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THE HOW-TO HOMEBREW BEER MAGAZINE

JULY-AUGUST 2023, VOL. 29, NO. 4

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contents

JULY-AUGUST 2023, VOL. 29 NO. 4




features

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Brew Your Own — THE HOW-TO HOMEBREW BEER MAGAZINE

departments

26

where to find it

RECIPE INDEX

RECIPE STANDARDIZATION

EXTRACT EFFICIENCY: 65%
(i.e. — 1 pound of 2-row malt, which has a potential extract value of 1.037 in one U.S. 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. For post-boil hop stands, we calculate IBUs based on 10% hop utilization for 30-minute hop stands at specific gravities less than 1.050. Increase hop dosage 10% if using whole leaf hops.

Gallons:
We use U.S. gallons whenever gallons are mentioned.


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Cover Photo:
Charles A. Parker/Images Plus

Q

Lawnmower beers may not be the same as they were 20 years ago. What's your current go-to lawnmower style?

Three styles come to mind, depending on my mood:

1. If I want something with a little more hops, I'm grabbing a Pilsner. 2. If I want something a little lighter but still flavorful, I'm grabbing a Kölsch. 3. Finally, what better time to grab a hefeweizen!?

The beer I want after mowing the lawn is a good Belgian blond. Especially one with a slight yeast phenol profile that just hits everything perfectly. Unfortunately, you will have to brew it as I can't find a great one here in the States . . . so far, but I'm willing to keep looking.

Call me a traditionalist, because I still reach for a yellow beer! A craft-brewed Pilsner, helles, or a hoppy lager like an Italian Pilsner works great from the lager world. For ales, you can't beat a nice Kölsch or golden ale on a hot day.

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suggested pairings at BYO.COM

New Age Kveik

Kveik yeast strains can produce clean beers even in hot environments and impart unique flavors unlike any other yeast — many of which complement hazy IPAs. Get tips for fermenting new-age kveik beers. https://byo.com/article/new-age-kveik/

Induction Brewing

A cheap and easy way to switch from gas to electric brewing is with the use of an induction burner. Both highly efficient and affordable, if you're looking to ditch the propane tank you should definitely give induction a look to understand its pros and cons. https://byo.com/article/induction-brewing/

Can Your Homebrew

Cans have become the packaging of choice for craft brewers over the past decade. More recently they have gained popularity among homebrewers as more single-can seamers hit the market. Crack open a can and take a look at home canning techniques and a comparison of systems for homebrewers. https://byo.com/article/yes-homebrewers-can/

Weizenbock

Weizenbock has the same spicy/fruity character of a hefeweizen, but it also has a rich, bock-like malt character. Like most weizen-style beers, weizenbock has a grainy, bready flavor underlying the beer with moderate spicy notes and some banana-like esters from fermentation. https://byo.com/article/style-profile-style-profile-3/

MAIL

CLOSED TRANSFER SYSTEM DIY

Thank you for the "Projects" article "Closed-Transfer System" in the March-April 2023 *BYO*. I am intrigued by the project because the fabrication was well explained and I believe I can do this to make my beer better. Who doesn't want that? What is eluding me is the "when" to deploy this gadget and an understanding of the tasks it helps to accomplish. The tasks listed include:
1. Connect fermenter to gas supply during cold crashing (is this only during cold crashing or is the modified lid attached during entire storage in fermentation vessel?)
2. Prevent oxygen contact during dry hopping (I'm not sure how this is accomplished with the modified lid?)
3. Dry hop with positive pressure (Why is this helpful?)
4. Use fermentation gas to fully purge serving kegs (I think I get this.)
5. Transfer from fermenter to serving keg without oxidation (I get this.)

I know at least I would appreciate learning more about the when and why of accomplishing these tasks. I'm sure this is because I still have a lot to learn about finishing my beer and protecting it from oxygen. Is it possible, as a follow up, to touch on the "why" for the above tasks, and perhaps a little more on exactly how/when to deploy this clever gadget?

Chris Bader • *Cincinnati, Ohio*

Thanks for the questions, Chris. First, we hope you saw the May-June 2023 issue that included a homebrewer covering his protocol to best achieve a smooth and polished closed-transfer. Now, we'll let the author of this build, Dom Gallo, answer your questions:

*"**1.** The modified lid can be connected immediately after the pitch, however, if you do, you need to have the CO_2 post connected to a blow-off tube that runs to a bucket with sanitizer in it or can be connected to a keg filled with sanitizer, then to an empty bucket. If you set up the latter, that is how you can purge your keg of oxygen completely utilizing the CO_2 created during fermentation. If you choose to place the lid from the start, there is a chance that the dip tube will get some trub/kräusen in it. If that is the case, place*

contributors

Terry Foster was born in London, England, and holds a PhD in chemistry from the University of London. He now lives part of every year near New Haven, Connecticut, where he often brews commercially with Brewport Brewing in Bridgeport, Connecticut. Terry is known to many homebrewers as the author of the *Pale Ale* and *Porter* books in the *Classic Beer Styles Series* (Brewers Publications), *Brewing Porters and Stouts* (Skyhorse), as well as many articles in *BYO*. He also wrote the "Techniques" column for *BYO* from 2010–2016.

In this issue, Terry explores the ways and styles in which homebrewers use wheat, beginning on page 30.

Paul Crowther is a beer writer and homebrewer based in Newcastle, England. He has a regular homebrew piece in *Pellicle Mag* and bylines in *Vittles and Ferment*. He enjoys pushing the boundaries of homebrew and making innovative and unusual new brews. Paul lives with his wife, son, and three rescue dogs. He is a keen gamer and loves long walks in the country. He can often be found wittering about beer and politics through his Twitter persona the mad brewer (@themadbrewery).

Beginning on page 36, Paul offers advice on brewing brown ale, whether English, American, or somewhere in-between, as well as offering four clone recipes from both sides of the pond.

John Blichmann is the Owner and Founder of Blichmann Engineering, a design and manufacturing firm wholesaling highly engineered products for brewing and winemaking. He has more than 20 years of extensive product design (both mass-production and custom), testing, manufacturing, service, sales, marketing, and management, all gained while he worked at Caterpillar in a variety of positions and locations. He ultimately "retired" as an engineering supervisor to focus on the design of high-quality brewing equipment. Blichmann has been an avid brewer since 1991 and is a BJCP judge.

Beginning on page 48, John explains what homebrewers planning to go electric should consider in regards to designing the homebrewing space.

Brew Your Own — The How-To Homebrew Beer Magazine

28th Annual Homebrew LABEL CONTEST

Send us your best homebrew labels and you could win some of the thousands of dollars worth of great brewing prizes from **BYO** advertisers! Enter as often as you like, but you can only win one prize. Winners will see their artwork featured in the November issue of the magazine.

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DEADLINE: August 31, 2023

Rules: Entrants can mail OR email labels to dave@byo.com. The judges say that labels can be attached to bottles full of beer. All rules are made up by the editors of *BYO* as we go along. Labels are judged in one category, open to graphic artists and amateurs alike, so ultimate bragging rights are on the line. When submitting your labels, tell us a bit about the artwork and its inspiration. Is it hand-drawn? Created on a computer? Send us your best labels, tell us how you made them, and good luck!

a liquid ball-lock fitting to your regulator and run gas down the liquid post to expel it from the dip tube. You won't need much pressure to do this, so make sure your regulator is set below 10 psi before trying. Or you can certainly wait to add the lid until after high kräusen or at the point of dry hopping. After high kräusen you will still have enough CO_2 produced during the remainder of fermentation that it will still purge the serving keg, so it is a perfectly fine time to use the modified lid. When it comes to adding it at dry hopping, I don't advise it as it increases the risk of oxidation.

***2.** To make this possible you will need to place a liquid ball-lock fitting to your regulator's gas line. Have your dry hop load ready and in something that will allow you to dump them in easily and quickly. As you begin to unscrew the lid, get your regulator set to 2–5 psi and have the gas line that is now attached to the liquid fitting ready. Right before it is completely unscrewed, connect the gas line to the liquid post of the lid, then unscrew completely. This will run CO_2 down the floating dip tube, pushing CO_2 out of the vessel and minimizing/preventing air to enter. Then dump in the hops. Next put the lid on the fermenter, close the top of the fermenter, and allow the air to continue to flow for 5–10 seconds. This will push out any air that got in. Finally, start to screw on the lid and remove the gas line.*

***3.** Low positive pressure during dry hopping has anecdotally shown to prevent aroma compounds from leaving the beer. It also prevents splashing or foaming if you need to move the fermenter for any reason.*

***4&5.** Answered in previous responses.*

"The 'why' for each step is due to oxidation. Dissolved oxygen in wort or beer will cause the oxidation of malt and hop compounds. Oxidation can and will negatively affect a beer's aroma and flavor and tremendously shorten the freshness/shelf life of a beer. All beers are susceptible to oxidation, however, lite lagers and heavily dry-hopped beers are the most susceptible to it."

FINDING THE SURVIVABLE COMPOUNDS HANDBOOK

In the "Techniques" column from the March-April 2023 issue of *Brew Your Own*, regarding advice on choosing the hops to use and when to use them, the authors recommended reading the Yakima Chief Hops Survivable Compounds Handbook. Though the column was not clear on how to find that great resource. A pdf of the digital handbook is online at: https://cryopopblend.com/wp-content/uploads/2022/11/Survivable-Compounds-Handbook-2022.pdf

WRITE TO *BYO*

Have a question about something you've seen in *BYO*? Want to show off your latest DIY homebrewing gear or recipe? Write to us at: edit@byo.com, find us on Facebook: www.facebook.com/BrewYourOwn, Instagram: @brewyourownmag, or reach out to us on Twitter: @BrewYourOwn. BYO


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BEGINNER'S BLOCK

BY DAVE GREEN

BEATING SUMMER'S HEAT

It's a task I try to avoid as best I can . . . brewing on a hot summer day. I don't deal well with heat and the addition of big boiling pots and all the steam that gets released doesn't help my cause. Add to that the fact that fermentation temperatures can be hard to control during heat spells without dedicated temperature control equipment and it's easy to see why I used to take summers off from the hobby. But things have changed and even without a heavy investment in space and equipment, homebrewers can navigate through even some of summer's warmest spells.

BREW DAY TRICKS

The first piece of advice is the most obvious to anyone that has to cope with intense summer heat on a regular basis . . . early mornings are the coolest part of the day. Setting your alarm to get going at the crack of dawn can assure you that things are wrapping up before the intense heat of the day gets going. Now if you live in a humid environment, you may find that mornings are coolest, but humidity levels can often be near 100% at that time. Evenings you may find to be quite a bit warmer, but humidity levels can be significantly lower. A misting spray bottle on hand will find more efficacy during the less humid times.

If you have air conditioning, brewing indoors can certainly be a nice relief from the heat. The rise of electric systems has made this a simple and safe solution for many homebrewers in hot climates, but unfortunately sending all that vapor into your air can really stress your HVAC unit. There are two solutions, but both require an investment. Many indoor brewers will add a good ventilation system to collect the steam from the brew kettle and send it outside. This can still stress your HVAC system as any air vented out will be replaced with hot air from outside . . . but it's still better than steam. Another system is a condensation unit where a cool mist is sprayed into steam and the cool water is enough to knock the steam out of vapor phase and back into liquid mode. To find plans, visit: https://byo.com/project/homebrew-steam-condenser/

If you're into sour beers, no-boil, quick sours are not only perfect thirst-quenching drinks for the summer, but the fact that you don't need to boil the wort can save a lot of sweat. A simple pasteurization step means bringing the wort to 175 °F (80 °C) for 15 to 20 minutes can kill most all troublesome microbes that could be lurking. For more on this style of brewing, check out: https://byo.com/mr-wizard/57426/

CHILLING PROBLEMS

For folks in warmer climates, the temperature of your chilling water may be a problem when trying to get wort down from boiling to standard fermentation temperatures. There are many workarounds available and nothing can be more helpful than patience. Australia is well-known for their no-chill approach to cooling their wort and it's perfect for those that live in a region where water is scarce since it uses no water. In this process, the hot wort is placed into a sterile, heat-tolerant container and allowed to cool overnight. Aussie's typically use a HDPE "hedpack" container to store the wort while it cools. A stainless container could also be used. Glass or PET plastic vessels should not be used for this process. The yeast is then pitched once wort has sufficiently cooled. A refrigerator can be utilized if further cooling is needed.

Ice can also be used if your tap water is too warm to chill all the way down to yeast-pitching temperature. Some homebrewers will utilize a two-stage chilling process if using a counterflow system, but others that utilize either an immersion chiller or counterflow system will switch from tap water to ice water bath for the final step down to yeast-pitch temperature.

No matter what, patience should be used to make sure that the wort is not too warm when yeast is pitched as brewers will want the wort to be within recommended temperature range within 12 hours after pitching to avoid off-flavors.

BEAST YEAST

As mentioned in the introduction, fermentation temperature control can be a challenge. When the recommended temperature range of many lager and ale yeast strains is exceeded, the yeast can start to produce off-flavors, such as fusel alcohols that can make the beer taste "hot," as well as excess esters. Luckily, we now have a whole world of yeast strains available that can handle temperatures that far exceed standard room temperature of roughly 68 °F (20 °C).

Just how warm your fermentation space is can dictate what strains specifically should be used. If the space is generally in the lower 70s °F (low 20s °C), then a forgiving ale strain like the Chico strain can be used. Past that and you'll want to look at Belgian and other farmhouse ale strains like saison yeast, some of which can handle temperatures well into the 90s °F (low 30s °C). Another family of yeast that can easily handle temperatures like this are kveik strains, which, unlike most Belgian strains, are POF- (phenolic off-flavor negative) meaning they can produce fairly clean beer. A whole range of styles can be brewed with kveik yeast including lager-like beers, IPAs, and stouts.

ECLIPSE® HOPS

The newest release from Hop Products Australia (HPA), Eclipse® hops were previously known as HPA-016. Released commercially in 2020 despite being first bred in 2004, it garners a lot of praise for its bright citrus character (described as sweet mandarin and citrus peel) with a pine background. It has found its way into many brewers' hearts for its ability to shine in a single-hop IPA, in a hop blend to round out citrus flavors, or to give subtle character to a lighter beer like a blonde ale. It's best used in the hopstand/whirlpool phase or as a dry hop. Typically it clocks in between 15–19% alpha acids.

The 2023 HPA hop harvest report was released and showed that volumetrically, Eclipse® harvest was up a whopping 70% year-over-year, so hopefully more of this hop will be showing up at your supplier in the coming months. The report also showed that this year's harvest saw an increase in oil content. To find a beer recipe that highlights this hop's strengths, check out: https://byo.com/recipe/cupitts-estates-eclipse-hazy-pale-ale-clone/

Photo courtesy of Hop Products Australia

WHAT'S NEW

GRAINFATHER GC2 GLYCOL CHILLER

A new 2-stage glycol chiller is launching from Grainfather. It will be very similar to the current GC4 Glycol Chiller (4-stage) that was launched by Grainfather a few years ago, but it will only feature ports for running glycol to two different fermenters, instead of four. The unit will be much smaller, weigh less, and will have a lower price point and weight ($999.95 | 49 lbs.) than the GC4 ($1,199 | 62 lbs.). Both the GC2 (new) and the GC4 feature wireless control capabilities, so users can cold-crash their beer as low as 39 °F (4 °C). Both units are designed to sync seamlessly with the GF30 conical fermenter, or the Grainfather Glycol Chiller Adapter (GCA) kit, which allows users to hook up to almost any kind of fermenter on the market. https://grainfather.com

THE MONGOOSE IMMERSION WORT CHILLER

Designed with 5-gallon (19-L) batch brewers in mind, the Mongoose is engineered in both depth and diameter requirements for submersion in systems of that size. Even a 5-gallon (19-L) batch in a 20-gallon (76-L) kettle has just a small showing of copper coil out of the wort. With a total outside diameter of 10⅜ in. (190 cm) and a height of about 7 in. (18 cm), this chiller fits pretty much every kettle or all-in-one system on the market. With 75 ft. (23 m) of U.S.-made convected copper heat transfer, you can expect rapid and efficient wort cooling and a cold break at the end of every brew day. https://www.exchilerator.com/product/mongoose-immersion-wort-chiller/

Photo courtesy of 9 Mile Legacy Brewing Co.

AI WINS BEER RECIPE COMPETITION OVER HUMANS

The rise of AI (artificial intelligence) has become a hot-button topic over the last few years as its availability is on the rise and is not universally loved. A Saskatoon, Canada, brewery, 9 Mile Legacy Brewing Co., recently held a competition that pitted an AI-derived recipe against their own brewing team's recipe. As you learned in the title, the AI-produced recipe garnered the most votes when it came time to serve the beer to the judges — their customers — in a people's choice award judging system.

While this seems like a bit of a shock, when you dig into the details you realize that the AI-derived recipe was really just partially computer made with a heavy hand from the brewers themselves, having to refresh the recipe 5 or 6 times before a feasible recipe came to pass. A few of the first recipes were up near distillates strength, at 40% ABV. The brewing process was also heavily modified by the brewing team. So while this was a fun event to hear about, brewers worldwide shouldn't be worried that AI will be taking over their creative avenue just yet. But it does show how AI could possibly be of assistance. https://globalnews.ca/news/9673919/beer-generated-chatgpt-peoples-choice-saskatoon-brewery/

Upcoming Events

JULY 15, 2023
Entry Deadline For the Clash of the Carboys Homebrew Competition

Registration opened June 1 for the Clash of the Carboys Homebrew Competition, hosted by the Redstick Brewmasters. The Best of Show judging will be determined by a Best of Show panel based on a second judging of the top winners. Each entry requires three bottles and costs $10. https://clashofthecarboys.com/

AUGUST 5, 2023
National Mead Day

The 21st annual National Mead Day takes place in the U.S. to celebrate and increase awareness of this ancient, fermented honey beverage and foster camaraderie among meadmakers. Join us in raising a glass of mead on August 5. For information on meadmaking, visit: https://mead-makers.org/

BYO **REPLICATOR**

BY DEREK DELLINGER

DEAR REPLICATOR,

On a recent road trip through New England, my wife and I stopped by Kinsmen Brewing in Milldale, Connecticut, to meet up with a few friends. We got a kick out of their creative beer names and their extensive beer line-up, but one beer that really stood out to me was their Pollendrome DIPA. It seemed like the sort of beer that would have an interesting story behind it, and the hop presence was fantastic. I thought it was well balanced even with the honey notes. Would love to know how they went about making this one so I can try my hand brewing up something like it at home.

Frank Bergier
Wilkes-Barre, Pennsylvania

Kinsmen Brewing Company, located in Milldale, Connecticut, is no ordinary small-town brewpub. Having released more than 300 unique beers in only a handful of years, brewers Bob Bartholomew and Justin Benvenuto are no strangers to experimentation. They've become well known in the area for their many creative riffs on the hazy IPA template, testing out many different hop configurations, as well as punchy, fruited sours, and big, barrel-aged stouts. But for their Pollendrome DIPA brewed with local honey, even these highly adventurous brewers went above and beyond.

"We've used honey many times in our beers, but when an opportunity came up to travel to Austin, Texas, for the National Honey Board's honey training, Justin went down and got some tips on using it more productively," says Bartholomew. While in Austin, Justin learned about a beer from Hold Out Brewing made in conjunction with the National Honey Board and Yakima Chief Hops (YCH) called Hivemind. When this beer was sent to the lab at YCH, the brewers had discovered a significant boost in thiols — a class of sulfur-based aroma compounds that contribute fruity and tropical flavors — compared to the exact same recipe without honey.

This got Bartholomew and Benvenuto's creative gears turning: Here was an opportunity to call upon local ingredients while also ramping a DIPA to the next level. Thiols make up less than 1% of the essential oils in a typical hop cone and often are quite volatile, thus, are easily lost during the brewing and fermentation process. In recent years, however, many brewers have devised methods to boost thiols in order to further emphasize the tropical flavors that tend to define the modern IPA.

"We knew we wanted to try to make a honey DIPA because of the thiol boost, so we designed it to be as much of a 'hazy DIPA' as possible," Bartholomew says. "Our goal was a big, adjunct-heavy Citra® bomb with a hefty dose of local honey."

