BREW A BIG MALTY BOCK | CRAFTING QUÉBEC CLONES | MAKE HARD CIDER EASIER

Brew Your Own

THE HOW-TO HOMEBREW BEER MAGAZINE

JANUARY-FEBRUARY 2015, VOL.21, NO.1

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20 BYO ANNIVERSARY

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features

WILLIAMSWARN

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In 2011, Master Brewer Ian Williams launched the WilliamsWarn Personal Brewery, along with award winning recipe kits in New Zealand. Homebrewing took a leap forward, allowing the home brewer to make cold, clear, cleanly fermented, perfectly carbonated beer at home in just 7 days. This had never been achieved at home anywhere – professional quality beer in the same time-frame as that of a modern brewery. Following large amounts of international interest, WilliamsWarn has now launched its award winning ingredient kits in the United States through betterbrewing.com and amazon.com. WilliamsWarn brewing equipment will also be available soon.

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Each of the 14 WilliamsWarn brew kits accurately matches a style within the BJCP Style Guidelines. All kits consist of liquid and dry malt extract made in state-of-the-art brewhouses. Only the best strains of yeast from Fermentis and Lallemand are used in each kit. A hard cider kit made from 100% New Zealand apples is also available.

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departments

where to find it

RECIPE INDEX

BYO RECIPE STANDARDIZATION

Extract efficiency: *65%*
(i.e. — 1 pound of 2-row malt, which has a potential extract value of 1.037 in one 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.

Gallons:
We use US gallons whenever gallons are mentioned.

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what's happening at BYO.COM

Brewing for Flavor: Hops

After learning all about the history of hops in brewing (starting on page 68), travel back to 1995 for this story by Ashton Lewis (Mr. Wizard) that details all hops have to offer to your beer, if you know how to control them.
http://byo.com/story285

Breakfast Beers: Bacon Beer

Have we wet your whistle for beer-themed breakfasts with this issue's story on homebrew jellies? Take that craving a step further with this recipe for a bacon beer.
http://byo.com/story2001

Bock in Four Movements

From the doppelbock of 16th century monks to today's light-hearted helles, we go through four popular bock beers, their histories, characteristics, and, most importantly, how you can brew your own examples.
http://byo.com/story241

Sweetness: Brewing Sugars and How to Use Them

Sugars add strength to beer without bulking up the body. John Palmer conducts a survey of sweetness to help you choose when to use sugar and which sugar to use. From Belgian candi sugar to xylose, it's all here.
http://byo.com/story1441

Brew Your Own — The How-To Homebrew Beer Magazine

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Volume 21, Number 1: January-February 2015

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Brutus 10 — electric?

A couple of months ago I ordered the re-print of the Brutus Ten building instructions from *Brew Your Own*. However, it has come to my realization that building a full system using gas doesn't make a whole lot of sense for me since I live in Toronto and it is much too cold to brew outside all year round. So basically, I am just wondering if there are any instructions out there that might show how to take the Brutus Ten build instructions and convert it to an electrical brewing system?

Iain Robertson
Toronto, Ontario

Brew Your Own *Editor Betsy Parks replies: "Hi, Iain. Funny you should ask that question— when your email came in (in mid-November) I was just putting the finishing touches on the current issue of* Brew Your Own, *with the cover story about building an all-electric "Brutus"-like homebrew system. You can check out that story, written by* Brew Your Own *newcomer Trent Neutgens, on page 54 of this issue. Trent has built a system that utilizes easily accessable parts that I think many homebrewers interested in going electric will find helpful and approachable. In addition to that story, there is a great wealth of information on the Web these days for all-electric homebrewers. Your first stop should definitely be the website of fellow Canadian Kal Wallner, who created and maintains www.theelectricbrewery.com. His website not only includes extensive plans and information for building an electric system and about electric brewing, but there is also a forum where readers can post questions and thoughts about their own systems and experiences. In addition to his work on his website, Kal was also a technical editorial reviewer on the story in this issue, and has been very helpful to* BYO *readers with electric brewing questions over the years.*

Hopefully with the help of this issue's story, Kal's website, our electric brewing advertisers, and with what you can find on the Internet (HomeBrewTalk and Reddit are also good places to look), you will build your own great system — and then send us photos of how it comes out! Good luck!"

contributors

Trent Neutgens is an IT professional and homebrewer living in Chaska, Minnesota with his wife and three children. He started homebrewing back in 1995 and after a few extract batches switched to brewing 10-gallon (38-L) all-grain batches using a system made up of a combination of keggles and coolers. Life, family and career got in the way, which lead to a nearly 10-year break from brewing.

When Trent finally decided to get back into brewing last year, he decided to say goodbye to brewing outdoors in the Minnesota winters and build an all-electric indoor brewery. In this issue, starting on page 54, Brent makes his *Brew Your Own* writing debut by showing off his indoor homebrewing system, including specifications and advice for building your own electric brewery.

Horst Dornbusch is the owner and founder of Cerevisia Communications, a consulting firm that deals with all aspects of the brewing industry. (His website is www.cerevisiacommunications.com.) Horst is the author of several books on beer and brewing and was *BYO*'s "Style Profile" columnist for several years. He was an Associate Editor for *The Oxford Companion to Beer* and the author of *PROST! The Story of German Beer* (1997); *Altbier* (1999); *Bavarian Helles* (2000); and *The Ultimate Almanac of World Beer Recipes* (2010).

Horst lives in Massachusetts, but was born in Düsseldorf, Germany and visits there frequently — in addition to lots of other world travel. In this issue, on page 68, Horst explores the history of why brewers add hops to beer.

Ruth Miller has been a homebrewer for 12 years, and a craft beer-lover always from her home-base in Northwestern Vermont. Her musings on beer culture and beer and cheese pairings led her to become "The Beer & Cheese Maven," a consultant on, and presenter of, events all over New England featuring beer and cheese pairings.

In this issue, on page 36, longtime friends Ruth and Anne Whyte team up for a trip to the Canadian province of Québec to explore the craft brewing scene and conjure up a few commercial clone recipes.

Anne is the Co-Owner of Vermont Homebrew Supply in Winooski, Vermont and a long-time member of *Brew Your Own*'s Editorial Review Board. She has been a homebrewer for more than 20 years and is a nationally ranked BJCP beer judge.

It's Brew Day!

Los Angeles

#ItsBrewDay

304 Ss Stainlessium BREWING TECHNOLOGIES

KIP'S BREW GARAGE

One of the most rewarding parts of our "job" here at Ss Brewtech is not only getting to make innovative and high quality brewing gear, but also getting to meet the brewers who use our products and drink their beers! Recently we met up with Kip, a home brewer in So Cal, who has used our products to take his home brew game to the next level. Kip has transformed his Los Angeles area garage into a full-on home brewery and is making some fantastic beers.

Check out www.ItsBrewDay.beer for more pics from our Brew Day with Kip. Submit pics of your own brew cave for a chance to be featured on our site and to get some free Ss Brewtech gear!!!

Kip's Ss Gear

SEE MORE OF KIP'S SET UP & SUBMIT YOURS AT:
WWW.ITSBREWDAY.BEER

SHOW US YOUR SET UP FOR A CHANCE TO WIN SOME Ss BREWTECH GEAR!

Homebrew pumps

In the article in the November 2014 issue about modifying homebrew pumps, I had a question: Can you use a 3-way ball valve on pump 1 for the bleeder and save yourself two 2-way valves?

Matt Eckhart
via Facebook

Story author Christian Lavender replies: "Hi, Matt. With a 3-way valve you can purge air from the motor in the same way you would with the dual 2-way valve setup. With a 3-way valve you are either on or off, so you couldn't use the valve as a throttle like you can with the dual 2-way valve setup."

Oktoberfest question

I brewed Jamil Zainasheff's Oktoberfest recipe from the October 2014 issue of *BYO* on 10/2. I used two packs of Wyeast 2206 (Bavarian Lager) yeast with a starter. My original gravity was 1.062. I have a controlled temperature fermentation and kept the temp at 50 °F (10 °C). Fermentation started within 12 hours and was good, I transferred the beer to a secondary on 10/26. Gravity was 1.014. Fermentation at that point was one bubble every 15 seconds. On 11/6 the fermentation activity is every 21 seconds. Is this normal for a fermentation to take this long? I am waiting to do a diacetyl rest but it is recommended to wait until the activity is down to one bubble per minute. Can you advise on the next step?

Dale Pudenz
Caldwell, Indiana

Brew Your Own *Recipe Editor Dave Green replies: "Hi Dale. Lagers. . . . they sometimes can take forever to finish. This is probably why Oktoberfest is traditionally brewed in the early spring to be served in September (although it definitely shouldn't take your beer that long to finish!) We have a Vienna lager here at the office that's acting pretty fickle as well. I would definitely say take another sample and see where the gravity stands. That will tell you if the beer was just de-gassing or if the yeast are still eating. But ultimately no matter what the gravity says, I would perform your diacetyl rest now. That's my opinion. My reasoning is that if the yeast are still trying to chew on any remaining sugars, this temperature jump should allow them to finish up and process any diacetyl. Then you can drop the temperature to near or just below freezing if possible to get the yeast to flocculate out. Hopefully you should be ready in another two weeks or so. Best of luck and let me know if you have any other questions."*

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BSG HandCraft is the exclusive distributor of the maltsters featured above and many more. We're obsessed with delivering the best ingredients because they make the best beers. Looking for any of the above malts? Please ask for BSG HandCraft distributed products at your local homebrew store. Happy brewing!

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homebrew nation

READER PROFILE:

Brewer: Richard Eidle

Hometown: Charlottesville, Virginia

Years brewing: 5

Type of brewer: All-grain

Homebrew Setup: 10-gallon (38-L) setup, converted Rubbermade mash tun and liquor tank and a Polar Ware 15-gallon (57-L) stainless pot. My efficiency is around 80% and I mostly make 5-gallon (19-L) batches.

Currently fermenting: Belgian IPA

What's on tap/in the fridge: On tap is Belmont IPA, in the fridge is a breakfast stout and Hiltilda (Belgian Pale Ale).

How I started brewing: I started on a Mr. Beer kit my wife bought me for my birthday many years ago and now I'm brewing all-grain batches as fast as I can. I started brewing for two reasons: My love of craft beer and my background in chemistry. I love science and the process of homebrewing appeals to my love of chemistry and scientific methods. From designing balanced recipes (using a balance between alpha and beta acids in hops and different malts), to hitting the right water profile to get the pH of the mash in the optimal range, to the brilliance of yeast and how it works, how it survives and how it makes delicious alcohol. Good science makes great beer and I love learning more about both as I become a more experienced brewer.

Homebrewing tips to share: 1. Start slow — the best way to know what equipment you need is to make beer with what you have. 2. When you think you messed up, you didn't. You'll know when you mess up. 3. Understand your ingredients and don't add something to your brew without a reason. 4. Use the extensive homebrewing resources that are available. 5. Make beer you want to drink and make it yours. 6. Make yeast starters.

A little about the recipe I'm sharing: When I first made this recipe for a winter warmer I pulled from a number of places trying to get a nice beer I would like to drink by the fire. Not much has changed to it as I have brewed it over the past few years. I've reworked a number of the malt amounts but otherwise this has remained fairly close to the same recipe. My favorite part of this beer is the nice citrus flavor balancing with the dark malts. It gives a nice bite with some dark, sweet notes that is perfect in the winter.

My blog/website: https://www.facebook.com/CraftBeerHeaven

reader recipe

Winter Wonderland
(5 gallons/19 L, all-grain)
OG = 1.060 FG = 1.014
IBU = 45 SRM = 21 ABV = 6.1%

Ingredients

9 lbs. (4.1 kg) Maris Otter pale ale malt
1.25 lbs. (0.57 kg) Vienna malt
1 lb. (0.45 kg) torrified wheat
8 oz. (0.23 kg) caramel/crystal malt (120 °L)
8 oz. (0.23 kg) chocolate malt
11.5 AAU Magnum pellet hops (60 min.) (1 oz./28 g at 11.5% alpha acids)
3.4 AAU Fuggle pellet hops (10 min.) (0.75 oz./21 g at 4.5% alpha acids)
1 oz. (28 g) orange peel, sweet (5 min.)
1 tsp. Irish moss (15 min.)
Wyeast 1084 (Irish Ale) or White Labs WLP004 (Irish Ale) yeast
⅔ cup corn sugar (if priming)

Step by Step

Mill grain and target a mash of around 1.5 quarts water to 1 pound of grain (1.5 L to 0.45 kg) and a temperature around 149 °F (65 °C). I like to hold my mash at 149 °F (65 °C) for 75 minutes and mash out with near-boiling water to bring the temperature to about 168 °F (76 °C). I collect wort until I collect about 7 gallons (26.5 L) of liquid in my kettle, but I find I lose a great amount due to evaporation during the boil.

The total boil time is 60 minutes and add ingredients as per the schedule. Once done, chill the wort to 68 °F (20 °C) and pitch 1 package of yeast that has been prepared into a 1.5 qt. (1.5 L) yeast starter.

Ferment at 68 °F (20 °C) for about one week. I like to transfer to a secondary carboy after fermentation is complete to clarify the beer by cold crashing the secondary before kegging. Carbonate to a level of 2.3 volumes.

what's new?

