount of priming sugar to use if you chose anhydrous glucose, glucose monohydrate or sucrose. These are all simple sugars. ("Anhydrous" means "without water" and "monohydrate" means "with one water molecule." The glucose you buy at your homebrew shop is most likely glucose monohydrate, a cheaper form of glucose than the anhydrous version.)

Dried malt extract is a mixture of maltose and other sugars and carbohydrates (such as "dextrins"). It is not equivalent to anyhydrous glucose. We don't include a dried malt extract option because dried malt extracts would vary somewhat depending on the mash conditions they were produced with.

Likewise, we don't include a chart for priming with wort. However, if you check out the article on page 26 of this issue, you'll see a technique for priming beer with fermenting wort — kräusening.

Late to late extract addition brewing

I have been brewing for over 20 years with good results. In all my years, the recipes call for adding the liquid extract right after you remove the grains then boil. In the recipes in your magazine, you add the liquid malt at or close to the end of boil. What is the reasoning for this and does it make better brew?

Jeff McCrave
via email

The idea of adding some of the malt extract late in the boil was first proposed by Steve Bader in the October 2002 issue of BYO. *Not too long after that, it became the standard for extract-based recipes in* BYO. *The basic rationale for this is that brewery-grade malt extract has already been boiled by the manufacturer and boiling it further will only darken your wort. Adding it late in the boil allows the extract to be sanitized, but not pick up much color.*

In addition, if you withhold some of the malt extract until the end of the boil, the specific gravity of the wort being boiled is lowered and this may help with hop utilization. (This is logical, but hasn't been proven.) BYO


GREAT
BRITISH
MALT

homebrew nation

READER PROFILE

Brewer: Phil Hochwalt

Hometown, State: Iowa City, Iowa

Years brewing: 7 years

Type of brewer: All-grain

Homebrew setup (volume, style, efficiency): My homebrew setup is arranged for 5-gallon (19-L) batches. The breakdown is as follows:

- mash tun/sparging system: 7.5-gallon (28-L) Rubbermaid cooler equipped with Bazooka-T screen and stainless steel ball valve. Sparge arm for fly sparging.
- 7.5-gallon (28-L) stainless steel brew pots, copper tubing wort chiller
- glass and Better Bottle carboys
- chest freezer modified with external overriding thermostat, wood collar, and two taps setup for 5-gallon (19-L) Cornelius kegs
- efficiency ~75%

Currently fermenting: imperial stout

What's on tap/in the fridge: strong Scotch ale, extra special bitter, Belgian tripel

How I started brewing: For the love of beer.

Recipe notes:
Scottish wee heavy is a style I've experimented with several times over the past few years. The inspiration for this recipe came from a craft beer aptly named Cold Smoke from Missoula, Montana's Kettlehouse Brewery. Over the years, the recipe has evolved, but the flavor maintains a strong malt character and low hop bitterness. While not absolutely necessary, the partial kettle caramelization adds to the sweetness and complexity.

reader recipe

BONSPIEL SCOTCH ALE (STRONG SCOTCH ALE/WEE HEAVY)
(5 gallons/19 L, all-grain)
OG = 1.075 FG = 1.019
SRM = 21 IBU = 21
ALC = 7.2%

Ingredients

11 lbs. (5.0 kg) British pale malt
1.5 lbs. (0.68 kg) Munich malt
1.0 lb. (0.45 kg) crystal malt 60 °L
3 oz. (85 g) chocolate malt
3 oz. (85 g) roasted barley
5.4 AAU Fuggles hops (1 oz./28 g at 5.4% alpha acid (60 mins.)
2.7 AAU Fuggles hops (0.5 oz./14 g) Fuggles hops (15 mins.)
1 pkg. Wyeast 1728 (Scottish Ale) yeast

Step by Step

Heat 18 quarts (17 L) of water to 170 °F (77 °C) and dough in. Mash at 156 °F (69 °C) for 60 minutes. Mash out with enough boiling water to bring the temperature to 168 °F (75.5 °C). Sparge slowly with 170 °F (77 °C) water. For partial kettle caramelization, collect 1.5 gallons from the first runnings, reduce to 0.5 gallons in separate brew pot. Collect the remainder of the wort in the main brew pot, boil for 80 minutes and add hops as described above. Add the partially caramelized first runnings to the main pot near the end of boil, chill the wort, and pitch yeast. Ferment around 58–60 °F (14.5–15.5 °C) for 1 week in primary, 4 weeks in secondary.

byo.com brew polls

Are you interested in brewing cask conditioned beers?

Yes, very much 49%
Yes, somewhat 33%
No, I'm not interested 18%

social homebrews

Join *BYO* on Facebook: www.facebook.com/BrewYourOwn

Follow *BYO* on Twitter at: @BrewYourOwn

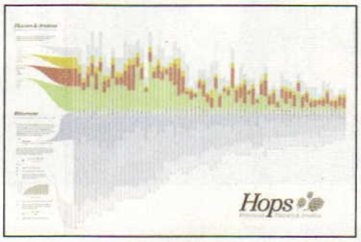
what's new?

Ruby Street Brewing Mega Ruby™

Based on demand for larger capacity equipment, Ruby Street Brewing, LLC has developed The Mega Ruby™, an all-grain brewing system featuring 30-gallon (114-L) kettles. The larger capacity system will easily brew 20-gallon (76-L) batches. The Mega Ruby™ features an all welded steel tube frame construction with industrial powder coated finish on a frame designed for convenience and portability.

For more information, visit www.rubystreetbrewing.com

Hops Chart



The Hops Chart poster indexes brewing hops with bitterness, flavor, and aroma characteristics. Use the Hops Chart to design better brewing recipes and keep tabs on what makes your favorite beers so great.

$30 http://hopschart.com/

Blichmann Engineering Tower of Power

Blichmann Engineering is releasing a new gasfired RIMS system built for ultra high accuracy. Simple to use, and easy to integrate into an existing system one module at a time or as a completely free-standing control unit.

More info at: www.blichmannengineering.com/TOWER_of_POWER/TOWER_of_POWER.html

Uncle Billy's Brew & Que · Austin Zealots Home Brewers "Beers from A to Z" · Austin Homebrew Supply EST. 1991

calendar

July 1
Uncle Billy's Keep Austin Beered Pro-Am
Austin, Texas

The Austin ZEALOTS homebrew club and Uncle Billy's Brew & Que present this competition that challenges brewers to make a beer in BJCP category 23 (special category selected: Zwickelbier/Kellerbier). If you win, Brian Peters and Amos Lowe at Uncle Billy's will brew your recipe and enter it into the 7th Annual GABF Pro-Am in 2012.
Entry Fee: $5 per entry
Deadline: June 24
Contact: George West, gswest1@gmail.com
Web: http://www.austinzealots.com/files/Uncle_Billy%27s_Keep_Austin_Beered_Pro-Am_Rules_2012.pdf

July 28
2012 German Fest Stein Challenge
Milwaukee, Wisconsin

This German Bier-only competition is limited to 300 entries. Entries submitted in categories 21A, 22B, 22C, and 23 MUST have a German Bier base style. One beer from the best of show round will be chosen to be ramped up and brewed by the Milwaukee Brewing Company for serving at the Milwaukee Ale House.
Entry Fee: $7
Deadline: July 14
Contact: Bruce Buerger Jr., brewmaster@bbbrew.com
Web: http://germanfesthbc.beerbarons.org/index.php?section=rules

August 25
Byggvir's Big Beer Cup
Shakopee, Minnesota

Byggvir's Big Beer Cup is only open to historically appropriate styles, which have, in some way, aspects that reflect back to beers of the Renaissance period.
Entry Fee: $7
Entry Deadline: August 12
Contact: Gera Exire LaTour, gera_latour@hotmail.com
Web: http://germanfesthbc.beerbarons.org/index.php?section=rules

homebrew nation

homebrew drool systems

BYO's Ultimate Home Bar Contest Winner

Tony Cronkhite • Rockford, Michigan

Thanks to everybody who posted photos of their home bars during the month of March on *Brew Your Own*'s Facebook page in our "Ultimate Home Bar Contest." With so many great entries it was a tough decision, but after lots of debate at the World Headquarters of *BYO*, Tony's amazing setup was the winner.

"I built the lower level of my home in 2009 to include a full bathroom, an office, the home bar, storage area and a small hair saloon area (I have all girls in the house and they are always changing their hair) as well as an eight-seat theater room.

"I had the idea for the build out from the time we built the house in 2007 as we wanted an area for entertaining and the bar ended up being the main focal point. It also grew a little from the original conception, but since this was "my" area no one really knew it was getting bigger until I built it, by then it was too late to go back and make it smaller.

"The construction took about six months from start to finish working on weekends and evenings. I did the entire project from design to completion myself with help from my wife.

"I added custom elements to the design to go along with my life interests, hockey, alcohol, motorcycles, but I wanted to keep it toned down not to end up being too cluttered or gaudy."

Tony's fantastic setup (which seems to have it all . . . except for taps) won him a brand new a triple tap homebrew kegerator to add to his incredible home bar courtesy of Beer Meister, LLC.

READING A WATER REPORT

by betsy parks

brewing water can be pretty confusing, especially to a new homebrewer who is starting to brew all-grain batches. All you need to know in the beginning, however, is if six certain ions in your water are in the proper range, which you can easily find out from reading a water report.

If you live in a place that has municipal water, you can request a water report from your department of public works. If you are using spring, well or some other source of tap water you won't have a public water report, but you can have it similarly tested for its content.

Water reports intended for the general public are typically expressed in parts per million (ppm), which is defined as one milligram of the substance per liter (1 mg/L).

The ions

The six important ions in water that you need to know about for brewing are: calcium, magnesium, bicarbonate (or total alkalinity as $CaCO_3$), sodium, chloride and sulfate.

• Calcium should be in the range of 50–150 parts per million (ppm). Calcium is an ion that makes water "hard," and it is important for many yeast, enzyme and protein reactions. Hardness is a measure of the calcium and magnesium content in water. When there is an equal amount of calcium and bicarbonate present, it is known as "temporary hardness," which can be reduced by boiling. Permanent hardness is measured by the amount of calcium that can't be removed by boiling. Water hardness is neither good nor bad, depending on what style of beer you want to brew. For example, temporary hardness is good for dark beers and permanent hardness is good for brewing pale ales. Research the style of beer that you want to brew to figure out if the hardness of your brewing water is appropriate for what you want to brew.

• Magnesium should be in the range of 0–30 ppm. It also contributes to water hardness and is a yeast nutrient. Magnesium is best kept at small amounts because it can contribute off/bitter/metallic flavors to the beer. Magnesium can also give food and beverages a laxative effect, which is another reason to limit this ion in brewing water.

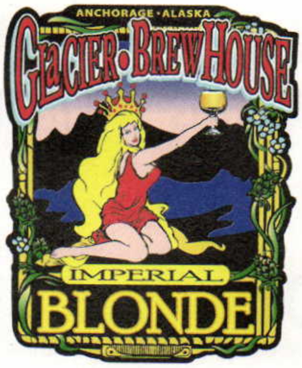
• Bicarbonate should be 0–250 ppm - or if your report reads as "total alkalinity" it should be in the 0–200 ppm range. More specifically (according to John Palmer's *How To Brew*), bicarbonate should be 0–50 ppm for pale, base-malt only beers. 50–150 ppm for amber colored, toasted malt beers and 150–250 ppm for dark, roasted malt beers (these levels assume calcium in the range of 50–100 ppm to balance the alkalinity of the bicarbonate). Bicarbonate affects the pH of your water. A high pH in the mash can cause poor extraction rates, darken the wort, and leach more tannins into your mash. (For more information about pH in brewing, visit www.byo.com/component/resource/article/1525)

• Sodium should be between 0 and 150 ppm. Sodium in moderate levels can accentuate malt flavor.

• Chloride can be anywhere between 0 and 250 ppm. Chloride is similar to sodium in that it can accentuate malt flavor if it is in a moderate range. If there is too much chloride, however, the beer can suffer from off flavors.

• Sulfate should be around 0 to 150 ppm. Sulfate can accentuate hop bitterness in moderation, but too much can make the bitterness seem harsh.

by marc martin



DEAR REPLICATOR, I WILL BE RETIRING AS A BOEING 777 CAPTAIN FOR A MAJOR PACKAGE DELIVERY COMPANY SOON, AND ONE FINE ESTABLISHMENT THAT WAS A REGULAR STOP FOR ME WAS GLACIER BREWHOUSE IN ANCHORAGE, ALASKA. THE ONE BEER THAT REALLY STANDS OUT FOR ME IS THEIR IMPERIAL BLONDE ALE. SINCE I WILL NO LONGER BE FLYING I HOPE YOU CAN HELP ME REPLICATE IT SO I CAN STILL ENJOY ONE OF MY ALL TIME FAVORITE BEERS.

CAPTAIN MICHAEL M. KEELEY
HOT SPRINGS VILLAGE, ARKANSAS

While Alaska is far from having as many breweries as Colorado, California or Oregon they have been doing their best to catch up. In fact, the state is now vying for the title of "most breweries per capita." Founded in May of 1996 Glacier BrewHouse has helped to lead the charge. They were one of the pioneers of bringing good craft beer to what was previously a macro beer stronghold. Now they are expanding Alaskan palates even further with their extensive barrel aging cellar.

Brewmaster Kevin Burton's college law degree and a lucrative law practice couldn't prevent him from succumbing to the brewing bug. His wife bought him a homebrewing kit for his 30th birthday and he was hooked. Attending the Siebel Institute and a two year stint at another Anchorage brewery, Midnight Sun, prepared him to take the helm at Glacier. Lead brewer, Drew Weber, was stranded in Anchorage on 9/11. He liked the area so much that he got a job at Glacier as a busser and eventually worked his way into the brewery. After completing the Siebel online course he quickly became Kevin's right hand man.

Glacier's beers are found only in limited distribution to Alaska and Washington state and fully 50% of their production is sold through their own taps. Total production for 2011 was 4,400 barrels.

The Imperial Blonde Ale was originally brewed as a request beer for the Denali mountain area climbers from Talketna, Alaska. They preferred to call it Ice Axe Ale. The goal was to produce a higher alcohol beer that was light in body, creamy and smooth but with low bitterness. Each gallon is made with a full half pound of honey which contributes to the light body and clean dry finish.

Michael, you will still be able to enjoy your favorite blonde ale because you can "Brew Your Own." For more about Glacier BrewHouse and their other fine beers visit the website www.glacierbrewhouse.com or call the brewery at 907-274-2739. BYO

GLACIER BREWHOUSE'S IMPERIAL BLONDE ALE clone
(5 gallons/19 L, extract with grains)

OG = 1.081 FG = 1.010 IBU = 25 SRM = 6 ABV = 9.0%

Ingredients

6.6 lbs. (3.0 kg) Muntons light, unhopped, malt extract
2.5 lbs. (1.13 kg) dried malt extract
14 oz. (0.39 kg) 2-row pale malt
14 oz. (0.39 kg) Pilsner malt
10 oz. (0.28 kg) flaked barley
12 oz. (0.34 kg) Carapils® dextrin malt
2.5 lbs. (1.13 kg) clover honey (last 5 min.)
6.8 AAU Centennial hop pellets (0.65 oz./18.4 g at 10.5 % alpha acid) (60 min.)
2.6 AAU Centennial hop pellets (0.25 oz /7.16 g at 10.5% alpha acid) (30 min.)
5.25 AAU Centennial hop pellets (0.5 oz /14.2 g at 10.5% alpha acid) (0 min.)
½ tsp. yeast nutrient (last 15 minutes of the boil)
½ tsp. Irish moss (last 30 minutes of the boil)
White Labs WLP 001 (American Ale) or Wyeast 1056 (American Ale) yeast
0.75 cup (150 g) of corn sugar for priming (if bottling)

Step by Step

Steep the crushed grain in 2 gallons (7.6 L) of water at 155 °F (68 °C) for 30 minutes. Remove grains from the wort and rinse with 2 quarts (1.8 L) of hot water. Add the liquid and dried malt extracts and boil for 55 minutes. Add the honey and boil for an additional 5 minutes. While boiling, add the hops, Irish moss and yeast nutrient as per the schedule. Now add the wort to 2 gallons (7.6 L) of cold water in a 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. Allow the beer to condition for 1 week and then bottle or keg. Allow the beer to carbonate and age for 3 to 4 weeks and enjoy your Imperial Blonde Ale.

All-grain option:

This is a single step infusion mash using an additional 3 lbs. (1.36 kg) 2-row pale malt and 8.5 lbs. (3.9 kg) of Maris Otter pale malt to replace the liquid and dry malt extracts. Mix the crushed grains with 4.5 gallons (17 L) of 175 °F (79 °C) water to stabilize at 155 °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. Reduce the 60-minute hop addition to 0.5 oz. (14 g) Centennial hop pellets (5.25 AAU) to allow for the higher utilization factor of a full wort boil. The remainder of this recipe and procedures are the same as the extract with grains recipe.

Note: For better flavor, Kevin recommends additional aging time for this high gravity beer.

Name of the Strain

Choosing the proper yeast

by Betsy Parks

THE GREAT THING ABOUT BEING A HOMEBREWER IN THIS DAY AND AGE IS THE WIDE ARRAY OF INGREDIENT CHOICES, INCLUDING YEAST. BUT HOW DO YOU ACTUALLY CHOOSE THE RIGHT STRAIN? IN THIS ISSUE, THREE YEAST EXPERTS SHARE SOME ADVICE.

If you aren't sure about what strain to use when you are trying to choose a yeast strain, always ask somebody who knows more about yeast strains. Also, choose a strain that is easy to work with at first. A lot of beginner homebrewers will start with a simple strain — like California Ale yeast, which is appropriate for a lot of different styles, and will also perform well. If you want to use just one strain for most of your beers, I think it's ok if you want your beers to all be very similar. On the other hand, do you want to make those beers a little more distinct? If you want to differentiate each beer somehow you don't have to change your recipe, just change up the strain of yeast you are using.

One method of experimenting with yeast strains, which is something that we do here a lot, is brewing up one big batch of beer, splitting it up into a bunch of small batches and fermenting each small batch with different yeast strains. This is a good controlled experiment that will show the different flavor characteristics of each strain.

The most common mistake I've seen with brewers choosing yeast strains is people not choosing the right strain that is appropriate for the style. It's fun to experiment with different strains, of course, but some strains just simply don't match the style and will produce unpleasant results.

If you are unsure about choosing a yeast strain, talk to people who have used a particular strain that you might be interested in using, or talk to your homebrew shop staff. Homebrew suppliers field these kinds of questions all the time. Also, definitely experiment with various yeast strains at home because you might find some that make a really great beer.

Neva Parker, Head of Laboratory Operations at White Labs Inc. in San Diego, California. Neva has been with the White Labs family since 2002. She earned her bachelor's degree in microbiology from Gonzaga University in Spokane, WA. She became interested in beer while studying abroad in London when she attended the annual Campaign for Real Ale (CAMRA) festival.

flavor profile is the most important factor when selecting a strain for small scale brewing. Use a strain that complements the style (e.g. a phenolic positive strain when clove and other phenolics are desirable or a "clean" strain when the brewer does not want yeast character to interfere with the malt and hop aroma). Other factors to consider are temperature range (ability to control) and alcohol tolerance.

If you find a strain you like, it's ok to use it for a variety of beers. There are a lot of versatile strains that perform well in a broad spectrum of styles. It is very common for commercial breweries to use one "house" strain (typically an American or British strain) for the majority of their production. Once you find a strain that you like, try it in a few other styles. Some common versatile strains include 1056 American Ale, 1968 London ESB, 1098 British Ale, and 1272 American Ale II.

Try experimenting with strains at home by breaking up a batch. I typically brew 10-gallon (38-L) batches and split it between two fermenters with different strains. This is a great way to learn how different strains affect the flavor profile. Other parameters including temperature and pitch rate can also be manipulated with split batches. I am always experimenting with using different strains under different conditions. With split batches, I typically use a control strain (1056 or other favorite strain for the style) next to a new strain or one that I haven't played with for a while.

Greg Doss, QC Manager/ Microbiologist at Wyeast Laboratories in Odell, Oregon. Greg graduated from Oregon State University in 1996 where he earned a B.Sc. degree in microbiology. Following college he brewed professionally for five years. In 2000, he joined the staff of Wyeast.

Jamil Zainasheff, Co-Author of *Yeast: The Practical Guide To Beer Fermentation* (Brewers Publications, 2010) and *BYO* "Style Profile" columnist. Jamil started homebrewing in 1999, and was awarded the prestigious Ninkasi Award in 2004 and 2007. He has been the "Style Profile" columnist for *Brew Your Own* since 2007.

There are so many important differences between strains, that it is difficult to focus on just a few when choosing a proper strain. In general, however, probably the best starting point for yeast selection is the overall flavor profile. Do you want yeast that produces Belgian-style phenols? British-style esters? Or a lager-like low ester beer? That should narrow down the field. Then you can start to consider things like attenuation, temperature range, and more.

If you want to experiment at home, do side-by-side comparisons of different strains. Make sure all the fermentation vessels are the same and use the same wort for all. Keep an eye on pitching rates and fermentation temperatures, so you are comparing apples to apples. If you have never done this before, you will be shocked at the differences between the beers. In many cases, you would wonder if there were different malts, hops, or even spice additions in one beer versus another. You can also try blends of two or more strains with interesting results. The yeast companies are now posting more and more information about the fermentation characteristics of their yeasts. While this information cannot tell you what yeast you should use, it can help you compare various strains and decide which ones might be great for trials.

In my opinion, the most common mistake homebrewers make when choosing a yeast strain is worrying about alcohol tolerance. Most brewers yeast strains, when pitched in the proper amounts and given the right nutrients, will tolerate fairly high levels of alcohol. It isn't until you are pushing 15% ABV and greater that you start seeing a lot of trouble. So, for those 12% ABV and lower beers, alcohol tolerance should be the last thing you worry about. BYO

Fermentation Finish

Plus "hopbursting" decoded

by Ashton Lewis

Q I AM AN ALL-GRAIN BREWER WHO CANNOT SEEM TO HIT MY FINAL GRAVITY ON ANY OF MY BREWS. I JUST FINISHED A STOUT THAT SHOULD HAVE GOTTEN DOWN TO ABOUT 1.020 SPECIFIC GRAVITY EVEN WITH THE ROASTED GRAINS, BUT IT STOPPED AT 1.037 AFTER TWO WEEKS. I AM AERATING MY WORT WITH AN AIR PUMP AND AIR STONE, I AM USING A YEAST STARTER, ADDING YEAST NUTRIENT, AND USING A TEMPERATURE CONTROLLED FREEZER WITH A CONICAL FERMENTER. I DON'T KNOW WHAT I AM DOING WRONG!

