

BRING THE HEAT! Choosing and Using Gas & Electric Sources Homebrew Burner Rundown: 14 Models Compared

Build Your Own Modular RIMS System

Beyond Oak: Brewing With Spanish Cedar

Sculpting Your Homebrew's Body



Hanly Clone Recipes From The Isle of Man



CELEBRATING **30 YEARS** OF CREATING PREMIUM LIQUID YEAST AND FERMENTATION PRODUCTS

Wyeast altered the course of brewing history in 1986 when we introduced the Wyeast Culture Collection[™]. We provide the industry with the freshest quality products for beer, cider, wine, and more. Professionals and home enthusiasts alike have the latitude to brew their best and be part of the thriving craft beverage community.

Explore our strains at:

WYEASTLAB.COM



Find the perfect temperature for the perfect beer.

Temperature plays a key role in brewing. Make sure it's spot on with the HI935012 Brewing Thermometer.

> 1 meter long, stainless steel probe for extended immersion into tanks and kettles

• ±0.1 °C / ±0.2 °F accuracy

• IP65-rated meter for durability on the brewery floor (includes rubber boot for greater protection)



HI935012 Brewing Thermometer

CONTENTS NOVEMBER 2018, VOL. 24 NO.7









features

36 ISLE OF MAN

With just four breweries producing beer for 80,000 residents, Isle of Man in the North Sea is an offshoot in United Kingdom beer culture. It now finds itself at a point where new-age beers and historic styles live side-by-side. Learn about the brewing culture and techniques, plus 3 Isle of Man clone recipes. **by Thom Cannell**

46 INSULATION FOR SINGLE VESSEL BREWING

What's the best way to hold a consistent mash temperature for brew-in-a-bag brewing? We put the popular Reflectix insulation to the test. **by Rob Friesel**

56 BRING THE HEAT

There are many factors to consider when deciding between propane, natural gas, and electricity as a heat source for your homebrew. John Blichmann walks us through those considerations, plus the pros and cons of each. **by John Blichmann**

66 HOMEBREW BURNER COMPARISON

There are a handful of features that differentiate popular homebrew burners on the market today. We've put the most popular burner options side-by-side, so you can compare each and decide which is best to meet your needs. **by Bob Peak**

76 BREWING WITH SPANISH CEDAR

Different from oak, the most common wood used in brewing, Spanish cedar imparts citrus, spicy white pepper, and sandalwood flavors, with aromas similar to a cigar box. It doesn't have the oak tannins that conflict with hops, making it a good wood option for hoppy beers. **by Rodney Kibzey**

84 HOME-DESIGNED MODULAR RIMS SETUP

A homebrewer shares pictures and plans for his modular RIMS brewing system, which uses a stainless steel work table as a base. **by Paul Mietz Egli**

Brew Your Own (ISSN 1081-826X) is published monthly except February, April, June and August for \$29.99 per year by Battenkill Communications, 5515 Main Street, Manchester Center, VT 05255; tel: (802) 362-3981; fax: (802) 362-3877; e-mail: BYO@byo.com. Periodicals postage rate paid at Manchester Center, VT and additional mailing offices. POSTMASTER: Send address changes to Brew Your Own, P.O. Box 469121, Escondido, CA 92046-9121. Customer Service: For subscription orders call 1-800-900-7594. For subscription inquiries or address changes, write Brew Your Own, P.O. Box 469121, Tescondido, CA 92046-9121. Tel: (800) 900-7594. Fax: (760) 738-4805. Foreign and Canadian orders must be payable in U.S. dollars plus postage. The print subscription rate to Canada and Mexico is \$\$4.99; for all other countries the print subscription rate is \$49.99.

ENGINEERING BETER BEER.





Departments

8 MAIL

12

18

Readers inquire about brewing with malted corn and scaling down recipes.

HOMEBREW NATION

If a homebrewer's setup allows brew day to flow naturally, all seems right in the world. If you believe in feng shui, then you may want to check out Jim French's garage. Also learn some of the basic terminology and jargon that surround hops.

6 REPLICATOR

Coconut DIPA? Yes, please. The Replicator travels to Iowa to try to uncover the secrets behind SingleSpeed Brewing's Coconut Migration.

TIPS FROM THE PROS

Stainless steel is a brewer's best friend, but when improperly handled can lead to heartache. We sat down with two professionals who know the best practices of cleaning and caring for your stainless steel for the long-haul.

21 MR.WIZARD

Water chemistry is a complex beast for all-grain brewers. The Wizard takes a spin through one reader's question about their well water run through a water softener. Also learn about using allspice in beer and the concept of "reverse" step mashing.

28 STYLE PROFILE

Munich dunkel is one of the classic beers styles of Bavaria. Find out the history behind the brew and what it takes to craft one in your brewery that would make a German proud.

97 TECHNIQUES

Things don't always go as planned when brewing beer. Make sure you're ready for those days when things go awry. Learn the basic remedial steps that brewers have in their arsenal to combat an "off-day."

IOI ADVANCED BREWING

Brewers often add adjuncts right into the main batch of beer before or during fermentation with the hopes that the characteristics of the beer will play nicely with the additive. But Michael Tonsmeire explains that fermenting the two separately may sometimes be your best approach.

112 LAST CALL

Located in central Africa, Rwanda is one of the most fertile places on the planet and banana beer is the local's homemade drink of choice. One reader discovers the art of homebrewing in the land of banana beer.

🗑 where to find it

Homebrew Holiday Gift GuideReader Service

106 Homebrew Supplier Directory

RECIPE INDEX

SingleSpeed Brewing Co.'s
Coconut Migration clone
Munich Dunkel 29
Old Laxey Brewing Co.'s
Bosun Bitter clone 40
Hooded Ram Brewing Co.'s
Mosaic clone 41
Okell's Brewery's Mild clone 42
Madero de Cedro
Acorn Oud Bruin

* Online Extra

Urugwagwa – Rwandan Banana Beer https://www.byo.com/recipe/ urugwagwa-rwandan-banana-beer

RECIPE STANDARDIZATION

EXTRACT EFFICIENCY: 65%

(i.e. -1 pound of 2-row malt, which has a potential extract value of 1.037 in one US 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 US gallons whenever gallons are mentioned.



PROP IT UP

AVAILABLE AT PROPPERSTARTER.COM AND SELECT HOMEBREW RETAILERS



EDITOR Dawson Raspuzzi

ASSISTANT EDITOR Dave Green

DESIGN Open Look

TECHNICAL EDITOR Ashton Lewis

CONTRIBUTING WRITERS Glenn BurnSilver, Michael Bury, Terry Foster, **Christian Lavender**, ---Michael Tonsmeire, Gordon Strong, Josh Weikert

CONTRIBUTING ARTISTS Shawn Turner, Jim Woodward, Chris Champine

CONTRIBUTING PHOTOGRAPHERS Charles A. Parker, Les Jörgensen

EDITORIAL REVIEW BOARD Tomme Arthur • Port Brewing/Lost Abbey

Steve Bader • Bader Beer and Wine Supply

David Berg • August Schell Brewing Co. Michael Dawson • BSG Handcraft Denny Conn • Experimentalbrew.com Horst Dornbusch • Brewery Consult LLC Chris Graham • MoreBeer! Bob Hansen • Briess Malt & Ingredients Co. Annie Johnson • PicoBrew

Micah Lenz • Electrical Engineer John Maier • Rogue Ales • • • • • • • • Paul Manzo • Homebrew Consultant Ralph Olson • RNV Enterprises Mitch Steele • New Realm Brewing Gordon Strong • BJCP President Mark & Tess Szamatulski • Maltose Express

Michael Tonsmeire ----

TheMadFermentationist.com Chris White • White Labs Kal Wallner • TheElectricBrewery.com Anne Whyte • Vermont Homebrew Supply David Wills • Freshops

EDITORIAL & ADVERTISING OFFICE Brew Your Own

5515 Main Street Manchester Center, VT 05255 Tel: (802) 362-3981 Fax: (802) 362-2377 Email: BYO@byo.com

SUBSCRIPTIONS ONLY Brew Your Own

P.O. Box 469121 Escondido, CA 92046 Tel: (800) 900-7594 M-F 8:30-5:00 PST E-mail: byo@pcspublink.com Fax: (760) 738-4805 Special Subscription Offer 8 issues for \$29.99

Cover Photo Illustration: Charles A. Parker/Images Plus



What's your desert island beer style (one that doesn't get old for you)?

It would have to be Kölsch. I get desert-island temperatures here in Texas and my goto is always Kölsch. Add a little fresh pineapple juice and we've reached perfection.

Aecht Schlenkerla Rauchbier Märzen – The world standard of Rauch biers. I just love the deep bacon-like smokiness of this beer. It's liquid crack in a glass!

Gueuze is my desert island beer. Drink it chilled from a tumbler and it is a tart-refreshing session beer. Allow it to warm in a snifter and there isn't a style more worthy of contemplation. It ages better than any 5-6% "wheat" beer has a right to thanks to the oxygen-scavenging Brettanomyces, even

warm (say in a shallow sand pit under a palm tree). A perfect pairing for delicate steamed seafood, while being tart and spritzy enough to cut through rich dishes (say wild boar roasted over a fire). Not to mention how well the flavors of gueuze work with fruit; there aren't many versions with tropical fruit, but l'd be willing to experiment. The bottle dregs are even a valuable source of microbes for homebrewing, helpful for fermenting cocnut wine. The thick bottles and corks

might even be sturdy enough to help construct a raft! PUBLISHER Brad Ring

ASSOCIATE PUBLISHER & ADVERTISING DIRECTOR Kiev Rattee

ADVERTISING SALES COORDINATOR Dave Green

EVENTS MANAGER Jannell Kristiansen

BOOKKEEPER Faith Alberti

WEBSTORE MANAGER Julie Ring

PRINT SUBSCRIPTION CUSTOMER SERVICE MANAGER Anita Draper

NEWSSTAND DIRECTOR Carl Kopf



All contents of Brew Your Own are Copyright © 2018 by Battenkill Communications, unless otherwise noted. Brew Your Own is a registered trademark owned by Battenkill Communications, a Vermont corporation. Unsolicited manuscripts will not be returned, and no responsibility can be assumed for such material. All "Letters to the Editor" should be sent to the editor at the Vermont office address. All rights in letters sent to Brew Your Own will be treated as unconditionally assigned for publication and copyright purposes and subject to Brew Your Own's unrestricted right to edit. Although all reasonable attempts are made to ensure accuracy, the publisher does not assume any liability for errors or omissions anywhere in the publication.

All rights reserved. Reproduction in part or in whole without written permission is strictly prohibited. Printed in the United States of America. Volume 24, Number 7: November 2018

ADVERTISING CONTACT: Kiev Rattee (kiev@byo.com) EDITORIAL CONTACT:

Dawson Raspuzzi (dawson@byo.com)



@BrewYourOwn



suggested pairings at **BYO.COM**



Oak Alternatives Beer aged in

oak barrels is a highly sought after commodity and procuring an oak barrel is often a costly and laborious undertaking. Luckily for us, oak alternatives are very cost-effective, require almost no effort, and are easy to find in just about any homebrew shop. Learn some of the basics to start wood-aging your homebrews on oak alternatives. https://byo.com/ article/oak-alternatives-beginners/

MEMBERS ONLY



RIMS and HERMS Because our batch

sizes are typically small compared to

commercial brews, one problem many all-grain homebrewers have is maintaining their mash temperature. Many homebrewers will design a recirculating mash system to correct for this heat loss. Learn about the pros and cons of RIMS (recirculating infusion mash system) and HERMS (heat exchange recirculating mash system). https:// byo.com/article/rims-and-herms/



Brewing Sugars and How to Use Them

John Palmer walks readers through

the various forms of sugars that brewers may choose to use in their beer. While most sugars will lighten the body of the beer, there are some notable exceptions. Find out the why, where, and how much sugar you should add to your next batch of homebrew. https://byo. com/article/sweetness-brewingsugars-how-to-use-them/

MEMBERS ONLY



Brewing With Coconut

It is getting time to start thinking about your win-

tertime sipping beers. Just because it's winter doesn't mean you need to confine your homebrew. Coconut can add a tropical twist to your favorite beer styles. Learn how to incorporate coconut into your next brew and find three clone recipes. https://byo.com/article/coconut/

MEMBERS ONLY

* For full access to members' only content and thousands of pages of homebrewing articles, recipes, and projects, sign up for a 14-day trial membership at byo.com



NORTH AMERICAN SPECIALTY MALTS Est. 1992 Okanagan, British Columbia

We have been solidly rooted in the Okanagan of British Columbia, Canada since 1992. Our facilities are situated in the north Okanagan Valley between Okanagan Lake and the Monashee Range, and the beauty and purity of our home is reflected in our products.

The original equipment for our malthouses came from Germany and was assembled on site in Armstrong, BC. Our plants combine the best of old world tradition and modern process control.

Although our production capacity has increased, we continue to malt in small batches to meet the requirements of artisanal brewers in the US and Canada, as well as throughout the world.



bsgcraft.com

contributors

🗠 MAIL



BREWING WITH MALTED CORN

In your article about brewing with corn in the January-February 2017 issue (available online at https://byo.com/article/brewing-with-corn/) author Jon Stika mentions malted corn but then no mention on how to brew with it. Any help please?

Ron Gregor • via Facebook

Author Jon Stika responds: "Malted corn can be crushed and included in a typical barley malt mash. Corn malt has its own complement of enzymes to convert the starch it contains into sugars, just like barley malt. Corn malt is gluten-free and may be kilned to varying degrees that may lend more complex flavors than ordinary flaked corn or cornmeal. Corn malt will lighten the color and flavor of a beer just as flaked corn will. Most corn malt is used to make mashes for whiskey production rather than as an ingredient in beer. Grouse Malt House in Colorado makes corn malt and other gluten-free malted and flaked grains for brewing if you wish to experiment with gluten-free brewing."

SIERRA NEVADA PALE ALE CLONE RECIPE

Regarding your recipe for Sierra Nevada Pale Ale (available at https://byo.com/recipe/sierra-nevada-pale-ale-clone-2/). Is it correct that Perle should be used as bittering hops together with Magnum at 60 minutes? Or should Perle be added at 30 minutes, as in other clones I've seen?

Magnus Sjøli • via Facebook

So the thing about Sierra Nevada is that their recipes are not static – ingredients change as different year's crops of hops and malts change in order to maintain the same taste. One of the (many) great things about Sierra Nevada is they actually provide updates on the recipes they are currently using on their website ...so while the BYO recipe was current about 6 months ago, Sierra Nevada has since changed their recipe back to the original using only Cascade hops (presumably related to the 2018 harvest). You can find that current recipe on their website here: https://sierranevada.com/beer/ year-round/pale-ale. Whatever recipe you use, it will produce a beautiful beer very similar to Sierra Nevada Pale Ale as long as you have fresh, aromatic Cascade hops for the end of the boil.



Rob Friesel is a software industry jackof-all-trades, a dilettante writer, and an ardent homebrewer. He fulfilled a lifelong dream when he brewed his first hoppy red ale back in 2014 and, never one to stay in

the shallow end, has brewed a steady stream of diverse styles ever since. He has won multiple awards for his beers and meads (including back-to-back Vermont Mead Maker of the Year awards), and recently earned his BJCP Recognized rank. Rob is a member of the Green Mountain Mashers homebrew club and keeps a running log of his brewing adventures at https://blog.founddrama.net/. When Rob isn't brewing, he's usually going through his latest brew day data with a fine-toothed comb, looking for process improvements.

As primarily a brew-in-a-bag brewer, Rob has done numerous tests on using Reflectix and other methods to hold temperature in single-vessel brewing systems, which he shares in his *BYO* writing debut on page 46.



Rodney Kibzey lives in Portland, Oregon, and is a member of the Oregon Brew Crew. He started homebrewing in 2002 when he lived in Chicago, Illinois, and became a BJCP certified judge in 2003. His

passion for recipe development has brought numerous accolades including medals in all 50 US states, Canada, and England. He is a two-time Samuel Adams Longshot competition winner, a Midwest Homebrewer of the Year, and winner of more than half a dozen medals in the National Homebrew Competition. One of his most popular recipes is an American IPA aged on Spanish cedar, which has received numerous accolades. Beginning on page 76, Rodney shares the recipe, tips for brewing with Spanish cedar, and directions to make your own staves.



Paul Mietz Egli began making ciders in 2006 for his wife, Heather, and started brewing beer soon after as a way of keeping his fermenters full in the off-season. He has a degree in microbiology from UC-Da-

vis and spent the first half of his career developing medical diagnostic tests. He has since switched professions and is now a senior software engineer at Amazon. Brewing keeps him in touch with his roots in the laboratory, though, and he is currently experimenting with wild and sour fermentations. A California native, Paul practices yoga, runs local trails, composes music, and performs and travels with a 70-horn-strong marching band. Paul and Heather share their home with a dog, a cat, house rabbits, turtles, and a tortoise.

Paul makes his *BYO* writing debut on page 84, sharing plans to build his portable RIMS brew system.



» Less oxygen, better taste

ster Market

With its weld-on double jacket the Braumeister PLUS is perfect for low-oxygen-brewing. A set of accessories for low-oxygen-brewing is now available through our shop.







PRO-BREWING

SMALL-BATCH BREWING

The fermenters I currently have are the 2-3 gallon (8–11 L) sizes. To make one of the 5-gallon (19-L) recipes in *BYO*, can I just half all the ingredients?

Mark Puccetti • via email

Halving the ingredients should do fine, but be careful about volumes — the smaller the batch size, the greater the effects of small volume discrepancies. You also need to take into consideration your own brewhouse efficiency when following any recipe. Ashton Lewis addressed this in more detail in his Mr. Wizard column here: https://byo.com/mr-wizard/scaling-down-recipes/

MEALY VS. GLASSY CORRECTION

The photos on page 56 of the September 2018 issue (in the story "Mastering Malt Analysis") showing the difference between mealy and glassy appear to be labeled incorrectly. Or am I just not seeing this right?

James Werner • via Facebook

Hi James, it does indeed look like our wires got crossed in the last line of that caption. The left image is indeed a kiln-roasted caramel malt (>90% glassy) while the right image is a drum-roasted crystal

RESULTS

malt (50% mealy).

Thanks for pointing out the error!



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.

THE RIGHT CHOICE FOR PRO RESULTS. THE SMART CHOICE FOR YOUR BOTTOM LINE.

Blichmann Pro Brewing equipment will have you up and running as efficiently as possible without sacrificing quality.



- Generate Quick ROI
- Versatile & Flexible Nano Brewing Systems
- Fast Setup & Easy Installation
- In Stock Ready To Ship





Star San | Saniclean | 10 Star | B.S. Remover| 10 % PHOS Acid PBW | 5.2 pH Stabilizer | Super Moss HB | Defoamer 105 | LLC



www.fivestarchemicals.com support@fivestarchemicals.com



facebook.com/FiveStarChemicals

Find Five Star Products At Your Local Homebrew Store

BYO HOMEBREW NATION

BEGINNER'S BLOCK

BY DAVE GREEN

LET'S TALK HOP SHOP

n this installment, we'll discuss the intricacies of hops and learn some of the key components that every homebrewer should understand in order to "talk hop shop."

HOP ANATOMY

Hop cones are actually the fruit of the female Humulus lupulus plant. Hops are bines, meaning they don't use tendrils for support. Each hop cone has bracts and bracteoles (which look like mini-leaves) that cover up the lupulin glands found clustering around the strig (or central pole) of the hop cone. The lupulin glands are yellow when the cone has ripened and the lupulin powder contains all the resins (alpha and beta acids) and oils (hundreds of various compounds) that brewers desire. In a ripe hop cone, lupulin powder accounts for between 20–30% of the weight of a dried hop cone. The main components of the lupulin gland that brewers focus on are the alpha acids, the beta acids, and the essential oils.

HOP'S RESINS

The hop cone's resins have traditionally been the focus of research studies (along with disease resistance, and yield) and brewers' attention in the past. Homebrewers will almost always find a particular hop's alpha acid percentage on the hop's packaging. This is because alpha acids most commonly are attributed to providing the bitterness and subsequently the preservative effects that characterize boiled hops. The percentage alpha acids are the weight of the alpha acid resins when compared to the total weight of the dried hop cone, often between 2-20% of the weight.

There are five different classes of alpha acids; most common to brewers are the adhumulone, cohumulone, and humulone. Cohumulone has long been notorious among brewers; with cohumulone thought to be the harshest of the alpha acid resins. But more recent studies show that cohumulone simply isomerizes more easily then the other resins. The isomerization process is a molecular rearrangement and when alpha acids isomerize, they turn from a somewhat bitter compound into a very bitter compound, about nine times more bitter in fact. This isomerization process occurs more quickly at warmer temperatures and is one reason brewers boil their wort. Isomerized alpha acids (iso-alpha acids) are also much more soluble in beer than their non-isomerized cousin. Without the isomerization process, alpha acids would not be able to contribute much to the bitterness found in the beer.

Beta acids are another resin that can contribute to a beer's bitterness, but whose impacts are much smaller than alpha acid's. Just like alpha acids, there are five beta acids that account for between 1-10% of the weight of a dried hop cone. A hop's beta acids don't isomerize during the boil, but during longer-term aging of hops, these beta acids can transform (oxidize) and create bitterness.

ESSENTIAL OILS

Many of the newer hop research and hop varieties being released today focus more on the lupulin gland's essential oils, rather than the resins. The majority of essential oils are highly volatile, meaning that they will be boiled out of wort during brew day but also they can be highly aromatic and the flavoring component to hops. They are also fairly unstable so aging an aromatic IPA is not advisable. While there are hundreds of essential oils in hops, brewers tend to focus on a few key oils such a myrcene and humulene. Essential oils only constitute about 0.5-3% of the weight to the cone, but their impacts can be potent.

HOP TIMING

The time that hops are added during brew day or after brew day is determined by what the brewer is looking to get out of the hops. Adding hops early in the boil increases the bittering aspect of the hops since more alpha acids can convert to iso-alpha acids. Adding them later in the boil emphasizes the essential oils, providing more flavor and aromatics to the beer. But just because you add the hops earlier in the boil, doesn't mean that no essential oils will be retained to provide hop character. And just because you add hops near the end of the boil, doesn't mean those hops won't provide bitterness. But brewers can accentuate one feature over the other depending on when they add the hops. For the most aroma, brewers will add hops very late in fermentation or after fermentation is complete. This is known as "dry hopping" a beer.

HOP FORMS

Homebrewers most often utilize whole hop cones or hop pellets (processed hop cones) for brewing. But there are many newer products available to brewers these days including CO₂ hop extracts (e.g., HopShot[®]) and purified lupulin powder (e.g., Cryo Hops[®]) that can be used for bittering, flavor, and aroma. Both products have the lupulin separated from the remaining vegetative material of the hop cone, which helps brewers with yields, reducing vegetative material and associated off-flavors. Homebrewers are also now starting to see distilled essential oils show up in the market. The distilled oils provide just that, the essential oils without the resins, so they cannot be used for bittering but can provide a flavor and aroma kick to a beer if the brewer so desires. First time users of all these hop extracts and oils should follow manufacturer's directions when starting to experiment with them.



HOMEBREW DROOL SYSTEMS JIM FRENCH – FORT COLLINS, COLORADO



y setup consists of a 20-gallon (76-L) insulated Ss Brewtech mash tun, a 20-gallon (76-L) insulated Ss Brewtech hot liquor tank (HLT), a 24-gallon (91-L) Ss Brewtech BME (brewmaster's edition) boil kettle, and a 14-gallon (53-L) Ss Brewtech Chronical BME. I run everything with two Chugger pumps, an Exchilerator counterflow chiller, and oxygenate with the Ss Brewtech inline oxygenation kit. I store parts, cleaning supplies, and glasses in a storage cabinet and serve from the 4-tap keezer I made.

I ferment in my garage so there is a big temperature swing. To help with that I converted a small chest freezer, that I already had, into a glycol chiller. That has enabled me to maintain ale fermentation temperatures, but I can't really cold crash. The next upgrade is definitely going to be a proper glycol chiller. What I made is working but it is not a long-term solution because it is not very efficient in cooling the glycol after the pump turns on. The coldest I can get the fermenter down to is 43 °F (6 °C) when the chest freezer is constantly running.

The size of my brewing equipment enables me to do 10-gallon (38-L) batches of any style, even imperial stouts and barleywines. I max the mash tun out with 50 lbs. (23 kg) of grain at 1.25 qt/lb. (2.6 L/kg). The insulation means I lose very little temp (if any) during 60–90 minute infusion mashes. The insulation is also really helpful for doing kettle sours.

The best part for me is how everything flows together, is relatively simple, and isn't cluttered. Keeping things clean and organized helps me stay on track and be more creative. That sense of flow was the main inspiration behind the way I laid out my setup. That, and "how can I get all my stuff in here in a functional way?" When it comes to brew day, I love that all I have to do is grab a propane tank and roll the boil kettle to the garage bay door. Then when it's time to fill up the fermenter, I disconnect it from the chiller (using shutoff quick disconnects), roll it over to the kettle, pump the wort through the counterflow chiller, and oxygenate as it's flowing into the fermenter.







NOVEMBER 2 & 3 NANOCON

Burlington, Vermont



SNANO Join Nanobreweries (and Nanos in planning) for two days

packed with over 30 seminars, workshops, and events geared just for the small-scale commercial brewery working on systems under 5 barrels - in craft beer-centric Vermont. Learn the business, marketing, and brewing strategies targeted for Nanosized needs. From strategies to maximizing taproom sales to more accurately forecasting future ingredient purchases; attendees will learn over two days from experts and fellow Nano colleagues about actionable ways to improve – or launch – a brewery with ideas targeted just for the small-scale size and business direction. Learn more at byo.com/nanocon

NOVEMBER 3 BREW SLAM 2018 Toronto, Ontario



The GTA Brew Club is proud to announce the 4th annual Brew Slam, a nation-wide homebrew competition for beer, mead, and cider. This is an AHA/BJCP

sanctioned competition and also part of the Canadian Brewer of the Year circuit. Entry deadline is November 3 with judging taking place from November 9-11. It is \$8 (CAD) per entry and there is a 12-entry maximum per person. This competition is capped at 850 total entries. The 2017 Brew Slam was the largest homebrew competition in Canada, so enter to see if your homebrew has the chops. Medals and prizes will be awarded to Brew Slam winners at an awards ceremony on Saturday, November 24. For more information, visit www.gtabrews.ca/brew-slam/

NOVEMBER 4 MOTOWN MASH Rockaway, New Jersey



The 5th Annual Motown Mash is hosted by the Morris Area Society of Homebrewers (MASH). The Motown Mash

is the largest AHA and BJCP sanctioned competition in New Jersey (just ahead of the long-standing New Jersey State Fair Homebrew Competition). Its goal is to provide entrants with top-quality feedback and to help put Morris County and New Jersey's craft beer scene on the map. The Best of Show judging will be determined by the Best of Show panel based on a second judging of the top winners. Entries are accepted October 20 through November 4 and judging takes place on November 17 followed by the 4th annual For The Love of the Craft (FLOC) beer dinner. The cost per entry is \$8. For more information visit www.mashnewjersey.com/ competitions/motown-mash/



WHAT'S NEW?

BREW PERFECT WIFI DIGITAL HYDROMETER



The Brew Perfect WiFi Digital Hydrometer takes real-time internal readings of specific gravity, temperature, and ABV to keep homebrewers up-to-date on the progress of their active fermentations. Each digital hydrometer includes a base unit and gravity "torpedo" that fits into any standard airlock hole such as in a rubber stopper. CO₂ and kräusen are rerouted through an

airlock or blow-off adapter. The digital hydrometer connects wirelessly to the cloud, updating data graphs every 20 minutes. Precision reading for density is to the 0.001, temperature reading is to the 1.0 (°F or °C) (with an optional temperature probe reading to the 0.01), and ABV is precise to the 0.01%. The app is Android and iOS compatible and users sign up for a subscription, so there is little overhead cost to start with a Brew Perfect. Learn more at www.brewperfect.com

PROPPER STARTER™

Sterilized, concentrated wort sold in 16-oz. (473-mL) cans, making a starter as simple as crack, pour, and swirl. No need to measure dried malt extract and no need to boil the wort. Simply mix one can of Propper Starter[™] with an equal amount of purified water in a sanitized flask and set your 1-L starter on a stir plate for 24 hours. This is ideal for those short on time or those that are tired of cleaning up boil-overs off their stove top. By increasing the biomass and vitality of your yeast, this is perfect for high gravity brews, cold-pitched



lagers, yeast packs nearing expiration, or whenever a starter is recommended. www.propperstarter.com

BEERMKR



Countertop brew systems continue to evolve. Introducing BeerMKR, a 3-tier countertop brewing system with a clean look, small footprint, and automated brewing. Set it up in the morning before work and have the wort ready for pitching yeast upon returning home. Ingredient kits cost \$12 each and are customizable. Users can monitor the brew's progress on the BeerMKR app. BeerMKR allows brewers to adjust temperatures during fermentation. Each batch produces a 12-pack

of beer (1.125 gallons/4.3 L) and the beer is dispensed out of a separate draft dispensing unit which easily fits in a refrigerator. An included CO_2 cartridge is installed and the beer can be carbonated in 24 hours. For more information, go to www.beermkr.com

SPIKE+ SYSTEM

All tri-clamp. All professional.







SpikeBrewing.com/SYSTEMPLUS



DEAR REPLICATOR, Last month, my family and

I went on our yearly get together with two of my old high school classmates and their families — usually somewhere with fun things for the kids, (and a brewery or two for the big kids). This year we went to Decorah, Iowa and had the pleasure of hitting the lesser-known of the two breweries there, Pulpit Rock Brewing Co. While there we sampled a collaboration between them and SingleSpeed Brewing of Cedar Falls, Iowa called Coconut Migration. This incredible double IPA with a smooth taste was a hit with us all and I'd love to brew up a batch before our next mini-reunion. Any chance you can help me out?



Ben Loots Fort Dodge, Iowa

hanks for the request, Ben! It's evident that you, your friends, and your families can spot a high-quality craft beer. When I reached out to Pulpit Rock to ask about Coconut Migration, Whitney Hirth got back to me within hours. Suffice it to say, I was impressed; their willingness to work with their community, both local and more broadly, foreshadowed good things to come. For the record, the initial brewing of Coconut Migration was collaborative in nature, but is now exclusively performed by SingleSpeed Brewing as they own the rights to the recipe.

SingleSpeed originated with humble beginnings and a desire to bring intriguing, guality ales to their local market in such a way as to be a sustainable beacon in the community. So, it was in Cedar Falls, Iowa that Dave Morgan decided to set up shop in a 1,700-square foot (158-sq. m) facility containing a modest 3-BBL system. This was no ragtag operation but rather a facility that was gifted the Silver level in LEED (Leadership in Energy and Environmental Design) certification. Why should anyone care about the certification? For the simple reason, to provide future generations with as much or more than we had during our very short time on this rock traveling through space.

Just like all successful breweries, they rapidly outgrew their space in Cedar Falls and the 3-BBL brewhouse couldn't keep up; it was time to find additional space. While keeping an eye open for potential sites in their local community, SingleSpeed was approached by the Friends of the Waterloo Wonder Bread Building. The historic building, as recognized by the National Register of Historic Places, was slated to be demolished.

At first, the remnants of the bakery, which was in operation from 1927 until 2012, were still in place. It took an imagination, trust, and \$6.5 million but the brewery's dreams were realized when the 20-BBL brewery opened in November 2016, while maintaining the historical value of the building. Such nods include a "proofing" lounge which is located where the factory's proofing box once stood, a lobby emulating what customers would experience in the 1950s, and the original flooring through multiple rooms. This site also has a LEED (Leadership in Energy and Environmental Design) certification: Gold!! And in addition, the Waterloo site reached Platinum for the Iowa Green Brewery Certifications. The infrastructure includes flowmeters for water consumption, a 101-kW solar photovoltaic rooftop array, and LED lighting with motion sensors.

But one could argue, that even more importantly was the community's response. Morgan mentioned that "(Having people) randomly come up to me and thank me was pretty sobering." It is more than just a brewery; it's a destination and a community hang-out. And as they've grown, so too has their commitment to their community. SingleSpeed does special brews and annual fundraisers to help support several worthy, local causes such as the Prairie Rapids Project. They recently added a Munich helles, Gable, to their core lineup. For every pint sold in the taproom, \$1 is donated to the National Wrestling Hall of Fame Dan Gable Museum, which is only a block away from the brewery. Portions of all canned sales are also donated to the museum.

Now onto the beer!! Coconut Migration is an East Coast Double IPA that is rested on toasted coconut before packaging. The heavy dose of late addition and whirlpool hops in combination with the coconut should invoke beaches, tossing around a frisbee, and great memories. The intense ripe mango and grapefruit marry well with the lime, pine, and a hint of kiwi. The hop showcase is fully supported by the grainy, slightly toasted malt backbone and is reminiscent of piña coladas with the addition of the coconut. To achieve such a feat, SingleSpeed's Head Brewer, Austin Myers, relies on the trinity of El Dorado®, Azacca®, and Citra[®] with a small addition of Nugget for bittering. The combination of hops is repeated in late boil additions but also in whirlpool and dry hop additions during which biotransformation should occur. The beer is rested on the coconut after primary fermentation (there's no need for a secondary fermenter) before ultimately being packaged.

Austin does feel that there's quite of bit of experimentation that one could do with the coconut including contact time, dosage rate, or the toast level intensity. So, go ahead and do what homebrewers do best . . . experiment. After all, you don't have to worry if an African or European swallow brought you the coconut. Enjoy your own personal vacation in the tropics without leaving your house. Cheers!



SINGLESPEED BREWING CO.'S COCONUT MIGRATION CLONE

(5 gallons/19 L, all-grain) OG = 1.072 FG = 1.017 IBU = 71 SRM = 6 ABV = 7.2%

INGREDIENTS

12 lbs. (5.44 kg) 2-row pale malt 1.25 lbs. (0.57 kg) flaked barley 1 lb. (0.45 kg) Munich malt 0.5 lb. (0.23 kg) corn sugar 12 oz. (340 g) toasted coconut 6 AAU Nugget hops (60 min.) (0.5 oz./14 g at 12% alpha acids) 9 AAU EL Dorado[®] hops (10 min.) (0.75 oz./21 g at 12% alpha acids) 9 AAU Azacca[®] hops (10 min.) (0.75 oz./21 g at 12% alpha acids) 15 AAU EL Dorado[®] hops (5 min.) (1.25 oz./35 g at 12% alpha acids) 15 AAU Azacca[®] hops (5 min.) (1.25 oz./35 g at 12% alpha acids) 6 AAU Citra[®] hops (5 min.) (0.5 oz./14 g at 12% alpha acids) 15 AAU EL Dorado[®] hops (0 min.) (1.25 oz./35 g at 12% alpha acids) 15 AAU Azacca[®] hops (0 min.) (1.25 oz./35 g at 12% alpha acids) 6 AAU Citra[®] hops (0 min.) (0.5 oz./14 g at 12% alpha acids) 2.5 oz. (70 g) El Dorado® hops (dry hop) 2.5 oz. (70 g) Azacca® hops (dry hop) 1 oz. (28 g) Citra[®] hops (dry hop) Omega OYL-052 (DIPA Ale) or GigaYeast GY054 (Vermont IPA) or LalBrew New England yeast ³/₄ cup corn sugar (if priming)

STEP BY STEP

Mill the grains, then mix with 17.8 qts. (16.86 L) of 167 °F (75 °C)

strike water to achieve a single infusion rest temperature of 152 °F (67 °C). Hold at this temperature for 60 min.

Vorlauf until your runnings are clear before directing them to your boil kettle. Batch or fly sparge the mash with 4 gallons (15 L) and top up as necessary to obtain 6.5 gallons (25 L) of wort. Add the corn sugar. Boil for 60 minutes, adding hops at the times indicated above left in the boil.

After the boil and 20-minute whirlpool, rapidly chill the wort to slightly below fermentation temperature, which is 68 °F (20 °C) for this beer. Pitch yeast.