When it comes to refining recipes and honing in on the right flavors, the brewers at Kinsmen have plenty of experience. With so many unique beers released to date at their brewpub, experimentation is the name of the game. After Kinsmen first opened in 2017, Bartholomew and Benvenuto tested out just about any recipe and style they wanted.

"We created experimental beers like a toasted marshmallow Scotch ale, spruce tip Gose, and big, flavored adjunct stouts," Bartholomew says. "Not all beers were hits, but this led us to understand more about our system, our guests, our tastes, and our techniques. As time progressed, we started to read our guests a little better. We've dialed in what we brew to four general categories: IPAs, fruited sours, lagers, and big stouts."

Out of all the techniques they've experimented with over the years in order to hone their IPAs, only a handful of techniques have withstood the tests of time and repetition. Just about all of their IPAs, Bartholomew says, receive a heavy dose of hops during the whirlpool stage, where they aim to hold the wort at 170 °F (77 °C).

Their investigations have also led them to largely avoid the technique of biotransformative-dry hopping — the process of using active fermentation to draw out new hop flavors — despite the recent popularity. They find it releases too many polyphenolic compounds and produces a more one-dimensional beer, detracting from individualized hop profiles when too many hops are added.

"We find it produces flavors that make all hazy IPAs end up tasting the same." That said, they will still on occasion add very small hop charges during active fermentation.

But when it comes to special ingredients like honey, one thing is clear: Quality is paramount and using local honey creates numerous new opportunities for experimentation. Bartholomew and Benvenuto found that experimenting with different varieties of honey opens up even more opportunities for creative expression. "The flavor range is incredible across different varieties," Bartholomew says, but he recommends that, above all else, the honey needs to be local and fresh. Discount honey from the grocery store won't cut it.

As they've worked laboriously to refine their techniques over the years, in the end, Bartholomew hopes to bridge their creativity with consistency. "We hear from some people that our IPAs have a 'Kinsmen flare,' as they should," he says. "We use our time-tested techniques to try and make them how we like them."

So grab some honey, Citra® hops, and find out what the hype is about.

KINSMEN BREWING CO.'S POLLENDROME DIPA CLONE

(5 gallons/19 L, all-grain)
OG = 1.078 FG = 1.013
IBU = 0 SRM = 4 ABV = 8.6%

INGREDIENTS

8.5 lbs. (3.9 kg) 2-row pale malt
2.5 lbs. (1.13 kg) flaked oats
1.5 lbs. (0.68 kg) flaked wheat
0.5 lb. (0.23 kg) Carapils® malt
2.5 lbs. (1.13 kg) locally sourced honey
4 oz. (113 g) Citra® hops (hopstand)
6 oz. (170 g) Citra® hops (dry hop)
SafAle S-04, Wyeast 1028 (London Ale), or White Labs WLP013 (London Ale) yeast
¾ cup corn sugar (if priming)

STEP BY STEP

With the goal of creating a moderately dextrinous wort, mash in with 3.3 gallons (12.5 L) of 165 °F (74 °C) strike water to achieve a single infusion rest temperature of 154 °F (68 °C). Hold for 60 minutes.

With sparge water at 170 °F (77 °C), collect about 6.5 gallons (24.6 L) of wort. Boil for 60 minutes. At end of boil, chill wort down to 170 °F (77 °C) then add hopstand-addition hops. Whirlpool for 20 minutes before beginning to chill wort to slightly below fermentation temperature, around 66 °F (19 °C). Pitch yeast.

As primary fermentation begins to slow, add the honey. Allow fermentation to finish completely. Several days after reaching terminal gravity, add the dry-hop addition. Wait 4–6 days before packaging.

Transfer beer to keg and force carbonate to 2.4 v/v or add priming sugar and bottle.

KINSMEN BREWING CO.'S POLLENDROME DIPA CLONE

(5 gallons/19 L, partial mash)
OG = 1.078 FG = 1.013
IBU = 0 SRM = 5 ABV = 8.6%

INGREDIENTS

5 lbs. (2.3 kg) extra light dried malt extract
1.5 lbs. (0.68 kg) 2-row pale malt
1.5 lbs. (0.68 kg) flaked oats
0.5 lb. (0.23 kg) Carapils® malt
2.5 lbs. (1.13 kg) locally sourced honey
4 oz. (113 g) Citra® hops (hopstand)
6 oz. (170 g) Citra® hops (dry hop)
SafAle S-04, Wyeast 1028 (London Ale), or White Labs WLP013 (London Ale) yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Mash the 2-row pale malt, flaked oats, and Carapils® in a muslin bag in 2 gallons (8 L) of water at 154 °F (68 °C) for 45 minutes. Afterwards, place the grain bag in a colander and wash with 1 gallon (4 L) of warm or hot water. Add water to reach a total volume of 5.5 gallons (21 L). Carefully stir in the dried malt extract, then bring wort to a boil. Boil for 10–15 minutes.

At end of boil, chill wort down to 170 °F (77 °C) then add hopstand-addition hops. Whirlpool for 20 minutes before beginning to chill wort down to slightly below fermentation temperature, around 66 °F (19 °C). Pitch yeast.

As primary fermentation begins to slow, add the honey. Allow fermentation to finish completely. Several days after reaching terminal gravity, add dry-hop addition. Wait 4–6 days before packaging.

Transfer beer to keg and force carbonate to 2.4 v/v or add priming sugar and bottle.

TIPS FOR SUCCESS:

While the recipe specs list this beer as 0 IBU, the hopstand and dry hops will provide bitterness to the beer.

TIPS FROM THE PROS

BY DAWSON RASPUZZI

BREWING WHEAT BEERS

From American wheat to hefeweizen

Often associated with easy summer drinking, wheat beers are common in many brewing cultures including Germany, Belgium, and North America. And in smaller quantities wheat is beneficial to many styles to increase head retention, mouthfeel, and texture. Yet, there are added difficulties compared to all-barley styles due to their lack of husks, which can cause lautering issues and even the dreaded stuck mash. Two pro brewers share how they brew gold medal-winning wheat beers, work to avoid the common pitfalls, and incorporate wheat into their brewing repertoire. With their advice, you too can be sipping a fine wheat beer on the patio as the summer heats up.

When we first opened, everyone wanted us to make a light beer. We didn't want to make a classic light American lager at the time, so we decided on a light, refreshing American wheat. We try to always use local ingredients so we worked with Malteurop Malting Company in Milwaukee to get Wisconsin-grown 2-row and malted wheat. Wheat makes up 70% of the grain bill and lays a great foundation for an easy-drinking beer perfect for summer weather. Wheat provides a nice base for a beer that complements fruit or yeast flavors, and is a nice alternative to light lagers for those looking for something in the same ballpark.

We aimed for 4.5% ABV to make Sweet Peel easy to drink, but we didn't want to make it so boring so we peeled a few hundred pounds of oranges to add a hint of complexity with a Belgian yeast fermented cold. At this point, it probably sounds like a Belgian wit, however we skip the coriander and we consider it an American wheat (fermenting cool will tame some of the common characteristics Belgian yeast is most known for).

The recipe for Sweet Peel is just standard malted white wheat as we were mostly looking for clean and crisp and didn't feel other wheats would add an additional layer to the recipe. We have done unmalted wheat and flaked wheat in our sour beers and we find they do tend to assist with body and foam stability. If I were still homebrewing and I was jumping on the wheat train for unmalted wheats, I'd stick with flaked wheat as it is pre-gelatinized, making it easy to work with.

We use a ton of Chico ale and Andechs lager yeast in our brewery as we make a lot of clean, highly drinkable beers. Sweet Peel is an exception, utilizing an easy-to-use Belgian strain that we encountered by sheer dumb luck that provides some light phenolics that play well with citrus. That's the joy of brewing, just trying stuff out.

We'd strongly encourage homebrewers to invest in rice hulls if they are making a lot of wheat-based beers. Wheat can cause a stuck mash that will make you want to cry. We have found that layering your mash is an effective way to save you heartache. First add rice hulls, next barley, then lastly add the wheat. Try it, and thank the smart brewer who taught me that.

Some other advice I'd offer for brewing wheat beers is to get a dialed-in grind setting on your mill for your wheat, as wheat malt is often slightly smaller than barley. Make sure you're using something besides 100% wheat or you'll have a long brew day and a lot of time on your hands. And rice hulls are your friend. The best yeast for a wheat is sometimes the least expected and it's good to experiment.

We have found that layering your mash is an effective way to save you heartache.

Dr. Aaron Gilling is the Co-Owner, Head Brewer, Master Dishwasher, and half of the namesake behind Stubborn Brothers Brewery in Shawano, Wisconsin. Their Sweet Peel won a gold medal in the American Wheat Beer category at the 2021 Great American Beer Festival.

Paul Fryman fell in love with beer in college during a semester abroad in Germany. He returned to write his senior thesis on the impact of microbreweries on the American beer industry. From there be started brewing professionally and in 2012 opened JAFB in Wooster, Ohio, with his father and brother.

Wheat is a tremendous way to add mouthfeel, slickness, and texture to a beer. Of course, it comes with challenges . . . the obvious slow runoff, potential for a stuck mash, etc. These problems can be avoided with careful technique and rice hulls. I find a very, very small amount will go a long way when using rice hulls, but it may depend on the brewhouse setup. We use about 15–20 lbs. (6.8–9 kg) for a 7-barrel batch. So we are looking at 2–4 percent in terms of mash bill quantity. We could of course use much more but we get good results with that little amount. That said, all equipment is different in having the ability to handle a large portion of wheat in a mash. If you're still having issues with lautering, you can try adding some extra rice hulls next time or try using a lower percentage of wheat and see if the flavor is still where you want it to be.

Our hefeweizen that won a gold medal at the 2021 Great American Beer Festival is brewed in the traditional German style. The recipe is roughly 50 percent wheat, give or take 5 percent counting acidulated malt for pH adjustment. It is brewed using a simple single infusion mash, but it has taken several years to figure out our tried-and-true recipe. Yeast selection, pitching amounts, temperature, and consistency are critical in brewing a good hefeweizen.

We have used several different wheat varieties and types on different beers over the years. I like both red and white wheat, but you get a little more color out of white wheat, which we like. For our application it makes sense to mostly use white wheat as we can use it in many different styles in smaller percentages, and of course in hefeweizen and other styles with large wheat additions. In fact, many of our beers have a small portion of wheat in them to help add texture. I'm talking like 5 percent or less. Think of it like Carapils® or Carafoam®, but instead we use wheat malt.

Wheat is an awesome ingredient. Have fun with it. I think it can be considered in any recipe and in any style.

BY ASHTON LEWIS

CONTRADICTORY ADVICE

Also: Nanobrewing business model and recipe rantings

Q PLEASE COMMENT ON SOME SEEMINGLY CONTRADICTORY PIECES OF BREWING ADVICE:
1. IT IS COMMONLY ADVISED TO CHILL THE WORT AS QUICKLY AS POSSIBLE POST-BOIL TO AVOID HOT-SIDE AERATION OR BACTERIAL CONTAMINATION. YET HOPSTANDS DELAY CHILLING, AND, IF YOU STIR TO CREATE A ROTATION, DON'T YOU RISK INTRODUCING O_2?
2. I'M TOLD THAT ONCE THE MASH IS MIXED TO LET THE GRAIN BED SETTLE WITHOUT DISTURBING IT TO FORM AN EFFICIENT FILTER BED AND AVOID A STUCK SPARGE. YET PEOPLE ALSO ADVISE STIRRING THE MASH FOR BATCH SPARGES OR TO STIR THE MASH HALFWAY THROUGH THE MASHING PERIOD. SO WHAT HAPPENS TO THE FILTER BED?

THOMAS WOOD
NICASIO, CALIFORNIA

A The world of brewing is full of seemingly contradictory advice, Thomas. Thanks for asking about these two rules!

PART ONE: WORT CHILLING

You are correct that conventional wisdom is to cool wort as quickly as possible after wort boiling is complete. The part of this general rule that is usually left off from casual discussion is how quick is quick enough. Like almost everything in homebrewing, this rule comes from commercial brewing.

Nearly all commercial breweries these days, even those using whole cone hops, use a whirlpool to remove trub, and for most of the breweries using pellet hops, hop material is also separated from wort in whirlpool vessels. It typically takes 10–20 minutes to transfer hot wort from the kettle to the whirlpool, wort spinning is allowed to slow over 5–20 minutes, during which time solids collect in the center of the whirlpool, and then wort cooling occurs over the next 30–60 minutes. That adds up to 45–100 minutes from the end of the boil to cooling the entire brew. A more meaningful rule for homebrewers is to target cooling wort in less than an hour after the end of the boil. This allows plenty of time for hopstands, if practiced, and cooling.

Regarding oxygen, when hot wort is splashed around and/or aerated, for example with a leaking pump seal that sucks air into the wort being pumped, it typically darkens in color. However, whirlpooling by gently stirring to get the wort rotating before removing the paddle or spoon does not splash the wort and is not on any list of process problems I have ever seen, including my own. For those concerned about hot-side aeration (HSA), it's important to recall that HSA is primarily a concern during mashing and mash transfer when malt enzymes are still active.

As far as the stirring question goes, there is absolutely nothing wrong with periodically mixing an infusion mash.


Photo by Marshall Schott

Should you chill the wort as soon as the boil is complete? The answer isn't black and white.

PART TWO: MASH MIXING

Mash stirring and filter bed development is a definite conundrum, even for commercial brewers using infusion mash tuns for mashing and wort separation. Let's step back from this vessel for a moment and consider breweries with a mash mixer and a separate lauter tun. The mash mixer is used to stir hydrated mash flowing from the grist hydrator, or sometimes pumped in from a pre-mixing vessel or wet mill, during mash-in. After mash-in is complete, the mash can be heated if step mashing is used, part of the mash can be pumped to a decoction kettle and then mixed with the rest of the mash following mash boiling for decoction processes, or the mash can be simply held at a single temperature. After the mash cycle, the contents of the mash mixer are gently mixed while the mash is pumped to the lauter tun. One very real consequence of mash mixing is improved raw material yield. And the modern combination of a mash mixer and a lauter tun is not known for poor mash filtration or slow run-off issues; in fact, this duo is known for flexibility, efficiency, and operational robustness over a wide range of brew types.

When mash from a mixer is pumped to a lauter tun, mash particles classify into layers based on particle density. Small, dense particles end up on the bottom of the filter bed (and usually below the false bottom), followed by husk bits, and topped with a gray-ish layer known as *teig* or top-dough (*teig* is German for dough). The difference between an infusion mash tun and a lauter tun is that the filter bed is established in an infusion mash tun soon after mash-in is complete.

In practical terms, part of an infusion mash tends to hover above the false bottom until the wort density falls sufficiently with sparging for the grains to settle upon the false bottom. This makes for easy wort collection. However, the infusion mash is not normally stirred and as such the yield is typically lower than the mash mixer + lauter tun duo. This reduced yield is exacerbated because lauter tun grist is usually finer than mash tun grist, and lauter tuns equipped with raking machines as a standard design feature can handle finer grist. This raises a practical process question: Can mash in an infusion mash tun be stirred during the mash? And should the mash be stirred?

As far as the stirring question goes, there is absolutely nothing wrong with periodically mixing an infusion mash. This is simple to do at home because our mash vessels are small. In breweries producing more than about 310 gallons or 1,200 liters per batch, stirring an infusion mash with a paddle is possible, but not so easy. For this reason, many breweries with infusion mash tuns don't stir mashes after mash-in is complete.

However, I argue that infusion mash brewers should indeed give their mashes a few stirs during mashing, when practicable, to improve yield. Dough balls are not uncommon and are often left behind after mashing-in. These masses are easy to break apart after malt enzymes have digested biogums, proteins, and starch polymers. Stirring also helps to homogenize wort density within the mash that is a remnant of mashing-in. Because the filter bed classifies based on particle density, stirring during the mash will not "mess up" your filter bed, provided you don't stir right before wort collection begins. In fact, the primary reason for the vorlauf or wort recirculation step preceding wort collection is to move high-density, fine, and often starchy, particles from the bottom of the vessel to the top of the mash bed. This helps establish the filter bed as wort flow "shakes out" the bed as it begins to compress and trap these small particles.

As with any craft, there are myriad approaches that can be used to get to the finish line, and these varied paths do not always align. We all know that cold storage after packaging results in extended shelf life, and we also know that heat pasteurization after packaging extends shelf life. Two true statements with an obvious contradiction. When brewers are faced with such contradictions, the best thing to do is evaluate the pros and cons of the two, pick the best route for their situation, and move forward in a practical and deliberate manner.

Q MY QUESTION FOR YOU HAS TO DO WITH THE NANOBREWING BUSINESS MODEL AS A LONG-TERM APPROACH. I OWN AND OPERATE A NANOBREWERY AND AM CONSTANTLY BEING QUESTIONED BY CUSTOMERS ABOUT WHY WE DON'T PURSUE THE REGIONAL/DISTRIBUTION MODEL. WE SELL ALMOST 100% OF OUR BEER THROUGH OUR TAPROOM AND SEE IT YIELDING POSITIVE RESULTS. I WOULD LIKE A CONCISE WAY TO EXPLAIN TO PEOPLE WHY OUR "NEIGHBORHOOD BREWERY" APPROACH IS OK TO MAINTAIN AND CELEBRATE. DO YOU HAVE ANY SUGGESTIONS ON HOW TO MARKET/EXPLAIN/JUSTIFY TO SKEPTICS?

KEVIN M.
VIA EMAIL

A As I write this piece, I sit in a local brewery in Springfield, Missouri, called Tie & Timber, listening to music, drinking beer, and looking forward to chatting with friends after I hit the save button. Tie & Timber has a 10-BBL brewhouse and is also focused entirely on selling beers in-house. Although they brew great beers and their brewhouse and fermenting tanks are open to and visible from the seating area, owners Jennifer Leonard and Curtis Marshall will tell you that they are first and foremost in the hospitality business. I think this is true of most successful taproom breweries, even if the owners of many of these great businesses don't always know what really makes their places tick. And when we look back at the history of brewing, most breweries did not sell beer outside of the brewery and the best of these great places attracted locals as a place to socialize, warm their bones, cool their heels, and enjoy a few beers over several hours. Indeed, many gasthauses, taverns, and pubs were probably more comfortable places for patrons to relax after work than their homes.

If I were in your position and questioned about my business decisions, I would politely and positively offer your perspective as the owner of a nanobrewery using business points that your friends and enthusiastic supporters should appreciate. Here are my top three answers to this great question:

1. When craft breweries of any size sell beer in the open market, they knowingly choose to compete with all beers in the retail outlets selling their beer. Cans of beer from breweries producing hundreds to millions of barrels annually are all sitting in the same store, often in the same cooler, and sometimes rubbing shoulders with one another. And they are all screaming, "Pick me! Pick me!"

The challenge that these beers all have is that their voices cannot be heard because, spoiler alert, beer cans don't make noise on the shelf. This is where marketing and branding is a key differentiator. Beer brands that are known and recognized often have an advantage to those brands that are unknown. I say this is often an advantage because not all brands resonate to all consumers. And to a very small minority of consumers, complete unknowns are an attraction. But in today's rich market with lots of choice, most consumers gravitate to what they know or have heard about.

The bottom line is that your taproom brewery does not have to compete with all beers in your market after one of your customers walks in through the door. Not too different from why great restaurants rarely choose to compete in grocery stores and markets.

2. The average consumer doesn't spend much time thinking about packaging and is rarely aware that the single most expensive part of a can/bottle of beer is the entirety of the package. This includes the container, the lid or cap, the label, shrink sleeve, or paint job, and it also includes a carrier for 4- and 6-packs plus a box or tray. And package costs are a volume game where smaller brewers are at a disadvantage out of the gate.

Packaging is also an efficiency game (labor spent per barrel); this is where small breweries get stomped by larger breweries with higher speed packaging lines. A nanobrewery filling packages at 4 x 16-ounce cans per minute (much faster than breweries doing this all by hand) are filling almost 1 BBL of beer per hour. In contrast, 30 x 16-ounce cans per minutes equates to 7.5 BBLs per hour, and 240 cans per minutes equates to 60 BBLs per hour. The largest craft brewers are filling 200+ BBLs per hour. This means that the labor cost of packaging for a nanobrewery is between 7.5 to 200 times greater than breweries with more automated packaging lines using the same number of operators (not at all uncommon).