Puck Off Bottle Opener

In their quest to celebrate the sport of hockey as well as homebrewed beer, two homebrewing brothers from Minneapolis, Minnesota (Kyle and Keith Jordan) discovered an innovation that has brought the best of both worlds together, Puck Off. Puck Off is a game quality Canadian-made hockey puck that has been adapted to hold a stainless steel bottle opener. The combination of the puck and the stainless steel opener creates superb durability, and an exciting new way to open your bottled homebrew. Get your mitts on one at www.puckoffopener.com.

Digital Temperature Control Package

Ruby Street Brewing has released a new digital temperature/ignition control option designed specifically for their systems. The control panel offers one convenient interface that is tower-mounted at the left side of any Ruby Street system. The panel is equipped with controls for three burners, two PID digital controls (one for the hot liquor tank (HLT) and one for the mash), an on/off switch for the boil kettle burner, and on/off/auto switches on the HLT and mash burners that allow for digital or manual control. Learn more about Ruby Street Brewing and their equipment at www.rubystreetbrewing.com

Wisdom For Home Brewers

Offering 500 tips plus basic homebrewing recipes; *Wisdom for Home Brewers* offers expert advice for the novice and experienced homebrewers. Award-winning beer writer Ted Bruning and Nigel Sadler (founder of Wibbler's Brewery in Essex, England, and a founding member of the UK's Craft Brewers' Association) divide the tips into 10 chapters covering everything from equipment and ingredients to troubleshooting and storage. This hard cover guide is now available at major booksellers.

Electric Homebrew System

Innovative Design Concepts, LLC introduces the new Brew-Boss® automated electric homebrew system. The Brew-Boss® system utilizes an Android application to control the entire brew process automatically. The brewing process is completely configurable by the user with editable brew steps created using a simple spreadsheet style editor. The controller maintains temperatures within 1 °F/°C and automates all timing functions. The system is available in both 120 VAC and 240 VAC versions in 10-, 15-, and 20-gallon (38-, 57-, 76-L) sizes. Visit www.brew-boss.com for more details.

calendar

January 9
Winterbrew 2015
Chicago, Illinois
Winterbrew 2015 is organized by Square Kegs Homebrewers and accepts entries in all BJCP styles through January 9. The competition, now in its fifth year, is AHA/BJCP sanctioned and will be held January 17. There is a limit of 210 entries for the competition. The entry fee is $10 and each entrant may submit up to 10 different homebrews.
Web: www.winterbrew.squarekegshomebrew.com

January 14
Lancaster Iron Brewer
Lancaster, Pennsylvania
Get ready for the third annual Lancaster Iron Brewer Homebrew Competition hosted by Lancaster Homebrew and Iron Hill Brewery! This is a BJCP certified event and entries will be accepted through January 14. Winners will be announced at Iron Hill Brewery on January 28. There will be Best of Show awards and a Brewers Choice award (selected by the Head Brewer of Iron Hill from the Best of Show finalists) that will be brewed and put on tap at Iron Hill in Lancaster. The entry fee is $7 and all submissions must include two bottles. The maximum number of entries is 250.
Web: www.lancasterhomebrew.com

January 24
Best Florida Beer Homebrew Championships
Tampa, Florida
The BFBC competition is an AHA/BJCP sanctioned event open to Florida homebrewers to submit beer, mead, and cider. It is the kick-off event for the Florida Circuit Homebrew Competition. The entry deadline is January 24 and judging will be held on the weekends of February 14-15 and 21-22. Prizes unique to each category will be awarded to all medal-winning beers. The entry fee is $6.
Web: www.bestfloridabeer.org/bfbc-homebrew

homebrew drool systems

Bistro Brew Closet

Danny Clark • Jaco, Costa Rica

As a chef and lover of good beer, the brewing process has always fascinated me. I had made beer in the past by improvising with my existing kitchen to the point of madness. As my fascination for the brewing process grew I felt it was time to take the next step and construct a brewing space at my restaurant. And so "The PuddleFish Brew Closet" at Side Street Bistro in Jaco, Costa Rica was born. Constructed in our saloon and visible to our guests to observe our art, the closet was built with a desire to efficiently brew a batch of beer with time enough to go for a surf between making dinner preparations at the restaurant.

The closet is approximately 6x7 feet (1.8x2.1 m). The equipment within is modest and basic but efficient. I brew all-grain and I have three 15-gallon (57-L) heavy-duty stainless stockpots retrofitted to deliver and receive brew. Production of 12 gallons (45 L) of wort takes about five hours start to finish. The working setup is a 220-volt heat exchange recirculating mash system (HERMS). Liquids are pumped via three March pumps: Hot water pump, wort recirculating pump for sparge/lautering and a wort transfer pump. The brew system employs two 5,500-watt electric hot water tank elements (one in the hot liquor tank, the other in the boil kettle). The mash tun utilizes a grain screen to keep the wort husk-free. Wort is filtered then transferred and cooled by a plate chiller. A recycled water system uses the heat exchange water for easy cleanup. The pico brew closet is completely controlled by a pocket-sized, home-built control panel. Another useful addition is the single induction burner for sterilizing and heating on the fly. The Ale Fermentation Chamber is a beverage cooler with a Johnson A-419 controller to maintain temperatures at 67 °F (19 °C). Lagers are fermented in a chest freezer with the same Johnson temperature control in the 45 °F (7 °C) range.

I had just as much fun building this room as I do brewing in it. With the addition of my brew closet I have gotten more serious about the art of making beer, and after all is said and done I get to enjoy a cold tropical homebrew with friends and patrons.

LAGERING

by dawson raspuzzi

Brewing lagers can be very intimidating for new homebrewers — which is one of the reasons most begin with brewing ales. But, if your favorite beer styles to drink are Pilsners, märzens, bocks, etc…, then you can't run from lagering! Once you understand the differences between brewing lager and ale, the extra steps really aren't too difficult. It will, however, take a little more patience and equipment.

Before we get to lagering, let's make sure we are all on the same track in defining what a lager is. The biggest difference between lager and ale is the yeast — lagers use bottom-fermented yeast while ales are top fermented. The conditions these yeast thrive in is also different, as most lager yeasts perform best at 50–55 °F (10-13 °C), while ale yeasts generally perform best from 60–70 °F (16–21 °C).

The actual brewing process is similar for ales and lagers (it can be different, but often times that is because of the difference in the German and English brewing traditions that continue to influence how ales and lagers are brewed … but that is a topic for another day). The real difference comes after the wort is cooled. Read the yeast label you are using to find the ideal temperature for fermentation. At cooler temperatures, fermentation will not appear as active as it is when fermenting ales. This is expected, however, so do not give into temptations to turn the heat up if the bubbles in your airlock never appear very rapid. The cooler fermentation temperature is needed in ensure the yeast metabolism byproducts are kept to a minimum.

When active fermentation appears nearly done, it is time to do a diacetyl rest where you want to slowly bring the temperature up to around 60–65 °F (15–18 °C) and hold it there for a couple of days. This warmer temperature speeds up the conversion of alpha-acetolactate to diacetyl and makes the yeast more active so it is in a better state to convert diacetyl (which, in turn, reduces the unwelcome buttery taste found in flawed lagers).

After the diacetyl rest it is time for the cold conditioning period (called lagering). Carefully rack the beer into a secondary fermenter (a keg if you have one, a fermentation bucket or carboy if you don't) and gradually reduce the temperature 1–2 °F (1 °C) each day until stabilized at your lagering temperature, which should be somewhere down around 30–45 °F (-1–7 °C).

Over this lagering period the beer will clarify and the taste will mellow out and improve as the yeast and haze-forming proteins drop out of suspension. How long of a lagering period you'll need is dependent on the temperature (the colder it is, the longer lagering period is required) as well as the beer style (higher alcohol beers take longer to lager). While a little time can be saved by lagering on the higher end of the scale, cooler temperatures result in a smoother tasting and clearer lager.

With temperatures in the 40s–50s °F (4–10 °C) required during fermenting a lager and colder than that for lagering, brewing lagers requires a way to control and maintain cool temperatures. Homebrewers usually resort to a chest freezer with a temperature controller, a lagering chamber large enough to house your fermenter, or a recirculating pump and thermometer setup. We've run some great stories about building your own fermentation chamber that can be referenced in the November 2009 issue (Build a Fermentation Chamber) and in the "Projects" column from September 2011. For more tips about maintaining temperature, read the "Techniques" column from the March-April 2009 issue.

by marc martin

DEAR REPLICATOR I WAS SHOWING SOME FRIENDS PHOTOS OF LAST YEAR'S VACATION WHEN WE TRAVELED UP I-5 HITTING BREWERIES AND BREWPUBS ALONG THE ROUTE. IMMEDIATELY WHEN I SAW THE PICTURE OF 7 SEAS BREWING IN GIG HARBOR, WASHINGTON I REMEMBERED WHAT I THOUGHT WAS THE BEST BEER OF THE TRIP — THEIR WHEELCHAIR BARLEYWINE. AFTER WE GOT BACK FROM VACATION I STARTED HOMEBREWING AND HAVE NOW GRADUATED TO ALL-GRAIN BREWS. THEIR BEERS AREN'T SOLD DOWN HERE, SO I THINK IT'S TIME TO TRY TO MAKE THAT BARLEYWINE.

MATT CONNORS
PHOENIX, ARIZONA

Sometimes to create a successful brewery you have to start with a disaster. That's exactly what happened with 7 Seas Brewery. Co-owners Travis Guterson and Mike Runion were all set to open their new brewery in January 2008.

A used 8.5-barrel system was purchased from the recently closed Stix Brewery in Seattle, Washington. They had also located a suitable multi-use building in downtown Gig Harbor, Washington. With the lease signed, everything moved in and all local codes met they were ready to brew their first beer. That's when an adjoining tenant left a space heater on and the fire started. The building was destroyed but fortunately their equipment survived and so began their success story.

Travis and Mike met while Mike was doing an internship from Washington State University where he was studying for a degree in business and entrepreneurship. Travis had been homebrewing for a couple of years and continued while in college. He quickly developed a love for the creativity of making beer. He scored his first brewery job at Pelican Brewery in Pacific City, Oregon. It was just an entry-level job of capping bottles and keg cleaning but it allowed him to watch their excellent brewmaster, Darron Welch. Travis was impressed by how clean he kept the brewery and efficiently it was run. He also learned a lot from the other brewer, Ben Love, who is now the Brewmaster and Co-owner of Gigantic Brewing in Portland, Oregon.

Weekends would find Travis enjoying the rapidly growing beer scene in Portland. This led him to land a full-time brewing job at the Old Lompoc in Portland where he performed all of the brewery functions. With lots of experience under his belt, he eventually decided it was time to move back to his home area by Puget Sound. When a brewer job became available at Silver City Brewery in Silverdale, Washington he made the move. It was there, while working under the guidance of Don Spencer, that he really took his skills to the next level.

After Mike graduated he and Travis began to develop a plan. With Travis' brewing skills and Mike's business knowledge things quickly came together. The fire at the original location was a setback but really turned into a blessing. They were quickly able to locate another building that had better parking and would also provide space for a taproom. It barely took them five months to recover as their first beer was brewed in June 2008.

Since then the seas have been calm and they have found success in every port. Their beers were immediately well received and production quickly grew. Early in 2009 they became the first brewery in Washington State to can their beer. Now, approximately 25% of their beer is sold in cans. With demand steadily increasing they outgrew both their facility and their original 8.5-barrel system. A vacant 12,000 square foot supermarket building in downtown Gig Harbor has become their new home. This allowed for the addition of a 25-barrel system with some fermenters as large as 75 barrels. The 8.5-barrel system is still being brewed on to make smaller batches of specialty beers. Currently they have 16 beers being served in their taproom.

Total production in 2014 was 5,100 barrels and Travis feels that they are on track to hit 6,000 for 2015.

The Wheelchair Barleywine is a big beer in all respects and draws a following when released each year. Only a 5-barrel batch is brewed and it is only made available in their taproom in 9 oz. snifters. Each batch is brewed slightly differently each year and aged a minimum of eight months. A thick tan head tops this high-alcohol brew that exhibits a reddish, brown hue. The aroma brings to mind sweet fruit and raisins. A strong presence of caramel and toasted malt dominates the flavor. The mouthfeel, while not overly heavy, can best be described as "coating," demanding that this beer be sipped like a fine Port wine.

Travis advises that this beer is best brewed as an all-grain batch if possible. He recommends Maris Otter, British carastan and Belgian special B malts. He also specifies an extremely long boil to boost the gravity, develop further caramelization and concentrate the flavors.