Maintain fermentation temperature to avoid fusels and unwanted esters. When primary fermentation is near but not yet complete, add the dry hops. Two days later, toast the coconut at 350 °F (175 °C) for a few minutes until you see a change in its appearance. Pull it out of the oven and let it cool before bagging it and placing it in the fermenter. Let it steep in the beer for 2 days; this will give the dry hops 4 days to work their magic. Bottle or keg the beer and carbonate to approximately 2.5 volumes.

SINGLESPEED BREWING CO.'S COCONUT MIGRATION CLONE

(5 gallons/19 L, extract only) OG = 1.076 FG = 1.018

IBU = 71 SRM = 7 ABV = 7.7 %

INGREDIENTS

- 7 lbs (3.18 kg) light dried malt extract
- 0.5 lb. (0.23 kg) Munich dried malt extract
- 0.50 lb. (0.23 kg) corn sugar
- 0.50 lb. (0.23 kg) maltodextrin
- 12 oz. (340 g) toasted coconut
- 6 AAU Nugget hops (60 min.)
- (0.5 oz./14 g at 12% alpha acids) 9 AAU El Dorado® hops (10 min.)
 - (0.75 oz./21 g at 12% alpha acids)
- 9 AAU Azacca[®] hops (10 min.)

- (0.75 oz./21 g at 12% alpha acids) 15 AAU El Dorado® hops (5 min.)
- (1.25 oz./35 g at 12% alpha acids) 15 AAU Azacca® hops (5 min.)
- (1.25 oz./35 g at 12% alpha acids) 6 AAU Citra® hops (5 min.)
- (0.5 oz./14 g at 12% alpha acids) 15 AAU El Dorado® hops (0 min.)
- (1.25 oz./35 g at 12% alpha acids) 15 AAU Azacca® hops (0 min.)
- (1.25 oz./35 g at 12% alpha acids) 6 AAU Citra® hops (0 min.)
- (0.5 oz./14 g at 12% alpha acids)
- 2.5 oz. (70 g) El Dorado® hops (dry hop)
- 2.5 oz. (70 g) Azacca[®] hops (dry hop)
- 1 oz. (28 g) Citra® hops (dry hop) Omega OYL-052 (DIPA Ale) or
 - GigaYeast GY054 (Vermont IPA) or LalBrew New England yeast
- 34 cup corn sugar (if priming)

STEP BY STEP

Bring 6.5 gallons (25 L) of water to a boil. Turn off heat and add the dried extracts while stirring to avoid clumps and continue until completely dissolved. Return to heat and boil for 60 minutes, adding hops at the indicated times left in the boil.

Follow the all-grain recipe for post-boil, fermentation, coconut addition, and packaging instructions for the beer.

TIPS FOR SUCCESS:

This beer is very hop-forward and as such you'll want to use the freshest hops you can get your hands on. The alpha acid percentages were chosen simply to help with AAU calculations but you should mainly focus on the weight amounts of each in the late addition hops; there will be enough IBUs to balance the beer. Finally, like any beer but especially IPAs, you should attempt to minimize oxygen contact with the finished product as it will destroy your well-crafted hop profile faster than you can say "Oxidation!!" Consider a keg with a closed transfer if you have a draft system. 90



Properly treating equipment is important because stainless steel is not indestructible.



Ashton Lewis wears many brewing hats. He is the Master Brewer at Springfield Brewing Company located in Springfield, Missouri and Technical Sales Manager – Central Midwest for BSG Craft Brewing. Ashton is also Brew Your Own's "Mr. Wizard" columnist and has answered hundreds of brewing questions since 1995. A collection of his favorite questions and answers are found in The Homebrewer's Answer Book. In addition, Ashton is BYO's Technical Editor, reviewing each manuscript with his extensive brewing knowledge.

STAINLESS STEEL CARE

The dos and don'ts with this alloy

Stainless steel may cost more than aluminum, but there are many reasons why it is used in both commercial breweries and homebreweries. If you're investing in stainless, it means you should make sure you are treating it correctly. Learn from two professionals who know what it takes to properly care for stainless steel equipment.

Stainless steel is a terrific material used for brewing equipment because it is resistant to corrosion, easy to weld, affordable, and malleable. This makes it a good metal to use in cold-forming operations such as tube and tank fabrication.

Properly treating equipment is important because stainless steel is not indestructible. The following tips should help to keep stainless steel tools in good condition for decades of dependable service.

#I - HANDLE WITH CARE

Stainless steel is relatively easy to polish, and sanitary equipment is polished to make cleaning easier. Polishing also makes for an aesthetically pleasing appearance on exterior surfaces. This ease of polishing also means that stainless steel is relatively easy to scratch. The easiest way to reduce the risk of scratching is by handling with care and by avoiding touching the surface of your equipment with anything that results in scratches. Common culprits of equipment scratches are cleaning pads, cleaning abrasives, and contact with other metal tools.

Green scrubbing pads used to clean cookware can quickly ruin polished surfaces because these pads contain bits of mineral crystals bonded to the fibers of the pad causing scratches to the surface. Not only do green pads damage the beauty of uniform surfaces, they can also make cleaning progressively more difficult if repeatedly used. White-colored cleaning pads, Teflon meshes, and natural fiber pads can be used on polished equipment.

Abrasives are also used in many

household cleaning products, such as Comet, Ajax, Barkeeper's Friend, and Soft Scrub. All of these products are capable of scratching stainless surfaces and should be generally avoided, or cautiously used after testing.

#2 - SAY NO TO BLEACH

Sodium hypochlorite bleach causes pitting corrosion, especially when the pH becomes acidic. Although short exposure times are not likely to cause problems, for example as a dip to sanitize spoons and whisks, stainless steel equipment should never be in contact with bleach solutions for any length of time. Most brewers simply avoid using bleach because of the risk to equipment and to beer flavor.

#3 - CHEMICAL CLEANING CAN BE YOUR FRIEND

Chemical cleaning is the most effective and least problematic method used to clean stainless steel. Alkaline detergents, such as sodium carbonate, sodium metasilicate, trisodium phosphate and sodium hydroxide, can be used to remove organic soils without any risk of equipment corrosion. Acetic acid (white vinegar) and phosphoric acid are good choices to remove mineral scale from equipment. Although chemical cleaning is the preferred method for large-scale cleaning, it is important to know the ingredients used in chemicals for two reasons; safety and corrosion. Know what you are using so you don't inadvertently use a cleaner that will damage your equipment. Mild detergents and soft cleaning cloths or brushes can be used on many of the soils encountered in the brewery.



Ben Caya, President of Spike Brewing, started his company out of his college basement to make a few extra bucks for his weekend beer fund. It has since grown to a staff of 20+ in a 22,000 sq. ft. facility in Milwaukee, Wisconsin that is home to a nationally recognized brand. You can find him cruising his pontoon boat down the Milwaukee River listening to Led Zeppelin on the weekends.

here are some "essential" brewery chemicals I think every brewer should have on hand: Dish soap - Upon receiving any piece of stainless equipment, I recommend using a good dish soap, hot water and some elbow grease. The dish soap will break down any oils or dirt that are present from the manufacturing process. Alkaline brewery chemical -Brewery wash is great for post-brew clean up. Alkaline Brewery Wash (ABW) and Powdered Brewery Wash (PBW) are designed to break down organic material, so it is great for soaking stainless accessories/parts or soaking in your stainless vessel. We recommend running an alkaline brewery chemical through your system at the end of a brew day to clean the inside of valves, hoses, pumps, etc.

There are also a couple misconceptions about stainless. **Passivation** – as it relates to stainless steel, means creating a very thin (only a few atoms thick) oxide layer on top of the underlying stainless steel material. This oxide layer acts as a barrier and helps

give stainless its 'stainless' properties. The misconception is that harsh chemicals or even Star-San should be used to passivate. The truth is stainless steel naturally passivates (almost instantly). The dish soap scrub described earlier would be plenty to passivate your new piece of stainless equipment. Rust many brewers believe stainless can't rust and get very concerned if they see a couple specs of rust on their equipment. The truth is stainless steel is approximately 70% iron, which rusts very easily. The chromium and nickel added to this iron mixture is what makes stainless rust resistant ... but not rust-proof.

Lastly, there are a couple no-no's when it comes to stainless. **Bleach** – never use bleach on stainless steel. Bleach can cause stainless to corrode and pit. **Abrasive Scrubbing Pads** – the green scrubbing pads are too abrasive for polished stainless and can cause scratches. Always use a non-abrasive pad when cleaning. **Steel Wool** – steel wool can impregnate the surface with iron and cause rusting. **(MO)**





A once-in-a-lifetime beer experience with visits to: • Weihenstephan • Schlenkerla • Andechs Monastery • Weyermann Malts & much more!

Explore Bavaria and Franconia's world-class breweries & great German food with BYO Publisher Brad Ring. You'll drink, pedal, hike, and eat your way through the beer-soaked culture of Bavaria & Franconia. This trip wraps up in Munich just as Oktoberfest kicks off so you can also enjoy the world's most famous beer fest.

*Limited to just 16 people – so don't wait to register!

BYO.COM/TRIP

PERFECT GIFTS for Beer Lovers





brewersr upincations.c

ĎА



BY ASHTON LEWIS

CHARGING UP ALKALINITY

Also: All-in with allspice and enzyme dynamics

I AM STARTING TO TRY AND UNDERSTAND THE pH AND MINERALS THAT AFFECT MY BEER. I HAVE WELL WATER AND THEREFORE I HAVE A SOFTENER TO TREAT THE WATER. THIS PUTS MY LEVELS OF CALCIUM AND MAGNESIUM AT ZERO BECAUSE THEY ARE NEGATED BY THE SODIUM. I ALSO HAVE NO CHLORIDES OR SULFATES BECAUSE IT IS WELL WATER. MY TOTAL ALKALINITY IS 160 PPM. MY QUESTION IS, IF I UNDERSTAND AND I DID THE MATH CORRECTLY MY TOTAL ALKALINITY AND RESIDUAL ALKALINITY ARE THE SAME?

> MEGAN BODI VIA EMAIL

Oh boy, this topic is one of the more confusing ones in all of brewing and I will do my best to keep this answer clear. Toward this goal, I am using a brief Q&A flow to tackle each part of your guestion, plus several questions of my own, in discrete bits. Not the most elegant form of writing, but hopefully clear! Much of the intermediate information about residual alkalinity falls into the "so what?" category of information, but is required to get to the end result. So buckle your seat belt, grab a cup of coffee (or beer), break out a calculator, and get ready for a deep dive into water calculations.

Q: Does a water softener remove calcium and magnesium from water?

A: Yes, water softeners remove calcium and magnesium. Salt-based softeners, the most common type used at home, add two sodium ions (Na⁺) for each calcium ion (Ca⁺²) removed from the water being treated, and add two sodium ions (Na⁺) for each magnesium ion (Mg⁺²) removed from the water being treated. If you have to add bags of salt (sodium chloride) to your softener, you have a salt-based softener. Some people prefer using potassium chloride in these softeners and the principal is the same, except two potassium ions (K⁺) are added instead of two sodium ions (Na⁺). **Q:** What about the chloride that is part of the salt added to the softener; is this also added to the water being treated?

A: No, chloride is not added to the water being treated because the chloride does not bind to the resin beads inside of the softener during the resin regeneration cycles. These cycles are required for softeners to properly function because they replace calcium and magnesium ions that are bound to the resin with sodium or potassium ions. The chloride component of the salt is flushed away with the calcium and magnesium ions that are displaced by sodium/potassium during the regeneration cycle.

Q: Does well water contain chlorides and/or sulfates?

A: It depends on the water source. Some groundwater sources are rich in these ions and others are not. So-called gypseous waters percolate through gypsum, aka calcium sulfate, and contain significant amounts of sulfates, and many natural water sources contain significant levels of chlorides. Testing is required to know the specifics of any water source. General knowledge about the local topography is very helpful in knowing the basics about your water. Geological maps are a good resource when it comes to researching Testing is required to know the specifics of any water source. General knowledge about the local topography is very helpful in knowing the basics about your water.



with sodium ions.

🔥 HELP ME, MR. WIZARD

particular regional differences in ground water.

Q: What is residual alkalinity?

A: Dr. Paul Kolbach developed the concept of residual alkalinity (RA) in 1951 to help compare waters from different brewing regions of the world. Kolbach's metric compares carbonates, the components in water that increase the pH of mash and wort, to calcium and magnesium, the components in water that decrease the pH of mash and wort.

Q: What units are used to express RA?

A: RA is either expressed in terms of $CaCO_3$ equivalents or in °dH (degrees German hardness) equivalents. Since Kolbach was German, his RA method uses °dH. Water hardness in the US, Britain, and France is based on $CaCO_3$, explaining why RA is also expressed in $CaCO_3$ equivalents. These differences in communicating water hardness are one reason that this topic is confusing and difficult to clearly explain. Here are the various standards:

- 1° US hardness = 1 ppm CaCO₃
- 1° British Hardness = 1 grain/gallon CaCO₃ = 14.3 ppm CaCO₃
- 1° French Hardness = 10 ppm CaCO₃
- 1° German Hardness = 10 ppm CaO

Q: What is meant by equivalent?

A: This is perhaps the single-most confusing part of discussing water hardness. Different compounds have different molecular weights, but many chemical reactions are a function of charge and are not influenced by weight. An equivalent weight expresses the concentration of something in terms of another thing. In the case of water hardness, the concentrations of calcium, magnesium, and carbonate are all expressed using a single unit of measurement; either equivalents of calcium carbonate or equivalents of calcium oxide. When concentration in mg/L (the same as ppm) is converted into an equivalent concentration, the term used is milliequivalent or mEq.

To express 1 ppm calcium, for example, in terms of CaCO₃, the following equation is used:

 Ca^{+2} as $CaCO_3$ = ppm Ca^{+2} x equivalent weight of calcium carbonate \div equivalent weight of calcium

 Ca^{+2} as $CaCO_3 = 1$ ppm $Ca^{+2} \times 50 \div 20 = 2.5$ mEq

To express 1 ppm calcium, for example, in terms of CaO, the following equation is used:

 Ca^{+2} as CaO = ppm Ca^{+2} x equivalent weight of calcium oxide \div equivalent weight of calcium

 Ca^{+2} as CaO = 1 ppm $Ca^{+2} \times 28 \div 20 = 1.4$ mEq

Chart 1 below shows the ions of interest to this topic as milliquivalents of $CaCO_3$ and CaO. This information is not immediately useful, but the RA calculation uses equivalent weights and it can be frustrating using a conversion without understanding what it means and why it is required.

Chart 1

lon	mg/L	mg/L as CaCO ₃ (aka mEq)	mg/L as CaO (aka mEq)
Ca ²⁺ (Example)	1.00	1.00 x 50 ÷ 20= 2.50 mg/l as CaCO ₃	1.00 x 28 ÷ 20 = 1.40 mg/l as CaO
Ca ²⁺	1.00	2.50	1.40
Mg ²⁺	1.00	4.12	2.30
HCO ₃ -	1.00	0.82	0.46
CaCO ₃	1.00	1.00	0.56
CaO	1.00	1.79	1.00

Q: How is RA calculated using US degrees of hardness?

A: Residual alkalinity as ppm CaCO₃ = Total alkalinity_{mEq} – [(Ca⁺²mEq \div 3.5) + (Mg⁺²mEq \div 7)]. The reason that the concentrations of calcium and magnesium are divided by 3.5 and 7, respectively, is to account for the solubility of calcium phosphate and magnesium phosphate, and to equate the acidifying power of calcium and magnesium to the alkalizing power of carbonate/bicarbonate (usually expressed as HCO₃⁻ in a water analysis).

This equation can be simplified by substituting the conversion from ppm to mEq. RA as $CaCO_3 = (ppm HCO_3^- x 0.82) - [(0.71 x ppm Ca^{+2}) + (0.59 x ppm Mg^{+2}))]$ If your water analysis has the value "total alkalinity as $CaCO_3$ ", use that value instead of "ppm $HCO_3^- x 0.82$ " in this calculation.

Here is an example where HCO_3^{-1} is 360 ppm, Ca^{+2} is 76 ppm, and Mg^{+2} is 18 ppm. RA as $CaCO_3 = (360 \times 0.82) - [(0.71 \times 76) + (0.59 \times 18)] = 231$ ppm as $CaCO_3$.

Q: How is RA expressed as CaCO₃ converted to °dh?

A: Hardness as $CaCO_3 \times 0.056 = °dH$. Brewers living in a country reporting alkalinity in terms of $CaCO_3$ may want to use this conversion when reading literature with reference using German degrees.

Q: How is RA applied to brewing?

A: RA is used to predict how mash pH is influenced by

Chart	2
	-

Metric	Burton (Pale Ale)	Munich (Dark Lager)	Pilsen (Pilsner)
RA (°dH)	3	13	0
Carbonate Hardness (ppm)	270	295	16
Ca ²⁺ (ppm)	263	76	7
Mg ²⁺ (ppm)	62	18	3
SO4 ²⁻ (ppm)	638	10	5
Cl ⁻ (ppm)	36	2	5

Chart 3

RA (as ppm CaCO ₃)	RA (as °dH)	Effect on Mash pH
170	10	Raises pH by 0.30 units
85	5	Raises pH by 0.15 units
0	0	No effect from water
-85	-5	Decreases pH by 0.15 units
-170	-10	Decreases pH by 0.30 units

brewing water. Chart 3 can be used as a guideline.

 $RA < 5^{\circ}dH$ or 85 ppm as CaCO₃ is recommended for pale colored and hop forward beers. Darker beer can handle higher RA because darker malts are acidic and balance the alkalinity found in water.

Q: My total alkalinity is 160 ppm with a pH of 6.5. If I did the math correctly, my total alkalinity and residual alkalinity are the same?

A: You are correct; your water is softened and contains no appreciable level of calcium and magnesium (in the absence of testing, this is a reasonable assumption), so RA = total alkalinity. All brewing water benefits from calcium because calcium stabilizes alpha amylase, improves trub formation, and helps to precipitate oxalates from malt. A general rule is to have at least 50 ppm of calcium in brewing water. This means your water needs some calcium. Magnesium influences mash and wort pH, and can add a metallic-like bitterness to beer when used at high levels. Without adding some sort of acid, your water is not well-suited for most beer styles because of the high RA. The RA equation can be used to calculate the calcium concentration required to reduce the RA of your water to 2, for example.

2 RA (as CaCO₃) = (160 ppm total alkalinity) – $[(0.71 \text{ x ppm Ca}^{+2}) + (0.59 \text{ x} 0)]$, and solving this equation results in Ca⁺² = 226 ppm.

Chart 2 compares water from three famous brewing centers. It is interesting to note the type of beer traditionally brewed in these cities and the RA of the three waters.





Build Your Own Beer! Select all the ingredients for your beer from one convenient page.

highgravitybrew.com 918-461-2605

🔥 HELP ME, MR. WIZARD

I TRIED A BEER IN WHICH ALLSPICE PEPPER HAD BEEN USED AND I WANT TO EXPERIENCE THIS SPICE IN MY BEER. WHAT STYLE DO YOU RECOMMEND FOR YOUR USE? SHOULD I USE THE ALLSPICE BERRIES WHOLE OR GRIND THEM BEFORE USE, AND AT WHAT POINT IN THE PROCESS SHOULD I ADD ' IT; BOIL OR FERMENTATION?

> LALO SEVERO MONTEVIDEO, URUGUAY

One of the easiest ways to work a spice into beer recipes is to consider how the spice is used in cooking and then create a beer that mimics the food concept. More advanced uses of spices include using spices to substitute and/or complement hops, add depth and complexity to fruit, augment yeast characters, and to round out complex beers that may seem a bit disjointed. Whatever the purpose, it is important to maintain balance when brewing with spices because it is very easy to overdo any one spice addition.

Allspice, also known as myrtle pepper and Jamaican pimento, is a berry harvested from the *Piementa dioica* tree that is native to the Caribbean, Mexico, and Central America. So named because it seems like a blend of cinnamon, nutmeg, and clove, allspice is used in a variety of dishes including Jamaican jerk chicken, aromatic breads and baked goods, pickles, desserts, and savory stews. Allspice lends itself to beer styles that play well with aromatic phenols, such as pumpkin ale, rich dark beers like porter, dunkel lager, imperial stout, and maibock. I am thinking beers with some residual malt character that can support the intensity of allspice. Judicious additions of allspice may also work well as accents to saison, hefeweizen, and beers with other aromatics such as vanilla, basil, rosemary, and chocolate. And any discussion of spices and styles these days is incomplete without mentioning pastry stout, the catch-all style for just about any and all ingredients.

Spices, like hops, can be used ground or whole, and can be added in the boil, during fermentation, or after fermentation. One of the challenges to using spices is usage rate. Whereas hops are labeled with alpha acid content and brewers can calculate how much to add based on this value, spices come with no similar indicator. This means that spice additions are approximate, even when using a recipe. For these reasons, I prefer to add spices to beer after fermentation is complete.

If you like precision and knowing what is going to happen in advance, begin by making an allspice tincture using vodka and freshly ground berries. A day of contact time is about all that is required for most spice tinctures, especially when ground spices are used. Tinctures allow for blending trials using small samples of beer to determine the preferred dosing rate. I like to take about 100 mL of beer and pipette small volumes of whatever it is I am trialing into the beer while swirling and smelling with each addition to determine approximately how much ingredient is required for the desired intensity. I then set up 3-5 glasses with 100 mL of beer per glass and add my test ingredient at a range that brackets the concentration in the first trial. This method is a great way to take the guesswork out of spicing.

Some brewers and cooks feel this food science approach to brewing and cooking lacks romance and prefer more rustic methods. If you want control without the pipette and graduated cylinder, consider containing your allspice berries in a spice bag and adding the bag to a keg or fermenter before filling with beer. Periodically sample your beer and rack it to another keg or bottle when the intensity is to your liking. I have used this approach to add oak flavor to beer when I was not sure how much oak was needed to produce the right amount of oakiness.

Spices can always be added to the kettle, but this method allows for the least amount of control unless you have previously gone through a recipe development process. Adding spices to the kettle is easier than adding during or after fermentation, and also adds a heat sterilization step that offers a level of surety to the process.

"THESE TWO ENZYMES, THOUGH THEY WORK IN CONCERT, BEHAVE DIFFERENTLY IN RESPONSE TO CHANGES IN MASH THICKNESS AND MASH TEMPERATURE. THIS IS BECAUSE OF THE DIFFERENCE IN THEIR STABILITY AT HIGH TEMPERATURES. ALPHA-AMYLASE HAS AN OPTIMAL RANGE FROM 149 TO 158 °F (65 TO 70 °C). THE OPTIMAL RANGE FOR BETA-AMYLASE IS 126 TO 144 °F (52 TO 62 °C)."

I PERFORM BREW-IN-A-BAG, AND AM RESEARCHING MASH THICKNESS, THEN I CAME ACROSS THIS INFORMATION IN *BYO* WHICH GOT ME THINKING ABOUT THE TEMPERATURES OF MASHING. IF WE NEED THE ALPHA-AMYLASE FOR THE PRIMARY PROCESS OF BREAKING DOWN THE STARCH MOLECULE CHAIN, THEN BETA-AMYLASE TO CLIP OFF MALTOSE. READING THE OPTIMUM TEMPERATURES FOR THESE ENZYMES, THEN WHY WOULDN'T MASH TEMPERATURE PROFILES HAVE A STAND AT "149 TO 158 °F (65 TO 70 °C)," THEN BACK THE TEMPERATURE OFF TO "126 TO 144 °F (52 TO 62 °C)" TO OPTIMIZE CONVERSION?

The old alpha and beta amylase temperature conundrum! It does indeed seem that the temperature optima for these two enzymes is reversed for the purpose of mashing. Beta amylase produces maltose by "biting" off maltose molecules from the non-reducing end of starch molecules. In the case of amylose, there is one reducing end and one non-reducing end, and in the case of amylopectin, a heavily branched molecule, there is one reducing end and multiple non-reducing ends. Amylopectin is often compared to a tree, where the trunk represents the reducing end and the tips of the branches represent the non-reducing ends. Alpha amylase randomly breaks bonds within amylose and amylopectin molecules, and in the process produces one reducing and one non-reducing end with each broken bond. The result of this activity is more sites for beta amylase to act upon, and this is the reason that brewers often lament that beta amylase activity occurs before amylase activity in a step mash.

As you suggest, this seems like an easy enough problem to solve; start in the alpha amylase range and simply cool the mash down to where beta amylase is most active. But this does not really work, and herein lies the conundrum. Enzymes are proteins with catalytic activity and are pretty resilient molecules. Change the solution pH over a pretty wide range and the surface charge of proteins change, and in the specific case of enzymes this charge change affects enzyme activity. Similarly, changing temperature results in a

CAN

BREWER'S

change in enzymatic rate. But changes in pH and temperature beyond enzyme-specific limits, cause an irreversible movement in the three dimensional structure of the protein that completely stops enzymatic activity. This structural change is known as denaturation. Fried eggs, cheese, tofu, grilled steak, and trub are all examples of food featuring denatured proteins. What this all means is that beta amylase is denatured when the mash is held at the alpha amylase optimum for any appreciable time.

Let's take a few steps back from this discussion and consider what happens in a normal infusion mash that is held at about 149 °F (65 °C). Although this temperature is higher than the optimal temperature for beta amylase and will eventually lead to denaturation, the denaturation is not instantaneous. As temperature increases, so does the rate of denaturation. This temperature is also not the optimal temperature for alpha amylase, but alpha is active at 149 °F (65 °C) even though its optimal temperature is 158 °F (70 °C). In other words, infusion mashing is a compromise mash. And it works quite well when brewing with well-modified malts.

There is a traditional mash type that plays with the balance of the various malt enzymes, and that is the decoction mash. The classic triple decoction begins by bringing water and malt together for an initial temperature in the 104-122°F (40-50 °C) range where beta-glucanase and proteases are active. A portion of the thick mash (that portion that settles when the mash is not mixed) is moved to a kettle and

PNOG[®] 20 Limited Release

BREWER'S BEST®

American IPA...the beer style that helped drive the craft beer revolution in the US. This year's HopNog[®] recipe is honoring the huge growth of the craft beer industry with our American IPA recipe. Deliciously malty with a mild bitterness and bursting with citrus and floral notes from the whirlpool hop additions. Raise your glass and say "cheers to craft beer!"

> Kent, OH 44240 800-321-0315

D Carlson

This year's kit includes a stainless steel pint!



heated to a boil. Many descriptions of decoction mashing quickly skips past this step, but this step is relevant to the topic at hand, so let's dive in a bit deeper.

When the thick mash is pumped to the kettle, much of the mashing liquid, or thin mash is left behind. This liquid contains enzymes that will hang about until the boiling mash is returned. In the meantime, the thick mash is heated up to about 158 °F (70 °C), held for about 10-15 minutes, and then heated up to a boil. The brief rest at 158 °F (70 °C) allows alpha amylase sufficient time to make a few nice whacks into the tree-like structure of amylopectin. This thins the mash out and really helps with mash pumping, and it also results in more non-reducing ends for beta amylase to act upon.

After this first boil, the mash is pumped back and mixed with the dilute, enzyme-containing, mash that was hanging about during the boil. Depending on the specifics of the brewery, the mash temperature increases to about 140 °F (60 °C) where beta amylase is most active. This process is repeated to bring the mash up to about 158 °F (70 °C) for the conversion rest, and is repeated once more to bring the mash up to about 169 °F (76 °C) for mash-off. The decoction mash method does move the system up and down in temperature, and up and down through the temperature optima of the various malt enzymes that we brewers have at our disposal. Exactly what you are asking about. A key thing with the decoction mash is that a portion of the mash, about $\frac{2}{3}$ of

the total, is not boiled and thus preserves enzymes.

The purpose of this answer was not to explain how to adapt principles of decoction mashing to BIAB, rather I wanted to review how decoction mashing does more than simply heat mash using traditional brewing methods. Hopefully this information is useful for you in your pursuit of mashing perfection!



Enzymes found in the mash have a specific structure and once that exact structure is lost due to heat, then the enzyme has become denatured and can no longer chop up starch molecules (or other target molecules).

For the homebrewer who likes to party PANCHO'S KEG KOOLER[™]

- Fits a 5 gallon keg
- Affordable
- Easy to install
- **Dimensions** 0D:30" x 15"

ID: 27.5" x 13.25"

HOLIDAY ALE

www.PanchosBrewingLab.com



WING

DISCOVERING THE WORLD OF MALT.

- Company Started In 1883
- Largest Specialty Malt Producer In The World
- Northern European Quality
- Null-Lox Barley Varieties Reduce Beer Staling

AMAZING QUALITY, SURPRISING COST SAVINGS



HOMEBREW SHOP INQUIRIES PLEASE VISIT

Brewmaster.

BREWMASTERWHOLESALE.COM OR CALL 1-800-288-8922 FOR BREWERY INQUIRIES PLEASE VISIT



MOREBEERPRO.COM OR CALL 1-800-880-8178



BY GORDON STRONG

Munich dunkel captures historical Bavarian brewing in a glass: Munich malt, decoction mashing, and clean, smooth lager character.

MUNICH DUNKEL BY THE NUMBERS

OG:1.048-1.056
FG:1.010-1.016
SRM:14-28
IBU:
ABV:4.5-5.6%



Photo by Charlie A. Parker/Images Plus

MUNICH DUNKEL

The original brown lager of Bavaria

unich dunkel is kind of like the dark mild of Germany – it just doesn't get the respect it deserves. Overshadowed by newer styles and flashier ingredients, it remains a solid everyday drinking beer. Enjoyable with food and not demanding on the palate, this beer is perhaps a throwback to simpler times when a good tasting beer (and maybe a pretzel) was all you needed.

I think about Munich dunkel along with the other beers of Bavaria: The normal-strength helles, dunkel, and schwarzbier, and the stronger Märzen, festbier, and bocks. The standard-strength beers are all malty, with the helles being pale, the dunkel dark (darker than amber), and the schwarzbier dark and roasty. The helles and dunkel have a malty balance, while the schwarzbier can be more bitter (but not burnt). None of these are as strong (or as malty) as a bock or other festtype beers.

Munich dunkel captures historical Bavarian brewing in a glass: Munich malt, decoction mashing, and clean, smooth lager character. A fellow homebrewer, Darren Link, once asked me for tips on brewing this style. I told him to use dark Munich malt, a decoction mash, noble hops for bittering at about 20 IBU, clean German lager yeast, and maybe a little Carafa® Special to adjust the color. Jump forward about a year when I was judging the best-of-show round at a local homebrew competition. Found in that line-up was a spot-on Munich dunkel, which turned out to be Darren's beer. I asked him for the recipe, to which he laughed and said I had told him everything he needed to know.

I still asked Darren for his recipe since I wanted to know what tweaks he had given it. He used a touch of melanoidin malt since he did a single infusion mash, but the rest was basically what I had described. He has since gone pro and still makes this beer at the Fifth Street Brewpub in Dayton, Ohio. He calls it "Funnel" because of me; apparently, I had texted "dunkel" to him but my phone autocorrected it to "funnel" and he thought it was hilarious. Thank you Siri.

The Beer Judge Certification Program (BJCP) groups dunkel and schwarzbier in Category 8, dark European lager, with dunkel being style 8A.

HISTORY

Bavarian lagers developed due to some regulatory and technological influences in medieval times. The Reinheitsgebot of 1516 was a beer purity law, but also was designed to keep wheat out of beer. Summer brewing was outlawed in 1553, which led to cool weather brewing and storage methods that favored the selection of lager yeast and brewing methods. Beer in Bavaria was dark by necessity until the early 1800s due to how malt was kilned. So a regional preference for these types of beers was established in Bavaria, although similar beers were made in Czech lands.

Munich malt was developed after improvements in kilning in the 1820s made it possible to have richer malts without a smoky taste. Gabriel Sedlmayr was able to take advantage of this malt at the Spaten brewery in Munich, developing the first modern dunkel in the 1830s. This led to what Michael Jackson called the heyday of dark lager in Bavaria from roughly the 1840s to 1890s.

The style persisted and never went away, but it remains somewhat of a regional specialty. Good commercial examples can be found from Ayinger, Spaten, König Ludwig, Ettaler, Hack-



er-Pschorr, Hofbräu, and Weltenberger. American examples from Chuckanut Brewing, Von Trapp Brewing, Harpoon Brewery, The Olde Mecklenburg Brewery, and Penn Brewery are all quite good.

SENSORY PROFILE

Munich dunkel is a malty beer that features a deep, complex, rich Munich malt flavor. There are bready-toasty flavors that often seem like toasted breadcrusts. Yet the beer isn't sugary sweet. You simply couldn't drink these beers a liter at a time if they were. The bitterness is on the low side so that the malt is emphasized, but the residual sugar is not high.

The quality of the malt is paramount in a proper Munich dunkel. Well-developed Maillard flavors permeate the beer, with some developed during the kilning of the malt, and others brought out during the mashing process. Background flavors of chocolate, nuts, caramel, and toffee can be present, but without sweetness, harshness, roasted, or astringent flavors.

The beer itself is a deep copper to dark brown, often with a reddish tint when held up to the light. The head is creamy with a light tan color. As a lagered beer, it is expected to be clear. The body is moderate, but the mouthfeel may feel a little more full due to dextrinous malts used. The beer should not feel heavy, though.

The hop character is minimal. Often without flavor or aroma hops, the bittering hops provide some balance at 20–25 IBUs. Classic German noble hops such as Hallertauer, Tettnanger, or Spalt are traditional.

The beer finishes relatively dry but with a malty aftertaste. Sweetness or pronounced caramel flavors are undesirable, although many may perceive a strong maltiness as sweet. The fermentation profile is clean with no esters or fermentation byproducts. The lagering period smooths out the beer.

An average-strength beer, a Munich dunkel is typically around 5% ABV (plus or minus a half percent). It shouldn't have a warming, bock-like feel; it should be a beer you can easily drink in quantity.

MUNICH DUNKEL

(5 gallons/19 L, all-grain) OG = 1.049 FG = 1.012 IBU = 21 SRM = 20 ABV = 4.9%

INGREDIENTS

- 10 lbs. (4.5 kg) Weyermann dark Munich malt (9 °L)
- 4 oz. (113 g) melanoidin malt
- 4 oz. (113 g) Weyermann Carafa[®] II Special malt
- 5.5 AAU Tettnanger hops (60 min.) (1.25 oz/28 g at 4.4% alpha acid)

White Labs WLP833 (German Bock Lager), Wyeast 2487 (Hella Bock Lager) or Mangrove Jack's M76 (Bavarian Lager) yeast

³⁄₄ 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 1 tsp. of calcium chloride to the mash.

Step mash: Mash in Munich malt at 131 °F (55 °C) and rest for 10 minutes. Increase to 146 °F (63 °C) using direct heat or hot-water infusion and hold for 40 minutes. Increase to 158 °F (70 °C) using direct heat or hot-water infusion and hold for 30 minutes. Add Carafa® and melanoidin malts on to the top of the mash and raise to 168 °F (76 °C), then hold for 15 minutes while recirculating the wort. Fly sparge with 170 °F (77 °C) water, collecting 6.5 gallons (25 L) of wort.

Boil the wort for 90 minutes, adding hops at the times indicated in the recipe. A kettle fining can be added but a proper lagering should sufficiently clear the beer.

Chill the wort to 50 °F (10 °C), pitch the yeast, and ferment at this temperature until complete. Lager the beer at 32 °F (0 °C) for six weeks. Rack and package the beer, or rack and clarify the beer, if desired, with finings before packaging (prime and bottle condition, or keg and force carbonate).

MUNICH DUNKEL

(5 gallons/19 L, extract with grains) OG = 1.049 FG = 1.012 IBU = 21 SRM = 20 ABV = 4.9%

INGREDIENTS

- 6.6 lbs. (3 kg) Munich liquid malt extract
- 4 oz. (113 g) melanoidin malt
- 4 oz. (113 g) Weyermann Carafa® II Special malt
- 5.5 AAU Tettnanger hops (60 min.) (1.25 oz/28 g at 4.4% alpha acid)
- White Labs WLP833 (German Bock Lager), Wyeast 2487 (Hella Bock Lager) or Mangrove Jack's M76 (Bavarian Lager) yeast ¾ cup corn sugar (if priming)

STEP BY STEP

Start with 6 gallons (23 L) of water in the brew kettle; heat to 158 °F (70 °C). Steep the Carafa® and melanoidin malts for 30 minutes, then remove.