3. When small breweries take the leap into the retail market, there is still more money to spend before beer is sold. Examples include the cost of sales staff, beer delivery, account service, schwag, tap handles, quality control, and spending money to defend market position from the ever-present school of sharks searching for opportunities. Entering the market outside of your four walls means starting an entirely new business venture. Distribution has been the demise of many small breweries and is something that taproom breweries do when they are desperate for business or when they underestimate the magnitude of the endeavor.

In my opinion, the smartest business decision for nanobreweries like yours is to max out beer sales in your own house. And when the day comes that you have done that, expanding the size of your facility, or even opening a tied house (where permitted), is a better move than playing in the distribution world. Even adding a segment to your business in the form of a morning café business using your existing building is an option that is simpler than entering the world of distribution. To echo my friends Jennifer and Curtis, taproom breweries are in the hospitality business. Not only is the highest margin returned from in-house beer sales, brewery exclusive sales guarantee control of the taproom environment, beer presentation, messaging, and beer quality.

I AM ONE OF THOSE ANNOYING FOLKS WHO QUESTION THINGS ON A REGULAR BASIS. SEVERAL YEARS AGO, I RETIRED FROM THE PROFESSIONAL BREWING WORLD AND MOVED BACK INTO THE HOMEBREWING SPACE. ONE THING THAT HAS CAUGHT ME IS — WHY DO HOMEBREWING RECIPES MAKE MY HEAD EXPLODE? THIS THOUGHT BRINGS ME TO MY KEYBOARD TO SHARE SOME "GRUMBLINGS FROM THE WIZ."

ASHTON LEWIS, AKA MR. WIZARD

I have witnessed many many positive changes over the last 37 years of homebrewing, yet recipes and recipe talk is a department where things have stagnated. Charlie Papazian's *Complete Joy of Homebrewing* seemingly stamped into homebrewing lexicon that the 5-gallon (19-L) batch-size is set in stone. Today, just like 37 years ago, a 5-gallon (19-L) recipe for a 1.050 OG (original gravity) pale ale may call for 9 pounds (4.1 kg) of English pale ale malt and 11 ounces (312 g) of crystal malt. What this recipe does not state is that these weights are based on assumptions about brewhouse efficiency and malt specifics. For example, the basic recipe above assumes 85% brewhouse yield, 78% FG as-is HWE (fine grind [as-is], hot water extract) for the pale ale malt, and 70% FG as-is HWE for the crystal malt. That's a lot of stuff to consider, but we all do it, knowingly or not.

While I understand that it simplifies things for the beginner homebrewer, these "recipe standards" actually make it more difficult for advanced brewers.

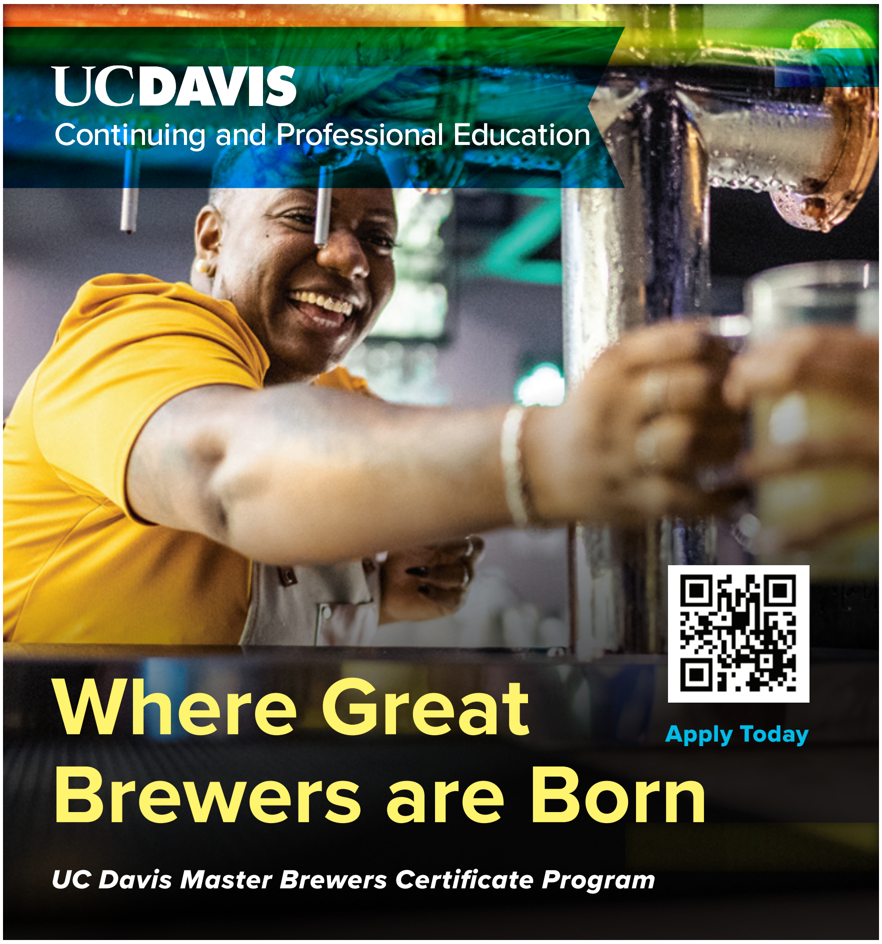
I implore that the conversations and recipes about the grist bill need to change. Essentially zero commercial breweries in the world communicate brewing recipes by weight because weights alone are totally useless to the practical brewer. The language of brewing is in percentages. The recipe spoken of earlier is best described by 1.050 OG wort comprised of 93.8% pale ale malt (% of total extract) and 6.2% crystal malt; that's it.

Volume does not matter because brewers calculate the grist bill based on the OG target and the percentage contribution of the grains in the recipe. Same is true for hop bitterness, color, and approximate % ABV, which are typically stated in today's recipe as a specification. Most of us are already using brewing software, apps, or custom-built spreadsheets based on percentages. So why do we all transcribe our recipes into weights? I propose a change to the homebrewing norm! Can I get a second on this motion?

Recipe Editor Dave Green replies: Motion denied, Ashton. BYO

BEER EDUCATION

Looking to advance your brewing knowledge? Check out some of the beer education programs on the following pages to start your journey down the path to a higher education in beer brewing or the business of beer.

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BY GORDON STRONG

AMERICAN PALE ALE

One of the first American craft beers

The first producer isn't really known, but Sierra Nevada introduced their pale ale in 1980 and it helped spark interest in the style and in craft beer in general.

AMERICAN PALE ALE
BY THE NUMBERS

OG:	1.045–1.060
FG:	1.010–1.015
SRM:	5–10
IBU:	30–50
ABV:	4.5–6.2%

Photo by Charles A. Parker/Images Plus

I first wrote about American pale ale almost 15 years ago. It's interesting to compare my contemporaneous musings on the style with my thoughts today; it helps demonstrate how the style has evolved and where it stands in the marketplace. However, it also gives me a sense of longing of the times when you could walk into any brewpub and find this beer along with a full range of styles, rather than nothing but hazy IPAs and fruity sours. I guess that's another reason why it's good to be a homebrewer — you can make what you want to drink.

American pale ale (APA) was one of the first craft beer styles in the United States in the 1970s and 80s, and it was a great showcase for newer American hop varieties like the grapefruit-like Cascade. Many pubs featured beers by color, with at least a pale beer, an amber beer, and a dark beer — these were often a pale ale, an ESB, and a brown ale, porter, or stout. Pale ale soon became the largest-selling craft style, a position it held until around 2011 when IPAs ascended. It is still a popular style with homebrewers, although commercially it has largely been replaced with session IPAs.

The Beer Judge Certification Program (BJCP) has American pale ale as style 18B in category 18, Pale American Ale, along with blonde ale. The Brewers Association style guidelines have both American-style pale ale and American-style strong pale ale styles, the latter of which encroaches on the American IPA style.

HISTORY

Early craft beer in the U.S. was influenced by English beer writer Michael Jackson, who wrote about world beer styles. Some of the earliest craft beers were essentially Americanized versions of English styles he described, using American malt, hops, and yeast, which all had different flavor and aroma characteristics from their English cousins. American pale ale was an interpretation of English pale ale (Bass and Samuel Smith's were two well-known imports then) using more neutral grain and yeast with citrusy and piney American hops.

The first producer isn't really known, but Sierra Nevada introduced their pale ale in 1980 and it helped spark interest in the style and in craft beer in general. It featured the relatively new Cascade hop, which was released in 1968 and was prominently used in Anchor's Liberty Ale in 1975. But it was Sierra Nevada Pale Ale that took the hop and style mainstream.

In the early days of craft beer, pale ale had a fairly wide range of color. American amber ale wasn't recognized as a style until the late 1990s, even though they began appearing in the mid-1980s. When all you have is a pale ale and a brown ale, the color division typically is in the copper range. But adding amber ale allowed pale ales to become more commonly golden in color.

As beers were expanding in color variety, the strength dimension was also subject to experimentation. Strengths of pale ales began increasing, as did bitterness – 3 Floyds Zombie Dust is a good example at 6.2% ABV and 50 IBUs. At the time, IPA was thought of mostly as an English style. The Brewers Association divided the APA style by strength, adding a strong pale ale style for professional competitions. I'm sure at the time entry numbers supported this division, but I suspect this is no longer true. Meanwhile, the IPA style was divided into many variations, including American IPA, which really set the upper bounds for an APA in terms of strength, bitterness, and balance.

Sometime in the mid/late-2010s, session IPAs started becoming popular.

The late 2010s were all about hazy IPAs, which were often found in pale ale strengths and less bitterness than traditional IPAs. These had an enduring effect on APAs, as many breweries simply began making these beers instead. With similar colors and alcohol levels (although body and balance were different), the distinction often wasn't enough to keep some pale ales in the market, such as the truly outstanding Firestone Walker Pale 31. So, today you can find commercial examples that carry on the historic tradition of the style, those that have more IPA-like qualities, and those that are playgrounds for new hop varieties and methods.

SENSORY PROFILE

Given the range of possible interpretations of the style, I think it best to talk about the classic sensory profile of the style for competition purposes since some of the other variations I've talked about will judge better in other competition categories.

The color of an APA is pale golden to light amber, but most are golden. The beer is generally clear, with a well-formed white to off-white head. The body is medium to medium-light; it should be neither thin nor heavy. Carbonation should be at least moderate, but can be higher. It is a standard-strength beer, around 5% ABV. All of this sounds fairly normal for an average beer.

Pale ales are bitter beers, but should have some supporting malt backbone evident in flavor and in body. They can have a slight residual sweetness or maltiness, but are generally well attenuated. However, they usually aren't sharp or crisp. There should be some late hop character evident in the aroma and flavor, but the beer doesn't need to have any specific variety evident or have a fresh dry-hopped character.

The hop profile can be classic grapefruity citrus and resiny pine, or have some newer hop attributes such as tropical fruit, stone fruit, berry, melon, and the like. The level of hoppiness should seem moderate to moderately high. Bitterness is moderate to high, but shouldn't have a biting or harsh quality. The malt flavor is relatively neutral, although a light caramel

AMERICAN PALE ALE

(5 gallons/19 L, all-grain)
OG = 1.050 FG = 1.013
IBU = 36 SRM = 7
ABV = 4.9%

INGREDIENTS

5 lbs. (2.3 kg) North American pale ale malt
4 lbs. (1.8 kg) Pilsner malt
1 lb. (454 g) Munich malt
8 oz. (227 g) crystal malt (60 °L)
5.5 AAU Cascade hops (first wort hop) (1 oz./28 g at 5.5% alpha acids)
9.2 AAU Amarillo® hops (5 min.) (1 oz./28 g at 9.2% alpha acids)
1 oz. (28 g) Cascade hops (hopstand)
1 oz. (28 g) Centennial hops (hopstand)
Wyeast 1968 (London ESB), White Labs WLP002 (English Ale), or Mangrove Jack's M15 (Empire Ale) yeast
¾ cup corn sugar (if priming)

STEP BY STEP

This recipe uses reverse osmosis (RO) water. Adjust all brewing water to a pH of 5.5 using phosphoric acid. Add 0.5 tsp. of calcium chloride and 0.5 tsp. of calcium sulfate to the mash.

This recipe uses an infusion mash. Use enough water to have a moderately thick mash (1.5 qts./lb. or 3.1 L/kg). Mash in the pale malts at 151 °F (66 °C) and hold at that temperature for 60 minutes. Then add the crystal malt and stir. Begin recirculating, raise the mash temperature to 169 °F (76 °C), and recirculate for 15 minutes.

Add the first wort hops to the kettle then sparge slowly and collect 6.5 gallons (24.5 L).

Boil the wort for 60 minutes, adding the Amarillo® hops with five minutes remaining in the boil. The final hops are added about 10 minutes after the boil or when the wort cools to about 180 °F (82 °C). Stir the wort gently and allow to stand for 20 minutes, then chill or begin transferring wort to the fermenter.

Chill the wort to 64 °F (18 °C), pitch the yeast, and ferment until complete. Condition for 5–7 days.

Rack the beer, prime and bottle condition, or keg and force carbonate to 2.5 v/v.

AMERICAN PALE ALE

(5 gallons/19 L, extract with grains)
OG = 1.050 FG = 1.013
IBU = 36 SRM = 7 ABV = 4.9%

INGREDIENTS

5.6 lbs. (2.5 kg) light dried malt extract
8 oz. (227 g) crystal malt (60 °L)
5.5 AAU Cascade hops (first wort hop) (1 oz./28 g at 5.5% alpha acids)
9.2 AAU Amarillo® hops (5 min.) (1 oz./28 g at 9.2% alpha acids)
1 oz. (28 g) Cascade hops (hopstand)
1 oz. (28 g) Centennial hops (hopstand)
Wyeast 1968 (London ESB), White Labs WLP002 (English Ale), or Mangrove Jack's M15 (Empire Ale) yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Use 6.5 gallons (24.5 L) of water in the brew kettle; heat to 158 °F (70 °C). Turn off the heat. Add the crystal malt in a mesh bag and steep for 30 minutes. Remove and rinse grain gently.

Add the malt extract and stir thoroughly to dissolve completely. Add the first wort hops. Turn the heat back on and bring to a boil.

Boil the wort for 60 minutes, adding hops at the times indicated. The whirlpool hops are added about 10 minutes after the boil or when the wort cools to about 180 °F (82 °C). Stir the wort gently and allow to stand for 20 minutes, then chill or transfer wort to the fermenter.

Chill the wort to 64 °F (18 °C), pitch the yeast, and ferment until complete. Condition for 5–7 days.

Rack the beer, prime and bottle condition, or keg and force carbonate to 2.5 v/v.

character is traditional. The malt and hop flavors shouldn't clash, however. The hops should have a stronger presence than the malt, but both should be apparent. The fermentation profile is usually fairly neutral, although a light yeast fruitiness is acceptable.

APA is distinguished from an English pale ale primarily in the malt flavor, lacking the bready, biscuity, or toasty malt flavor; and in the hop profile, lacking the qualities of traditional English varieties like Goldings or Fuggle. Side-by-side, APAs will usually have a more neutral fermentation profile.

If all of this seems vague, I try to remember that an APA is somewhere between a blonde ale and an American IPA. Blonde ales have a similar strength but less bitterness and hoppiness, so they seem less aggressive on the palate. IPAs are higher in alcohol, more bitter, and have a stronger late-hop character, typically with a fresh, dry-hop character. An APA should have more body and malty balance than a session IPA. It should have less color and darker malt flavors than an American amber ale and an American brown ale. Oh, and it should also have a cleaner yeast character than its English and Belgian cousins. If it avoids all these other styles, it is likely in the right space.

BREWING INGREDIENTS AND METHODS

Sometimes it's hard to nail down ingredients and methods because people then think that's the only way you can make a style. It's important to remember that I talk about how most brewers make the style, and that other approaches are possible. What's important to me is that the sensory profile of the finished beer is correct, not how it is achieved.

That said, most American pale ales will have a large portion of a pale base malt for the grist. A North American pale ale malt is perfect, but many use 2-row brewer's malt, lager malt, Pilsner malt, or a mix of several malts. As long as the resulting color doesn't stray too far into the amber range and the flavor doesn't get overly bready, biscuity, or toasty, you are likely to be fine. I have tried making APAs with a really characterful English malt like Maris Otter, but I find that I prefer the simpler, cleaner malt profile of the North American malts. Maris Otter can have too much flavor for some styles, and can lead to clashing flavors with the American hops.

Classically, APAs would have a light dose of caramel or crystal malt, something in the 40–80 °Lovibond range. More modern versions might use Munich or some other character malt instead. A wide range of malts are possible including some that bring in a light bready or toasty flavor, as long as it is kept in the background. Some may use dextrin-type malts to enhance the body instead of mash controls. This is generally an all-malt beer, but like some IPAs, it can take a little sugar. Mashing is traditionally a single infusion in the low 150s °F (say, 66–68 °C).

Hops are an area that have changed over time. In the early craft days, Cascade was most common, with bittering, flavor, and aroma additions. As the U.S. hop scene evolved so did the use of hops in this style. More modern U.S. or New World hop varieties can be used, and any hopping method is fair game. Classically, the beers weren't dry hopped, but late additions carried the aroma. Any methods that emphasize flavor and aroma of hops are welcome and I often use first wort hopping, hop bursting, and hop stands in my beers to good success. But the classic profile would use a strong bittering addition with a significant late hop charge.

Yeast likewise have changed over time. In general, I like to advise using a neutral to lightly fruity American or English strain that emphasizes a clean maltiness. With the advent of cold IPAs, some brewers might be exploring the use of neutral lager yeasts that are warm-fermented. Even something like a clean Kölsch yeast would work. Just keep in mind that you want to choose a yeast that doesn't bring a large character of its own and you want to avoid anything phenolic.

Water profiles can vary as well, depending on what you like in the profile. Something between a "wet" profile that uses calcium chloride and a "dry" profile that uses calcium sulfate works well. Just avoid carbonates in your water, since those really can interfere with the perception of bitterness. In my area, these can often give beers a soapy quality that hurts drinkability. Like the yeast, the water should help create a neutral playing ground for the hops with malt in support.

HOMEBREW EXAMPLE

My recipe is a modernized take of a classic pale ale using some of my favorite ingredients. The base malt is a mix of pale ale, Pilsner, and Munich malts. You can use U.S. 2-row brewer's malt instead of the pale ale malt. This mix of malts in a 45:45:10 percent ratio is one of my go-to base malt mixes for American beers. Some crystal 60 malt is added for flavor, body, and color, although I have also made this style without it. A simple infusion mash is used.

The hops reflect three of the classic American hops when this style was in its heyday: Cascade, Centennial, and Amarillo®. You can certainly go all Cascade with this beer, or limit your choices to two hops. The hopping methods are a bit more modern, using first wort hopping for a smooth bitterness and increased flavor, and whirlpool hops instead of dry hopping. I'm not trying to go extreme on the bitterness; you should know that you aren't drinking an IPA.

I'm fond of using the Wyeast 1968 or White Labs WLP002 yeast in this beer, as it gives a clean fermentation with a little fruitiness and helps retain a bit of residual maltiness. I'm using a balanced salt profile in the water with equal parts calcium chloride and gypsum, although I have also made this with all calcium chloride. If you want to use an American yeast, the Chico strain (Wyeast 1056, WLP001, SafAle US-05) is a good choice, but I also really like the Anchor strain too (Wyeast 1272, WLP051, Mangrove Jack's M36). I sometimes use a little orange blossom honey (0.5–1 lb./230–450 g) in this beer, especially when using the Anchor yeast.