JASON MANZANO
VIA EMAIL

A This is a difficult question to address because there are some important facts that are missing, such as wort original gravity (OG), grist bill, mashing method, yeast strain and fermentation temperature. But your problem is not uncommon to many new brewers and some general advice may help you with continuing to brew batches of beer that don't seem to finish.

I really want to know the wort OG because this has a real influence on the final gravity. A good rule of thumb for estimating expected final gravity is to multiply the number of gravity points in your wort (or °Plato for those like me who use Plato) by 0.2–0.25. For example, if the OG of this batch were 1.080 (80 gravity points) I would expect the batch to finish somewhere between 1.016 and 1.020. If the OG was actually 1.110, for example, the expected final gravity would be 1.022–1.028. If the recipe indicated something different from this range I would question the accuracy of the recipe. In your case, this brew really finished high and there is a problem beyond the obvious.

Culprit number one on my list is the grist bill, in particular the special malts that you used for your stout. I am assuming now that you either are an all-grain brewer or you used extract with some special malts added. High percentages of caramel/crystal malts in the grist will certainly increase the finish gravity because these malts contain a much higher percentage of non-fermentable carbohydrates than do paler malts that have been mashed. This is due to the formation of Maillard reaction products during the production of these special malts. If you used large additions of special malts, that could explain part of the problem.

Assuming that you brewed your stout using all-grains and no extracts, the high final gravity could be the result of an excessively high infusion mash temperature, too short of a mash at the proper temperature (148–158 °F; 65–70 °C), excessively thick mash or mash pH out of the range of 5.2–5.5. The goal of mashing is the conversion of starch to fermentables and it is very important to accomplish the goal through careful control of all variables that influence conversion.

Then there is the yeast strain and fermentation temperature. It is good that you aerated your wort using a rig that should do a good job, you used yeast nutrients and used a starter for the yeast. These are all things that should help ensure a healthy fermentation. But even when you perform all of these procedures properly, it is still possible to have problems if you selected a finicky strain that flocculates early, has a tendency of hanging up, like some saison strains, or has a particular temperature affinity. I honestly doubt that you have a yeast problem due to the care it sounds like you seem to have taken, but it is certainly a very common cause of fermentation issues.

"This brew really finished high and there is a problem beyond the obvious."

Photo courtesy of Istockphoto.com

Q I KEEP READING ABOUT "HOPBURSTING" AS A METHOD, BUT CAN'T SEEM TO FIND ANY DETAILED DEFINITION OF IT — LET ALONE A TECHNIQUE. SO WHAT IS HOPBURSTING AND WHAT CAN I EXPECT FROM THIS TECHNIQUE? WHO USES IT? HOW CAN I IMPLEMENT IT?

MATT REILLY
WASHINGTON, DC

A I must admit Matt that this is a method I have not heard of, until doing a little research to help me with an answer. The cool thing about homebrewing is that techniques often take on interesting names, and in the case of "hopbursting" made my research a little easier. This is in contrast to methods used by commercial brewers that frequently are used generically. I think the reason for this is that commercial brewers often develop methods that are viewed as "trade secrets" and as such are not named.

Mitch Steele, Brewmaster of Stone Brewing, helped me out on this one by digging around in the San Diego homebrew community and talking to Jamil Zainasheff, who has used this method. Here is what Jamil explained about it:

"Long ago I ran across a few commercial beers that were massively late hopped and had little or no bittering charge. The aroma wasn't anything more than you would expect from dropping in massive amounts of hops near the end of the boil, but the bittering had a "softer" character. It seemed to me at the time that boiling hops for a longer time not only resulted in more isomerized hop acids, but a harsher bittering the longer you boiled them. By switching to a shorter boil and a greater quantity of hops, you got a softer bittering and more hop character because you tossed in lots of late hops.

"I tried this when homebrewing for an article for *Zymurgy* a while back, and also had a number of other folks try the same thing. We used a standard boil time (60 to 90 minutes), a very small or no early hop addition (a few IBU at most), massive hopping the last 10 to zero minutes, and then rapidly chill the entire wort with an immersion chiller. Quick chilling of the entire wort retains more of the hop character. Of course, you are limited to how many IBU you can get so a really high IBU beer with this method is tough.

"In our initial commercial batches we tried this on a beer, adding massive hops at the end of the boil. Unfortunately, the hot stand in the whirlpool and during knockout was so long that we were getting 70 IBU even with no other additions. We switched to pre-chilling our water and also moved a lot of the hops over to dry hopping to get the IBUs down into the 40–50 range. The only issue is that dry hopping doesn't give the same character as late kettle hops. In our new brew plant we're going to try a hopback to see if we can get more of that late addition character instead."

I was just at the Craft Brewers Conference in San Diego and picked up some information related to the topic of new beers and brewing techniques. You ask who uses a method like hopbursting and why. A talk I listened to about Gen Y gives some insight into this general question. We know about the origins of this particular technique, but what about boundary pushing things in general? Many of these new methods are developed by brewers who want to try something completely contrary to conventional wisdom; apparently this is one of the traits of the Gen Y crowd. The "why" originated as simply doing something different in the kettle for a specific purpose, and this evolved into a method that delivers an intense hoppiness that is different than adding hops early in the boil for bitterness followed by aroma hops added late in the boil.

On a very practical note, Mitch commented that it may be a good idea to add a very small hop addition to the kettle when the boil begins, or right before the boil, to help control foaming. This is indeed sound advice since unhopped wort foams much more intensely than hopped wort. Like the old Dippity Do adds, a little dab will do you. If you are concerned about adding too much bitterness, select a low alpha variety for this purpose.

Many of the hop bombs I sampled while in San Diego during the CBC had hop intensities that defy normal brewing techniques. The Palate Wrecker brewed by Green Flash Brewing is one example of a brew with very high hop bitterness, coupled with aromas and flavors that I have never tasted in a brew that was simply "highly hopped." Some of these beers are being brewed with unbelievably high hop charges approaching 1/10th pound per gallon! I like to think the name hopburst may have been inspired by Green (hop?) Flash (burst?). I imagine that some creative naming may follow a tasting session of some of these monsters!

Being one of those brewers who likes to calculate things, large late additions presents a conundrum in my math. One can assume that hops boiled for 20–30 minutes have a utilization of somewhere around 15–20%, but what about hops added 5–10 minutes before the end of the boil? Depending on how long the hot wort is held to help settle hop solids the utilization reports found in the literature vary from about 5–15%. This makes it very difficult to "accurately" calculate late hop additions if you want to hit a target bitterness level. I think most brewers who are brewing these hoppy giants are more than likely relying on empirical methods more than anything. If the last brew had 30 pounds (14 kg) of hops dumped into a 10 BBL (310-L) batch and it turned out well, the next batch may contain 33 pounds (15 kg) because a 10% increase "feels right".

I was still trying to wrap my mind around this "hopbursting" method when I listened to a talk presented by Dr. Tom Shellhammer from Oregon State University. Some of the data presented directly relates to this topic and raised some interesting ideas. For starters, Tom discussed how the "old school" IBU method, where iso-octane is used to extract iso-alpha acids from beer, responds to more than simply iso-alpha acids. For example, polyphenols and alpha acids from hops directly affect the results of the IBU measurement. Many brewers assume that 1 IBU corresponds to 1 mg/L of iso-alpha acids, and the data presented in Dr. Shellhammer's talk clearly showed that this is not correct. As it turns out, the error becomes greater when huge late hop additions are made since late additions increase the polyphenol content of wort and beer more than early additions (polyphenols precipitate with proteins during boiling) and late additions also increase the amount of alpha acids present in wort and beer. Neither class of compounds significantly contribute to beer bitterness, meaning that the increase in IBUs measured using the iso-octane method is misleading.

I realize that I am drifting off topic, but this is interesting to me! Tom reported that this error is not seen when a more specific method is used to quantify iso-alpha acids in beer is used. The current standard accepted by the American Society of Brewing Chemists (ASBC) and the European Brewing Convention (EBC) is based on high performance liquid chromatography (HPLC). The HPLC method accepted by both the ASBC and EBC separates the constituents of beer using a chromatographic column and a detector to quantify the concentrations of the various compounds that are eluted from the column during the course of the run.

The interesting thing with all of this is that very few small breweries have HPLCs in their labs and do not use this method for measuring IBUs in beer. The iso-octane method, however, is pretty easy to perform if you have a UV spectrophotometer. The punch line is that an IBU is not an IBU . . . it depends on the method used in the lab. Most of you are probably thinking, "what's the big freaking deal, so what?" The big deal is that IBUs have become a bragging right in the community of extreme brewers. And based on the data I saw at the CBC I am thinking that some of the claims of very high IBUs, some as high as 150, are due to errors in the iso-octane method.

My point with all of this is that beers brewed by adding lots of hops late in the boil do indeed have interesting and different hop characters. But this method in general is a bit too new for much math to be available to help the brewer when it comes to beer formulation. This is one of those times when you need to rely on good notes, experimentation, patience and persistence to end up with the type of beer you seek. I saw an interesting show recently about the evolution of the guitar during the 20th century. Things got pretty interesting when the electric guitar was invented and then amped. Feedback was discovered and this led to the development of all sorts of pedals. None of these things could be put on paper with the musical notations used for centuries by composers, but that did not stop musicians like Jimi Hendrix from developing a whole new sound and style of guitar playing. I think this hopbursting method may be the brewing equivalent of feedback. As Wayne may have said, brew on, Garth! BYO

Ashton Lewis is the Brewmaster and Co-Owner at Springfield Brewing Co. in Springfield, Missouri. Do you have a question for Mr. Wizard? Email your questions with your name, city and state to wiz@byo.com.

Belgian Dark Strong Ale

Big, malty and spicy

by Jamil Zainasheff

I used to hate judging the Belgian strong category in competitions. Long ago, so many of the beers were syrupy sweet alcohol bombs that I found it most unpleasant. While Belgian dark strong ale is a beer with a higher level of alcohol, it should not be syrupy sweet. Luckily, with brewers practicing better fermentation control the typical Belgian strong ale category in competitions is now much more pleasant to judge.

Belgian dark strong ale ranges from 8 to 11% ABV with significant fruity esters and optional spicy notes from fermentation. The warming alcohol should be subtle and smooth. The body should be medium to full and the malt character rich and complex. Good examples will have some malt sweetness as well, but it can range from somewhat dry to fairly sweet. Even though hops play a role in balancing the overall character of this style, fermentation is really the centerpiece. Belgian dark strong ale is a complex mix of fruity esters (raisin, fig, plum, cherry, and more), alcohols (floral, spicy, sweet, bitter), and sometimes a delicate phenolic spiciness (pepper, clove). One thing to note is that the color of this style has a wide range, from deep amber to copper-brown.

The base malt for this style is continental Pilsner malt. Pilsner malt lends a slightly sweet, grainy malt character to the beer. If you can source it, Belgian Pilsner malt is ideal. If you cannot, do not worry, even the Belgian brewers use other continental Pilsner malts. If you are an extract brewer, try to use an extract made from Pilsner malt. Recipes for this style range from very simple to overly complex. I have made award-winning examples using both. If you want to go with a simple, more traditional recipe, Pilsner, Munich and dark Belgian candi syrup is all you need.

Overly complex recipes are often too malty and the flavors are muddy. Yet, despite that, my early complex recipes for this style always scored higher than the less complex versions. Specialty malts such as aromatic, melanoidin, CaraMunich®, Special B®, and biscuit are all fair game in this style. The trick is to build a rich malt character, with a balanced malt sweetness, while avoiding an overall muddy, generic maltiness. Good fermentation helps with this, but keep the total specialty malts down below 20% of the total grist.

When brewing a bigger beer with high starting gravities, you normally target a lower mash temperature to ensure a highly fermentable wort. In the case of Belgian dark strong, most judges seem to prefer the fuller, richer character that a higher mash temperature provides. You do not want it to be excessive, but a mash temperature around 152 °F to 154 °F (67 to 68 °C) is a good starting point. For extract brewers, most light colored extracts attenuate well enough. Whether all-grain or extract you can use a portion of simple sugar, such as table sugar or a Belgian-type candi sugar. Keep in mind that you want a rich beer, with a medium to full body, so do not over do it. Generally, 5 to 10% of the grist is plenty. If you want to use lots of Belgian dark candi syrup for character, then you might also need to raise the mash temperature to compensate.

The dryness and firm bittering of most higher gravity Belgian ales comes from a combination of alcohols, phenols, carbonation and minimal hops. I prefer to stick with noble hops such as Saaz, Hallertau, or Tettnang. Traditionally, breweries also use Styrian Goldings and in a pinch other varieties such as Mount Hood, Liberty, or Kent Goldings are fine as well. I prefer a single large charge of low alpha hops near the beginning of the boil. The flavor of that early addition can carry through and will provide a subtle hop character. Nowadays more brewers are experi-

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BELGIAN DARK STRONG ALE
by the numbers

OG:	1.075–1.110 (18.2–25.9 °P)
FG:	1.010–1.024 (2.6–6.1 °P)
SRM:	12–22
IBU:	20–35
ABV	8–11%

Photo by Charles A Parker/Images Plus

Belgian Dark Strong Ale
(5 gallons/19 L, all-grain)

OG = 1.103 (24.4 °P)
FG = 1.024 (6.0 °P)
IBU = 31 SRM = 21 ABV = 10.6%

Ingredients

13.44 lb. (6.10 kg) Best Malz Pilsen or similar Continental Pilsner malt (2 °L)
2.75 lb. (1.25 kg) Best Malz Munich malt (8 °L)
14.1 oz. (400 g) Franco-Belges Special Aromatic malt (20 °L)
14.1 oz. (400 g) Franco-Belges Caramel Munich 60 malt (60 °L)
14.1 oz. (400 g) Franco-Belges Caramel Munich 120 malt (150 °L)
13.4 oz. (380 g) cane or beet sugar (0 °L)
7.1 oz. (200 g) Best Malz melanoidin malt (28 °L)
7.1 oz. (200 g) Great Western wheat malt (2 °L)
8 AAU Hallertau pellet hops (2 oz./57 g at 4% alpha acids) (60 min.)
White Labs WLP530 (Abbey Ale) or Wyeast 1762 (Belgian Abbey II) yeast

Step by Step

Mill the grains and dough-in targeting a mash of around 1.5 quarts of water to 1 pound of grain (a liquor-to-grist ratio of about 3:1 by weight) and a temperature of 153 °F (67 °C). Hold the mash at 153 °F (67 °C) until enzymatic conversion is complete. With the low mash temperature, you may need to lengthen the rest time to 90 minutes or more to get full conversion. Infuse the mash with near boiling water while stirring or with a recirculating mash system raise the temperature to mash out at 168 °F (76 °C). Sparge slowly with 170 °F (77 °C) water, collecting wort until the pre-boil kettle volume is around 6.5 gallons (24.4 L) and the gravity is 1.080 (19.3 °P).

The total wort boil time is 90 minutes, which helps reduce the S-Methyl Methionine (SMM) present in the lightly kilned Pilsner malt and results in less Dimethyl Sulfide (DMS) in the finished beer. Add the bittering hops with 60 minutes left in the boil. Add the sugar and Irish moss or other kettle finings with 15 minutes left in the boil. Chill the wort rapidly to 68 °F (20 °C), let the break material settle, rack to the fermenter, pitch the yeast and aerate thoroughly.

You will need 3 packages of liquid yeast or you can make a 4-L starter from 1 package. Pitch yeast at 68 °F (20 °C), aerate or oxygenate, and let the temperature rise slowly to 72 °F (22 °C) by the last ⅓ of fermentation. Ferment until the yeast drops clear. With healthy yeast, the bulk of fermentation should be complete in a week, but do not rush it. It is important for the beer to attenuate fully. If you have trouble getting enough attenuation in big beers, you can hold off on adding the sugar to the boil. Instead, after the fermentation looks like it has started to slow, mix the sugar with just enough boiling water to make a syrup, then add that to the fermentation.When finished, carbonate the beer to approximately 2.5 to 3 volumes and serve at 45 to 50 °F (7 to 10 °C).

Belgian Dark Strong Ale
(5 gallons/19 L, extract with grains)

OG = 1.103 (24.4 °P)
FG = 1.024 (6.0 °P)
IBU = 31 SRM = 21 ABV = 10.6%

Ingredients

9.5 lb. (4.3 kg) Pilsner liquid malt extract (2 °L)
2.75 lb. (1.25 kg) Best Malz Munich malt (8 °L)
14.1 oz. (400 g) Franco-Belges Special Aromatic malt (20 °L)
14.1 oz. (400 g) Franco-Belges Caramel Munich 60 malt (60 °L)
14.1 oz. (400 g) Franco-Belges Caramel Munich 120 malt (150 °L)
13.4 oz. (380 g) cane or beet sugar (0 °L)
7.1 oz. (200 g) Best Malz melanoidin malt (28 °L)
7.1 oz. (200 g) Great Western wheat malt (2 °L)
8 AAU Hallertau pellet hops (2 oz./57 g at 4% alpha acids) (60 min.)
White Labs WLP530 (Abbey Ale) or Wyeast 1762 (Belgian Abbey II) yeast

Step by Step

Freshness is vital for a great beer. If you cannot get fresh liquid malt extract, it is better to use an appropriate amount of dry malt extract (DME) instead, since it does not oxidize nearly as fast and tends to be fresher. This recipe has several grains that need starch conversion: Munich, aromatic, melanoidin, and wheat malt. While there are Munich and wheat malt extracts that you can substitute, there are no substitutes for the others. The best thing to do is a partial mash. It is essentially the same as steeping your specialty grains, just pay attention to temperature. You will not get perfect conversion of the starches, but it is better than blindly steeping grains.

Mill or coarsely crack the specialty malt and place loosely in a grain bag. Avoid packing the grains too tightly in the bag, using more bags if needed. Steep the bag in about 2 gallons (~8 liters) of water at 160 °F (71 °C) for about 60 minutes. Lift the grain bag out of the steeping liquid and rinse with more warm water. Allow the bags to drip into the kettle for a few minutes while you add the malt extract. Do not squeeze the bags. Add enough water to the steeping liquor and malt extract to make a pre-boil volume of 6.5 gallons (24.4 L) and the gravity is 1.080 (19.3 °P). Stir thoroughly to help dissolve the extract and bring to a boil. Follow the boiling, fermentation, and packaging instructions for the all-grain version.

menting with increased hop character in all beers, but I would still avoid going with late additions in this style. The bitterness-to-starting gravity ratio (IBU divided by OG) ranges between 0.2 and 0.5, although most brewers will want to target approximately 0.3 unless you are getting a very dry finish from fermentation.

The characteristic fruity/spicy flavors and aromas of this style come from fermentation, not from the addition of fruits or spices. While some brewers may add spices, the problem is that spices will never really take the place of proper fermentation. The subtle complexity that comes from fermentation cannot be faked by spice additions. It is better to focus on perfecting fermentation.

There are several great yeast strains for brewing this style, but two of my favorites are White Labs WLP530 (Abbey Ale) or Wyeast 1762 (Belgian Abbey II). Other excellent choices are White Labs WLP500 (Trappist Ale), WLP540 (Abbey IV Ale Yeast), WLP545 (Belgian Strong Ale), WLP550 (Belgian Ale Yeast), Wyeast 3787 (Trappist High Gravity), and Wyeast 1214 (Belgian Abbey). When selecting yeast, keep in mind that this style is more about the fruity notes than spicy phenols.

One question many brewers have about Belgian beers is fermentation temperature. Often homebrewers will say, "Brewery X ferments their beer at xx °F, so that is the fermentation temperature I use." However, that most likely will not be the right temperature for you. Temperature is only one of many fermentation parameters. For example, fermenter height plays a role in flavor development, with very tall fermenters (like big commercial cylindroconical types) suppressing ester and fusel alcohol production. The shape of the brewery's fermenters, their pitching rates, their oxygen levels, their yeast collection and repitching methods may all be different from yours, which changes the production of esters, fusel alcohols and other aspects of fermentation. When you use the same fermentation temperature in your brewery with disregard for the other parameters, you may end up with fruit salad dissolved in paint thinner. Well, maybe not that bad, but pretty darn close. Do not let "how the classic brewery does it" determine your process unless you are using the same equipment and methods. Instead, get to know the beer style intimately and work on adjusting your process until you are making an outstanding example. It might take many tries and a vastly different process for you to achieve those results, but that is the fun of homebrewing.

With most of these yeasts I recommend pitching at a rate of 0.75 million cells per milliliter per degree Plato (see the pitching rate calculator at www.mrmalty.com for help in calculating this for your beer). Pitch the yeast and allow 12 to 36 hours for the majority of yeast growth, then ramp up the temperature for the rest of fermentation to ensure good attenuation. For example, pitch the yeast at 68 °F (20 °C) and at the end of the next day slowly begin raising the temperature each day. Try to end up at 72 °F (22 °C) by the last ⅓ of fermentation. You may find a higher or lower temperature or a faster or slower rise in temperature gives you the ideal result, so do not be afraid to tweak the parameters until you get it right.

One concern with a beer this big and full of specialty malts is getting enough attenuation to avoid too sweet a finish. Many brewers go with lower and lower mash temperatures in an attempt to achieve this, but that is not always the problem. It isn't that you need to get rid of all of the long chain dextrins. Those dextrins are not

Belgian Dark Strong Ale Commercial Examples

Achel Trappist Extra
Brouwerij der St. Benedictusabdij de Achelse
Hamont-Achel, Belgium
www.achelsekluis.org

Allagash Black
Allagash Brewing Co.
Portland, Maine
www.allagash.com

Brother Thelonious
North Coast Brewing Co.
Fort Bragg, California
www.northcoastbrewing.com

Chimay Grande Reserve (Blue)
Bières de Chimay S.A.
Baileux (Chimay), Belgium
www.chimay.be

Judgment Day
The Lost Abbey
San Marcos, California
www.lostabbey.com

Rochefort 10 (blue cap)
Brasserie de Rochefort
Rochefort, Belgium
http://users.pandora.be/gerritvdb/rochefort/English/RochefortIndex.htm

Salvation
Russian River Brewing Co.
Santa Rosa, California
http://russianriverbrewing.com/

St. Bernardus Abt 12
Brouwerij St. Bernardus
Watou, Belgium
www.sintbernardus.be

Trois Pistoles
Unibroue
Chambly, Quebec
http://www.unibroue.com/

Westvleteren 12 (yellow cap)
Brouwerij Westvleteren
Westvleteren, Belgium
www.sintsixtus.be

very sweet and they can be present in a dry beer. The important thing is to make sure you ferment out all of the simpler sugars completely. If you leave a lot of unfermented maltose, then the beer is going to taste sweet, even though it might attenuate well. The key to attenuation is starting with a healthy pitch of yeast, aerating or oxygenating properly and controlling fermentation temperatures.