Matt, you won't have to make another road trip for your favorite barleywine because now you can "Brew Your Own." For more information about 7 Seas Brewing Company and their other fine beers, visit their website www.7seasbrewing.com. BYO

7 Seas Brewing Company's Wheelchair Barleywine clone

(5 gallons/19 L, all-grain)

OG = 1.107 FG = 1.026
IBU = 38 SRM = 22 ABV = 12%

Ingredients

17 lbs. (7.7 kg) Maris Otter pale ale malt
1.25 lbs. (0.57 kg) British carastan malt (34 °L)
13 oz. (0.37 kg) Belgian Special B malt (120 °L)
5.7 AAU Glacier hop pellets (60 min.) (1 oz./28 g at 5.7% alpha acids)
5.7 AAU Glacier hop pellets (40 min.) (1 oz./28 g at 5.7% alpha acids)
3.6 AAU East Kent Golding hop pellets (20 min.) (0.75 oz./21 g at 4.75% alpha acids)
2.4 AAU East Kent Golding hop pellets (5 min.) (0.5 oz./14 g at 4.75% alpha acids)
2 lbs. (0.91 kg) clover honey (10 min.)
½ tsp. Irish moss (30 min.)
½ tsp. yeast nutrient (15 min.)
White Labs WLP001 (California Ale) or Wyeast 1056 (American Ale) yeast or Safale US-05 yeast
¾ cup corn sugar if priming

Step by Step

This recipe is a single step infusion mash. Mix all of the crushed grains with 6.7 gallons (25 L) of 170 °F (77 °C) water to stabilize at 151 °F (66 °C). This is a medium-thin mash using 1.4 quarts. (1.3 L) of strike water per pound (0.45 kg) of grain. This is designed to help achieve maximum fermentability. The lower mash temperature also serves to create a more fermentable wort. Mash for 60 minutes then slowly sparge with 175 °F (79 °C) water.

Collect approximately 7.5 gallons (28 L) of wort runoff to boil for three hours. While you are boiling the wort, add the hops, Irish moss and yeast nutrient as the schedule indicates. Add the honey for the last 10 minutes of the boil. During the boil, use this time to thoroughly sanitize your fermentation equipment.

After the boil is complete, cool the wort to 75 °F (24 °C) and transfer to your fermenter. Pitch the yeast and aerate the wort heavily. Allow the beer to cool to 68 °F (20 °C) and then hold at that temperature until fermentation is complete. Gently transfer to a carboy, avoiding any splashing to prevent aerating the beer. Allow the beer to condition for an additional week. Prime and bottle condition or keg and force carbonate to 2.2 volumes CO_2.

Allow the beer to age six more weeks (or longer) to fully develop the flavors and enjoy your Wheelchair Barleywine clone.

7 Seas Brewing Company's Wheelchair Barleywine clone

(5 gallons/19 L, extract with grains)

OG = 1.107 FG = 1.026
IBU = 38 SRM = 22 ABV = 12%

Ingredients

9.9 lbs. (4.5 kg) Muntons light, unhopped, malt extract (Maris Otter if possible)
9 oz. (0.25 kg) light dried malt extract
1.5 lbs. (0.68 kg) Maris Otter pale ale malt
1.25 lbs. (0.57 kg) British carastan malt (34 °L)
13 oz. (0.37 kg) Belgian Special B malt (120 °L)
7.1 AAU Glacier hop pellets (60 min.) (1.25 oz./35 g at 5.7% alpha acids)
7.1 AAU Glacier hop pellets (40 min.) (1.25 oz./35 g at 5.7% alpha acids)
3.6 AAU East Kent Golding hop pellets (20 min.) (0.75 oz./21 g at 4.75% alpha acids)
2.4 AAU East Kent Golding hop pellets (5 min.) (0.5 oz./14 g at 4.75% alpha acids)
2 lbs. (0.91 kg) clover honey (10 min.)
½ tsp. Irish moss (30 min.)
½ tsp. yeast nutrient (15 min.)
White Labs WLP001 (California Ale) or Wyeast 1056 (American Ale) yeast or Safale US-05 yeast
¾ cup corn sugar if priming

Step by Step

Steep the milled grain in 2.5 gallons (9.5 L) of water at 151 °F (66 °C) for 30 minutes. Remove grains from the wort and rinse with 2 quarts (2 L) of hot water. Boil for 30 minutes. Add the liquid malt extract and dried malt extract and boil for 60 more minutes. While boiling, add the hops, Irish moss and yeast nutrient as per the schedule. With only 10 minutes of the boil remaining, add the honey. During the boil, use this time to thoroughly sanitize your fermentation equipment. When the boil is complete, add the wort to 2 gallons (7.6 L) of cold water in the sanitized fermenter and top off with cold water up to 5 gallons (19 L).

Cool the wort to 75 °F (24 °C). Pitch your yeast and aerate the wort heavily. Allow the beer to cool to 68 °F (20 °C) and then hold at that temperature until fermentation is complete. Gently transfer to a carboy, avoiding any splashing to prevent aerating the beer. Allow the beer to condition for an additional week. Prime and bottle condition or keg and force carbonate to 2.2 volumes CO_2.

Allow the beer to age six more weeks (or longer) to fully develop the flavors and enjoy your Wheelchair Barleywine clone.

hop profile

Cluster

Cluster is one of the oldest U.S.-grown hop varieties, having emerged as a hybridization of Dutch and English imports along with indigenous male hops. Cluster is a great general-purpose hop for both bitterness and aroma. It has a strong floral and spicy aroma. Alpha acids are 5.5-8.5%. It is used in ales (usually as an aroma hop), lagers (usually as a bittering hop) and is common in stouts. It is also frequently used in the reproduction of historical U.S. beer styles. Possible substitutes are Galena and Brewer's Gold. Cluster has been featured in a few craft brewery single-hop IPAs in recent years, including releases by Mikkeller and Double Mountain.

Photo by Coral Studer

For more information on over 100 different hop varieties, check out our online hop chart at: http://byo.com/resources/hops

Story Behind the Label

Lukasz Szala • Glogówek, Poland

Inna Beczka (translated to English means "a different barrel") is a small homebrewery managed by two brothers Marek and Lukasz Szala in the little town of Glogówek, Poland. Through the ages our town has belonged to various countries or kingdoms: Silesian, Czech, and Prussian duchies and later to Germany and finally Poland. Taking into account this rich history, we have undertaken an ambitious goal to leverage and mix three brewing traditions (Polish, Czech, and German) in our brewing. Through our beer activity we also try to popularize local history, traditions, and legends. That is why each of our beers is given a name of one of the characters from local legends, fairytales or spoken stories. Two of our favorites are Skrzoutek and Chabernica.

Skrzoutek in Slavic beliefs is a small demon who protects the household and is a mix between a chicken and a dragon. Our Skrzoutek is a Polish beer style called Grodziskie that we brewed using German malts and Polish hops. We couldn't find a Skrzoutek image in any books or the Internet, so we had an image drawn especially for our brewery based on a legend by Piotr Sawicki.

Chabernica is a mythical character common to Eastern Europe countries. It is a noon demon in Slavic mythology, and in English is sometimes referred to as "Lady Midday." She was usually pictured as a young woman dressed in white that roamed the fields. She assailed folks working at noon, causing heatstroke and neck aches, sometimes even madness. Our Chabernica is a German hefeweizen using wheat from Germany, Pilsner malt from Czech Republic and the Polish hop Lubelski. A graphical editor, Lukasz Matuszek, who allowed us to use it for our label, created the image.

byo.com brew polls

What inspired you to start homebrewing?

55% General Curiosity
20% Tasting a homebrewed beer
16% Commerical beer
9% Literature on the hobby

Let us know your thoughts on different homebrewing subjects in our monthly poll at byo.com

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tips from the pros

by Dawson Raspuzzi

High Gravity Lagers

Brewing big, cold, and clean

BREWING A HIGH GRAVITY LAGER (WITH AN ORIGINAL GRAVITY ABOVE 1.070) TAKES A LOT OF PATIENCE AND A LOT OF YEAST. THESE PROS HAVE BREWED AWARD-WINNING EXAMPLES, AND WITH THEIR ADVICE YOU CAN TOO.

All of our high-gravity lagers undergo a long, slow fermentation for about 10-12 days at 53 °F (12 °C). They have a similar diacetyl rest as our other lagers: As fermentation nears its terminal gravity we allow the fermentation to free rise to about 62 °F (17 °C) and hold it there for about 36 hours. That being said, diacetyl should not be of too much concern for these beers because they are lagered for so long and some yeast is still present in the lagering tank that any diacetyl present at the end of fermentation will be re-metabolized by that yeast prior to the end of lagering. After the rest, the fermenter is then crash cooled down to 35 °F (2 °C) and the beer is transferred to a lagering tank and held at that temperature for a minimum of another five weeks. Ideally, our doppelbocks are lagered six or seven weeks, but that is not always feasible depending on the production demands of the brewery.

> "To keep it simple for brewing at home, I would recommend increasing your pitch rate by 50–100%."

Thankfully, our proprietary yeast strain can handle the high gravity lagers with ease. However, we do increase the pitch rate for these fermentations and we also use some additional yeast nutrient supplements that we do not use for our regular lagers. To keep it simple for brewing at home, I would recommend increasing your pitch rate by 50–100%.

Challenges with high-gravity lagers are usually related to pushing the physical constraints of your brewing system. It is very likely that you will have to reduce the size of your brew. For instance, in our brewhouse a typical 12-13 °P (1.048–1.053 SG) wort will yield 35.5 barrels. For our doppelbocks, which run about 19 °P (1.079 SG), we only yield about 19.5 barrels.

For homebrewers, one thing to be mindful of is mash density (i.e. lbs. malt/gallons water). The easiest thing to do is decrease the batch size; however, if you really prefer not to do that, add some rice hulls to the mash to help with the lauter. Another thing to consider is fermentation temperature. I believe low and slow is the way to go, and especially at home. Since there is so much sugar there to start with, if your fermentation gets too warm (and as a result too vigorous) you are very likely going to blow the top off your fermenter and all of your hard work to date will be for naught. Increasing the size of your blow-off tube can help alleviate any additional head pressure in your fermenter.

Once you have mastered the art of producing and fermenting high gravity worts, and you really want to test your skill as a brewer, here is what I recommend: Make a recipe that is 15-16 °P (1.061–1.065) with roughly the following ingredients: 60-65% blend of 2-row and 6-row base malt, 25-30% flaked corn or rice, and 5-10% caramel 60 °L malt and target about 15-20 for the IBUs. Ferment and lager for a total of four weeks. Prior to finishing (racking or bottling) dilute by ⅓ with carbonated water (you should boil and cool the water prior to carbonating to sterilize it). At this point, you just brewed yourself a nice premium American lager. Conversely, enjoy at full strength and you are drinking a good old American malt liquor. Lastly, if you substitute dextrose or candi syrup for the corn or rice in the mash bill, ferment and lager the same way, and dilute by ⅓ with carbonated water prior to finishing; you'll have yourself an authentic American light lager.

If you can brew those styles without any perceivable flaws you can truly brew anything.

Brian Destree is Director of Operations for Capital Brewery in Middleton, Wisconson. He has degrees in Biochemistry and Chemical Engineering from the University of Wisconsin. He also attended the Master Brewers Program at UC-Davis. Prior to joining Capital Brewery in 2012, Brian worked for MillerCoors for 7 years.

High gravity lagers have the same challenges as any lager but they are amplified. More time, more yeast, more oxygen, and more patience are needed to get the perfect brew. Higher gravity lagers tend to have a thicker grain to water ratio so we can fit extra grain in the mash/lauter tun. The result is more water is used during the sparge and a reduction in overall efficiency. We typically do a single infusion mash and let it rest for 40 minutes before starting a 20-minute vorlauf. The temperature of the mash is going to depend on various things such as yeast strain and desired characteristics (dry or sweet, clean or fruity). If using a high-attenuating yeast, we like to mash in at the 154–156 °F (68–69 °C) range, to ensure the beer doesn't get too dry or boozy.

For lower gravity lagers like our Munich Helles (5.5 % ABV) we pitch about 1.5 million cells per mL per degree Plato. For higher gravity lagers like our Liberator Doppelbock (8.5%) we use the same yeast strain but pitch anywhere from 2–2.5 million cells per mL per degree Plato. For homebrewers, try brewing a lower gravity lager first as a propagation and collecting yeast from that batch. For aerating wort, splashing it into a bucket won't be enough. I suggest attaching a barbed diffusion stone to an aquarium pump with an air filter and aerate for 30 minutes before pitching yeast.

Our typical diacetyl rest is at fermentation temperature for 1–2 days after fermentation completes. The beer must pass a diacetyl test where a sample is heated to transform all VDK (diacetyl precursor) into diacetyl. If any buttery notes are still present, it needs more time. If it passes this sensory test, we start cooling the beer for lagering. As a general rule with this style you should taste your brew at every step until you are sure your beer is ready for the next step.

Lagering times tend to be longer for higher gravity lagers because more esters and higher alcohols are produced during fermentation and more time is needed to smooth out and balance these flavor compounds. For us, the difference is six to eight weeks, compared to four to five weeks for the lower gravity beers. BYO

Sean Piel and Jeff Pasquale are brewers on the Thomas Hooker Brewing team, in Bloomfield, Connecticut. Sean attended Brew Lab in Sunderland, England where he received a diploma in British brewing technologies. After completing the course he traveled around Europe to learn more about brewing techniques in different regions. Jeff holds a World Brewing Academy Master Brewer diploma from the Doemens Academy in Munich, Germany, and a diploma from the Siebel Institute in Chicago, Illinois.