Turn off the heat. Add the liquid malt extract and stir thoroughly to dissolve completely. You do not want to feel liquid extract at the bottom of the kettle when stirring with your spoon. Turn the heat back on and bring to a boil.

Boil the wort for 60 minutes, adding remaining hops at the times indicated. A kettle fining can be added but a proper lagering should sufficiently clear the beer.

Chill the wort to 50 °F (10 °C), pitch the yeast, and ferment at this temperature until complete. Lager the beer at 32 °F (0 °C) for six weeks. Rack and package the beer, or rack and clarify the beer, if desired, with finings before packaging (prime and bottle condition, or keg and force carbonate).

TIPS FOR SUCCESS:

Don't skimp on two important aspects with this style of beer: Appropriate yeast pitching and a proper lagering phase.



Compared to other styles, the beer has the balance of a Munich helles, but with a much richer malt flavor. It is not as strong, rich, or full-bodied as a bock. It should not have the roasted flavors of a schwarzbier; deep toasted malt is fine, but anything that gets roasty does this style a disservice. A Munich dunkel has less hops than its cousin, the Czech dark lager, with a cleaner German profile and slightly richer malt flavor. The toasted malt flavors are deeper in character than a Märzen.

BREWING INGREDIENTS AND METHODS

Munich malt plays a major role in this style, with dark Munich malt being the choice of many German brewers. It can be used for the entire grist, but is often transformed further through the use of the traditional decoction mash. It is one of the few styles where a triple decoction mash is traditional, although few use this intensive process today.

An interesting alternative to the triple decoction mash is to use a step mash, followed by a kettle mash. This is a single decoction mash program, but boils the entire thick portion of the mash. The enzyme-rich thin portion is drained off after the final saccharification rest, the thick portion is boiled for 20–30 minutes, then the two portions are recombined to complete the mash program.

Both of these mash programs develop intense Maillard reaction products that give the rich, toffee, almost meaty flavors. The use of specialty malts and caramel-type malts is rare, or kept to a low percentage to avoid an overly sugarysweet flavor and to keep the body in check.

Step mashes do not develop the same flavors as decoction mashes but are important in creating a well-attenuated beer that still has a pleasant body and mouthfeel without being heavy. Continental barley tends to be higher in protein than other European maritime malts, so these mash programs help develop the right character in the beer. Since more highly kilned malts such as Munich can be lower in enzymes, the more intensive mash programs also help guarantee proper conversion of starches in the mash.

Using specialty malts to add color, malty sweetness, and flavor are tricky since they never really give the same combination of flavor, body, and character as developing them naturally from Munich malts. Using color malts that impart too much of a roasted flavor are especially problematic. Color adjustment using de-husked malts such as Carafa® Special are fine, but it's better to have a paler version of the beer than one with the wrong flavors.

Traditional German hops are used, such as Hallertauer, Tettnanger, or Spalt, but since the beer doesn't have much of a hop character, this isn't critical. American versions can be substituted, such as Liberty, Vanguard, Crystal, Mt. Hood, Santiam, or Sterling, but any hop should not have a strong character that interferes with the malt.

German lager yeast, fermentation process, and lagering methods are traditional. German lager yeasts that are clean, low sulfur-producing, and slightly malty are best. A cool fermentation followed by a long, cold lagering period reduces yeast byproducts and creates the smooth character that is desired. Munich water is moderately carbonate, but the beer doesn't have a minerally taste. Sulfur in the water should be avoided since the sharp dryness is not desirable in this style. Relatively neutral water can produce good results, as with the Czech lagers.

HOMEBREW EXAMPLE

This recipe is somewhat of a compromise in mash techniques. Traditionally, this is a decocted style, but we're going to use a step mash and a little extra character malt instead. If you want to use a decoction, I'll describe that as well.

The base malt is almost all dark Munich; I prefer Weyermann Munich II malt for this beer. Note that if you use another malt, check the color specifications and conversion capabilities because not all dark Munich is the same. Given a choice, choose the ones with the least color. If you can't find the dark Munich malt, substitute Munich but understand that the flavor will be less malty.

The step mash program helps create an attenuated beer that still has some body, which is a hallmark of German styles. The melanoidin malt adds an extra toasted-breadcrust flavor, while the Carafa® Special II adjusts the color darker without adding much flavor. The rich dark Munich malt carries the beer.

If you want to decoct the beer, go ahead but delete the melanoidin and Carafa® malts. Use the same rest temperatures for a traditional triple decoction beer as indicated in the step mash. The beer can also be made using a single decoction, but I like to use a kettle mash technique. This technique uses the same steps as the step mash, but after resting at 158 °F (70 °C), drain the liquid portion of the mash and reserve. Bring the full thick portion of the mash to a boil, and boil for 20 minutes, then mix back in the reserved thin portion. Hold for 20 minutes, then proceed to lauter.

German noble hops provide 21 IBU of bittering, which is enough to balance the malt and not make the beer seem sweet. However, the beer should not have a bitter finish and aftertaste. No aroma or flavor hops are needed; the malt should be foremost in the balance.

Any neutral German lager yeast will work; however, I prefer the White Labs WLP833 (German Bock) yeast, which reportedly is from Ayinger. It gives a malty profile to the finished beer and doesn't throw much sulfur. It can sometimes be hard to find, so a good substitute is the workhorse Weihenstephan yeast (White Labs WLP830, Wyeast 2124 Bohemian Lager, Saflager W34/70).

The fermentation and lagering process is pretty standard for German beers. I don't find that these yeast strains produce diacetyl during normal processes, so I only do a diacetyl rest if needed. A cool fermentation followed by a cold lagering period adds the clean smoothness so characteristic of a proper lager.

Remember that the finished beer should be somewhat dark but not really have a dark malt, roasty character. The balance should be malty but not sweet, with a somewhat lean body that allows you to drink these a liter at a time. It's a difficult balance to pull off properly, but when it's right, it's a magical beer.

This baliday season give the diff of hear Check out

This holiday season give the gift of beer! Check out all of the great beer gear on the next few pages for some gift ideas for friends and family or make your own homebrew holiday wishlist...







No pumps, no coolers, no frozen 2-liters

35° + / - Ambient

BrewJacket.com

US Patent No. 9423163

byo.com/shop or by calling 802-362-3981 ext. 106

FERMENT LIKE NEVER BEFORE

WITH THE GRAINFATHER CONICAL FERMENTER

Di

000

10.0 1

PROFESSIONAL

FERMENTATION CONTROL

FOR HOMEBREWERS

- 🕂 BUILT-IN HEATING & DOUBLE WALLED INSULATION
- 🕂 dual valve tap for yeast dump and sampling
- + HASSLE-FREE CLEANING
- + MULTIPLE FERMENTATION PROFILES
- 🕂 GLYCOL CHILLER ADD ON AVAILABLE

INTEGRATED COOLING SLEEVE



THE

ALL GRAIN BREWING

ACCURATELY CONTROL THE BUILT-IN HEATING UNIT OR COOLING ADD ONS

INNOVATIVE DUAL FUNCTION TAP Reduces cleaning time



www.grainfather.com



up to **30%** off plus free shipping until Dec.20th

BAYCASSIC

🖸 @shopthebayou 🛐 @thebayou

BAYCENSI

Complete line of Bayou Brew Equipment www.shopthebayou.com



The best gifts keep on giving BEER all year long!



Access live brew graphs for gravity, temperature, & ABV from anywhere, any time! Get started for only \$39.99, order at www.brewperfect.com





Perfect for brew days and beer fests, these BYO logo items live up to your classic homebrews.

Get yours today at byo.com/shop 802-362-3981 ext. 106






Final and the North Sea between England, Ireland, and Scotland is a pristine and unique island. Tiny - just 50 kilometers by 20 kilometers (32.5 x 13.5 miles) — it was settled by Norse explorers, Scots, and Irish. It has its own language, its own currency, and a 10,000-year history. Tynwald, its parliament (established in the Norse tradition) has lasted over 1,000 years. It is a place of glens and kirks, sheep-covered hillside pastures, fish-ing fleets, and of course, fairies.

The Isle of Man, home of Celtic god Manannan, is a UNESCO-protected biosphere known for tailless cats, kippered herring, and motorcycle races. The famous — or infamous — Manx TT races stretch two weeks from May into June each year, and doubles the nor-





At the end of the Manx Electric Railway between Ramsey and Douglas, the best way to get from one end of town to the other is picturesque on the Douglas Bay Horse Tramway.

mal population of 80,000. And those TT tourists are notoriously thirsty beer lovers.

Since the mid-1800s the Isle of Man has produced beers known throughout England; the Isle of Man was a Victorian-era holiday hotspot and a premiere tourist destination well into the 1960s. Manx beers are different from continental beers, as the Isle of Man has only surface water from impoundment reservoirs capturing rainwater. So, Manx beers tended to be rounder, fuller in the mouth than, say, the beers of Burton-on-Trent or Dublin. due to lower minerals and calcium carbonate. As a result, most beers historically were bitters and milds, and their ABV was well under what is most common in North America, typically hovering around 3.2% ABV.

When I visited a decade ago I saw no beer — Manx or English — stronger than 4.2 percent, and almost none in bottles with the exception of Bushy's TT Lager. Public houses would advertise each beer, all in cask, by brewery and strength — and resulting priceper-pint. For instance, "Theakston's 3.2%, £2.6d" written on the chalkboard. You were expected to know all the beers a brewery produced. As they were all session beers, you could.

On that decade-ago visit, I walked the promenade in Douglas, pub-topub, pint-to-pint relying only on shoe leather. While much has remained unchanged, years later as I once again visited Isle of Man, I still walked pubto-pub, but the beers offered were of a greater variety. Pints pulled from beer engines are now more regularly as strong as 4.5% ABV, and occasionally well beyond. In that respect, the island has followed the UK, which has followed the United States . . . slowly. So, the Manx idea of a strong beer would be what passes for a North American session beer.

Perhaps unique, there is no large bottling facility at any of the four Isle of Man breweries. Earlier this year I visited three of these island breweries, but unfortunately ran out of time before having a chance to visit Bushy's Brewery. Traditional cask beer remains the standard throughout the Isle of Man, as do hand pulls and beer engines. While bottled beer is available from all the Manx breweries, little is bottled on the island. Interestingly, that "green" beer is sent off the island to be bottled. An exception is Hooded Ram, which hand bottles a select few specialty beers, sending the others to be bottled in England.

From a brewer's perspective, the island's reservoirs contain very soft and pure water subjected to multiple daily purity tests. According to the Manx Public Works Department, 2017 water averaged 40 mg/L of total hardness as CaCO₃ mg/L. Brewing authority John Palmer says 150 mg/L is necessary to brew typical beers. So, Manx brewers have no need to purify their water, only to adjust acidity and hardness and filter out requisite chlo-





rination to suit their brewing process.

Similar to laws in some other countries centuries ago — most famously the German *Reinheitsgebot* — Isle of Man enacted the "Manx Brewing Purity Act of 1874," which prohibited the use of certain ingredients early in the Industrial Revolution. The original law read:

"No brewer shall use in the brewing, making, mixing with, recovering or colouring, any beer or any liquid made to resemble beer, or have in his possession any copperas, coculus indicus, nux vomica, grains of paradise, guinea pepper, or opium or any article, ingredient, or preparation whatever for, or as a substitute for malt, sugar or hops."

Every brewery on the island credits the Manx Brewing Purity Law with creating opportunity for great beer. Like the German *Reinheitsgebot*, the mandate for nothing but malt, hops, sugar, and water (recently updated to allow production of lager, wheat beer and fruit beer) is heartily endorsed by CAMRA (Campaign for Real Ale). They, and most people on the island, believe this results in better beer.

Visiting Manx breweries (as well as distilleries and one winery, which I won't be covering here) required travel from lodgings in Ramsey to Douglas, roughly north to south, often using the Manx Electric Railway and Douglas Bay Horse Tramway. That allowed sightseeing along the eastern coast as I headed out for my first Manx beer, a proper pint of Bosun Bitter.

OLD LAXEY BREWING COMPANY

Old Laxey Brewing Company is the smallest brewery on the Island. The brewery is connected to the Shore Hotel on the northeast coast (pictured, at left). Brewer Paul Phillips and a friend who brewed for Tetley's started Old Laxey 22 years ago. Their intent was "To take over the world with our beers," Paul told me. "It didn't happen."

"We're not big enough to brew more than one beer," Paul says. "We (have the brewing capacity) without a doubt. Still, this is the only cask beer we sell. You see, we have (mostly) the same patrons year around; it's a nice village pub and I think the secret to good beer is to keep it moving." Paul explained.

Paul brews on a 5-barrel, direct-fired brew system. Over the years his recipe has changed little. "Bosun Bitter is the beer we brewed first and we've kept it the same, apart from reducing the hops and the boil time. Everything else is exactly the same," Paul told me. Atypically, Paul does not use dry hopping in the casks. "We only have cask beer in the house and I think Bosun Bitter is hoppy enough as is," he said.

Brewing his traditional Bitter proceeds in accordance with the Manx Beer Purity Act, using a grist composed primarily of English pale malt, some crystal malt, and a hint of chocolate malt for color.

Hopping is also traditional, a combination of Challenger and Fuggle with additions at 40 minutes for bittering and 10 minutes before flame out for aroma. The beer, after chilling and fermentation using Thwaites Brewery's yeast, goes into firkins the second day to create natural carbonation. Well, mostly firkins, in summer the sizes go up to 18-gallon (that's imperial, so 21 US gallons/79 liters) kilderkins, or kils.

Talking makes for thirst, so a pint of Bosun Bitter was in order. Jill Phillips, Paul's wife, poured "a proper pint," which took nearly a minute using a traditional beer engine. The beer was bright, barely any sign of haze, and with a wonderful copper color. The head touched the rim of its traditional English beer glass, and there was modest aroma from the Fuggle and Challenger hops. In the mouth, Bosun



Paul Phillips and Old Laxey Brewing Co. brew just one beer, Bosun Bitter, on their 5-barrel system, which can be seen behind Paul in the photo on the right.

Bitter was firmly hopped, with lingering hop bitterness, and clean. I could taste the malt (my best guess, Golden Promise) and modest crystal to deliver both sweetness and mouthfeel.

"I'm very pleased with what we produce. It's what we don't put in our beer that makes it different. We stop the beer from working (fermenting); we put it to sleep with some residual sugars by chilling and it carbonates naturally as it warms. We cannot aid the beer in any way; there are no CO₂ additions," Paul explained.

HOODED RAM BREWING COMPANY

Departing Laxey, I boarded the Manx Electric Railway to Douglas' Derby Castle Terminus, and then rode the 140-year old Douglas Bay Horse Tramway as it clopped and wobbled along Loch Promenade to the IOM Sea Terminal. I then walked along Kerrin Oonlee (Bath Place in Manx) and over the swing bridge crossing the River Glass, then meandered down Castletown Road.

Passing muffler shops, auto mechanics, and warehouses, I wondered if Siri was leading me astray. Then a large charcoal building with a giant ram logo appeared. At last, a clue! Once inside, I met Rob Storey.

Rob, while working in finance, had the good fortune to join CAMRA, be-



came local secretary, and eventually organized the 2011 Manx CAMRA Beer Fest. Rob saw that there was a great quantity of beer imported. "Seeing a business opportunity, I decided to give it a go," he told me.

In 2012, Rob booked a brewing course at Sunderland Brewlab in the UK, having never homebrewed. He left with a 300-page brief "that had almost no relevance to what happened, in the end." Visiting Loch Ness Brewery in Scotland to look at their 2.5-barrel system, he then bought a second-hand brewing system from Three Kings Brewery in North Shields, Scotland. His first brew on the Isle of Man was September 15, 2013, Little King Louie IPA, named after his son, and a recipe he'd sketched while at the brew course.

It was bottled, kegged, filled into casks, and canned in a previous facility. On Hooded Ram's first birthday they increased the brewhouse to ten barrels. "In the early days we would brew, bottle, and bottle condition. Mom and Dad would come and stick labels on the bottles; very much a family affair," Rob explained.

From the start, Hooded Ram has set out to make its brand distinctive from other options on the island. "Beer on the island, before I started brewing, filled a narrow margin of what beer and real ale is. The exception is Okell's, who have made some exceptional beers, even winning the World Beer Cup!" Hooded Ram does a lot of — by Manx standards — very hoppy beers. "Some people complain that we use too many hops — there is no such thing! If you want brown and wet, that's made on the island as well."

Hooded Ram is "now on recipe 68 in five years, some to be brought back, some not." A previous brewery was accessible; people could visit, tour and smell the brewing process. That's something the new brewery doesn't (yet) offer.

The first recipe, Little King Louie, has remained unchanged since the recipe was drawn, Fat Ram (recipe #5) has undergone a hopping tweak, and Amber Ram (which Rob says makes up 40 percent of sales) "was recipe number six or seven." They also make pilot brews that they refer to as



Hooded Ram's industrial plant includes small test-batch production, as well as new stainless and wood-jacketed tanks.

Manx Beer Clone Recipes



OLD LAXEY BREWING CO.'S BOSUN BITTER CLONE (5 gallons/19 L, all-grain)

OG = 1.036 FG = 1.007 IBU = 30 SRM = 11 ABV = 3.8%

While the gravity and ABV might lead you to think this is a watery beer, it is not. Mashing in relatively warm and the addition of crystal malts make for a nice mouthfeel. The low ABV makes it an easy beer to enjoy pint after pint. And that's the way it is meant to be.

INGREDIENTS

- 7.5 lbs. (3.4 kg) Golden Promise or Crisp pale malt
- 4 oz. (113 g) British light crystal malt (10 °L)
- 4 oz. (113 g) British medium crystal malt (55 °L)
- 3 oz. (85 g) chocolate malt (340 °L)
- 2.5 AAU East Kent Golding hops (40 min.) (0.5 oz./14 g at 5% alpha acids)
- 6 AAU English Challenger hops (40 min.) (0.5 oz./14 g at 12% alpha acids)
- 2.5 AAU East Kent Golding hops (10 min.) (0.5 oz./14 g at 5% alpha acids)
- 6 AAU English Challenger hops (10 min.) (0.5 oz./14 g at 12% alpha acids)
- 1 Whirlfloc tablet (10 min.)
- White Labs WLP005 (British Ale) or Wyeast 1098 (British Ale) or

Wyeast 1026 (British Cask Ale) or Safale F-2 yeast ½ cup corn sugar (if priming)

STEP BY STEP

Mill the grains and dough-in, targeting a mash of around 1.25 quarts of water to 1 pound of grain (2.6 L/kg) and a temperature of 156 °F (68 °C). Hold the mash at 156 °F (68 °C) until enzymatic conversion is complete. Sparge slowly with 170 °F (77 °C) water, collecting wort until the pre-boil kettle volume is 6.25 gallons (23.7 L).

Total boil time is 60 minutes. Add hops and Whirlfloc tablet as indicated. Chill the wort to 65 °F (18 °C) and aerate thoroughly. Pitch 1-quart (1-L) yeast starter if using liquid yeast or a package of dried yeast.

Carbonate the beer to around 1.5-2 volumes of CO₂ if kegging or bottling. If using casks, you may consider transferring two days after fermentation begins, being sure to take as little trub into the pin or firkin as possible.

OLD LAXEY BREWING CO.'S BOSUN BITTER CLONE (5 gallons/19 L,

extract with grains) OG = 1.036 FG = 1.007 IBU = 30 SRM = 11 ABV = 3.8%

INGREDIENTS

- 5 lbs. (2.3 kg) Maris Otter liquid malt extract
- 4 oz. (113 g) British light crystal malt (10 °L)
- 4 oz. (113 g) British medium crystal malt (55 °L)
- 3 oz. (85 g) chocolate malt (340 °L)
- 2.5 AAU East Kent Golding hops (10 min.) (0.5 oz./14 g at 5% alpha acids)
- 6 AAU English Challenger hops (10 min.) (0.5 oz./14 g at 12%

alpha acids)

1 Whirlfloc tablet (10 min.) White Labs WLP005 (British Ale) or Wyeast 1098 (British Ale) or Wyeast 1026 (British Cask Ale) or Safale F-2 yeast ½ cup corn sugar (if priming)

STEP BY STEP

Place crushed grains into a muslin bag. Heat 4 gallons (15.2 L) water to 160 °F (71 °C) with the grains submerged. Remove the grains and the pot from heat. Add the liquid malt extract in the brewpot, dissolving completely before adding heat again. Then top off with water to 6.5 gallons (25 L).

Total boil time is 60 minutes. Add hops and Whirlfloc tablet as indicated. Chill the wort to 65 °F (18 °C) and aerate thoroughly. There should be 5.5 gallons (21 L) of wort in the fermenter. Pitch 1-quart (1-L) yeast starter if using liquid yeast or a package of dried yeast.

Carbonate the beer to around 1.5-2 volumes of CO₂ if kegging or bottling. If using casks, you may consider transferring two days after fermentation begins, being sure to take as little trub into the pin or firkin as possible.

TIPS FOR SUCCESS:

This beer, from firkin, pin, keg, or bottle is meant to be served at cellar temperature, 47–55 °F (8–12 °C) and enjoyed by the imperial pint. Don't over-carbonate and don't over-chill.

Manx Beer Clone Recipes



HOODED RAM BREWING COMPANY

HOODED RAM Brewing Co.'s Mosaic Clone

(5 gallons/19 L, all-grain) OG = 1.043 FG = 1.005 IBU = 22 SRM = 5 ABV = 4.9%

This is a relatively simple beer, one designed to showcase Mosaic® hops. By North American standards, it is modestly hopped. Enjoy an alternative to aggressively hopped beers.

INGREDIENTS

- 7 lbs. (3.2 kg) Golden Promise malt
 1.5 lbs. (0.34 kg) rye malt
 1 lb. (0.45 kg) light Munich malt
 8 oz. (233 g) white wheat
 6 AAU Mosaic® hops (60 min.) (0.5 oz./14 g at 12% alpha acids)
 4.8 AAU Mosaic® hops (10 min.) (0.4 oz./12 g at 12% alpha acids)
 1 oz. (28 g) Mosaic® hops (dry hop)
 1 Whirtfloc tablet (10 min.)
 Safale US-05, or White Labs WLP001 (California Ale) or Wyeast 1056 (American Ale)
- ¹/₂ cup corn sugar (if priming)

STEP BY STEP

Mill the grains and dough-in, targeting a mash of around 1.25 quarts of water to 1 pound of grain (2.6 L/kg) and a temperature of 156 °F (69 °C). Hold the mash at 156 °F (68 °C) until enzymatic conversion is complete, about 60 minutes. Sparge slowly with 170 °F (77 °C) water, collecting wort until the pre-boil kettle volume is 6.5 gallons (24.6 L). Total boil time is 60 minutes. Add hops and Whirlfloc tablet as indicated.

Chill the wort to 65 °F (18 °C) and aerate wort thoroughly. There should be 5.5 gallons (21 L) in the fermenter. Pitch 1-quart (1-L) yeast starter if using liquid yeast or a package of dried yeast. Transfer to secondary when fermentation is complete, adding dry hops for 1 week or less to avoid grassy flavor.

Carbonate the beer to around 1.5-2 volumes of CO₂ if kegging or bottling. If using casks, you may consider transferring two days after fermentation begins, being sure to take as little trub into the pin or firkin as possible.

HOODED RAM BREWING CO.'S MOSAIC CLONE

(5 gallons/19 L, partial mash) OG = 1.043 FG = 1.005 IBU = 22 SRM = 5 ABV = 4.9%

INGREDIENTS

- 5 lbs. (2.3 kg.) Maris Otter liquid malt extract
- 1.5 lbs. (1.36 kg) rye malt
- 1 lb. (0.45 kg) light Munich malt
- 8 oz. (233 g) white wheat
- 6 AAU Mosaic[®] hops (60 min.) (0.5 oz./14 g at 12% alpha acids)
- 4.8 AAU Mosaic[®] hops (10 min.) (0.4 oz./12 g at 12% alpha acids)
- 1 oz. (28 g) Mosaic[®] hops (dry hop)
- 1 Whirlfloc tablet (10 min.)
- Safale US-05, or White Labs WLP001 (California Ale) or Wyeast 1056 (American Ale)
- ¹/₂ cup corn sugar (if priming)

STEP BY STEP

Heat 4.5 quarts (4.3 L) of water up to 168 °F (76 °C). Place crushed grains in a muslin bag and submerge in the water. Stir to make sure there are no dough balls in the grain bag. Try to maintain mash temperature in the 148–158 °F (65–70 °C) range for 60 minutes. Remove the grains and place in a colander. Wash the grains with 1 gallon (4 L) hot water. Dissolve malt extract into wort; and top off to 6.5 gallons (24.6 L).

Total boil time is 60 minutes, adding bittering hops at 60 minutes into the boil and again 10 minutes before flame out. Add Whirlfloc with 10 minutes left in the boil.

Chill the wort to 65 °F (18 °C) and aerate wort thoroughly. There should be 5.5 gallons (21 L) in the fermenter. Pitch 1-quart (1-L) yeast starter if using liquid yeast or a package of dried yeast. Transfer to secondary when fermentation is complete, adding dry hops for 1 week or less to avoid grassy flavor.

Carbonate the beer to around 1.5-2 volumes of CO₂ if kegging or bottling. If using casks, you may consider transferring two days after fermentation begins, being sure to take as little trub into the pin or firkin as possible.

TIPS FOR SUCCESS:

Because Manx water is so soft, the brewer Rob Storey Burtonizes the water for this beer (his schedule is Na+ 400, Cl- 200, HCO- 325-50, Ca+ 170 g/bbl). Yours will be different unless starting with reverse osmosis or very soft water.

For his lower hopped beers, Rob first chills to 64–65 °F (17–18 °C) to assist in cold break, then runs off into the fermenter at (65–66 °F (18–19 °C) before pitching. Several yeasts are used; a majority of Hooded Ram's beers are fermented with Safale's US-05 yeast, others with Lallemand's Nottingham.

Manx Beer Clone Recipes



OKELL'S BREWERY'S MILD CLONE

(5 gallons/19 L, all-grain) OG = 1.029 FG = 1.006 IBU = 12 SRM = 10 ABV = 3%

INGREDIENTS

- 5 lbs. (2.3 kg) Golden Promise malt
 14 oz. (400 g) British light crystal malt (20 °L)
 1 oz. (30 g) British medium crystal malt (60 °L)
 1.4 oz. (40 g) black malt (500 °L)
 2 oz. (57 g) treacle (100 °L)
 5 oz. (140 g) invert sugar
 1.1 AAU Fuggle hops (60 min.) (0.25 oz./7 g at 4.5% alpha
- acids) 2.2 AAU Fuggle hops (60 min.) (0.2 oz./6 g at 11% alpha acids) 0.15 oz. (4 g) Fuggle hops (5 min.) 0.15 oz. (4 g) East Kent Golding
- hops (5 min.) 1 Whirlfloc tablet (10 min.) Safale S-04 or White Labs WLP002 (English Ale) or Wyeast 1968 (London ESB Ale) ½ cup corn sugar (if priming)

STEP BY STEP

Mill the grains and dough-in, targeting a mash of around 1.25 quarts of water to 1 pound of grain (2.6 L/kg) and a temperature of 156 °F (68 °C). Hold the mash at 156 °F (68 °C) until enzymatic conversion is complete, about 60 minutes. Sparge slowly with 170 °F (77 °C) water, collecting wort until the pre-boil kettle volume is 6.5 gallons (24.6 L).

Total boil time is 60 minutes.

Add hops and Whirlfloc tablet as indicated. Chill the wort to 65–68 °F (18–20 °C) and aerate thoroughly. There should be 5.5 gallons (21 L) of wort in the fermenter. Pitch 1-quart (1-L) yeast starter if using liquid yeast or a package of dried yeast.

Carbonate the beer to around 1.5-2 volumes of CO₂ if kegging or bottling. If using casks, you may consider transferring two days after fermentation begins, being sure to take as little trub into the pin or firkin as possible.

OKELL'S BREWERY'S MILD CLONE

(5 gallons/19 L, extract with grains) OG = 1.029 FG = 1.006 IBU = 12 SRM = 10 ABV = 3%

INGREDIENTS

- 3.3 lbs. (1.5 kg) Maris Otter liquid malt extract
- 14 oz. (400 g) British light crystal malt (20 °L)
- 1 oz. (30 g) British medium crystal malt (60 °L)
- 1.4 oz. (40 g) black malt (500 °L)
- 2 oz. (57 g) treacle (100 °L)
- 5 oz. (140 g) invert sugar
- 1.1 AAU Fuggle hops (60 min.) (0.25 oz./7 g at 4.5% alpha acids)
- 2.2 AAU Fuggle hops (60 min.) (0.2 oz./6 g at 11% alpha acids)
- 0.15 oz. (4 g) Fuggle hops (5 min.) 0.15 oz. (4 g) East Kent Golding
- hops (5 min.)
- 1 Whirlfloc tablet (10 min.)
- Safale S-04 or White Labs WLP002 (English Ale) or Wyeast 1968 (London ESB Ale)
- 1/2 cup corn sugar (if priming)

STEP BY STEP

Place crushed grains into a muslin bag. Heat 4 gallons (15.2 L) water to 160 °F (71 °C) with the grains submerged. Remove the grains and the pot from heat. Add the liquid malt extract in the brewpot, dissolving completely before adding heat again. Then top off with water to 6.5 gallons (25 L).

Total boil time is 60 minutes. Add hops and Whirlfloc tablet as indicated. Chill the wort to 65–68 °F (18–20 °C) and aerate thoroughly. There should be 5.5 gallons (21 L) of wort in the fermenter. Pitch 1-quart (1-L) yeast starter if using liquid yeast or a package of dried yeast.

Carbonate the beer to around 1.5-2 volumes of CO₂ if kegging or bottling. If using casks, you may consider transferring two days after fermentation begins, being sure to take as little trub into the pin or firkin as possible.

TIPS FOR SUCCESS:

The water used at Okell's is soft, so they Burtonize their water with salts for best results in the Mild. The beer should be ready to drink only a few days after fermentation is complete, adding necessary time for bottle conditioning or keg carbonation. If kegging, I'd suggest natural carbonation in the keg. "Funky beers, for the Manx palate on a 26-gallon (100-L) system."

In addition to more hops, Hooded Ram also strays from the island's norm with unique ingredients and styles. As stated earlier, the Manx Brewing Purity Act is still in effect that said, Hooded Ram is clearly pushing the limits with beers that include ingredient additions of chai, mint, chocolate, and other non-traditional brewing ingredients. When asked about the discrepancy related to the law, Hooded Ram's Founder and recipe designer Rob Storey said it's a gray area and the law is open to interpretation. "It's a good question and one I have been seeking an answer to as no one is able to tell me what the repercussions are for not complying, but almost anything can now be added, and I believe so long as they are not "substituting" one of the four core ingredients they are "additions."

Their Black Pearl Oyster Stout is one beer that stretches the limits. "We smashed it full of Scottish oysters. We brewed while eating oysters stewed in brewing liquor pulled from the kettle, and while drinking the previous ovster stout. It was all very decadent." They have done other experimental brews — a Chai IPA, a spice-aged beer, a brew with a late pineapple juice addition, another with orange and black pepper, a key lime pie beer, and a chocolate mint stout, which Rob says, "worked quite well. We cask aged our normal stout with fresh mint and Madagascar cocoa nibs."

In other ways, the brewery adheres to old-school British brewing. "Only leaf hops, which pushes our kettle to the limit as we have no whirlpool (yet), and no lauter tun. We use English grain, with some Manx rye, and our hops are partly English," Rob said. "The majority of our hops come from the Yakima Valley."

"What we do is so simple — until we start to bottle and have to worry about bacteria and wild yeast," Rob confided. That concern will be magnified when Hooded Ram begins to can their beers, hopefully this year.

"English beers are so easy — and then we smash it full of American hops!" Rob says.



Consultant Brewer Dr. Mike Cowbourne inside Okell's Brewery, in Douglas.

OKELL'S BREWERY

Okell's is the island's oldest continuously operating brewery. Its history begins in 1850 when Dr. William Okell opened his first brewery, at the time outside Douglas. Dr. Okell soon outgrew the original location and custom-built a new brewery, the Falcon Steam Brewery, which opened in 1874. As a scientist, he created a forward-looking, steam-fired brewery. Okell's now brews a large array of beers for local consumption, and also distributes to pubs "over" on the mainland, supplying them in casks, bottles, and kegs from a new brewery built in 1994.

Okell's has three beers on permanent cask, 13 seasonal cask beers, and three bottled beers. Their brewery is the island's largest with a 20,000-barrel annual capacity (10,000 barrels of ale, another 10,000 barrels of lager). Okell's is the most fully featured brewery on the island and is the least visitor-friendly, as it is contained within an enormous warehouse.

That didn't stop Consultant Brewer Dr. Mike Cowbourne from welcoming me warmly on my latest visit by offering a handshake and a fluorescent lime-green safety vest.

We traipsed through the warehouse of Heron & Brearley's, a major Manx hospitality industry importer and owner of Okell's. After climbing multiple flights of stairs we reached Okell's impressive brewhouse. Clad in wood and topped by stainless domes, were eight kettles. These are unique in all of the UK, as they are not heated by steam or direct-fired. Instead, wort is heated using "a wide-gap plate-andframe heat exchanger, the only one in the British Isles," Mike told me.

At first, Okell's brewed only bitters and milds, similar to most English breweries. "Our Mild used to be 3.4% ABV, which was quite strong for a Mild, when most were 3.0–3.2," Mike said. In 1996 Okell's brewed their first special brew, a strong bitter, for the Onchan Commissioner's celebration. From that modest beginning, their fleet of offerings has grown.

At the other end of the room filled with coppers was the computer-driven command center, offering Mike a Doctor of Biochemistry — retrieval of all recipes and control over the mash tun — which is multi-step capable. In the original brewery design, lagers were important to both revenue and growth. Labatt Brewing Co. and Carling were willing to license their beer to be brewed at Okell's, and Labatt was chosen because of its Formula 1 sponsorship. At the time, F1 driver Nigel Mansel lived on the Isle of Man, an obvious connection. When Nigel and the opportunity vanished, Okell's tried their own "cooil" or cool in the Manx language, which was semi-successful at 4,000 barrels per year, while making and selling 10,000 barrels of ale. Lager is no longer made, as consumption has dropped on the Isle of Man. Thus, several bright tanks now sit idle.

Okell's Bitter, their best seller, is a typical English bitter at 3.7% ABV. "There's quite an art, I think, in making a beer that is very low ABV and drinkable, and sessionable. Not sessionable because of low ABV, but because you want another pint," the brewer opined.

The next highest seller is Manx Pale Ale, or MPA, at 3.6% ABV, a hoppy-citrusy and light-in-color beer that is atypical of British bitters. It was developed for Okell's Yorkshire pubs. That makes Okell's a provider of non-standard beers (for England). Though Mike considers it unbalanced towards hops, it's a big seller.

Mike says 5.5% ABV is the maximum Manx drinkers will approve. That said, his 1907 (first brewed to commemorate the centenary of the Manx TT races in 2007) is bottled at 6.1% ABV (a draft version is 4.5% ABV). The 2018 batch sold out all 20 imperial barrels in just four days! Perhaps the higher-ABV revolution is trans-continental?

"Our hopping regime is fairly conservative. When we're about half way to copper-full we put the first lot in, and start heating. They're pure bitterness hops of all sorts, mainly English, though we do use American, Australian, and New Zealand hops. When we moved here in '94, we were using only English hops, mainly Fuggle and Goldings, some Challenger," Mike continued.

"Five minutes before the end of

the boil we add more hops. When going to whirlpool we add more hops. For most of the seasonals and specials we will dry hop in the fermenter, at end of fermentation."