So, I've described my base recipe and given you a few options to explore. This is a fairly flexible style and I often use this as a template for experimenting with new hop varieties. The malt is noticeable but definitely in support of the hops. Yet it doesn't drink like hop juice; there is some backbone to it without getting heavy. It's a good everyday drinking beer, which is why it once dominated the American microbrew scene. I'm certainly looking forward to it coming back into fashion with a new generation of beer enthusiasts. BYO


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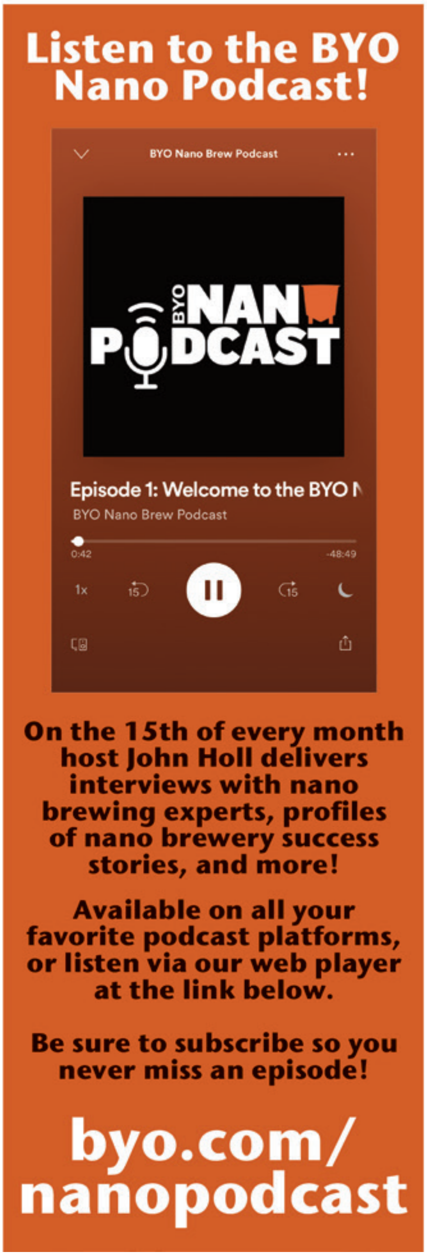
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Brewing with WHEAT

Removing the haze around this tricky ingredient

by Terry Foster

It is easy to fall into the assumption that barley malt is the only base for brewing beer. Barley malt does happen to be well suited to this purpose and malt production is an important end-use of barley. But wheat is just as easily malted and has a long history of being used in beer brewing. Most modern wheat beers have long, traditional pedigrees. Notable among these are lambic beers and weizenbier from Belgium and Germany, respectively. In fact, there has been an increase in popularity of wheat beers in Germany in modern times and, according to *The Oxford Companion to Beer*, one out of every ten beers drunk in that country today is brewed with wheat.

Germany and Belgium (along with some more modern American styles) may be where wheat-based beers are most common, but English brewers also use wheat in their ales, just in small proportions with the aim of improving the beer's head-retention property. Actually, in earlier times English brewers used quite a lot of wheat, although that use never developed any particular style for such beers. English agricultural and malting techniques were ahead of others in the 18th and 19th centuries and highly modified barley malts became more common in Britain. As these improved barley malts could be efficiently mashed by a simple, single-infusion mash, whereas wheat and wheat malt are more difficult to handle in such a procedure, wheat malt began to be neglected by English brewers. Why wheat is more difficult to handle is a statement that requires some explanation.

PROBLEMS WITH WHEAT

These perhaps stem from the fact that wheat varieties suited to brewing have never been developed. To quote from the *Oxford Companion to Beer*, "Virtually all wheat is bred and cultivated for non-beer purposes." In contrast, while there are other uses for barley, a good deal of the crop is used in brewing, and many varieties most suitable for beer production have been bred and cultivated specifically for this purpose.

The first problem with wheat is that, unlike barley, it has no husk. That makes it easier to malt, but more difficult to mash, for purely physical reasons. The husks from barley are split off from the kernel during milling and are spread through the grain in the mash tun, where they help to separate the particles of spent grain from one another. This makes for a porous, permeable bed that allows for efficient run off of wort and for percolation of sparge water through the bed. In the case of wheat and wheat malt, the spent grain particles are in contact with another and tend to obstruct the flow of wort through the bed. At its worst, this can result in a seriously stuck mash. It has been said that this can be due to the presence of β-glucans, a glucose polymer derived from the cell wall, which can cause gel formation in the mash. However, as far as I can determine, it seems that this is a minor problem that is just as likely to occur with barley malt.

The other problem with wheat is its protein content, which is usually higher than that of barley and barley malt. Although there may be less of a difference between the grains in terms of protein content in North America. In fact, it may not be a question of the purely numerical level of protein but rather a difference in its type with wheat containing more gluten — which is why it is much easier to make bread from wheat than from barley flour. Further, wheat proteins are generally higher in molecular weight than those in barley and can cause two problems in brewing. The first is that using wheat results in higher viscosity wort than with barley alone, which can exacerbate the difficulties with run-off. Second, these proteins are more difficult to degrade during mashing, leading to hazy, turbid beers. For that reason many wheat beer brewers use a so-called protein rest during mashing when working with wheat malt; more on that later. Using raw wheat is even more complicated, since the wheat must be cooked to gelatinize its starches prior to mashing.

So, overall, the difficulties with wheat in brewing are largely a problem in mashing, so what I shall discuss applies to all-grain brewing. In fact, extract brewers have an advantage brewing wheat beers in that there are wheat extracts on the market in which, of course, the mashing has already been done for you. That does restrict you to the manufacturer's specification for wheat beer, but that is a small price to pay for the simplification of the brewing process.

WHY USE WHEAT?

It's simple enough; using wheat in a beer can confer different flavors than barley malt so it is another shade in the brewer's palette (and palate). It makes for a softer, yet crispy, even slightly tart finish; especially in the various forms of German wheat beers that are relatively light in alcohol (say, 5–5.5% ABV). Some drinkers find wheat also gives the beer an estery or fruity and bready character. However, these are ales brewed with ale yeasts, so ester formation might be more a function of the yeast than of wheat.

One particular flavor should be mentioned and that is "clove" or "clove-like," often a characteristic of weizenbier. This flavor is due to 4-vinyl guaiaicol, which has been said to be formed by POF+ (phenolic off-flavor positive) strains of yeast in fermentation, rather than arising from the wheat. However, it is more often held that this flavor is produced from ferulic acid, which is certainly present in wheat. Some brewers look for wheat varieties high in ferulic acid, and some even use a low mash-in temperature of about 100 °F (38 °C) since this favors enzymatic production of ferulic acid.

Another important effect of using wheat is that it helps both head formation and head retention. I have already alluded to the use of wheat malt/wheat flour in low-alcohol draught British ales. In genuine wheat beers brewed with a significant proportion of the grain in the grist, head formation can be dramatic with the foam sometimes being inches deep (which also depends on the level of carbonation, of course).

WHEAT BREWING PROCEDURES

Next, we'll look at how wheat is used and treated in some of the most common wheat beer styles.

LAMBIC

Lambics, of Belgian origin, are brewed with around 40% raw wheat, which may be pre-cooked by doughing in with around 10% of the malt at 156–158 °F (69–70 °C), then raising to a boil, before adding to the main malt mash. Alternatively, you can do a decoction mash — removing a portion of the mash, bringing it to a boil, and then returning it to the main vessel. This is done two or three times so as to take the mash through several rests, starting at around 115–120 °F (46–49 °C), then about 130 °F (54 °C), 148–149 °F (64–65 °C), and finally to about 160 °F (71 °C). Each stage usually takes 15–20 minutes and traditionally the mashes are very dilute.

Decoction is an awkward procedure, requiring time, effort, and a second heated mash vessel, and it can be burdensome for homebrewers who may not have the mash tun near a stove or a second heat source. A slightly simpler alternative is an upward infusion, adding boiling water at each stage to bring the mash temperature to the required level, the various stages being at similar temperatures to those mentioned earlier. This procedure is not a direct substitute for decoction mashing as it thins the mash, which is not the case with the decoction process.

I do not have space here to go further into the production of lambics because of their complicated fermentation process, which was historically a spontaneous process using wild yeasts and bacteria derived from a specialized environment. Many of these have been identified and you can now buy suitable strains for brewing these beers such as Wyeast 3278 (Belgian Lambic Blend) containing a *Brettanomyces* strain among others.

BERLINER WEISSE

This is another soured beer using a combination of a *Lactobacillus* and an ale yeast. It is brewed with from 25–60% wheat malt and has an original gravity (OG) of 1.030–1.032 (7.5-8.0 °P), so about 3% ABV. Modern versions are often soured through kettle souring and fruited, which isn't traditional but the tart, clean structure does lend itself well to fruit flavors.

WEISSBIER

German for "white beer," perhaps written more properly as weizenbier "wheat beer," is a style produced mainly in southern Germany and must be brewed with wheat malt making up 50–60%, of the grist by definition. Like so many wheat beers, it is low in both color and hop bitterness and usually 4–5% ABV, although there are stronger weizenbocks at 6% ABV and up, which may be pale or dark, with the latter using some color malts. Weissbier is customarily mashed by a decoction process, using similar temperature rests to those in lambic brewing. Of course, decoction mashing is a very traditional German procedure for barley malt-based beers as well as weissbier. Homebrewers may consider this process too complicated for brewing regular beers, but for weissbier with such a high proportion of wheat it is the traditional process to ensure that sufficient degradation of those high molecular weight proteins occurs. As mentioned with lambic beers, an upward infusion mash is, I think, an acceptable alternative. That said, nowadays German maltsters produce malts that are highly-modified and do not require decoction mashing so you do not need to be concerned that a step-infusion mash will result in a beer that is inferior to the traditionally brewed German products!

For an authentic German-style weizen you need an appropriate yeast to bring the required clove character in the beer. Typical examples of these are Wyeast's 3068 (Weihenstephan Wheat), Wyeast 3368 (Bavarian Wheat), or White Labs WLP300 (Hefeweizen Ale) and WLP351 (Bavarian Weizen).

A variation on this theme is dunkel weissbier or dunkelweizen, which only differs from weissbier in that it is darker in color, up to around 20 SRM, which makes it more of a bronze color than its pale relation. This level of color can be achieved with the addition of Munich malt or the lighter versions of caramel malt. There is even a crystal wheat malt available that would serve well in this beer.

WITBIER

This Belgian style is brewed with curaçao orange peel, coriander, and sometimes other added spices, with these additions usually being steeped in the hot wort at the end of the boil. There are significant variations in the spices that are not always revealed by the brewers. But generally, witbier is brewed from a grist consisting of about 40–50% wheat and the rest barley malt. It ferments out to about 5% ABV using an ale yeast and normal ale fermentation temperatures. One of the more famous examples, Hoegaarden, is said to also use about 10% oats in the mash.

AMERICAN WHEAT BEERS

These beers are quite different from Belgian or German wheat styles. For a lambic beer you would want to use yeast and bacteria specifically designed for the purpose. German styles also have a unique yeast character with the aforementioned clove flavor. But the craft-brewed American wheats go their own way; most pros will use whatever their house strain is. That means they might use an English ale strain, or even a lager yeast, although there are a couple of American wheat yeasts available such as Wyeast 1010 (American Wheat) and White Labs WLP320 (American Hefeweizen ale yeast). The result is that American wheat beers have a more malty, less fruity and spicy flavor than their European counterparts.

American wheats often (though not always) use less wheat malt than their forebears, around 10–35% of the grist and are made by simpler mashing techniques. Some use a two-step upward infusion mash with a so-called protein rest at around 110–120 °F (43–49 °C), followed by a "normal" rest at around 150 °F (65.5 °C). Others use a one-step infusion mash at this latter temperature. That may seem astonishing in view of what I have said about the problems with wheat proteins, but there is no doubt that it works. Note that the protein rest referred to above may not degrade proteins at all, which would suggest that direct infusion is the best way to go. It may also be that the complicated traditional mashing methods arose because of the use of poorly modified malts, whereas modern wheat and barley malts are more uniform and well-modified than was the case in the past.

To ensure that you do not get a stuck mash with these simpler approaches you have to take some precautions. Make sure you have a high quality wheat malt and that it is properly ground, which may mean a couple of passes through the mill as it is harder and less friable than barley malt. Keep the sparge water as hot as you can, preferably at 175–180 °F (79–82 °C), so as to reduce the viscosity of the wort and speed up run-off. More important is the use of rice hulls to ensure the formation of a properly structured filter bed. These are added at the rate of 1–5% of the grist by weight, and should be distributed throughout the grain as evenly as possible, and it is advisable to add a portion first, so as to form a layer on the false bottom before running in the grains. There is no risk in using such grains as they are inert and do not decompose in the mash, having been boiled to remove all color and flavor.

WHEATWINE

This is a wheat version of barleywine and can be brewed with up to 50% wheat in the grist. At 8.5% ABV and up it is a big beer and not easy to make because of the amounts of grain involved. But it can be made by single temperature infusion, using the methods described earlier. In particular, use a full 5% of rice hulls, properly distributed throughout the grain, and watch sparge water temperature carefully. If you get a stuck mash with around 20 lbs. (9 kg) grain and an almost full mash tun you will be facing a long, difficult afternoon. Indeed, if you want to make a beer in this style you may consider making it only from extract, using one designed for weizen (which would be a combination of wheat and barley), or if you can get it, a 100% wheat extract plus some regular pale extract.

NEW ENGLAND IPAS?

Because the juicy flavors from heavy late-hopping is the star of the show here, and because wheat additions are smaller than other styles mentioned earlier, New England IPA is not often thought of as being a wheat beer. However, wheat malt, because of its high protein content, is an important contributor to the characteristic haze of such beers. These beers feature a significant portion of wheat, oats, or sometimes both to boost the soft mouthfeel the style is known for. Wheat malt can be used at a rate as high as 30–40% of the grist, which is treated via a simple infusion at 152–154 °F (67–68 °C). It should be noted that wheat malt is not the only cause of haze in NEIPAs but that subject has already been covered (see "From Juicy to Hazy," in the March-April 2021 issue of *BYO*).

ENDPIECE

I have mostly concentrated on brewing wheat beers by mashing procedures, but extract brewers should not be deterred by this. As pointed out, there are wheat extracts available to homebrewers and these can serve admirably for making acceptable versions of this somewhat unusual family of beers.

To help illustrate how broad of a style may be brewed with wheat, I have included my homebrew recipes for American wheat and wheatwine on the following pages.

Wheat Beer Recipes

AMERICAN WHEAT

(5 gallons/19 L, all-grain)
OG =1.048 FG = 1.010
IBU = 15 SRM = 4 ABV = 5%

INGREDIENTS

7 lbs. (3.2 kg) North American 2-row pale malt
3 lbs. (1.4 kg) white wheat malt
0.5 lb. (0.23 kg) rice hulls
4 AAU Liberty hops (60 min.)
  (1 oz./28g at 4% alpha acids)
Wyeast 1010 (American Wheat), White Labs WLP320
  (American Hefeweizen Ale), or SafAle S-33 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Make sure malts are thoroughly crushed and mash at 152–154 °F (67–68 °C) with 3 gallons (11 L) water, adding about half the rice hulls before the grain and distributing the rest throughout the addition of the grain. Allow to rest for 45–60 minutes then run off the wort, recycling the first 0.5–1 gallon (2–4 L) until clear. Sparge with hot water at 175–180 °F (79–82 °C) to collect about 6.5 gallons (24.6 L) of wort in your brew kettle. Bring wort to a boil and add the Liberty hops.

Boil until the volume of wort is 5.75 gallons (22 L) of hot wort in your kettle, approximately 60 minutes. The goal is to have 5.25 gallons of cool wort in the fermenter, losing 1 qt. (1 L) to thermal contraction and another 1 qt. (1 L) to trub. Give the wort a long stir to create a whirlpool after turning off the heat and allow to settle for 10 minutes.

Cool to about 60 °F (16 °C), aerate wort if using a liquid yeast, and then pitch the yeast. After fermentation is complete and the beer is allowed to settle (about seven days), rack then bottle with priming sugar or keg and force carbonate to 2.5 v/v.

AMERICAN WHEAT

(5 gallons/19 L, extract only)
OG =1.048 FG = 1.010
IBU = 15 SRM = 4 ABV = 5%

INGREDIENTS

5.5 lbs. (2.5 kg) wheat dried malt extract
4 AAU Liberty hops (40 min.)
  (1 oz./28g at 4% alpha acids)
Wyeast 1010 (American Wheat), White Labs WLP320
  (American Hefeweizen Ale), or SafAle S-33 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Heat 4 gallons (15 L) of water in your brew kettle and stir in to dissolve about 4 lbs. (1.8 kg) of the malt extract, being careful to make sure all is dissolved before reaching a boil. Add the hops just before boiling commences. Boil for 40 minutes, turn off the heat and very carefully add the remainder of the extract, stirring thoroughly to ensure complete dissolution.

When the boil is complete, cool to about 60 °F (16 °C) and top off to 5.25 gallons (20 L). Aerate wort if using a liquid yeast, and then pitch the yeast. After fermentation is complete and the beer is allowed to settle (about seven days), rack then bottle with priming sugar or keg and force carbonate to 2.5 v/v.

WHAT'S UP WHEATWINE

(5 gallons/19 L, all-grain)
OG = 1.093 FG = 1.025
IBU = 64 SRM = 16 ABV = 9%

INGREDIENTS

10 lbs. (4.5 kg) white wheat malt
4 lbs. (1.8 kg) North American 2-row pale malt
2 lbs. (0.91 kg) Munich malt (10 °L)
1.5 lbs. (0.7 kg) caramel malt (80 °L)
1 lb. (0.45 kg) cane sugar
1.5 lbs. (0.7 kg) rice hulls
12 AAU Centennial hops (60 min.)
  (1 oz./28 g at 12% alpha acids)
12 AAU Centennial hops (15 min.)
  (1 oz./28 g at 12% alpha acids)
½ tsp. yeast nutrients (15 min.)
LalBrew Nottingham Ale, Wyeast 1028 (London Ale),
  or White Labs WLP013 (London Ale) yeast
⅔ cup corn sugar (if priming)

STEP BY STEP

Mash grains at 152–153 °F (67 °C) with 5 gallons (19 L) of water — first adding about a quarter of the rice hulls then the malt, mixing in the remainder of the hulls as evenly as possible. At 60 minutes (or longer if a starch-iodine test is negative) start run off and sparge with water at 175–180 °F (79–82 °C) to collect 7 gallons (26.5 L) of wort. Add the sugar. Bring the wort to a boil adding the first hops after 30 minutes. Keep boiling until the volume of wort is 5.75 gallons (22 L) of hot wort in your kettle, approximately 90 minutes total. The goal is to have 5.25 gallons of cool wort in the fermenter, losing 1 qt. (1 L) to thermal contraction and another 1 qt. (1 L) to trub. Give the wort a long stir to create a whirlpool after turning off the heat and allow to settle for 10 minutes.

Cool to 68 °F (20 °C), aerate wort if using a liquid yeast, and then pitch the yeast. Ferment 10–14 days at about 68 °F (20 °C) and then rack to secondary for 2–3 weeks to cool condition at cellar temperatures (roughly 55 °F/12 °C). Bottle with priming sugar or keg and force carbonate to 2.2 v/v. Preferably, you should age this beer for at least three more months.

WHAT'S UP WHEATWINE

(5 gallons/19 L, extract with grains)
OG = 1.093 FG = 1.025
IBU = 64 SRM = 16 ABV = 9%

INGREDIENTS

8 lbs. (3.6 kg) wheat dried malt extract
1 lb. (0.45 kg) Munich dried malt extract
1.5 lbs. (0.7 kg) caramel malt (80 °L)
1 lb. (0.45 kg) cane sugar
12 AAU Centennial hops (60 min.)
  (1 oz./28 g at 12% alpha acids)
12 AAU Centennial hops (15 min.)
  (1 oz./28 g at 12% alpha acids)
½ tsp. yeast nutrients (15 min.)
LalBrew Nottingham Ale, Wyeast 1028 (London Ale),
  or White Labs WLP013 (London Ale) yeast
⅔ cup corn sugar (if priming)

STEP BY STEP

Begin by heating 5 gallons (19 L) water. Place crushed grains in muslin bag and submerge in the kettle as the water heats up. When the water reaches 170 °F (77 °C) remove grain bag, allowing it to drip into the kettle. Turn off heat and stir in to dissolve sugar and dried malt extract in the kettle. Be sure that all of it is dissolved before turning heat back on. Bring wort to a boil, then add the first hop addition and boil for 60 minutes. At the end of the boil, turn off heat then give the wort a long stir to create a whirlpool and allow to settle for 10 minutes.