Yeast Starters

Nitro gas, metallurgy madness

help me
mr. wizard
by Ashton Lewis

Q I'VE BEEN DOING A LOT OF RESEARCH ON MAKING YEAST STARTERS AND MY QUESTION THAT I CAN'T SEEM TO FIND THE ANSWER TO IS WHETHER THERE IS AN UPPER LIMIT TO HOW MUCH STARTER CAN BE MADE FROM A SINGLE VIAL OF YEAST? ALSO, IS THERE AN UPPER LIMIT TO HOW BIG A STARTER STEP CAN BE? MEANING, SHOULD YOU NEVER MAKE MORE THAN SAY 2 QUARTS (2 L) OF STARTER AT A TIME? I'M MAKING A STARTER FOR A CIDER PRESSING FOR MY HOMEBREW CLUB IN A FEW WEEKS AND JUST WANT TO MAKE SURE I'M NOT OVER-EXTENDING MY INITIAL VIAL.

BRIAN JAMESON
POUGHKEEPSIE, NEW YORK

A There are a few generalities that may make this topic easier to understand, so let me cover a few things that may not seem relevant right away. The first general rule is that the density of yeast cells growing in a flask without any gas supply other than the oxygen that diffuses through a cotton stopper fitted to the flask is about 100 million cells per milliliter. Shaker tables and stir plates help gas transfer, especially when the flask is simply fitted with a cotton plug, and the rate of cell growth and cell density can be enhanced with these tools. The upper limit to cell density using these methods is about 150 million cells per milliliter. When I think about cell density I cannot engage my brain with gallons because microbiologists always measure cell density in metric units, so gallons, even to folks who use that volume of measurement on a daily basis, simply make things very confusing to follow. So this answer will not contain any conversions from liters to gallons, except this one . . . 5 gallons is roughly 20 liters and for the purpose of this discussion I will assume that the nominal homebrew batch size is 20 liters.

Another general rule is the rule of 10; that is starter cultures are stepped up tenfold per jump. In a yeast lab most starters begin by selecting a single colony from a Petri dish and inoculating a 20 mL starter. After a couple days of growth this starter is moved up to 200 mL, then 2 liters and then 20 liters. This last step is where many homebrewers end up for pitching. If you begin with a vial of yeast and perform a starter step you can inoculate the 2 liter starter and pitch your 20 liter batch after a couple of days.

The rule of ten makes perfect sense because the cell density of the culture is diluted from 100-150 million cells/mL to 10-15 million cells/mL and that is a perfect pitching rate . . . for most lager beers. Like many brewing methods adopted by commercial breweries, yeast propagation rules are usually applied to lager brewing because that is the most common beer type brewed in the world. Many ale brewers pitch at about half the rate of lager brewers meaning that you could use a smaller starter for ale brews and have a healthy fermentation.

"Another general rule is the rule of 10; that is starter cultures are stepped up tenfold per jump."

You ask about how large a starter can be made from a single vial and that depends on the number of cells contained by the vial. The goal should be about 10 million cells/mL of starter when you begin the propagation step. Since thick yeast slurry contains about 1 billion cells/mL you want to increase the volume of the vial by a factor of 100. So if your vial contains 20 mL of thick yeast at 1 billion cells/mL, you will have about 10 million cells per mL when this is added to 2,000 mL

(2 liters) of wort.

The answer to your first question is that there is really no limit to how much yeast can be produced from a single starter. A few years ago I visited the yeast culture facility at Anheuser-Busch in St. Louis, Missouri where all of the yeast used for their beers is produced. When I saw their labs I was pretty amazed because the setup looked identical to how I was taught to grow yeast in the UC Davis brewing labs. I saw many small Erlenmeyer flasks with little cotton plugs stuffed in the tops and was told that their cultures were grown by transferring the culture from a smaller flask to a larger flask containing sterile wort until the culture was too large to grow in glass. I was also told that a small amount of culture was "moved backwards" so that a small volume of yeast cells was always growing in the smaller flasks that are required for this method to stay in motion.

The Anheuser-Busch yeast lab has a door that leads to the part of the lab that grows their yeast in stainless steel tanks and what I saw was pretty surprising; a room full of fermenters that vary in size from about 66 gallons to 33,800 gallons (250 to 128,000 L). When we first walked into this part of the lab I thought we had stepped into one of their very large cellars, but was told that we were still in the lab! I believe they jump their volumes by a factor of eight and it takes three jumps to go from 66 gallons to 33,800 gallons (250 L to 128,000 L). This slurry is then transferred to kegs and shipped out to Anheuser-Busch breweries as fresh slurry.

If your plan is to be the yeast source for your homebrew club's cider day and want to grow a bunch of slurry that can be distributed to the entire club, you will not be over-extending the yeast you purchase as long as you follow the rule of ten. The most important part of this whole process is keeping things in a commercially sterile condition (code language for pretty darn clean, but technically not sterile). That is the subject for another day and about a question that you did not ask. I am assuming you know to keep it clean for the overall success of your endeavor and the happiness of your fellow brewers!

Q I ENJOYED THE POSSIBILITIES RACING THROUGH MY MIND AFTER READING THE "TIPS FROM THE PROS" ARTICLE FROM THE NOVEMBER 2014 ISSUE "NITRO BEERS: CHANGE THE GAS; CHANGE EVERYTHING!". MY QUESTION IS WHETHER THERE ARE SPECIFIC GUIDELINES ON FORCE-CARBONATING (FORCE-NITROING?) KEGS THAT ARE DIFFERENT WHEN USING NITROGEN COMPARED TO CO_2 GAS? DO YOUR SUGGESTED CARBONATION LEVELS FOR CO_2 CROSS OVER TO NITRO AS WELL (I.E. 2.2–3.0 VOLUME FOR AMERICAN ALES, 2.4–2.6 VOLUMES FOR EUROPEAN LAGERS, ETC.)?

ERIC TOMME
FORT WORTH, TEXAS

A Great to hear your enthusiasm about this technique! Using a blend of nitrogen and carbon dioxide, or "nitrogenating" was perfected and popularized by the Guinness Brewery in Dublin, Ireland several decades ago. The origins of the method began by investigating why cask ales have a different foam structure than carbonated beers dispensed without addition of air and the scientists at Guinness developed a very good understanding of the significance of nitrogen to beer foam. The main reason for this research had to do with oxidation and how to develop a method for pouring Guinness' famous stout that resulted in better shelf life and also retained the type of foam they wanted. The result was nitrogenated stout. Although the early dispense methods used for this new type of beer were far different than today's nitro taps, the basic method was the same. Today, nitro beers are popular across the globe, brewed by brewers large and small, and for commercial sale as well as enjoyment at home.

The method does have some very key differences from those used to carbonate beer. One of the key differences has to do with the carbonation level in the beer. Nitro beers contain between 1.2 to 1.8 volumes of carbon dioxide (2.4 to 3.6 grams per liter). Without diving into the gritty details of gas tables, this very low level of carbonation is actually a bit hard to achieve in a commercial brewery when normal practices involving carbon dioxide blanketing and cold temperature are used. For example, many breweries add a very slight carbon dioxide overpressure at the end of fermentation so that as the beer tank is chilled to near-freezing temperatures the tank headspace does not dip into vacuum pressures. Although this pressure is very low, it is sufficient to cause the beer to have too much carbon dioxide at temperatures below about 42 °F (6 °C). I will get back to this topic shortly.

The other key difference between nitro beers and conventionally carbonated beers is the presence of nitrogen. Call me Mr. Obvious, but this is important! The concentration of nitrogen is actually quite low and is somewhere around 20 mg/liter. And if the concentration is much higher than this the beer becomes "wild" upon dispense and foams like mad. This is not the idea. What all brewers who produce nitro beers desire is that wonderful dance of tiny bubbles that lasts for about a minute after pouring and results in a perfect, thick, creamy foam that lays atop the beer like a smooth mousse.

There are several ways to go about getting the proper blend of nitrogen and carbon dioxide into beer. Commercial breweries tend to implement in-line methods when vessels are too large to allow for batch-type processes and this is

especially true with nitro beers because nitrogen is difficult to dissolve in beer. But for small commercial brewers and homebrewers, it is very easy to batch nitrogenate in a keg. I first began playing around with this technique when I was a graduate student at UCDavis over 20 years ago and continue using the same method today for 15-barrel batches of nitro beer at Springfield Brewing Company.

I believe the key to producing great nitro beer begins with warm beer in a non-pressurized fermenter. This is the norm for most homebrewers. Step one is to rack your beer into a keg. Step two is applying about 30 psig of pressure to the keg using a blend of nitrogen and carbon dioxide. The blend is critical because the blend — along with beer temperature and pressure — directly affects the solubility of carbon dioxide and nitrogen. The blend commonly used for nitro beers is 75% nitrogen and 25% carbon dioxide. Step three is to cool your keg to about 34 °F (1 °C). Allow at least 12 hours for the beer temperature to drop, switch your gas supply to the dip tube of your keg and shake the keg as aggressively as possible for about one minute. Allow the keg to rest for about 10 minutes and repeat this step five times followed by an hour rest before pulling a sample from your nitro tap.

A properly nitrogenated beer will display the dance of the bubbles and a rich creamy foam that should be about ½-inch (1.25 cm) thick. If the dance is weak or the foam too thin there is insufficient nitrogen. More shaking or a slight increase in keg pressure will help dissolve more gas.

If nitrogen and carbon dioxide content set the stage for this great dance, the nitro tap starts the music. The nitro tap contains a plate designed to cause gas breakout when the beer is pushed from the keg at 30 psig pressure. If breakout does not occur during dispense no magic happens. But if you follow these easy steps and have the right tap you will be good to go!

If you are wondering what makes a nitro tap special, read on. The simple

help me mr. wizard

description of a nitro tap is a syringe with a plate attached to the end of it with tiny holes. I am not making this up! The early nitro beers developed by Guinness used a syringe to induce what foam researchers call gas nucleation and break-out in the beer. Can you imagine buying beer with a syringe banded to the side of the bottle? Nitrogen is an interesting gas because it is somewhat difficult to get it into beer, and it's also a bit of a challenge to get it out.

The modern nitro tap has a smooth bore inside of the tap that accelerates the beer's velocity on its way to the orifice or restrictor plate. This plate, at least on a Guinness faucet, has five holes that generate a significant pressure drop when beer at a certain velocity flows through the plate. It's the pressure drop that causes gas breakout and the proper velocity through the tap is directly related to the pressure applied to the keg. After the nitro beer is pushed through the restrictor plate it flows through a device called a flow straightener that neatly directs the flow of beer and gas bubbles down into the end of the faucet where it exits this contraption and enters your beer glass. I have always admired the details required to dispense this type of beer. Sláinte!

Q I RECENTLY USED A NEW SANITIZER RECOMMENDED BY THE LOCAL HOMEBREW SHOP PROPRIETOR. ABOUT A WEEK AFTER CLEANING AND SANITIZING MY KEG I OPENED IT AND SAW A PATINA OF RUST. CLEARLY I DIDN'T FULLY RINSE THE SANITIZER AND SOMETHING REACTED WITH THE STAINLESS STEEL. MOST OF THE RUST SEEMED TO COME OFF EASILY WITH A SCOURING PAD. BUT THERE WERE SEVERAL SPOTS, PARTICULARLY AROUND THE WELDS AT THE BOTTOM, WHERE I COULD NOT REMOVE ALL OF THE RUST. NOW WHAT? HAVE I PERMANENTLY DAMAGED THE KEG BY SCORING ITS SURFACE? WILL SURFACE RUST RUIN THE BEER? MOST IMPORTANTLY, ARE THERE ANY HEALTH ISSUES? I HAVE VISIONS OF TETANUS.

BRAD SEIBERT
OAKTON, VIRGINIA

As I have noted in the past that I work for Paul Mueller Company and that Mueller is one of the largest stainless steel fabricators in the United States. Unfortunately there are many things that cause damage to stainless steel and many owners of this alloy find out the hard way that stainless steel is not stainless in all situations. The good news is that certain types of damage to stainless steel can be repaired, especially when the damage is identified soon after it occurs and that remedial actions soon follow.

There are two general causes of rust on stainless steel; iron contamination on the surface of the steel and embedded iron. Surface contamination can come from dust, water, tools and any other things that can cause free iron to settle on the surface (stainless steel is mainly comprised of iron, but since the iron is part of the alloy's crystalline structure it does not rust). The other type of iron contamination is when iron is embedded in the steel. This can happen from deep tool marks or when iron is somehow accidentally made to be part of the vessel. Although the latter is not common it can occur, for example, when the incorrect weld wire is used to build a piece of equipment.

Another type of rusting that occurs is when the area around a weld is affected by heat during welding. The so-called heat-affected zone around a weld is typically more prone to corrosion because the chromium content is not as high as the parent metal. This problem is more pronounced when too much heat is applied during a weld and is why weld color is used to judge the quality of a weld.

In all of these cases rusting often appears when certain chemicals are applied. And one of the things often seen is that the rusting does not affect all of the metal, just parts. The most likely cause for this spotty rusting is localized failure in the passive layer that makes stainless resistant to corrosion and oxidation.

One common method to repair the damage in the passive film is a

cleaning method referred to as passivation. This type of cleaning uses an oxidizing acid to remove free iron from the surface of the steel and to remove embedded iron that is very close to the surface.

The most effective passivating acid is hot nitric acid used at relatively high concentrations (sometimes as high as 50%). The problem with this method is that it is dangerous and generates a waste stream that cannot simply be flushed down the drain. Nitric acid also damages elastomers and the normal method is to replace all valve seats, O-rings and other items made from these materials following passivation with nitric acid. The only reason I mention this method is that it is very effective and is the preferred method for industrial users of stainless steel. What this means is that if you Google "stainless steel passivation" you will see all sorts of stuff about this method. Please DO NOT use this method at home.