The best beer Okell's has brewed, in Mike's opinion, is a smoked porter using distiller's peated malt. "Aile" smoked porter won gold in Best Specialty Beer (against Sam Adams Utopias!) and Best Specialty Beer in the World at the International Beer Challenge (Sussex, England, 2016). However, "If I'm having only one or two, I'll drink Triskelion, basically a West Coast IPA." At 5-percent ABV it's low on our scale, but it's a higher ABV beer for Manx drinkers. For Triskelion, Mike uses Cascade, Amarillo[®], and Citra[®] hops. Note that UK brewers formerly dismissed North American hops as unusable, but seem to have come around!

LOOKING FORWARD

Asked about the future of beer on the Island, Mike said, "We're slowly following the UK, which is slowly following the States. Last year we did a Northeast IPA — cloudy, murky, citrus fruit bomb. (It was) the first time we've intentionally sold a cloudy beer; it's sloppy brewing," he said, ruefully.

New England IPA may be a passing fad on the island, or it may continue. At Okell's, that will depend on the next brewer; Mike is retiring soon. According to Rob, Hooded Ram "Likely will see what we can do with the style." It's certainly not in the future at Old Laxey Brewing Company.

As to the future of native beer, midst the increase of alco-pops of endless variation, I like a comment Rob made while we were talking.

"I think the most important change is the attitude of younger drinkers. Instead of 'How many pints can I get for 20 quid?' now they want an *experience* to share on Facebook, WeChat, and Instagram," he told me. That seems similar to what many brewpubs in the States are creating, "the experience."

And oddly, while some of the Manx breweries explore higher-ABV beers and new styles, many of our domestic breweries are turning, at least partly, away from high-ABV products and returning to perfectly crafted session beers and traditional styles. Long live the revolution! m



Consultant Brewer Dr. Mike Cowbourne filling casks at Okell's.

YEASTS & FERMENTATION SOLUTIONS

Make it Casy.



With E2U[™] active dry yeasts, you can pitch directly or rehydrate; depending on your equipment, habits and feelings. We offer you the opportunity to make your life easier, and eventually contribute to sustainability by saving water and energy. Any process you choose, we will be happy to ensure you the highest standards of quality, productivity and security. Discover all our solutions on www.fermentis.com



SAVE TIME. GET COMFORT. ACT GREEN.

Insulation for Single Vessel Brewing Experimenting with Reflectix and more

he wisdom among all-grain (and partial mash) homebrewers is that you want to hold your temperatures as steady as possible for each step of your mash. Meanwhile, the desire among single-vessel brew-in-a-bag (BIAB) brewers is to keep the process as simple as possible and the gear to a min-imum. As just such a brewer (all-grain, single-vessel BIAB), that was the challenge in front of me: How do I hold a reasonably steady mash temperature while staying true to my goal of single-vessel simplicity?

My friend Aaron Ritchie (you may remember him from the March-April 2018 Brew Your Own article "Big Batch BIAB") suggested that I try using Reflectix insulation (which we lovingly refer to as "battle armor") to help meet that challenge. It's relatively inexpensive; it's durable enough to easily last dozens, if not hundreds, of brew days; and given that it was designed to insulate houses and ductwork, why wouldn't we give it a shot?

by Rob Friesel

46 NOVEMBER 2018 BREW YOUR OWN



IMPORTANCE OF MASH TEMPERATURE

First of all, why is a steady mash temperature important at all? I won't pretend to be an expert, but I've read a lot, so I'll turn to my bookshelf.

In The Complete Joy of Home Brewing 3rd Edition (2003), Charlie Papazian writes:

The time it takes to fully convert starch to dextrins and fermentable sugars varies with temperature, amount of enzymes and amount of starch to be converted.

Generally, higher temperatures will inspire quicker conversions but will produce more dextrins.

Then there's John Palmer, who in *How to Brew* (2006) notes:

Each of these enzyme groups can be influenced by different temperature and pH conditions. However, enzyme activity is usually more dependent on temperature than on pH. You can adjust the mash temperature to favor each successive enzyme's function and thereby customize the wort to your taste and purpose.

Gordon Strong asserts in Brewing Better Beer (2011):

One of the biggest misconceptions about enzymes is that they work like transistors or diodes — that they just switch on or off under specific conditions. Don't think of it as a switch, think of a bell curve — there is a region where the enzymes are most active, but they are still functioning outside the prime temperature range. However, once enzymes are heated beyond their normal functioning range, they begin to denature (or break down), an irreversible process.

Putting these bits of knowledge together, we can conclude that temperature matters because:

- It has the most significant influence over the activity of different enzymes.
- 2. Letting the temperature get too cool can slow the activity for certain critical enzymes.

3. Letting the temperature get too hot can start to denature those enzymes, slowing or even halting their activity altogether.

In other words, let the mash temperature drop too low and alpha amylase isn't working as quickly as you expect; start too warm and run the risk of denaturing too much beta amylase before it has had a chance to work. In both cases, there's a risk that you might not get full conversion. In the former case, you might end up with wort that's more fermentable than you expected, lowering the final gravity and increasing the strength while decreasing the body. In the latter case, you might wind up with a more dextrinous wort with a higher-than-expected final gravity and thus more body and a lower ABV.

Or even more succinctly: If you can't hold a steady temperature, you won't end up with the wort you wanted, and therefore might not get the beer you wanted.

MASH TEMPERATURE CONTROL METHODS

Before jumping in with the Reflectix, we should consider what other methods are out there for controlling mash temperature in a single-vessel BIAB system.

The obvious first response is: "Why not just use a dedicated mash-lauter tun (MLT)? Something like a converted picnic cooler with a false bottom?" And to that I would respond that that's a great idea! Except for the part where I'm trying to keep my process as simple as possible and my gear to a minimum. There's nothing wrong with an MLT, it just doesn't fit my brewing style. (I'd rather save money on gear so I can spend it on ingredients.) But stating this up front helps to put a ceiling on how complicated (gearwise, at least) we want our mash temperature control process to get - in other words, no RIMS (recirculating infusion mash system) or HERMS (heat exchange recirculating mash system) in this list!

Bath Towels

If we're talking about simplicity, then

it doesn't get any simpler than wrapping the kettle with a couple of bath towels. This is where I started when I did my first partial mashes on the stovetop. I would grab two or three towels from the bathroom closet and, after mashing in, drape them over the kettle. Typically, I would cinch the towels with bungee cords to keep them snug.

The pros here are that you've almost certainly got a couple of bath towels lying around; simply re-purpose them for an hour or two on your brew day. As an added bonus, you'll now have those towels handy to help with any cleanup as the day progresses.

The cons are that the towels themselves are not great insulators. Looking over my brew day notes from that period, I would lose on average of 6-8 °F (3.3-4.4 °C) per hour during the mash. This is better than heat losses from a naked kettle, but it's hardly great. Also, towels are flammable, so if you're not careful they can present a fire hazard.

Kettle Cozy

Another option is to build a kettle (or tun) cozy like the one James Gilbert described in the December 2015 issue of Brew Your Own (or online at https://byo.com/project/keep-mashtun-insulated/). Gilbert's method is to use insulating expanding spray foam to create a custom-fit removable shell for the kettle. I won't go into the details of the build here, but suffice it to say that he claims the project can cost as little as \$25 and you can bang it out in a couple of short work sessions (plus the 24-48 hours of waiting while the spray foam sets and cures). A picture of Gilbert's kettle cozy can be seen on page 49.

Reading Gilbert's article, there seem to be a number of pros here. First, after the build, you end up with a sturdy and reusable insulated shell that is the perfect size for your kettle. Second, the spray foam has good insulating qualities and can restrict overall heat loss to approximately 4 °F (2 °C) per hour.

On the cons side, the shell is somewhat bulky, so if storage space is at a premium, this may pose a challenge. Also, while Gilbert describes the project as fairly easy, I'm going to once again invoke my laziness and say: "Looks like too much work for me."

Multiple Infusion Mash

If you have an extra kettle and heat source, you could try to hold the mash temperature through multiple infusions over the course of the mash. If you've ever performed a step mash then this technique is similar. You start your mash at a known temperature and, with an idea of your heat loss over time, make subsequent infusions of hot water at set intervals to raise that temperature back up to the desired range. Where this technique differs from the step mash is that you are not performing multiple rests at multiple different temperatures; instead you are trying to stay as close as possible to your target temperature for as long as possible.

For example, if you are trying to hold a mash temperature of 152 °F (67 °C) for 60 minutes, you could make infusions after 15, 30, and 45 minutes in an effort to maintain that temperature. For example, on my system, I might calculate a total of 30.16 qts. (28.54 L) of water needed for the mash, and I might expect a naked kettle to lose 10 °F (5.5 °C) over that hour. I could knock back the initial infusion to 18.16 qts. (17.19 L) and add 4 qts. (3.8 L) at 162.5 °F (72.5 °C) after 15 minutes, then another 4 qts. (3.8 L) at 164.5 °F (73.6 °C) after 30 minutes, and lastly 4 qts. (3.8 L) at 166.5 °F (74.7 °C) after 45 minutes.

There are a couple of pros to using this method. First of all, if performed with precision, you can hold your mash temperature to between 1-2 °F (0.6–1.1 °C) for the duration of the mash. Another potential upside is that you can take advantage of a thicker mash, particularly in the early stages of the mash schedule. The other pro is that, depending on your system, you probably already have a large-enough kettle left over from your early brewing days, and your stovetop is likely powerful enough to heat the volume you need in the time you need.

This method isn't without its cons though. First of all, though you probably have that extra kettle, it's still another piece of gear to wrangle. Second, be prepared to do a lot of math. Even if using homebrew software, you need to figure out how much water you need for your mash overall, make some choices about the size of each infu-



what the temperature will actually be at each of those intervals. Therein lies the third wrinkle: It might be difficult to predict just what the mash temperature will be at each of these intervals. The temperature loss isn't necessarily linear, and is influenced by a number of factors that include (but are not limited to) the material of the mash tun, whether you're using insulation, how much headspace is in the tun, what the liquor-to-grist ratio is, and what the ambient temperature is. As a result, you wind up having to either place faith in your guesses and ride it out, or else take temperature measurements with each infusion, plug them into your calculator, and adjust on the fly. And that's assuming that your heat source can keep up with demand. And that you're not making mistakes along the way.

sion, and do some guesswork around

Having tried this method a couple of times, let me just say that it's not for the faint of heart.

Periodic Direct Heating

In the same vein as the multiple infusion mash method, you can periodically apply direct heat to your kettle with an eye toward holding the temperature in the right range. The general idea is that, as the mash progresses, you would stir to homogenize and sample the temperature at intervals. If the temperature is holding within a certain margin (e.g., 1-2 °F or 0.6-1.1 °C) then you just leave it alone until either the next reading or whenever you can reasonably predict that it will go out-of-band. If it the mash does fall below the threshold, then you would apply direct heat to the kettle, stirring the whole time, and then shutting off the heat when the temperature gets back to its target.

This method has a couple of items in the pros column. First, it doesn't require any additional gear. You're using the same kettle, heat source, thermometer, and stirring utensil that you did when you mashed in. Second, with knowledge of your system and attention to the heat, you can hold those temperatures within a couple degrees of your target.

Of course, as with all of these



Other than the Reflectix material itself, making Reflectix insulation for your kettle/mash tun requires no special tools.



When fitting the Reflectix, mark handles or any ports your kettle has one at a time, cut a slit for it to poke through, and then go to the next one.

methods, there are a couple of cons. The biggest potential con is the risk of scorching your grains or having your grain bag "fuse" to the bottom. Either of these events could ruin a batch - either by imparting inappropriate burnt flavors or destroying your brew bag (and maybe your kettle) in the process. This method also takes nearly constant monitoring of your mash. The other major con here is that, unless you know your system very well, applying the direct heat is still a bit of a guessing game. Is one minute of heat enough? How about two? How quickly does your thermometer update? Did you accidentally overshoot the target temperature by a degree or two? Or more? Lastly, if you are using some kind of insulation around your mash tun, this method translates into tedious "undressing" and "redressing" with each application of heat — otherwise you wind up burning the insulation in the process.

I've used this method many times, and while I can say confidently that it works, I can also say that it's way more tedious than I want for my brew day.

ENTER THE REFLECTIX INSULATION

Seeking that happy medium between effectiveness and simplicity, I turned to the Reflectix insulation. As mentioned earlier, the material is designed to insulate homes, ductwork, hot water heaters, and other objects where heat loss is a concern. I picked up 25 linear feet (7.6 meters) of the 24-inch (60-cm) wide Reflectix at my local hardware store for about \$25. It's quite a bit more than I needed, but this way I could fashion insulated wraps for both of my kettles.

Creating the Reflectix battle armor was easy. Here were the steps I took:

- Get your kettle dimensions. You'll want to know the height and the diameter. From the diameter you can derive the circumference.
- 2. Roll out Reflectix equivalent to the circumference, then maybe add an inch or two to give yourself some buffer. Cut this off of the roll.

- 3. Using the height of the kettle, mark how much Reflectix you need to cut off. I used a long straightedge and a permanent marker to draw a line, then I just used a pair of sharp scissors to trim the excess. A utility knife would work equally well.
- 4. Hold the Reflectix up to your kettle and start to wrap it around. You will want to use the permanent marker again to mark where the handles are. Use the scissors or utility knife to cut slits for the handles to poke through. For best results, cut the slit for the first handle before continuing with the wrap and marking the second. Optionally, if your kettle has ports, mark and cut gaps for these as well.
- 5. Roll out some more Reflectix, this time at least equal to the diameter of the kettle. Place the kettle lid on top of this stretch and trace the lid with the permanent





ElectricBrewing supply www.ebrewsupply.com







^{photos} by Rob Friesel

After fitting Reflectix around the kettle, trace the circumference of the lid to size a piece for the top of it.

The finished kettle wrapped in Reflectix "battle armor."

marker. Once again, use the scissors or utility knife to cut out the insulation.

- Place this circle of insulation on top of the kettle lid and mark where the handle is. Use the scissors or utility knife to cut a slit for the handle to poke through.
- 7. Double-check everything to make sure it fits around the kettle. If you have enough overlap, you could use Velcro with adhesive backing on the Reflectix to hold it together. Otherwise, just wrap a couple bungee cords around the kettle.

Voila! Now we have our custom-fit "battle armor" insulation ready for brew day.

DOES IT ACTUALLY WORK?

I'll admit that when I first made my "battle armor," I just took for granted that it worked. In other words, I assumed that because I used a material designed for insulation, that it would hold the mash temperatures pretty darn close to target.

But when I did my first mash with the Reflectix on, I noticed a loss of about 5 °F (2.8 °C) over 60 minutes. This was better than when I'd been using the towels but not quite the improvement I expected. The second time I used the Reflectix, I noticed that I lost 4.4 °F (2.4 °F) over 60 minutes. I continued to track these temperatures (like I always had) over the next couple months, and saw the trend was that I lost somewhere in the vicinity of 3-5 °F (1.6-2.8 °C) per hour — not what I'd hoped, but better than the 6-8 °F (3.3-4.4 °C) I had been getting with towels on the stovetop.

Finally, I decided to put this to the test and devised a little experiment with seven steps.

 I would fill my 10-gallon (38-L) kettle up half way with 5 gallons (19 L) of water.

- I would heat the water to 150 °F (65.5 °C).
- 3. Every 15 minutes I would perform 10 seconds of stirring to homogenize the water, then record the temperature.
- **4**. After 60 minutes, I would record the terminal temperature.
- 5. I would do this with a "naked" (i.e., uninsulated) kettle.
- 6. And again with a single layer of Reflectix.
- 7. And then again with a double layer of Reflectix.

I chose these conditions because they seemed a reasonable facsimile of what might go down for a typical mash on a typical brew day. While there was no actual grist, and slightly less water than my usual BIAB mash, the times and temperatures would be



is now



Our mission remains the same - connecting family hop farms to the world's finest brewers. Visit us at YAKIMACHIEF.COM

AMERICAN HOPS FROM THE PACIFIC NORTHWEST



Time	No Insulation	Single Layer Reflectix	Double Layer Reflectix
0:00	150.0 °F (65.5 °C)	150.0 °F (65.5 °C)	150.0 °F (65.5 °C)
0:15	149.0 °F (65.0 °C)	149.0 °F (65.0 °C)	149.0 °F (65.0 °C)
0:30	146.5 °F (63.5 °C)	148.0 °F (64.5 °C)	148.0 °F (64.5 °C)
0:45	142.5 °F (61.5 °C)	146.0 °F (63.5 °C)	146.5 °F (63.5 °C)
1:00	140.0 °F (60.0 °C)	144.5 °F (62.5 °C)	145.5 °F (63.0 °C)

Table 1: Average temperature for each condition at 15-minute incremental observation point.

pretty normal.

In Table 1 (above) and Chart 1 (below) you can see the results. Having run the experiment twice, I observed that on average the naked kettle lost 10 $^{\circ}$ F (5.5 $^{\circ}$ C) over an hour, while the single layer of Reflectix lost only 5.5 $^{\circ}$ F (3 $^{\circ}$ C), and the double layer lost 4.5 $^{\circ}$ F (2.5 $^{\circ}$ C).

In other words: It works! Still not quite as well as I'd hoped, but certainly better than nothing at all.

CONCLUSION

The Reflectix insulation is an inexpensive way to make a serviceable insulated jacket for your kettle. For BIAB brewers who place a premium on simplicity, it doesn't get much better than this. You can make yourself a jacket in just a few minutes, and from there on out you can reasonably expect to hold your mash temperature within 3-5 °F (1.6-2.8 °C) over the course of an hour.

Even though I started off using the Reflectix with a blind faith as to its usefulness, the experiment (along with the other data I've collected over the past couple months) has convinced me that it's a worthwhile part of my brewing process.

(P.S. If anyone is wondering what happened to the 5 gallons (19 L) of water from the experiment, fear not! It was not wasted, I used it in a batch of mead I made that afternoon.) **(Proceeding**)



Chart I: Average temperature loss as a function of insulation

WE BREW WITH YOU. CONSISTENT, RELIABLE BREWING YEASTS & BACTERIA

Take control of the brewing process, exercise your full creativity, and impart the exact aromatic and flavor qualities you desire. With unparalleled purity and unmatched technical support, at *Lallemand Brewing* we take pride in helping you perfect your craft.

DISCOVER LALLEMAND BREWING'S FULL RANGE OF PREMIUM BREWING YEAST & BACTERIA



www.lallemandbrewing.com

PRECISE BREWING CONTROL

- Precise temperature and time control
- Multiple mash step temps & durations
- Automatic boil-detect
- Multiple hop insertion alarms
- Pump venting & grain resting control
- Controls cooling to fermentation temp
- Controllers for 1, 2 and 3 vessel systems

www.EINBREW.com

NB

VEN 13





Gas vs. Electrical Heat Sources

By John Blichmann

ver since I started homebrewing in the early '90s, heating water quickly has been a challenge. A watched pot truly never boils. Until you walk away. Then it makes a colossal mess and gets you permanently banned from the kitchen. If you're like most brewers, you take on your first batch with a stovetop extract batch using a kettle that isn't big enough for boiling all the wort at once. Residential stoves are great for the 1- to 2-gallon (4- to 8-L) batch sizes, but they just aren't powerful enough to boil much more than 2 or 3 gallons (8 or 11 L) of water. To accommodate doing larger 5-gallon (19-L) batches on a stovetop, with a smaller volume kettle, a concentrated wort boil is the typical solution. This is done by adding water in the fermenter to dilute the wort to your desired original gravity. That's how I started brewing, as have many brewers over the years. But I quickly wanted to do larger 10-gallon (38-L) batches, and also wanted to dive into all-grain brewing. And that is where the heat source dilemma first reared its ugly head.

There are basically two types of energy readily available: Fuels such as propane and natural gas, and electricity. In this article I'll discuss the pros and cons of each, and how to properly and safely use each type of energy. While electric brewing is becoming more common, particularly with the all-in-one brewing equipment becoming available, propane is still the most common.

PROPANE AND NATURAL GAS

Other than the obvious chemical differences between these two fuels natural gas, which is mostly methane (CH_{4}) , and propane $(C_{3}H_{8})$ — there are several important physical and thermal differences. Natural gas is pumped to your home in gaseous form, and for safety reasons, at a fairly low pressure — usually less than 10 inches (25 cm) of water column (0.36 PSI, 2500 Pa). Propane, on the other hand, is available only in bottled form, typically 20- to 40-lb. steel pressurized canisters. Note that the propane is in liquid form inside the tank as it is at about 120 PSI at room temperature. The regulator on your propane tank will reduce that pressure typically from 1–10 PSI; many more times more pressure than that of residential natural gas.

The other main difference is that methane has less energy per cubic foot of fuel than does propane. Couple that with the low pressure available for natural gas and the result is that propane burners are capable of much higher ratings than the same burner run on natural gas. That's why propane burners remain the most common for homebrewing. They put out a lot of power for a relatively low price, are quite portable, and are more than adequate for even large batches.

There are a couple cons to using



A potential downside of using propane for your homebrewing heat source is in most scenerios it should only be used outdoors. Then again, outdoor brewing is fun when the weather is nice!

propane. The first is refilling tanks — you'll get about 3–5 batches out of a 20-lb. tank of propane, so the cost is around \$4–5 per batch. The second is inadvertently running out of fuel mid-batch (been there) is frustrating. So always have a spare tank on hand or make sure your tank is full before brew day.

Sizing for a gas burner is fairly straightforward. If you're doing 5gallon (19-L) batches, you'll want about 30,000-50,000 BTU/hour rating. For 10-gallon (38-L) batches you'll want about 50,000-70,000 BTU/hour for a reasonable heating time. A BTU (British Thermal Unit) is a measure of heat energy. The measure for burner power is BTUs consumed per hour (BTU/hr). That rating is the total heat output of the burner at the maximum rating. Measuring the actual output of a burner is quite simple if you have a scale that is accurate to about 0.1 lb. (0.5 kg) and can weigh up to about 30-40 lbs. (13-18 kg). Simply weigh the propane tank before lighting your burner, and then run the burner at full power for one hour. Weigh the tank again to measure the amount of fuel burned (starting weight – ending weight). Make sure you remove the regulator hose for each weighing so that it doesn't influence the measurement. Multiply this by the heat energy in 1 lb. of propane (21,700 BTU/lb.). For example, if your burner burns 1.5 lbs. of fuel in one hour, the rating is 1.5 X 21,700 = 32,550 BTU/hr.

From my experience, many published ratings are overstated, so don't always believe what is printed on the box. Doing a search online for other brewers' experience with a particular model, or reaching out to your local homebrew retailer is highly advised. One important thing to note is that the max rating is not the actual energy you're putting into your water! Only about 30–45% of that energy ends up being transferred through your kettle into your water! The remainder ends up heating the atmosphere. That leads to the next con of propane burners — ventilation. It is highly recommended to only use burners in an outdoor space. Not only

will the heat build up in an enclosed room, but so will the fumes potentially leading to asphyxiation and carbon monoxide poisoning. I wrote an article in the January-February 2017 issue of Brew Your Own for properly ventilating indoor brewing rooms for safe operation. However, if outdoor brewing doesn't work for you, natural gas is a much better choice for indoor use for safety and also convenience. Plus, natural gas is cheaper and is pumped to your house! I'll talk about converting burners for natural gas use in a bit.

While some brewers use multi-jet type "wok" burners due to their high output, I don't generally recommend them for homebrewing as they are not as adjustable as the traditional burners (many yellow flame at lower settings and blacken the bottoms of the kettles) and they are quite noisy. For very large kettles, 50-gallon (190-L) and larger, they are more common due to their high output potential. There are also "turkey fryer" burners that use a simple "cup" burner. They are very inexpensive and put out a reasonable amount of heat. But they are quite noisy and not very efficient.

ANATOMY OF A BURNER

Figure 1, below, shows the elements common to nearly all propane burners in the market today, although some will look different on different burner designs. Let's take a closer look at what each part does.

Venturi – This is the long neck where the fuel is mixed with a portion of the air needed for combustion. The mixture inside the venturi is too rich to burn. If you get too much air, you can get a back-lighting condition where the fuel burns inside of the venturi. This emits a growling sound. It is never advised to run any burner in this condition. Always assemble the burner according to the manufacturer's instructions. When the fuel exits the nozzles on the top of the burner, additional air is available for combustion. While some venturis are straight, most have a hyperbolic curve to them, much like cooling towers you see at electrical power plants. This shape allows air to be drawn in more efficiently from the jet of fuel that passes through the inlet.

Orifice – This is a brass fitting with a small hole at one end. This hole (or-



Figure I: Anatomy of a burner



Correct Burn: Ideally the flame is pale blue and never lifts off of the nozzles. This is the most fuel-efficient mode for operation and the best for transferring the heat to the water



Not Enough Air: When you see yellow flames, the fuel doesn't have enough air to burn and you'll need to open the damper to let more in. Yellow flames are not as hot as blue.



Too Much Air: If the flame begins to lift off of the nozzles and becomes a brighter blue, there is too much air and fuel for the nozzle to effectively burn.

ifice) controls the fuel delivery and creates a jet of fuel into the venturi. The hole diameter is tuned specifically for each burner for proper burn quality, so they are not interchangeable with other burners. The other end of the fitting is connected to the fuel hose leading to the tank, and may also have an adjustment valve affixed to it.

Damper – The damper controls the amount of air allowed into the venturi. The more open it is, the more air it draws in. Some burners require the damper to be adjusted to achieve the correct burn. Others use a fixed damper position.

Nozzles – Burner nozzles are where the fuel is mixed with more air and begins to burn.

Body – The body and frame of a burner not only supports your kettle and the burner itself, it also controls the flow of air to the outside of the burner and directs the heat energy onto the bottom of your kettle. In addition, the burner ring can shield wind gusts you'll experience brewing outdoors. Most are painted steel. The more premium material is stainless steel, which stays nice looking for years and will last for a very long time. If you're using a painted burner for the first time, expect some burning, fumes, and discoloration for the first few uses. I highly recommend a "burn-off" for an hour with no kettle on it for the first 30 minutes, and then with a full kettle on for the next half hour. Any char on the bottom of the kettle can be scrubbed off with Bar Keepers Friend. After that you shouldn't get too much more fumes from the paint.

BURNER ADJUSTMENTS

Adjusting a burner is fairly simple, but also very important to do. It is important to adjust the fuel and air flow using the damper for the most efficient burn. Ideally, the flame is pale blue and never lifts off of the nozzles. It will burn very quietly. This is the most fuel-efficient mode for operation and the best for transferring the heat to the water, not the great outdoors.

If the flame begins to lift off of the nozzles and becomes a brighter blue, there is too much air and fuel for the nozzle to effectively burn. You'll also hear a grumbling from the flame. To correct this, simply restrict the air flow using the damper. You may also need to reduce the fuel flow using the valve. Note that some regulators come with a fuel control knob that serves this function. While it is possible to continue adding fuel and air to increase the power and heating rate, it does create more combustion pollutants (NOx), which tends to make your eyes itch. In addition, the transfer efficiency of the fuel to your water is decreased. It also burns a lot of fuel.

If at any time you see yellow flames, the fuel doesn't have enough air to burn and you'll need to open the damper to let more in. The drawback with yellow flames is that they aren't very hot, and they soot the bottom of your kettle with black carbon that is annoying to remove. Also note that if the flames are reaching up the side of your kettle you'll want to pull back on the power. Those flames are not increasing the heating rate of the water and you'll likely begin damaging the valve and thermometer on your kettle. In all cases, I highly recommend shielding the ancillary equipment on your kettle from the heat of the burner with a metal plate or other shield. Some burners come with an integral shield. A rule of thumb is that if you can't comfortably rest your hand on the thermometer or handle of the valve it's too hot.

Several companies offer natural gas conversion kits for their burners and include a new orifice and a flow control valve. Note that you can't use your propane regulator on natural gas since the pressure for natural gas is much lower.

If your burner doesn't have a natural gas option, converting it to natural gas is pretty simple. All you need is a drill and a set of bits with several small diameters ($\frac{1}{32^-}$ to $\frac{1}{8^-}$ inch or so). The process is iterative. Increase the diameter of the orifice starting with the smallest drill size.

Hold the orifice in a vise and drill carefully. Brass is super easy to drill. Reinstall the orifice and connect the natural gas hose to the burner. You'll need a valve to control the gas flow. Note that the propane regulator supplied with your burner will NOT work with natural gas. Open the air damper about 3/4 open, not all the way. **Important:** Place a full kettle on top of the burner; the kettle influences the burn of the fuel. Turn on the gas all the way and light. You should see pale blue flames that do not lift off the nozzles. Repeat this process, increasing the diameter of the orifice until you see the flames start to turn yellow. Stop enlarging the hole at this point. Open the damper the rest of the way and the flames should return to pale blue again. That's it!

FINAL THOUGHTS ON GAS BURNERS

I do hear on occasion brewers concerned with scorching or wort darkening from high power burners. But I have never experienced this to be the case. In fact, I've run side-by-side tests with single-wall bottom kettles and multi-layer clad bottoms and haven't found any noticeable difference in wort darkening or heating rates between them. That said, always turn off the burner when adding malt extract as the thick syrup will quickly settle to the bottom and will scorch. Once you get it fully dissolved you won't have any troubles.

Safety considerations are paramount for burners. Never operate indoors without proper ventilation and a carbon monoxide detector. Keep at least 15 feet (4.5 m) away from buildings, and always operate on non-flammable, firm surfaces such as concrete (remember, a wood deck is flammable). Keep children away, and wear long pants and covered shoes for burn protection. Never store propane tanks indoors — propane is heavier than air and can fill your house with explosive vapors if there is a leak.

ELECTRIC HEATING SOURCES

Electric heating is really growing in

popularity and for a lot of good reasons. The pros are numerous, beginning with efficiency and ease. Electricity provides fast, efficient heating without requiring refilling propane tanks. Electric units are ideal for indoor use since nearly all of the power goes into the water and very little is discharged into the room. They operate silently, and ventilation requirements are minimal, as you only need to ventilate the vapors created by the boil. They are also extremely economical to operate costing about \$1 per batch in energy costs. The only cons with them, for the most part, are the availability of enough electrical power to operate them for larger batches, the higher equipment costs (particularly for larger batch sizes), and lastly, the lack of portability. So almost the opposite pros and cons of propane burners!

There are three predominant types of electric heating for electric brewing. Induction, immersion, and surface type heating.

INDUCTION HEATERS

Induction heating has been on the market for about 50 years and can be found in residential stovetops and small portable units as well. They work by converting the 50/60Hz AC input electrical power to high frequency AC - 20,000-40,000 Hz output power. This high frequency power is fed to a coil of wire just under the glass top of the heater (see Figure 2, on page 62). This coil is an inductor (hence the name) and induces small, localized current flow in the metal placed above it. These are called eddy currents. These rapidly moving currents heat the material of the pan, but eddy currents only occur if it is magnetic material. That's also a con for induction heaters. Most homebrewing kettles are 304 stainless steel and that material is only slightly magnetic. Aluminum isn't at all. There are, however, a number of manufacturers that use clad bottom kettles that contain a magnetic steel plate bonded to the bottom of the kettle with aluminum. They were developed specifically for induction use. So if you're interested in induction, be sure your kettle is compatible. If your kettle isn't induction capable, induction interface discs are available to place between your kettle and the stove, but some efficiency is lost.

Residential-grade induction heaters are readily available for smaller kettles at 120V (these are ideal for about 2.5 gallons/9.5 L of water, although they will work for up to 5 gallons/19 L if you aren't in a rush getting it to a boil). Larger models are available, but these commercial-sized units are a few hundred bucks and require 240V and 10-15A of current. However, they will easily handle 5-gallon (19-L) batches. They do have power control, but the models with temperature control, in my experience, are not accurate enough

for brewing needs. The other drawback is that they require fans inside the device to cool the electronics that create the high frequency current. So they can be a little noisy. For much more on induction brewing, see Josh Weikert's story "Induction Brewing" in the January-February 2018 issue of BYO.

IMMERSION HEATERS

Immersion heaters are the most common amongst electric brewers. Immersion heaters often are repurposed electric water heating elements (as pictured on page 63). The risk with using an off-the-shelf water heating element is that while the element itself is often available in stainless steel, the fitting is often plated steel. The zinc plating will eventually cor-

rode away leaving rust and bare iron. This may lead to a metallic taste in your beer. So make sure you're getting a fully stainless steel element. Several companies have developed elements specifically for the homebrewer using all stainless steel low-watt density designs. But most require a large hole for the weldless types, or a large sanitary fitting or NPT fitting to be welded into your kettle to install them.

A perceived con of electric brewing is wort scorching. That is where watt density comes to play. Watt density is simply the wattage of the element divided by the heated surface area of the element. The units are typically watts/square inch or watts/square cm. You'll hear "low watt density" (LWD) and "ultra-low watt density"



Figure 2: Anatomy of an induction heater



An electric immersion heating element. It's important to make sure the fitting, in addition to the heating element, is stainless steel.

(ULWD) thrown around on the web, but this generally is a marketing term used for water heater elements. I've never found a standard that defines the exact range. Industrial heater manufacturers do make recommended maximum watt densities for water, oils, syrups, acids and others. but no recommendation is made for beer wort. My experience over the years is that anything under 60W/square inch (9.3 W/square cm) will work and not scorch your wort, and most ULWD elements are in this range. Ideally, you'll want to be under 40W/square inch (6.2W/square cm). Unfortunately, most element manufacturers don't publish this data. Like my recommendations for propane burners, do a web search or talk to your local retailer for recommendations. In general, elements listed as ULWD are usually fine. The most important thing is to always clean them thoroughly after each use. Built up proteins and water salts act as an insulator and this will reduce the life of the element and also lead to scorching.

Calculating watt density is a fairly

simple matter. Although you'll need to make a couple assumptions. Here is the equation to use:

Watt Density = Element Wattage / surface area of heating element

Surface area is: 3.14 x diameter x length. Length is where some assumptions need to be made. Heating elements generally have a "cold pin section" an inch or two (2.5 to 5 cm) from the fitting before the resistive heating element starts. This keeps the electrical connection and fitting from getting too hot. Using a flexible tape measure, measure the total length of the heater tube. Then subtract 3 inches (7.5 cm) from that length to accommodate for the approximate cold length. This will get you fairly close to the actual active heating length.

Lastly, you cannot use an immersion heater directly inside of your mash tun to heat your mash, even if you're stirring. The thick mash inhibits convection and free flow of the wort so scorching is inevitable. If you are a brew-in-a-bag brewer, simply lift the bag and then turn on the heating elements. Otherwise you'll likely scorch and melt your bag. Recirculating immersion mash systems (RIMS) work great since there is a continual flow of wort over the elements as you're heating, but you'll want to ensure wort is flowing any time you energize the element.

SURFACE HEATERS

Another type of electric heating element used in homebrewing is the surface heater. This product is used in the all-in-one brewing systems that leverage commercial coffee urn designs. The construction is simply a resistive heating coil that is permanently bonded to the underside of the kettle using a ceramic material. The heat is then transferred through the bottom of the kettle. The only drawback with these heating elements is that the heat is quite intense and has a fairly high watt density, so you can get some scorching, particularly if you don't get the kettle bottoms shiny clean after each use. Like immersion heaters, the heating rates and boil intensity are limited by the available power in your home. Most of these products are rated at 1500W at 120V in the USA. They are quite economical, though, and do include temperature control.

ELECTRIC HEAT CONSIDERATIONS

Before you run out and install an element in your kettle, you need to do a little research on what power you need for your system, and more importantly, what power you have available in your home, and whether that power is available where you intend to set up your brewery.