Oxygen is important to yeast health and is necessary for fermentation to reach terminal gravity in a reasonable amount of time. However, too much or too little oxygen can have unintended consequences, so adding the right amount of oxygen is important. That is difficult for many homebrewers, but you should try to control the amount of oxygen added by measuring timing and flow rate. The amount of oxygen required is a balancing act and can result in excessively high or low esters and fusel alcohols. If you are using air, there is no chance of over-aerating your wort, but there is a chance of under-aerating. If you are using oxygen with a sintered stone, a good starting point for 5 gallons (19 L) is a flow of 1 L per minute for 1 minute. You might go up or down from there, as experience shows you what is right for your brewing. If you find yourself getting stuck fermentations when brewing high gravity beers, you can add a second dose of oxygen between 12 and 18 hours after pitching. The second dose should be about ½ to ¾ the normal amount of oxygen. This will give the yeast the ability to rebuild their cell membranes after having replicated. They will better tolerate the high alcohol environment ahead with this additional dose of oxygen.

If you are having trouble getting the beer to attenuate enough, one trick that might help a little is waiting until the fermentation is nearly done before adding the simple sugars. Wait until fermentation has started to slow and then add the sugar. When I do this I dissolve the sugar in just enough boiling water to make a thick syrup. Once it cools, I add it to the beer.

If all else fails and you still are not getting full attenuation, you can pitch an actively fermenting lager yeast into the stuck beer, which will consume some complex sugars that the ale yeast will not. Do not add this extra dose of yeast if they are not in an active fermentation state, because they will just settle out in a high alcohol, low sugar environment. Make a small starter and wait until the yeast are at high kräusen before you add it to the beer.

If your beer is attenuating properly but still tastes sweeter than it should, it might be fermentation related compounds that are making it seem sweet. If that is the case, then you need to revisit your fermentation parameters and /or try a different yeast strain. BYO

Jamil Zainasheff writes "Style Profile" in every issue of BYO.

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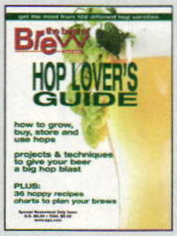

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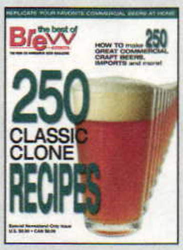

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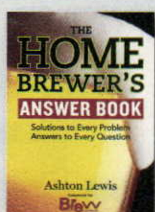

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THE HOUSE of HEILEMAN

Story by **Bill Pierce**

THE RISE, FALL AND REBIRTH OF BEER FROM "GOD'S COUNTRY"

While two large brewing conglomerates — Anheuser-Busch InBev and MillerCoors — now account for more than 78% of US beer sales, and craft beers are enjoying a renaissance, these are relatively recent phenomena. As late as the 1990s, a significant number of regional breweries produced popular brands that had a major share of local markets in some of America's largest cities. Among these was the G. Heileman Brewing Company, which operated from the small city of La Crosse, Wisconsin, for nearly 140 years from 1858 to 1996. Their legacy includes names still familiar to, and fondly remembered by, many American beer drinkers.

From The Old Country To The New

The roots of Heileman, like so many American brewing stories, go back to Germany, where Johann Gottlieb Heileman was born in the southern state of Wurttemberg in 1824. In 1852 he left for America and soon settled among many other German immigrants in Milwaukee, where he helped to found a bakery. Five years later he moved to the western Wisconsin city of La Crosse, which was growing due to lumbering and shipping on the Mississippi River. His first job there was at a small brewery recently started by fellow German immigrant Johann (John) Gund. After less than a year, Gund sold the brewery building and entered into an agreement with Heileman to build the new City Brewery. The partnership between Gund and Heileman lasted for 14 years until 1872, when Gund sold his interest to Heileman and went on to found his own John Gund Brewing Company. Heileman continued, changing the company name to G. Heileman Brewing, but was outsold by his former employer and partner. Among the problems was the sudden death of Heileman himself in 1878 at the relatively young age of 54. His widow Johanna struggled, but succeeded in keeping the brewery open, becoming the first female CEO of an American brewing company. She continued her involvement in the business until 1911, although in the later years operations were managed by son-in-law Emil Mueller.

Photo courtesy of TheBeerCanGuide.com

RECIPE

Old Style Light clone (American light lager)

(5 gallons/19 L, all-grain)

OG = 1.037 FG = 1.005
IBU = 14 SRM = 2–4 ABV = 4.0%

Ingredients

5 lb 10 oz. (2.6 kg) 6-row pale malt
1.5 lbs. (0.68 kg) rice syrup solids (add at beginning of boil)
2.7 AAU Cluster hops (60 mins) (0.38 oz./11 g of 7.0% alpha acids)
1.3 AAU Mt. Hood hops (25 mins) (0.25 oz./7.1 g of 5.0% alpha acids)
1.9 AAU Sterling hops (0 mins) (0.25 oz./7.1 g of 7.4% alpha acids)
White Labs WLP840 (American Lager) or Wyeast 2272 (North American Lager) yeast

Step by Step

Mash 60 minutes at 149 °F (65 °C) Boiling time is 75 minutes. Ferment at 53 °F (12 °C). Use the following formula to calculate how much kräusen wort to set aside (after boiling the main batch of wort and before pitching the primary yeast):
V_k (qts.) = 12 * V_w (gallons)/D (sgp)

where V_k = is the volume of wort to set aside for kräusening, V_w is the the volume of post-boil wort and D is wort density in specific gravity points. Specific gravity points are the portion of the specific gravity to the right of the decimal point multiplied by 1000. For example, in this recipe 1.037 is 37 gravity points.
Metric brewers can use this version of the formula:
V_k (L) = 3.17 * V_w (L) / D (sgp)

Add approximately one pint (500 mL) of wort to the calculated volume. This will allow for variations in the degree to which it has fermented before being added to the beer. Freeze and store the retained wort in a sealed, clean container. Two days before bottling or kegging, add just a little water to account for the boiling losses, and boil the stored wort for 10 minutes to sanitize. Chill the wort after boiling and pour into a well sanitized vessel with enough volume to contain the saved wort plus an additional 10–15 percent. Pitch several grams (approximately 0.1 oz.) of dry, neutral yeast into the sanitized vessel. Stir or agitate well. Cover the vessel loosely with a sanitized lid or aluminum foil and allow it to ferment at room temperature. After two days (48 hours), the wort should be actively fermenting (at high kräusen), yet enough sugars should remain to provide carbonation. Add the fermenting kräusen wort in the same manner you would use priming sugar solution for the rest of the beer that is ready for bottling or kegging. You should leave behind most of the trub (sediment) that has settled to the bottom of the vessel used to ferment the kräusen wort. Carbonation should be completed in approximately 7–10 days at room temperature. (Thanks to homebrewer Kai Troester for the concepts and outline of this kräusening method.)

Old Style Light clone (American light lager)

(5 gallons/19 L, extract)

OG = 1.037 FG = 1.005
IBU = 14 SRM = 5 ABV = 4.0%

Extract brewers will need to find American lager extract (made with corn as an adjunct).

Ingredients

4.25 lbs. (1.93 kg) American lager liquid malt extract
1.0 lbs. (0.45 kg) rice syrup solids
2.7 AAU Cluster hops (60 mins) (0.38 oz./11 g of 7.0% alpha acids)
1.3 AAU Mt. Hood hops (25 mins) (0.25 oz./7.1 g of 5.0% alpha acids)
1.9 AAU Sterling hops (0 mins) (0.25 oz./7.1 g of 7.4% alpha acids)
White Labs WLP840 (American Lager) or Wyeast 2272 (North American Lager) yeast

Step by Step

Boiling time is 60 minutes. Add hops at times indicated and rice syrup with 15 minutes left in boil. Ferment at 53 °F (12 °C) and kräusen according to instructions given in the all-grain recipe.

A disastrous fire destroyed the Gund brewery in 1897. It was rebuilt, but the disruption allowed Heileman to expand operations and increase sales. In 1902 they produced more than 100,000 barrels and replaced their flagship brand, Golden Leaf, with Old Style Lager, a name that would be associated with Heileman throughout the rest of its history. In 1919, just before Prohibition ended the legal manufacture and sale of alcoholic beverages in the US, 285 people were employed at the brewery. During the more than 13 years of the "noble experiment," Heileman reduced its staff and produced non-alcoholic "near beer." In addition they sold malt, ostensibly to bakeries, but also to the public, including bootleggers and homebrewers who defied the law by brewing their own. Gund Brewing closed in 1920, with some of its facilities being used by Heileman. The Gunds moved to Cleveland, where they later became one of the city's most prominent and wealthy families.

A Good Time For Beer

With Prohibition's welcome repeal, Americans' long delayed thirst for beer created a tremendous demand for those breweries that still had the ability to produce it. Heileman was inundated

Photo courtesy of Wisconsin Historical Society

with calls from as far away as both the East and West Coast. Newly rehired workers labored during 7-day, 12-hour brewing shifts and managed to ship 2,500 barrels in the 48 hours following the legalization of beer on April 7, 1933. Office employees returned almost $100,000 in checks that accompanied orders that the brewery had no hope of filling.

The ensuing decades were good times for many American breweries, and Heileman was no exception. Often the easiest way to expand market territory and share was to acquire competitors. Businesses touted the economies of scale. Heileman responded by purchasing two smaller Wisconsin breweries, the first in 1959, followed by four more regional breweries in Minnesota and Kentucky during the 1960s. The largest acquisition came in 1969 with Milwaukee brewer Blatz, which had faltered after seeking to become a national brand. This expansion continued during the 1970s and included breweries from throughout the Midwest, as well as the East and Northwest with the purchase of Carling and Rainier, along with Texas brewer Lone Star in 1983. The number of American brewing companies shrank from nearly 700 in 1933 to 54 in 1975. While in 1956 Heileman was the

39th largest American brewer with annual production of about 550,000 barrels, by 1978 they brewed more than 7 million barrels and were number five. In the 1980s, they briefly occupied third place behind Anheuser-Busch and Miller Brewing.

Marketing became increasingly important. Heileman was one of the earlier brewers to appeal to the then young generation of Baby Boomers who were coming of age. They updated the labels and packaging, promoted light beer lower in calories and alcohol, and found ways to enter new markets as well as to increase their share of traditional ones.

Among their biggest successes was their sales in Chicago, the nation's third largest beer market. Despite rival Milwaukee brewers Miller and Pabst being closer, Heileman and its distributors aggressively priced and promoted their beer, and by 1977 Old Style was the largest selling brand in the Chicago area, a title it did not relinquish to Budweiser until the mid-1990s.

Heileman advertising emphasized its Wisconsin heritage by stating their beers were "brewed in God's country." It also featured a technical aspect of the brewing process, boasting that both Old Style and Heileman's premium-branded beer, Special Export, were "fully kraeusened." Beer drinkers were not expected to understand the complexities of the term, but the ads stressed that this more expensive and labor-intensive traditional German method was not used by other large American brewers and resulted in better beer. (Of course, kräusening was used by some other breweries, including Anheuser Busch, but not all breweries did this.)

Another popular Heileman promotion was the "world's largest six-pack," a set of six large outdoor tanks adjacent to the flagship La Crosse brewery that were encased in a plastic covering that matched the labels on cans of Old Style. Visitors who toured the Heileman brewery were given souvenir post cards of this attraction.

In addition, the company helped the city of La Crosse found its annual Oktoberfest, a popular event that continues today as one of the largest such celebrations outside of Munich.

Bond . . . Alan Bond (Or, A Bad Time for Beer)

Dramatic as the growth was, Heileman realized that the future lay in national distribution. There was speculation and brief discussion of merging with Wisconsin rivals Joseph Schlitz and Pabst Brewing Company during the early 1980s. The struggling Schlitz, once America's largest brewer, was eventually purchased by Stroh, another relatively large Midwest brewery with expansion on its agenda. Nor was Heileman immune to corporate raiders. Among these was Alan Bond, who controlled mining and media businesses in Australia, and had recently taken over Australian brewers Swan, Castlemaine and Tooheys. Bond greatly desired to enter the American brewing market.

A dashing figure and captain of Australia's victorious entry in the America's Cup yacht races, Bond set his sights on Heileman. In September 1987, after an initial offer had been rejected, he persuaded Heileman shareholders to accept a package that valued the company at more than $1.3 billion. The transaction, known as a leveraged buyout (LBO), was financed with "junk bonds" that had little security, but offered investors high yields. LBOs use the cash flow from the acquired business to pay off the debt, in this case estimated to be $850 million. Faced with such a high debt load, Bond was under pressure to make Heileman perform.

Costs were trimmed, but instead of spurring growth and profit, the result was that sales declined and the company began to lose money. The Bond empire unraveled as world financial markets reacted to the excesses of LBOs and junk bonds. Beset by accusations of financial misdeeds in Australia, and by Heileman's poor performance in the US, in 1990 Bond was forced to resign from his own holding company, which recorded the greatest single-year loss in Australian history. He later served four years in prison for financial fraud.

With the value of its growing debt exceeding its assets, Heileman declared bankruptcy in January 1991. They continued to operate under the protection of the court but were unable to hold back the tide of red ink. In 1993 the court allowed Heileman's creditors to sell the company for $390 million to a Texas investment partnership that specialized in turning around troubled firms. The new owners had no experience in brewing and made several missteps, including offering a menthol-flavored version of Colt 45 Malt Liquor that drew charges of racism and calls for a boycott. In early 1996, faced with the inability to make required interest payments and meet its payroll, Heileman declared bankruptcy a second time, agreeing to be acquired by the Stroh Brewery Company of Detroit, which was fighting for its own survival. Stroh closed several inefficient breweries and used the Heileman facility in La Crosse to brew a variety of brands. However, beer sales flattened for all brewers in the late 1990s, and Stroh announced in 1999 that it would cease brewing and sell its brands, including Heileman's, to competitors Miller and Pabst.

The End And A New (Old) Beginning

The La Crosse brewery, home to Heileman operations for 138 years, closed on August 8, 1999, marked by a black-bordered article in the local newspaper. More than 500 employees lost their jobs. A group of former Heileman managers and local business leaders sought to find a way to reopen the plant. There were several false starts, but by early 2001 the newly resurrected City Brewery (the original name used by Heileman and Gund in 1848) was again brewing beer. They secured contracts from other brewing firms such as Pabst, which had closed all of its production to become strictly a marketing company. And they produced other beverages, including packaged cocktails, coolers, tea and energy drinks, as well as bottled water. Heileman had long promoted and used an artesian well on the brewery property as the source of its water.

City Brewery did not own any of the former Heileman brands, which now belonged to Miller and Pabst, although ironically one of the beers they brewed under contract to Pabst was Special Export. For their own sales, they created new brands: La Crosse Lager and La Crosse Light used the former Old Style and Old Style Light recipes, while City Lager imitated Special Export. These were promoted as being "fully kraeusened" using the same methods and resulting in the same flavor as the original beers, and distributed in the heart of Heileman's original Midwest market. The "world's largest six-pack" at the brewery was recovered to resemble cans of La Crosse Lager.

In 2006 Anheuser-Busch took over regional brand Rolling Rock and closed the brewery in Latrobe, Pennsylvania, where it had been brewed for 67 years. City Brewery stepped in with a plan to duplicate their modest success in La Crosse. Again they struggled, and the plant was idled briefly in 2008; since 2009 it has again been producing contract beers for other brewers. More recently, in early 2011 City purchased its largest property, a brewery in Memphis built by Schlitz and later operated by Coors. They say they hope to expand production there.

Today City Brewery survives as the largest contract beer and beverage producer in the US, with more than 800 employees and the fourth largest capacity among American brewers. Much of their production isn't beer, however — they produce 4 Loko, Mike's Hard Lemonade and other "alcopops." No doubt it's a different business than Gottfried Heileman envisioned back in 1858, but it does recall and preserve at least a portion of a long and proud brewing history.

The Recipe, Please

Many of today's popular American lagers approximate the beers brewed by Heileman, especially during its last 40 years. However, the author admits to an attempt early in his homebrewing days to please a friend who claimed to drink only light beers. The result was a beer that was surprisingly close to Old Style Light, and which went on to win a Bronze Medal in the Light Lager category of the National Homebrew Competition.

The recipe also employs a technique used and highly promoted by Heileman. Kräusening is the use of newly fermenting wort that is added at bottling or kegging in order to carbonate the beer and provide additional conditioning.

In a lager fermentation, it is common for the yeast to produce vicinal diketones (VDKs) to such a level that they cannot take them all back up by the end of primary fermentation. The most well-known VDK is diacetyl, a molecule that lends a buttery or butterscotch character to beer and is generally considered undesirable. (A few ales, most notably Redhook ESB, intentionally retain a small amount of diacetyl as part of their flavor profile.)

One solution to the problem of diacetyl is to perform a diacetyl rest. The brewer allows the temperature of the fermentation to rise at the end of primary fermentation to around 60 °F (16 °C) from lager temperatures, which are lower than this. The higher temperature keeps the yeast active and they can then reduce the levels of diacetyl. Breweries that employ diacetyl rests monitor VDK levels and do not package the beer until they have dropped below the point at which they can be perceived by beer drinkers.

Kräusening is another method for lager brewers to deal with VDKs. Instead of allowing the fermentation temperature to rise, and the heat to spur the primary yeast to keep going, fresh yeast is added to the beer. The fresh yeast is added in the form of fermenting beer, or kräusen beer. The fresh yeast have no problem taking up the residual VDKs left behind by the primary yeast and, as a bonus, the carbon dioxide given off by the active yeast can be retained to carbonate the beer. There is no doubt that it adds another level of complexity to the brewing process, but there are those who claim it results in a finer, more even carbonation and smoother flavor.

Detailed instructions for this procedure are in the recipe on page 28. (The recipe also can be brewed with normal carbonation via priming sugar or forced carbonation if you wish.)

One problem with kräusening is getting freshly fermenting wort at packaging time. A good solution for this is to save (unpitched) wort from your brew day in a sanitized container stored in your fridge or freezer.

A second problem for homebrewers is achieving the right carbonation levels. Because the kräusen wort is added at the peak of fermentation (high kräusen), the amount of sugar in the kräusen wort is decreasing constantly. You need to add it at just the right time, or your carbonation level will be off. For those who keg, this problem is easily manageable. If the beer is over carbonated, you can vent the keg a few times to bring the carbonation levels down. If the beer is undercarbonated, let it sit under the CO_2 pressure you will use at serving for a few days. BYO

Bill Pierce is a frequent contributor to Brew Your Own *magazine.*

Oh, Say Can You "C"

BREWING HOPPY AMERICAN-STYLE BEERS

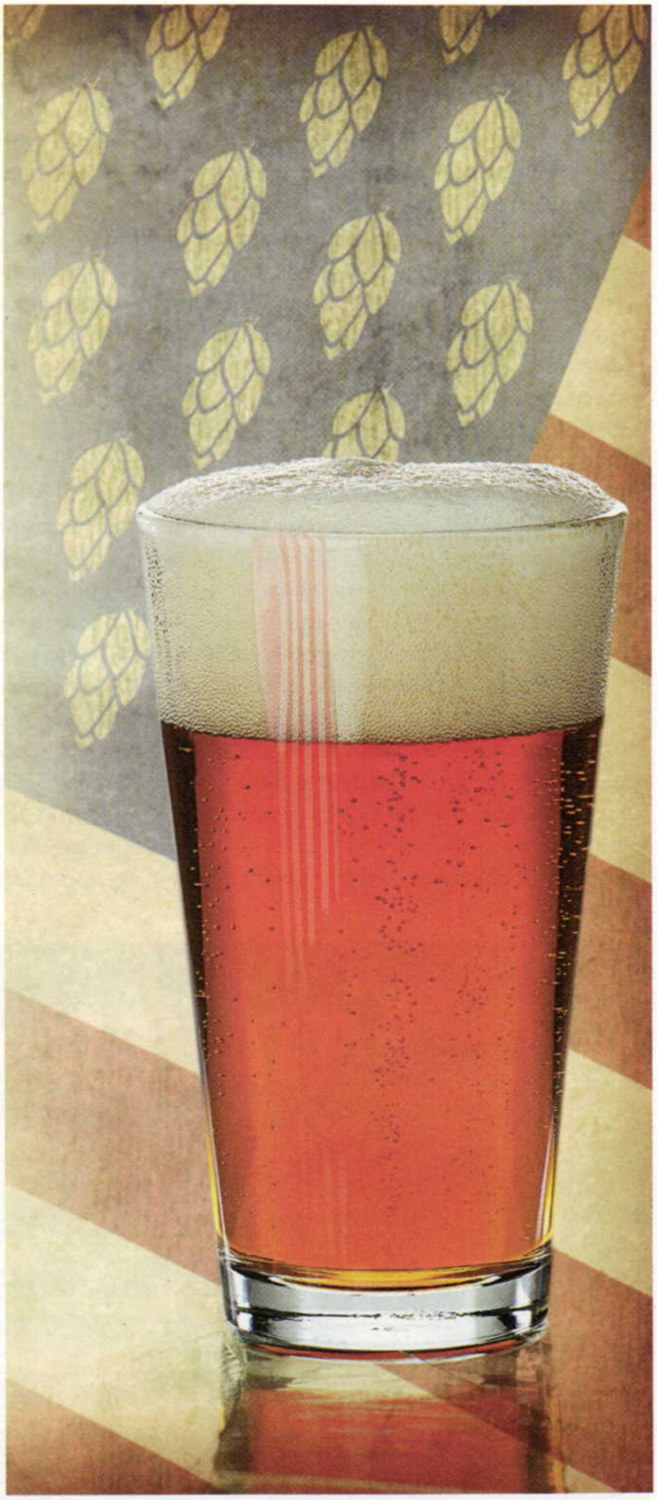


Photo by Charles A. Parker/Images Plus

During the past 15 years or so, there has been an obvious upward trend in modern American brewing culture when it comes to the creation and consumption of hoppy beers. Hoppy American-style pale ales have given way to even hoppier American IPAs, and American double IPAs have pushed hop character to its limits.