Another method that is much more safe is citric acid passivation using EDTA as a chelating additive to bind iron. Although this technique is not as aggressive and not as effective as nitric acid passivation, it is much more safe, does not have the disposal challenges and does not damage elastomers. For these reasons citric acid passivation is commonly used as an alternate method.

Both of these methods help to restore the passive layer by cleaning the surface of the steel and oxidizing chromium to form chromium oxide. While this film spontaneously forms on the surface of clean stainless steel without the aid of oxidizing liquids, passivation does help to repair damaged surfaces.

Grinding and polishing are mechanical methods to remove free and embedded iron and in larger vessels and process systems these methods are usually not the first choice of remediation because they are labor intensive and often times difficult because damaged areas are frequently hard to access. However, they are very effective methods to use and when the affected area is easy to access should be considered before the use of passivating acids. The easiest way to grind and polish at home is by hand using a red (150–180 grit) polishing pad or wheel. Make sure to polish with the stainless steel grain so that the resulting finish is smooth. After you polish the affected area you should clean the surface with a degreaser followed by an alkaline detergent and thorough rinse. Allow the cleaned steel to air-dry and the chromium oxide film will reform.

I may have missed the mark with your problem, but I am pretty confident that you have not done severe damage to your keg and that a more aggressive mechanical cleaning with a polish pad or citric acid passivation will take care of the problem. BYO

style profile
by Jamil Zainasheff

Traditional Bock

The beer of Einbeck

I have never been to the German city of Einbeck. It is not a common tourist destination, but I am still more than a little surprised I have never been there. From what I have heard, it has a lot to offer — from half-timbered houses to medieval fortifications, and most importantly, the history of beer. Einbeck, even in the 14th century, was a substantial and well-known brewing center. Every citizen had the right to brew beer and the city boasted over 700 master brewers. With all that beer production, what the citizens did not consume, the city council marketed across Germany and abroad.

> "All bock beers have a wealth of bready and toasty malt character, but that does not mean they are overly sweet."

Of course, if you live in another city and want to brew beer like Einbeck, what do you do? You lure away one of their brewmasters. That is what Munich did in the early 17th century to recreate the famous "Ainpöckische Bier." In 1612, the Bavarian ruler from the House of Wittelsbach enticed an Einbeck brewmaster, Elias Pichler, to come to Munich as an employee of the Wittelsbachs and brew a beer close to the Einbeck beer, which was almost certainly an ale. Under Elias' guidance, and in accordance with prevailing Munich brewing practices, the famous Einbecker strong ale metamorphosed into a strong lager, the kind of bockbier we know today. The first strong Munich lager brewed the "Einbeck way" was dispensed at the Hofbräuhaus in 1614. The Bavarian dialect soon mangled the name Einbeck to "ayn pock" and, eventually, to "ein bock" (one bock). And that's how the bock got from Einbeck to Bavaria, with "bock" also being the German word for billy goat.

Bock is a smooth lager beer with a rich malt character. It ranges in color from light copper to brown. All bock beers have a wealth of bready and toasty malt character, but that does not mean they are overly sweet. A traditional bock should be well-attenuated, but low hop bittering results in a balance toward the sweet side. Any alcohol should be smooth and only slightly warming, never hot or solvent-like. The fermentation character is clean, with low esters and no diacetyl. While the beer should have minimal esters, some examples will exhibit a fruity, grape, or dark fruit character from a combination of malts and alcohol.

A great bock recipe is relatively simple, but many brewers try to make it far too big or more complex than needed in an effort to increase malt character. Keep in mind that all German beers are easy drinking and bock should be no exception. The best way to achieve that great German malt character is with high quality, full-flavored base malts and excellent fermentation practices. I would never attempt to make a bock without using continental Pilsner and Munich malts. You can use other base malts, such as Vienna, but the light, grainy and bready taste of high quality Pilsner and Munich malt is right on target for this style. The bulk of the grist should be Munich malt, anywhere from 50 to 70% is good, depending on the character and color of the Munich malt you source. A portion of caramel malt is acceptable, and I like the rich malty sweetness of caramel Munich malts. You can experiment with different color levels and percentages, but approximately 5–10% of a mid-color (40 to 80 °L) caramel is plenty. Use high-quality continental Pilsner malt for the remainder of the grist. You should be able to make an excellent example of the style with

TRADITIONAL BOCK by the numbers

OG:	1.064–1.072 (15.7–17.5 °P)
FG:	1.013–1.019 (3.3–4.8 °P)
SRM:	14–22
IBU:	20–27
ABV:	6.3–7.2%

Photo by Charles A. Parker/Images Plus

Traditional Bock
(5 gallons/19 L, all-grain)

OG = 1.070 FG = 1.018
IBU = 23 SRM = 17 ABV = 7%

Ingredients

4.4 lbs. (2 kg) continental Pilsner malt (2 °L)
8.8 lbs. (4 kg) Munich malt (8 °L)
14.1 oz. (0.4 kg) Weyermann Caramunich® III malt (57 °L)
8.8 oz. (250 g) melanoidin malt (28 °L)
4.8 AAU Magnum hop pellets (60 min) (0.4 oz./11 g at 12% alpha acids)
Irish moss (15 min.)
White Labs WLP833 (German Bock Lager) or Wyeast 2206 (Bavarian Lager) yeast
⅔ cup corn sugar (if priming)

Step by Step

I currently use Best Malz Pilsen, Munich and melanoidin, but feel free to substitute any high quality malt of the same type and color from a different supplier. Some malting companies offer Munich malt with even 20 °L, which is unsuitable in spite of the malt's name. If you use Weyermann®, for instance, Munich I (not Munich II) is the one you want. My hops are in pellet form and come from Hop Union, Crosby Hop Farm, or Hopsteiner depending on the variety.

Mill the grains and dough-in targeting a mash of around 1.5 quarts of water to 1 pound of grain (a liquor-to-grist ratio of about 3:1 by weight) and a temperature of 155 °F (68 °C). Hold the mash at 155 °F (68 °C) until enzymatic conversion is complete. Infuse the mash with near-boiling water while stirring or with a recirculating mash system raise the temperature to mash out at 168 °F (76 °C). Sparge slowly with 170° F (77 °C) water, collecting wort until the pre-boil kettle volume is around 6.5 gallons (25 L) and the gravity is 1.055.

The total wort boil time is 90 minutes, which helps reduce the S-Methyl Methionine (SMM) present in the lightly kilned Pilsner malt and results in less Dimethyl Sulfide (DMS) in the finished beer. Add the hops with 60 minutes remaining in the boil. Add Irish moss or other kettle finings with 15 minutes left in the boil. Chill the wort to 50 °F (10 °C) and aerate thoroughly. The proper pitch rate is nearly 500 billion cells, which is five packages of liquid yeast or one package of liquid yeast in a 3.75-gallon (14-L) starter. That would be a starter equal to a batch of beer, so consider making a smaller beer first and repitching the yeast from that beer into this one.

Ferment around 50 °F (10 °C) until the yeast drops clear. With healthy yeast, fermentation should be complete in two weeks or less, but do not rush it. Cold-fermented lagers take longer to ferment than ales or lagers fermented at warmer temperatures. If desired, perform a diacetyl rest during the last few days of active fermentation. Rack to a keg and force carbonate or rack to a bottling bucket, add priming sugar, and bottle. Target a carbonation level of 2 to 2.5 volumes. A month or more of cold conditioning at near-freezing temperatures will improve the beer. Serve at 43 to 46 °F (6 to 8 °C).

Photo courtesy of Wikipedia

The town of Einbeck, pictured here, is where the traditional bock beer style originated. What used to be known as a brewing center now only has one remaining brewery, Einbecker.

Traditional Bock
(5 gallons/19 L, extract with grains)

OG = 1.070 FG = 1.018
IBU = 23 SRM = 14 ABV = 7%

Ingredients

9.2 lbs. (4.2 kg) Munich blend liquid malt extract (7 °L)
14.1 oz. (0.4 kg) Weyermann Caramunich® III malt (57 °L)
8.8 oz. (250 g) melanoidin malt (28 °L)
4.8 AAU Magnum hop pellets (60 min) (0.4 oz./11 g at 12% alpha acids)
Irish moss (15 min.)
White Labs WLP833 (German Bock Lager) or Wyeast 2206 (Bavarian Lager) yeast
⅔ cup corn sugar (if priming)

Step by Step

I have used a number of Munich blend extracts. While most have less Munich malt in them than I prefer for this style, they still do an admirable job of brewing bock. Always choose the freshest extract that fits the beer style. If you cannot get fresh liquid malt extract, use an appropriate amount of dry extract instead. Using fresh extract is very important to this style. I use Best Malz melanoidin malt. My hops are in pellet form and come from Hop Union, Crosby Hop Farm, or Hopsteiner depending on the variety.

Add enough water to the malt extract to make a pre-boil volume of 5.9 gallons (22.3 L) and a gravity of 1.060. Stir thoroughly to help dissolve the extract and bring to a boil.

Once the wort is boiling, add the bittering hops. The total wort boil time is 1 hour after adding the first hops. Add Irish moss or other kettle finings with 15 minutes left in the boil. Chill the wort to 50 °F (10 °C) and aerate thoroughly. The proper pitch rate is nearly 500 billion cells, which is five packages of liquid yeast or one package of liquid yeast in a 3.75-gallon (14-L) starter. That would be a starter equal to a batch of beer, so consider making a smaller beer first and repitching the yeast from that beer into this one.

Ferment around 50 °F (10 °C) until the yeast drops clear. With healthy yeast, fermentation should be complete in two weeks or less, but do not rush it. Cold-fermented lagers take longer to ferment than ales or lagers fermented at warmer temperatures. If desired, perform a diacetyl rest during the last few days of active fermentation. Rack to a keg and force carbonate or rack to a bottling bucket, add priming sugar, and bottle. Target a carbonation level of 2 to 2.5 volumes. A month or more of cold conditioning at near-freezing temperatures will improve the beer. Serve at 43 to 46 °F (6 to 8 °C).

just those three malts, but you can add other malts, such as head- and body-forming dextrin malts, color-enhancing malts, or melanoidin malts. Avoid overloading the beer with too many extra specialty malts, keeping it to no more than 5% of the grist. A common problem is making the beer too rich in an attempt to make a beer with a lot of malt character. While you want a lot of those rich melanoidin flavors, too much can make the beer taste brothy or cloying.

Extract brewers will need to use a Munich extract or do a partial mash with Munich malt. Most Munich malt extract is a blend of Munich and Pilsner (or other pale malts) in different percentages. I would try to get an extract made with as much Munich malt as possible, but always let flavor and freshness be your guide. That said, most Munich extract blends are close enough for a decent bock without any adjustment. The only supplier of 100% Munich extract I am aware of is Weyermann. If you can get 100% Munich extract, then you can blend it with a Pilsner malt or pale malt extract to get the right proportions.

I like to avoid any work that I do not feel improves a beer, so I prefer a single infusion mash. Perhaps, historically, a brewer would use a decoction mash when brewing most German-style beers, but I find that high quality continental malts, a single infusion mash, and excellent fermentation practices will produce beer every bit as good as the best commercial examples. It is far more important to invest time and effort in fermentation, sanitation, and post-fermentation handling than on decoction. If you have ensured that all of those other aspects of your process are flawless, then decoction might be something of interest. For a single infusion mash, target a mash temperature range of 152 to 156 °F (67 to 69 °C). Higher in that range is a better choice, because it gives you more dextrins, which is what you want in a bock.

At most, hop character is just a background note in traditional bock. This is a beer about rich malt character and a fine example exhibits no hop character. The classic hop for bock is Hallertauer Mittelfrüh, because it has one of the highest percentages of humulene (roughly half of all oils in Hallertauer Mittelfrüh are humulene). Humulene gives beer a woody, earthy, and herbal character, with even a slight note of spicy coriander, or just a touch of orange-like flavors. I always prefer German-grown hops when making German beers and others such as Tettnang, Perle, Magnum or Tradition work well too. These hops, when grown outside of Germany, can still work well but you should check with your supplier first if you are not sure how closely they match the German-grown hops. If you cannot get any of those hops, try to select hops with that same flowery or spicy noble hop character. You do

not want to use anything fruity or citrusy. Some decent substitutions are Liberty and Mt. Hood. You can also try Crystal, Ultra, and Vanguard. The big picture is that you want very, very low hop character and just a balancing bitterness, both complementing and integrating with the malt. The balance of bittering versus malt sweetness should be even or slightly on the sweet side. The bitterness to starting gravity ratio (IBU divided by the decimal portion of the specific gravity) ranges from 0.2 to 0.4, but I like to target around 0.3 in one 60-minute addition.

You can ferment bock with almost any lager yeast, though my favorites are White Labs WLP833 (German Bock Lager) and Wyeast 2206 (Bavarian Lager). You will find that different lager yeast strains will emphasize different aspects of the beer. Some will emphasize malt character, some will emphasize hop character, and some will be in-between, but all can produce an excellent bock with proper fermentation. It is important to note that the sweetness present in bock is from relatively low hop bitterness rather than incomplete fermentation.