In the US, residences have 120V power readily available, but 240V service is available only in select areas of your home or apartment. 120V 15A power is pretty common in homes in the US, but it really can only provide about 1500W of power max to avoid nuisance breaker tripping. Note that Power in Watts is Voltage x Amperage. That'll be fine for a 2.5- to 3-gallon (9.5- to 11-L) batch, but it produces a marginal boil for a 5-gallon (19-L) batch. You might be able to install a 20A receptacle depending on the breaker size in your panel. But you'll want to make sure nothing else is running on these circuits while you're brewing. Even with a 20A breaker, you'll be limited to about 1750W to keep that breaker from nuisance tripping. Still, this is adequate for a 5-gallon (19-L) batch. If you can get access to 240V through a dryer, oven, or have direct access to the main

Chart I: Batch size requirements

Batch Size	Recommended Wattage	
2.5–3 gallons/9.5–11 L 120V	1200–1500W (15A breaker)	
5 gallons/19 L	1500W	
120V	(15A breaker)	
5 gallons/19 L	2200W	
120V	(20A breaker)	
5 gallons/19 L	3000–3750W	
240V	(20A breaker)	
10 gallon/38 L	4500–5500W	
240V	(30A breaker)	
20 gallons/76 L	5500–6000W	
240V	(30A breaker)	

breaker panel, you'll be in great shape! In all cases, you'll want to consult with a licensed electrician to be sure the equipment will operate reliably and safely. Speaking of safety: Always use a GFCI breaker (ground fault circuit interrupter) on your heating system to prevent electrocution in the event of a failure or defect. It is always best to have a licensed electrician do the wiring.

The next step is calculating what power you need to power your brewery. First, review your brew system and process. How many kettles or RIMS heaters will you be energizing at the same time? How fast do you want to heat? Bear in mind that rarely do you heat brewing liquor from ground water temperature all the way to a boil in one step. Normally, you'll heat from ground water temperature to strike (a temperature rise of about 100 °F/ 56 °C) and from there another 60 °F (33 °C) or so temperature rise to get to a boil. You will also want adequate power to generate a sufficiently vigorous boil. A 10-15% per hour boil off rate is fairly typical for homebrewing. Calculating the heating rate is pretty simple. But bear in mind, the power of your heaters is a balance of what power you have available, and what heating element wattages are available to you in the market. That said, if you aren't into the geeky math, Chart 1 on this page is a guide based on my experience as to what you'll need for a good heating rate, and for a nice rolling boil.

Now let's dig into the numbers:

Heating Rate (temp. rise/min.) = (Rest temp. – start temp.)/ desired time.

So if I am raising my liquor from 60 °F (16 °C) ground water up to 160 °F (71 °C) strike, that is a 100 °F (55 °C) temperature rise. If I want to complete that in 45 minutes, that is 100 °F/45 min = 2.2 °F/min. (55 °C/45 min = 1.2 °C/min.). In general, a 2–2.5 °F (1.1–1.4 °C) ramp rate per minute is pretty common.

To calculate what wattage heating element is needed to achieve that heating rate is simple as well: Watts = desired ramp rate in °F/min. x gallons of water / 0.0068

or

°C per minute x liters of water / 0.00286

It would be ideal to get exactly the heating element wattage you need, but they are only available in certain wattages. And you may not have the power available to drive it, so pick an element that is close and then use this equation to estimate your final heat rate:

Heat rate Ramp Rate in °F/min. = 0.0068 x Watts / gallons of water

or

°C per min = 0.00286 x Watts / liters of water

If you're in the 1.7 °F/minute (0.9 °C/min.) range then you'll get your strike water from ground water temperature to 160 °F (71 °C) in about an hour, and will generate a reasonable boil. Although 2–2.5 °F/minute (1.1–1.4 °C/minute) is ideal.

Note that while using a higher wattage heater will shorten your brew day you'll want to be mindful of your watt density so that you don't scorch or darken your wort. And it will also increase your boil-off rate. Of course that can be accommodated by adding more water for a higher boil-off rate, but if you have the ability to control the power output of your heating element, you can dial in the exact boil rate every time. Some controllers, and PIDs have that ability and it is a great feature to have!

HOOKING IT UP

So you've managed to get a nice element installed in your kettle and adequate power to fire it up. Can you just plug that into your wall outlet and start brewing? Nope. A receptacle and a plug are NOT a replacement for a switch! In short order (pun intended) you'll zap your receptacle and have an impressive waft of ozone in your brewery. The inrush of full power current will arc and burn the plug and receptacle contacts permanently damaging them.

That's where controls come into play. While a properly-sized element tuned to the perfect boil can be operated with an on/off switch, the reality is you'll want to be able to vary the power, control the temperature, or both. There are a number of manufacturers that make controls for electric brewing and they range from about \$150 for a basic control to \$2,000+ for an automated system. It all depends on what you're trying to accomplish and how much power you're trying to control. In general, you'll want temperature control for your strike water, and possibly your hot liquor tank as well. All that is needed for your boil is power control, or perhaps just an on/off switch. What I personally love about electric brewing is the ease in which you can control power and temperature, although that does come at a cost. But bear in mind that you'll make a lot of that cost up over time vs. buying propane. At least that's how I justified the investment to my wife!

At the end of the day, both propane and electric heat sources have their place. Both will perform well and allow you to make great beer. What you as a brewer need to consider when choosing your heat source is what your individual brewing needs are. Specifically: Brewing indoors, ventilation, portability, budget, batch size, and electric power availability in your home. The decision is pretty straightforward after answering those questions.

RELATED LINKS:

• Still have more questions about electric brewing? We hosted a Q&A with Kal Wallner (from The Electric Brewery) and Trent Neutgens (who authored the January-February 2015 cover story for BYO with specifications to build his electric brewing system) on Facebook a while back. Questions covered all topics around electric brewing. Read the full transcript of the event here: https://byo. com/article/electric-brewing-q-a/

You'll Have A Blast With Our Stainless Steel Bottle Washer



Another innovative product made by:

info@thev www.thev

ihfo@thevihtageshop.ca www.thevihtageshop.ca



RD

RUSSIAN IMPERIAL STOUT OUR BIGGEST BEER KIT. EVER!

GREAT FERMENTATIONS

SNARK

GREATFERMENTATIONS.COM/SNARK-LORD @GR8FERMENTATION

HOMEBREW BURRER COMPARISON

hen you make the decision to take your homebrewing hobby out of the kitchen, a propane burner may be your next consideration. While several features will influence your purchase choice, one of the most

significant is the BTU/hour rating. While the name is obscure (British Thermal Units per hour), it is useful as a comparison of energy output by a burner over time. When considering burners, though, keep a few points in mind. First, bigger is not always better. Very high output burners may not work well at lower settings to keep a rolling boil going. Second, the rating is derived from how fast the burner burns propane, not exactly how much heat goes into your kettle (see John Blichmann's article on electric vs. gas heating on page 56 for more details — including how to measure your own burner's rate). Third, I have not run John's test on these burners; all the figures are from published websites or directly from the burner distributors. Note that none of the propane burners discussed here are safe for indoor use without major ventilation upgrades. For the burner heads themselves, a few characteristics appear across many models. Most are cast iron while a few are cast aluminum. Two fundamental burner head designs appear in this rundown. Burner castings I have designated as "cup type" (CT) have a profile something like a tobacco pipe: A horizontal stem leading to a bowl or cup under the kettle. The stem provides a venturi effect to draw air into the gas mixture and a star-shaped insert in the cup spreads the gas flow, effectively making gas nozzles to produce a ring of flame. I have designated the other basic style as "spoke type" (ST). These castings have a similar venturi tube leading to a hollow ring with three to eight hollow spokes. The upper face of the ring (and sometimes the spokes) has an array of holes, each constituting a burner orifice and supporting a flame. The ST shape is often referred to by the Bayou Classic brand name as a Banjo burner. For boiling wort in very large kettles, propane jet burners that concentrate the flame in one or two large nozzles are also available. None of the burners in this review use that style of burner head.

Besides the purpose-built burners discussed here, there are others that you may want to consider. Turkey fryer burners and camping stoves from Backyard Pro, Camp Chef, Gas One, Hurricane, King Kooker, Masterbuilt, Sportsman, and other manufacturers may provide an economical start on outdoor homebrewing. In the meantime, this article provides a rundown of the scope and extent of variability and options you may find in your burner search.



Adventures in Homebrewing 14" Propane Burner

Adventures in Homebrewing homebrew shop specifically set out to produce a high-output burner and this is one of two versions they came up with, maxing out at 220,000 BTU/hr. This one has a 14-inch (36-cm) square frame layout with supportive "V" bars extending toward the middle to rest the brew pot on. The frame is black painted steel and a round stainless steel wind guard surrounds a 4-inch (10-cm) diameter cast iron cup-type burner head. The burner stands 11 inches (28 cm) high, includes a 36-inch (91-cm) propane hose, and is designed to support large stock pots in sizes up to ½ barrel (15.5 gallons/59 L). A 10psi regulator and a brass control valve are also featured. It is described as suitable for full boils and all-grain brewing.

MSRP: \$109.99

https://www.homebrewing.org/14-Propane-Burner--220000-BTU_p_1190.html



Adventures in Homebrewing 18" Propane Burner

Also equipped with a 220,000 BTU/hour burner head, this alternative to the 14-inch (36-cm) burner has a square 18-inch (46-cm) frame and stands 10 inches (25 cm) tall. It is described as suitable for 15 to 20 gallons (57 to 76 L), using a black painted steel frame enclosing a stainless steel wind guard. A full steel "X" bar supports the pot all the way to the center of the frame. It uses a center-bolted 4-inch (10-cm) cup-type high-pressure cast iron burner head. It includes a 36-inch (91-cm) propane hose and a brass control valve.

MSRP: \$119.99

www.homebrewing.org/18-Propane-Burner--220000-BTU-_p_3214.html



Anvil Forge Burner

This burner from Anvil Brewing Equipment comes standard with legs that allow assembly at 7 inches (18 cm) or 16 inches (41 cm) high. Optional add-on leg extensions (MSRP \$29.99) extend the height to 24 inches (61 cm), allowing for direct drainage of a kettle into a carboy for fermentation. The three support bars give the burner stand an effective diameter of 20 inches (51 cm). It features a high-temperature coating and a deep burner guard for outdoor use under windy conditions. The burner head, a 6.5-inch (17-cm) cast iron spoke-type, is rated at 72,000 BTU/hr. Burner orifices are arranged in radial rows of three around the circular face of the casting for even heat distribution. The legs feature self-leveling feet that allow good stability and assembly directly to a bench or, with more than one burner, set up as a multi-tier brewery. Each burner can support a 20-gallon (76-L) kettle. A 10-psi regulator and hose are included.

MSRP: \$99.99

www.anvilbrewing.com/product-p/anv-forgeburner.htm



Bayou Classic Brew Cooker SQ84 & SS84

This is a painted vs. stainless pair of burner models from Bayou Classic. The SQ84 has black painted steel legs, kettle support, and wind screen. For the SS84, those parts are made from stainless steel. Other features are common to both burners. Each stands 13.25 inches (34 cm) high and has a square top that measures 16 inches (41 cm) across. Four V-shaped supports are welded to the square frame to provide the burner support, with a 12-inch (30-cm) minimum kettle diameter required. The kettle capacity goes up to 25 gallons (95 L). The heat rating is 60,000 BTU/hour from a 6-inch (15-cm) diameter cast iron spoke-type burner head. The flame orifices are arranged in radial pairs around the circumference of the burner ring. A 48-inch (122-cm) braided stainless steel propane hose, brass control valve, and 10-psi regulator are included.

MSRP: \$69.00 (SQ84) / \$104.00 (SS84)

www.shopthebayou.com/products/steel-bayou-brew-cooker www.shopthebayou.com/products/stainless-steel-bayou-brew-cooker



Bayou Classic Banjo Cooker KAB4 & SAB4

These burners are offered under the Bayou "Banjo" burner name, reflecting the 10-inch (25-cm) spoke-type cast iron burner. Burner orifices are arranged in radial pairs around the circumference of the burner and along each of the eight spokes. KAB4 uses a black painted steel frame and wind guard, while the SAB4 is stainless steel. In each case, four welded rod-type legs support a cooking surface 16 inches (41 cm) across. The kettle frame is 12.5 inches (32 cm) high and is rated for kettles up to 25 gallons (95 L), with a 14-inch (36-cm) minimum pot diameter. Each burner features a hose guard shield extending from the wind guard to protect the hose from excessive heat near the burner. A 48-inch (122cm) braided stainless steel propane hose is included, along with a 30-psi adjustable regulator. The heat output is rated for each at 104,171 BTU/hr.

MSRP: \$75.00 (KAB4) / \$108.90 (SAB4)

www.shopthebayou.com/products/banjo-cooker-w-hose-guard www.shopthebayou.com/products/16-in-stainless-banjo-cooker



Bayou Classic Patio Stove SQ14 & III4

This is once again a pair of similar burners, differing in that SQ14 uses a black painted steel frame and 1114 is stainless steel. The frames are welded, 16 inches (41 cm) square and 13 inches (33 cm) high. The burner head is a spoke-type 6-inch (15-cm) cast iron unit with pairs of burner orifices around the rim. A 36-inch (91-cm) braided stainless steel propane hose is included along with a 5-psi adjustable regulator. The heat output rating is 58,925 BTU/hour. The frame will support kettles up to 25 gallons (95 L) with a 14-inch (36-cm) minimum diameter required.

MSRP: \$47.00 (SQ14) / \$78.00 (1114)

www.shopthebayou.com/products/outdoor-patio-stove www.shopthebayou.com/products/stainless-steel-outdoor-patio-stove



Bayou Classic SP3I & SS3I

Another homebrew burner from Bayou, the SP31 burner has three sturdy black painted steel legs that take it to a height of 14 inches (36 cm). It is also 14 inches (38 cm) in diameter and requires a minimum kettle diameter of 12 inches (30 cm). The burner head is a cup-type casting made of aluminum, 4 inches (10 cm) in diameter. The star-shaped insert in the burner head produces a full ring of flames when in use. A 48-inch (122-cm) braided stainless steel propane hose is included, as is a 12-inch (30-cm) fry thermometer. The burner is rated at 58,000 BTU/hour and will support a kettle up to 11 gallons (42 L). It has a 10-psi regulator and a brass control valve.

An upgraded version of this burner for less than \$10 more, the SS31, has legs and burner supports made from stainless steel.

MSRP: \$69.00 (SP31) / \$78.50 (SS31)

www.shopthebayou.com/products/14-in-highpressure-cooker-kd www.shopthebayou.com/products/bayou-brew-cooker



Bayou Classic Cooker SP50 & SS50

Our final pair of Bayou burners in this list is the tallest of that producer's burners included here. Once again there is a black painted model, the SP50, and its stainless steel counterpart, the SS50. Each burner features welded construction with three legs supporting a 14-inch (36-cm) round kettle ring at a height of 21 inches (53 cm). Three welded V-shaped supports extend inward to support kettles up to 30 qts. (28 L) with a minimum kettle diameter of 12 inches (30 cm). A wind guard of the same material and finish helps with use under windy conditions. A 36-inch (91-cm) braided stainless steel propane hose is included, along with a 5-psi adjustable regulator. A cup-type 4-inch (10-cm) cast aluminum burner head is rated at 41,741 BTU/hr.

MSRP: \$69.90 (SP50) / \$119.00 (SS50)

www.shopthebayou.com/products/high-pressurecooker-1 www.shopthebayou.com/products/stainless-steel-highpressure-cooker-1


Blichmann HellFire™

This stainless steel unit from Blichmann Engineering can be installed as the burner module in their TopTier[™] brew stand system, used as a stand-alone by itself, or fitted with optional leg extensions (sold separately, MSRP \$47.99). It is 9.5 inches (24 cm) tall alone, or 24 inches (61 cm) with the extensions. It has dual-mode burn settings rated at 140,000 BTU/hour in high power mode and 80,000 BTU/hour in high efficiency mode. Four adjustable kettle retaining bars accept kettles to 19.75 inches (50 cm) in diameter and are rated to support 30 gallons (114 L). Optional wider legs are available to increase the kettle support diameter to 24 inches (61 cm) and the load capacity to 55 gallons (208 L). These wider legs retail for \$54.99. The burner head is a spoke-type 10-inch (25cm) iron casting with burner orifices arranged in lines of four in a radial pattern along an inner ring and the outer ring, along with groups on four short spokes. A stainless steel wind guard surrounds the burner head and a patent-pending snap-on heat shield protects your valve and thermometer from excess heat. A propane hose with a 10-psi adjustable regulator is included.

MSRP: \$149.99

www.blichmannengineering.com/products/hellfire



BrewBuilt AfterBurner

This is a tall, square burner made from Type 304 stainless steel. With a height of 24 inches (61 cm), the square top is 19.5-inches (50 cm) across and includes four welded arms supporting a round wind guard in the center. The frame is rated to support kettles up to 25 gallons (95 L). It can be equipped with optional handles and wheels or bolted to additional AfterBurners to assemble a horizontal brewery. The 10-inch (25cm) spoke-type cast iron burner head can be operated in an efficiency mode for around 70,000 BTU/hour or in full AfterBurner mode at 100,000 BTU/hr. A 10-psi adjustable regulator and propane hose are included. When not in use, multiple AfterBurners can be stacked for more compact storage.

MSRP: \$249.99

www.morebeer.com/products/brewbuilt-after burner-propane-brewing-burner.html

Brewer's Best[®] Element Burner™

This is a round black painted steel burner standing 10.75 inches (27 cm) high with a diameter of 18 inches (46 cm). It can support the weight of up to a 10-gallon (38-L) brew pot. The spoke-type burner head is 10.125 inches (26 cm) in diameter with burner orifices arranged in pairs all around the outer rim and along each of the eight spokes. It is rated at 150,000 BTU/hour with a 10-psi adjustable regulator and 36-inch (91-cm) propane hose included. It has a 6.25-inch (16-cm) black painted steel wind guard.

MSRP: \$84.99

http://brewersbestkits.com/equipment.html

P120

Northern Brewer Dark Star[®] 2.0

This round burner from Norther Brewer features a top ring, bottom ring, and three legs of black painted steel rod, welded to spokes that support kettles up to 15 gallons (57 L). Its diameter is 18 inches (46 cm) and it stands 13.4 inches (34 cm) tall, with a 3.5-inch (9-cm) wind guard. The heat output rating of 65,000 BTU/hour is achieved with a spoke-type cast iron burner head that measures 6 inches (15 cm) in diameter. Burner orifices are arranged in pairs on top of the outer ring, which has three spokes. A 5-psi adjustable regulator and propane hose is included.

MSRP: \$65.99

www.northernbrewer.com/products/dark-starburner-2-0



.....



Northern Brewer Dark Star® Stainless Burner

While it resembles its painted steel namesake, this all-stainless steel frame is a somewhat different design. It stands at a height of 12 inches (30 cm) on three legs, offering stability on slightly uneven floors. A 16-inch (41-cm) diameter top ring features three kettle support spokes with a capacity to 15 gallons (57 L). The 5-psi adjustable regulator, propane hose, and cast iron burner head are the same as in the Dark Star® 2.0 burner.

MSRP: \$99.99

www.northernbrewer.com/products/darkstar%C2%AE-stainless-burner



Northern Brewer Edelmetall Brü®

This round burner stand includes a deep, brushed stainless steel wind guard with three bright copper-finished legs. It has three adjustable stainless kettle support arms that extend to a maximum diameter of 19.5 inches (50 cm). Standing alone, it is 13.5 inches (34 cm) high. Available copper-finish leg extensions (MSRP \$48.99) raise it to 27 inches (69 cm). The extension legs are secured with stainless steel cross bars forming a triangular base that offers good stability on uneven surfaces. Capacity is rated to 30 gallons (114 L). The burner head is spoke-type cast iron measuring 10 inches (30 cm) in diameter with burner orifices arranged in pairs around the top of the circumference and on the eight spokes. The output is rated at 72,000 BTU/ hour with the included 10-psi adjustable regulator and propane hose. Propane flow is controlled with a precise needle valve that comes included.

MSRP: \$149.99

https://www.northernbrewer.com/products/ edelmetall-bru-burner

PROPANE BURNER

BURNER	PRICE (US)	BTU/HOUR RATING	BURNER TYPE*	SIZE
Adventures in Homebrewing 14" Propane Burner	\$109.99	220,000	CT 4-in. (10-cm) cast iron	14 in. square x 11 in. h (36 x 28 cm)
Adventures in Homebrewing 18" Propane Burner	\$119.99	220,000	CT 4-in. (10-cm) cast iron	18 in. square x 10 in. h (46 x 25 cm)
Anvil Forge	\$99.99	72,000	ST 6.5-in (17-cm) cast iron	20 in. dia x 16 in. h (51 x 41 cm)
Bayou Classic Brew Cooker SQ84/SS84	\$69.00/\$104.00 PS / SS	60,000	ST 6-in. (15-cm) cast iron	16 in. square x 13.25 in. h (41 x 34 cm)
Bayou Classic Banjo Cooker KAB4/SAB4	\$75.00/\$108.90 PS / SS	104,171	ST 10-in (25-cm) cast iron	16 in. square x 12.5 in. h (41 x 32 cm)
Bayou Classic Patio Stove SQ14/1114	\$47.00/\$78.00 PS / SS	58,925	ST 6-in. (15-cm) cast iron	16 in. square x 13 in. h (41 x 33 cm)
Bayou Classic SP31/ SS31	\$69.00/\$78.50 PS / SS	58,000	CT 4-in. (10-cm) cast aluminum	14 in. dia x 14 in. h (36 x 36 cm)
Bayou Classic Cooker SP50/SS50	\$69.90/\$119.00 PS / SS	41,741	CT 4-in. (10-cm) cast aluminum	14 in. dia x 21 in. h (36 x 53 cm)
Blichmann HellFire™	\$149.99	140,000/ 80,000 adjustable	ST 10-in (25-cm) cast iron	19.75 in. dia x 9.5 in. h (50 x 24 cm)
BrewBuilt AfterBurner	\$249.99	70,000 to 100,000	ST 10-in (25-cm) cast iron	19.5 in. square x 24 in. h (50 x 61 cm)
Brewer's Best® Element Burner™	\$84.99	150,000	ST 10.125-in. (26-cm) cast iron	18 in. dia x 10.75 in. h (46 x 27 cm)
Northern Brewer Dark Star® 2.0	\$65.99	65,000	ST 6-in. (15-cm) cast iron	18 in. dia x 13.4 in. h (46 x 34 cm)
Northern Brewer Dark Star® Stainless	\$99.99	65,000	ST 6-in. (15-cm) cast iron	16 in. dia x 12 in. h (41 x 30 cm)
Northern Brewer Edelmetall Brü®	\$149.99	72,000	ST 10-in (25-cm) cast iron	19.5 in. dia x 13.5 in. h (50 x 34 cm)

* Burner type is designated as CT for Cup Type and ST for Spoke Type

** Most common frame materials are Painted Steel (PS) and Stainless Steel (SS)

COMPARISON CHART

LEG EXTENSIONS AVAILABLE	FRAME MATERIAL**	CAPACITY	REGULATOR PRESSURE	WIND GUARD
Ν	PS	15.5 gal./59 L	10 psi	Y
Ν	PS	20 gal./76 L	10 psi	Y
24 in. (61 cm)	Steel (with, high temp. coating)	20 gal./76 L	10 psi adjustable	Y
N	PS (SS option available)	25 gal./95 L	10 psi	Y
Ν	PS (SS option available)	25 gal./95 L	30 psi adjustable	Y
Ν	PS (SS option available)	25 gal./95 L	5 psi	Ν
N	PS (SS option available)	11 gal./42 L	10 psi adjustable	Y
Ν	PS (SS option available)	7.5 gal./28 L	5 psi adjustable	Y
24 in. (61 cm)	SS	30 gal./114 L	10 psi adjustable	Y
Ν	SS	25 gal./95 L	10 psi adjustable	Y
Ν	PS	10 gal./38 L	10 psi adjustable	Y
Ν	PS	15 gal./57 L	5 psi adjustable	Y
N	SS	15 gal./57 L	5 psi adjustable	Y
27 in. (69 cm)	SS and copper	30 gal./114 L	10 psi adjustable	Y







Story and Photos by Rodney Kibzey





After thoroughly enjoying this beer, I thought it would be fun to make one and have it on tap at home. I started by thinking through the base IPA, something that would help support and complement the wood flavor in the end beer. A beer that has the hops in check, where they are there, but don't scream DANK at you. Once I had the recipe envisioned, the next hurdle was the wood aspect. At that time, no one was producing retail Spanish cedar staves/spirals/cubes/chips, so my DIY side kicked it and I decide to make my own staves. I eventually found out that the homebrewer of the beer I judged in the first round of nationals got the Spanish cedar from Cigar City Brewing. I knew this wouldn't be an adequate source for me. So I was left contemplating where to get the wood from, how to process it, and then how to use it?



I allow the Spanish cedar staves to age for about two weeks in the carboy after primary fermentation.

WHAT IS SPANISH CEDAR WOOD?

Spanish cedar is not a true cedar. It is actually closer to a mahogany. Its color can range from light brown to a pinkish/red brown. Allergies are uncommon, but some people have reported respiratory problems. Spanish cedar is quite easy to work with when you have sharp tools, though some sanding may still be necessary. Spanish cedar is also known as cigar-box cedar, as this is one of its traditional uses.

At that time, I had heard Cigar City had made a commercial Spanish cedar version with their Humidor Series beers — a beer idea inspired by a homebrewer from the Tampa Bay, Florida B.E.E.R.S. homebrew club. I never got to try the Cigar City example back then because their distribution didn't include my part of the country. Eventually I did get my hands on some at the Great American Beer Festival a few years later after I had brewed my own. There are also some other brewers doing beers with Spanish cedar; Jester King Brewing's El Cedro is another well-known example.

WHAT DOES SPANISH CEDAR IMPART IN THE BEER?

Spanish cedar is a very aromatic

wood, adding a warm aroma of a cedar closet or dresser drawer, or the smell of a good cigar box. The flavor imparts citrus with woody, spicy white pepper and sandalwood notes. The combination of the wood aroma and the spicy cedar flavor creates a comfort feel in the beer. I like to call it my comfort beer.

In comparison, oak can produce some of the following aromas and flavors based on oak type and toast levels: Coconut, vanilla, clove, cinnamon, floral, and fruitiness. American oak has a stronger oak flavor, while French oak is more subtle, and Hungarian oak is a middle ground of the other two. The astringent tannins that oak produces can conflict with hop bitterness, where Spanish cedar complements the bitterness. Astringency is sometimes described as tannic, and it's these tannins that give your palate a dry and mouth puckering feeling.

BARRELS VS. ALTERNATIVE FORMS

The idea that a good tasting woodaged beer has to be aged in a wooden barrel is not true. You can make some really great beers with a variety of different wood formats such as staves, spirals, cubes, and chips. You actually have more control over the amount of wood contact and length of time for how little or how much wood flavor you want to impart in your beer with these formats. With a barrel you can't control the level of wood character that will be imparted in your beer, other than limiting the contact time with the barrel. In fact, Cigar City uses spirals in their Spanish cedar woodaged beers.

WOOD SOURCING

There are many different types of cedar woods out there — make sure you use Spanish cedar wood. It can be sourced either locally or online. I've done both, with similar results. For sourcing locally, find a specialty wood shop in your area. They would usually have it in planks that are couple feet (60 cm) long. I've found it's best to get the $\frac{1}{2}$ -inch (1.25-cm) thick boards. Have these planks cut into 6 inches (15 cm) long pieces.

Searching online, a Google search for "Spanish cedar wood" turns up Spanish cedar hardwood samples in various sizes. I've found some sample sizes of $\frac{1}{2}$ -inch x 3-inch x 6-inch (1.2 x 7.6 x 15 cm) — these work best for cutting to size with no scrap left over. MADERA DE CEDRO

(5 gallons/19 L, all-grain) OG = 1.067 FG = 1.012 IBU = 64 SRM = 6 ABV = 7.2%

INGREDIENTS

- 11 lbs. (5 kg) Great Western 2-row pale malt
- 2 lbs. (0.9 kg) Vienna malt (3.5 °L)
- 0.5 lb. (0.23 g) crystal malt (20 °L)
- 0.5 lb. (0.23 g) Carapils[®]/dextrine malt (1.5°L)
- 12 AAU Chinook hops (first wort hops) (1.25 oz./35 g at 9.6% alpha acids)
- 12.2 AAU Centennial hops (15 min.) (1.5 oz./43 g at 8.1% alpha acids)
- 1.5 oz. (43 g) Centennial hops (dry hop)
- 1/2 tsp. yeast nutrient (10 min.)
- 1 tsp. Irish moss (10 min.)
- 5 Spanish cedar staves
- (1/2 x 1 x 6 in. / 1.2 x 2.5 x 15 cm) White Labs WLP001 (California Ale) or Wyeast 1056 (American Ale) or Safale US-05 yeast
- ³/₄ cup corn sugar (if priming)

STEP BY STEP

Mill the grains and dough-in targeting a mash of around 1.4 quarts of water to 1 pound of grain (2.9 L/ kg) and a temperature of 152 °F (67 °C). Hold the mash at 152 °F (67 °C) until enzymatic conversion is complete. Sparge slowly with 170 °F (77 °C) water, collecting wort until the pre-boil kettle volume is 6 gallons (22.7 L).

Total boil time is 60 minutes. Add the first wort hops before the boil starts, and flavoring hops with 15 minutes left in the boil. Add Irish moss and yeast nutrient with 10 minutes left in the boil. Chill the wort to 68 °F (20 °C) and aerate thoroughly. Pitch the yeast.

For the wood-aging, after primary fermentation is finished, rack the beer to the secondary fermenter and add the five Spanish cedar wood staves. Age for 8 to 10 days, then add the dry hops and age additional 2-3 days. Keg or bottle, carbonating the beer to around 2.5 volumes of CO₂. If bottle conditioning, you may consider pitching fresh yeast at bottling.

MADERA DE CEDRO

(5 gallons/19 L, extract with grains) OG = 1.067 FG = 1.012 IBU = 64 SRM = 7 ABV = 7.2%

INGREDIENTS

- 6 lbs. (2.7 kg) extra light dried malt extract
- 1 lb. (0.45 kg) Vienna dried malt extract
- 0.5 lb. (0.23 g) crystal malt (20 °L) 0.5 lb. (0.23 g) Carapils®/dextrine malt (1.5°L)
- 12 AAU Chinook hops (first wort hops) (1.25 oz./35 g at 9.6% alpha acids)
- 12.2 AAU Centennial hops (15 min.) (1.5 oz./43 g at 8.1% alpha acids)
- 1.5 oz. (43 g) Centennial hops (dry hop)
- ¹/₂ tsp. yeast nutrient (10 min.)
- 1 tsp. Irish moss (10 min.)
- 5 Spanish cedar staves
- (½ x 1 x 6 in. / 1.2 x 2.5 x 15 cm)
- White Labs WLP001 (California Ale) or Wyeast 1056 (American Ale) or Safale US-05 yeast
- 3/4 cup corn sugar (if priming)

STEP BY STEP

Place the crushed grains in a mesh bag and steep in 6 gallons (22.7 L) of water as it heats up to 160 °F (71 °C). Remove the grains, allowing the liquid to drip back into the brew pot. Remove from heat and stir in all the dried malt extract and the first wort hops. Stir until there are no clumps of malt extract remaining. Turn heat back on and bring wort to a boil.

Total boil time is 60 minutes. Follow the remainder of the all-grain recipe.





To make wood staves, all you need is a saw, ruler or tape measurer, a drill with a drill bit, and some fine sandpaper. Cut the staves approximately 6 inches (15 cm) long by 1 inch (2.5 cm) wide, and then drill holes through the stave to increase its surface area. Give the piece a light sanding on all sides.

Some sites will even give free shipping on the samples.

There are now Spanish cedar spirals you can buy as well. I've never used these, since I've always been happy with my own homemade staves, but if you want to save time that is an option. Some of the premade spirals do come with a toast on them, usually a light toast. One benefit of Spanish cedar is that it can be used in its raw untreated form, with no toast needed, however a toast will add a different taste. I use the wood with no toast on them.

You should NEVER use cigar boxes

as a wood substitute, this could impart undesired off-tobacco characteristics. Also, avoid using any wood that has been treated with paint, oil, or sealers.

MAKING WOOD STAVES

To make your own staves, you will need a wood saw of some type. In the past I've used a handsaw, jigsaw, and table saw. All worked great, you just need something that will cut fairly straight. A 6-inch (15-cm) or longer tape measure or ruler for measuring out the dimensions, a drill with a ½-inch drill bit for drilling the holes in the stave, and some clean, fine sandpaper for sanding off any splinters and cleaning the surface are the only other tools required.

When using glass carboys, most have an opening of $1-\frac{1}{8}$ inches (2.9 cm). The boards should be sawed into strips of 1-inch (2.5-cm) width by 5 or 6 inches (12 or 15 cm) length. Test to make sure they can fit into your carboy easily, because they will slightly expand once they get wet from the beer, which could make it harder to remove them. If you can, cut the strip lengths with the grain of the wood, this makes them stronger, so they won't break when drilling the holes.

Drill 6 or 7 holes with a ¼-inch sanitized drill bit in each strip. The holes can be in a line or zigzag pattern; it doesn't need to be fancy. Having these holes will add for more surface area for the beer to extract the wood flavors.

After all holes have been drilled, give a light sanding with some fine sand paper on all sides of the newly created stave. Knock off the dust before adding to the secondary fermenter. No need to rinse the wood, and do not sanitize the stave, this would just add a sanitizer flavor to your beer.

I'm a very thorough brewer when it comes to cleanliness and sanitation and my approach has not caused any problems. But if you don't think sanding all sides of the wood is adequate enough, here are a couple of other approaches to sanitizing the staves before using them. Bake the wood in an oven at 175–180 °F (79–82 °C) for 15 minutes, or steep them in boiling water for 15 minutes. Baking the wood over an extended period of time at high temperatures could possibly toast the wood, and also change the compounds in the wood, so watch your time and temperatures. Cool to room temperature (70 °F/21 °C) before adding to the secondary.

USING WOOD STAVES

I've found that using 5 staves in a 5-gallon (19-L) batch has the best balance for my taste between the beer and the wood character, of course this is subjective and you may prefer more or less. Once the fermentation has completed, rack the beer to the secondary fermenter and add the staves for about 10 to 12 days, right before kegging or bottling the beer. Secondary condition temperature should be (65-70 °F/18-21 °C). This should provide sufficient time for the wood to extract the aroma and flavors. When adding the staves into the fermenter, slowly insert them and try not to make a big splash. You could also add the staves to an empty fermenter and rack the beer onto them, if you are worried about splashing when adding them. Make sure all staves have full contact with the beer. If desired level of aroma or flavor isn't met after kegging, more staves can also be added to the keg or secondary for an indefinite amount of time.

You can reuse the staves and still get the wood characteristic, but the intensity is lower than using them the first time. If you prefer to reuse the staves, it might be best to think about using them in a subtle flavor beer, such as a German or American wheat or light lager. For reuse, it's best to clean the staves after using them in a beer. Give them a thorough hot water bath and brush scrubbing. Drill the holes a little bigger, and give another good sanding on all sides before adding to the next secondary.

HOMEBREW RECIPE

The recipe on page 79 is one of my regular "house beers." The recipe has had a fair amount of competition successes. Within one year, the beer was selected to be brewed by three different professional breweries in the Pacific Northwest: Laurelwood Brew Pub (Willamette Week ProAm Competition), Widmer Brothers Brewery (Oregon Brew Crew Collaborator), and Elliot Bay Brewing Company (Great American Beer Festival Pro-Am). It's named, "Madera de Cedro," which is Spanish and translates to "cedar wood."

This is a beer I brew every year, and is a permanent fixture among my 17 beers I have on tap at home. I love sharing this beer when people come over to visit and watching the expression of amazement after tasting it. I know right then and there, that they get it. Hopefully you will too when brewing it.