Cool to 68 °F (20 °C) and top off to 5.25 gallons (20 L). Aerate wort if using a liquid yeast, and then pitch the yeast. Ferment 10–14 days at about 68 °F (20 °C) and then rack to secondary for 2–3 weeks to cool condition at cellar temperatures (roughly 55 °F/12 °C). Bottle with priming sugar or keg and force carbonate to 2.2 v/v. Preferably, you should age this beer for at least three more months.

Shades of BROWN

Exploring brown ale: English, American, and in-between

by Paul Crowther

I was born in Yorkshire, U.K., and have lived half my life in Newcastle, so brown ale forms a big part of my brewing DNA with Sam Smith's Nut Brown Ale and Newcastle Brown being two of the biggest beers of my two home counties.

The history of brown ale goes back centuries; before the invention of pale malt in the 1700s all beer was brown, although there are arguments as to exactly how dark the beer from brown malt a couple hundred years ago was. For a little time after the invention of pale malt, brown ales continued to be made with 100% brown malt,[1] but soon brewers realized just how much more efficient pale malt was and so brown ales began to be made from blends of brown and pale malt. Before you all go and decide to try and make a historic brown ale using 100% brown malt though, brown malt from that period was quite different from modern brown malt in that today's version is fired to such a degree that it has no diastatic ability. Historic brown malt was kilned over wood and so had a smoky character with enough diastatic ability to be used at 100% of the grist.

In strives to be even more efficient brewers eventually ditched brown malt almost entirely, shifting to a base of up to 100% pale malt and added color to their beer with either caramel syrups or small amounts of roasted or crystal malts. While solely using caramel syrup to color brown ales has largely fallen out of favor, it should be noted the practice continues to be used by a small number of traditional brewers and even Newcastle Brown Ale was made this way until 2015.[2]

Photo by Charles A. Parker/Images Plus

A pale malt base with crystal malt and roasted malt additions for coloring takes us to our modern understanding of the basics of a brown ale recipe. However, there was a divergence in the style, a divergence caused by the Atlantic Ocean that split the style into the two most common sub styles: The British brown ale and the American brown ale. (For the purposes of this article I'm not discussing London brown ale, as I feel that's more its own unique offshoot — whereas American brown ales were an evolution of the British or northern brown ale.)

The first beer that described itself as an "American brown" was Pete's Wicked Ale in 1986, but the style was formally codified in the first Beer Judge Certification Program (BJCP) style guidelines in 1997, which actually credits the style as an "adaptation by American homebrewers desiring higher alcohol and hop bittering levels to go along with the rich, malty character of all brown ales. Dark amber to dark brown color . . ." Not much has changed in this guideline over the years except the hop bittering: The current BJCP guidelines have both British and American brown ales at 20–30 IBUs, and while it states that American brown ales can have a medium hop aroma, it's now an optional interpretation and the super-hopped browns are now categorized as brown IPAs.

It's a blunt stereotype to say American brewers like their beers *bigger*, but there's some truth to it. Give a beer style to an American and they'll want it higher in ABV, packed with hoppy aroma, and when it comes to dark beers American brewers often make them darker, sweeter, and maltier. The original BJCP guidelines as much as says this outright — American brown ale became a style because of American homebrewers brewing instincts and personal tastes.

The BJCP style guidelines, however, set analytical boundaries and descriptions that brewers and particularly homebrewers gravitate towards following. The names are not a marker of where the beer is made — you get British brown ales brewed in the U.S. and American brown ales in the U.K. I would argue, however, that those same cultural drivers on style divergence have happened again. There is so much leeway in the guidelines that you could (and I will) make the argument that the two styles have effectively split into four: A British-American brown, an American-British brown, a British-British brown, and an American-American brown. Confused? Well come with me as we look at the ingredients set out in the BJCP guidelines and how brewers tend to approach them on either side of the Atlantic. We'll also get some clone recipes supplied for some of the best examples of these styles.

GRAIN BILL AND MASHING

British brown ales are specified as 12–22 SRM and an ABV of 4.2–5.4%. American browns are to style quite a bit darker and have a range with 18–35 SRM and a bigger ABV of 4.3–6.2%. Technically, then, when you have a beer at 18–22 SRM and 4.3–5.4% ABV it fits into both and could have a bit of an identity crisis, like Ozzy Osbourne when he sings in an American accent. This flexibility in the styles allows for what I'm talking about with the divergent approaches.

British-British browns will usually be the lower end of the SRM range, include 85–90% pale malt, with additions of brown, medium crystal, and Munich malts to make up the rest of the grist. You might even see a small addition of chocolate just to get it to the right color but not enough to impart any roasted character. American-British browns will rarely be the 12 SRM (usually pushing the 18), they'll also be at the bigger end of the ABV, and chocolate malt is a lot more common and in higher quantities.

American-American browns will be strong, and will tend to push the color to porter levels of brown with higher amounts of chocolate malt (up to 10%) to achieve this. British-American browns will tend to be at the lower end of the American brown ale spectrum color-wise but will still need to use 3–4% chocolate malt or a lot of dark crystal to get up to the lower end of the American brown ale spectrum. All of these styles often use traditional English or American single-infusion mashes, as we'll see in the following clone recipes.

HOPS AND BOILING

British-British brown ales tend towards British landrace hops like Fuggle and Goldings, but American-British browns can use American hops with similar earthy and floral aromas such as Willamette or Sterling. There should be just enough bitterness and aroma to balance the sweetness — this is not a hoppy style after all and the BJCP guidelines indicate 20-30 IBUs.

American browns have the same IBU range but hop character can have a lot more influence in this beer. The BJCP style guidelines are flexible on the matter though, saying that "some interpretations" of American brown ales are highly hopped; so Americans can be hoppy or not and still be to style. I've found that typically British-American browns tend towards the hoppy interpretation of the style. Any "American-style" for British brewers is associated with citrus-flavored, high-alpha hops so the likes of Citra®, Simcoe®, Cascade, or Ekuanot® would be appropriate whereas American-American Browns tend towards the more lower hop version and focus on malt character, using hops such as Willamette, Sterling, or Nugget.

YEAST AND FERMENTATION

British brown ales should have some fruity esters built into the character. The BJCP guidelines say low to moderate, but for me, I want a characterful British yeast like White Labs English Ale (WLP002) or Mangrove Jack's Empire Ale yeast. I want lower attenuation to again end with a higher final gravity.

American brown ales have a similar guideline of very low to moderate esters, so you can still use a more characterful yeast but I believe if you're going for the more hoppy interpretation of the style then a clean finishing yeast such as the Chico strain would be ideal.

To get a clearer picture of all of this, let's take a look at some clone recipes that came straight from the brewers to better understand ingredient selection and brewing methods for creating these brown ale variations.

References

[1] Daniels, R. (2000) *Designing Great Beers: The ultimate guide to brewing classic beer styles.* Boulder, CO: Brewers Publications.

[2] Knapton, S. (2015) "Newcastle Brown Ale recipe to change to keep America happy," *The Telegraph, 6* February 2015. https://www.telegraph.co.uk/news/science/science-news/11395877/Newcastle-Brown-Ale-recipe-to-change-to-keep-America-happy.html

CONTEMPORARY BROWN ALE CLONES

I asked my editor for recommendations of American brown ales that are popular in the states and Cigar City Brewing Co.'s Maduro was a suggestion. However when I looked this beer up I saw it was marketed as a "Northwest English" brown ale. So we're going to slot this into the so-called American-British brown ale category.

I spoke to Wayne Wambles, Brewmaster at Cigar City, who told me when he traveled to the U.K. and tried Sam Smith's Nut Brown he was disappointed and wanted to make a beer that truly had a nutty character and so he made Maduro. Since then, despite never meaning it to be an American brown ale, it's been hailed as one of the best examples of the style and at competitions it actually tends to do best if entered as a brown porter.

This is far darker than the BJCP guidelines for an English brown and pushes past the upper limit in terms of ABV, but it shows you cannot contain American brewing culture behind the bars of strict BJCP styles, that irresistible urge to push a beer bigger and bolder will not be stopped.

CIGAR CITY BREWING CO.'S MADURO BROWN ALE CLONE

(5 gallons/19 L, all-grain)
OG = 1.059 FG = 1.017
IBU = 25 SRM = 32 ABV = 5.5%

INGREDIENTS

8.25 lbs. (3.7 kg) Simpsons Extra Pale Ale Malt
1.4 lbs. (0.64 kg) Simpsons Crystal T50™ malt
1 lb. (0.45 kg) flaked oats
15 oz. (425 g) Briess Victory® Malt
11 oz. (312 g) Simpsons Brown Malt*
5.5 oz. (156 g) chocolate malt
5.1 AAU Northern Brewer hops (60 min.) (0.6 oz./17 g at 8.5% alpha acids)
3.9 AAU Willamette hops (15 min.) (0.7 oz./20 g at 5.5% alpha acids)
Wyeast 1335 (British Ale II), SafAle S-04, or LalBrew Nottingham yeast
¾ cup corn sugar (if priming)

**Be careful if substituting, at 170 SRM Simpsons Brown Malt is a lot darker than other brown malts. Coffee malt is an appropriate substitute.*

STEP BY STEP

Wayne suggested to mash a little higher than normal, so I'd mash in at 154 °F (68 °C); this will give you a higher final gravity and thicker mouthfeel. Mash the pale malt and oats for 40 minutes then stir in the crystal, Victory®, brown, and chocolate malts. Begin recirculation and slowly raise to mash out temperature of 168 °F (76 °C), hold for 5 minutes before beginning sparging.

Collect 6.5 gallons (24.6 L) wort in the kettle and bring to a boil. Boil for 60

minutes adding the hops according to the ingredients list. After the boil, give a long stir to create a whirlpool then let the break material settle. Chill down to yeast-pitch temperature, about 66 °F (19 °C). Aerate if using a liquid yeast strain and then pitch the yeast.

Ferment at 68 °F (20 °C) until terminal gravity reached, about one week. Condition for an additional week then transfer to a keg and force carbonate or bottle and prime to 2.4 v/v.

Partial mash option: Replace 6 lbs. (2.7 kg) of the extra pale malt with 3.5 lbs. (1.6 kg) of extra light dried malt extract. Place the extra pale malt, flaked oats, and Victory® malt in a large muslin bag then submerge in 2 gallons (7.6 L) hot water to stabilize at 154 °F (68 °C) and hold for 40 minutes. Add in the chocolate, brown, and crystal malts in a separate muslin bag and hold for 15 minutes. Remove both grain bags and place in a colander over the kettle. Slowly rinse the grains with 2 gallons (7.6 L) of hot water, then top off kettle to 6.5 gallons (24.6 L). With the heat turned off, stir in the malt extract. Bring the wort up to a boil and then follow the remainder of the all-grain recipe instructions.

Up next is what I'd call an American-American brown ale courtesy of Avery Brewing Co. Ellie's Brown Ale is quite restrained in its color but a big addition of chocolate malt ensures a nutty, toffee, and lightly roasted character. This is definitely not the aggressively hopped version of an American brown; a slight amount of Sterling hops added late in the boil brings a slightly floral and spicy aroma to balance the sweetness. The London Ale yeast adds some fruity esters, but overall this is a beer that leans heavily into its malt bill.

AVERY BREWING CO.'S ELLIE'S BROWN ALE CLONE

(5 gallons/19 L, all-grain)
OG = 1.056 FG = 1.014
IBU = 20 SRM = 24 ABV = 5.5%

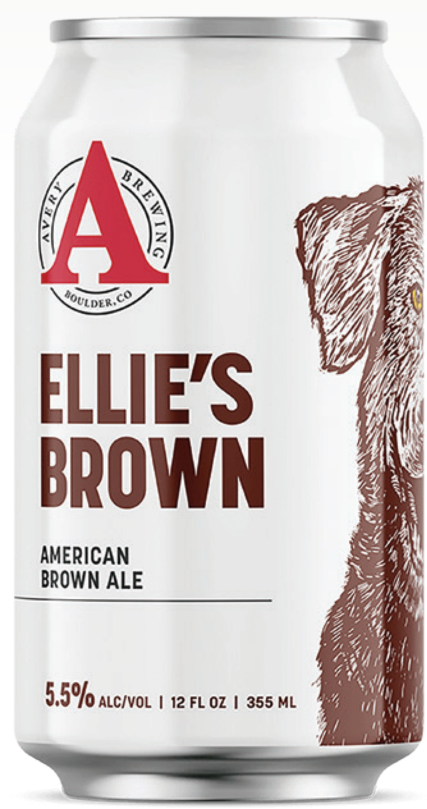
INGREDIENTS

9.8 lbs. (4.5 kg) 2-row pale malt
12 oz. (340 g) chocolate malt
10 oz. (285 g) Munich malt
6.5 oz. (185 g) crystal malt (120 °L)
3.5 oz. (100 g) melanoidin malt
3.8 AAU Bullion hops (60 min.)
(0.5 oz./14 g at 7.6% alpha acids)*
1.6 AAU Sterling hops (30 min.)
(0.33 oz./9 g at 5.1% alpha acids)
1 oz. (28 g) Sterling hops (0 min.)
White Labs WLP013 (London Ale), Wyeast 1028
(London Ale), or Mangrove Jack's M13 (Empire Ale) yeast
⅔ cup sugar (if priming)

**If you cannot find Bullion hops you may substitute with Nugget or Magnum.*

STEP BY STEP

Mashing the grains at 152 °F (67 °C) should be enough just to ensure you get that slightly higher final gravity. Mash all



the grain together for 60 minutes before beginning lauter. Collect enough wort to boil for 60 minutes and obtain 5.25 gallons (20 L) of cooled wort in the fermenter.

After sparging, bring to a boil and boil for 60 minutes, adding the hops according to the ingredients list. After the boil, give a long stir to create a whirlpool and let the break material settle for 10 minutes. Chill down to yeast-pitch temperature, about 66 °F (19 °C). Aerate if using a liquid yeast strain and then pitch the yeast.

Ferment at 68 °F (20 °C) until terminal gravity reached, about one week. Condition for an additional week then transfer to keg and force carbonate or bottle and prime to 2.3 v/v.

Extract with grains option: Replace the 2-row pale and Munich malts with 5.4 lbs. (2.7 kg) of extra light dried malt extract and 8 oz. (230 g) of Munich dried malt extract. Add the chocolate, melanoidin, and crystal malts in a muslin bag and submerge in 4 gallons (15 L) of water as it heats up to 170 °F (77 °C). Remove grain bag, allowing to drip back into the kettle, then top off kettle to 6.5 gallons (24.6 L). With the heat turned off, stir in the malt extract.

Bring the wort up to a boil and then follow the all-grain recipe for boil and fermentation instructions.

Coming back to my side of the pond for what I'd call a British-British brown ale, Thornbridge and Bundobust's collaborative Nut Brown Ale is an homage to the classic Sam Smith's Nut Brown, the same beer that inspired Maduro, but you get a very different outcome. It is dark copper in color, with a grain bill all about building caramel flavor and a hint of chocolate malt for some of the darker toffee character, but not enough to add any roasted character. Eminently sessionable, this beer is designed for a long afternoon at the pub.

The recipe uses a slightly unconventional hop choice with Ernest, a British hop first bred in the late 1950s but never gaining mainstream appeal at the time due to its unpopular "American aroma" of apricot and citrus. With the popularity of such flavors in today's craft beer landscape, Ernest has seen a recent resurgence.

THORNBRIDGE BREWERY & BUNDOBUST BREWERY'S NUT BROWN ALE CLONE

(5 gallons/19 L, all-grain)
OG = 1.044 FG = 1.011
IBU = 25 SRM = 14 ABV = 4.3%

INGREDIENTS

7 lbs. (3.2 kg) Maris Otter pale ale malt
1.5 lbs. (0.68 kg) Munich malt
5.3 oz. (150 g) crystal malt (60 °L)
2.6 oz. (75 g) brown malt
2.6 oz. (75 g) chocolate malt
6.9 AAU Ernest hops (60 min.) (1.25 oz./35 g at 5.5% alpha acids)*
4.5 AAU Ernest hops (hopstand) (1.6 oz./45 g at 5.5% alpha acids)*
White Labs WLP037 (Yorkshire Square Ale), Wyeast 1469 (West Yorkshire Ale), or SafAle S-04 yeast
½ cup corn sugar (if priming)

**If you can't get hold of Ernest hops, Cascade hops would be a good substitute.*

STEP BY STEP

You don't want as thick a mouthfeel for a British brown ale as you would for the previous examples, so mash in fairly low at 148–150 °F (65–66 °C). Hold at this temperature for 60 minutes and confirm the saccharification step is complete with an iodine test before proceeding to the lauter steps. Sparge with enough water to collect 6.5 gallons (24.6 L) in your kettle.

Boil for a total of 60 minutes, adding the hops at the times indicated in the ingredients list. At the conclusion of the boil, cool the wort down to 185 °F (85 °C) and then halt cooling and add the hopstand addition of hops. Stir the wort and let stand for 20 minutes before chilling to yeast-pitch temperature.

Ferment on the warm end of the yeast range, about 72 °F (22 °C), to coax all the fruity esters out of the characterful Yorkshire ale yeast. Bring down 54 °F (12 °C) after primary fermentation is complete for maturation of a week or so prior to packaging.

This kind of classic British-style ale would normally be served on cask or bottled conditioned. Keg if you must, but if you bottle condition you'll get the best out of this beer. Add ½ tsp. of priming sugar to each bottle (or ½ cup for the entire 5-gallon/19-L batch) for low carbonation and serve at cellar temperature.

Extract with grains option: Replace the 2-row pale and Munich malts with 4 lbs. (1.8 kg) of extra light dried malt extract and 12 oz. (340 g) of Munich dried malt extract. Add the chocolate, brown, and crystal malts in a muslin bag and submerge in 4 gallons (15 L) as it heats up to 170 °F (77 °C). Remove grain bag, allowing to drip back into the kettle, then top off kettle to 6.5 gallons (24.6 L). With the heat turned off, stir in the malt extract.

Bring the wort up to a boil then follow the all-grain recipe for boil and fermentation instructions.

Our last recipe is what I'd consider a British-American brown ale, named Barnum Brown from Neon Raptor. This is a good example of the hoppy version of the American brown ale style you tend to see from British craft brewers. A grain bill that could well be a British brown ale, but the star of the show is the New World hops adding a big hit of pine, spice, and citrus. The Chico yeast ensures a clean fermentation that allows these big hop flavors to shine.

NEON RAPTOR'S BARNUM BROWN CLONE

(5 gallons/19 L, all-grain)
OG = 1.052 FG = 1.012
IBU = 18 SRM = 20 ABV = 5.2%

INGREDIENTS

5 lbs. (2.3 kg) Golden Promise pale ale malt
2.5 lbs. (1.1 kg) Maris Otter pale ale malt
1 lb. (0.45 kg) crystal malt (60 °L)
8.3 oz. (235 g) Munich malt
8.3 oz. (235 g) brown malt
8.3 oz. (235 g) flaked oats
8.3 oz. (235 g) flaked barley
5 oz. (142 g) chocolate malt
5.6 AAU CTZ hops (60 min.)
(0.4 oz./11 g at 14% alpha acids)
2.2 AAU Cascade hops (15 min.)
(0.4 oz./11 g at 5.5% alpha acids)
9.6 AAU Cascade hops (hopstand)
(1.75 oz./50 g at 5.5% alpha acids)
2 oz. (56 g) CTZ hops (dry hop)
2 oz. (56 g) Simcoe® hops (dry hop)
2 oz. (56 g) Centennial hops (dry hop)
SafAle US-05, Wyeast 1056 (American Ale), or
White Labs WLP001 (California Ale) yeast
⅔ cup corn sugar (if priming)

STEP BY STEP

You don't want as thick a mouthfeel in a British brown ale and want the hops to be the star of this show for this beer, so mash in fairly low at 148–150 °F (65–66 °C). Hold at this temperature for 60 minutes. Proceed to the lauter steps. Sparge with enough water to collect 6.5 gallons (24.6 L) in the brew kettle.