So why are we so crazy about these little green cones and what makes American hops so special? Generally speaking, hops are the yin to the malt's yang when it comes to the balance of bitter versus sweet in beer flavor. They also inhibit the growth of some beer-spoiling bacteria, promote head retention and even assist in clarification.

If you have ever tried to make a beer with just malt and no hops, you'd find out quickly that it's got very little foam, it's pretty sweet (not in a good way!) and aging of any kind would become a risky proposition.

American hops are unique because, well, they are American. Hops from Europe were transplanted here in the US, and find themselves in a new environment. Many of them were bred with native varieties in their respective regions which all have a distinct climate and soil profile. Over time, growers and brewers alike have driven the selection process to give us the high alpha, citrusy, piney and floral characteristics we know and love today. A few classic varieties that exemplify this hop evolution are Cascade, Centennial, Chinook and Columbus — the so-called "C" hops. With Rolling Stone-like staying power, they have

Story by **Justin Burnsed**

brought their coveted bitterness and unique flavors to our pint glasses for decades. These have been the backbone of many great beers and work well alone, with each other and some of the more recently released varieties.

What's in Hops?

Before we get into the heart of how to best brew a hop forward beer, I think we should briefly put on our lab coats and delve into the the composition of a hop cone as it pertains to brewing value. Most of the compounds that end up in our beer can be found in the lupulin glands. These are the yellow, sticky spots on the underside of each tiny bracteole (leaf). They contain the all powerful alpha acids that are the root source of bitterness. These acids go through a chemical change in the boil and become isomerized (and solubilized) so that they can stick to the bitterness receptors in your mouth. These iso-alpha acids are also responsible for the preservational quality of hops, as they prevent Gram-positive bacteria from being able to absorb nutrients, severely limiting their ability to reproduce. When purchasing hops, the percentage of alpha acids listed on the package is a direct indication of the hops bittering potential.

The oil content is a good baseline indicator of how much flavor and aroma a particular hop can add to your beer. Though not commonly listed on the package, the level of oil is typically expressed in mL/100g, generally ranging from 0.5–3.0. These oils contain varying degrees of volatile compounds that give them their individual character. Many of these compounds, such as myrcene, are highly volatile and are quickly lost in the vapor during the boil. While others, such as linalool, are more soluble and can survive into the final beer more easily.

The polyphenols in hops have almost a Dr. Jekyll and Mr. Hyde relationship when it comes to their contributions to beer. During the boil, they help coagulate proteins and drop them out in the kettle, preventing them from making it to fermentation. Further down the road, when the beer is chilled, these same compounds bind with remaining proteins to create chill haze. That is why dry hopped beers tend to be a bit cloudy, since some of the polyphenols were extracted post-boil. Tannins are the most notorious of this group because in large amounts they can cause your beer to become highly astringent. Since they mostly come from the plant material itself and not the lupulin glands, using high alpha hops in your bitter beers will get you the alpha acids you need and keep those pucker face inducing tannins in check. If you have any ideas about making an all Cascade Imperial IPA, you may want to think twice. It could end up a little rough around the edges—not to mention suffer from severe beer loss!

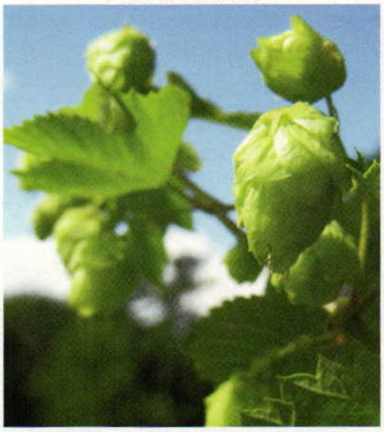
Brewing Hoppy Beers

Now we can get to the topic at hand. The beer styles that are most known for showcasing American-style hops are American pale ale (APA), American IPA and Imperial IPA. (These are located in the Beer Judge Certification Program (BJCP) style guidelines as 10A, 14B and 14C.) They are not what you would call balanced, but keeping your beer from going too far to the bitter side is critical. When planning out your recipe, you should keep an eye on the bitterness units vs. gravity units ratio (BU/GU). For example, if an IPA has a projected IBU of 75 and an OG of 1.075, then it would have a BU:GU ratio of 1.0 (75 IBUs/75 "gravity points"). This is a much better indicator of how bitter your beer will end up than if you just look at the projected IBUs. I'd shoot for the following values: APA (0.6–0.8), IPA (0.8–1.0), IIPA (1.0–1.3).

Ingredient Selection

As far as ingredient selection goes, I would say that it is mostly an area of personal preference, but here are a few guidelines. When selecting your malt bill, try not to make it too complicated. Remember, you want the hops to be the star of the show here and the malt is more like a supporting actor. Using 2-4 different malts in any of these styles should create enough complexity to keep things interesting. Keep the crystal malts under 10% for an APA and less than 5% for the IPA and especially the IIPA, if you use any at all. Slightly kilned malts like Munich make a nice complement to a standard 2-row pale malt base. You could also use a more robust base malt like Maris Otter or Golden Promise if you like. Sugars can be used in addition to malt to help keep the beer on the dry side, especially in the high gravity styles like an Imperial IPA. I would keep them at 15% or less if you choose

CASCADE



CENTENNIAL

CHINOOK

COLUMBUS

HOPPY RECIPES

Sam The Eagle American Pale Ale

(5 gallons/19 L, all-grain)

OG = 1.053 FG = 1.013
IBU = 36 SRM = 7 ABV = 5.3%

Ingredients

10 lbs. (4.5 kg) North American 2-row pale malt
1.0 lb. (0.45 kg) American crystal malt (40 °L)
1 tsp. Irish moss or 1 whirfloc tablet (15 min)
5.5 AAU Chinook hops (60 min) (0.50 oz./14 g of 13% alpha acids)
5.5 AAU Cascade hops (10 min) (1.0 oz./28 g of 5.5% alpha acids)
11.0 AAU Cascade hops (0 min) (2.0 oz/57 g of 5.5% alpha acids)
White Labs WLP001 (California Ale), Wyeast 1056 (American Ale) or Fermentis Safale US-05 yeast (1.25 qt./~1.25 L yeast starter)
0.75 cup (150 g) priming sugar

Step by Step

Mill the grains. Dough in using 2.5 gallons (9.5 L) of water with a target mash holding temperature of 152 °F (67 °C). Hold the mash temperature for approximately 60 minutes or until the conversion is complete. Raise the temperature of the mash to 168 °F (76 °C) and begin sparging with 170 °F (77 °C) water until you collect 6.0 (23 L) gallons of wort in the kettle. The total wort boiling time for this recipe is 60 minutes. At the onset of a full rolling boil add your scheduled hop addition. When there are 10 minutes remaining in the boil, add the second hop addition and be sure to add your Irish moss or whirfloc tablets to help with precipitation of the hot break. At flame-out, prior to cooling the wort, add the final hop addition. Cool the wort to 70 °F (21 °C), transfer to your fermentation vessel and aerate the wort adequately. Add the contents of your yeast starter (if using liquid yeast) to the chilled wort. Ferment around 70 °F (21 °C) until the final gravity is reached, which should be in 5 to 7 days. Rack to a secondary vessel and allow the beer to mature another 5 to 7 days around the same temperature. Rack into a keg or bottle along with the priming sugar.

Sam The Eagle American Pale Ale

(5 gallons/19 L, extract with grains)

OG = 1.053
FG = 1.013
IBU = 36 SRM = 8 ABV = 5.3%

Ingredients

6.75 lbs. (3.1 kg) light liquid malt extract (such as Briess or Alexander's)
1.0 lbs. (0.45 kg) American crystal malt (40 °L)
1 tsp. Irish moss or 1 whirfloc tablet (15 min)
5.5 AAU Chinook hops (60 min) (0.50 oz./14 g of 13% alpha acids)
5.5 AAU Cascade hops (10 min) (1.0 oz./28 g of 5.5% alpha acids)
11.0 AAU Cascade hops (0 min) (2.0 oz./57 g of 5.5% alpha acids)
White Labs WLP001 (California Ale), Wyeast 1056 (American Ale) or Fermentis Safale US-05 yeast (1.25 qt./~1.25 L yeast starter)
0.75 cup (150 g) priming sugar

Step by Step

Mill the specialty grains. Place the milled grains in a grain bag. Steep them in 2 gallons of 152 °F (67 °C) water for 30 minutes. Rinse the grain bag with about 2.0 quarts (1.9 L) of water and allow it to drip into the kettle for about 15 minutes, but be sure not to squeeze the bag. Add enough water for a pre-boil volume of 6.0 gallons (23 L). (If you cannot perform a full-wort boil, boil at least 3 gallons/11 L of wort and reserve about half of the malt extract for the final 15 minutes of the boil.) Stir in the malt extract and begin the boil. The total wort boiling time for this recipe is 60 minutes. At the onset of a full rolling boil, add your scheduled hop addition. When there are 10 minutes remaining in the boil, add the second hop addition and be sure to add your Irish moss or whirfloc tablets to help with precipitation of the hot break. At flame out prior to cooling the wort, add the final hop addition. Cool the wort to 70 °F (21 °C), transfer to your fermentation vessel and aerate the wort adequately. Add the contents of your yeast starter to the chilled wort. Ferment around 70 °F (21 °C) until the final gravity is reached, which should be in 5 to 7 days. Rack to a secondary vessel and allow the beer to mature another 5 to 7 days around the same temperature. Your beer is now ready to rack into a keg or bottles along with the priming sugar.

Hop Skip & A Jump American IPA

(5 gallons/19 L, all-grain)

OG = 1.069 FG = 1.017
IBU = 66 SRM = 6 ABV = 6.9%

Ingredients

12.0 lbs. (5.45 kg) North American 2-row pale malt
2.0 lbs. (908 g) Munich malt (10 °L)
0.50 lbs. (227 g) American crystal malt (15 °L)
1 tsp. Irish moss or 1 whirfloc tablet (15 min)
13.1 AAU Columbus hops (60 min) (0.85 oz./24 g of 15.4% alpha acids)
4.0 AAU Amarillo® hops (30 min) (0.50 oz./14 g of 8.0% alpha acids)
6.5 AAU Simcoe® hops (10 min) (0.5 oz./14 g of 13.0% alpha acids)
4.0 AAU Amarillo® hops (0 min) (0.5 oz./14 g of 8.0% alpha acids)
13.0 AAU Simcoe® hops (dry hop) (1.0 oz./28 g of 13.0% alpha acids)
8.0 AAU Amarillo® hops (dry hop) (1.0 oz./28 g of 8.0% alpha acids)
White Labs WLP001 (California Ale), Wyeast 1056 (American Ale) Fermentis Safale US-05 yeast (2.25 qt./~2.25 L yeast starter)
0.75 cup (150 g) priming sugar

Step by Step

Mill the grains. Dough in using 3 gallons (11 L) of water with a target mash holding temperature of 150 °F (65 °C). Hold the mash temperature for approximately 60 minutes or until the conversion is complete. Raise the temperature of the mash to 168 °F (76 °C) and begin sparging with 170 °F (77 °C) water until you collect 6.0 (23 L) gallons of wort in the kettle. The total wort boiling time for this recipe is 60 minutes. At the onset of a full rolling boil, add your first hop addition and the other three additions as scheduled above. When there are 10 minutes remaining in the boil, be sure to add your Irish moss or whirfloc tablet to help with precipitation of the hot break.

Cool the wort to 70 °F (21 °C), transfer to your fermentation vessel and aerate the wort adequately. Add the contents of your yeast starter to the chilled wort. Ferment around 70 °F (21 °C) until the final gravity is reached, which should be in 5 to 7 days. Rack to a secondary vessel and allow the beer to mature another 5 to 7 days around the same temperature. Your beer is now ready to rack into a keg or bottles along with the priming sugar.

Hop Skip & A Jump American IPA

(5 gallons/19 L, extract with grains)

OG = 1.069 FG = 1.017
IBU = 66 SRM = 8 ABV = 6.9%

Ingredients

8.25 lbs. (3.75 kg) light liquid malt extract (such as Briess or Alexander's)

1.0 lb. (454 g) Munich malt extract (10 L)
0.5 lbs. (227 g) American crystal malt (15 °L)
1 tsp Irish moss or 1 whirfloc tablet (15 min)
13.1 AAU Columbus hops (60 min) (0.85 oz./24 g of 15.4% alpha acids)
4.0 AAU Amarillo® hops (30 min) (0.5 oz./14 g of 8.0% alpha acids)
6.5 AAU Simcoe® hops (10 min) (0.5 oz./14 g of 13.0% alpha acids)
4.0 AAU Amarillo® hops (0 min) (0.5 oz./14 g of 8.0% alpha acids)
13.0 AAU Simcoe® hops (dry hop) (1.0 oz./28 g of 13.0% alpha acids)
8.0 AAU Amarillo® hops (dry hop) (1.0 oz./28 g of 8.0% alpha acids)
White Labs WLP001 (California Ale), Wyeast 1056 (American Ale) Fermentis Safale US-05 yeast (2.25 qt./~2.25 L yeast starter)
0.75 cup (150 g) priming sugar

Step by Step

Mill the specialty grains. Place the milled grains in a grain bag. Steep them in 2 gallons of 150 °F (66 °C) water for 30 minutes. Rinse the grain bag with about 2.0 quarts (1.9 L) of water and allow it to drip into the kettle for about 15 minutes, but be sure not to squeeze the bag. Add enough water for a pre-boil volume of 6.0 gallons (23 L). (If you cannot perform a full-wort boil, boil at least 4 gallons/15 L of wort and reserve about half of the malt extract for the final 15 minutes of the boil.) Stir in the malt extracts and begin the boil.

The total wort boiling time for this recipe is 60 minutes. At the onset of a full rolling boil, add your scheduled hop addition. When there are 10 minutes remaining in the boil, add the second hop addition and be sure to add your Irish moss or whirfloc tablets to help with precipitation of the hot break. At flame out prior to cooling the wort, add the final hop addition.

Cool the wort to 70 °F (21 °C), transfer to your fermentation vessel and aerate the wort adequately. Add the contents of your yeast starter to the chilled wort. Ferment around 70 °F (21 °C) until the final gravity is reached, which should be in 5 to 7 days. Rack to a secondary vessel and allow the beer to mature another 5 to 7 days around the same temperature. Your beer is now ready to rack into a keg or bottles along with the priming sugar.

The Tri-Centennial DIPA
(5 gallons/19 L, all-grain)

OG = 1.096
FG = 1.021
IBU = 106 SRM = 11 ABV = 10.0%

Ingredients

18.0 lbs (8.17 kg) Maris Otter pale malt
1.0 lb. (454 g) Carared® (17 °L)
1 tsp Irish moss or 1 whirfloc tablet (15 min)
30.0 AAU Centennial hops (first wort) (3.0 oz./85 g of 10% alpha acids)
30.0 AAU Centennial hops (5 min) (3.0 oz./85 g of 10% alpha acids)
30.0 AAU Centennial hops (dry hop) (3.0 oz./85 g of 10% alpha acids)
White Labs WLP001 (California Ale), Wyeast 1056 (American Ale) Fermentis Safale US-05 yeast (4.25 qt./~4.25 L yeast starter)
0.75 cup (150 g) priming sugar

Step by Step

Mill the grains. Dough in using 4.5 gallons (17 L) of water with a target mash holding temperature of 148 °F (65 °C). Hold the mash temperature for approximately 60 minutes or until the conversion is complete. Raise the temperature of the mash to 168 °F (76 °C) and begin sparging with 170 °F (77 °C) water until you collect 6.0 gallons (23 L) of wort in the kettle. As runoff begins, add the first wort hops to the kettle.

The total wort boiling time for this recipe is 60 minutes. When there are 10 minutes remaining in the boil, be sure to add your Irish moss or whirfloc tablets to help with precipitation of the hot break. Add the second hop addition 5 minutes prior to flame out.

Cool the wort to 70 °F (21 °C), transfer to your fermentation vessel and aerate the wort adequately. Since this is a very high gravity beer, you will likely need to use pure oxygen to get the levels of 10–12 ppm needed to ensure a complete fermentation. It should also be noted that normal pitching rates will be inadequate as well. To be on the safe side, you should pitch about 2–3 times the amount of yeast you normally do for a 1.050 beer. (The yeast starter size listed in the ingredients list a compromise between the optimal amount of yeast for fermenting a beer of this gravity and the fact that overpitching can scrub some hop character.) Add the contents of your yeast starter to the chilled wort. Ferment around 70 °F (21 °C) until the final gravity is reached, which should be in 10 to 14 days. Rack to a secondary vessel and allow the beer to mature for 1 week around the same temperature. Then dry hop the beer for an additional week. Your beer is now ready to rack into a keg or bottles along with the priming sugar.

The Tri-Centennial DIPA
(5 gallons/19 L, extract with grains)

OG = 1.096 FG = 1.021
IBU = 106 SRM = 11 ABV = 10.0%

Ingredients

12.25 lbs (5.55 kg) liquid light malt extract (such as Muntons)
1.0 lbs (454 g) Carared® (17 °L)
1 tsp Irish moss or 1 whirfloc tablet (15 min)
30.0 AAU Centennial hops (first wort) (3.0 oz./85 g of 10% alpha acids)
30.0 AAU Centennial hops (5 min) (3.0 oz./85 g of 10% alpha acids)
30.0 AAU Centennial hops (dry hop) (3.0 oz./85 g of 10% alpha acids)
White Labs WLP001 (California Ale), Wyeast 1056 (American Ale) Fermentis Safale US-05 yeast (4.25 qt./~4.25 L yeast starter)
0.75 cup (150 g) priming sugar

Step by Step

Mill the specialty grains. Place the milled grains in a grain bag. Steep them in 2 gallons (7.6 L) of 148 °F (66 °C) water for 30 minutes. Add the first wort hops to the kettle. Rinse the grain bag with about 2.0 quarts (1.9 L) of water and allow it to drip into the kettle for about 15 minutes, but be sure not to squeeze the bag. Add enough water for a pre-boil volume of 6.0 gallons (23 L). (If you cannot perform a full-wort boil, split your wort into two 2.5-gallons (9.5-L) batches and boil individually. Split the ingredients proportionally between batches.) Stir in the malt extracts and begin the boil. The total wort boiling time for this recipe is 60 minutes. When there are 10 minutes remaining in the boil, be sure to add your Irish moss or whirfloc tablets to help with precipitation of the hot break. Add the second hop addition 5 minutes prior to flame out.

Cool the wort to 70 °F (21 °C), transfer to your fermentation vessel and aerate the wort adequately. Since this is a very high gravity beer, you will likely need to use pure oxygen to get the levels of 10–12 ppm needed to ensure a complete fermentation. It should also be noted that normal pitching rates will be inadequate as well. To be on the safe side, you should pitch about 2–3 times the amount of yeast you normally do for a 1.050 beer.

Add the contents of your yeast starter to the chilled wort. Ferment around 70 °F (21 °C) until the final gravity is reached, which should be in 10 to 14 days. Rack to a secondary vessel and allow the beer to mature for 1 week around the same temperature. Then dry hop the beer for an additional week. Your beer is now ready to rack into a keg or bottles along with the priming sugar.

to use them.

Extract brewers should stick to a pale malt extract as a base and possibly include some Munich extract in your recipe if you can get your hands on it. A small addition of some crystal malt steeped for about 30 minutes in a nylon bag wouldn't be a bad idea either.

Hop selection will be critical to how these beers end up tasting. You can do some research on beers you already like and see if you can find out the variety of hops that were used in them or just use some of the ones mentioned above. In addition to those, there are others like Simcoe®, Amarillo®, Citra®, Willamette, and many more, that blend well with the "C" hops. There really is no limit to how many varieties you can include in your recipe, but some people choose to do the exact opposite and go for a single hop beer. That's a great way to explore what a variety is truly like.

Another decision you will come across is what form of hops you would like to use. Some people prefer pellets, whole hops, hop extracts or a combination of these options at different points of the process. Traditionalists tend to lean toward whole hops and usually feel that they benefit from being less processed giving a more pure hop flavor to the beer. This is due to the lupulin glands remaining intact until you are ready to unleash them. On the other hand, those that prefer pellets would argue that a higher utilization rate and less plant material contributing to beer loss more than makes up for it. The debate on whether there is a flavor difference between the two has been going on for some time. I will only point out that many commercial breweries use pellets from start to finish without any complaints from their customers. And if you really want to maximize the yield on your next batch, you could give hop extracts a shot. The ones I have seen are 90% pure iso-alpha acids that can add bitterness to the beer post boil. I wouldn't eliminate the use of hops entirely in lieu of extracts, as you would miss out out on many of the benefits we've already covered, not to mention a lack of hop flavor in the beer.

I think it is also worth mentioning

what to look for when you rip open that chilled, vacuum sealed or nitrogen purged package. That is the state you found your hops when you purchased them right? I hope it was, since air, heat and sunlight are enemies of the hop and your beer if it was exposed to one or more of these degredational factors for any length of time. You'll know fairly quickly if your hops are in trouble just by looking at them. They tend to turn yellow, tan and even brown as they progressively go downhill. Also, if the first whiff you get reminds you of stinky cheese or sulfur, you know it's time to find another supplier and call your brew buddy to borrow some of his secret stash of hops.

The yeast strain you choose will have two major impacts on how bitter your beer ends up being. The first is the yeast's ability to metabolize sugars in the wort, also known as attenuation. The higher the attenuation, the less sugar is left in the beer. The less sugar that is left in the beer, the more bitterness you will taste. The three beer styles mentioned should be on the dry side, so a strain with an apparent attenuation of 72–80% would be ideal. The other impact that it has on bitterness is the yeast's ability to adsorb alpha acids. Some strains promote bitterness and others eat up a fair portion of it. There isn't a number associated with this characteristic, but the yeast supplier's description or your local homebrew shopkeeper should be able to point you in the direction of one that will best suit a hopped up brew.