The wood is mostly used in the secondary fermenter, for about 10 to 12 days while it's dry hopping. I felt that the main hop choice in the recipe for flavoring and aroma (dry hopping)



Brewmation Incorporated 19 Donovan Dr. Hopewell Junction, NY 12533 845-765-8395 www.brewmation.com Visit our web site and try our Brewery Designer



One of the Spanish cedar staves made by Widmer Brothers Brewery when my Spanish cedar IPA was selected as one of the winners of the 2014 Oregon Brew Crew Collaborator homebrew competition. The beer was brewed at their production brewery in Portland, Oregon.

additions should be Centennial. Centennial hops have a pleasant spicy, citrus aroma and clean bitterness, and the cedar plays nice on this. In the past, I used Centennial as a bittering addition, but now use Chinook you could also Northern Brewer as a substitute — just to save on hops and utilize their higher alpha acids. The malt bill leans towards a pale-colored beer with a low amount of crystal malt and slight toastiness from the Vienna malt. I personally enjoy beers that are drier and with less crystal malt flavor, and for this beer in particular I have found that a drier beer helps the wood character shine through. For IPAs, I prefer to keep the fruity esters from the yeast down, so I tend to use the Chico yeast strain and ferment in the 65–68 °F (18–20 °C) range for a clean fermentation.

ROMIDEUK

ANVI

TASTING NOTES

From Jeff Rankert, a Beer Judge Certification Program (BJCP) National Rank Judge:

Aroma: Medium hop aroma, wait there is something else, a new cigar box aroma, no tobacco.

Appearance: Looks like an IPA.

Flavor: Good malt support, medium hops, and dang, that is a prominent spicy, herbal, woody thing going on.

Mouthfeel: Mouthfeel is normal for an IPA, can't remember any astringency from the wood.

Overall: I had a second one. I need to find some Spanish cedar to make some. I have had the Humidor beers from Cigar City. Equivalent or better.

Born from the idea that brewing great beer doesn't require expensive equipment. Built by a team of engineers to ensure peak performance.

7.5 GALLON BUCKET FERMENTOR

GET BREWING WITH ANVIL



A BLICHMANN ENGINEERING COMPANY



Back Issues...



Collect them all! Order back issues from 2009-18.

Special Issues and Books...



Build a brewing reference library with these timeless classics.

Digital Downloads...



Immediately access downloadable homebrew recipes & projects to your desktop or mobile device for as little as \$1.99!

Apparel & Gear...







Show your homebrewer pride with these BYO logo items.

Events Registration...





2019 location and dates to be announced soon!

Register for top-notch homebrewing & small-scale commercial brewery education events.





HOME-DESIGNED BODULAR BODULAR RIMS SETUP Story and Photos by Paul Mietz Egli

've always loved craft beer, but I actually started out my home fermentation hobby by making cider. I began brewing when I realized that I could fill my carboys with wort in between apple harvests and have something to drink when the cider ran out. I borrowed a two-burner camp stove and stock pot from my father-in-law, purchased a couple of extract kits from the local homebrew store, and was off and running. I quickly moved to all-grain brewing, acquired better kettles, and built a mash tun from a 10-gallon (38-L) insulated beverage cooler. I brewed many infusion mash batches and was fairly pleased with the results. One thing that always bothered me about my wort production, though, was the inevitable loss of temperature during the mash. Books by the master brewers said that mash temperature had a huge effect on the body of the finished beer, and I was determined to control that part of my process. So that is where this project all began.

AUTO - OFF - ON

GOALS AND LIMITATIONS

First big question: RIMS or HERMS (recirculating infusion mash system or heat exchange recirculating mash system)? I had a few constraints to work around, which helped me decide. In the area where I brew, I had access to a single 110V, 20A circuit, so without calling in an electrician, I would need to continue heating liquids on propane burners. The camp stove doesn't have an automated ignition, which meant that I would not be able to use a controller to automatically heat the hot liquor tank in a HERMS system. I was a bit reluctant to punch holes in my new Blichmann kettle, and also felt that a RIMS tube would be easier to take apart for cleaning than a HERMS coil. I did consider the risk of scorching the wort due to contact with the RIMS heating element. Taking everything into account, I decided that RIMS would work better for me.

The next challenge to be faced was storage. I had a vision of mounting the controller, RIMS tube, plate chiller, pumps, and valves on a compact frame that would fit into the approximately 4 ft. x 4 ft. (1.2 m x 1.2 m) space I had available in my shed and could be easily rolled in and out on brew days. The frame had to hold everything that I need for brewing except for the burners and kettles. I used a program called SketchUp to come up with a design for how all of the brewing components could be mounted. The model helped me figure out the relative positions of all of the equipment and how I wanted to lay out the plugs and door on the controller box.

I had intended to build the frame using strut material or to have it fabricated out of stainless steel stock. I had started pricing out strut material and fittings around the same time that my brewing buddy, Eric, purchased a stainless steel work table for his all-electric build. A light bulb went on over my head: Why build when you can buy? I looked through the tables available from restaurant supply stores and on the web and ended up ordering a 30-in x 24-in. (762-cm x 610-cm), 18-gauge stainless steel work table for a price that was less than what I would have paid for strut or a custom fab. The table has an overhang on the front and sides and a backsplash at the rear, so there was plenty of vertical and horizontal space to mount system components. It also came with locking casters, so I would be able to easily move it from storage to brewhouse.

The top of the table is 34 in. (864 cm) and the top of my cooler mash tun is about 20 in. (510 cm) above that. This setup could be too tall for some brewers. If that is the case, you could purchase a stainless steel equipment table from a restaurant supply store. Equipment tables are shorter than work tables and would work just as well for this build. Personally, I like having the extra tabletop space at a convenient height for writing, but if you don't care about that, a shorter steel table would do fine.

For my liquid lines, I selected high-

temperature ½-in. silicone tubing as well as Camlock fittings. I found a RIMS tube with pre-welded Camlock fittings and assembled the pumps and valves with Camlocks as well for a unified fitting system.

THE CONTROLLER

There are plenty of high-quality, prebuilt controllers available for purchase. I decided to get a kit and assemble my own controller because I wanted to learn how each part of the circuit works so I could fix or extend it in the future. If you are interested in assembling the controller, you must be able to follow an electrical schematic and must be comfortable working with electricity levels that can potentially injure you. Read all of the instructions and cautions that come with the kit, and if you are not completely confident in your ability, spend a little more money and get a



Using Adobe Illustrator, I created a template with the layout of the switches, plugs, and indicator lamps on the front and side of the enclosure box. After printing the layout, I taped it onto the enclosure box and cut the holes for each switch, lamp, and plug.

prebuilt controller.

I purchased an enclosure that was pre-cut for the PID that was compatible with the controller kit. I used Adobe Illustrator to create a printable template with the layout of the switches, plugs, and indicator lamps on the front and the side of the enclosure box. With the template taped onto the box (as pictured on page 86) and armed with a Greenlee conduit punch and my trusty Dremel tool, I cut holes for each switch, lamp, and plug. Always use eye protection when cutting metal! I did a dry fit of all of the components, removed them, then painted the box with the traditional hammered metal black spray paint.

For me, the RIMS component kit was like putting together a really cool Lego set. I proceeded slowly, worked in stages, and tested the circuit as I went to make sure my controller was both safe and working correctly. I also consulted with the kit manufacturer when I had questions. I used 12-gauge wire for all of the circuits in the box and put spade clamps on the ends to ensure that each connection was secure. I've read that you can use 14gauge wire for internal connections, and that would be something I would consider if I was to build another controller as the 12-gauge wire can be a bit stiff and hard to route. A larger enclosure box would also have made the wiring easier.

The front of the box has a master key switch, an emergency stop button, the PID, and switches for a mash pump, sparge water pump, and heating element. The plugs on the side of the box are for the temperature probe, heating element, and two pumps. I cut the neutral bus on the 110V receptacle for the pumps and wired each plug separately so I could turn them on and off independently.

I used ¼-in. square aluminum stock to attach the controller box to the backsplash of the table. When drilling holes in the stainless steel table, use eye protection and cutting oil to lubricate your drill bit. The mounted box is very stable and at a convenient height for monitoring the PID display and operating the switches.



The wiring inside the controller box, which was built using a RIMS component kit that guided me through the steps.



My controller box has a master key switch, an emergency stop button, the PID, and switches for a mash pump, sparge water pump, and heating element. The plugs on the side of the box are for the temperature probe, heating element, and two pumps.

RIMS TUBE

I prototyped my liquid flow by mounting the pump and RIMS tube on sawhorses, planks, and some shelving supports. A couple of iterations on the sawhorse setup brought some important lessons. I found that when the RIMS tube is mounted horizontally and wort is pumped from the lower inlet connection, air in the tube is forced out of the outlet instead of being trapped in the tube. I also found that the pumps are easier to prime when they are mounted as low as possible. While brewing batches on the prototype, I learned that switching the output line of the mash pump from the mash tun to the boil kettle is messy and that hot wort poses a burn risk. To minimize the number of hose changes, I bought two threeway valves and fitted them with Camlock connectors. I placed one valve at the outlet of the mash pump. That valve switches between the RIMS tube (recirculation) and the boil kettle (sparge). I put the other valve at the inlet of the RIMS tube and plumbed that to switch between the mash pump (recirculation) and the sparge pump (sparge).

While I was experimenting, I added a bulkhead fitting at the top of my mash tun that leads to a Loc-Line hose inside. The hose lets me control the level of the wort return; I can put it underneath the liquid surface during recirculation and lift it out of the liquid during fly sparging. I mounted a cheap plastic aerator attachment to the end of the Loc-Line to divert the wort stream and minimize channeling in the mash bed.

The RIMS tube kit came with tri-clover (TC) clamps that were welded to M8/1.25 bolts. I drilled two holes in the overhang of the tabletop and attached the clamps to the table. To install the RIMS tube, I open the TC clamps, drop it in, close the clamps, and tighten.

PUMPS AND LIQUID LINES

I mounted the mash pump on the left side of the bottom shelf of the table and the sparge pump near the front of the bottom shelf. Both pumps have a ball valve mounted at their outlets to



A Loc-Line hose attached to a bulkhead fitting lets me control the level of wort return. I can put it under the liquid surface during recirculation and lift it out during fly sparging.



The RIMS tube's tri-clover clamps are attached to the overhang of the tabletop. To install the RIMS tube, I open the clamps, drop it in, close the clamps, and tighten.

THE BOILCOIL[™] ELECTRIC HEATER.

HOT, FAST,



We redefined electric heating with unrivaled performance, speed, and simplicity. Just plug in a BoilCoilTM for immediate, high-efficiency heat ideal for indoor use in new or retrofitted BoilerMakerTM kettles. Its ultra-low watt density gives you scorch-proof brewing, a removable power cord makes cleaning a cinch, and our TOWER of POWERTM controller offers precise temperature control. Hot, fast, and easy. The way you want it, so you can focus on what matters most — your beer.



BREWING INNOVATION

blichmannengineering.com

control flow rate, and the mash pump has a tee with a garden valve to help with priming. Once the pumps and RIMS tube were in place, I created a set of liquid lines by cutting tubing to fit the distances between the components and installing the Camlock fittings. Having a set of hoses that are all different lengths doesn't bother me, and cutting everything to fit minimizes the distance that the wort has to travel between vessels.

My plate chiller also came with convenient mounting posts, so I drilled two holes in the left side of the tabletop overhang and mounted it on the left side of the table.

DIALING IN THE SYSTEM

The Auber PID model that I used has several parameters that affect the accuracy and stability of the temperature of the wort. The first step towards getting those parameters in the ballpark is running the auto-tune program in the PID. I added a couple of gallons (8 L) of water to the mash tun, started recirculating through the RIMS tube, and ran auto-tune according to the instructions that came with the PID unit. During the auto-tune process, the PID turns the heating element on and off rapidly and measures the resulting changes in temperature, then uses that data to adjust how rapidly it cycles and for how long. After the auto-tuning program was complete, I continued to run the heater and checked the temperature of the water in the mash tun with a Thermapen. The Thermapen and PID didn't quite agree, so I used the PID's temperature offset function to set the PID to the Thermapen reading. I used the Thermapen to verify the temperature during my first few brew sessions and found that I still had to make small adjustments to the PID temperature offset each time. I believe the minor inaccuracy in temperature was due to the small mass of water that I used in my initial auto-tune run and subsequent adjustments.

The recipes that I like to brew often contain 20% to 40% wheat. Wheat, oats, and other glutinous grains are notorious for creating sticky, impermeable mash beds in recirculating systems and contribute to "stuck" mashes where the wort stops flowing through the mash bed. Because the RIMS element heats wort directly, a stuck mash can be more than annoying; if wort isn't flowing over the heating element, it can overheat and get scorched. I now routinely add rice hulls if the grain bill contains any sticky grains.

RESULTS

I've brewed more than 25 batches using my RIMS table, several of which have won gold medals at regional competitions and popularity awards at local homebrew festivals. I was even able to load up my system and bring it to a company picnic for a field brewing demonstration! Recirculating the mash results in extremely clear wort in the boil kettle. The system routinely holds mash temperature at plus or minus 0.5 °F (±0.25 °C). I've noticed that the temperature appears to be more stable when I'm able to run the recirculation at a higher flow rate. I've been eyeing flow meters for the system to see if I can quantify the relationship between flow rate and temperature stability.

Recently, I've started doing step mashes, and I've found that my RIMS system can raise the temperature of a 5-gallon (19-L) batch by 0.5 °F (0.25 °C) per minute, which is acceptable for protein or ferulic acid rest steps. Most importantly, I have fun on my brew days and enjoy the satisfaction of brewing on a rig that is designed to fit my process.









- Gold-stamped logo on front and spine
- Opens flat for easy use
- · Leather-grained in royal blue
- Each binder holds 10 issues

Only \$15 each (plus shipping)

Order Today at brewyourownstore.com

When sanitizing your equipment, NO residue is best!

NEW from LOGIC, Inc.

Unlike Some Sanitizers in the Homebrew Shop, San Step Is:

- Virtually foam free!
- · Effective even when used in hard water!
- Based on organic acid!
- More efficient (up to 20%) more solution; dilution rate is 1oz/6 gallons)!



Also Provides the Following Benefits:

- No rinsing after sanitation of brewing equipment
- Activity against a broad spectrum of bacteria and fungus
- Not deactivated by organic matter
- Provides an acidified rinse to prevent scale formation.

ecologiccleansers.com 608-658-2866 info@ecologiccleansers.com

ENTER YOUR CIDER & MEAD IN THE Entry **WineMaker** deadline is: March 15th, 2019 Online entry, forms, and WINE COMPETITION competition rules are available at: /ww.winemakermag.com/ The world's largest competition for competition hobby winemakers.

Enter your best in one of the three mead categories:

TRADITIONAL MEAD

FRUIT MEAD

HERB AND SPICE MEAD Sponsor: Ancient Fire Mead & Cider

BEST OF SHOW MEAD AWARD Sponsor:

> DUTCH W GOLD PURE HONEY

And also: HARD CIDER OR PERRY

Questions? Contact us at: Battenkill Communications 5515 Main Street • Manchester Center, VT 05255 e-mail: competition@winemakermag.com ph: (802) 362-3981 ext. 106 fax: (802) 362-2377 www.winemakermag.com/competition

SAVE \$100 FOR A LIMITED TIME

SMALL-CLASS • HANDS-ON • FULL-DAY



MARCH 22 & 23, 2019 • ASHEVILLE, NORTH CAROLINA

Join *Brew Your Own* for in-depth, full-day, small-class, brewing learning experiences over 2 days in the craft beer hotbed of Asheville.

 Learn hands-on from brewing experts including: John Palmer,
 Dr. Chris White, Gordon Strong, Brad Smith, Michael Tonsmeire, Ashton Lewis, Steve Parkes, Marshall Schott, Denny Conn, John Blichmann, and more!
 Each Boot Camp is limited to just 35 people so don't wait to sign up.
 *Check Out the Full Program Details on the next three pages.

2 WAYS TO SAVE:

SAVE WHEN YOU REGISTER EARLY! SAVE WHEN YOU REGISTER FOR BOTH DAYS!

BYOBootCamp.com

Thank you to our BYO Boot Camp Sponsors:

BLICHMANN

LESAFFRE FOR BEVERAGES





GIC inc









... And more sponsors to come! List current as of September 24, 2018

THURSDAY, MARCH 21, 2019



INSIDER TOURS OF ASHEVILLE CRAFT BREWERIES - You'll tour – and taste – at four different craft breweries around Asheville during this pre-Boot Camp offering. You'll have the opportunity to meet brewers and ask questions in addition to sampling beers. Includes a meal. A great way to kickoff your Boot Camp experience and check out some of Asheville's booming craft beer scene.

FRIDAY, MARCH 22, 2019 ASHEVILLE BOOT CAMPS

Each Boot Camp will run from 10 a.m. to 5 p.m. and is limited to just 35 people. Your boot camp includes lunch, a lunch keynote with Brian Grossman of Sierra Nevada Brewing, plus a post-Boot Camp Asheville Craft Beer Reception with local craft breweries pouring samples.



ADVANCED HOPPING TECHNIQUES – *Josh Weikert* – Join *BYO* Contributing Writer Josh Weikert as he explores when and how to add hops to create awesome hop-forward beers. You'll cover timing and techniques of hop usage including mash hopping, boil hopping, whirlpool/knockout hop stand additions, and dry hopping. You'll cover hop varietal choices, hop pairing/blending, evaluating hops including hop rubbing and sensory training, water adjustments and much more to get the most out of your hops and into your glass. *Please note this workshop will also be offered on Saturday as well.*



TROUBLESHOOTING HOMEBREW FAULTS & FIXES – *Ashton Lewis* – Join *Brew Your Own*'s Mr. Wizard and Technical Editor Ashton Lewis as he walks you through the potential minefield of beer flaws and faults homebrewers can face. You'll learn how to troubleshoot – and fix! – your own homebrews with Ashton who has helped thousands of homebrewers over the last 20 years as *BYO*'s Mr. Wizard. You'll have the chance to experience many faults first-hand to better recognize them later.



ALL-GRAIN BREWING ESSENTIALS – *John Palmer & John Blichmann* – Designed for intermediate to beginner homebrewers getting into all-grain brewing, this full-day workshop will cover all you need to know to successfully make great homebrews using all-grain brewing both with traditional and newer techniques. *How To Brew* best-selling author John Palmer and equipment guru John Blichmann will take you hands-on through the full all-grain process from milling, mashing, and sparging before going into the boil. You'll get to know the equipment, techniques, and ingredients first-hand and learn all-grain brewing by doing in a small-class environment. They'll also cover newer homebrew all-grain techniques such as Brew-in-a-Bag and No Sparge in addition to traditional mashing and some advanced tips as well.



ADVANCED ALL-GRAIN TECHNIQUES – *Gordon Strong* – Pull out the mash tun and get ready to learn advanced all-grain techniques hands-on with *Brew Your Own* Columnist, book author, and President of the Beer Judge Certification Program, Gordon Strong. Gordon will walk you through a world beyond straight infusion mashing with keys to mastering step mashing, sour mashing, and decoction mashing. Plus you'll learn about playing with mash thickness and other ways to control your all-grain wort production. *Please note this workshop will also be offered on Saturday as well.*



BARRELS & WOOD-AGING – *Michael Tonsmeire* – Learn how to choose, use, and maintain oak barrels – and oak alternatives – for your brewing. Barrels are a significant investment in money, time, and beer so understanding how to properly select and use them is essential. Learn hands-on from *Brew Your Own* Columnist and *American Sour Beers* book author Michael Tonsmeire. Michael will also cover options for barrel alternatives and how to best use the broad variety of available products such as chips, staves, and spirals including both oak and non-oak alternatives. This full-day workshop will also cover special brewing and recipe considerations to making beers to complement the flavors of woods, spirits, and wines to take your wood-aged beers to a new level.



HOMEBREW EXPERIMENTS – *Denny Conn and Marshall Schott* – Developing your own recipes, refining your own brewing techniques, and tweaking your equipment set-up all require the know-how to conduct your own homebrew experiments. Without reliable results you rely on guesswork instead of facts to improve your brewing. Join two of the true leaders in experimenting with homebrews – podcaster/book author Denny Conn from Experimental Brewing and blogger/podcaster Marshall Schott from Brülosophy – as they first walk you through how to properly conduct your own experiments at home including structured blind evaluation techniques, and then walk you through some real life homebrew case studies to show how these experiments can play out. Get ready to roll up your sleeves and get your science on! *Please note this workshop will also be offered on Saturday as well*.



ADVANCED RECIPE FORMULATION – *Brad Smith* – Create your own signature recipes and learn the keys to developing the specific grain bill, hop schedule, and ingredient proportions to meet your homebrewing goals. Brad Smith, *BYO* Contributor and BeerSmith software owner, has helped thousands of homebrewers design their own beer recipes and now you'll learn first-hand from this recipe building expert how to use both artistic and scientific approaches to beer design to end up with the beer you envisioned in your glass. You'll also explore ingredients, techniques, and understanding your own brewing system. *Please note this workshop will also be offered on Saturday as well*.



ADVANCED YEAST TECHNIQUES – *Dr. Chris White* – Join Dr. Chris White of White Labs as he discusses how to master different yeast-related techniques including harvesting yeast, figuring cell counts and viability, the do's and don'ts of repitching including steps such as yeast washing, building up a proper yeast starter, storing your yeast samples, and much more! Here's your unique chance to learn in a full-day seminar format about getting the most from your yeast from one of the true leaders in the beer yeast field.

TWO-DAY BOOTCAMP: COMMERCIAL BREWERY START-UP – *Steve Parkes* – When you register for this Boot Camp you will attend it for both Friday and Saturday unlike our other offerings to better cover more material in greater depth. Opening a commercial craft brewery is a far cry from just ramping up the amount of beer you brew. Over Friday and Saturday you'll walk through the steps, planning decisions, and keys you need to know on both the brewing and management side to successfully open a commercial craft brewery with the Lead Instructor and Owner of the American Brewers Guild Steve Parkes, who has trained hundreds of professional brewers. Learn from Steve's decades of experience to help you better achieve your goals. Over two full days you'll be guided through all the various elements you'll have to know for the next big step toward starting a craft brewery.

SATURDAY, MARCH 23, 2019 ASHEVILLE BOOT CAMPS Each Boot Camp will run from 10 a.m. to 5 p.m. and is limited to 35 people. Your Boot Camp includes lunch, a BYO Columnist Q&A lunch keynote, plus a post-Boot Camp Asheville Craft Beer Reception with local craft breweries pouring samples to wrap up your full day.



SOUR BEER TECHNIQUES – Michael Tonsmeire – Learn hands-on traditional European as well as newer American methods to produce sour and funky beers from Michael Tonsmeire, the Brew Your Own Columnist who literally wrote the book on the subject with American Sour Beers. Michael will demonstrate the unique skills needed to create your own delicious sour beers including wort production (extract and all-grain), growing alternative microbes, blending, aging on fruit, and sanitation. The focus will be on practical topics difficult to convey by words alone, so no biology or chemistry degree required. You'll leave with a clear understanding of the processes to reliably produce sour beers suited to your palate and desired time frame.



HANDS-ON HOMEBREW SCIENCE – *Ashton Lewis* – Get hands-on with pH meters, refractometers, slants and loops, stir plates, centrifuges, and other brewing science gear with *BYO* Technical Editor and Mr. Wizard Columnist Ashton Lewis. Ashton will walk you through how to best use scientific gear at home to help you improve the quality of the beer. You'll have the chance to understand how to not only use and care for the equipment properly, but also how to take the results and put that data into action to produce better beer in your glass. This workshop will focus only on those pieces of equipment . suitable – and affordable – for your homebrewery.



ADVANCED YEAST LAB - Kara Taylor - Join White Labs' Laboratory Operations Manager Kara Taylor at White Labs' Asheville facility for some hands-on yeast lab work to develop skills you can bring back home to help you make better beer. Learn how to accurately count yeast using a microscope, culturing yeast, using slants, harvesting yeast, washing and reusing yeast, propagation and determining growth rates, and more. Here's your chance to learn up close and personal what you may have read in books or magazines, or listened to in seminars, and Kara is the perfect teacher to lead you personally through the world of yeast using lab equipment you can source for your own home use.



BREWING WATER ADJUSTMENTS - John Palmer - Water is the least understood ingredient when making great beer. John Palmer, who literally wrote the definitive book on the subject, Water: A Comprehensive Guide for Brewers, will help take the mystery out of water's role in brewing and how to make better beer as a result. You'll learn how to read water reports, understand flavor contributions, and how to adjust your brewing water to brew different styles of beer. You'll leave with not only an understanding of the chemistry concepts of brewing water, but also the practical how-to aspects of getting the most from this critical ingredient.

Due to many requests we are repeating four of our most popular Boot Camp topics from Friday again on Saturday to give more people the opportunity to register for the following workshops that have all sold out at prior locations.



ADVANCED HOPPING TECHNIQUES - Josh Weikert - Join BYO Contributor Writer Josh Weikert as he explores when and how to add hops to create awesome hop-forward beers. You'll cover timing and techniques of hop usage including mash hopping, boil hopping, whirlpool/knockout hop stand additions, and dry hopping. You'll cover hop varietal choices, hop pairing/blending, evaluating hops including hop rubbing and sensory training, water adjustments and much more to get the most out of your hops and into your glass. Please note this workshop will also be offered on Friday as well.



HOMEBREW EXPERIMENTS - Denny Conn and Marshall Schott - Developing your own recipes, refining your own brewing techniques, and tweaking your equipment set-up all require the know-how to conduct your own homebrew experiments. Without reliable results you rely on quesswork instead of facts to improve your brewing. Join two of the true leaders in experimenting with homebrews – podcaster/book author Denny Conn from Experimental Brewing and blogger/ podcaster Marshall Schott from Brülosophy – as they first walk you through how to properly conduct your own experiments at home including structured blind evaluation techniques, and then walk you through some real life homebrew case studies to show how these experiments can play out. Get ready to roll up your sleeves and get your science on! Please note this workshop will also be offered on Friday as well.





ADVANCED ALL-GRAIN TECHNIQUES - Gordon Strong - Pull out the mash tun and get ready to learn advanced all-grain techniques hands-on with Brew Your Own Columnist, book author, and President of the Beer Judge Certification Program, Gordon Strong. Gordon will walk you through a world beyond straight infusion mashing with keys to mastering step mashing, sour mashing, and decoction mashing. Plus you'll learn about playing with mash thickness and other ways to control your all-grain wort production. Please note this workshop will also be offered on Friday as well.

ADVANCED RECIPE FORMULATION - Brad Smith - Create your own signature recipes and learn the keys to developing the specific grain bill, hop schedule, and ingredient proportions to meet your homebrewing goals. Brad Smith, *BYO* Contributor and BeerSmith software owner, has helped thousands of homebrewers design their own beer recipes and now you'll learn first-hand from this recipe building expert how to use both artistic and scientific approaches to beer design to end up with the beer you envisioned in your glass. You'll also explore ingredients, techniques, and understanding your own brewing system. Please note this workshop will also be offered on Friday as well.

SUNDAY, MARCH 24, 2019



INSIDER TOURS OF ASHEVILLE CRAFT BREWERIES

You'll tour – and taste – at four different craft breweries around the Asheville during this post-Boot Camp offering. You'll have the opportunity to meet brewers ask questions in addition to sampling beers. Includes a meal A great way to wrap-up your BYO Boot Camp experience and check out some of Asheville's booming craft beer scene.

TWO-DAY BOOTCAMP: COMMERCIAL BREWERY START-UP - Steve Parkes - When you register for this Boot Camp you will attend it for both Friday and Saturday unlike our other offerings to better cover more material in greater depth. Opening a commercial craft brewery is a far cry from just ramping up the amount of beer you brew. Over Friday and Saturday you'll walk through the steps, planning decisions, and keys you need to know on both the brewing and management side to successfully open a commercial craft brewery with the Lead Instructor and Owner of the American Brewers Guild Steve Parkes, who has trained hundreds of professional brewers. Learn from Steve's decades of expertise and wide range of experience to help you better achieve your goals. Over two full days you'll be guided through all the vari-ous elements you'll have to know for the next big step toward starting a craft brewery.



REGISTRATION **ASHEVILLE, NORTH CAROLINA**

MARCH 22 & 23, 2019

Name	
Address	
City	State/Province
Zip/Postal Code	Country
Phone	

E-mail _

UP TO \$100 BY REGISTERING FOR BOTH DAYS EARLY!

- EARLY BIRD DISCOUNT REGISTER BY JANUARY 22 \$450 (SAVE \$100!) BOTH FRIDAY AND SATURDAY BOOT CAMPS (choose one each day)
- TWO-DAY REGULAR REGISTRATION AFTER JANUARY 22 \$500 BOTH FRIDAY AND SATURDAY BOOT CAMPS (choose one each day) (SAVE \$50!)
- ONE-DAY REGULAR REGISTRATION \$275
 EITHER FRIDAY OR SATURDAY BOOT CAMP (choose only one below)
 Saturday, March 23, 2019
 Saturday, March 23, 2019 Hands-On Homebrew Science Advanced Recipe Formulation
 - □ Barrels & Wood-Aging

 - □ Advanced Hopping Techniques **Troubleshooting Homebrew**
 - Faults & Fixes
 - □ Advanced All-Grain Techniques
 - Homebrew Experiments
 - □ All-Grain Brewing Essentials
 - Advanced Yeast Techniques
- Please note due to repeated reguests we are repeating four of the most popular Boot Camp topics from Friday again on Saturday to give more opportunity to register for the following workshops.
- Advanced All-Grain Techniques

Sour Beer Techniques Brewing Water Adjustments

Advanced Yeast Lab

- Advanced Hopping Techniques
- □ Advanced Recipe Formulation
- Homebrew Experiments
- □ Turning Pro & Commercial Brewery Start-Up TWO DAY BOOT CAMP

PLEASE NOTE A SEPARATE REGISTRATION FORM & FEE IS REQUIRED FOR EACH BOOT CAMP ATTENDEE

REGISTRATION FOR BOOT CAMP INCLUDES:

- 10 a.m. to 5:00 p.m. Boot Camp limited to 35 people per class
- Lunch with your Boot Camp group plus lunch speakers each day
- Course materials
- Boot Camp Welcome Bag from Sponsors
- One year (8 print issues) Subscripton/Renewal to Brew Your Own magazine
- Asheville Craft Beer Reception with local craft breweries pouring samples (Discounted hotel room needs to be reserved directly with the Crowne Plaza Asheville, go to BYOBootCamp.com for details)



Check Enclosed (payable to *Brew Your Own* magazine) Credit Card 🗅 Visa

□ MasterCard

Card # _____

Name on card:

Signature:

By registering for the Boot Camp I give permission for the free use of my name and photo in any media account of this event. I also certify that I am 21 years of age or older. Cancellation policy: For a refund, less a \$100 administrative charge per person, send written notice by February 22, 2019. Refund requests received after February 22, 2019 will not be refunded. All refund requests will be processed post-Boot Camp. Early Bird Discount registration must be received and paid for by January 22, 2019.

______ 3-Digit CCV# ______ Exp. Date ______

HOTEL INFORMATION

The BYO Boot Camp will take place March 22 & 23, 2019 in Asheville. North Carolina at the Crowne Plaza Asheville. We've reserved a limited number of rooms at a special discounted rate for Boot Camp attendees. Check out BYOBootCamp.com for full details on reserving your discounted room.

4 WAYS to REGISTER

WEB PAGE: **BYOBOOTCAMP.COM**

MAIL THIS FORM WITH PAYMENT TO: BYO BOOT CAMP 5515 MAIN STREET **MANCHESTER CENTER, VT 05255**

PHONE: 802-362-3981 EXT. 106

FAX THIS FORM TO: 802-362-2377

ASHEVILLE CRAFT BREWERIES INSIDER TOUR

Thursday, March 21, 2019 (\$135) □ 11 a.m. to 3:45 p.m. □ 4:00 to 8:00 p.m.

Sunday, March 24, 2019 (\$135) 12:00 to 4:00 p.m.



6.6 GALLON CONICAL UNITANK FERMENTER \$599.99^{MSRP}

WILLIAMSWARN

The WilliamsWarn BrewKeg25 allows you to pressure ferment up to 6.6 gallons of wort with consistent, high-quality results.

- Stainless conical pressure fermenter with 25 psi working pressure and built in relief/spunding valve.
- Extra large, unique sediment removal system for clearer beer.
- Easy to clean and sanitize.
- Eliminate kegging, dispense directly from the BrewKeg125inside your fridge or kegerator.
- The beverage is carbonated perfectly at the end of fermentation and ready to enjoy sooner.
- Fermenting under pressure reduces esters allowing your beer to ferment at higher and more varied temperatures.

Choose from our range of internationally award-winning no-boil beer and cider styles or brew your own. The BrewKeg25 is suitable for extract, partial extract and all-grain brewers.

PRE-ORDER NOW AT: www.MoreBeer.com FOLLOW US: WilliamsWarn f 20 0 LEARN MORE: www.WilliamsWarn.com

WHOLESALE ENQUIRIES (USA): www.BrewmasterWholesale.com





Free Shipping on most items

Visit us at www.MarylandHomebrew.com

The difference is service

888-Brew-Now

We have everything you need for beer, wine, mead, cider, cheese and spirits!

The NEW Byo.com -

Móre

A World of Brewing Knowledge at Your Fingertips!

Starting with the January-February 2018 issue our digital edition has changed over to our new web-based delivery at byo.com. With the new format all articles and recipes are separated out for easier, more flexible viewing on any device. After you log in as a paid digital member, the full contents of the current issue can be found on the homepage.

All future *BYO* content will be added online as part of a *Brew Your Own* Digital Membership. In addition, all content from *BYO* issues dating back to 2012 has been uploaded so every article, project, and recipe in *BYO* over the past six+ years is now waiting for you in our secured digital membership website. Furthermore, as a digital member, you'll also have the benefit of:

- · Over 3,000 updated articles, projects, and recipes from our archives in one convenient place
- Full access to our 10 BYO Special Issues an \$85 value if purchased on the newsstand available in a
 digital content format for the first time
- Hundreds of homebrewing questions and answers sorted and organized for troubleshooting from the popular "Ask Mr. Wizard"
- · Enhanced search capabilities and better indexing to help you find what you want, easily and quickly
- · A mobile-optimized website for a better reading experience on any portable digital device
- · Future issues of Brew Your Own will be added automatically as new digital content for your convenience

Sign up or try a 14-day free trial membership at www.byo.com



ADJUSTING BODY AND GRAVITY

Many ways to hone your beer

eer is alcoholic – we all know that. What too often gets lost in the shuffle of recipes and flavor profiles and hopping rates and more is that the underlying source of that alcohol (sugar, as measured by gravity) has important effects on other ingredients and on the finished product. Brewers do pay attention to the mix of sugars – fermentable and unfermentable – in the recipe, but may not utilize their knowledge of it to its fullest extent! We're going to give these two areas a thorough once-over today by examining how and why we adjust gravity and body in each stage of the brewing process.

Gravity and body matter, and are quite tightly linked. Gravity matters, obviously, because of its relationship to the potential alcohol level of your finished product. Beyond that, though, it also interacts with other ingredients whose output we care about, particularly hops and yeast. Hops utilization rates decrease as gravity increases - a more-sugary wort is less adept at extracting and isomerizing hops acids - so a proper assessment of bittering potential relies on an accurate prediction and/or measurement of gravity in the wort. Yeast health and performance are also a function of gravity, because alcohol is toxic to yeast cells. Given that, we should be cognizant of the potential alcohol in our wort. And, of course, the ratio of alcohol and *residual and/or unfermentable* sugars in your finished beer will have a significant impact on the mouthfeel of it. Body is important in its own right, but a thin/ thick mouthfeel will also impact the expression of flavors from malts, hops, and even water.

In short, time spent planning for and tweaking specific levels of gravity, alcohol, and body is time well-spent if we're looking to produce our best beer. This is also a feature that we can "work" the entire way through our process, from the moment we pull the recipe log down off the shelf to the moment we drain the last drop from the keg.

MAKE A PLAN

This all begins in recipe design. Before brewing, always make a recipe (you almost certainly do already, but it can't hurt to say it). That's not to say you can never just freestyle it and add whatever you have whenever you want, but if you do you'd better be content with never brewing (or improving) that beer ever again! The good news is that planning a recipe and deriving the statistics that will quide your process has never been easier. Free and inexpensive brewing software abounds, and at a minimum these programs always provide information like original gravity, target final gravity, predicted ABV, calculated IBUs, and more. The rest is up to you.