Boil for a total of 60 minutes, adding the hops at the times indicated. At the conclusion of the boil, cool the wort down to 185 °F (85 °C) and then halt cooling and add the hopstand addition of hops. Stir the wort and let stand for 15 minutes before chilling to yeast-pitch temperature.

Ferment at 66 °F (19 °C). Add the dry hop addition after 3 days and then leave in for 7 days or until fermentation is complete (whichever is longer).

Bottle and prime with sugar or keg and force carbonate to 2.2 v/v.

Extract with grains option: Replace Golden Promise, Maris Otter, Munich, and flaked grains with 6.6 lbs. (3 kg) Maris Otter liquid malt extract. Place the crushed grains in a muslin bag and submerge in 4 gallons (15 L) as it heats up to 170 °F (77 °C). Remove grain bag allowing to drip back into the kettle, then top off kettle to 6.5 gallons (24.6 L). With the heat turned off, stir in the malt extract.

Bring the wort up to a boil and then follow the all-grain recipe for boil and fermentation instructions.

BEER IS IN SESSION

What it takes to get an education in brewing

by Kristen Kuchar

For many beer enthusiasts and homebrewers, the idea to turn their passion into a profession has crept up while sipping a finely made brew. And why not? Across the beer industry, there are more than two million jobs according to a report by the Beer Institute and National Beer Wholesalers Association. (This includes roles in agriculture, manufacturing, brewing, importing, distribution, and retail jobs in bars, restaurants, and supermarkets.)

In the past few decades, options for pursuing a formal education in brewing have become more widely available. While enrolling in a beer course can seem like a dream come true, it's certainly not an easy path — there is often a plethora of information to learn and a rigorous hands-on trial of what physically goes into being a brewer.

There are schools entirely devoted to teaching how to brew and beer education, such as The Siebel Institute of Technology in Chicago, Illinois, and the American Brewers Guild in Vermont. In addition, colleges and universities across the country (and world) offer brewing-related certificates or professional development courses and workshops.

To get a better understanding of some of the options available to prospective students, the work that goes into a formal brewing education, and the benefits of completing a program, I sought out a diverse group of industry and educational professionals to shed some light on the subject. Of course, I couldn't speak with representatives from every program, but anybody interested in taking their brewing knowledge to the next level via academia will find through research on the internet that there are many great options available to them. Determining the best fit is up to you based on your goals, budget, desire for online or in-person schooling, etc.

WHAT TO EXPECT

Chris McCombs, Head Brewer at Coopersmith's Pub and Brewing in Fort Collins, Colorado, decided to enroll in a course at The Siebel Institute of Technology after eight years of working in the industry. McCombs fell in love with craft beer in college and started his brewing career in Montana. But with an English Literature degree in his pocket, he started to realize there were gaps in the science aspect that inspired him to pursue education.

"I was coming across problems in the process that I knew had a scientific explanation but I needed to learn that to troubleshoot and improve," he recalls.

McCombs was already working full-time in the engineering department at New Belgium Brewing in Colorado, so he decided to pursue a two-week course


Photo courtesy of Appalachian State


Photo courtesy of the American Brewers Guild

Photo courtesy of the American Brewers Guild

Photo courtesy of UC-Davis

Photo courtesy of Appalachian State

As homebrewers are aware, brewing is a labor-intensive endeavor. And so is an education in brewing.

at Siebel with his boss's support. He chose the Chicago institute because of the high reputation of academic excellence along with a course option that fit his work schedule.

He describes the course as intensive with excellent instructors. As someone who already had industry experience, the course really reinforced certain things and provided him with a good understanding of the science of brewing. It had a huge impact on him as a brewer, he says, immediately helping him better understand yeast metabolism, clean-in-place, and water chemistry, for example. The passionate brewer even built a calculator in Excel for recipe development based on a formula he learned at Siebel that has resulted in medal-winning beers.

McCombs not only has completed a program himself, but is now teaching at Colorado State University's Fermentation Sciences program. Pursuing a formal education in beer may not be right for everybody, he cautions — it depends on the person and their goals, and how their education manifests as a useful tool. It's great to have that educational insight for troubleshooting and innovating, and certainly not discounting education, but he says it's essential to have follow-through, be responsible, and be reliable to make it in this career, not just an understanding of how beer is made. "I think it takes years of cleaning tanks, cleaning kegs . . . that work ethic is so important."

He points out there is a lot to factor in. It's important to consider a likely low starting salary for production brewing, the possibility for limited time off, and being aware of what is happening in the brewing industry and challenges it faces, he says. There's also the issue of job outlook with increased competition and a changing brewing industry with closures being a common thing and still feeling the impacts of the pandemic.

Before getting started, McCombs recommends consulting a school or career counselor. "They can help in many ways, not the least of which would be to chart the path towards graduation, or even find learning alternatives if career goals lean towards a certain area of fermentation production or another," he says. "For instance, a seasoned homebrewer might find it more useful to take an MBA course to prepare them to open their own brewery vs. brewing science." Other pre-requisites he adds would be starting to homebrew, taking good notes, and joining a homebrew club for networking. Once in the program, his advice is: Go to your classes, ask a lot of questions, keep a notebook of questions that come up, communicate with your instructors, and, once the homework is done, have a beer with your fellow students.

Another suggestion McCombs offers for those who have made the decision to pursue an education in beer is to broaden their knowledge base. "Whatever program you go into you want a diversity of knowledge," he says. Consider a program that doesn't just focus on brewing beer but also offers experience in cider, hard tea, and kombucha, for example. He also suggests considering augmenting beer education with a trade such as sanitary welding. "You immediately become more employable," he says. When it comes to the post-education job search, be open to working in other areas of brewing, such as a lab or packaging brewery, he says.

Improving employment was a part of the motivation that led Alyson Hartwig to enrolling at Siebel, along with the desire to continue education. Hartwig completed the Master of Beer Styles and Evaluation Course in 2013, then completed the Concise Course in Brewing Technology. In 2017, Hartwig did the International Diploma in Brewing Technology, half taking place in Chicago and half in Munich, Germany. She is currently the Fermenting Senior Specialist at Molson Coors Beverage Company and has interned at Goose Island Beer Company and brewed at Dry Dock Brewing Co. and Pike's Peak Brewing in Colorado.

"It has definitely helped me get jobs," Hartwig says.

That education helped her be more adaptable through the changing roles in her career, and she learned where her interests were through education. "My passions laid more in the process and organization side than the recipe development and experimentation," she says.

Oftentimes breweries are looking for an education to show grit and commitment to completing. Prerequisites vary by program, but Hartwig recommends hands-on experience before starting a program. She suggests contacting local breweries to see if there is any availability for an entry-level position, packaging role, or other position that doesn't require professional experience.

She also suggests starting your education in advance by reading as much brewing literature and listening to as many podcasts as possible. "There is a lot of material out there readily available in order to further your education on your own."

In making the decision, Hartwig recommends prospective students assess goals, including furthering their career in the industry, taking on management roles, or opening their own brewery. Consider how much time you have and what fits into your schedule, she says. She also advocates for finding a program with an internship component or hands-on experience as a part of the education if you do not have very much experience in the field.

Hartwig says to pursue possible scholarships and even ask your employer to help you pay for your education. Once in the program, she spent two hours each night, including weekends, studying — so learn to balance studying and networking. And hang onto paperwork after the program to reference later.

Jonathan Hughes, PhD, Director of Brewing and Sensory Science at UC-Davis Continuing and Professional Education, explains that a formal education in brewing gets into the science behind brewing and comprehensive coverage of necessary topics all in one place from some of the top instructors in the world.

"Anyone can follow a recipe or a standard operating procedure, but if you understand the science behind what's going on in the malting and brewing process, you know the reasons for your actions," Hughes says.

During the professional brewing program at UC-Davis, and many others, the entire process of beer production is covered from raw materials through packaging the finished product, including malting, wort production, fermentation, maturation, and processing. Instructors also cover quality, sensory analysis, and brewery engineering — the mechanical, chemical, and process engineering fundamentals involved in running a brewery. Students can also expect guest speakers from those active in the beer industry, such as brewers, suppliers, and brewing scientists who give further insight and provide additional context for the curriculum.

Hughes points out that another benefit of educational programs is the ability to build a professional network as you're pursuing your education. "Many of our alumni have stayed in touch with their classmates for years, some even decades," he says. They help each other troubleshoot issues, do collaboration brews, and sometimes just enjoy a few pints with each other. In fact, his biggest advice for students in the program is to interact with each other, instructors, and guest speakers that come to visit.

Jane Killebrew received a degree in 1981 from UC-Davis with a Food Science & Technology, Brewing Emphasis, degree and says her experience and education had an amazing impact on her career and made her a lifelong learner and teacher.

"The guidance and support I received on top of the technical training was instrumental in getting my first job in 1981 with Pabst Blue Ribbon and then on to Anheuser-Busch (ABI) in 1985," she says. In her 37-year career there, Killebrew rose to the highest level in brewing at ABI, Global VP of Brewing and Quality.

Killebrew received a sound foundation in brewing principles, she explains — organic chemistry, enzymology, microbiology, sensory analysis, and the brewing technical-specific training. "I applied many of these topics over the years in a lifetime career in the brewing industry," she says.

Brian Hunt, Founder and Brewmaster at Moonlight Brewing Company in Santa Rosa, California, says he is grateful for what he learned getting a degree in the field at UC-Davis in 1980. "I was taught the theories of why brewing works, and only minimally how to do it. That was my foot in the door in a 5-million-barrel brewery," he says. Hunt found he really wanted to create and work with his hands, less than manage people and process. "I soon found work in the (then emerging) craft scene, and learned how many generalizations I had learned in school that didn't apply in smaller breweries. But you gotta start somewhere," he says. "If you want to learn new things, you can go far. For advancement though, both practical experience and technical training are a must."

Hunt says he suffered through far more chemistry than his brain could tolerate, but from it he became able to better understand why something unexpected was happening. He now follows along with presentations on

Photo courtesy of UC-Davis

A formal brewing education is more about understanding the science of beer than just how to make it.

Photo courtesy of the American Brewers Guild

The American Brewers Guild offers a technical 23-week program with one week on-site at the Middlebury, Vermont, campus where they get hands-on experience.

in-depth scientific studies and articles are more meaningful than to those who have not memorized the likes of the Krebs cycle. Hunt says that everyone needs to learn their own mix of practical and theoretical knowledge because everybody learns differently and will play different parts in brewing. "Follow your passion, be it in a classroom or by shoveling spent grain," he says. He adds that knowledge of the coolest new hops or procedures pales to the knowledge of how and why to clean every brewery surface. "Hop varieties and beer styles become obsolete about every five years, but cleaning, microbiology, and chemistry will forever be relevant," he says.

Brett Taubman, PhD, Professor and Director of Fermentation Sciences at Appalachian State University, says when he has met brewers who aren't following best practices and asks them why they are doing it that way, the answer is inevitably because they were taught to do so. "A formal education gives a brewer the background necessary to learn why certain methods are used and to question every step in the process," Taubman says. "Likewise, if something goes wrong, which it will, a brewer with a formal education has the background to understand why it went wrong and how to fix it."

For instance, he says his students can expect to learn the science behind the fermentation processes, including the microbiology of the organisms involved, the metabolic pathways used by the microbes under varying circumstances, the physics and engineering aspects necessary to facilitate the fermentations, and the quality management protocols to ensure the product meets all metrics and if not, why not, and how to correct it for next time. "We also ensure that students get the most hands-on production experience possible so that they can put the theory to work as well as the analytical skills necessary to analyze the fermentation products," Taubman says.

In addition to fermentation science, math, economics, and chemistry courses related to the industry, other potential courses students may take in the program include ones on the hospitality and tourism industry, management, accounting, design thinking and entrepreneurial mindset, introduction to business, and principles of marketing.

When it comes to feedback, Taubman explains that while there are students who can feel a bit overwhelmed by the amount of information to digest at first, it all makes sense once they join the workforce. "I get so many emails from our graduates who are so grateful for their formal education because they now understand why the information was so important," he says. "Likewise, I get emails from their employers thanking us for providing such well-trained employees who understand why things are done certain ways and how to change them when necessary."

Beyond the technical understanding a brewing education provides, it gives you a head start in finding employment and lets prospective employers know you have the drive, determination, brewing knowledge, and work ethic that enables you to contribute to the success of the brewery from the start, says Steve Parkes, American Brewers Guild Owner and Lead Instructor.

"For graduates of the course it provides the confidence to take on responsibilities, and to take the first steps toward leadership," Parkes says. "As a brewery owner I can't do everything myself, so having someone there who is educated and trained making decisions in my absence is a huge comfort."

American Brewers Guild was founded in 1995 and offers practical, hands-on experience with brewing. Students embark on a highly technical 23-week program — one week on-site in Vermont and the rest via online learning. (Working brewers aren't required to come to Vermont provided their head brewer can conduct the practical training necessary to complete the program.)

"We cover everything from grain-to-glass," Parkes says, including delving into water chemistry, hop production, and the fundamental concepts of engineering and packaging. Once the coursework is complete, there is an optional 5-week unpaid training course where a student is matched with a brewery.

Eric Graham, Central Washington University (CWU) Craft Brewing Program Director says students are often surprised to find the courses are science-based and rigorous. In addition to the math and chemistry prerequisites Bachelor of Science degree seekers take, there are many others: Brewing microbiology, brewing process and biochemistry, sensory analysis for brewing, and brewing process technology, which focuses on the "hardware" side of a brewery. A farm-to-glass course explores the agriculture side of brewing with tours and input from local hop farmers or cider producers. Strategy for the Craft Brewing Industry covers the marketing and branding aspect of the business.

"We believe that exposure to the academic and research side of brewing better prepares our students for life both within and beyond the brewery," Graham says. "Our academic and real-world classes better prepare our students for troubleshooting brewery issues, understanding the bigger picture of fermentation as it relates to the brewing industry, and opens up avenues for advancement within the beverage industry."

CWU is a program that requires hands-on industry experience and practicum projects, such as making non-alcoholic beverages, experimenting with different sugars to make seltzers, comparing fermentation temperatures for lagers, and reproducing historical brews. Cooperative education internships allow students to get experience in breweries, hop laboratories, and within the food industry.

FURTHER CONSIDERATIONS

Of course, there are things to consider when choosing a career path and brewing program including costs, job outlook and salary, and working conditions. The average brewer salary in the U.S. is $44,701, and typically falls between $35,801 and $54,425, according to Salary.com. The Brewers Association reports that in 2022 there were 9,500 operating breweries in the United States, with approximately 550 openings and 220 closures last year. For 2023, the association's predictions include new openings will be the lowest in over a decade, distributed craft volume won't grow but total brewery employment will still grow.

Graham says that one thing people should keep in mind when it comes to choosing a program is the time commitment, which can be challenging for those who are working at the same time. The program at CWU, for example, is mainly focused on students who are able to commit to a four-year degree (through they also offer a Craft Brewing minor for science-based students and a certificate program for non-science majors).

When choosing a program, Hughes says to consider who the instructors are. "Are they notable in the field? Do they have actual industry experience? Do they have a research background?" Another thing to consider, he adds, is outcomes for alumni – are they getting jobs, and if yes, what types of jobs.

For students enrolled in a formal brewing program, Killebrew's advice is to be professionally curious, and soak up everything. Don't just learn the basics, she says. "Dig in and learn not just the topic but the deeper 'whys'," she says. "Be that person who asks too many questions." BYO

Photos courtesy of John Blichmann

PREPARING TO GO ELECTRIC

Setting up an electric homebrewery

by John Blichmann

I've had the great fortune of homebrewing since the early '90s. At that time brewing with cans of malt extract and doing concentrated wort boils on a residential stovetop was the norm. Only a small percentage of brewers were doing a full-wort boil in a large kettle on a propane burner. An even smaller percentage were brewing all-grain. I don't even recall anyone using electric immersion heaters at that time. I'm sure there were, but it was certainly rare. These days, however, electric brewing has become more the norm than the exception. In fact, electric brewing is even common in commercial breweries producing up to about 7 barrels per batch, and with good reason. The advantages of electric brewing are significant:

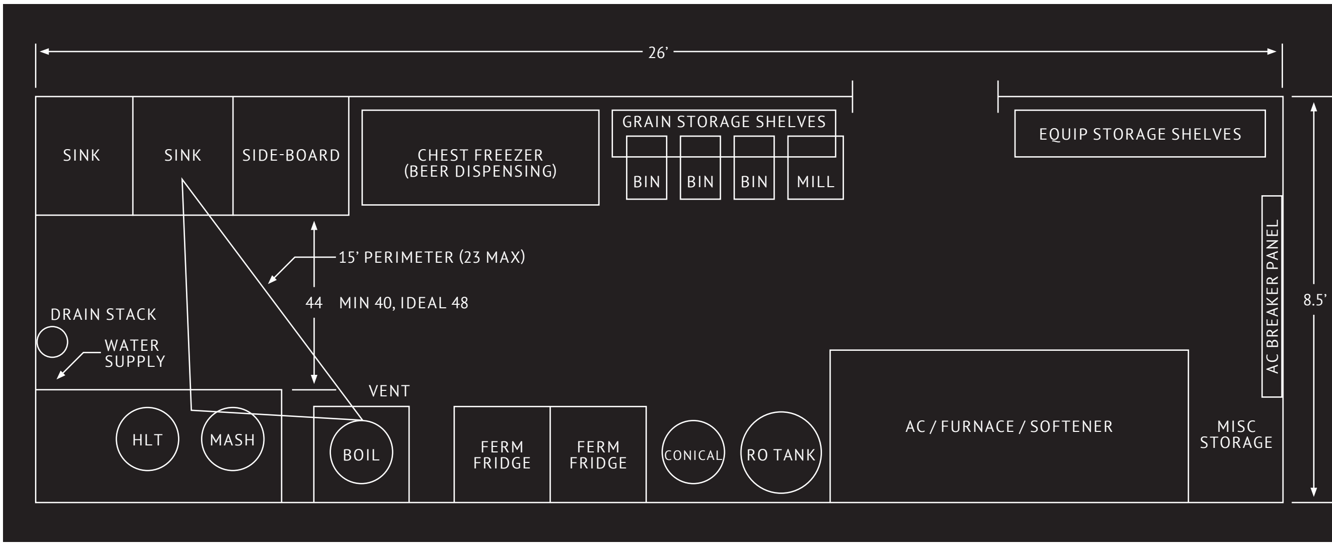
- Nearly silent operation.
- Safer for indoor brewing from a burn, fire, and fume standpoint.
- Heating speeds can be very fast.
- Requires only a quarter of the ventilation as gas/propane.
- Less expensive to operate per batch compared to propane.
- Never run out of fuel in the middle of a brew day (assuming the power doesn't go out), and no tanks to refill.
- More efficient use of energy: With a gas heater much of the heat is lost to the atmosphere.
- Easier to precisely control the temperature.

There are a few cons, and I'll address those in this article as well:

- Not as portable as propane due to availability of needed power.
- Can be expensive to add the necessary power supply.
- Higher up-front costs for heaters and electrical controls.

There seems to be a perception that setting up an electric brewery is chock full of danger, mystical wiring needs, complicated terminology, and general intimidation. But, realistically, it's like all things: If you don't know anything about it, it can seem quite daunting. I'll walk you through all of this and you'll ultimately realize that while there is a lot to think about, there isn't anything here that is terribly difficult. Even if you end up hiring a professional to do much of it, it is important to have some fundamental understanding of what is required so that you can ensure your contractors are providing what you need.

The first thing to think about with any indoor homebrewery is to make a scaled drawing of where each piece of equipment and infrastructure will be located. See the example drawing I made



The first step in planning an electric brewing space is mapping out the locations of all your equipment, power source, ventilation, water, and drains.

for my new indoor brewery above. Note where the key pieces of infrastructure are located, as those are difficult and potentially expensive to relocate. Specifically, water supply, water drains, access for ventilation, and in the case of electric brewing, access to adequate electrical power connections. If you're lucky, they are all nearby. If not, you will need to decide which are the easiest to install, which you are willing to do without, or which you can accomplish in some other manner.