Water

The last and most abundant ingredient in your beer is obviously water. Depending on your source and water profile, you may or may not already be treating it with brewing salts. When it comes to promoting a crisp hop bitterness to your beer, an addition of calcium sulfate (gypsum) can help get you there. And yes, that's the stuff that sheet rock is made of, although I wouldn't recommend scraping some off the piece that's showing in your garage and dropping it into your kettle. If you don't have a clue what's in your brewing water and your beers usually turn out fine, I wouldn't mess with it. If you do have that information available, then I would try to get a sulfate vs. chloride ratio from 2–3 to 1 with a max of 300 ppm for the sulfate. Chloride accentuates maltiness, while sulfate brings out the bitter side in a beer, but not so much that it gets harsh tasting. For every gram of gypsum you add to a 5-gallon (19-L) batch, you will get about a 30 ppm increase in sulphate in your wort.

Techniques

Let's now look at the process of brewing a solid American hoppy beer. A single infusion mash with a temperature range of 148 °F (65 °C) through 152 °F (68 °C) will help you achieve a high conversion of starch to fermentable sugars, giving you the low final gravity and subsequent dryness you are looking for. The higher the gravity or percentage of specialty malts you use in your recipe, the lower mash temperature should be on this spectrum.

The timing of your hop additions will largely determine what flavors and aromas get into your beer. The earlier you add your hops, the more bitterness you will get, but less hop aroma and flavor. The later you add them, the reverse is true. This is why hoppy beers rely on multiple additions during the brewing process to get the best of both worlds. Some brewers go as far as "continually hopping" during the entire boil in an attempt to harness every possible flavor from the hop spectrum.

Utilization is a term that refers to the degree to which the alpha acids added to the wort get converted to iso-alpha acids and remain in the wort after the boil is completed. There are many different factors of varying degrees that impact this number. They include: Length and vigor of the boil (More vigor/longer boil = higher utilization%), wort gravity (lower gravity = higher utilization%), wort composition (varies), wort pH (Higher pH = higher utilization%), hopping rate (more hops = lower utilization%) and whole cone vs pellets (pellet utilization% is slightly higher). Most homebrewers rely on a computer program like BeerSmith, ProMash or Beer Calculus to calculate their estimated IBUs. (Note that this number is an estimate, and other factors can impact how bitterness is perceived — a 40 IBU sweet stout brewed with chloride-rich water will likely not taste as hoppy as a 40 IBU dry pale ale made with high-sulfate water.)

The mash is the first point where you can add your hops, although this is not a very common practice. Some brewers believe you're able to get a more smooth bitterness, a higher utilization rate by adding the hops this early and also reduce wort loss in the

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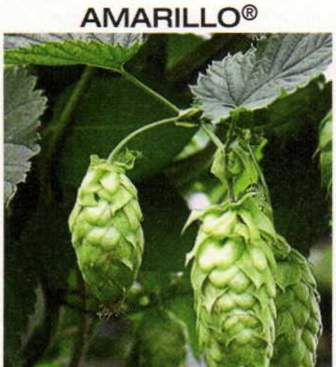

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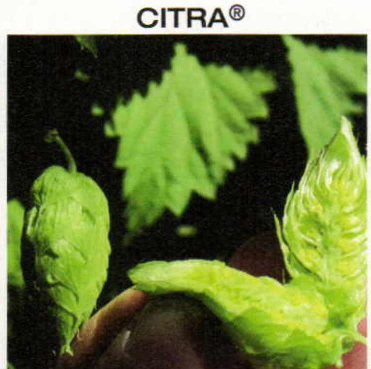

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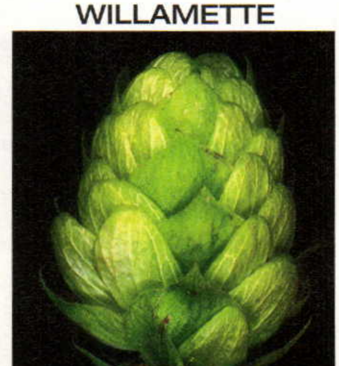


American Hop Varieties

Four of the classic "C" hops

Cascade

Type:	Aroma
Alpha Acids:	4.5–7.0%
Cohumulone:	33–40% of alpha acids
Total Oil:	0.7–1.4 mL/100g
Aroma:	Floral, citrus (grapefruit)
Description:	One of the earliest American bred hops, Cascade has been a favorite among craft brewers and homebrewers alike since the 1970s. Its aromatic properties and low alpha acids lend its use to late boil and dry hopping.

Commercial Beer Highlighting This Hop: Sierra Nevada Pale Ale

Centennial

Type:	Dual purpose
Alpha Acids:	9.5–11.5%
Cohumulone:	29–30% of alpha acids
Total Oil:	1.5–2.3 mL/100g
Aroma:	Medium Intense, floral, citrus
Description:	Sometimes referred to as Super Cascade, it lacks the signature grapefruit character of the Cascade hop, but makes up for it with a higher oil content and alpha acid percentage, hence its selective use at all points of the brewing process.

Commercial Beers Highlighting This Hop: Stone Ruination IPA, Bell's Two-Hearted Ale

Chinook

Type:	Dual purpose
Alpha Acids:	12.0–14.0%
Cohumulone:	29–35% of alpha acids
Total Oil:	1.7–2.7 ml/100g
Aroma:	Spicy, piney, grapefruit
Description:	Developed by the U.S.D.A. in the 1980s, this dual purpose hop tends to be used commercially for bittering and flavoring during the boil. It can be used for dry hopping as well and will give a distinct aroma to your beer.

Commercial Beer Highlighting This Hop: Stone Arrogant Bastard

Columbus

Type:	Super high alpha
Alpha Acids:	14.5–16.5%
Cohumulone:	28–32% of alpha acids
Total Oil:	2.0–3.0 ml/100g
Aroma:	Pungent
Description:	This hop also goes by the names Tomahawk and Zeus, depending on which farm it was grown on. It is used primarily for bittering due to its very high alpha acid content and moderate levels of cohumulone.

Commercial Beer Highlighting This Hop: Dick's Bottleworks IPA

Hops that blend well with the "4 Cs"

Amarillo®

Type:	Dual purpose
Alpha Acids:	8.0–11.0%
Cohumulone:	21–24% of alpha acids
Total Oil:	1.5–1.9 ml/100g
Aroma:	Floral, tropical fruit, citrus
Description:	A highly prized dual purpose hop in the brewing industry. Its combination of low cohumulone levels, good oil content and desirable aroma properties have brewers scrambling to get their hands on it.

Commercial Beer Highlighting This Hop: Brewdog Punk IPA

Simcoe®

Type:	Dual purpose
Alpha Acids:	12–14%
Cohumulone:	15–20% of alpha acids
Total Oil:	2.0–2.5 ml/100g
Aroma:	Intense, pine-like
Description:	Released in 2000 and developed by the Yakima Chief Ranches, this hop is often used in conjunction with citrusy hops to round out its strong pine aroma and flavor.

Commercial Beer Highlighting This Hop: Russian River Pliny the Elder

Citra®

Type:	Dual purpose
Alpha Acids:	11.0–13.0%
Cohumulone:	22–24% of alpha acids
Total Oil:	2.2–2.8 ml/100g
Aroma:	Intense citrus
Description:	One of the more recently developed hop varieties, it lives up to its namesake by delivering large amounts of citrus flavor and aroma when added late in the boil to the hopback or by dry hopping.

Commercial Beer Highlighting This Hop: Sierra Nevada Torpedo

Willamette

Type:	Aroma
Alpha Acids:	4.0–6.0%
Cohumulone:	30–35% of alpha acids
Total Oil:	1.0–1.5 mL/100g
Aroma:	Mild, pleasant, spicy
Description:	As a descendent of the English Fuggle hop, it exhibits much of the same characteristics. Not as potent in flavor or aroma as many of the other American hop varieties, it is often used to complement them.

Commercial Beer Highlighting This Hop: Odell 5 Barrel Pale Ale kettle. I don't know of any scientific evidence to support this, as the temperature is pretty low in relation to boiling and the leftover malt could hold some of the alpha acids back. Give it a try and you can be the judge of that.

First wort hops are added to the kettle when the runoff is being transferred over from the mash. This practice began as a way to prevent boilovers, but some brewers today feel first wort hopping adds a distinct character, although the evidence does not support this idea.

Once the wort starts boiling, that's when most people begin their hop additions. Hop utilization increases as the time they are boiled increases. However, the return on investment for boiling your hops longer than 60 minutes is minimal. Any hops added to the kettle prior to 30 minutes remaining, will contribute a significant amount of bitterness and very little in the way of actual hop flavor. This is where high-alpha hops typically come into play. Inside the final 30 minutes of the boil is when flavoring hops are usually added. The later you add them, the more of the volatile compounds from the hop oils will make it on to fermentation.

If you are using pellets, you can just throw them into the kettle freely and create a whirlpool once the boil is finished to separate them from the wort. Whole cones can be added this way too or you can put them in a nylon bag for ease of removal later on. Placing them in the bag may reduce the amount of contact the hops get with the wort, resulting in a little less extraction of alpha acids and oils.

Once the boil is finished and we have reached flame out, you can add one last hop charge prior to cooling or you can employ the use of a hop back or hop jack. These two names refer to the same concept of a small, covered storage container capable of holding a few ounces of hops with an inlet and an outlet for wort flow. It works by flowing the hot, but not boiling, wort through the hop filled container on its way to being cooled through a counterflow or plate heat exchanger or back to the kettle prior to being cooled there. The idea is that the hot work will pick up much of the hop oils and retain most of them on its way to the fermentor as it cools down.

As with any other beer, the wort should be sent off to the fermenter, aerated and the yeast added. Dissolved oxygen levels in the wort when using air for aeration should be okay for both the APA and the IPA. Where it could get a little tricky is the IIPA as the higher gravity wort and subsequently higher pitching rate of yeast will greatly benefit from the use of pure oxygen. Pitch rate can be determined by what has worked for you in the past for certain beers of a similar gravity or you can use a pitching rate calculator, such as that found at mrmalty.com (Jamil Zainasheff's site). In regard to a a big beer like a IIPA, for those that want to keep it simple, I would pitch 2-3 times what you normally would for a 1.050 gravity beer.

The next port of call for adding hops is when the yeast has finished its magic and you now have green beer in your fermenter. At this point, you can take it to the next level by dry-hopping — add hops (usually whole hops) to your conditioning beer. This is usually conducted at room temperature from 5 days to 2 weeks. Any longer than that will likely impart vegetal flavors to the beer which is not pleasant. During this process, the newly created ethanol in the beer acts as an organic solvent and pulls the flavorful hop oils into the beer. Since there is no heat involved, no isomerization of alpha-acids occurs. That means you are getting all hop flavor and aroma with no bitterness!

Make sure you are using a hop variety that brings the characteristics you are looking for in that particular beer. You should be safe by choosing a hop labeled as aroma or as dual purpose. Some high alpha hops like Summit can add an onion-like aroma to the beer when used this way. Dry-hopping can be used in any of the styles I have discussed. Some commercial APAs are dry hopped, and the vast majority of IPAs and IIPAs are. Depending on the oil content of the varieties used, anywhere from 0.5–4.0 oz (14–113 g) per 5-gallon (19-L) batch is appropriate, with the high end reserved for the 8% ABV and above beers. For you worry worts out there, hops are very resistant to bacteria on their own, so don't go soaking them with sanitizer beforehand.

Post-Fermentation

When transferring and packaging your beer, be sure to purge whatever you can with CO_2, as many of the compounds in hops can become oxidized, producing off flavors. Just when you thought it was over, there is one place you can add even more hops to the beer, just before serving. The Randall, invented by the Dogfish Head Brewery, is a small chamber containing whole cone hops, similar to a hop jack, that the draft beer flows through on the way to the glass. They can be purchased or easily made at home. More recently I've seen that some people are pouring their beer into a French press filled with hops prior to dispensing it.

So to sum it up: don't let your malt bill interfere with the hop character, and don't let the sweetness of a beer detract from the bitterness. Use fresh hops and think about the form — whole, pellets or extracts — you use in your hoppiest beers. Choose a yeast strain that won't dull your hops and make your water sulfate-rich enough to accentuate them. Add high-alpha bittering hops early in the boil, lower-alpha aroma or dual-purpose hops later in the boil, and be aware of other possibilities (mash hopping, first wort hopping, using a hop jack or using a Randall).

So there you have it. The groundwork for creating a perfectly hoppilicious beer has been laid before you. The question is: What do you intend to do about it? You could just walk over to your fridge and grab a cold one, but where's the fun in that? I think the answer is pretty obvious. Get out there and brew your own! BYO

Justin Burnsed is Partner and Brewmaster at Prospectors Brewing Company in Mariposa, California near Yosemite National Park, which is opening this summer in late July/early August. He is a frequent contributor to Brew Your Own.

2012 LABEL CONTEST WINNERS

One event that never gets old for the *BYO* staff is the annual label contest. Each year we all look forward to seeing what homebrewers have come up with for designs for their cherished homebrews. From the handdrawn to the computer designed (and this year to the hand-stitched), the label contest is a fun way for homebrewers to express their creativity outside of the bottle. This year we sorted through hundreds of entries to find our favorites: a beer fit for a French Canadian beast, a Ukrainian design made entirely from needlepoint, a label for a brew to honor a great dog, and finally a label that any "C" hop lover can appreciate.

Thank you to everyone who entered this year, we had a great time choosing this year's winning designs, which wasn't an easy task. Congratulations to all the winners, and thank you to our sponsors for providing all of the great prizes. And for all of you homebrew artists out there, start thinking about what your next designs will be — next year will come around sooner than you think!

GRAND

KRIS MERRILL
Sandy, Utah

Kris' top-winning design is for a beer that he and his friend Baker made for a friend's birthday, La bête noire de cerise — the black cherry beast. "With some research I found that black cherries grow near the French speaking area of Canada, so the name got to En Français. I got a kick out of coming up with the mythology of 'the beast.'"

PRIZES: Gift certificate from **Northern Brewer**; Stainless steel double draft tower from **HomeBrewStuff.com**; Gift certificate from **Midwest Homebrewing & Winemaking Supplies**; 30 qt. brew kettle from **Polar Ware Company**; Gift certificate from **Bader Beer & Wine Supply**; BrewLab from **LaMotte Company**; Gift certificate from **Quality Wine and Ale Supply**.

SILVER

JASON FERSTER
Englewood, Colorado

Jason's design is part of a series of labels made in honor of his pack of dogs: Tessa, Sasha and Nanook. Tessa is "named after our Harlequin Great Dane, Tessa." The background image is a figure ground (black and white image) profile of a Harlequin Great Dane.

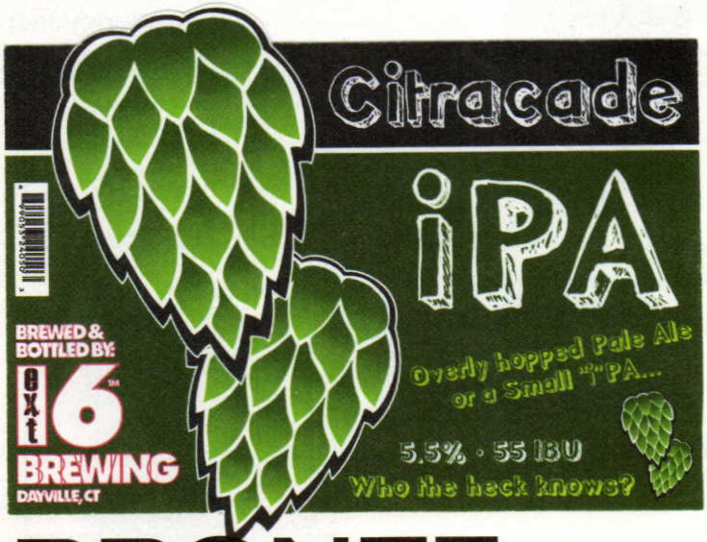
PRIZES: Gift certificate from **Midwest Homebrewing & Winemaking Supplies**; 30 qt. brew kettle from **Polar Ware Company**; Gift certificate from **Brew Your Own Brew and Wine**; Gift certificate from **Quality Wine and Ale Supply**; Neoprene bottle cozy from **HomeBrewStuff.com**

GOLD

THOMAS CRAWFORD
Tallahassee, Florida

Thomas is not only a homebrewer, he is also adept at needlepoint. "My mom and sister taught me in the late 1970s and it has been a source of stress relief ever since. I have always wanted to incorporate my love of beer into my craft," he said of his kvass label.

PRIZES: Gift certificate from **Midwest Homebrewing & Winemaking Supplies**; 30 qt. brew kettle from **Polar Ware Company**; BrewLab from **LaMotte Company**; Gift certificate from **Quality Wine and Ale Supply**; Neoprene growler cozy from **HomeBrewStuff.com**



BRONZE

ERIC MILOT
Dayville, Connecticut

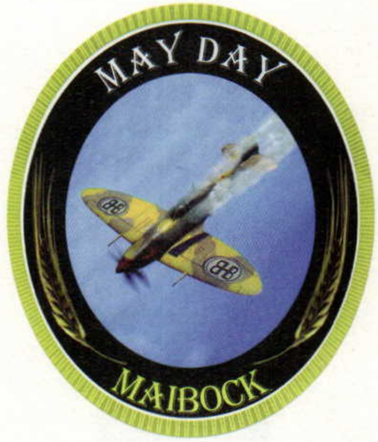
The name of Eric's beer, of which this label was created for, is inspired by the Citra® and Cascade hops he used for flavor, aroma and dry hopping. "The artwork is inspired by my love of hops as a major hophead when it comes to my choice in beers."

PRIZES: Gift certificate from **Midwest Homebrewing & Winemaking Supplies**; *Designing Great Beers* book and 1 oz. Cascade hops from **Above The Rest Homebrewing Supplies**; Gift certificate from **Maryland Homebrew**; Gift certificate from **Quality Wine and Ale Supply**; Neoprene bottle cozy from **HomeBrewStuff.com**

honorable mention

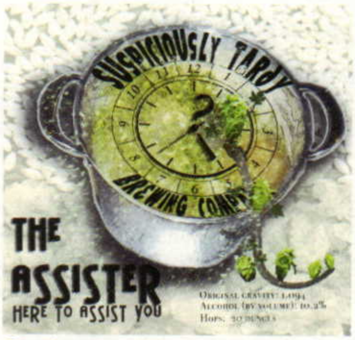
Aaron Winey • Warsaw, Indiana
Prize: Gift certificate from **Quality Wine and Ale Supply**

Andy Wilhite • El Cajon, California
Prize: Gift certificate from **Original Home Brew Outlet**



Brian Miller • Sonora, California
Prize: Gift certificate from **Hop Tech Home Brewing Supplies**

Brad Eaton • Broken Arrow, Oklahoma
Prize: Gift certificate from **High Gravity**



Craig Werkheiser • Wescosville, Pennsylvania
Prize: Gift certificate from **Homebrew4less.com LLC**

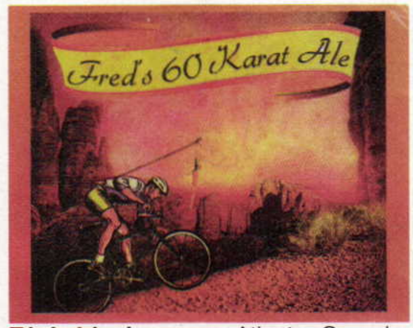
John B. McDonald • Shady Shores, Texas
Prize: *The Beer Book* from **Home Brew Party**

Shane Dubay • Chicago, Illinois
Prize: Gift certificate from **Leeners**

Eddie L. Angleton • Indianapolis, Indiana
Prize: Gift certificate from **Quality Wine and Ale Supply**

Joshua A. Webb • Murrieta, California
Prize: Thermometer from **Hobby Beverage Equipment**

Matt Thomas • Pearland, Texas
Prize: Gift certificate from **High Gravity**



Rich Lindeman • Atlanta, Georgia
Prize: Gift certificate from **The Flying Barrel**

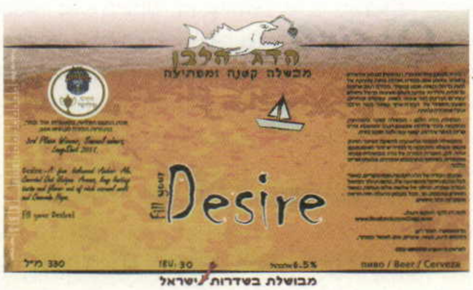
Mike Person/Sean Ryan • Elgin, Illinois
Prize: Gift certificate from **Home Brew Ohio**

Todd McCallister • San Diego, California
Prize: Gift certificate from **Bader Beer & Wine Supply**

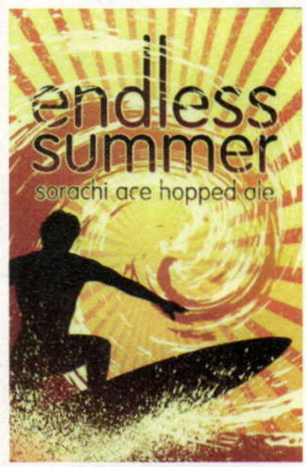
Andy Swaggerty • Greenville, North Carolina
Prize: Tap Board marker from **myLHBS.com**

Heath Gelinas • Vernon, CT
Prize: Gift certificate from **Quality Wine and Ale Supply**

Steve Pribek • Hales Corners, Wisconsin
Prize: Gift certificate from **Shrivers Pharmacy**



Tomer Ronen • Sderot, Israel
Prize: *Hop Lover's Guide*, *250 Classic Clone Recipes* and *25 Great Homebrew Projects* from **Brew Your Own**

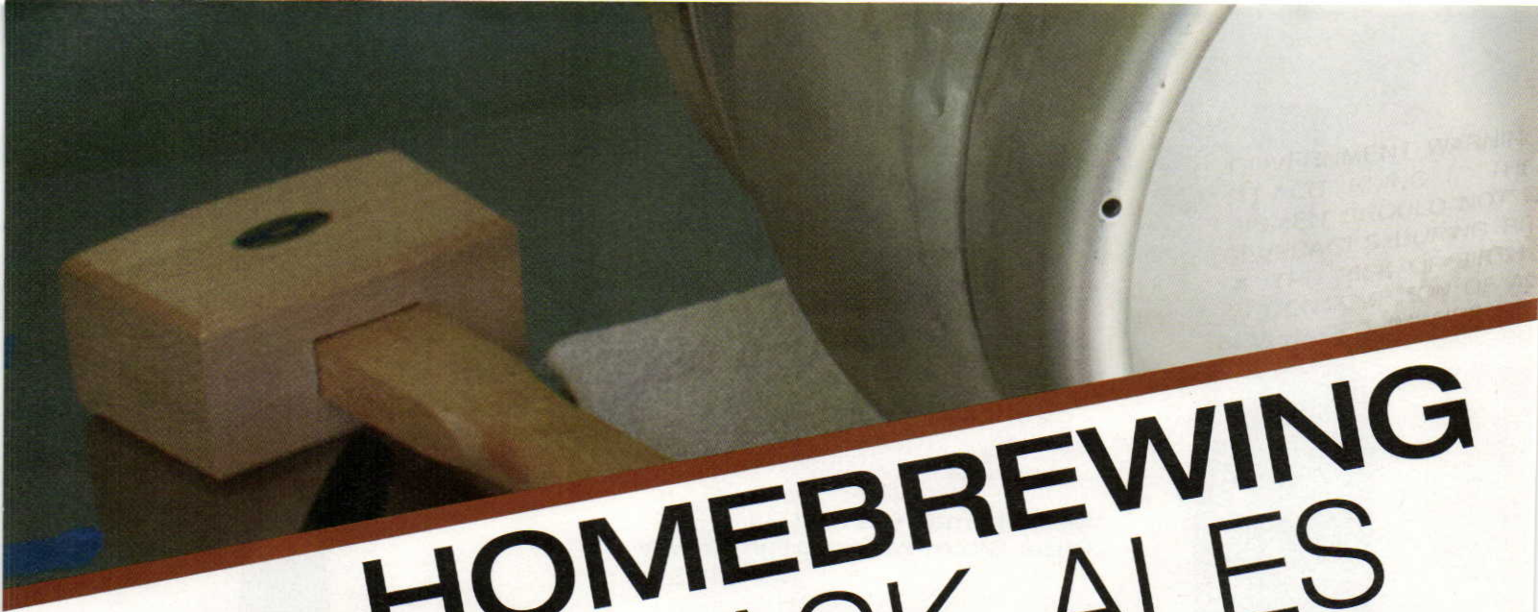


Ryan DeLutis • Lancaster, PA
Prize: Gift certificate from **TheBeerTapStore.com**

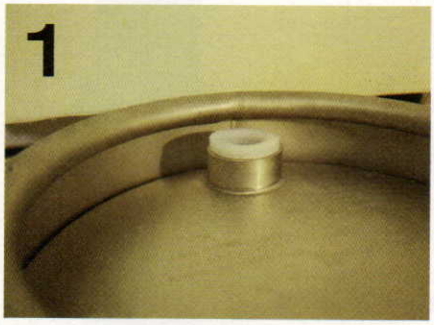
Web extra:

Check out our "Editor's Choice" label contest winners on the Web:

www.byo.com/component/resource/article/2553



HOMEBREWING CASK ALES



serve homebrew as real ale

On a recent road trip through eastern Oregon, my wife and I finally got to visit a brewpub that has been on our list for a long time, Deschutes Brewing in Bend. The atmosphere and food were excellent, but obviously the star attraction was the beer. Getting to drink Mirror Pond, Black Butte Porter, and Obsidian Stout at the source was an unforgettable experience, though one beer in particular triggered that unique homebrewer war cry — "I have to brew that!"