While this style is a higher in alcohol than some lagers, the beer should never be hot or solvent-like. Anything more than a gentle hint of alcohol warming is a flaw. You will run into judges that do not understand this point and seem to think any bock should taste like rocket fuel. Do not fall into that trap. Instead, make efforts to educate those that think hot alcohols are good to drink. Proper control of fermentation temperature, a proper pitch of healthy yeast, and adequate nutrients is all it takes to avoid that hot alcohol problem.

When making lagers, I like to chill the wort down to 44 °F (7 °C), oxygenate, and then pitch my yeast. I let the beer slowly warm over the first 36 hours to 50 °F (10 °C) and then I hold this temperature for the remainder of fermentation. If fermentation seems sluggish at all after the first 24 hours, I am not afraid to raise the temperature a couple degrees more. The idea is to reduce the diacetyl precursor alpha-acetolactate, which the yeast creates during the early phase of fermentation. Once the growth phase of fermentation is complete, it is important that fermentation be as vigorous as possible. It may never be as robust as fermentation at ale temperatures, but it is important to have enough activity to blow off aromatic sulfurs and other unpleasant compounds. Vigorous yeast activity at the end of fermentation also improves reduction of compounds such as diacetyl. Starting fermentation colder only works well if you are pitching enough clean, healthy yeast at the start. If not, you will need to start warmer (perhaps 55 °F/13 °C) to encourage more yeast growth. Even if you start fermentation warmer, you can still raise the temperature toward the latter part

Bock Commercial Examples

Aass Bock
Aass Brewery
Drammen, Norway
www.aass.no

Anchor Bock Beer
Anchor Brewing Co.
San Francisco, California
www.anchorbrewing.com

Back 40 Bock
New Glarus Brewing Co.
New Glarus, Wisconsin
www.newglarusbrewing.com

Battlefield Bock
Red Oak Brewery
Whitsett, North Carolina
www.redoakbrewery.com

Blizzard Bock
Flying Bison Brewing Co.
Buffalo, New York
www.flyingbisonbrewing.com

Einbecker Ur-Bock Dunkel
Einbecker Brauhaus AG
Einbeck, Germany
www.einbecker.de

La Trappe Bockbier
Bierbrouwerij De Koningshoeven
Berkel-Enschot, Netherlands
www.latrappetrappist.com

Millstream Schokolade Bock
Millstream Brewing Co.
Amana, Iowa
www.millstreambrewing.com

Schell's Bock
August Schell Brewing Co.
New Ulm, Minnesota
www.schellsbrewery.com

Shiner Bock
Spoetzl Brewery
Shiner, Texas
www.shiner.com

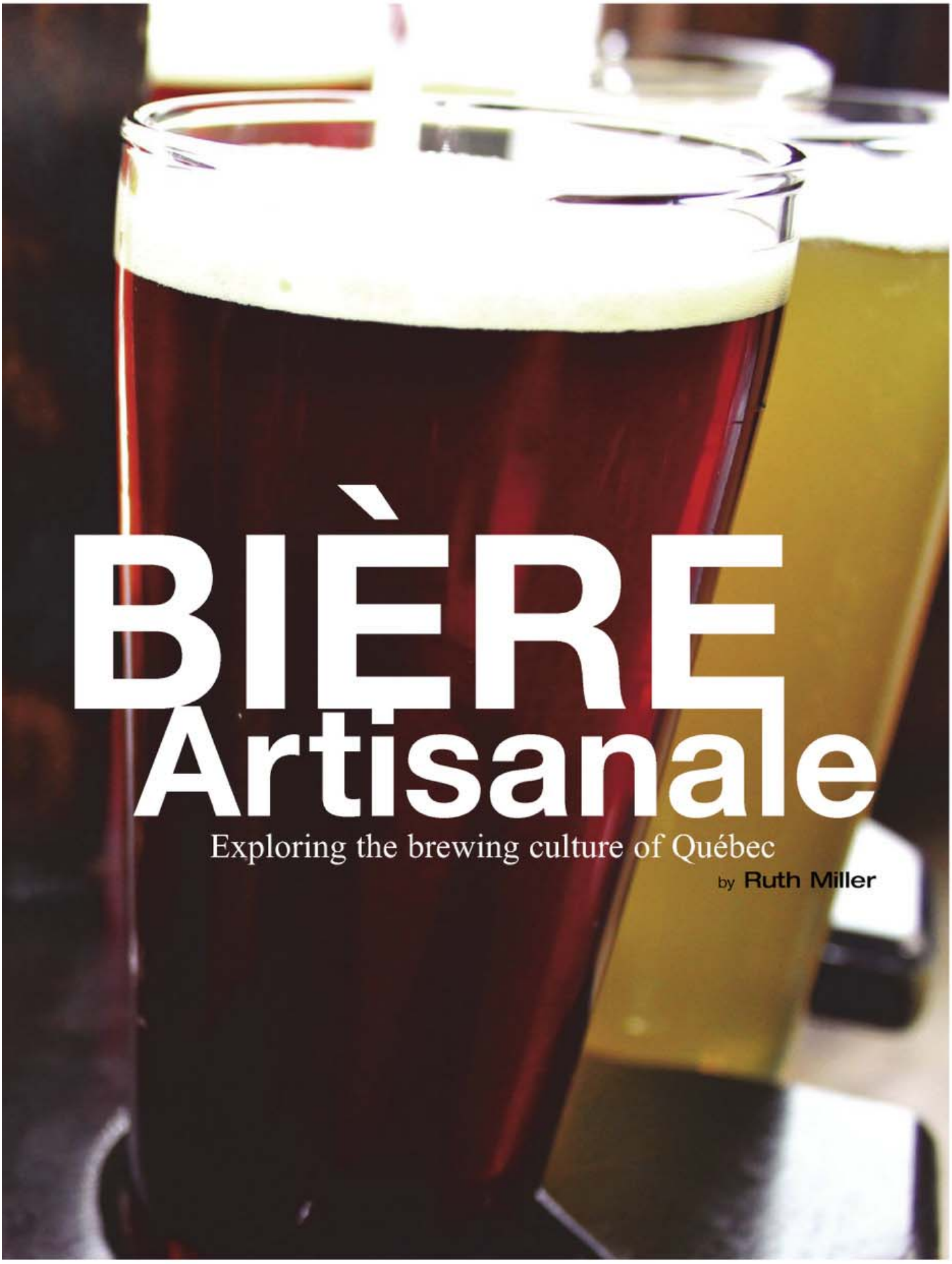
Yuengling Bock
Yuengling Brewery
Pottsville, Pennsylvania
www.yuengling.com

of fermentation.

Since diacetyl reduction is slower at colder temperatures, a cold-fermented lager may require a diacetyl rest. To perform a diacetyl rest, simply raise the temperature into the 65 to 68 °F (18 to 20 °C) range for a two-day period near the end of the fermentation. While you can do a diacetyl rest after the fermentation reaches terminal gravity, a good time for a diacetyl rest is when fermentation is 2 to 5 specific gravity points (0.5 to 1 °P) prior to reaching terminal gravity. Brewers ask how they should know when fermentation has reached that stage. My advice is to raise the fermentation temperature for a diacetyl rest as soon as you see fermentation activity significantly slowing. It will not hurt the beer and it should help the yeast reach complete attenuation as well.

It seems that every beer improves with some period of cold conditioning and this style is no exception. Traditional lager conditioning utilizes a slow temperature reduction before fermentation reaches terminal gravity. The purpose of the slow cooling rate is to avoid sending the yeast into dormancy. After a few days, the beer reaches a temperature close to 40 °F (4 °C) and the brewer transfers the beer into lagering tanks. If you want to use this technique, you will need precise temperature control so that fermentation slowly continues and the yeast remains active. Rapidly chilling the beer near the end of fermentation can cause yeast to excrete a greater amount of ester compounds instead of retaining them.

Personally, I prefer to wait until fermentation is complete, including any steps such as a diacetyl rest, before lowering the beer temperature. The yeast is far more active and able to reduce fermentation byproducts at higher temperatures. Once I am certain the yeast have completed every job needed, I use a period of cold storage near freezing. This time in storage allows very fine particulates to settle out and the beer flavors to mature. In any case, great lagers take time, so do not rush things. BYO



BIÈRE Artisanale

Exploring the brewing culture of Québec

by **Ruth Miller**

When it comes to peeking over the neighbor's fence, Québec is the US's friendly abutter who heartily welcomes American brewing peers and consumers to hop that fence . . . and have a beer!

There are ample opportunities to partake in this unique form of international relations: Attending one of Québec's many beer festivals; visiting the local brewpubs and taprooms that abound in both metro and rural burgs; and enjoying some of the goods that are available for purchase to haul homeward for personal enjoyment. Although customs regulations may occasionally throw a curve ball when bringing beer back to the States, the shared spirit of brewing techniques, styles, and conviviality knows no bounds or barriers.

A visit to taste the beers of Québec is an easy choice. The exchange rate can be favorable and the drive from the Northeast only a few hours (and if you live farther away, Pierre-Elliot-Trudeau airport is only 20 minutes from downtown Montréal). Additionally, Québec brewing culture is very accessible — rarely is speaking French a necessity as there seems to be a universal "brewer's language" in play — even if it entails just gesturing and/or facial expressions. But if you can't make it there yourself, don't worry — I'll take you on a quick tour right now, and later you can try brewing a few Québécois beers of your own with three clone recipes from a couple of my favorite up-and-coming breweries (starting on the next page).

Québec City brewpub La Barberie serves up a wide selection of craft beers in the province's capital.

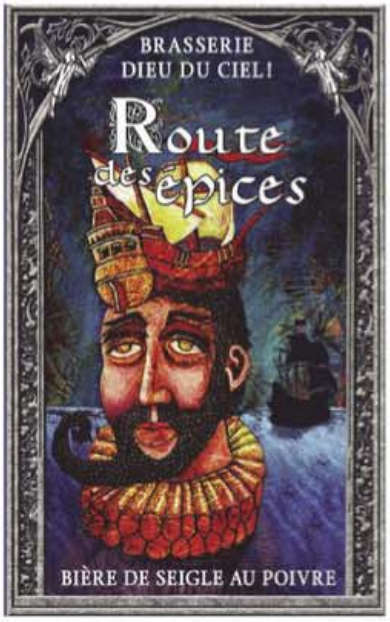
Québec Brewing Roots

Québec brewing culture sprang from Euro-French and Anglo roots, but over the years has assimilated the styles and flavors of their Belgian, German and American cohorts as well. While French influence remains very apparent, it is by no means dominant in the brewing culture that had been historically wine-centric. The welcoming nature of Québecers who enjoy brewing and drinking their beer makes them some of the friendliest and most reciprocal folks I've ever met. They are as keenly interested in what is brewed in the States as what is produced in their own province.

Québec also has many devotees of homebrewing, borrowing aspects of the Beer Judge Certification Program (BJCP) used in the US for style categorization and judging. Having never been menaced by the spector of Prohibition, yet able to observe and participate in it with US complicity, Québec has become enriched with the habits of its large and ethnically-diverse population that brought homebrewing and winemaking with them after WWII, and more recently as Third World refugees have been welcomed.

There is a bracing air of "DIY" in Québec. Locals enjoy traditional pleasures of good food, art, music, libations, and hockey (FYI: Political debate appears to be their "other" national sport!) It is a very diverse and energetic culture, of which quality commercially-produced craft beer is a rather new arrival. Having passed through the age of mass-produced lagers, Québec has emerged in the last 20 years as a producer of excellent craft beers brewed in scale from nano to mid-size, with the likes of giants Molson, Sleeman

Québec Clone Recipes



Brasserie Dieu du Ciel! Route des épices (Spice route) clone

(5 gallons/19 L, all-grain)

OG = 1.057 FG = 1.018
IBU = 29 SRM = 17 ABV = 5.3%

This is a malty rye ale spiced with peppercorns. It features rich chocolate and rye grain flavors, a medium body balance and a peppery finish. If you want the peppercorns to stay in the fermenter, you can bag them with the final hops addition. If you follow that process, the cooled wort with the peppercorns can go right from the kettle into the fermenter.

Ingredients

8.5 lbs. (3.8 kg) English pale ale malt
2 lbs. (0.91 kg) rye malt
12 oz. (0.34 kg) Cararye® malt (65 °L)
6 oz. (170 g) melanoidin malt
8 oz. (0.23 kg) pale chocolate malt (220 °L)
2.5 AAU Goldings hops (60 mins.) (0.5 oz./14 g at 5% alpha acids)
6.3 AAU Bramling Cross hops (30 mins) (1 oz./28 g at 6.3% alpha acids)
1 tsp. green peppercorns (0 mins.)
1 tsp. black peppercorns (0 mins.)
Wyeast 1318 (London Ale III) or Lallemand Windsor Ale yeast
⅔ cup corn sugar (if priming)

Step by Step

This is a single infusion mash. Mash the grains at 156 °F (69 °C) for a rich, fuller-bodied ale. Hold at this temperature for 60 minutes. Collect 6 gallons (23 L) of wort in the kettle and boil for 60 minutes, adding the first hop addition at the beginning of the boil and the second hop addition with 30 minutes left in the boil. Add the peppercorns at the termination of the boil and let them soak for five minutes before chilling.

Chill the wort to 68 °F (20 °C) and aerate it well. Pitch the yeast and ferment at that temperature. Fermentation should commence within 24–48 hours. After primary fermentation, let the beer condition for one to two weeks before you bottle or keg. Carbonate to 2–2.5 volumes of CO_2.