Ventilation can be one of those things that can be accomplished in another manner by using a steam condenser, discussed later in this article. Otherwise, you'll need access to an exterior wall or the ability to run ducting to an exterior wall. Venting steam and aromas is important.

A brewery without water drains may mean hauling brewing liquor through the house and carrying soiled equipment to a sink for cleaning. Since brewing involves a lot of equipment cleaning, this should be a high priority for your brewery.

You will also want to consider dedicated space for storing brewing ingredients, measuring equipment, kegs, bottles, etc. The closer you can locate all the equipment and materials needed throughout your brew day, the less time you'll spend moving and searching for things before you even get started brewing.

It is also highly recommended that you have easy-to-clean floors and walls. While a floor drain is nice, in a homebrewery that falls into the luxury list. White tile walls or fiberglass wall panels are an inexpensive way to make a durable, washable wall, particularly if you do the installation yourself. For floors, garage floor epoxy or slip resistant tile are both amazing choices. Both are great DIY projects that can save a lot of money. For more general details on setting up your homebrewery, I wrote an article on designing a space for homebrewing that is online at https://byo.com/article/homebrewery-design/. That article gives a lot of detailed information on infrastructure and other brewery setup topics. But the remainder of this article is going to focus specifically on the needs for creating an electric homebrewing space.

After mapping out locations, the next step is deciding what size batches you plan on doing now, and what size you foresee in the future. Are you always going to be brewing 5-gallon (19-L) batches? Or will you eventually go to 10- or 20-gallon (38- or 76-L) batch sizes, or even bigger? Will you always be using a 2- or 3-vessel system, or will you only be using a single vessel "all-in-one" type system? Will you ever transport your system to brew in another location where 240V power may not be available? The driver here is how much electrical power you will need, at what voltage, and what type of system you will be brewing on.

ELECTRICITY 101

For the electrical novice, a great way to understand the relationship between voltage, amperage, resistance, and wattage (power) is to use a water plumbing analogy:

- **Voltage (Volts)** is synonymous to pressure
- **Current (Amps)** is synonymous to flow
- **Resistance (Ohms)** is the resistance to flow such as pinching a hose, or a very small diameter hose
- **Power (Watts)** is how fast you can fill the bucket (total amount of water flowing in a given time).

Therefore, the higher the pressure (voltage) the faster you can move the water through a given diameter of hose. And the bigger the diameter the hose, the faster you can move the water at a given pressure since there is less resistance. Not a perfect analogy, but it gives you the idea.

Mathematically: Watts = Amps x Volts, and Volts = Amps x Ohms.

Figure 1 shows the typical power needs per vessel that you intend to heat. These values are going to give you fast heating times and good boil intensity. Of course that will vary with kettle geometry and whether it is insulated.

Putting it in use, small batch sizes (5 gallons/19 L and less) can operate off a typical residential voltage (in the USA) of 120V and with the available current provided by a com-

FIGURE 1: TYPICAL POWER REQUIREMENTS BY BATCH SIZE

Batch size gallons (L)	Volts	Amps	Watts
2.5–3 (9.5–11)	120V	10–12	1200–1500
5 (19)	120V	12.5–16.7	1500–2000
5 (19)	240V	10.5–14.6	2500–3500
10 (38)	240V	18.8–23	4500–5500
20 (76)	240V	23–25	5500–6000
1 BBL/32 gal. (121)	240V	25–50* (dual element)	6000–12000

** For large vessels, multiple elements are typically needed for boil kettles. The hot liquor tank typically uses one element unless faster heating times are desired.*

mon 15–20A circuit. The current is limited by a circuit breaker to prevent the wires from overheating and potentially causing a fire if too large of a heater is connected. Those circuits can provide 15A x 120V = 1800W or 20A x 120V = 2400W depending on the breaker installed. In use, breakers don't like to operate at their maximum rating, so you will typically see heaters sized to draw a few amps below the maximum rating to keep the breaker from nuisance tripping. Now you can understand why batch size is limited by 120V residential circuits. If you want faster heating speeds, more aggressive boils, or larger batch sizes, you are going to have to move up to 240V circuits. Fortunately, residential power is provided at 240V to your main breaker panel, so you do have the ability to provide 240V power.

WIRING CONSIDERATIONS

If your panel is near your intended brewing space, you have an easy job of installing a 240V power receptacle. If it is on the opposite side of the house or a different floor, that becomes more involved. Main breaker panels are commonly found in garages, basements, utility rooms, etc., which may or may not be in a convenient location for your brewery. That said, laundry rooms and kitchens usually have 240V outlets that can be adapted for powering your brewery, and all you may need is an adapter to match and an extension cord.

If you're running new power to an area, consider running more than what you need to allow for future expansion. Or if running wire through conduit outside of a wall, at least leave room in the conduit for larger or additional wiring if you decide to add power in the future. It is inexpensive to run the next larger size of conduit or wire, but expensive to start over.

I highly recommend hiring a licensed electrician before doing any wiring modifications. Codes you regularly hear about in the U.S. are NEC (National Electrical Code) and NEMA (National Electrical Manufacturers Association). Every municipality and state has different "interpretations" of wiring codes, and you definitely want to follow those. Some locations prohibit homeowners from doing the work as well, so tread lightly there. Simply put, have a qualified electrician familiar with local codes do the work for you, which will save money and potential hazards if done improperly.

CHOOSING A PLUG AND RECEPTACLE TYPE

There are quite a few varieties of receptacles and plugs that vary based on the intended voltage and amperage. The main reason is that it prevents you from connecting a load to an unmatched voltage and ampacity of the power source. A very common connector used in homebrewing is L6-30. The L denotes it being a locking type. The 6 generally denotes 240V (5 generally 120V) and the 30 denotes the max ampacity. The suffix R or P denotes receptacle and plug. So L6-30P is a locking 240V, 30A plug. There are a number of commercially available connectors to match what you are looking for.

You will also see 3-wire and 4-wire style connectors. A 3-wire for 120V configuration contains a ground, neutral, and one hot wire known as "line" or "leg." If you look at a residential main breaker panel it will have two 120V sides that added together create 240V. As you move down the bank of breakers the sides alternate. The "double wide" (2 pole) breakers you see in the panel actually connect to both sides of the panel simultaneously. That is why a 240V configuration will contain a ground wire (green), and two hots, (black and red, or black and white) from the left and right of the panel. A 4-wire connector will have a ground and a neutral (white). You will also see 3-wire connectors at 240V. In those you will have a ground wire, no neutral, and two hot wires. Industrial applications usually have 208V supplied in one conductor (leg), not two. Most residences in North America use 120V, whereas most other countries have 220-240V single leg power.

And of course, receptacle types are different as well. If you are lucky enough to have an existing power supply in your intended brew space you can easily buy a mating connector at most home improvement stores and run an extension cord, if needed, to your equipment. If you need to run a cord very far, you will want to pay close attention to gauge of the cord, and make sure to check the allowable amperage. That said, it is always best to have the power hard wired where you need it.

WALL RECEPTACLES

Locate the wall receptacle for your heater(s) near your brew kettles to minimize the need for an extension cord, but in a placement that inadvertent splashing or a boilover won't get them wet. In the Blichmann brew lab, where we test a lot of different heaters, we have up to 50A of power available. The top is a single 50A receptacle, and the bottom two are 30A receptacles. We have also added a 120V receptacle for convenience (shown in the top picture on page 52).

CHOOSING A BREAKER

It is required to install a ground fault circuit interrupter (GFCI) in any area where you are close to open water. Kitchens, baths, hot tubs, and homebreweries. These breakers not only protect the wires from overcurrent, but also offer personal protection.

Electric receptacles at the Blichmann brew lab.

Since water is a marginal conductor, it is possible to energize the water inside of a kettle and still not open the breaker. This can present an electrocution hazard. To help prevent this, an additional feature is added to GFCI breakers to detect current that is possibly travelling through the water and, if detected, opens the circuit. It does this by comparing the difference in current flowing in versus current flowing out. If there is even a slight difference, the circuit breaker opens. GFCI breakers are sometimes prone to nuisance tripping, but that is a small sacrifice for safety. Note that GFCI breakers can be found integral to power cords, or for 240V they are most commonly installed in your main breaker panel. 120V GFCI breakers are found in all bathrooms and kitchen wall receptacles. While 4-wire GFCI wiring is common for 240V applications, wiring a GFCI breaker in a 3-wire system is also commonly done and is most common in homebrewing setups. Your electrician can guide you in the installation of a GFCI breaker, and since that is such an important component, it is highly advised to have a licensed electrician inspect or install it. GFCI breakers are significantly more expensive than standard breakers, but are still much cheaper than a funeral. ALWAYS use a GFCI breaker.

The optional steam condenser made for the Anvil Foundry is an alternative to a vent hood.

It is also important to procure your heating elements from a reputable supplier that fully understands how the product is installed in homebrew kettles so you are sure everything is properly grounded. Water heater elements are designed for water heaters, not brew kettles, so bear that in mind. Fortunately, there are a number of reputable companies making elements specifically intended for homebrew kettles and they have a good track record of safety and reliability.

VENTILATION

Of course, just because you are brewing with electricity doesn't necessarily mean you are brewing indoors, as you could hook up an extension cord or use an outdoor outlet. But, let's assume we're brewing indoors, as getting out of the summer sun or avoiding the winter ice is a huge reason homebrewers choose electric brewing. One option for ventilation at a low cost, if possible, is brewing next to an open door or below a basement window with a fan blowing the steam outdoors. It's easy, largely effective, and will save money. However, that isn't an option for everyone, and when brewing larger batches it isn't the best option for ventilation.

The main reason to provide adequate ventilation for indoor brewing is that you're boiling a significantly larger volume of liquid than you typically would on a stovetop in your kitchen. Typically, you'll boil off about 10% of the volume of your batch, so for a 5- to 10-gallon (19- to

38-L) batch that is ½–1 gallon (2–4 L) of steam entering your house. For reference, 1 gallon (4 L) of water creates 230 cubic feet of steam. In very dry climates this may not be an issue, but excessive moisture can cause condensation on windows and cause mold to form. The other main reason to ventilate is the elimination of aromas in your house. While we brewers love that fine potpourri of hops and malt, others in the household may not.

Fortunately, ventilation for electric brewing only requires about a quarter of the capacity that a similar size propane system does. Typically, you will need about 34 cubic feet per minute for each 1000W of heating element power. For detailed advice on ventilation, see "Ventilation: Proper Airflow in your Homebrewery" from the January-February 2017 issue, available online at https://byo.com/article/ventilation.

Steam condensers are another type of device used to control steam and to a large degree, aroma. These devices are great for areas where you can't install a vent hood. They do require boiling with the lid on so that steam from the boil enters the discharge tube where it flows over a nozzle ejecting cool water mist. This causes the steam to cool, condense back into a liquid, and drain out of the bottom. Since the steam is condensing, it creates a slight vacuum in the boil kettle so no need to clamp on the lid. Another nice benefit to steam condensers is that they require about half of the power to maintain a boil than an open-top kettle. Subsequently, the amount of boil off is also reduced in half. Dimethyl sulfide (DMS) is not an issue with steam condensers as that is removed in the condensing tube. The mist used to cool the steam is generated by the high pressure of your tap water. A downside is they do use a decent bit of water, typically 1–2 times the batch size. Since the water does not enter the boil kettle you can use ordinary tap water. If you are in an area where water is scarce, it is possible to recirculate the condensed water using a high-pressure pump. However, if the water gets much over 120 °F (49 °C) it doesn't condense the steam very effectively so you will need to change the water or add ice to it. The other drawback to a steam condenser is they do not eliminate as much of the aroma or heat as a properly designed hood.

CONCLUSION

Hopefully this article has demystified electrical power wiring for indoor electric brewing. While there are a lot of terms, acronyms, and potential hazards associated with electric brewing, breaking it into the fundamentals should give you the confidence to make the move to electric brewing. Whether you plan to install the infrastructure yourself or hire a professional, it's valuable to know the basics. I can personally attest to how awesome electric brewing indoors is. No propane to buy. No blazing hot burners to deal with, whisper quiet efficient operation, and a perfect space to enjoy a homebrew with friends and family. BYO

BY DREW BEECHUM & DENNY CONN

LEARNING FROM MISTAKES

Paths to better brew days ahead

For evolutionary safety, the human brain is geared to recording and re-running events with a "negative outcome" in the hopes of preventing them from happening again and ensuring the continuation of our lines . . . well at least in theory. For that reason, too, our brains overestimate the chances of something bad happening. In other words, our brains are primitive, spongy disaster calculators with a panic button roughly the size of Manhattan.

Disasters are inevitable — it's why the brain works the way it does. The key to managing a disaster during your brew day (or after) is recognizing what can befall you and calmly, deftly handle it.

Drew's day job is all about predicting and preventing massive system failures in the "cloud" (ooooh, fancy, right?). The best way to deal with a disaster is to make sure it doesn't happen in the first place and taking proactive, preventative measures. During a brew day this means both Denny and Drew practice one very no-fun rule — no drinking until you're "done."

In this case, "done" is very much in the eye of the beer holder. For Drew that means no beer until the boil is going, the chiller is clean, the fermenter is sanitized, etc. (also Drew tends to brew during the work week, which puts a damper on drinking). For Denny, "done" usually translates to "the beer is in the fermenter, things are clean and I can see my favorite chair."

We know, we know — "But I must sacrifice beer to the beer gods lest they be angry and ruin my batch!" You do you — we just know that our incident rate of forgotten hop additions, open valves, cracked carboys, etc., dropped when we stopped swilling during our brew sessions. Having said that, there are certainly times when a brew session party is a lovely thing, in which case, it's about the party and shared company and not the brew itself.

We put out a call to folks — "what are your biggest brew day disasters?" (and we'd still love to hear even more of them! – podcast@experimental brew.com). By and large, most of the incidents come down to inattentiveness. Let's walk through a few of the major mistakes that brewers make:

By and large, most of the incidents come down to inattentiveness.

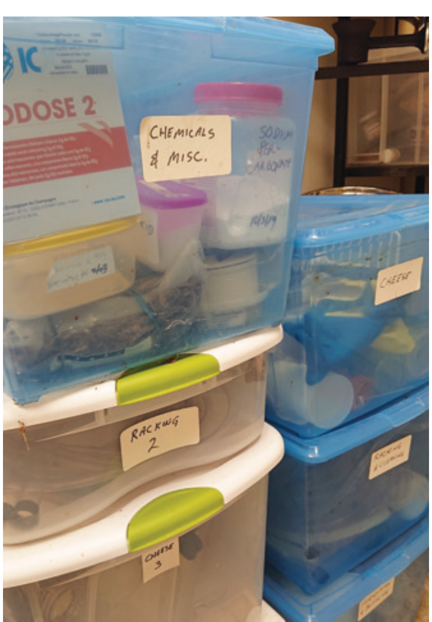


Photo by Bob Peak

Keeping your brewing supplies organized can prevent a lot of frustration on brew day.

INGREDIENT/RECIPE MISHAPS

What can possibly go wrong with your ingredients? Just wait!

The Mystery Bag: You go to the homebrew shop, you pick out your grains and dump them into the store's brown paper bags (or equivalent), bring them home, because you've got a brew day scheduled! Then life happens and that bag sits on a shelf long enough that you actually forget what's in the bag.

Or maybe you're like us and you maintain a small collection of grains and hops for use in spur of the moment brewing and also in the spur of the moment forget to break out that Sharpie to aid your memory.

Solution: As with many things in life, you can make your future life much easier! Take a split second and make sure the random bag of goodies is labeled. Otherwise, you can always make a "mystery beer" when you get enough random goods piled up!

Too Much of a Good Thing: This is admittedly the sort of thing that impacts newer brewers more often, but it still comes around to bite experienced brewers in the palate from time to time. We get a little too excited about a new ingredient or too focused on a numerical impact and don't stop to consider the ramifications of our ingredient choices. Whether it's a few too many chili peppers in your chili beer or something less fiery like Drew's insistence on using 33% brown malt in a traditional porter that created something undrinkable, we get it.

Solution: Learn your ingredients and their impacts before you commit to large-scale usage. In Drew's brown malt mistake, that came from not knowing how different modern brown malt is from the stuff of the old porter guidelines of "⅓ amber, ⅓ pale, ⅓ brown malt."

This is why we usually advocate for taking the approach of making big flavor additions as late in the game and as adjustable as possible (e.g., adding things just prior to packaging instead of trying to nail a spice addition in the kettle).

Remember, with all things flavor – it's easy to add more, and usually impossible to take it out.

Killed My Yeast: Now that summer is in full swing here in the Northern Hemisphere, we're sure to see more stories of yeast packs going through hot sunny days in the back of a sweltering delivery van. "I think my yeast is dead." Or maybe you have an old pack that you were waiting to use. In both cases, you can avert disaster with a bit of work.

Solution: Avoid shipping liquid yeast packs — buy local if you can or plan your shipment so that the yeast spends minimal time on a hot deck. If you do discover that your liquid yeast is half-cooked, make a starter and give it a chance. Yeast is a lot hardier than we tend to give it credit for. Make a small starter, ensure you have growth and then grow the starter with additional wort. And keep extra dry yeast sachets on hand in case that liquid yeast pack took a permanent vacation.

BREW DAY MISHAPS

The brew day can be a whirl of confusion and chaos if you're not prepared. Here are some of the ones that we always see.

Missing Stuff: It never fails – "where's my hydrometer? Where's the transfer hose? Where's a spare gasket?" We've been there more than once — and we'll include half empty propane tanks in this mess. Nothing can stop your brew day with more assured speed than not having the right tool when needed. Maybe you loaned it out? Maybe you misplaced it? Maybe it migrated from the brewhouse to the house-house when the door needed fixing.

Solution: We're both big proponents of pre-gaming your brew day. No, we don't mean drinking a couple of cheap beers ahead of time, we mean pre-staging and running the brew day in your head and making sure everything is where it needs to be.

Like the Sharpie and your ingredients notes, take a few minutes to organize and inventory your tools needed for your brew day before you hit the play button. Put tools back in the toolbox and ensure other items are put away in the right area, etc. A little pre-work saves a lot of hassle.

Have a dedicated brew house toolbox that contains the wrenches, screwdrivers, pipe cutters, etc. that you want in the brewery. Never let those tools wander away. Since they're occasional light use tools, they don't need to be the most expensive high-quality bits of kit.

Melting Floors and Other Acts of Destruction: This was the one that made Drew snort when he read the comment, but yes, someone used a propane burner over a linoleum flooring and plasticky substances tend to melt when exposed to lots of heat and this was no exception and a fairly expensive lesson to learn. (See also people cracking ceramic cooktops, etc.)

Open flame is just one of the many dangerous things we encounter while brewing. Electric rigs always carry a shock risk. Water retains a ton of heat energy and is one of the most destructive forces on the planet and glass is very sharp and fragile.

Solution: Be mindful. Again, with a pre-gaming plan. Before you start heating anything, look around, think about what can go wrong — what could catch fire, where water can flow, how electrical cords can get frayed or damaged. How can I protect the area I'm working in? And for the love of Pete, keep a fire extinguisher handy!

For the longest time, Drew used an old powerful drill that threw sparks to drive his mill. The thing was a beast, but he finally got rid of it when he stopped and actually applied his brain cells to the equation of "sparks, milled grain powder, oxygen."

Forgot the <Blank>: Brewing is a fairly standardized process with lots of little variations, but recipes and brew days all read the same. It's very easy to get complacent and flat out forget something you intended to do. What was that mash step and hop regimen? Did I put the Whirlfloc in?

Denny famously once made a German Pils, got all the way through the boil, chilled the beer and turned to look and see all of his hops weighed out and waiting to go into the boil. Despite doing the smart thing (having the hops pre-staged), he still somehow managed to completely skip all of his hop additions. So he sighed, added a gallon of water back to the wort and boiled the wort — again — this time with the hops.

Solution: Denny had the right idea — even in this day of computerized recipes and timers, you can still completely mess up. Have a printed version of your brew day procedures and check things off! (Or use an old-fashioned notebook like Denny.) Get your water salts and hops and other additions into staged cups. If pilots and surgeons can use checklists to make sure you don't fall out of the sky or that you don't lose the wrong limb, you can use one to make sure your beer gets all the right process steps and ingredients.