Deschutes' Bachelor Bitter showcases complex toasty and nutty English malts, an earthy and floral hop bouquet and complementary fruity esters from the yeast. The brewery emphasizes each of these characters by serving the beer on cask, as would be done with traditional real ales in Great Britain. The lower carbonation and cellar temperature make this 5.3% ABV beer drink very smoothly and we had no trouble downing a couple of pints in addition to all the other tasters that night. As we passed back through the area on the return trip, we filled a growler to go.

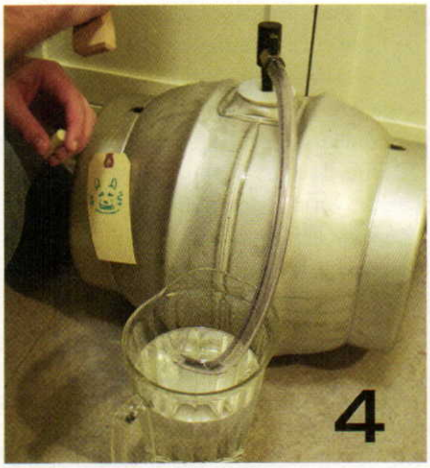
While I have drank craft beer "on cask" at many breweries in the past, that generally entailed the brewer simply putting some of their regular carbonated beer in a firkin (a vessel holding approximately 11 gallons (41 L) of beer), serving it slightly warmer, pulled through a beer engine. Each time I found the experience interesting, but the balance was off in the final product due to the tacked on gimmick. Deschutes, on the other hand, made the cask character an integral part of the beer.

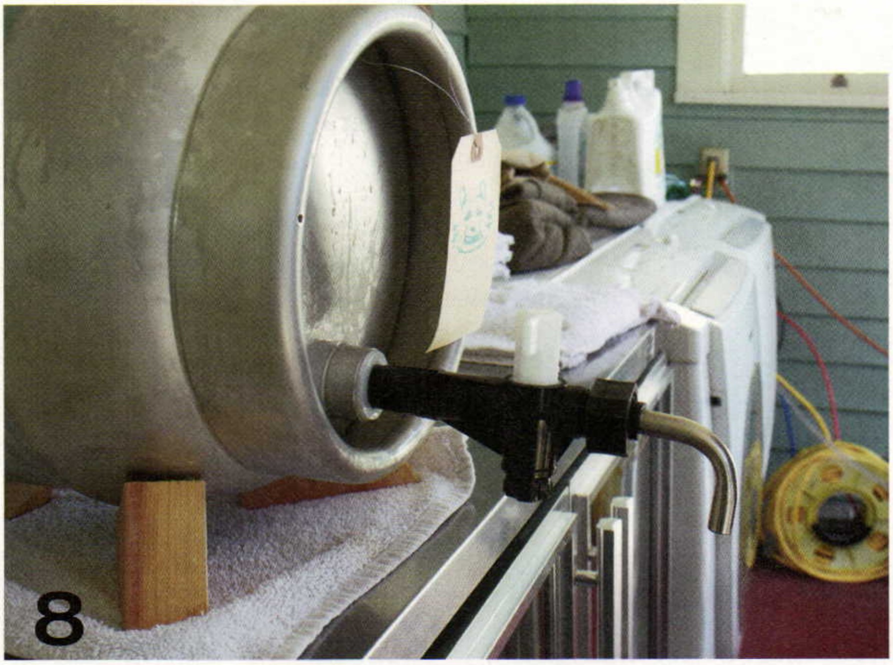
Returning home, thoughts of brewing and drinking real ale consumed my free time. I gathered and read everything I could find on the topic and began plotting my first batch. Those efforts ultimately culminated in a very successful cask party with my friends and family in which we made short work of a cask of standard bitter. The experience convinced me that more homebrewers would enjoy brewing and serving cask ales.

Cask Ale

Britain's Campaign for Real Ale (CAMRA, www.camra.org.uk) movement defines real ale as "a natural product brewed using traditional ingredients and left to mature in the cask (container) from which it is served in the pub through a process called 'secondary fermentation.'" As such, you can see that homebrewed beer that is carbonated in the bottle through the addition of priming sugar already

Story and photos by **Dave Louw**





shares a lot of traits with this packaging and serving technique.

Beyond this fairly broad definition, most drinkers would recognize real ale as typically having a lower carbonation level than most lagers and American ales, served at cellar temperatures (~50 °F/10 °C), appearing brilliantly clear and showcasing the yeast character. All this leads to a supreme drinkability across many pints. (And of course, pints of cask ale are the original session beers.) Oftentimes drinkers will identify a unique character in the beers at their favorite pub that develops over the time the cask is consumed.

Why would a homebrewer want to make cask ale at home? The most obvious reason is the same reason we brew anything. There are many styles of beer that are best experienced in their original cask form including English pale ales, Scottish and Irish ales, English brown ales, porters and stouts. In the US, we often have to settle for less than fresh bottled examples (which are often higher gravity and car-

1. Keystone Bung — Seat the keystone bung all the way.
2. Filling the Cask — Rack into the cask as you would with any keg. Note that I'm filling through the keystone bunghole, although the recommended approach is to fill through the shive bunghole.
3. Filled Cask — Pin all sealed up and labeled, ready to condition in a room temperature location.
4. Venting the Cask — A venting tool with blow-off hose ensures any gushing does not end up on the ceiling.
5. Cask with Chocks and Cooling Towels — The homemade wooden chocks are positioned two in the front and one at the back. Placing all three on a single towel prevents them from slipping out of place.
6. Ready to Tap — Before tapping be sure to sanitize the keystone and tap. Pull out the spile from the top as well.
7. Tapping — Here is the birthday boy lining up to drive the tap through the keystone. Note the large wooden mallet; this is the style I recommend.
8. Tapped — Turndown spout attached and ready to pour. Cheers!

MATERIALS

Cask (pin (5.4 US gal./20.4 L) or firkin (10.8 US gal./40.9 L) size)
Keystone bung (plastic or wood)
Shive bung (plastic or wood)
Heavy wooden mallet
Three wooden chocks
Venting tool
Hard spile
Soft spile
Tap
Turndown spout (or beer engine)
Washer
Nut

RECIPE

Oxfordshire Ordinary Bitter
(6 gallons/23 L, all-grain)

OG = 1.034 (8.5 °Plato)
FG = 1.005 (1.3 °Plato)
IBU = 47 SRM = 9 ABV = 3.8%

This beer is ideal for the no-sparge method, which emphasizes the malt character. The 6-gallon (23-L) batch size is enough to fill a pin, with enough beer left over to fill a few 22 oz. bottles.

Ingredients

6.75 lbs. (3.1 kg) Maris Otter pale ale malt
1.2 oz. (34 g) UK dark crystal malt (75–80 °L)
1.2 oz. (34 g) black malt
9.5 oz. (270 g) granulated cane sugar
11 AAU UK Challenger hops (60 mins) (1.45 oz./41 g at 7.6% alpha acid)
0.25 oz. (7.1 g) Styrian Goldings hops (flameout)
0.25 oz. (7.1 g) East Kent Goldings whole hops (dry hop in cask)
1 tablet whirlfloc
White Labs WLP023 (Burton Ale) yeast
2 oz. (57 g) granulated cane sugar (for priming)
10 mL Biofine Clear finings (at venting)

Step by Step

Mill the grains and dough-in targeting a temperature of 151 °F (66 °C). Hold the mash at 151 °F (66 °C) until enzymatic conversion is complete (roughly 60 minutes.) Collect 7.25 gallons (27 L) of SG 1.026 wort. The total boil time will be 60 minutes. Add the bittering hops at the start of the boil and boil for 45 minutes. Add the whirlfloc tablet to encourage coagulation in the kettle with 15 minutes to go. At roughly the same time, turn off the flame, add the granulated sugar. Stir well before turning the flame back on to avoid scorching. Complete the boil and add the flameout hop addition before chilling to 68 °F (20 °C), racking, oxygenating, and pitching yeast. Ferment at 68 °F (20 °C) until fermentation subsides, roughly one week later.

Rack to cleaned and sanitized cask along with priming sugar solution. Condition for roughly two weeks at about 70 °F (21 °C). Chill cask to 50 °F (10 °C) and then vent through the shive. Add finings, plug shive with soft spile, and mix gently. Let the cask settle for at least 24 hours, switching the soft spile for a hard spile as soon as visible off-gassing completes. Set up for final serving at 50 °F (10 °C), tap and enjoy.

Based on the Brakspear Bitter clone recipe from "Brew Your Own British Real Ale," by Graham Wheeler.

Extract Option

Replace the Maris Otter pale ale malt in the recipe with 4.5 lbs. (2.0 kg) of malt extract. Steep the remaining grains for 30 minutes at 151 °F (66 °C) before adding the malt extract. Otherwise follow the rest of the recipe as described above.

bonation than their draught counterparts) or Americanized interpretations. Homebrewing is a way to drink something we could not easily buy.

For homebrewers who do not have the space, funds or desire to have a dedicated kegerator, packaging in casks provides a great option for sharing a large amount of beer at once. Rather than cleaning, filling, and conditioning 50–100 bottles, you just deal with one cask. During conditioning, you treat the cask like a primed bottle, leaving it somewhere at around room temperature to carbonate. Any closet should do just fine. When it comes time to serve, you only need to chill the cask down in a fridge or cellar for a short period of time. As I will describe below, the serving equipment is minimal and easy to maintain.

Finally, cask ale fascinates people. While I seldom have trouble attracting a crowd of friends to a party with free beer, the turnout for my first cask party was astonishing. I had naively worried that the cask would go to waste because I would not get enough beer drinkers to finish the entire 5 gallons (19 L) in one night. To my surprise, a little over an hour after tapping the beer, I started seeing signs the cask was on its last legs. People eagerly downed multiple pints and the low alcohol level kept the discourse civil. I think they really enjoyed participating in something special and ultra-local. Few had experienced true cask ale and discussion between brewing friends and non-brewing friends was lively.

Equipment and Supplies

The equipment for brewing cask ale is no different than what you would use for any other beer. You can brew the beer as extract, mini-mash or all-grain and should expect similar results as with non-cask beers. Along the same lines, primary fermentation does not require any special procedures. Of course there will be different ingredients and techniques unique to the styles you typically cask, but I will cover that later.

Packaging and serving require unique equipment, though. Northern Brewer (www.northernbrewer.com) has shown a consistent dedication to spreading the cask ale message and supplying homebrewers with everything they need. At the 2011 National Homebrew Convention in San Diego, for example, they brought several casks of homebrewed ale for demonstration and served them in the hospitality suite. I recall a particularly excellent mild ale they tapped on that Saturday. Additionally you'll find that their Brewing TV (www.brewingtv-.com) video podcast covers cask beers in a fair amount of depth. In any case, the easiest way to get into cask beer is to purchase their homebrew cask kit that includes a pin cask and all equipment short of a mallet and chocks.

The equipment itself can be broken into three categories: packaging, stillaging and serving. The packaging equipment is what you need to store and age your beer. It comprises the cask, keystone bung and shive bung.

Modern casks are typically stainless steel and very well-built. They come in multiple sizes, but the two most common are the pin (5.4 US gallons/20.4 L) and the firkin (10.8 US gallons/40.9 L). So, the pin holds just slightly more than a standard 5-gallon (19-L) Cornelius keg. The sizes go up from there, but are more appropriate for a brewpub setting that can handle the significant challenge of moving around the increased weight. Pins and firkins cost roughly the same, so the choice really comes down to how much beer you want to brew at once and how much you think you can consume before it stales.

There are two holes in the cask itself that you bung up during the packaging process. The hole in the cask head is the keystone bunghole and the other one is the shive bunghole. The bungs can be either made of traditional wood or the more modern and consistent plastic. As far as I can tell, there is not a compelling reason to use one material over the other, but I chose plastic because I was more confident I could properly sanitize it. Both bungs have a recessed and partially bored out center. Later on you will knock these out and so you will need to replace the bungs for each batch. Their cost is less than that of the required crown caps to bottle an equivalent amount of beer, so this is not a big deal.

Unlike Sankey kegs (and most other modern beer packaging vessels) traditional casks are stored and served in a horizontal position with the heads on the front and back rather than the top and bottom. Storing the keg, or stillaging, faces the challenge that the cask is round and so would roll around without something to keep it in place. In many commercial settings there are special racks for holding the casks. For the homebrewer the best choice is to make wooden chocks. You need three of them (I will explain why later), but these are the one item I have not found for sale. Making the chocks yourself is simply a matter of cross cutting a 2x4 at a 30 degree angle. You should also trim the tip off the sharpest point so that the chocks do not hit each other when in use. While it may be tempting to make these out of a nice hardwood and apply a glossy finish, in practice rough-cut softwood is better. You want them to be somewhat rough so they don't slip out of place in use.

Once the beer has carbonated and is almost ready to serve, you will vent the pressure from the keg to get it to the level you desire. Doing so involves knocking the center, or tut, out of the shive bung. You can use a metal punch of some sort or purchase a fancy venting tool that has a blow-off hose. The benefit of the venting tool is, if your keg is over-carbonated, the resulting beer spray will be diverted through the tube into whatever catch-vessel you set up rather than shooting up at you and the ceiling.

Once the keg is vented, your job as cellarmaster involves maintaining the right condition or carbonation level. If the carbonation is higher than intended, you drive a porous wooden peg, or soft spile, into the shive bung. This allows excess carbonation to slowly leave the beer while preventing contaminants from entering the cask. Once the beer is at the condition you want, you replace the soft spile with a non-porous wooden peg, or hard spile, to seal it up. New spiles should be used for each batch since sanitizing the wood would be fairly difficult. Much like the bungs, this is not much concern as they are trivially cheap.

Of course all of this effort is for naught unless you can get the beer out of the cask and into a glass to drink. This is where the traditional tap comes in. The tap has a tapered end that you will drive through the keystone bung. A quarter turn valve controls the flow of beer. Taps typically have either one or two threaded fittings to allow attaching spouts or serving lines. Taps come in affordable plastic or in much more expensive and durable stainless steel. The brass taps common from earlier in the 20th Century have all but disappeared.

Which brings us to the biggest choice you have to make when serving cask beer. Do you want to go simple with a gravity spout or do you want to use a beer engine? While many beer drinkers automatically picture the ubiquitous beer engine when thinking of cask ale, its real practical purpose is for something homebrewers rarely face. At a pub the casks are stored in the cellar and left undisturbed to prevent sediment from kicking up. This cooler room is often a floor below the pub. Rather than have the barman walk down to the cellar to pour each pint, the beer engine (sometimes called hand pump) was developed. Basically the pump is a piston that fills and pours beer when the barman pulls the handle. Luckily this is much simpler for the homebrewer or someone serving at a festival because you can simply station the keg on a table or bar where you will be serving. There is no need for a fancy contraption to get the beer out of the cask as gravity is always at hand. A simple turndown spout can be fixed to the threaded fitting with a washer and nut. Turn the valve and beer comes flowing out to fill your pint glass.

The one trick you can employ with a beer engine that is not available on a gravity setup is using a sparkler. The sparkler is a fitting that goes on the end of the beer engine spout and forces the beer through lots of little holes. This agitation knocks a significant amount of carbon dioxide (CO_2) out of solution making the beer less gassy and helping to kick up a head and enhance the aromatics in the glass. Like many aspects of real ale serving, drinkers do not universally accept the use of sparklers. Given the roughly $500 price tag for a new beer engine in the US, it would be difficult to make the case for buying one based on the sparkler effect alone.

The final piece of equipment to consider is something I will not go into much detail about. CAMRA's definition of real ale does not allow for additional CO_2 to be added to the beer, so the cask is simply vented to the atmosphere. As the beer is served from the keg, the air from around the cask is drawn in through the shive leading to oxidation and eventual spoilage. If the cellarman does not expect to serve the entire cask quickly enough, a special valve called a cask breather can be used. Essentially it attaches to the shive and supplies CO_2 to blanket the beer rather than regular air. The ingenious design of the valve ensures that the CO_2 is at atmospheric pressure to prevent over-carbonation. This could be a good solution for anyone who wants to drink their cask over a longer period of time.

Brewing for the Cask

While technically the wort production and fermentation for a beer you intend to serve in a cask is identical to any other beer, there are some things to keep in mind. When brewing any beer you need to consider how all the aspects of the finished beer interplay. There are no hard and fast rules, but consider how to make the best use of the following characteristics.

Cask ale has a much lower carbonation level than many modern beers. Carbonation plays several important roles in beer. The carbonic acid "CO_2 bite" is greatly reduced in these beers, so you must pay particular attention to any residual sweetness in the beer, which will effectively be heightened. Similarly, since carbonation can help dry out a beer you may want to replace some of the malt with simple fermentable sugars, as is commonly done in Great Britain.

Finally, note that any roasty character in your beer will shift more towards a chocolate note rather than the acrid quality it can sometimes take in the presence of higher levels of CO_2.

Since it is usually served at cellar temperatures, cask beer amplifies otherwise subtle flavors and aromas. Any harsh notes that might be imperceptible at colder temperatures will move to the forefront. Be extra careful with your fermentation and sanitation, as there is less room to hide. That said these tend to be much more flavorful beers than macro-brewed light lagers. The drinker will notice the yeast, malt and hop characters even more than usual. Splurge for quality grains such as the excellent choices from Simpson's, Muntons, Thomas Fawcett, and Crisp Malting. Choose a characterful English yeast strain and experiment with temperatures that cause them to express their wonderful esters. Consider dry hopping your cask with fresh hops or the freshest quality hops you can find. On the positive side, you will likely be drinking this beer very fresh so you do not have to worry about losing character over time to staling.

In terms of timing, you are likely to be brewing a fairly low alcohol beer (though stronger beers like old ales and barleywines certainly are not out of the question.) As such the time from brewing to consumption is actually quite short. Assuming a healthy pitch of yeast and a vigorous fermentation, you would be racking your beer to the cask with priming sugar after about 7 days and then drinking the final product at the three-week mark. Note that since this is a live beer and there is active yeast in the cask, you do not have to worry as much about acetaldehyde and diacetyl problems you can otherwise get from taking the beer off the yeast too soon.

For my inaugural batch, I tracked down and slightly modified a recipe for traditional English ordinary bitter. (See the sidebar on page 48 for the Oxfordshire Ordinary Bitter recipe.)

Packaging and Serving

Once primary fermentation completes, you are ready to package your beer in a cask. Prepare the cask by cleaning it well. Since the cask has smaller openings that prevent you from reaching into it, as with Corny kegs, you might want to soak it in a hot solution of percarbonate based cleaner such as Powdered Brewery Wash (PBW.) You can gently put in the spile bung at this time to allow the cask to hold a full volume of cleaning solution while standing on one of its heads with the keystone bunghole facing up. Rinse the keg well and then sanitize the shive and keystone bungs.

Use a heavy wooden mallet to drive the keystone bung into the cask to seal it. Do not use a metal hammer or anything that might damage the keystone hole surface because over the long run you may not be able to achieve a leak-free seal. A shot-filled dead-blow mallet can also work in a pinch. Rubber mallets often do not have enough heft and are simply frustrating to use as they bounce away. It takes a surprising amount of force to get the keystone bung to seat completely, so invest in a substantial wooden mallet.