Brasserie Dieu du Ciel! Route des épices (Spice route) clone

(5 gallons/19 L, extract with grains)

OG = 1.057 FG = 1.018
IBU = 29 SRM = 17 ABV = 5.3%

Ingredients

6.6 lbs. (3 kg) golden liquid malt extract
1 lb. (0.45 kg) rye malt
12 oz. (0.34 kg) Cararye® malt (65 °L)
6 oz. (170 g) melanoidin malt
8 oz. (0.23 kg) pale chocolate malt (220 °L)
3.5 AAU Goldings hops (60 mins.) (0.7 oz./20 g at 5% alpha acids)
6.3 AAU Bramling Cross hops (30 mins) (1 oz./28 g at 6.3% alpha acids)
1 tsp. green peppercorns (0 mins.)
1 tsp. black peppercorns (0 mins.)
Wyeast 1318 (London Ale III) or Lallemand Windsor Ale yeast
⅔ cup corn sugar (if priming)

Step by Step

Steep crushed grains in 6 qts (5.7 L) of water at 155 °F (68 °C) for 30-40 minutes. Wash the grains with 2 qts. (2 L) hot water. Add the malt extract to the grain tea and top off to boil volume of about 3 gallons (11.3 L). If you are doing a full 5-gallon (19 L) boil, use the hop quantities from the all-grain recipe.

This is a 60 minute boil, adding the first hop addition at the beginning of the boil and the second hop addition with 30 minutes left in the boil. Add the peppercorns at the termination of the boil and let them soak for five minutes before chilling.

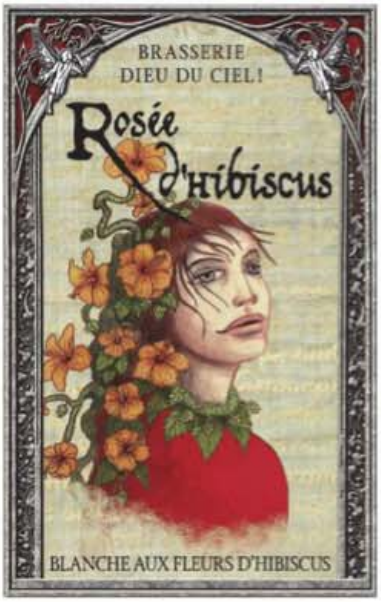
Chill the wort to 68 °F (20 °C) and aerate it well. Pitch the yeast and ferment at that temperature. Fermentation should commence within 24–48 hours. After primary fermentation, let the beer condition for one to two weeks before you bottle or keg. Carbonate to 2–2.5 volumes of CO_2.

Tips for Success:

Brewing with rye is notorious for causing stuck mashes. The amount of rye in this recipe is rather high, so it may be advisable to add some rice hulls to the mash. Between 1.5–3% of the total malt bill will work. You could also try using a step mash rather than a single infusion mash. As Erik Ogershok, Head Brewer of Real Ale Brewing Company in Blanco, Texas explains, "This is because the enzymes that break down the beta-glucans — and hence reduce the gumminess of your mash — are active in the lower temperature range (98–113 °F). You can take your choice of mash schedules."

This recipe calls for Bramling Cross hops, a variety we don't hear too much about. This is a British hop known for its "American" aroma. According to the British Hop Association (www.britishhops.org.uk/wgv/), Bramling Cross is a cross between Bramling (a traditional English Golding variety) and a male seedling of a Manitoban hop (a wild Canadian hop). If you can not source Bramling Cross, you can use extra Goldings, or try substituting with U.K. Progress or Whitbread Golding.

Québec Clone Recipes



Brasserie Dieu du Ciel! Rosée d'hibiscus (Pinkish hibiscus) clone

(5 gallons/19 L, all-grain)

OG = 1.055 FG = 1.011
IBU = 15 SRM = 5 ABV = 5.9%

Very pink, very floral, very crisp and light bodied — very drinkable! This beer's color and aroma are quite eye-catching and aromatic. It won a gold medal (fifth place amongst 10 gold medal winners) at the adjudicated "MBeer" contest during the Mondial de la Bière in Montréal in 2007, and a silver medal in the 2008 Popular Beer Contest during the Mondial de la Bière in Montréal. With just a hint of tartness (accentuated by the hibiscus), it is a perfect pair with creamy goat cheese or as an aperitif. Look for dried hibiscus flowers at your local food coop, health food store or from any local or online dried herb retailer.

Ingredients

5.2 lbs. (2.36 kg) Belgian Pilsner malt
4 lbs. (1.81 kg) wheat malt
1 lb. (0.45 kg) light candi sugar (10 mins.)
2.9 AAU Nelson Sauvin hops (50 mins.) (0.25 oz./7 g at 11.4% alpha acids)
4.6 AAU Nelson Sauvin hops (10 mins.) (0.4 oz./11 g at 11.4% alpha acids)
2–4 oz. (57–113 g) dried hibiscus flowers (5 mins.)
0.5 oz. (14 g) coriander seed (0 mins.)
Wyeast 3944 (Belgian Witbier) or White Labs WLP400 (Belgian Wit Ale) or Fermentis Safbrew T-58 yeast
⅔ cup corn sugar (if priming)

Step by Step

This is a single infusion mash. Mash the grains at 150 °F (66 °C) for a crisp dry ale. Hold at this temperature for 60 minutes. Collect 6 gallons (23 L) of wort in the kettle and boil the wort for 90 minutes. Add the first hop addition 40 minutes after the beginning of the boil. With 10 minutes remaining in the boil, add the final hop addition and the candi sugar then wait five minutes before adding the hibiscus flowers. Wait another five minutes and then add the coriander seed at the termination of the boil; let it soak for five minutes before chilling.

Chill the wort to 68 °F (20 °C) and aerate it well. Pitch the yeast and ferment at that temperature. Fermentation should commence within 24–48 hours. After primary fermentation, let the beer condition for one to two weeks before you bottle or keg. Carbonate to 2–2.5 volumes of CO_2.

Brasserie Dieu du Ciel! Rosée d'hibiscus (Pinkish hibiscus) clone

(5 gallons/19 L, extract only)

OG = 1.055 FG = 1.011
IBU = 15 SRM = 5 ABV = 5.9%

Ingredients

6.6 lbs. (3 kg) wheat liquid malt extract
1 lb. (0.45 kg) light candi sugar (10 mins.)
3.4 AAU Nelson Sauvin hops (50 mins.) (0.3 oz./9 g at 11.4% alpha acids)
4.6 AAU Nelson Sauvin hops (10 mins.) (0.4 oz./11 g at 11.4% alpha acids)
2–4 oz. (57–113 g) dried hibiscus flowers (5 mins.)
0.5 oz. (14 g) coriander seed (0 mins.)
Wyeast 3944 (Belgian Witbier) or White Labs WLP400 (Belgian Wit Ale) or Fermentis Safbrew T-58 yeast
⅔ cup corn sugar (if priming)

Step by Step

Add the malt extract to 3 gallons (11.3 L) of hot water. If you are doing a full 5-gallon (19 L) boil, use the hop quantities from the all-grain recipe.

Boil the wort for 60 minutes, adding the first hop addition 10 minutes after the beginning of the boil. With 10 minutes remaining in the boil, add the final hop addition and the candi sugar then wait five minutes to add the hibiscus flower. Wait another five minutes to add the coriander seed at the termination of the boil and let it soak for five minutes before chilling.

Chill the wort to 68 °F (20 °C) and aerate it well. Pitch the yeast and ferment at that temperature. Fermentation should commence within 24–48 hours. After primary fermentation, let the beer condition for one to two weeks before you bottle or keg. Carbonate to 2–2.5 volumes of CO_2.

Tips for Success:

Brasserie Dieu du Ciel! Head Brewer Jean-Francois Gravel relays that the tartness (and some of the bitterness) from this recipe comes from the hibiscus flowers. He says, "The tartness is coming the hibiscus. Just be aware that the hibiscus will drop the pH of the wort down to 4.5 easily."

Coriander can also be a somewhat tricky spice to brew with. The intensity of the spice can vary quite a bit depending on the source and freshness, and it is easy to overshoot the flavor. *BYO*'s "Style Profile" columnist Jamil Zainasheff advises crushing the seeds coarsely with the back of a heavy spoon rather than using whole seeds to get more coriander flavor into your brew. Also, "If you have fairly fresh coriander, start with 0.4 oz. (11 g) per 5-gallon (19-L) batch added during the last five minutes of the boil."

Québec Clone Recipes

Hopfenstark Saison 16 clone
(5 gallons/19 L, all-grain)

OG = 1.051 FG = 1.002
IBU = 25 SRM = 7 ABV = 6.5%

This is an extremely well balanced, easy-to-drink saison brewed with rye. The hops are not the star here, it's all about the rye and the brewer's skill.

Ingredients
8 lbs. (3.6 kg) Belgian Pilsner malt
2.25 lbs. (1 kg) flaked rye
7 oz. (200 g) Weyermann Caramunich® III malt (56 °L)
6 oz. (170 g) rice hulls
5.4 AAU German Magnum hops (60 mins.) (0.4 oz./11 g at 13.5% alpha acids)
5 AAU German Tettnang hops (10 mins.) (1 oz./28 g at 5% alpha acids)
Wyeast 3711 (French Saison) or Lallemand Belle Saison yeast
¾ cup corn sugar (if priming)

Step by Step
This is a single infusion mash. Mash the grains at 151 °F (66 °C) to develop a balanced mouthfeel and light body. Collect 6.5 gallons (25 L) of wort in the kettle and boil the wort for 90 minutes, adding the first hop addition 30 minutes after the beginning of the boil. With 10 minutes remaining in the boil, add the final hop addition.

Chill the wort to 73 °F (23 °C) and aerate it well. Pitch the yeast and fermentation should commence within 24–48 hours. Let the fermentation temperature rise up to about 79 °F (26 °C) over the course of the week and hold at a warmer temperature until fermentation is complete. After primary fermentation, let the beer condition for one to two weeks before you bottle or keg. Carbonate to 2.5–3 volumes of CO_2.

Hopfenstark Saison 16 clone
(5 gallons/19 L, partial mash)

OG = 1.051 FG = 1.002
IBU = 25 SRM = 7 ABV = 6.5%

Ingredients
3.3 lbs. (1.5 kg) Pilsen liquid malt extract
3 lbs. (1.36 kg) Pilsner malt
2.25 lbs. (1 kg) flaked rye
7 oz. (200 g) Weyermann Caramunich® III malt (56 °L)
6.8 AAU German Magnum hops (60 mins.) (0.5 oz./14 g at 13.5% alpha acids)
5 AAU German Tettnang hops (10 mins.) (1 oz./28 g at 5% alpha acids)
Wyeast 3711 (French Saison) or Lallemand Belle Saison yeast
¾ cup corn sugar (if priming)

Step by Step
Steep the crushed grains in 9 qts. (8.5 L) of water at 151 °F (66 °C) for 30–40 minutes. Wash the grains with 1 gallon (4 L) of hot water. Add the malt extract to the wort and top off with water to achieve a boil volume of about 3 gallons (11.3 L). If you are doing a full 5-gallon (19 L) boil, use the hop quantities from the all-grain recipe. Boil the wort for 60 minutes, adding the first hop addition at the beginning of the boil. With 10 minutes remaining in the boil, add the final hop addition.

Chill the wort to 73 °F (23 °C) and aerate it well. Pitch the yeast and fermentation should commence within 24–48 hours. Let the fermentation temperature rise up to about 79 °F (26 °C) over the course of the week and hold at a warmer temperature until fermentation is complete. After primary fermentation, let the beer condition for one to two weeks before you bottle or keg. Carbonate to 2.5-–3 volumes of CO_2.

Tips for Success:
As mentioned on page 39, brewing with rye brings a risk of a mess in the mash tun. If you are worried about getting stuck, you can use rice hulls in the mash to be on the safe side. Between 1.5–3% of the total malt bill will work.

Be sure when you are fermenting this beer to control the temperature when you let the temperature naturally rise. Letting your temperature get very hot will promote the development of fusel alcohols and solvent-like characters that you don't want. You also don't want to go too high because cooling them down can cause the yeast to stop. In his 2006 story for *Brew Your Own* titled "Fermenting Belgian-Style Beers," Stan Hieronymus explains that many commercial Belgian brewers allow their fermentation temperatures to go quite high, but this is because they can control the temperatures better than a homebrewer. Stan relays the advice of White Labs' Chris White regarding trying to correct Belgian-style fermentations that are too hot: "When you cool them, they stop. They go into survival mode. You can try rousing them, raising the temperature, but they won't start again. You just have to add a new yeast. You don't want to let it spike, and that can be hard to control in a homebrew situation." Read more about performing Belgian-style fermentations, including temperature control, pitching rates and fermenter shape, in Stan's story on the Web at: http://byo.com/story636

and Labatt forced to make room at the taps and in the coolers. Tastes that have changed and new breweries that are finding their footing — and each other — are driving a brewing renaissance in Québec.