Start adding your ingredients (on paper), then take a look at your predicted ABV (or, even better, decide on a target in advance and build up your grist and adjunct sugars to it). Then, consider not just the predicted gravity, but how much of that is actually fermentable – what's the mix of fermentable and unfermentable sugars? Base malts, if handled properly, can contribute a high percentage of fermentable sugars, while crystal/caramel malts and roasted malts contribute less as they move up the Lovibond scale. Toasted malts or unmalted grains *may* add fermentable "... your recipes should aim to match the fermentability of your sugar additions with the level of attenuation you seek."



Final gravity and body are inextricably linked through a number of variables that brewers are able to adjust throughout a beer's life.



sugars. It's important to know what you're adding, and what it can/will do. The software you're using may or may not be doing that math for you (it probably isn't – they tend to treat all grain additions as effectively identical in terms of fermentability), and your six-pound (2.7-kg) crystal malt addition could be interpreted as adding a meaningful amount of alcohol when in reality it's adding a lot of residual, unfermentable sugars. By contrast, your maple syrup or candi sugar addition is 100 percent fermentable. Some of this is a question of experience and experimentation and good record-keeping — hard and fast rules on fermentability and grain/adjunct types are hard to come by — but your recipes should aim to limit less-fermentable additions if your goal is greater attenuation, and increase them in beers that require less attenuation.

BREW DAY ADJUSTMENTS

So, you've written your recipe, and you're in-process. It's brew day! It'll all turn out just like the computer said, right? Well, maybe, but you still have plenty of choices to make, and if

regardless of targeted body/attenuation! There are ways of addressing body and alcohol downstream, as we'll see.

After you mash, lauter, and sparge, check your gravity. Remember, your hop's utilization depends in part on the gravity of the beer, and if you're off, now is the time to find out. If you're low, you can add some malt extract (you keep some on hand, right?) to bring up your gravity to the appropriate level. If you're too high and have room in your kettle (and fermenter) to dilute your mash with some water, go ahead and do so. If you don't, then hop back on your brewing software and punch in the new gravity, then adjust your hopping schedule accordingly. If you don't have extract handy, you can use simple sugars to bring up the gravity, but this can thin out your finished beer because those sugars will be 100 percent fermented off into alcohol while malt extract is closer to 70 percent. Any adjustment small enough to make that consideration (a hotter, thinner beer) irrelevant is also probably small enough to ignore. And you don't need to hit your numbers spot-on - if I'm within five gravity points, I consider that close enough. One last gravity adjustment option at this

And you don't need to hit your numbers spot-on — if I'm within five gravity points, I consider that close enough.

things don't sync up to your projected numbers you still have some adjustment options.

The first thing – and this might have been part of your recipe planning – is to decide on mash temperature and thickness. The traditional brewer's "window" for mashing is a range of temperatures that enables both alpha- and beta-amylase activity in the mash, which are types of enzymatic activity that will create an appropriate mix of more-fermentable and less-fermentable sugars (we're leaving a lot of science out, here!). The center of that range is typically considered 152 °F (67 °C). If you're targeting "medium body" in your beer, that's where you're probably mashing. Increasing that temperature towards 155-159 °F (68–71 °C) should produce a less-fermentable wort, while dropping it towards 149 °F (65 °C) should yield a more-fermentable wort.

Mash thickness also matters (though probably only incrementally), with thicker mashes (about one quart per pound of grain) producing more-fermentable wort and thinner mashes (closer to two quarts per pound of grain) producing less-fermentable wort. Both, though, are probably only making minor differences, except at extreme ends of each variable. Don't sweat it too much, and consider the virtues of consistency here and maybe just stick to a standard mashing procedure, stage (boiling) is to simply extend the length of your boil to increase evaporation and concentration — just be sure to time your hops consistently, from the *end* of the boil.

Now that you've finished boiling (and before you chill), check your gravity. If it's too high, dilute with water. If it's too low, bring it on up with some of that extract (you did run out and get some earlier if you didn't have it already, right? Maybe just keep a bag in the brewery from now on ...). The whirlpool is a perfect time to do so, since you have very hot wort that *isn't* being actively heated and is being stirred, so dissolving liquids or powders is fairly straightforward. It's at this point that you might also consider an addition for body. If you know in advance that you're brewing a beer that needs some heft (a milk stout, for example, or a session beer that you're bulking up so it isn't too light and thin), you can add it manually here by using products like lactose sugar or dextrin powder. Both are nearly unfermentable. Lactose will add a smooth sweetness in addition to body, but dextrin (maltodextrin powder) is basically flavorless, and should just add weight. At the same time, if you're brewing up a beer with light, digestible body (a Belgian quad, for example), now is a great time to add your candi syrup, molasses, dextrose (corn sugar), honey, or other simple sugar additions.

IN THE FERMENTER

After any adjustments, go ahead and chill your wort and pitch your yeast. Done! Not guite. If you want a more fully-attenuated beer, consider a quick dose of pure oxygen aeration (via diffusion stone) to assure the yeast are receiving enough of this vital element for proper reproduction. Doing so will promote yeast health and get you a guicker, cleaner start at the beginning of fermentation. Not every brewer agrees that this has much impact on the final result in lower- to moderate-gravity beers (yeast are hardy buggers, and brewing is a robust process), but it may have incremental effects that, combined with other attenuation-encouraging steps like a cooler mash, will yield a better result. But this step is vital in bigger beers that need healthy yeast to complete fermentation. The stress of a high-sugar environment at the start of fermentation as well the stress of a highly *specific sugar type*. toxic, ethanol environment at the end of fermentation can produce off-flavors and an under-attenuated beer. Proper aeration is key in this style of beer.

We can also manage temperature in the fermenter to encourage greater/lesser attenuation – warmer or temperature-ramped fermentations will push your yeast to consume all of the sugars they can, whereas cooler fermentations may leave some amount of sugar behind due to a general sluggishness in activity at colder temperatures. Let me en-



Sugar selection can play a role in determining whether the brewer wants to increase a beer's body or decrease the body depending on brewing yeast's ability to ferment that specific sugar type.

courage you, though, *not* to attempt to under-attenuate your beer. Make sure to try to stay within the recommended range provided by the yeast manufacturer, or you may want to try to push above it at the very end of fermentation. If you deliberately stress your yeast to discourage their metabolism, you can produce significant off-flavors. While you may be successful temporarily, if the yeast wake up in a warm bottle to find a lot of simple sugars laying around, you'll produce





over-pressured gushers or dangerous bottle-bombs.

Fermentation is done – congratulations! We're finished! Well ... actually there is room for more tweaks. Post-fermentation, you can still adjust for body and gravity. If things are too thin and/or over-attenuated, your lactose/dextrin approach is still viable here, and you can always bulk that beer back up. If your final gravity is higher than you'd like, you can try moving the fermenter to a warmer room and/or rousing the yeast to try to get them to re-engage and work a bit longer. If that fails, a small simple sugar addition will increase your ABV and decrease your apparent final gravity, as well as lighten the body of the beer. This may also be the time that, after all of your efforts at fully attenuating have failed and you don't get your way-too-high gravity down to tolerable levels, that you go ahead and go radical: Introduce some bugs. Wild yeast and bacteria cultures/strains/blends can often break down those long, unfermentable sugars that your brewer's yeast couldn't handle, and over time you could end up with a fantastic funky/sour beer!

PACKAGING

It's time to package up — congratulations! You're finished! Not quite ... one last step remains: Carbonation/conditioning. Carbonation is an undervalued step, flavor, and style characteristic, but it's essential to getting the appropriate mouthfeel and presentation of the finished beer's flavors. The higher the carbonation, the fuller the mouthfeel; the lower the carbonation, the thinner the mouthfeel. Cask



English bitters pour down your throat as smooth as silk, and not just because they're delicious: Their low level of carbonation makes them highly drinkable and light on your palate and in your stomach.

Carbonation also accentuates bitterness (as carbonic "bite" joins bitter flavors on the palate), and can affect the overall aromatic quality of the beer. High carbonation can carry more flavors up and out of the beer into your nostrils – but be aware that at high enough levels that it can also smell faintly metallic. Much like we did back in the recipe-building stage, we should make a decision based on our target style or goals, and consider the effect of carbonation in-context. Often brewers will base the carbonation levels on a beer-style's traditional carbonation level. For example, British beers were often served on cask and have lower levels of carbonation while German weizens and weisse beers can benefit from being highly carbonated with a big frothy head on top of the beer and carbonic bite. Now, though, we can also consider the final flavor of our beer.

Once your beer is carbonated, it's time to drink, and adjustments are done! In fact, no ... just kidding. I mean, we could talk about glassware and how it affects perceptions of alcohol and body, but we won't. There are also some minor adjustments that could be done in the glass (like adding a lime wedge or salt) ... but again, not going to touch that subject. You've done more than enough. Your beer is yours – make it *all* yours, including managing its gravity and body from start to finish. Fill that glass, and enjoy!





FERMENTATIONS APART

Selecting different yeast for different jobs

ermentation is undoubtedly the most important part of homebrewing. The way that brewer's yeast convert wort into beer is absolutely magic. As the yeast consume sugar to produce ethanol and carbon dioxide, their enzymes interact with compounds from the grain and hops to create potent aromatics. While the brewer can shape the fermentation through microbe selection, temperature, aeration, pressure, and adjuncts, sometimes it also makes sense to conduct a separate prior or parallel fermentation of a single ingredient to generate flavors otherwise impossible to achieve within the constraints of the alcohol, water, and pH of beer.

Several staple craft-beer flavorings ferment as part of their normal processing; e.g. coffee, cocoa, and vanilla. Few people, however, have access to the raw materials to carry these fermentations out at home. One fermentation option that can be done at home is rye bread, which is the basis for kvass (see "Kvass Revival" in December 2010 *BYO*). For this article I want to start by tackling an even weirder home-fermentation: Acorns!

I also want to discuss some of the benefits of split fermentations, which allow you to exert additional control by blending two finished products together to suit your palate. Specifically, fruit wines are a perfect splitting opportunity and a convenient technique to bypass many issues that nag traditional fruit beer methods, especially at more aggressive fruiting rates.

FERMENTED ACORNS

The Homebrewer's Almanac (Countryman Press, 2016) is one of my favorite brewing books. Written and photographed by Marika Josephson, Aaron Kleidon, and Ryan Tockstein of Scratch Brewing in Ava, Illinois, it details the huge variety of approaches that they developed to infuse their beers with local and foraged ingredients. One technique that captivated me was dry-fermenting acorns. The authors describe the resulting aromas as "[R]um, raisin, plum, bourbon, Madeira, all of the most amazing smells anyone could hope to get from oak." All of that character from something you can pick-up off the ground for free!

The century-old white oak in my front yard cooperated during fall 2017 by dropping buckets of acorns; more than I'd ever seen from it. I gathered several pounds soon after they landed, before the squirrels got to them. My first step was to sort through my haul, discarding any that were cracked or otherwise damaged. I placed the keepers in glass dishes arranged in a single layer and allowed them to air dry indoors for a week. This step is essential as excess moisture can foster the conditions for future mold growth.

I discovered that a few of my acorns contained weevil larva. It was easy to spot the round exit holes and to discard the acorns that larva had destroyed. What I missed on my initial inspection were acorns with pinprick blemishes where eggs had been laid.

When I had the opportunity to visit Scratch a few months later on a drive from St. Louis to Indianapolis, I saw huge jars of acorns in their tasting room; they mentioned that luckily they had not experienced any weevil issues. Exactly what pests you deal with will depend on your location.

After a week, I moved the dried acorns to lightly closed mason jars without addition. The wild yeast and other microbes resident on the acorns do the work. If you seal the lid completely, make sure to burp the jars the I brewed a beer with compatible flavors for the acorns: A rye sour somewhere between English old ale and Flemish oud bruin.





first few weeks to release any carbon dioxide pressure. After ten months in a cool basement the aroma was a combination of apricot, distillery barrel-room, and old library books. While the exterior of the acorns was largely unchanged, the meat had turned from khaki to leathery brown. Exactly what process causes this change isn't understood, but I'd guess a combination of ethanol/ CO_2 fermentation from yeast or bacteria along with a slow Maillard reaction between the proteins and carbohydrates.

I brewed a beer with compatible flavors for the acorns: A rye sour somewhere between English old ale and Flemish oud bruin. I pitched East Coast Yeast Oud Brune, which contains both *Lactobacillus* and *Saccharomyces* but no *Brettanomyces*. *Brett* can yield so many wild flavors that I was worried it would obscure the aroma of the acorns. A sour beer is also less likely to be negatively effected by the microbes from the acorns.

I reached out to Head Brewer at Scratch Brewing, Marika Josephson, to see if she had any updates to the acorn process since publication. She responded, "[W]e did 6 or 7 experiments last year to try to figure out the best way to infuse their flavor. Ultimately we decided that cold steeping in secondary (in a refrigerated space) and warm steeping (at room temp) was the best way of preserving the incredible flavor and aroma. Steaming and boiling the acorns before adding them to the beer in an attempt to pasteurize extracted quite a bit of tannic bitterness. In all cases we did break up the acorns into chunks first to help add surface area for more extraction--just bashed them up with a mallet of some kind." So once the beer was soured, I wacked one pint (0.46 L) of the acorns with my mini-sledgehammer, splitting them in half. I dropped the meat and shells into a stainless-steel mesh tube weighted with glass marbles; this is the setup I use for keg hopping. After a weeklong infusion, I kegged the beer.

The acorns added wonderful depth of flavor, replacing some of the character that could have been provided by oak cubes, but with more depth and less "woodiness." Despite a lack of long-aging, the beer had leathery notes I associate with well-stored oud bruin.

FRUIT WINES

The ratio of fruit used in commercial sour beers is approaching the point of saturation. Fruit in absurd quantities can lead to results close to fruited mead (melomel). For example, Side Project Brewing in Maplewood, Missouri adds 6 lbs. of black raspberries for each gallon (0.72 kg/L) of base sour beer to create Fencerow. The result is a deliciously-intense fruit flavor that reveals little of the beer behind it.

Another approach to adding fruit flavors to beer is to directly add wine to your base. While commercial (grape) wine is an easy addition to replicate the flavors of wine-barrel aging or a grape-must addition, it is not the only option. You can ferment your own fruit, and then blend it into the beer to suit your tastes. Sour cherries for a Flemish red, or peaches for an IPA?

There are several advantages to fermenting fruit separately from the base beer:

ACORN OUD BRUIN

(5.5 gallons/21 L, all-grain) OG = 1.046 FG = 1.010 IBU = ~2 SRM = 18 ABV = 4.7%



INGREDIENTS

6 lbs. (2.7 kg) Briess Pilsen malt 2.5 lbs. (1.1 kg) Weyermann Munich I malt (6 °L) 1.5 lbs. (0.7 kg) flaked rye 0.5 lb. (0.23 kg) Dingemans Special B malt 0.25 lb. (113 g) Weyermann Carafa® Special II malt 0.625 oz. (18 g) Willamette hops (aged) (60 min.) ½ Whirlfloc tablet (50 min.) East Coast Yeast ECY23 (Oud Brune) yeast 2 cups (0.46 L) fermented acorns ¾ cup corn sugar (if priming)

STEP BY STEP

Begin the acorn fermentation process about 1 year prior to brew day. Dry out acorns for one week on baking sheets or other suitable surface. Place the acorns that are free of defections into ball jars and cover, burping the ball jar(s) every week or so. Store in a cool, dark place for 8-12 months.

Heat 5-gallons (19-L) water to target mash temperature of 157 °F (69 °C) for 30 minutes. Run off into kettle. Sparge to collect 7.5 gallons (28.4 L) of wort. Boil for 90 minutes, adding hops and Whirlfloc as noted. Chill to 66 °F (19 °C). Aerate the wort and pitch the suggested blend, or a blend of English ale and *Lactobacillus* of your choice.

Allow the fermentation to warm to 68 °F (20 °C) until fermentation appears complete. Place the fermented acorns on a piece of aluminum foil and tap each with a hammer to split. Add acorns including shells to the fermenter either loose or bagged and weighted. Leave at the same temperature, tasting weekly until the desired flavor is achieved. Either keg or bottle the beer to achieve 2.3 volumes of CO_2 .

- 1. The best yeast for the beer may not be desirable for the fruit. Wine yeast strains are selected to free bound aromatics from fruit and generate esters that enhance the perception of fruit. By fermenting the fruit separately, you can tailor the fermentations for both fruit and wort. See "Brewing with Wine Yeast" in May/June 2018 *BYO*.
- The carbon dioxide released during fermentation carries aromatics with it. By adding fruit to the primary fermentation, you scrub more aromatics because of the combined fermentation of malt and fruit sugars.
- Long exposure to fruit skins and seeds can be beneficial in some cases, but in others produces off-flavors. I dislike the toasty "seedy" flavor that raspberry beers develop during long-term contact with the seeds.

 Your beer may not be ready for fruit when the season is right.
 Fruit can be frozen and vacuum bagged if you have room in your freezer, but making a fruit wine can save time and effort.

Often fruit "country" wine recipes call for a considerable amount of refined sugar to increase the amount of alcohol. This is not necessary in the context of blending with beer. I suggest skipping this step as the fruit contains enough simple sugars. Starting with whole fruit, simply separate liquid from pulp. I find it most convenient to strain the liquid before fermentation to limit the risks of oxidation later.

You can use a juicer, but they can be difficult to clean let-alone sanitize. In a food processor or blender, puree and then squeeze ripe fruit through a sanitized mesh bag. Frozen fruit may not even need to be pureed. At this point you can add metabisulfite and wait 24 hours for it to kill any wild microbes or pitch the wine or brewer's yeast that suits your palate immediately. As a simple alternative, you can ferment commercially pressed and pasteurized fruit juices in the bottle they come in (pour out a sample to make room for the kräusen). If you'd rather not ferment the fruit alone, add all of the fruit to half of the beer, then blend the two back together to taste once the sugars in the fruit are fermented.

Many homebrewers try their hand at hard cider, which despite the name is easy to make. If you do, you can add your homemade cider to a batch of beer. At Old Trade Brewery in Brandy Station, Virginia, my friend Garrett Thayer brews Malum with that process. He combines 40% cider, which he ferments with Safale S-04, with Pilsner or Kölsch in the brite tank. This approach cuts the bitterness and malt flavor, creating an approachable and refreshing beer with a wonderfully fresh apple aroma. You can do the same in a keg or bottling bucket at home. If you're



🔁 ADVANCED BREWING



By fermenting the fruit addition separately from the beer, brewers can hone in a specific yeast profile (often wine yeast) to complement the final product.

not sure whether or not this idea sounds delicious, mix cider and beer in a glass to explore different base beers, apple varieties, and ratios. Apple cider blended into tripel is wonderful, and perry (pear cider) can be especially good with Belgian golden strong.

Similarly, there is nothing to prevent you from making mead and later blending it with a base beer to create a honey beer or braggot (depending on the ratio). In addition to affording control, blending provides an easy course to experiment how a varietal honey influences beer flavor.

FINAL THOUGHTS

Many homebrewers are fermentation nerds, and it is fun to combine elements and ingredients from the various traditions. You could make a beer-washed cheese, a kettle sour with yogurt whey, or a sour beer with your sourdough culture. Homebrewers brag about using the "same" ingredients as the best breweries in the world, but it can be even more fun to use ingredients that the best breweries in the world don't! Fermenting fruit and acorns are just two examples of the range of fermented flavors:

White miso for salinity in a gose? Tepache for fruitiness in a blonde? Sake to bolster a West Coast double IPA?

Get weird with your fermentations and your beer! 100





Complete your brewing library with these BYO Style Guides...



IPA Style Guide

101 homebrew recipes, key brewing techniques & tips for making your own English IPA, American IPA, Imperial or Double IPA, and newer variations of IPA. All recipes come formatted for all-grain and extract brewers.

Stout Style Guide

101 homebrew recipes, key brewing techniques & tips for making your own American, Irish, Imperial, Oatmeal, Foreign Extra, Sweet, and Specialty Stouts. All recipes come formatted for all-grain and extract brewers.



ORDER AT Byo.com/shop

FOR DIRECT LINKS TO ALL OF OUR AD W.BYO.COM/RESOURCES/READERSERVICE

AMERICAN BREWERS GUILD BREWING SCHOOL
ANVIL BREWING EQUIPMENT
BAYOU CLASSIC
BEERMKR [™]
BEST OF BREW YOUR OWN IPA AND STOUT STYLE GUIDES
BLICHMANN ENGINEERING, LLC 10, 89 & Cover 3 www.blichmannpro.com www.blichmannengineering.com
BREW PERFECT
BREW YOUR OWN BACK ISSUE BINDERS
BREW YOUR OWN BOOT CAMP
BREW YOUR OWN GEAR
BREW YOUR OWN GERMANY TRIP
BREW YOUR OWN STORE
BREWER'S FRIEND
BREWERS PUBLICATIONS
BREWING TOOLS, LLC
BREWJACKET, INC
BREWMASTER WHOLESALE
BREWMATION
BREWSSSENTIAL
BRIESS MALT AND INGREDIENTS CORecipe Cards www.brewingwithbriess.com/Homebrew info@brewingwithbriess.com
BSG SELECT INGREDIENTS

READER SERVICE
VERTISERS' WEBSITES, GO TO WW
BYO.COM DIGITAL MEMBERSHIP96 www.byo.com
CHOP & BREW 91 www.chopandbrew.com chopandbrew@gmail.com
CLEAR BEER DRAUGHT SYSTEM BY BREW PRODUCTS, LLC
E.Z. CAP
EINBREW
ELECTRIC BREWING SUPPLY, LLC
EXCHILERATOR - BRUTOOLS LLC
FERMENTIS - A LESAFFRE DIVISION
FIVE STAR CHEMICALS & SUPPLY INC
THE GRAINFATHER
GREAT FERMENTATIONS
GROGTAG
HANNA INSTRUMENTS
HIGH GRAVITY
HOMEBREWER'S ANSWER BOOK

www.byo.com/shop store@byo.com

www.lamotte.com mkt@lamotte.com

LD CARLSON COMPANY
LOGIC, INC
MARYLAND HOMEBREW
MONSTER BREWING HARDWARE LLC
MOREBEER!
PANCHO'S BREWING LAB
PROPPER STARTER
RUBY STREET BREWING
SPEIDEL TANK - UND BEHÄLTERBAU GMBH 9 www.speidels-braumeister.de
SPIKE BREWING
SS BREWTECH
THE VINTAGE SHOP 19 & 65 604-590-1911 www.thevintageshop.ca info@thevintageshop.ca
WHITE LABS PURE YEAST & FERMENTATION
WILLIAMSWARN
WINEMAKER INTERNATIONAL AMATEUR WINE COMPETITION
WISCONSIN ALUMINUM FOUNDRY CO
WYEAST LABORATORIES, INC. Cover 4 Fermentation Cultures: Beer, Wine, Cider www.wyeastlab.com customerservice@wyeastlab.com

HOMEBREW DIRECTORY

UNITED STATES ALABAMA

WERNER'S TRADING COMPANY

1115 Fourth St. SW Cullman 1-800-965-8796 www.wernerstradingco.com The Unusual Store

THE WINE SMITH

6800 A Moffett Rd. (US Hwy. 98) Mobile 36618 (251) 645-5554 *e-mail: winesmith@bellsouth.net www.thewinesmith.biz* Serving Central Gulf Coast Homebrewers

ARIZONA

BLACK CANYON BREWING SUPPLIES 2734 W. Bell Rd., Suite 1300 Phoenix 85053

(623) 363-BREW www.blackcanyonbrewingsupplies.com info@blackcanyonbrewingsupplies.com Arizona's only one stop beer and brewing supply shop - Full line of home brewing supplies with craft beer sales and growler fills. Brewery coming in 2018!

BREWERS CONNECTION

1425 E. University Drive, #B103 Tempe 85821 (480) 449-3720 ami@brewersconnection.com www.brewersconnection.com Arizona's oldest homebrew store. Full service 7 days a week!

BREWERS CONNECTION

4500 E. Speedway Blvd. #37 Tucson 85711 (520) 881-0255 www.brewersconnection.com Arizona's oldest homebrew store. Full service 7 days a week!

EVERYTHING HOMEBREW

3366 N. Dodge Blvd. Tucson 85716 (520) 232-1904 support@EverythingHomebrew.com www.EverythingHomebrew.com Smart brewing solutions for beginners and a strong inventory of ingredients for long time brewers. Friendly & expert staff to assist you.

WHAT ALE'S YA

4925 West Bell Road, Ste. D-3 Glendale 85308 (623) 486-8016 www.whatalesya.com Great selection of beer & wine making supplies.

ARKANSAS FERMENTABLES 3915 Crutcher St.

3915 Crutcher St. North Little Rock 72118 (501) 758-6261 www.fermentables.com Complete homebrew & winemakers supply

CALIFORNIA BEAR VALLEY HYDROPONICS

& HOMEBREWING 17455 Bear Valley Rd. Hesperia 92345 (760) 949-3400 fax: (760) 948-6725 info@bvhydro.com Excellent customer service and selection whether you grow or brew your own or both.

THE BEVERAGE PEOPLE

1845 Piner Road, Suite D Santa Rosa (707) 544-2520 www.thebeveragepeople.com Fast Shipping, Great Service, Classes and Cheesemaking too!

THE CHI COMPANY

6070 Enterprise Dr., Suite K Diamond Springs 95619 (530) 622-8265 info@chicompany.net www.chicompany.net 4,000+ Beverage related parts: Beer, Wine, Soda. New & used equipment. Brass & Stainless Fittings. ALL Ball, Pin & Sanke keg parts. If we don't have it -We will find it for you!

DOC'S CELLAR

855 Capitolio Way, Ste. #2 San Luis Obispo (805) 781-9974 www.docscellar.com

HOP TECH HOME BREWING SUPPLIES

6398 Dougherty Rd. Ste #7 Dublin 94568 1-800-DRY-HOPS www.hoptech.com Are you passionate about beer? So are wel Extensive inventory of ingredients/ equipment. On the Web or in our Shop we are here to help you brew your favorite beer.

NORCAL BREWING SOLUTIONS

1768 Churn Creek Rd. Redding 96002 (530) 243-BEER (2337) or (530) 221-WINE (9463) www.norcalbrewingsolutions.com Full line of beer, wine & distilling supplies, hardware and custom made equipment including the world famous "Jaybird" family of false bottoms.

O'SHEA BREWING COMPANY

28142 Camino Capistrano Laguna Niguel (949) 364-4440 www.osheabrewing.com Southern California's Oldest & Largest Homebrew Store! Large inventory of hard to find bottled & kegged beer.

PHANTOM ALES

1211 N. Las Brisas St. Anaheim 92806 (714) 225-3206 rob@phantomales.com Www.phantomales.com Huge selection of the highest quality hops, malt, and yeast. Also carrying equipment and cider supplies. Come enjoy a pint while you shop!

STEIN FILLERS

4160 Norse Way Long Beach 90808 (562) 425-0588 www.steinfillers.com brew@steinfillers.com Your complete Homebrew Store, serving the community since 1994. Home of the Long Beach Homebrewers.

UNRESTRICTED BREWING

24002 Via Fabricante, Ste. 502 Mission Viejo 92691 (949) 305-1904 *jim@unrestrictedbrewing.com Inrestrictedbrewing.com For all your Home Brewing needs. UNLEASH YOUR HOME BREW*

COLORADO Altitude homebrewing & supply

2801 Walnut St. Denver 80205 (303) 292-BREW info@AltitudeBrew.com AltitudeBrew.com DOWNTOWN DENVER'S AFFORDABLE HOMEBREW SHOP. Beer and Wine Supplies. Ingredients, Equipment, Brew-on-Premises and Classes. Let's make beer!

BOULDER FERMENTATION SUPPLY

2510 47th - Unit 1 Boulder 80301 (303) 578-0041 www.boulderfermentationsupply.com Newly Expanded! Proud vendor of Colorado Malting Co. With a wide ran

Colorado Malting Co. With a wide range of gluten free grains, CO_2 refills and all your fermentation needs. Stop in, open weekdays 11-7, weekends 10-6.

THE BREW HUT

15120 East Hampden Ave. Aurora, CO (303) 680-8898 www.thebrewhut.com Beer, Wine, Mead, Soda, Cheese, Draft, & CO₂ refills, Hands On Education Department – WE HAVE IT ALL!

CO-BREW

1133 Broadway Denver 80203 (720) 485-4959 www.cobrewdenver.com Homebrewing Supplies • Learn to brew • Make your own beer • Full brewery • Events - teambuilding, bachelor parties, birthdays, date night, customer appreciation, family reunions, and more!

LIL' OLE' WINEMAKER

516 Main Street Grand Junction 81501 (970) 242-3754 Serving Colorado & Utah brewers since 1978

QUIRKY HOMEBREW

425 W 115th Ave., Unit 6 Northglenn 80234 (303) 457-3555 Quirky@QuirkyHomebrew.com QuirkyHomebrew.com www.facebook.com/quirkyhomebrew# Homebrew Super Store. More Grains. More Hops. More Yeast. More of the stuff you brew. Beer-Wine-Cheese-Soda-Cider... and more. Special orders welcome, we compete with internet pricing.

CONNECTICUT BEER & WINE MAKERS WAREHOUSE

290 Murphy Road Hartford 06114 (860) 247-BWMW (2969) e-mail: info@bwmwct.com www.bwmwct.com Area's largest selection of beer, wine, cheese, kombucha and coffee roasting supplies. Complete line of kegging equipment. Custom made beer ingredient kits. All-Grain brewing classes available.

BREW & WINE HOBBY

Classes available! Area's widest selection of beer making kits, supplies & equipment. 12 Cedar St. East Hartford 06108 (860) 528-0592 or 1-800-352-4238 www.brew-wine.com Always fresh ingredients in stock. Pick Your Own grain room & free Crush!

DELAWARE XTREME BREWING SUPPLIES

11307 Trussum Pond Rd. Laurel 19956 (877) 556-9433 or (302) 280-6181 www.xtremebrewing.com doug@xtremebrewing.com The 'Homebrew Headquarters' on Delmarva with Distilling, Wine, Coffee, Tea & Cheese making supplies.

FLORIDA CRAFT BEER CARTEL

557 SW 12th Ave. Fort Lauderdale 33312 (954) 541-3206 craftbeercartel@gmail.com facebook/craftbeercartel We have a huge selection of malts, hops, yeast, supplies, and equipment. Everything you need to brew, equipment, expert advice as well as beginner and advanced classes.

GEORGIA BREW DEPOT - HOME OF BEER NECESSITIES

10595 Old Alabama Rd. Connector Alpharetta 30022 (770) 645-1777 fax: (678) 585-0837 877-450-BEER (Toll Free) *e-mail: beernec@aol.com www.BeerNecessities.com Georgia's Largest Brewing Supply Store. Complete line of draft dispensing equipment, CO2 and hard to find keg parts. Beginning and Advanced Brew Classes available. Call or email to enroll.*
HOMEBREW DIRECTORY 🐽

OPERATION HOMEBREW

1142 Athens Hwy #105 Grayson 30017 (770) 638-8383 Operationhomebrew.com Best darn homebrew supply store in Georgia!

HAWAII Homebrew in paradise

740 A Moowaa Street Honolulu 96817 (808) 834-BREW bill@homebrewinparadise.com www.homebrewinparadise.com Fermenting with ALOHA since 1996. Everything you need for beer, wine, mead, cider, and more!!

IDAHO Homebrewstuff.com

9115 W. Chinden Blvd., Ste 105 Garden City 83714 (208) 375-2559 www.homebrewstuff.com "All the Stuff to Brew, For Less!" Visit us on the web or at our Newly Remodeled Retail Store! Now offering a selection of over 800 craft beers.

ILLINOIS

BREW & GROW (Bolingbrook)

181 W. Crossroads Pkwy., Ste A Bolingbrook 60440 (630) 771-1410 www.brewandgrow.com Your complete one stop shop for all your brewing and winemaking needs.

BREW & GROW (Chicago)

3625 N. Kedzie Ave. Chicago 60618 (773) 463-7430 www.brewandgrow.com Your complete one stop shop for all your brewing and winemaking needs.

BREW & GROW (Rockford)

3224 S. Alpine Rd. Rockford 61109 (815) 874-5700 www.brewandgrow.com Your complete one stop shop for all your brewing and winemaking needs.

BREW & GROW (Roselle)

359 W. Irving Park Rd. Roselle 60172 (630) 894-4885 www.brewandgrow.com Your complete one stop shop for all your brewing and winemaking needs.

CHICAGOLAND WINEMAKERS INC.

689 West North Ave. Elmhurst 60126 Phone: (630) 834-0507 info@chicagolandwinemakers.com www.chicagolandwinemakers.com Full line of beer & wine making supplies.

WHAT'S BREWING?

335 W. Northwest Highway Palatine 60067 (847) 359-2739 info@whatsbrewingsupply.com WhatsBrewingSupply.com Supplying homebrewers with the best equipment and freshest ingredients. 10% Club discount. CO₂ Refills. Let's make it! Beer and Wine.

INDIANA THE BREWERS ART SUPPLY

1425 N. Wells Street Fort Wayne 46808 (260) 426-7399 brewersartsupply@gmail.com www.brewingart.com Facebook: BrewersArtSupply Your Complete STOP Homebrew Shop! Beer • Wine • Cider • Mead • Soda Pop.

QUALITY WINE AND ALE SUPPLY

Store: 108 S. Elkhart Ave. Mail: 530 E. Lexington Ave. #115 Elkhart 46516 Phone (574) 295-9975 *E-mail: info@homebrewit.com* Online: www.homebrewit.com Quality wine & beer making supplies for home brewers and wine makers. Secure online ordering. Fast shipping. Expert advice.

SUPERIOR AG CO-OP

5015 N. St. Joseph Ave. Evansville 47720 1-800-398-9214 or (812) 423-6481 superioragevv@gmail.com Beer & Wine. Brew supplier for Southern Indiana.

IOWA BEER CRAZY

3908 N.W. Urbandale Dr./100 St. Des Moines 50322 (515) 331-0587 www.beercrazy.com We carry specialty beer, and a full-line of beer & winemaking supplies!

BLUFF STREET BREW HAUS

372 Bluff Street Dubuque (563) 582-5420 jerry@bluffbrewhaus.com www.bluffbrewhaus.com Complete line of wine & beermaking supplies. In operation since 2006.

KANSAS BACCHUS & BARLEYCORN LTD.

6633 Nieman Road Shawnee 66203 (913) 962-2501 www.bacchus-barleycorn.com Fast, friendly, personalized service since 1968. Full line of fresh ingredients for home beer, wine, mead, cider and cheese makers. Your home fermentation specialists.

HOMEBREW PRO SHOPPE, INC.

2061 E. Santa Fe Olathe (913) 768-1090 or Toll Free: 1-866-BYO-BREW Secure online ordering: www.homebrewproshoppe.com

KENTUCKY WINEMAKERS & BEERMAKERS SUPPLY

9475 Westport Rd. Louisville 40241 (502) 425-1692 www.winebeersupply.com Complete Beermaking & Winemaking Supplies. Premium Malt from Briess & Muntons. Superior Grade of Wine Juices. Family Owned Store Since 1972.

LOUISIANA BREWSTOCK

3800 Dryades St. New Orleans 70115 (504) 208-2788 www.brewstock.com e-mail: kyle@brewstock.com The Largest Selection of Homebrewing Supplies in Louisiana!

LA HOMEBREW

7987 Pecue Lane, Suite 7G Baton Rouge 70809 (225) 773-9128 www.lahomebrew.com info@lahomebrew.com Massive selection of brewing grains, liquid and dry yeasts, everything for beer, wine, cider, spirits. Order online for in store pickup or same day shipping.

MARYLAND THE FLYING BARREL

1781 North Market St. Frederick (301) 663-4491 fax: (301) 663-6195 www.flyingbarrel.com Maryland's original Brew-On-Premise; winemaking and homebrewing supplies!

MARYLAND HOMEBREW

6770 Oak Hall Lane, #108 Columbia 21045 1-888-BREWNOW www.mdhb.com Beer, wine, cheese, cider making and more. Most items ship free!