Once the keystone bung is in place set the keg on its side with the shive hole facing upwards. At this point you may want to use the chocks you made to keep the cask from rolling around. Make your priming solution to achieve 1.5 to 2.0 volumes of CO_2 and add it to the cask through the shive hole. Then gently rack your beer into the cask, leaving a small amount of headspace. Seal up the cask by driving the shive bung home with a series of firm hits with your wooden mallet. There is a slight lip on the plastic bung and you want to drive it in all the way till the lip seats firmly against the cask. On my first attempt, I was shocked at how much effort this took but that was mostly because I was using a light 10-ounce (280 g) wooden mallet. I later upgraded to a 20-ounce (570 g) model, which was much easier to use.

Go ahead and roll your cask around a bit at this point to mix in the priming solution. Carefully inspect the keystone and shive bungs to make sure they're not leaking. A few good taps should solve any problems. If you are using wooden bungs and observe some leaking, know that they will soak up some beer and swell to seal any leaks within an hour or two.

Now you wait. Just like when bottle conditioning beers, you want to store the cask in a room temperature location to allow the remaining yeast to work through the priming sugar and provide carbonation. This is a fairly forgiving process, though. The biggest things to avoid are storing the keg so cold that the yeast goes dormant without carbonating the beer or storing the keg so warm that the beer starts to degrade. Again, this is no different than when bottle conditioning beers. Carbonation should take roughly a couple of weeks under ideal conditions.

When you know when you are going to serve the beer, you need to plan a few days ahead of the event. Ideally you want to store the cask on its side (with heads facing front and back and shive upwards) in the serving location for as long as possible for the yeast and other sediment to settle to the bottom of the cask. The trick of course is that you also need to get the cask down to serving temperature of 50 °F (10 °C). As a homebrewer I will assume you don't have a dedicated cellar at this temperature, so I will tell you what I do. I put the cask in a fridge and set the temperature to 45 °F (7.2 °F) then pull it out and set it up in its final location the morning of the event. I cover the cask with an insulating blanket of some form to keep it cool. This is when you will definitely need those chocks you built. Place two under the front of the cask from the sides and one in the back with the sharper point facing forward. Set the keg up to be roughly level.

At least 24 hours before you serve the cask, you need to vent it to ensure you have the right level of carbonation, or condition. It is critical that the beer be at roughly serving temperature since a warmer beer will off-gas too much CO_2 (think of the gushing you see if you open a warm beer or serve a warm keg). Start by cleaning and sanitizing the shive bung surface. As mentioned in the equipment section earlier, drive the tut through the center of the shive bung into the cask using a sanitized metal punch or venting tool. Once any initial foaming subsides (which may be almost immediately for a beer that is already close to serving condition) it is time to fine the beer.

The goal of fining is to get the yeast and sediment to drop out and settle inside the bottom of the cask leaving brilliantly clear beer. There are multiple choices for fining agents including isinglass, gelatin and Biofine Clear. I personally prefer Biofine Clear as it is easier to use and is entirely vegetarian and vegan friendly (using it avoids awkward conversations where I would have to ask if people eat meat before handing them a pint of my beer). Follow the directions for your fining of choice, but in general I use about 10 mL of Biofine Clear in a 5.4 US gallon (20 L) pin cask.

Once you have added the fining through the newly created hole in the shive bung, sanitize and gently press a soft spile into the shive hole. Rock the keg back and forth to ensure the fining is mixed well into the beer. Spray some sanitizer on and around the soft spile. You are looking to see bubbles from the gas coming through the spile as it leaves the beer. Check back on the cask regularly and spray with sanitizer to check for active venting. As long as you see a significant off-gassing, the beer is probably too carbonated. This is more art than science and you will learn over time what gets you the results you want. Once visible off-gassing (bubbling) subsides, you want to lock in the remaining CO_2. Remove the soft spile and replace it by gently tapping in a hard spile.

To be clear, unless you have a

The Language of Real Ale

Most of the individual ideas behind serving real ale are not new to homebrewers, but much of the terminology is. Here's a quick guide to help you tell your spile from your bung hole.

Real ale and CAMRA — Real ale is ale conditioned in and served from a single vessel. CAMRA is the Campaign for Real Ale, a British group that champions serving real ale in pubs.

Cask, pin, firkin and kilderkin — A cask is the vessel real ale is served from, and casks come in many different sizes. Homebrewers most frequently chose the pin (5.4 gallons/ 20.4 L) or firkin (10.8 gallons/40.9 L), while commerical pubs often serve from kilderkins (22 gallons/83 L)

Bungs and bungholes — Casks have two holes, called bungholes. The keystone bunghole is on the front head of the cask. This is the hole that is tapped when the beer is served. The shive bunghole is on the body of the cask and faces upward when the cask is filled. The cask is filled through this hole, and is opened to the air when beer is served (unless a cask breather is being used). While the beer is being conditioned, both bungholes are sealed by wooden or plastic plugs called bungs.

Spile — The spile can be thought of as a "bung within a bung." Once the shive bung is punched to release pressure on the cask, it is resealed by inserting a spile. A soft spile allows CO_2 to exit from the cask. A hard spile creates an airtight seal. Bungs and spiles must be replaced with every batch.

Tap — The tap is driven through the keystone bung, and beer flows out through it. The tap may be connected to a simple spout or a beer engine.

Beer engine — A beer engine is a device that allows the barman to hand pump beer from a cask, as opposed to pushing it out with CO_2 pressure.

mechanism for keeping the cask at cellar temperatures in its final serving location, it is likely that you will be venting the beer while you store it in a refrigerator. This is not a problem at all. In any case, as mentioned before I move the cask to the serving location the morning of the event to let it settle clear. The finings will be kicked up along with any yeast and will help reclarify the beer.

In a commercial setting, a cellarman will often tap a beer hours in advance of pouring the first pint to ensure that the disturbance has time to settle. Part of the fun of serving a homebrewed keg at an event is the showmanship of driving the tap through the keystone, so I like to wait till everyone shows up. At a recent event, I had my neighbor who was turning 40 do the honors. You can see the fun in a video I posted online at http://www.youtube.com/watch?v=xiaGOFikmd8.

In terms of technique, there's not much to it. Examine the keystone and ensure it is clean and sanitized, as the middle will be driven into the beer. Either brace the cask or have someone hold it in place. Remove the spile from the shive to vent the keg. Hold the tapered end of the tap against the center of the keystone and square to the keg. Make sure that the threaded fitting and valve is facing the direction you want as it is difficult to adjust later. With everything in place, wind up and land a solid blow on the end of the tap to drive it directly into the cask through the keystone. Be prepared to follow that up with a couple more taps if the first one does not complete the job.

If you are using a gravity spout, attach it to the threaded fitting on the tap with the supplied washer and nut. Connecting a beer engine is beyond the scope of this article, but it is pretty straightforward.

Pouring a beer is a simple task of opening the valve and filling the glass. The spile that you removed during the tapping should remain out as long as you are serving the beer since make-up air needs to enter the keg to replace the beer you drink. If you take a break in serving the beer, immediately replace a sanitized hard spile into the shive bung to ensure that you don't lose too much carbonation.

If you look at a cask you will see that the level of the tap is higher than the lowest point when in serving position. Left horizontal there will be at least a half-gallon (~2 L) of beer that you cannot pour. This finally answers the question of why we use three chock blocks on the cask. When you have served the cask down enough so that beer will not spill out of the shive hole you want to tilt the cask forward in one smooth motion and then slide that rear center chock forwards. The final position is a little over 10 degrees forward such that the bottom front taper of the cask is effectively level.

That is it. Eat, drink and be merry.

Challenges

While packaging and serving cask beer is pretty straightforward once you have done it a few times, it does have some unique challenges. Hopefully my experience and research can help mitigate some of them for you.

Getting the carbonation right can be a bit hit or miss, just like with bottle conditioning. Ensuring you have healthy yeast, carefully following recipes or priming charts, and storing the cask at room temperature go a long way avoiding problems. It is easy to vent off a little excess CO_2, but it is not feasible to add carbonation when it comes time to serve the beer so aim slightly on the high side when in doubt. Beyond nailing your carbonation, the best cask ale is brilliantly clear with all yeast and sediment settled out of the beer. Those things affect the aroma and flavor of beer so it is not simply a matter of looks. If you have haze problems, consider trying a different type or amount of fining. Also ensure that you are disturbing the cask as little as possible shortly before and during serving. If those do not work then consider a different yeast variety that settles out more solidly.

Depending on the resources at your disposal, keeping the cask at the ideal 50 °F (10 °C) can also be a significant challenge. British pubs have come up with all kinds of mechanisms to cool casks that do not have the benefit of being kept in the cellar. Most of these are out of reach of the homebrewer as they involve glycol, pumps and fancy stainless piping. You could, though, make an insulating jacket or cooler to cover the cask. Evaporative cooling is another alternative and relies on a damp towel on the cask to provide modest cooling. Finally, the old standby of bags of ice works, but pay attention to ensure that you do not accidentally cool the beer too much.

The challenge I thought would be the biggest issue may not be a concern at all. Once you have started serving the keg and drawing air you effectively start a countdown before the beer is spoiled. The exact amount of time you have depends on numerous factors but it is safe to say you have at least 12 hours and perhaps 36–48 hours. On a homebrew scale and without a cellar at a consistent temperature, it is best to plan to finish the keg by the end of the evening. If you want to serve and store the keg for longer than that, you will want to investigate cask breathers and cooling jackets.

Your best option, though, is to invite over your friends, family and neighbors and ask for their help. A pin holds just over 40 pints of beer, so base your number of invitations on this. Make it a potluck or bring-your-own-meat BBQ and you will have an event that leaves a lasting impression.

Conclusion

While I have yet to replicate Deschutes' Bachelor Bitter, the journey into cask ales has reinvigorated my brewing enthusiasm and creativity. I have a long list of styles I plan to brew and share with friends including dry stout and mild. For more information on cask ales, CAMRA has published several very affordable books, including "Cellermanship: 5th Edition," by Patrick O'Neill (2011, CAMRA) and "Brew Your Own British Real Ale: 3rd Edition," by Graham Wheeler (2010, CAMRA). BYO

Dave Louw's article on no-sparge brewing can be found in the November 2011 issue of BYO.

Second Generation

Recycle your homebrew yeast

by Terry Foster

My March-April 2012 "Techniques" column dealt with making an adequately sized starter in order to ensure proper fermentation performance in high gravity beers. If you read it you may have wondered what the connection is between that and repitching yeast from one batch to another. Well, quite simply, repitching ensures that you have a plentiful supply of healthy, active yeast without having to prepare a starter every time you brew.

Repitching is a technique widely used by commercial brewers mainly because of its convenience, rather than the relatively trivial cost savings it offers. Do note that you can't do it forever, as the yeast will eventually mutate and will then need to be replaced with a fresh sample. But commercial breweries brew all the time and it is easy for them to ensure that they have one fermentation finished and ready for cropping just when the next batch of wort needs to be pitched. This is not so simple a matter for a homebrewer, who usually has a much more irregular pattern of brewing and often brews beers of quite a different nature. In fact, if you brew only once a month or less, this method will not work for you at all. Should you brew more frequently then repitching is an option for you, but only if you carefully plan your schedule in advance. This is true even if you brew the same beer each time, but it is especially so if you are going to turn out a line of different beers.

It's always the same isn't it? No matter how great the idea may be there are always limitations on it. In this case when you have harvested yeast from one batch you do not really want to store it for much more than a week before pitching it into your next brew. That means you have to brew at least every two weeks to make this work well. And you do not want to take it from a beer that is strongly flavored, like an IPA or doppelbock and pitch it into something more neutral like a pale ale or Pilsner. So there should be a progression in intensity of flavor with each successive brew and I'll offer some suggestions as to how to go about this. At BrüRm @BAR here in New Haven, Connecticut our approach is straightforward. Yeast is only repitched from our Toasted Blonde, which is a fairly bland, pale beer low in bitterness and OG 1.040 (10 °P). It is our biggest seller, and so is brewed more often than any other beer. Yeast is taken from this at the end of fermentation and used to pitch all our other beers — pale ale, amber, stout and all our specialty beers, and the yeast from these is discarded. The next batch of Blonde is repitched from the last, and its yeast will be used for the subsequent batch. In short we only continually repitch from and to the same beer.

Therefore it would seem that you should only carry over the yeast into identical beers, or into beers falling into a narrow band of OG, flavor, color and hop bitterness. That is certainly true if you want to re-use the yeast indefinitely, but what if you don't want to brew more than a few weeks at a time, and/or you want to make some very different beers? And what if you only want to make a couple of brews for the foreseeable future and these are very different in nature? The answer to the last question is that this is no problem. In fact if you want to make a big beer, say an imperial stout at around OG 1.090 (20.4 °P), a good way to make sure you have sufficient yeast to handle this wort, is to repitch all the yeast from another beer. This could be another stout, or pale ale but it should be brewed from a wort with an OG of no greater than 1.050 (12.5 °P). In short you are effectively using the lesser beer as your yeast starter for the imperial stout, which is a somewhat specialized case of repitching.

So back to the first question, and

"Repitching is a technique widely used by commercial brewers mainly because of its convenience, rather than the relatively trivial cost savings it offers."

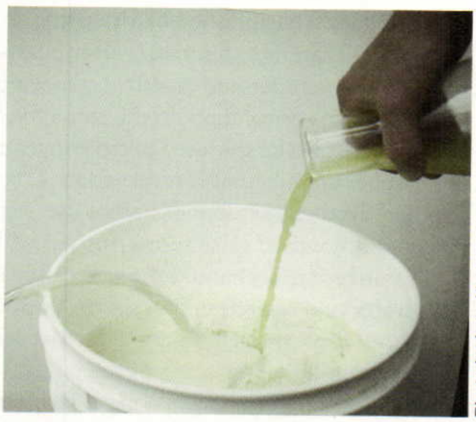


Photo by Les Jörgensen

the answer is that you can brew a progression of beers, repitching one to the next, and with the last beer being very different in strength and style from the first one. All you have to do is to ensure that you do not have a big jump in wort gravity at each stage of repitching, and that changes in flavor are progressive. By the latter I mean that you are always going from a lighter level of flavor to a higher one, and that each stage leads naturally to the next. For example, you could start with an English bitter at 1.040 then repitch from that to an ESB, from there to a robust porter at a similar gravity, and from there on to an oatmeal stout and finally to an imperial stout. Or you could start with a lightly-hopped Pilsner, and move along to stronger lagers such as bock, then doppelbock. Just note in the latter case that you should be more careful with lager yeasts than their ale cousins. Professional brewers generally repitch lager yeasts after eight or ten cycles, whereas ale yeasts have been taken much farther along the chain. In all cases, you should check the fermentation carefully at each stage. If the last one has been sluggish, or the finishing gravity at the end of the primary is higher than you targeted, then the yeast should not be re-pitched.

How to repitch

The bottom layer of yeast sediment will contain whatever trub (hop residue and/or proteinaceous from the hot and cold breaks) is present in the fermenter; it will also contain a high proportion of dead yeast cells. The top layer may contain alpha-acids which precipitate during fermentation, and the cells in it will have been exposed to the alcohol in the beer for longer than any other cells, and may therefore be somewhat weakened. So, the ideal is to collect only the middle layer for repitching, as this will be the cleanest and will have the highest concentration of "normal" active cells. If your yeast forms a thick skin on the surface you still do not want the top layer which has been exposed to air and will contain precipitated hop alpha-acids. However, the layer beneath that is fine and will contain plenty of active cells, as most of the dead cells will have settled to the bottom of the vessel. Collecting yeast is much easier, by the way, when you ferment with a wide-mouth vessel such as a brewing bucket.

So you need to try and scrape off the top layer from the head or from the sediment after racking. Be sure fermentation has finished before doing so, which should be no longer than five to six days after pitching the wort. Take a suitable scraper and carefully remove the first ¼ inch (0.64 cm) or so, then do the same for the next layer, and try not to take the very bottom layer in doing so. I use a rubber spatula that is reserved for brewing yeast only and sanitized with iodophor before use. I collect the yeast in a wide-mouthed glass screw-top jar, which has also been sanitized beforehand. I then store the sealed jar in a refrigerator and repitch within six to seven days. Be careful with screwtops, though, as some further fermentation may occur and there is a risk of the jar exploding. If you are lucky enough to have a conical fermenter you can collect the yeast through the racking arm, or run off the bottom layer through the drain valve and collect the middle layer the same way. Whatever system you use, collect a half to two-thirds of a pint for repitching in the next brew.

Pitching schemes

Now, before I list some schemes there are a couple more caveats about re-pitching I should mention. First, make sure the first brew in the series is pitched with a good supply of yeast, either by using more than a single pack or vial, or more preferably by making a good-sized starter — a quart (1 L) being a good size. The second is that you must be very careful with your hygiene. Every vessel and utensil must be properly cleaned and sanitized, or you may simply be repitching spoilage organisms along with the yeast.

Scheme one: (The lager path):
Start with a clean, straightforward lager yeast, such as White Labs WLP830 (German Lager) or Wyeast 2001 (Pilsner Urquell), both of which tend to emphasize malt characteristics and offer a reasonable compromise for the listed beers.

First: American lager (1.045, 11.2 °P, 15 IBU)
Second: premium lager (1.050, 12.4 °P, 20 IBU)
Third: Munich helles (1.048, 11.9 °P, 20 IBU)
Fourth: Dortmunder export (1.052, 12.9 °P, 30)
Fifth: German Pilsner (1.050, 12.4 °P, 40 IBU)
Sixth: classic American Pilsner (1.055, 13.6 °P, 35 IBU
Seventh: Märzen (1.055, 13.6 °P, 24 IBU)
Eighth: bock (1.070, 17.1 °P, 24 IBU)

This is about as simple a repitching series as you can get, with only a little variation in OG until the last jump to the bock, and only modest variations in bitterness and color. Yeast contributions to flavor are relatively, maltiness being the main characteristic flavor of these beers. On those grounds Kölsch is not included in this series, despite its similar color and bitterness level to those of the beers listed, because of the yeasts I selected. If you want to make a genuine Kölsch you have to live in Köln, but to get as close as you can to the style you should really use a Kölsch yeast strain.

Note that you could at any stage repeat any of the individual beers in this series, before progressing to the next, except for the last of them. Once you have got to the high OG of the bock it's the end of the road for that yeast, no more repitching. Note also that you would not have to make the last beer a bock, as you could have gone straight from the Märzen to a doppelbock just as easily.

Scheme two: (The pale ale path):
First: ordinary bitter (1.038, 9.5 °P, 30 IBU)
Second: special bitter (1.046, 11.4 °P, 35 IBU)
Third: Irish red ale (1.050, 12.4 °P, 28 IBU)
Fourth: extra special bitter (1.055, 13.6 °P, 40 IBU)
Fifth: American pale ale (1.052, 12.9 °P, 40 IBU)

Sixth: English IPA (1.065, 15.9 °P, 60 IBU)
Seventh: double IPA (1.085, 20.3 °P, 90 IBU)

For this series I would suggest White Labs WLP051 (California V), or Wyeast 1272 (American Ale II), because most of these beers need a little fruity, estery character, but not too much or the American pale ale will be thrown out of character. If you eliminate that beer from the series, then you use a more typical English yeast, such as White Labs WLP005 (British Ale), or Wyeast 1098 (British Ale).

Note that this scheme is relatively brief, because, unlike Scheme one it is necessary to balance bitterness levels as well as OG in this progression. Also, you do not have to follow this roughly similar color scheme. For example, if you did not want to make an IPA at this stage, but instead wanted to move to porters and/or stouts this can easily be done as you will see below.

Scheme three: (The dark path):
First: ordinary bitter (1.038, 9.5 °P, 30 IBU)
Second: special bitter (1.046, 11.4 °P, 35 IBU)
Third: Irish red ale (1.050, 12.4 °P, 28 IBU)
Fourth: northern English brown ale (1.047, 11.7 °P, 25 IBU)
Fifth: brown porter (1.046, 11.4 °P, 30 IBU)
Sixth: robust porter (1.053, 13.1 °P, 35 IBU)
Seventh: dry stout (1.045, 11.2 °P, 40 IBU)
Eighth: foreign extra stout (1.064, 15.7 °P, 50 IBU) or imperial stout (1.090, 21.5 °P, 80 IBU)

You can have your pick of English yeast strains for this one, but I think White Labs WLP004 (Irish ale), or Wyeast 1084 (Irish ale) would be a good choice. Of course, you can repeat any individual step as often as the yeast will take it. For the porters and dry stout you can even take a step backwards and brew a robust porter after the dry stout, and from there back to a brown porter. But you can't go back from the foreign extra stout, and as I have indicated you should not expect repitched yeast to handle going from that beer to an imperial stout.

Final thoughts

I have not mentioned the fact that the yeast grows at each stage, so you actually end up with more than you need to pitch your next beer. You can do a split at any stage, and use half the collected yeast for one beer, and the other half for a different beer. That means that you could do a full sequence of pale beers, and at any point cross over to a dark beer or series of dark beers. If you do this, however, you are going to be pretty busy, and your planning must be even more detailed than for a single series. BYO

Terry Foster writes "Techniques" in every issue of BYO.

Temperature Control

Importance of probe placement

by Chris Bible

Fermentation temperature is a critical brewing variable. Temperature directly influences the metabolic rate of the yeast and the rate of the biochemical reactions associated with fermentation. Fermentation temperature has a significant impact on the quality of the finished beer, so control of this variable is very important for the brewer.

There are numerous ways for a homebrewer to control fermentation temperature. One very common method used by homebrewers is to place the fermentation vessel inside a temperature-controlled chamber (e.g. a converted refrigerator or chest freezer). The temperature control system that is most commonly used is an external controller with a temperature sensor probe that is installed in the system in such a way as to override the built-in thermostat on the refrigerator or freezer. The temperature sensor that is used for this type of controller is commonly a thermocouple, thermistor or sealed-bulb-type probe. The temperature sensor is designed to detect the temperature of whatever it is in contact with, and transmit this information to the controller. The controller receives the temperature information from the sensor and takes action depending upon the difference between the temperature setpoint on the controller and the temperature data that is being received from the temperature sensor.