Open Valves and Spitting Chillers: Remember, hot liquids burn! We have legions of stories from brewers getting scalded with hot liquid when they start a pump or turn a valve. Immersion chillers also add fun because they'll usually spit leftover water out of the coil when you drop them in the boil.

Solution: Know your water/gas path before you turn any valve/pump. We both use the "trace it with your finger method." Sure, you may look goofy doing it, but it beats wort in your shoe! Also, before starting to fill vessels, double check to make sure all valves are closed that need to be.

ADVANCED BREWING

BY FEDERICO TONDINI

TROPICAL THIRST

Biotransformation in the brewery

Hops have traditionally been an essential ingredient in brewing and their increased usage reflects the changing tastes of beer drinkers. To meet their desire and to create new and interesting beer styles that stand out in an increasingly crowded market, brewers have been implementing techniques, such as dry hopping during fermentation, to enhance the hops and yeast impact on beer aroma. Indeed, while fermenting, yeast cells can metabolize and transform compounds other than sugar in the wort, converting anonymous compounds into something new.

"Biotransformation" is the umbrella term used to encompass these flavor-changing reactions during active fermentations. Thiols, terpenes, and esters are all affected differently by yeast metabolic reactions, such as esterification of hop compounds, hydrolysis of hop glycosides to release monoterpene alcohols, and the release of polyfunctional thiols from amino acid conjugates. These biochemical processes generally enhance the fruit and floral aromas in the beer. Certain yeast strains have been found to exhibit higher levels of enzymatic activity associated with biotransformation, in particular β-glucosidase and β-lyase enzymes. These enzymes are involved in the hydrolysis of hop glycosides to release monoterpene alcohols and the release of polyfunctional thiols from non-aromatic precursors, respectively.

"Biotransformation" is the umbrella term used to encompass these flavor-changing reactions during active fermentations.

Photo by Charles A. Parker/Images Plus

While the overall impact of yeast β-glucosidases on increasing terpene alcohols remains unclear due to discordant observations, yeast β-lyase activity has a bigger and more clear impact due to particularly low flavor thresholds of thiol compounds. It has become evident how this enzyme plays a key role in releasing desirable aromatic flavors in beer, adding to the complexity and character of the final product.

CHASING THE THIOLS

Polyfunctional thiols are among the most intense aromatic compounds found in fermented beverages due to the sulfur functional groups, resulting in an extremely low aroma threshold concentration (~2–200 ng/L). Among others, the predominant polyfunctional thiols that are commonly found in beer are 3-mercaptohexanol (3MH), 3-mercaptohexyl acetate (3MHA), and 4-mercapto-4-methylpentan-2-one (4MMP). 3MH, for example, is known for its grapefruit and citrusy aroma, while 3MHA is associated with a passion fruit or guava-like aroma. 4MMP, on the other hand, can give beer a distinctive aroma of blackcurrant or grapefruit. Thus, beers containing higher levels of these compounds are expected to be perceived higher in tropical aromas.

In the hops, thiols exist in both free and precursor forms depending on varietal, growing location, and harvest. Free thiols are compounds that are already volatile, therefore unlocked, and ready to create aromas. Thiol precursors instead are bound to non-aromatic amino acids, cysteine and glutathione, and therefore non-volatile.

These precursors can be found in hops at significantly higher concentrations than their free forms. Concentrations of 3MH precursors have been reported 1,000-fold higher than the concentrations of free 3MH in Cascade hops. To create aromas, these compounds need to be cleaved by yeast's β-lyases during fermentation, which break the carbon-sulfur bond and release the volatile thiol compounds.

While the rise of many hops has been related to their ability to impart free thiols to beer (e.g., Citra®, Tomahawk®, Nelson Sauvin™), other cultivars with a large pool of odorless conjugated thiol precursors could be re-evaluated, independently from their amounts of free thiols (e.g., Cascade). Additionally, it has been reported that malt can also be a source of cys-3MH precursors, although to a lesser extent. Given the vast pool of odorless precursors that have been identified in malt and hops, it is now clear there is a potentially underutilized resource allowing production of beer with higher tropical aromas using hop varieties that are otherwise low in free thiols.

FRUITS OF YEAST LABOR

In *Saccharomyces cerevisiae* and *pastorianus,* the IRC7 gene encodes for a cysteine S-conjugate β-lyase enzyme that can release polyfunctional thiols from cysteine, thereby promoting thiol aroma in beer. The release of volatile thiols from conjugated precursors during yeast fermentation has been directly linked to IRC7 expression, which is involved in sulfur metabolism and amino acid biosynthesis and linked to the nitrogen catabolite repression. This means that, in the presence of favorable nitrogen sources, such as ammonium, IRC7 is repressed.

Instead, during periods of nitrogen scarcity for yeast, β-lyase is expressed more, because the yeast is going after the amino acid bound to the non-volatile thiol. In addition to regulation, thiol release is also affected by the coding sequence of IRC7. Most existing beer yeast strains have a limited ability to release polyfunctional thiols due to a 38 bp deletion in the IRC7 gene, resulting in a suboptimal enzyme, ultimately able to only convert minimal amounts into flavor-active volatile thiols.

Regarding less conventional brewing yeast, considerable β-lyase activity has been observed in *S. uvarum* and *Torulaspora delbrueckii,* making them a very attractive alternative for their ability to produce beers with superior sensory quality.

IN THE BREWER'S HAND

Overall, the number of thiol precursors in wort can be carefully influenced by the brewer's choice of hop and malt, making the yeast choice critical. The inability of brewing yeasts to catalyze efficient biotransformation results in most thiol precursors remaining in the flavor-inactive form, at the cost of a significant loss in the potential tropical fruit flavor in finished beer. Since the IRC7 enzyme is directly related to thiol release, technical information on β-lyase activity is essential to decide which strain would best fit your recipe. Other synergetic solutions available are the pure forms of the enzyme to boost the activity during fermentation, as well as additives, such as Phantasm (leftover Sauvignon Blanc grape skins), that are being tested to increase the precursors available.

The following page contains a recipe with a few yeast strains available to the homebrew crowd. Here are a few recommended β-lyase-active yeast strains. Talk to your favorite yeast provider to learn what they have available.

- Omega Yeast OYL-405 (Helio Gazer Ale)
- Omega Yeast OYL-402 (Cosmic Punch)
- LalBrew Verdant IPA
- Berkeley Yeast Vermont Tropics
- Escarpment Laboratories Thiol Libre
- AEB Levulia Torula (*non *Saccharomyces*; it needs to be paired with a brewing yeast)

Tropical Punch IPA

(5 gallons/19 L, all-grain)
OG = 1.060 FG = 1.012
IBU = 10 SRM = 4 ABV = 6.2%

INGREDIENTS

10 lbs. (4.5 kg) North American 2-row pale malt
1.5 lbs. (0.68 kg) flaked oats
1 lb. (0.45 kg) North American red wheat malt
1 oz. (28 g) Cascade hops (mash hop)
2 oz. (57 g) Cascade hops (hopstand)
1 oz. (28 g) Citra® hops (hopstand)
2 oz. (57 g) Cascade hops (1st dry hop)
2 oz. (57 g) Citra® hops (2nd dry hop)
1 oz. (28 g) Cascade hops (2nd dry hop)
50 mL Berkeley Yeast Thiol Boost or 2.5 oz. (70 g) Phantasm Thiol Powder (optional)
1 mL AEB ENDOZYM® Thiol (optional)
Omega Yeast OYL-405 (Helio Gazer Ale), Omega Yeast OYL-402 (Cosmic Punch), or LalBrew Verdant IPA yeast
⅔ cup corn sugar (if priming)

STEP BY STEP

Mash in targeting a saccharification rest temperature of 155 °F (68 °C), stirring the mash hops in with the grains at the start of the mash. Lauter as normal, collecting about 7 gallons (26.5 L) of wort in the kettle. Bring wort to a boil. You may want to add a few hop pellets to help with foam control.

After a 60-minute boil, chill the wort down to 175 °F (80 °C) then add the hopstand hops. Begin to actively whirlpool wort for 15 minutes then allow to settle for another 15 minutes. Quickly chill to yeast-pitch temperature and pitch the yeast of your choice.

Ferment within the yeast manufacturer's recommended range. After roughly ⅓ of the fermentation is complete add the first round of dry hops along with Thiol Boost or Phantasm Thiol Powder, if using. After fermentation is complete, consider dumping yeast and first round of dry hops or racking into a purged container like a corny keg. Add second round of dry hops and the ENDOZYM® Thiol, if using. Wait five days, then it's ready for final packaging. Keg and force carbonate to 2.4 v/v (much preferred technique), or prime and bottle.

TIPS FOR SUCCESS:

Some of the optional ingredients may be difficult to source on the homebrew level. Just note that they are optional and may not have a huge impact on the final beer's profile, depending on several factors.

While this recipe says the IBU count will be 10, there will be bitterness derived from the hopstand and dry hops not accounted for as iso-alpha acids. BYO

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BY VICTOR ANDUEZA

CAN SEAMER

Taking homebrew on the go

As a homebrewer, you know that the ultimate goal is to enjoy the delicious and refreshing taste of your own handcrafted beer. However, with the traditional bottling process, you might find yourself struggling with inconsistent carbonation levels, or even worse, exploding bottles. There are better ways to package.

First off, to deal with the inconsistent carbonation, kegging your beer is the first step towards the goal of improved packaging. The advantages to kegs beyond carbonation are plentiful, but portability is a clear disadvantage. Bottling the now carbonated beer does fine, but canning, to me, is the winner.

Canning your beer provides a host of benefits, from longer shelf life (if canned properly) to increased portability. Cans are impervious to light and oxygen, which can degrade the flavor of your beer over time. Additionally, cans are much easier to transport than bottles, and they're also more durable, meaning you can take your homebrew with you to the river or pool without worrying about breakage.

Unfortunately, commercial can seamers can be expensive for most beginner homebrewers. In addition, in many countries there are not many suppliers that offer this type of product. This is where a DIY can seamer comes in handy. By building your own can seamer using a 3-D printer, you can save a significant amount of money while still achieving professional-level results.

Of course, building your own can seamer requires some technical know-how, but with the right resources and a bit of patience it's a feasible project for most homebrewers. By sourcing the necessary components and using open-source design plans, you can customize your can seamer to your specific needs and preferences.

Ensuring good stability for a can seamer, especially with a 3-D printed design, presents a significant challenge. To solve this problem, my solution was to mount the seamer on a wall to address the variability of vibrations and movements. In addition, the design of the can seamer faced another challenge in finding an efficient way to seam the lid. This was addressed by purchasing two commercial seam rollers through AliExpress, which provided the necessary precision and efficiency to achieve high-quality seams without compromising the integrity of the can. The first roller makes the seal and the second rounds the edge and thus makes it safe and pleasant to the touch.

To keep costs down and make the can seamer affordable, I opted to use a drill for rotation power instead of the laborious installation of a motor with its electronics. Despite potentially providing less precision and consistency, this solution has worked well.

All in all, a DIY can seamer is a great addition to any homebrew setup, allowing you to easily and efficiently package your beer in a portable and durable container. With the added benefit of potentially improving flavor retention, canning your beer is a no-brainer for any serious homebrewer. So why not take the plunge and build your own can seamer today?

Tools and Materials

- 3-D printer
- 3-D models to print (link at: byo.com/project/can-seamer)
- (1) First operation roller
- (1) Second operation roller
- (1) Screw for bearing M6 - D8 - L35 mm
- (2) Hex head screws M8 - L40 mm
- (3) M8 nuts
- (1) Nut M6 L20 mm (drill attachment)
- Several M8 washers
- (5) 608 Bearings – 8 x 22 x 7 mm
- (8) Screws and wall plugs

Canning your beer provides a host of benefits, from longer shelf life (if canned properly) to increased portability.

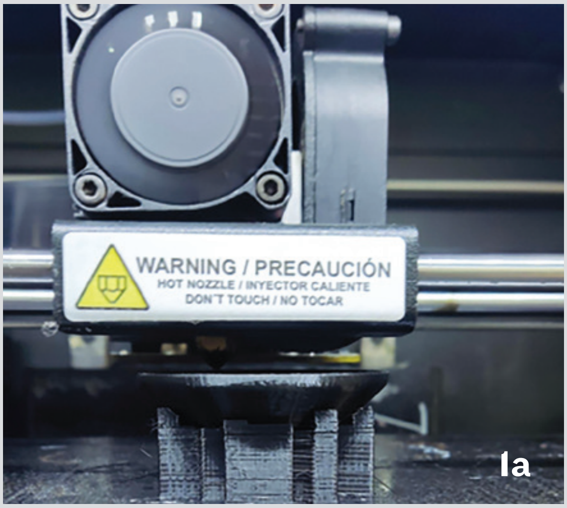
Photos by Victor Andueza

STEP BY STEP

1. PRINT THE PLASTIC PIECES

To begin, you'll need to 3-D print the plastic pieces for the seamer. I recommend that, as much as possible, you print them with a high amount of infill, close to 100%, since several of them will bear significant forces.

Photo 1a on the right shows the 3-D printer and the results from the printer are found below in photo 1b. I have provided my 3-D files to *BYO* that you could use and a link to those can be found at: byo.com/project/can-seamer



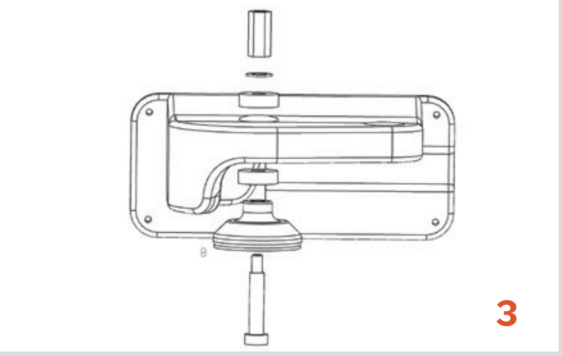
2. MOUNT TOP PART ON THE WALL

Make sure it is completely horizontal, as any inclination will result in increased vibrations when operating. High precision in this step will save you a lot of trouble in the future.

Mounting the screw into wood or some other form of a stable base is required in case some instability exists.

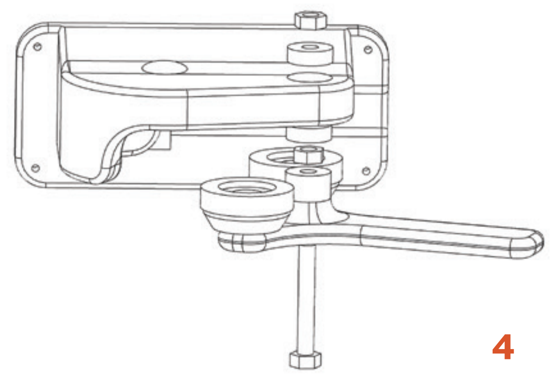
3. ASSEMBLE LEFT AXIS

Mount the retaining wheel in the left hole with the special screw for bearings and two bearings. It is important that the screw is secured with extra-strong glue to the retaining wheel. You can apply threadlocker glue to the top nut to prevent it from loosening due to vibrations.



4. ASSEMBLE RIGHT AXIS

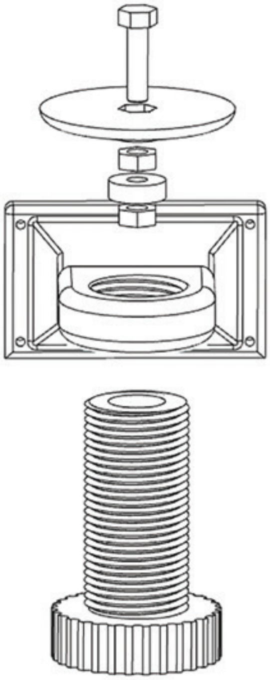
Mount the handle with the two sealing wheels in the right hole of the bracket and align it with the help of washers or nuts so that it matches the height of the retaining wheel.



4

5. ASSEMBLE THE BASE AND MOUNT IT ON THE WALL

Finally, align and screw the bracket with the screw that serves as the base for the can to the wall. It is important that it is perfectly aligned with the top wheel to avoid imperfections in the seal due to misalignment. Keep in mind that the screw's travel is designed for cans from 11 to 17 oz. (330 ml to 500 ml), so you will need to measure the distance accurately in these two positions before attaching the bracket to the wall.



5

6. LET'S WORK

Once you have the assembly in place, you can position your drill on the top part. The following are my tips from using it:

- Tighten the can as much as possible to the top bracket to avoid potential leaks.
- The drill speed should be between medium and low; as you become more comfortable, you can increase it.
- The first sealing operation is performed with the wheel that has the thin groove; you'll need to press firmly and for an extended period to ensure a good seam.
- The second operation with the wheel of the thick groove should be done more gently and at medium speed.

6

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LAST CALL

BY RYAN COLVIN

DESERT SEAR

Brewing in intense heat

Brewing in the desert during the summer months isn't for everyone. The steam of a boil kettle wafting against your face almost feels cooler than the 115 °F (46 °C) ambient air around you. With every minute ticking by, the imminent threat of heat stroke sets in. Instead of reaching into an ice chest next to you for a beer, you reach for water or a sports drink . . . because you have to.

I live in Tempe, Arizona, home base for the Arizona Society of Homebrewers (ASH) to which I am a proud member of. Many homebrewers around here take a hiatus from the hobby during the summer, but not me. I've found there's other crazy people like me who also liked to brew in the extreme heat because it adds an extra challenge to the brew day. I'm going to take you on a journey of what it's like to homebrew here with the hope that some of the tips I share can be applied to your own summer brew days, whether the temperature gets to triple digits or not.

A typical brew day here from June through August starts at 6 a.m. or earlier in an attempt to beat the heat (though 95 °F/35 °C) at 6 a.m. is hardly a victory. Waiting for strike water to heat up to temperature is a very fast process since the water is already 90+ °F (32+ °C) ambient temperature if it has been sitting in the garage. The mash will hardly need a heating device like a recirculating heat system or heating pad because your loss will probably only be a degree or two in a 60-minute mash. This may be the lone benefit of brewing in this type of heat.

It's now 7:30 a.m., 98 °F (37 °C), 70% humidity because of the awesome monsoonal storm last night. Your mash is complete and your t-shirt is already soaking through in sweat, but you push on because this is the very moment you have been looking forward to all week. There's something special about brewing a beer outside with the sun still rising, birds chirping, and the world so quiet around you.

At 10:30 a.m. it's time to flip that pump on for a big whirlpool hop addition on that hazy IPA your friends have been pleading for you to brew again. The 108 °F (42 °C) temperature is starting to make you feel exhausted but you keep telling yourself "just a little bit longer." As the aroma of Citra® and Mosaic® take over your senses you start to feel a tingle in your hand. It turns out that scorpion you noticed during the boil did get you and now your right hand is numb.

11:00 a.m. and it's time to knock out and start to chill the wort. In the Phoenix area our ground water can get near 90 °F (32 °C) in the summer so it's very hard to use tap water as a complete way to chill wort. Most of us will choose to knock out to a certain point with tap water and then switch over to a submersible pump in an ice bath to chill the rest of the way down. It usually takes 60 lbs. (27 kg) of ice to get the wort cold enough for most ale yeasts.

11:30 a.m. and now it's not even worth looking at the outside thermometer. The wort has been chilled and moved to the fermenter. Yeast pitched. You get some help from your partner to lift it all into the fermentation chamber because you only have the use of one hand at the moment, damn scorpion! Now, it's time to crack a beer and start cleaning all that equipment for the next brew day.

Since being kicked out of the kitchen, we homebrewers around the world have some crazy battle stories like mine to tell. We put up with it all because we love what we do and in many ways, it's therapeutic. The plus side is that we make a product so special that it brings people from all walks of life around a table to laugh and cry together. I am proud to be a homebrewer and will stay one for as long as my body will let me.

Hmmm, it's supposed to be 118 °F (42 °C) next weekend, that sounds perfect for another brew day . . . BYO

Hmmm, it's supposed to be 118 °F (42 °C) next weekend, that sounds perfect for another brew day . . .

Photo courtesy of Ryan Colvin

Brewing through the intense heat of a desert summer day adds a challenge to homebrewers dedicated enough like the author seen here.