MASSACHUSETTS beer and wine hobby, inc.

155 New Boston St., Unit T Woburn 01801 1-800-523-5423 e-mail: bwhinfo@beer-wine.com Web site: www.beer-wine.com Brew on YOUR Premise™ One stop shopping for the most discriminating beginner & advanced beer & wine crafter.

THE BEER SHOP!

33 Harkness Ave. East Longmeadow 01028 (762) 233-7472 thebeershop.us drink@thebeershop.us Premier craft beer/wine shop with an extensive selection of homebrew supplies. Equipment, ingredients, kits; for your next batch or to upgrade your brewery. Check us out online or stop in.

BOSTON HOMEBREW SUPPLY

1378B Beacon Street Brookline 02446 (617) 879-9550 www.bostonhomebrewsupply.com info@bostonhomebrewsupply.com Offering ingredients, equipment and expertise to help brew excellent beer at home. Convenient urban location. Friendly customer service. Wide selection and competitive prices.

MODERN HOMEBREW EMPORIUM

2304 Massachusetts Ave. Cambridge 02140 (617) 498-0400 www.beerbrew.com email: mhe@beerbrew.com Amazing selection of equipment and fresh supplies to make and dispense beer, wine, mead, cider, cheese for beginner to master. Kegging, chillers, honey, books, labels, more. 7 days a week.

NFG HOMEBREW SUPPLIES

72 Summer St. Leominster (978) 840-1955 www.nfghomebrew.com nfgbrew@aol.com New England's Biggest Little Homebrew Store!!! Personalized service, offering a wide variety of the finest ingredients for beer and wine making at GREAT PRICES!! Celebrating 23 years in business.

SKYLINE HOP SHOP

124 Elm St. Westfield 01085 (413) 378-3333 SkylineBeerCo@gmail.com www.skylinehopshop.com We carry all your equipment, supplies & fresh ingredients at competitive prices. We offer advice and classes to get you started & tend to the seasoned brewers. Open late!

SOUTH SHORE Homebrew Emporium

86 Finnell Drive, Unit 20 Weymouth 02188 (781) 340-2739 www.beerbrew.com email: sshe@beerbrew.com NE's largest homebrew store. Amazing selection of equipment and fresh supplies to make and dispense beer, wine, mead, cider, cheese for beginner to master. Classes available. 7 days a week.

HOMEBREW DIRECTORY

STRANGE BREW

416 Boston Post Rd. E. (Rt. 20) Marlboro 1-888-BREWING strangebrew@Home-Brew.com www.Home-Brew.com New England's Largest Retail Home Brewing and Wine Making Store!

WEST BOYLSTON HOMEBREW EMPORIUM

Causeway Mall, Rt. 12 West Boylston (508) 835-3374 www.beerbrew.com email: wbhe@beerbrew.com Amazing selection of equipment and fresh supplies to make and dispense beer, wine, mead, cider, cheese for beginner to master. Kegging, chillers, honey, books, labels, more. 7 days a week.

THE WITCHES BREW, INC.

12 Maple Ave. Foxborough 02035 (508) 543-0433 steve@thewitchesbrew.com www.thewitchesbrew.com You've Got the Notion, We've Got the Potion

MICHIGAN Adventures in homebrewing

6071 Jackson Rd. Ann Arbor 48103 (313) 277-BREW (2739) Michigan's Largest Supplier of Brewing Equipment & Ingredients Visit us at: www.homebrewing.org

ADVENTURES IN HOMEBREWING

23869 Van Born Rd. Taylor 48180 (313) 277-BREW (2739) Full Line of Kegging Supplies! Visit us at www.homebrewing.org

BELL'S GENERAL STORE

355 E. Kalamazoo Ave. Kalamazoo 49007 (269) 382-5712 www.bellsbeer.com Staying true to our roots, Bell's General Store has been supplying homebrewers since 1983. Visit us next door to Bell's Eccentric Café or online at www.bellsbeer.com

BREWERS EDGE HOMEBREW SUPPLY, LLC

RUMEDREW SOFFLT, LLC 650 Riley Street, Suite E Holland 49424 (616) 399-0017 www.brewersedgehomebrew.com email: brewersedge@gmail.com Your Local Homebrewing & Winemaking Supply Shop...get the Edge!

CAP N CORK HOMEBREW SUPPLIES

16776 - 21 Mile Road Macomb Twp. 48044 (586) 286-5202 fax: (586) 286-5133 info@capncorkhomebrew.com www.capncorkhomebrew.com Wyeast, White Labs, Hops & Bulk Grains!

GRAVEL BOTTOM CRAFT BREWERY & SUPPLY

418 Ada Dr. Ada 49301 (616) 920-7398 gravelbottom.com Enjoy a pint with our brewers and learn to brew your own with over 75 malts, 90 hops, and 40 yeast strains. Take it easy!

SICILIANO'S MARKET

2840 Lake Michigan Dr. N.W. Grand Rapids 49504 (616) 453-9674 fax: (616) 453-9687 *e-mail: sici@sbcglobal.net www.sicilianosmkt.com The largest selection of beer and wine making supplies in west Michigan. Now selling beer & wine making supplies online.*

MINNESOTA BREW & GROW

8302 Hwy 65 NE Spring Lake Park 55432 (763) 780-8191 or 800-230-8191 info@brewNgrow.com Winnesota's best beer brewing and wine making supply store giving superb customer service with inventory to please all levels of brewers and vintners. BrewandGrowMN is individually owned and operated.

MIDWEST SUPPLIES, LLC

5825 Excelsior Blvd. Minneapolis 55416 952-562-5300 www.MidwestSupplies.com America's Largest homebrewing & winemaking supply store.

NORTHERN BREWER, LLC

6021 Lyndale Ave., South Minneapolis 55419 612-843-4444 northernbrewer.com #1 Homebrew Supply Company in the World!! Over 25 years providing the best equipment, ingredients, expertise, and service in the industry.

NORTHERN BREWER, LLC

1150 Grand Ave. St. Paul 55105 651-223-6114 northernbrewer.com #1 Homebrew Supply Company in the World!! Over 25 years providing the best equipment, ingredients, expertise, and service in the industry.

MISSISSIPPI BREW HA HA HOMEBREW SUPPLY

4800 I-55 North Suite 17A Jackson 39206 (601) 362-0201 mac@brewhahasupply.com Brewhahasupply.com Mississippi's 1st Homebrew Store entirely dedicated to homebrewing, winemaking and cheesemaking, located in LeFleur's Gallery Shopping Center.

MISSOURI BREWER'S TRUE VALUE HARDWARE

915 Jungermann Rd. St. Peters 63376 (636) 477-7799 ww3.truevalue.com/brewerstruevalue/ Stop in for the largest selection of beer and winemaking supplies in St. Charles County!

DESIGN2BREW

9995 Winghaven Blvd. O'Fallon 63368 (636) 265-0751 www.design2brew.com Eastern Missouri's largest selection of FRESH ingredients! Extensive line of brewing and draft equipment. Beginning and advanced classes in our education center. Brewers serving Brewers.

THE HOME BREWERY

1967 W. Boat St. Ozark 65721 1-800-321-BREW (2739) brewery@homebrewery.com www.homebrewery.com Over 30 years of great products and great customer service. One Stop Shopping for all your Beer, Wine, Spirits, Soda and Cheese Making Supplies.

ST LOUIS WINE & BEERMAKING LLC

231 Lamp & Lantern Village St. Louis 63017 (636) 230-8277 www.wineandbeermaking.com Making the Buzz in St. Louis.

MONTANA ROCK HAND HARDWARE

2414 N. Montana Ave. Helena 59601 (406) 332-7770 www.rockhandacehardware.com We take the worry out of your wort. Montana's home brew headquarters. Beginner through Advanced brewers, our knowledgeable staff will help you craft your best beer.

NEBRASKA FERMENTER'S SUPPLY & EQUIPMENT

& Euror FILENT 8410 'K' Plaza, Suite #10 Omaha 68127 (402) 593-9171 contact@fermenterssupply.com www.fermenterssupply.com Beer & winemaking supplies since 1971. Same day shipping on most orders.

KIRK'S DO-IT-YOURSELF BREW

1150 Cornhusker Hwy. Lincoln 68521 (402) 476-7414 www.kirksbrew.com e-mail: kirk@kirksbrew.com Serving Beer and Winemakers since 1993!

PATRIOT HOMEBREW SUPPLY

2929 N 204th St #107 Elkhorn 68022 (402) 991-6655 www.patriothomebrewsupply.com Large selection of quality Equipment & Ingredients for making beer, wine & hard cider! Plus classes and free seminars.

NEW HAMPSHIRE A&G HOMEBREW SUPPLY

175 High St. Portsmouth 03801 (603) 767-8235 www.aghomebrewsupply.com alex@aghomebrewsupply.com Quality supplies for beer, wine, cheese making and more. CO₂ exchanges. Classes. Craft beer t-shirts, gifts. Kegging parts & accessories. Friendly, expert service. Great prices. Affiliated brewpub in the building!

KETTLE TO KEG

123 Main Street Pembroke 03275 (603) 485-2054 www.kettletokeg.com NH's largest selection of homebrewing, winemaking, spirit, soda and cheesemaking ingredients, supplies & equipment. Located conveniently between Concord and Manchester. Classes available. CO₂ Fills.

NEW JERSEY Cask & Kettle Homebrew

904-B Main St. Boonton 07005 (973) 917-4340 www.ckhomebrew.com email: info@ckhomebrew.com New Jersey's #1 place for the homebrew hobbyist. Brew at home, or Brew on premise.

LOVE2BREW

1583 Livingston Ave, Ste. #2 North Brunswick 08902 (888) 654-5511 www.love2brew.com New Jersey's largest Homebrew Supply serving the nation. Huge selection, free shipping on orders over \$75, and live customer support seven days a week!

NEW MEXICO southwest grape & grain

SOUTHWEST GRAPE & GRAIN 2801 Eubank NE, Suite N Albuquerque 87112 (505) 332-BREW (2739) www.southwestgrapeandgrain.com For all your homebrew needs. Open 7 Days a Week.

NEW YORK DOC'S HOMEBREW SUPPLIES

451 Court Street Binghamton 13904 (607) 722-2476 www.docsbrew.com Full-service beer & wine making shop serving NY's Southern Tier & PA's Northern Tier since 1991. Extensive line of kits, extracts, grains, supplies and equipment.

HOMEBREW DIRECTORY 🐽

HOMEBREW EMPORIUM

470 N. Greenbush Rd. Rensselaer 12144 (800) 462-7397 www.beerbrew.com email: heny@beerbrew.com NY's largest homebrew store. Amazing selection of equipment and fresh supplies to make and dispense beer, wine, mead, cider, cheese for beginner to master. Classes available. 7 days a week.

HOPS & BARLEY MARKET

756 Upper Glen St., Suite 12 Queensbury 12804 (518) 798-2337 hopsandbarleymarket.com Homebrew supplies and craft beer. Everything you need to go from grain to glass!

NIAGARA TRADITION HOMEBREWING SUPPLIES

1296 Sheridan Drive Buffalo 14217 (800) 283-4418 or (716) 877-8767 On-line ordering. Next-day service. Huge Inventory. www.nthomebrew.com

PANTANO'S WINE GRAPES & Home Brew Shop

249 Rte 32 South New Paltz 12561 (845) 255-5201 or (845) 706-5152 (cell) www.Pantanosbeerwine.com pantanowineandbeer@yahoo.com Find Us On Facebook. Full line of homebrewing equipment & ingredients for all your brewing needs and Distilling Yeast. Serving Hudson Valley's homebrewers. Beer Club in House! M.H.B.A.

SARATOGA ZYMURGIST

112 Excelsior Ave. Saratoga Springs 12866 (518) 580-9785 email: szymurgist@gmail.com www.SaratogaZ.com Let us be your guide into the world of Zymurgy. Reaching the Adirondack Park, Capital District, Southern Vermont and beyond! Great Online Store.

NORTH CAROLINA

ALTERNATIVE BEVERAGE (Belmont) 1500 River Dr., Ste. 104 Belmont 28012 Advice Line: (704) 825-8400 Order Line: 1-800-365-2739 www.ebrew.com 44 years serving all home brewers' & winemakers' needs! Come visit for a real Homebrew Super Store experience!

ALTERNATIVE BEVERAGE (Charlotte)

3911 South Blvd. Charlotte 28209 Advice Line: (704) 825-8400 Order Line: 1-800-365-2739 www.ebrew.com 44 years of serving all home brewers' & winemakers' needs! Visit our stores to learn how we can help you make the best beer you can make.

ALTERNATIVE BEVERAGE (Cornelius) 19725 Oak St.

27725 Udk SL. Cornelius 28031 Voice Line: (704) 527-2337 Fax Line: (704)522-6427 www.ebrew.com 44 years of serving all home brewers' & winemakers' needs! Visit our stores to learn how we can help you make the best beer you can make.

AMERICAN BREWMASTER

3021-5 Stony Brook Dr. Raleigh 27604 (919) 850-0095 www.americanbrewmaster.com abrew@americanbrewmaster.com Serving Homebrew since 1983. (and Homebrewers, too!)

ASHEVILLE BREWERS SUPPLY

712-B Merrimon Ave. Asheville 28804 (828) 358-3536 www.ashevillebrewers.com Value. Quality. Service. Since 1994

ATLANTIC BREW SUPPLY

3709 Neil St. Raleigh 27607 (919) 670-4043 *info@atlanticbrewsupply.com www.atlanticbrewsupply.com The largest homebrew shop on the East Coast! Our low prices are now available nationwide on our new website!*

OHIO THE GRAPE AND GRANARY

915 Home Ave. Akron 44310 (800) 695-9870 www.grapeandgranary.com Complete Brewing & Winemaking Store.

HBYOB "HOME BREW YOUR OWN BEER"

123 N. Springboro Pike Dayton 45449 (937) 404-2739 www.hbyob.com sales@hbyob.com The place to get everything you need to home brew your own beer, cider and wine.

LABEL PEELERS BEER & WINE MAKING SUPPLIES, INC.

211 Cherry St. Kent 44240 (330) 678-6400 info@labelpeelers.com www.labelpeelers.com Specializing in winemaking / homebrew supplies & equipment. Free monthly classes. Hours: Mon-Sun 10am-7pm

MIAMI VALLEY BREWTENSILS

2617 S. Smithville Rd. Dayton 45420 Next Door to Belmont Party Supply (937) 252-4724 chad@schwartzbeer.com www.brewtensils.com Beer, wine & cheese making supplies. Monthly classes.

OKLAHOMA HIGH GRAVITY

HIGH GRAVITY 6808 S. Memorial Drive Tulsa 74133 (918) 461-2605 store@highgravitybrew.com www.highgravitybrew.com High Gravity's Electric Brewing Systems. Simple. On Purpose.

OREGON F.H. STEINBART CO.

234 SE 12th Ave Portland 97214 (S03) 232-8793 fax: (503) 238-1649 *e-mail: info@fhsteinbart.com www.fhsteinbart.com Brewing and Wine making supplies since 1918!*

HOME FERMENTER

123 Monroe Street Eugene 97402 (541) 485-6238 www.homefermenter.com Providing equipment, supplies and advice to homebrewers and winemakers for over 30 years.

THE HOPPY BREWER

328 North Main Gresham 97030 (503) 328-8474 thehoppybrewer@gmail.com OregonsHoppyPlace.com Homebrewing Supplies, Draft Equipment, Bottle Shop, Tap Room & Nanobrewery.

LET'S BREW

8235 SE Stark St. Portland 97216 (503) 256-0205 fax: (503) 256-0218 email: kim@letsbrew.net www.letsbrew.net Since 1996. Beer-Wine-Kegging supplies-Cheese kits. Brew on Premise - 5 & 12 gallon batches. Free beer samples that were brewed here!

THYME GARDEN HERB COMPANY

20546 Alsea Highway Alsea 97324 1-800-487-8670 Visit us at: www.thymegarden.com Email: herbs@thymegarden.com Order NOW for the best selection! Over 22 varieties of hop rhizomes, extra large and rooted rhizomes. Wholesale by phone or email. Also dried hop cones.

PENNSYLVANIA BAILEE'S HOMEBREW & WINE SUPPLIES

3605 E. Market St. York 17402 (717) 755-7599 baileeshomebrew@gmail.com baileeshomebrew.com York county's largest selection of equipment, grain, malt extracts, and wine supplies. We strive for excellence in service and customer satisfaction, with a personal touch. Classes available.

BOOTLEGGERS BREW SHOP, LLC

917 Pleasant Valley Blvd. Altoona 16602 (814) 931-9962 http://bootleggersbrewshop.com bootleggersbrewshop@gmail.com Find us on Facebook! Central PA's LARGEST homebrew supplies store! We carry ALL the top quality, freshest products available in all the major brand names. Special orders welcome!

CROAKER'S KEGS & CORKS

2017 W. State St., Suite E New Castle 16101 (724) 202-7808 Email: mara@croakersbrew.com Website: croakersbrew.com Check out our homebrew shop and BOP (Brew-on-Premise) to keep your hobby "bubbling." Make your own craft beer here!

KEGGLE BREWING

Glenshaw 15116 www.kegglebrewing.com Huge selection of brewing equipment, draft beer equipment, and beer kits. From kettles, to fittings to DIY kits, we've got you covered.

KEYSTONE HOMEBREW SUPPLY

126 E. 3rd St. Bethlehem 18015 (610) 997-0911 infobeth@keystonehomebrew.com www.keystonehomebrew.com Larger location with expanded product selection & services for your beer & wine making needs.

KEYSTONE HOMEBREW SUPPLY

435 Doylestown Rd. Montgomeryville 18936 (215) 855-0100 sales@keystonehomebrew.com Where Homebrewing Dreams Come True www.KeystoneHomebrew.com

PORTER HOUSE BREW SHOP, LLC

114 Perry Highway, Unit 4 Harmony 16037 (just north of Pittsburgh) (724) 473-0971 www.porterhousebrewshop.com Offering home-town customer service and quality products at a fair price. Large selection of home brewing, winemaking and kegging supplies. Hours: Tu-F 12-6, Sat 10-4

SCOTZIN BROTHERS

65 N. Fifth St. Lemoyne 17043 (717) 737-0483 or 1-800-791-1464 www.scotzinbros.com Open 6 days! Tu-F 10am-6pm, Sat 10am-5pm, Sun 10am-3pm Central PA's Largest IN-STORE Inventory!

HOMEBREW DIRECTORY

RHODE ISLAND BLACKSTONE VALLEY BREWING SUPPLIES

403 Park Ave. Woonsocket (401) 765-3830 www.blackstonevalleybrewing.com Quality Products and Personalized Service!

CONANICUT BREWING

34 Narragansett Ave., Suite C Jamestown 02835 (401) 524-9359 conanicutbrewing@gmail.com www.conanicutbrewing.com Beer- and Wine-Making Supplies, Equipment, And Ideas For Getting Your Fermentation On!

TESSIER'S HARDWARE & HOMEBREW

837 Central Ave. Pawtucket 02861 (401) 726-9627 admin@tessiershardware.us www.tessiershardware.us Beer and Wine Crafting Supplies and Home Improvement all in one stop.

SOUTH DAKOTA goodspirits fine wine & Liquor

3300 S. Minnesota Ave. Sioux Falls 57105 (605) 339-1500 www.gsfw.com Largest selection in South Dakota for the home brewer and winemaker. We are located in the Taylor's Pantry Building on the corner of 41st & Minnesota Ave.

TENNESSEE ALL SEASONS GARDENING & BREWING SUPPLY

924 8th Ave. South Nashville 37203 1-800-790-2188 fax: (615) 214-5468 local: (615) 214-5465 www.allseasonsnashville.com Visit Our Store or Shop Online. Nashville's Largest Homebrew Supplier!

TEXAS AUSTIN HOMEBREW SUPPLY

9129 Metric Blvd. Austin 78758 1-800-890-BREW or (512) 300-BREW www.austinhomebrew.com Huge online catalog!

DALLAS HOME BREW A DIVISION OF THE WINE MAKER'S TOY STORE

1500 North Interstate 35E, Ste 116 Carrollton 75006 (866) 417-1114 www.finevinewines.com Dallas' largest home brew supply store.

DEFALCO'S HOME WINE AND BEER SUPPLIES

AND BEEN SUPPLIES 9223 Stella Link Houston 77025 (713) 668-9440 fax: (713) 668-8856 www.defalcos.com Check us out on-line!

FARMBOY BREW SHOP

3814 North Shepherd Dr. Houston 77018 (832) 667-8081 farmboybrewshop.com Farmboy Brew Shop strives to supply fresh, quality ingredients at competitive prices with a touch of personal service and friendly, down home attitude. Relax, have fun, and ferment, ya'll.

HOMEBREW HEADQUARTERS

300 N. Coit Rd., Suite 134 Richardson 75080 (972) 234-4411 or 1-800-966-4144 www.homebrewhq.com Proudly serving the Dallas area for 30+ years!

PANCHO'S BREWING LAB

3427 New Boston Rd. Texarkana 75501 (903) 306-1771 pancholozano@panchosbrewinglab.com www.PanchosBrewingLab.com For all your homebrewing ingredients and equipment. Servicing the ArkLaTex area and South Oklahoma.

UTAH Ogden city brew supply

2269 Grant Ave. Ogden 84401 (385) 238-4995 ogdencitybrewsupply.com info@ogdencitybrewsupply.com Ogden Valley's only brewing supply store serving the needs of beer, wine, cider, and mead brewers.

SALT CITY BREW SUPPLY

723 E. Fort Union Blvd. Midvale 84047 (801) 849-0955 www.saltcitybrewsupply.com Located in the middle of the Salt Lake Valley, we have what you need for your homebrew hobby!

VERMONT BREWFEST BEVERAGE CO.

199 Main St. Ludlow 05149 (802) 228-4261 www.brewfestbeverage.com Supplying equipment & ingredients for all your homebrewing needs. Largest selection of craft beer in the area. Growlers poured daily!

VIRGINIA Mylocal homebrew shop

6201 Leesburg Pike #3 Falls Church (703) 241-3874 info@myLHBS.com www.myLHBS.com

ORIGINAL GRAVITY

6118 Lakeside Ave. Richmond 23228 (804) 264-4808 www.oggravity.com Extensive selection of ingredients, supplies, and equipment for all levels from beginner to seasoned brewer. We have a knowledgeable and friendly staff to assist you with brewing and kegging questions and recipe formulation.

SOUTHERN HILLS Homebrew Supply, LLC

5342 Franklin Rd. SW Roanoke 24014 (540) 400-0091 brewit@southernhillshomebrew.com www.southernhillshomebrew.com Selling the supplies, ingredients and equipment you need to make world class beer and wine in your own home.

WASHINGTON BADER BEER & WINE SUPPLY 711 Grand Blvd.

/11 Grand Blvd. Vancouver, WA 98661 1-800-596-3610 BaderBrewing.com \$6.99 Flat Rate Shipping on orders over \$75.00 for western states. See our website for details.

THE BEER ESSENTIALS

2624 South 112th St., #E-1 Lakewood 98499 (253) 581-4288 www.thebeeressentials.com Mail order and secure on-line ordering available. Complete line of brewing and kegging supplies.

THE CELLAR HOMEBREW

Make your own beer & wine 14320 Greenwood Ave. N. Seattle 98133 1-800-342-1871 FAST Reliable Service, 40 Years! Secure ordering online www.cellar-homebrew.com

MICRO HOMEBREW

17511 68th Ave NE Kenmore 98028 (425) 892-8425 tony@microhomebrew.com www.MicroHomebrew.com A great local shop with a friendly, knowledgeable staff!

SOUND HOMEBREW SUPPLY

6505 5th Place S. Seattle 98108 (855) 407-4156 info@soundhomebrew.com soundhomebrew.com Knowledgeable Staff. Great Selection.

WISCONSIN BREW & CROW (Indian

BREW & GROW (Madison) 1525 Williamson St

Madison 53703 (608) 226-8910 www.brewandgrow.com Your complete one stop shop for all your brewing and winemaking needs.

BREW & GROW (Waukesha)

2246 Bluemound Rd. Waukesha 53186 (262) 717-0666 www.brewandgrow.com Your complete one stop shop for all your brewing and winemaking needs.

THE CELLAR BREW SHOP

465 N. Washburn St. Oshkosh 54904 (920) 517-1601 www.thecellarhomebrew.com cellarbrewshop@outlook.com Beer & Wine ingredients and equipment. Extensive inventory at Competitive prices, bulk discounts. Great service and free advice from our experienced staff.

FARMHOUSE BREWING SUPPLY

3000 Milton Ave. Janesville 53545 (608) 305-HOPS farmhousebrewingsupply@gmail.com Farmhousebrewingsupply.com Conveniently located minutes off of 1-90 and offering Southern Wisconsin's largest selection of hops.

HOUSE OF HOMEBREW

410 Dousman St. Green Bay 54303 (920) 435-1007 staff@houseofhomebrew.com www.houseofhomebrew.com Beer, Wine, Cider, Mead, Soda, Coffee, Tea, Cheese Making.

NORTHERN BREWER, LLC

1306 S. 108th St. West Allis 53214 414-935-4099 northernbrewer.com #1 Homebrew Supply Company in the World!! Over 25 years providing the best equipment, ingredients, expertise, and service in the industry.

POINT BREW SUPPLY & O'SO BREWING CO.

3038 Village Park Dr. I-39/Exit 153 Plover 54467 (715) 342-9535 katina@osobrewing.com www.pointbrewsupply.com www.osobrewing.com "The Feel Good Store with a team of Professional Brewers on Staff"

WINDRIVER BREWING CO., INC

861 10th Ave. Barron 54812 1-800-266-4677 www.windriverbrew.com Fast nationwide shipping.

HOMEBREW DIRECTORY 🐽

WINE & HOP SHOP

1919 Monroe Street Madison 53711 1-800-657-5199 or (608) 257-0099 www.wineandhop.com info@wineandhop.com Madison's locally-owned homebrewing and winemaking headquarters. Offering fresh ingredients, quality supplies, and expert advice for over 40 years.

WYOMING THAT HOMEBREW STORE

213 W. 18th St. Cheyenne 82001 (307) 514-5437 fax: (307) 514-5438 ThatHomebrewStore@hotmail.com www.ThatHomebrewStore.com Equipment and supplies to make beer, wine, cheese, cider, mead & yogurt.

AUSTRALIA

BETTABREW BEER & WINE MAKING SUPPLIES

Unit 1, 12-16 Tonga Place Parkwood 4214 Phone: 07 55940388 ibrew Australia www.ibrew.com.au email: info@ibrew.com.au Craft brewing & wine making supplies. Mail order specialists. Established since 1976.

VICTORIA BEERCO PTY LTD

Unit 1 / 1-3 Disney Ave. Keilor East 3033 +61 400 040 195 orders@beerco.com.au www.beerco.com.au Our Search is Your Satisfaction Gladfield Malts + Hops + GigaYeast + Equipment. Use coupon code "byo" for 10% off on your first order online. Domestic and International Shipping available.

CLEVER BREWING

www.cleverbrewing.com.au sales@cleverbrewing.com.au Home brewing for clever Aussie folks!

GRAIN AND GRAPE PTY LTD.

5/280 Whitehall St. Yarraville 3013 (03) 9687 0061 www.grainandgrape.com.au Equipment, ingredients and advice for the beginner & expert. Full mail order service.

W. AUSTRALIA BREWMART BREWING SUPPLIES

32 Railway Parade Bayswater 6053 618 9370 2484 email: info@brewmart.com.au www.brewmart.com.au Wholesale and Retail distributors for Blichmann, Still Spirits, Keg King, BrewCellar, Coopers, Edwards Essences, Mangrove Jacks, Kegland, Pure Distilling, Samuel Willards, Morgans, All in Brewery.



5308 - 17th Ave. SW Calgary T3E 656 (403) 243-5907 www.grapestoglass.com Calgary's largest selection of brewing, winemaking & distilling supplies. Online shopping available with delivery via Canada Post.

BRITISH COLUMBIA BOSAGRAPE WINERY & BREW SUPPLIES

6908 Palm Ave. Burnaby V5J 4M3 (604) 473-9463 www.bosagrape.com Established since 1989 and dubbed the homebrewer's candy store; we have all that your brewing heart desires.

NOVA SCOTIA EVERWOOD AVE BREW SHOP

731-6 Old Sackville Road Lower Sackville B3Z 0J7 (902) 869-2337 info@everwoodavebrewshop.com www.everwoodavebrewshop.com Ingredients and equipment for beginners to professionals, Canada's most complete homebrew store.

NOBLE GRAPE CANADA

www.shopnoblegrape.ca Customer Service: 1-844-913-2739 Extensive selection of brewing, distilling, and winemaking ingredients ON-LINE! Beginners to advanced. FLAT RATE shipping in Canada.

ONTARIO CANADIAN HOMEBREW SUPPLIES

10 Wilkinson Rd., Unit 1 Brampton L6T 5B1 (905) 450-0191 chs-store@bellnet.ca www.homebrewsupplies.ca Drink a Beer, Waste an Hour. Brew a Beer, Waste a Lifetime! For all your homebrew supply needs and wants.

QUEBEC beer grains supply co.

99, rue Crémazie Gatineau J8Y 3P1 1-888-675-6407 (Canada Only) info@beergrains.com www.beergrains.com We bring homebrew supplies and fresh ingredients across North America for all levels of brewing! Fournisseur d'équipements et d"ingrédients de premiéres qualités pour les brassuers de tous niveaux.



4028 Long Dong Ave., #145 Pudong 201201 +86-158-2111-3870 m.sherretz@yahoo.com Everything for Beer and Wine. The most complete line of ingredients and equipment in China. Beer making classes held monthly. Email for catalogue via return email.

C		F		R	Ì			4	N		١
H	N	PF	Έ	Ν	U	N	D	M	E	H	R

Schulstraße 27 88099 Neukirch (+49) 7528 96990-10 fax: (+49) 7528 96990-20 info@hopfen-und-mehr.de www.hopfen-und-mehr.de Everything for home and hobby brewers. Great selection, fast shipping. Alles für Haus-und Hobbybrauer. Grosse Auswahl, schneller Versand.



www.brewshop.co.nz sales@brewshop.co.nz Online homebrew beer supplies



1412 Sofiemyr +47 22650866 www.bryggselv.no

ØLBRYGGING AS

Østerskogen 55 4879 Grimstad +47 37407040 olbrygging.no



Bergkällavägen 28 SE-19279 Sollentuna (+46) 8 514 501 20 fax: (+46) 8 514 501 21 Email: info@humle.se Website: www.humle.se Supplier of professional equipment and fresh ingredients to craft breweries, homebrewers and retailers since 1992. Large selection of malt, hops & yeast. Rapid order fulfillment to 25 countries in Europe.

MALTMAGNUS AB

Östra Åby 408 Hagen 692 93 Kumla (+46) 19 18 97 90 *E-mail: info@maltmagnus.se Website: maltmagnus.se Extraordinary service! Products making your beer taste great. A wide range of ingredients and equipment you're drooling for. Worldwide shipping.*



THE HOME BREW SHOP Unit 3&4 Hawley Lane Business Park 108 Hawley Lane Farnborough GU14 8JE Tel: 01252 338045 sales@the-home-brew-shop.co.uk

www.the-home-brew-shop.co.uk The Home Brew Shop supplies beer kits, wine kits, cider kits, hops, and grains. We are one of the Oldest homebrew shops in the UK with over 47 years in the Home-Brewing trade.

KEG KINGDOM

Somers Road Halesowen Birmingham B62 8EN www.kegkingdom.co.uk sales@kegkingdom.co.uk Supplier of Homebrew ingredients including Hops, grains and kits. We also specialise in Cornelius kegs and related dispensing equipment, beer faucets, beer towers and drip trays. 5% discount code 'BYO'

LIST YOUR HOMEBREW SUPPLY BUSINESS Email Dave at dave@byo.com or call (802) 362-3981 ext. 107



HOMEBREWING IN RWANDA

Making beer in a land of banana-beer

G rowing up several hours from Chico, California, I had learned to take craft beer for granted. But when I moved to Rwanda in 2013, a good pale ale couldn't be found within a thousand miles. Suffice to say that I first came upon homebrewing as a hobby born from necessity. During my four years in Rwanda, I spent a disproportionate amount of time learning to and eventually homebrewing a wide variety of ales.

Commercially-available Rwandan beer runs from the higher-gravity, molasses-based "dark beer" called Turbo King (marketed as the "man's beer"), to the low-ABV rice and maize lager, Primus. A 72-cL (24-oz.) bottle of Primus retails for the bargain price of \$0.85 USD. Skol and Heineken operate similar businesses based on cheap lagers and uninspired attempts at dark beer.

While Rwanda's beer market is bland, local alcohol production is alive and well. The most popular drink is banana beer, known as *urugwagwa*, which uses unripe bananas as the primary sugar source. There is also banana wine which pushes the ABV from around 6% to 10% and has a much drier finish as a result. In certain regions, sorghum is added to the banana beer prior to fermentation, which gives it a nice sour kick. A downside of this is that a lot of the sorghum grain remains suspended in the liquid so you end up crunching your way through a pint.

About six months into my time in Rwanda, a few friends and I started bringing back homebrewing ingredients from the United States in suitcases. TSA had a bad habit of cutting into my malt extract bags with a knife, so there was almost always a mess to clean upon arrival.

We started out with an opaque yellow 20-L (5.25-gal.) jerrycan as our first fermentation vessel. This proved

impossible to clean, and we had a series of gushers each time we would reuse a jerrycan. Then the improvements started to come through. We got a real carboy, a boil kettle, a blow-off tube, a carboy thermometer, a siphon, a racking cane, etc.; all of this brought back from the USA piecemeal in suitcases. Our biggest process improvement was putting the fermenting carboy in a big bath of water and religiously adding ice cubes during primary fermentation to keep the wort temperature under 24 °C (75 °F). A few runaway fermentations and we quickly learned our lesson on temperature control in an equatorial climate.

After about 18 months, we started hitting our groove. Beers came out consistently drinkable, several of them surprisingly good. We started circulating our bottles more widely to expatriate and Rwandan friends. Dark beers and saisons went over best with Rwandans. The dark caramel malts and saison yeast esters brought the beer much closer to the banana beer flavor profile. Expats loved the hoppy beers.

Thinking back on homebrewing in Rwanda, my biggest regret is not experimenting enough with local ingredients. There is abundant tropical fruit such as passion fruit, quava, papaya, and pineapple that would have been fun to brew with. A quick shout-out to my homebrewing buddies, Brekke Berg and Leah Hazard, and my brewing sensei, Andy Shumaker, who coached me from Boston. And thanks to Stevie Varin for her work on our "Umuzehe Brewing" label which, in the local language of Kinyarwanda, translates to "Old Man Brewing" and was inspired by the unique style and presence of older Rwandan men. (BYO)

Find an authentic banana beer recipe from Alex at: https://www.byo.com/ recipe/urugwagwa-rwandan-banana-beer

The most popular drink is banana beer, known as *urugwagwa*, which uses unripe bananas as the primary sugar source.



HOTTER THAN HELLFIRE

BLAZING FAST PERFORMANCE.



HellFire™

Unmatched in the market, the HellFire[™] Burner offers dual modes perfect for all types of brewers. On high power mode, the patent pending burner casting produces 140,000 BTU/hr. Also included is a patent pending heat shield. The HellFire[™] Burner not only makes your brew day quicker, but will also last you for years of brewing to come.

BREWING INNOVATION

blichmannengineering.com

FORHOMEBREVING



1 GALLON BREWING STARTER KIT



BASIC HOMEBREW STARTER KIT



DELUXE HOMEBREW STARTER KIT



PREMIUM HOMEBREW STARTER KIT



MOREBEER!™ GIFT CARDS



Ss BREWTECH™ BREW BUCKETS



TORPEDO™ KEGS



HOMEBREW STOCKING STUFFERS





AND WE'LL TELL YOU THE EXACT DAY YOUR ORDER WILL ARRIVE BY!