In a system such as this, the placement of the temperature sensor is an important consideration. The temperature sensor detects the temperature of its immediate surroundings. If the sensor is mounted to the wall of the chamber, it is detecting (mostly) the temperature of the chamber wall. If the sensor is dangling from the wire and hanging in the air within the chamber, it is detecting the temperature of the air. If the sensor is immersed in the wort, it is detecting the temperature of the wort in contact with the sensor. The temperature controller responds to the signal that is being sent by the sensor. The controller doesn't know or care where the sensor probe is located. It only sees the temperature output signal from the sensor and takes action based on deviation from the temperature set-point in a way that is governed by the logic programmed into the controller.

Comparison of temperature responses

For the purposes of our discussion, assume that the temperature controlled chamber is a cooling chamber (i.e. a refrigerator or chest freezer). Two common locations for a temperature sensor in a homebrewer's temperature-controlled chamber are in the air of the chamber and submerged in the wort being fermented.

When a signal is sent by the sensor indicating that the temperature is higher than the controller set-point, the temperature controller sends a signal to the system to activate the cooling unit. The cooling unit then begins to lower the temperature within the chamber until such time as the temperature is reduced below the controller set-point. The controller then tells the cooling unit to stop cooling. Depending upon the location of the temperature sensor, the on/off cycle duration of the cooling unit will be different because the controller will be responding to a temperature sensor signal that will be different in the two different system configurations.

The air temperature within the chamber will quickly become cooler when the cooling unit is operating. If the sensor is reading the temperature of the air, the controller will respond accordingly and will stop the cooling cycle fairly quickly when the air temperature falls below the set point.

For a fixed temperature differential, wort in the fermenter will take a much longer time to become cooler as compared to the temperature of the

> "Fermentation temperature has a significant impact on the quality of the finished beer, so control of this variable is very important for the brewer."

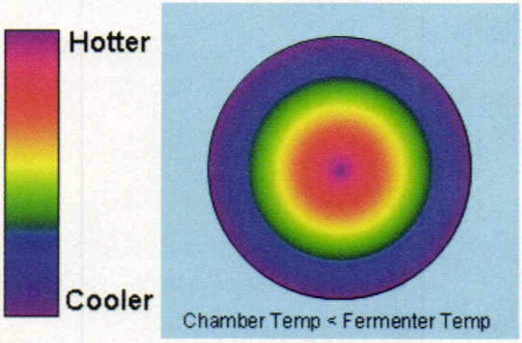
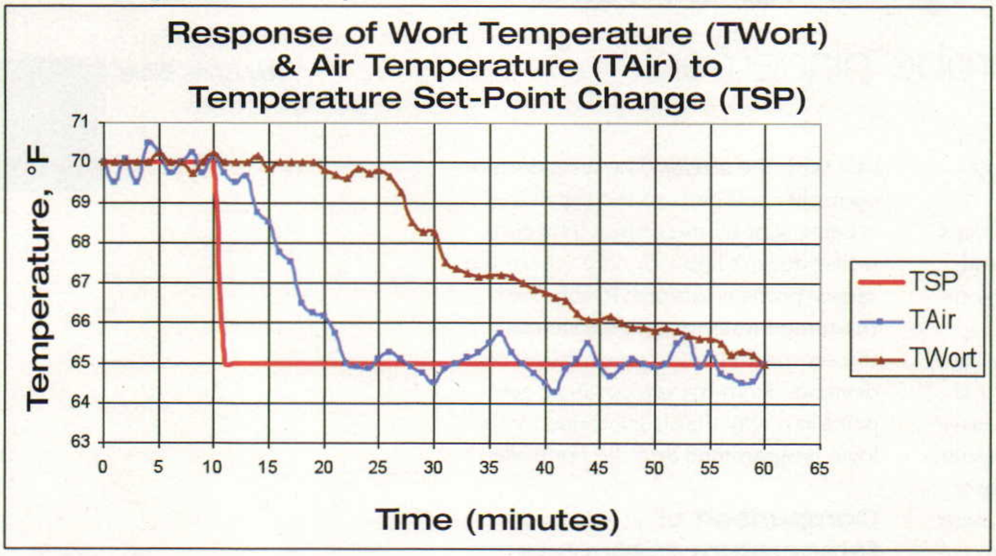


Figure 1: Temperature Controller Sensor in Air



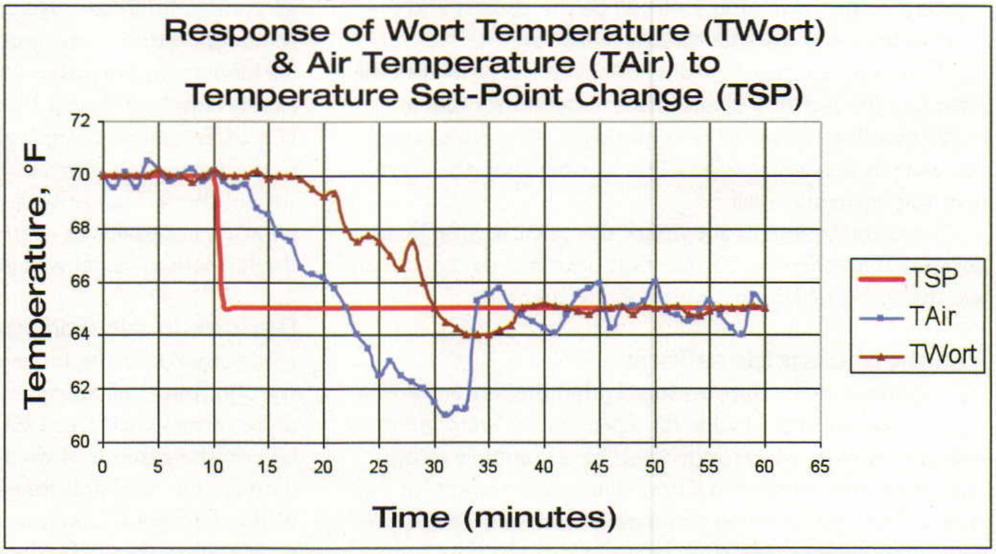
air. This is because the cooling unit cools the air, which then cools the fermenter, which then cools the fermenting wort. All of these cooling steps take time. Additionally, it generally takes much more time to reduce the temperature of solids (the fermenter) and liquids (the wort) due to the relatively higher heat capacity of solids and liquids vs. gasses. Heat capacity is defined as the amount of energy required to change the temperature of a unit-amount of a substance. The heat capacity for air is approximately 0.24 BTU/lb. The heat capacity for water is approximately 1.0 BTU/lb.

Additionally, there is not a large mass of air in a sealed refrigerator or freezer. There is a much greater mass of water (wort) inside our example sealed refrigerator or freezer (even though the volume of air is greater). Cooling the smaller mass of air happens much more quickly than cooling the larger mass of water (wort).

The cooling unit cools the chamber until such a time as the temperature of the sensor is equal to the setpoint temperature on the controller. If the sensor is immersed in the wort, it will tell the cooling unit to continue lowering the temperature of the chamber more and more, even to a point such that the temperature of the air in the chamber is much lower than the temperature of the sensor immersed in the wort.

The figures on page 62 and 63 illustrate representative temperature response data for these two different temperature sensor location scenarios. The figures illustrate temperature response data for the chamber air and the wort when a temperature setpoint adjustment is made at the 10 minute point on the graphs. In the system configuration where the sensor measures wort temperature, the chamber air temperature is allowed to become much cooler than that of the controller setpoint.

Figure 2: Temperature Controller Sensor in Wort



Important considerations for the brewer

Yeast generates heat as a by-product during fermentation. Because the wort within the fermenter is cooled from the outside by the cold air in the chamber, temperature gradients will always be present to some extent within the wort (even though the wort is slightly mixed by the action of evolution of CO_2 during fermentation). The wort nearest to the fermenter wall will have the lowest temperature and the wort in the center of the fermenter will have the highest temperature. The graphic on page 61 illustrates this temperature gradient concept.

This means that if the temperature sensor is placed in the wort in the center of the fermenter, all of the other wort within the fermenter will be at a lower temperature than the temperature the sensor is reporting. The wort adjacent to the fermenter wall will be the coolest and the wort at the center will be the warmest.

If the temperature sensor is placed in the air within the chamber, the sensor will indicate a temperature that is lower than the temperature of the wort. In this instance, the wort in the center will still be warmer than the wort near the fermenter wall.

Since the biological activity of the yeast is strongly temperature dependent, it is important to understand and manage these thermal details within the fermenter.

Practical considerations

Management of the temperature within the fermenter is a very critical control variable for a brewer. To brew great beer a brewer must keep the yeast happy and try to optimize their environment in a way that is appropriate for the style of beer that is being produced. As homebrewers, we have limited methods available to allow us to control fermentation temperature, and we are forced to brew our beer within the realities of the physical constraints of the system that we have. Since temperature gradients within the fermenter exist, we must manage them as best we can. Here are some recommendations that might be useful.

Sensor in wort configuration

This configuration is generally preferred over the sensor-in-air configuration because the sensor is actually measuring the temperature of the wort, not the temperature of the air. Understand that the wort near the wall of the fermentation vessel will be cooler than indicated by the sensor. Use LCD adhesive-strip-type thermometers on the exterior of the fermentation vessel in order to monitor the temperature of the fermenter wall. Adjust the setpoint on the temperature controller as needed to ensure that the wort near the fermenter vessel wall does not become too cold.

Sensor in air configuration

Understand that the temperature the sensor is reporting to the controller will always be cooler than the actual temperature of the wort. Use LCD adhesive-strip-type thermometers on the exterior of the fermentation vessel in order to monitor the temperature of the fermenter wall. Take note of the differential between the sensor temperature and the temperature shown by the thermostrip. Adjust the setpoint on the controller so that the temperature shown by the adhesive-strip is approximately 1–2 °F (0.5–1 °C) lower than your desired fermentation temperature. An even better approach is to immerse a separate thermometer into the wort and adjust the setpoint on the controller to sustain the desired temperature on the other thermometer. BYO

Chris Bible is BYO's *"Advanced Brewing" columnist.*

DIY Water Filter

Add some insurance to your homebrew

by Christian Lavender

As homebrewers we strive for perfection in our brews. There is a lot going on to get that water flowing into your home and more that a homebrewer can do to control the quality of the largest ingredient in the brewing process.

Mineral content, particulate matter, pH, hardness, alkalinity levels, salts, chlorine, microbes and temperature levels. Water can seem overwhelming if you try and address everything at once, so start with the basics and work your way up into more advanced chemistry constructs.

Once water reaches the tap in your home you as a brewer have a choice: trust the water from the magical source or add some insurance to the next batch of brew with a simple DIY filtration system.

A simple filter set at a proper flow rate can help remove contaminants (scale, sediment, and rust particulate) that your water picked up in the pipes from the treatment plant to the homebrewery. Filtration is also recommended for those using well water.

Chlorine, chloramines and pollutants have also got to go. When brewing beer with treated water, chlorine and chloramines can combine with malt phenols in the wort to create a compound called chlorophenol, which can give the beer a medicinal taste. Also, cleaning your brewing gear with unfiltered water and not allowing it to dry properly will leave chlorine on the surface and lead to the same production of chlorophenols. So, cleaning with filtered water is suggested. Activated carbon filtration will also remove chlorinated compounds including Trihalomethanes (THMs) and organic pollutants such as pesticides. Cartridge carbon filtration is inexpensive and requires no presoaking, sterilization or backwashing. The filters can be replaced quickly once the flow rates start to diminish due to accumulation of suspended solids on the filter.

Filters, filter housings and copper, brass or stainless fittings can be found at your local big box hardware store. You may need a dual filtration or a reverse osmosis system in extreme cases of ion imbalance or contaminants in your water, so it's a good idea to get a water analysis report from your city or town before you start.

“Once water reaches the tap in your home you as a brewer have a choice: trust the water from the magical source or add some insurance to the next batch of brew with a simple DIY filtration system.”

Tools and Materials

- GE Household Pre-Filtration System - Model # GXWH20S
- GE FXWTC Carbon Water Filter
- ¾-inch MPT to ½-inch FPT bushings
- ½-inch MPT to ½-inch FPT elbow
- ½-inch MPT adaptor
- Copper pipe
- ¾-inch MPT to ¾-inch FPT Shutoff valve
- ¾-inch MPT Quick disconnect
- Filter wrench
- Teflon tape
- Adjustable wrench
- Welding Torch, tinning flux & lead-free solder
- Propane striker

1. GET FITTED

Incorporating a standard hose quick disconnect, shutoff valve and bent elbow on the water outlet can help shave time off the brew day, so think about your filter design and modify it to fit your specific needs. There are many different materials and fittings you can choose for the water outlet. I have seen PVC and silicone tube setups, but on this design I chose a copper pipe elbow. To make this fitting you can either use instant push fittings which do not require any welding, but check to make sure it is food grade and safe for drinkable water sources. Another component of the filter that you can modify to your needs is the cutoff valve. You can go for extreme control using automated ball valves. These can be controlled by a computer system or float sensor, but manual quick cutoff valves work great too.

2. WRAP AND HEAT

Clean and Teflon wrap all MPT fittings. Make a clean, burr-free cut on your copper pipe with a pipe cutter. Brush the joints with a pipe brush before fluxing. Assemble pipe and adaptor, apply heat and solder the joint together. If you are going to weld please use caution when operating the torch. Read up on safety standards and precautions when doing any welding or plumbing. Put on your safety glasses and high heat resistant gloves. Keep a bucket of water within reach and have a fire extinguisher on hand.

3. ALL TOGETHER NOW

Once you have decided on your elbow and cutoff valve designs gather up all the parts and lay them out. Thoroughly clean the water filter housing. On the inlet side of the filter screw on your cutoff valve ½-inch MPT to ½-inch FPT bushing and the elbow and copper pipe fitting. You can cut your copper pipe to fit the length of your kettle. The copper pipe will also act as a hanging arm and allow you to add water to a HLT or boil kettle hands free.

4. FILTER IS IN THE HOUSE

To install the filter unscrew the housing and wash inside the housing with warm soapy water and lubricate o-ring gasket. Remove the shrinkwrap and install the new filter. Reassemble the housing and turn on your water supply. Run water through the filter for 5 minutes to flush the system. The filter will remove particulate from 1-5 micron and will last around three months (15,000 gallons/ 56,781 L) depending on usage. The filter has a spiral wound carbon paper construction and reduces chlorine taste and odor, sand, soil, silt, sediment and rust.

5. HANG'N OUT

Click in your water source/hose and you are ready to dispense some purified water. You can easily hang the filter on the side of a hot liquor tank and fill to the desired level. This design adds another level of safety with its cutoff valve by allowing the operator to cut the water off locally instead of from a distant wall faucet. Leaving any brew system unattended is never advised especially if you are using open flames.

6. FUTURE UPGRADES

A final upgrade for this filter was an added automated ball valve with float sensor, which could be set to a certain water level. Design inspiration was from Randy Mosher's "automate everything" mantra. BYO

Christian Lavender is a homebrewer in Austin, Texas and the founder of the websites Kegerators.com and HomeBrewing.com.

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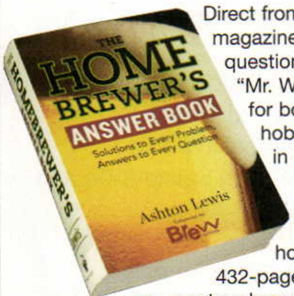

Sharing A Brew

A tasty website for homebrewers

Matt Gauzza • Lancaster, Pennsylvania

By day, I'm a Web developer, and to keep my sanity at night, I homebrew. It has been around three years since I made my first batch. What I love most about homebrewing is sharing what I've created; watching as a friend or family member takes their first cautious sip of my homebrew and putting the glass down with a smile. I wanted a way to share that experience with other homebrewers, so I combined my skills to create BrewShuffle.com.

For months I scoured the Web to plan my site. I thought that the idea of the communal sharing of homebrew had to already exist. To my surprise, nothing really fully encapsulated what I was looking for. I wanted a place where homebrewers and beer geeks could come together and share our homebrew; a place where I could try that homebrew recipe I was always cautious about brewing myself.

Perhaps, invite some local homebrewers over to have a great brew day with a collective mishmash of different types of equipment and ingredients I wouldn't be able to amass on my own.

Many months later, after lots of long nights and weekends the website BrewShuffle.com was "launched." I knew it still needed some polish, but it was time to get some real feedback. Initially the hits were slow, but soon they started to pick up. A few months after its launch BrewShuffle.com is doing pretty well for a site as young as it is. Hopefully it has a very bright future and finds its place in the homebrewing community. I think it is a great place to get feedback on your beers without submitting to competitions, try a homebrew that you haven't brewed yet and learn about how ingredients affect flavors. So go forth and share your homebrew! visit us at http://brewshuffle.com. And to share a little bit of my homebrewing with you, check out my Imperial IPA:

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Photo Courtesy of Matt Gauzza

Matt Gauzza's Imperial IPA

(5 gallons/19 L, all-grain)

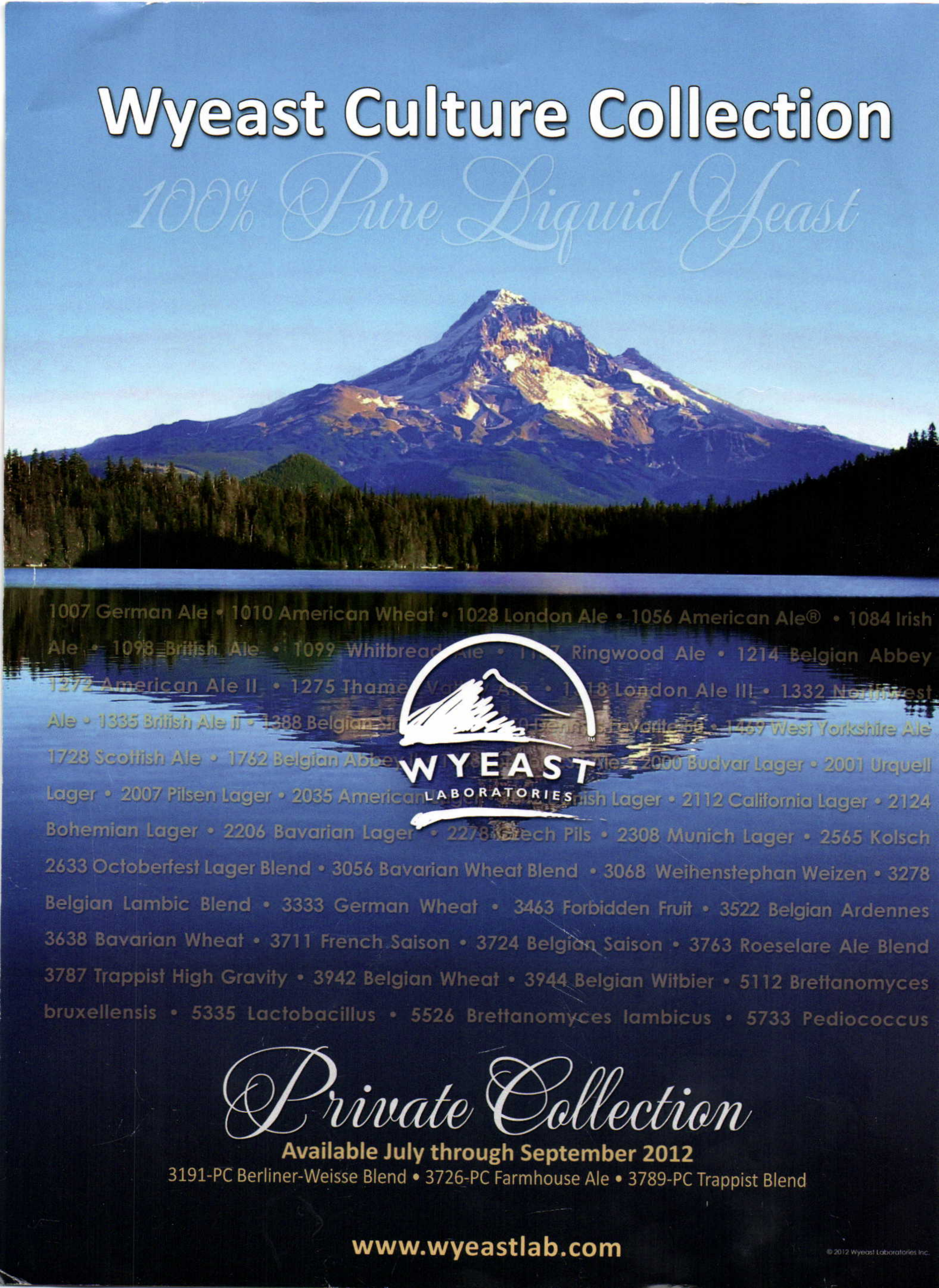
OG = 1.084 FG = 1.020
IBU = 91 SRM = 9 ABV = 8.5%

Ingredients

- 11 lbs. (5 kg) North American 2-row pale malt
- 4 lbs. (1.8 kg) Munich malt (7 °L)
- 2 lbs. (0.9 kg) Carapils®/dextrine malt (2 °L)
- 1 lb. (0.45 kg) Vienna malt (3 °L)
- 15 AAU Warrior hops (1 oz./28 g at 15% alpha acids) (first wort)
- 6.5 AAU Simcoe hops (0.5 oz./14 g at 13% alpha acids) (60 min.)
- 8.5 AAU Amarillo Gold hops (1 oz./28 g at 8.5% alpha acids) (15 min.)
- 6.5 AAU Simcoe hops (0.5 oz./14 g at 13% alpha acids) (15 min.)
- 8.5 AAU Amarillo Gold hops (1 oz./28 g at 8.5% alpha acids) (1 min.)
- 13 AAU Simcoe hops (1 oz./28 g at 13% alpha acids) (1 min.)
- 1 oz. (28 g) Simcoe hops 13% alpha acids (dry hop)
- 1 Tb. Irish Moss (15 min.)
- 1 package each Safale S-04 and Safale US-05 yeast

Step by Step

Mash in for 60 minutes with 5.5 gallons (21 L) of water at 164 °F (73 °C). At mash out add 3 gallons of water at 200 °F (93 °C) for 10 minutes. Fly sparge 0.5 gallons (1.9 L) of 168 °F (75 °C). Add the hops and Irish moss according to the ingredients list. Rapidly chill the wort to yeast pitching temperatures and pitch the yeast. When the primary fermentation is complete, dry hop for 7 days. BYO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Ale • 1335 British Ale II
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