I recall some of the first producers of craft beer in Québec when I began traveling to Montréal for the "exotic" pleasures that a large city offers — it was like a pauper's trip to Europe in a weekend. This was the late 1980s when craft beer was just starting to take hold in the US. The McAuslan Brewery and Les Brasseurs RJ in Montréal were both making really nice ales and stouts then in the Anglo tradition. Le Cheval Blanc was the first of several brewpubs to later open in the city. Styles tended to lean toward English and Scottish — ESB, ordinary bitter, pale ale, Scotch ale, and stouts.

At the time I noticed that Belgian beer styles were quite popular in Québec, likely driven by Unibroue's influence and the traditional French farming culture of northern Québec. Unibroue had hired a French-Belgian brewer who was turning out classic Belgian styles named for old Québec folk tales — there was a quirky story behind every beautiful label. And the beers were wonderful — wits, dubbels, tripels, quads, and an annual seasonal fruit beer — all brewed with a proprietary yeast strain that lent house esters, aromas and flavors. Belgian styles began to spread around the province, but when you walked into a brewpub you were often greeted with a chalkboard listing beers presented by color, not style: Blanche, ambrée, rousse, blonde, and noir corresponded to wit, brown ale, red ale, golden ale and stout or porter. Sometimes you would see Belgian monikers like Trappiste, bière de Garde, and quad. Very few German beers were in evidence at that time. Unibroue beers started to become available in the US in the early 90s, and I credit them with my introduction to, and long-sustained interest in Belgian styles. Their Bières et Saveurs festival in Chambly (now run by the local Chamber of Commerce) allowed me the opportunity to taste top-notch Belgian

imports, brought in for sale by the provincial liquor-control agency, the *Société des alcools du Québec* or SAQ. Some were only available at SAQ retail outlets; others could be located at local *dépanneurs* (convenience stores) or high-end gourmet shops and restaurants like fine wines. At this point, Québec beer culture was in the process of re-inventing itself.

Québec Brewing Culture

I spoke with Fred Cormier, owner/master brewer at the Hopfenstark Brewery in L'Assomption (northwest of Montréal) whose bottles are somewhat available in the States now. His is one of the province's relatively new operations, and he is one of the younger brewers of the community. Fred described the brewing culture of Québec as progressing from styles that were brought to the public via newcomers from Europe; then the more Anglo approach with ubiquitous and inexpensive light golden lagers; to the "homebrewers-gone-pro" who now own and operate many of the craft breweries there. He started as a homebrewer and had no formal training or apprenticeship before starting his facility. Now he bottles for domestic and export, and maintains a popular taproom called Station Host in downtown Montréal where he tries out his pilot brews with the drinking public. Styles include Berliner weisse, wine barrel-aged saisons, spirit barrel-aged porters/stouts, and pale ales — many with unusual adjuncts.

Fred describes the culture of Québec people as one of continual adaptation to whatever circumstances evolve as "new" — from the inception of French settlers coming in after several wars with the British, to post-WWII three centuries later. Indigenous First Nation peoples were always a part of the mix. He feels that Québecers are a people that don't like static situations and are constantly rallying for change. It is not a market to be filled these days; rather it his being re-created from the ground up.

Comparing Québec beer culture from 20 years ago to now, Fred describes styles that were a reflection of transient influence, from limited available ingredients and expertise of the era, to the widely available styles of present. French-Belgian cultural iconic brews began to displace the Anglo-inspired light lagers, mirroring the Franco-Anglo political and social conflicts of the time. Yeast became more of a celebrated ingredient. Hop varieties were not a big player back then, so hoppier styles were not given a lot of attention. As more craft breweries opened and brewers began to feel comfortable adapting to a more accepting and adventurous beer audience, that newfound confidence inspired more creative and independent recipes and styles to try out on the public, who were once again ready for change.

Microbrasserie des Beaux Prés located north of Québec City specializes in Belgian- and American-style ales brewed along the banks of the St. Lawrence River.

Although initially enamored of hoppy DIPAs and their ilk, Fred now prefers beers that are balanced in all aspects. His advice is to brew a base beer repeatedly until it is perfectly balanced, and then proceed to play with it in terms of flavors and treatments, making careful notes for every single tweak. He describes big, hoppy beers using the metaphor of a musician using a "wall of sound" to express him or herself. It is invigorating, but ultimately unidimensional and wearing on the audience. Conversely, a well-balanced beer of lower ABV is an accomplishment to make well, and is more akin to a solo acoustic guitarist whose every note plays a key role in the listener's perception, opening them up to contemplation that begs to be shared with others. The "melody" of a great beer incorporates multiple layers of flavors, balance, and interplay in perfect harmony, opines Fred.

At the *Mondial de la bière* festival in Montréal early June of 2014, I had the opportunity to speak with Jean-François Gravel, (aka "JF") master brewer and co-owner at Québec's wildly popular Dieu du Ciel! Brewery. His recipes are pilot-brewed in 5-hectoliter batches at their Montréal brewhouse/taproom, and then put on draft to gauge interest before scaling up to 200-hectoliter batch production at their facility in Saint-Jérôme in the suburbs where their flagships are brewed and bottled. There are often 20 beers on offer at the brewpub. A common story for Gravel once again: He started as a homebrewer in '91; no formal beer school experience other

The Fleurdelisé flies over Québec's Parliament Building as a craft beer revolution sweeps through La Belle Province.

than a degree in microbiology. He says he is rather surprised at the huge growth in craft beers in Québec, but light lagers can no longer command the market as they once did. He confirms that Unibroue also was a big influence on him for Belgian styles. He also cites Vermont publican and author, the late Greg Noonan, as a mentor. Greg delighted in spending time in Montréal sharing and absorbing technique, and socializing; then later hosting JF's brew crew at his Vermont Pub and Brewery in Burlington, Vermont to make collaboration beers. JF also credits brewing with John Kimmich of The Alchemist Brewery, and Shaun Hill of Hill Famstead Brewery as time well spent to concoct some unique collaborative beers. The ongoing debate of whether black IPA originated with Greg at his brewpub with his iconic Black Watch has been sustained by JF's collaboration with Shaun Hill to produce a beer called Pioneer. JF has also immortalized Greg on the label of a Dieu du Ciel! black IPA called Pénombre ("Twilight"). One of JF's latest collaborations is with the hard/ice cidery Les Vergers de la Colline. He is experimenting with blending their unfermented cider with witbier wort and beer yeast to achieve a cider-beer hybrid. He relates that controlling the acid in the cider is the hardest part in achieving reliable fermentation. I tasted the pilot batch at Mondial de la bière and found it quite engaging — very dry, slightly tart, and redolent of Normandy-style funky ciders with a refreshing beer finish.

I also spent time at the Mondial festival chatting with Benoît Mercier, co-owner and master brewer of the Benelux Brewpubs — the original in Montréal, and its new sister brewery in the nearby suburb of Verdun. Given that the Verdun brewpub was the first establishment licensed to make and serve alcohol in dry Verdun since 1870, a lot of thought and commitment went into its concept and execution. Yet again — Benoît got started as a homebrewer, but he had no formal training when he opened his first brewpub. Local Québecer Philippe Tremblay is Head Brewer at the Montréal facility, and Teklad Pavisian holds that title at the Verdun location. Both showcase beers of a huge breadth of styles, but here the American, highly-hopped influence comes more into play.

North Meets South

Benoit suggests that Montréal's proximity to northern New England has generated a lively exchange of ideas and techniques in Québec brewing culture recently (also citing Greg Noonan's influence) as hop varieties become more accessible to them. Sours are also gaining traction. Saisons are a staple. As a university/high tech town, Montréal has a lot of forward-thinking patrons who enjoy drinking local as well as traveling south to taste what the States have to offer. They return and ask their local Québec publican if they can enjoy some of those unfamiliar styles, and the brewers come down to investigate or invite our brewers up there to discuss and share for some cross-border cultural pollination. Benoît has made a couple of collaboration beers with Vermont brewers at his facilities so far, and vice-versa. Several Québec breweries are now regular exhibitors at New England beer festivals, and Québec kegs are now showing up in taprooms in the States on a limited basis. Surely there will be more to come!

Bienvenue, amis des bière! Québec beers are welcome here, and we will share freely our cultures through the conviviality that beer naturally inspires in us all — borders be damned! BYO

Brew Your Own 20th Annual Homebrew LABEL CONTEST

THE HOW-TO HOMEBREW BEER MAGAZINE

Send us your best homebrew labels and you could win some great brewing prizes from **BYO** advertisers! Enter as often as you like, but you can only win one prize. Winners will see their artwork featured in the July-August issue of the magazine. **Deadline to enter is April 30, 2015.**

Rules: Entrants can send labels or labels already stuck to bottles. The bottles can be full of beer. No digital or electronic files will be accepted. All other rules are made up by the editors of *BYO* as we go along. Labels are judged in one category, open to graphic artists and amateurs alike, so ultimate bragging rights are on the line. When submitting your labels, tell us a bit about the artwork and its inspiration. Is it hand-drawn? Created on a computer? Send us your best labels, tell us how you made them, and good luck!

Brew Your Own Label Contest Entry Form

Name _____

Address _____

City _____ State/Prov _____ Postal Code _____

E-mail _____

Daytime Phone _____

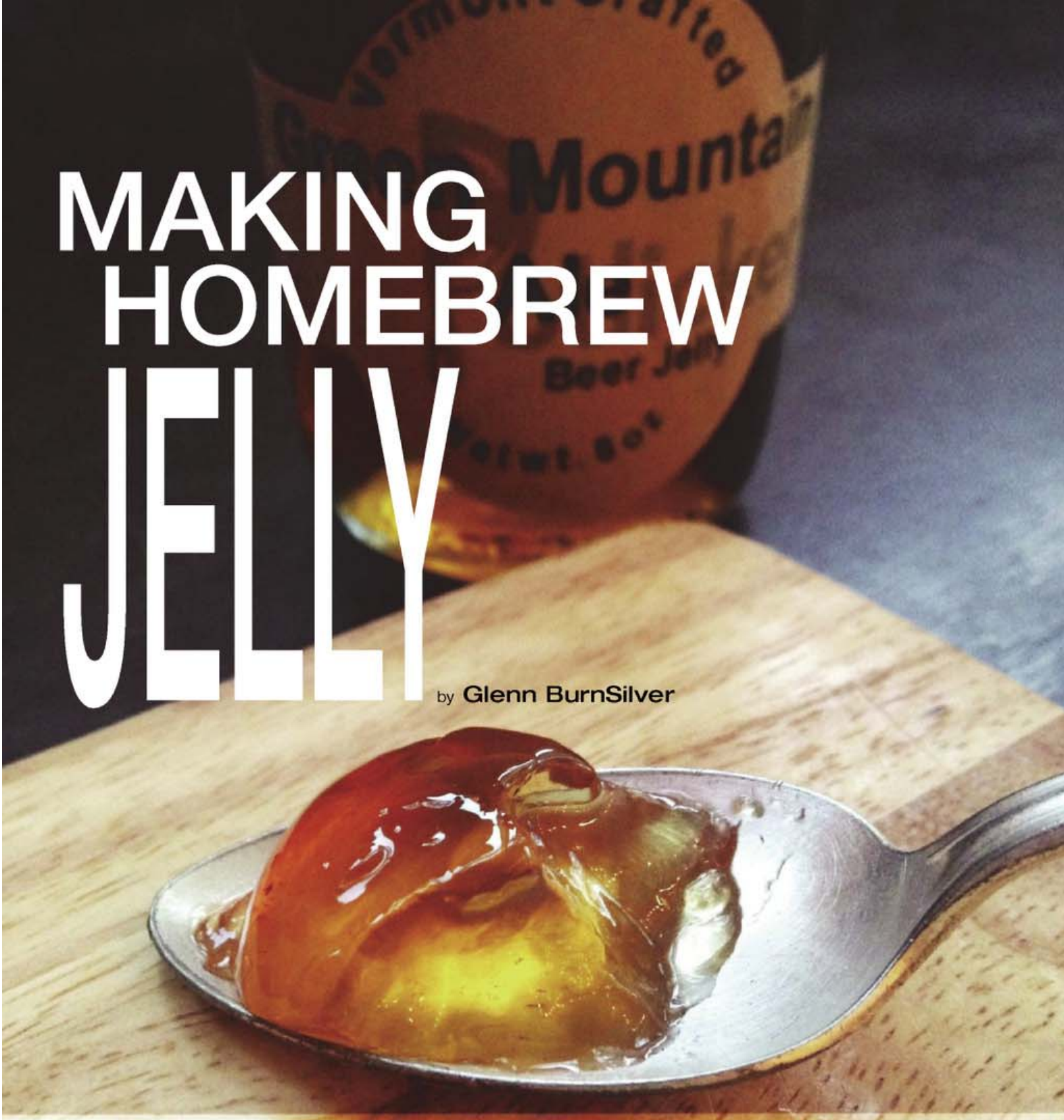
All original artwork? Y or N (circle one)

Send your entry to:
BYO Label Contest
5515 Main Street
Manchester Center, VT 05255

DEADLINE: April 30, 2015

MAKING HOMEBREW JELLY

by Glenn BurnSilver



Photos courtesy of Potlicker Kitchen

Beer for breakfast? What was once a fun jest, now becomes reality — and we're not talking Funky Buddah's Maple Bacon Coffee Porter either — as beer jellies fill a growing market niche.

"There are all kinds of ways to use beer jelly besides spreading it on toast in the morning," says Walter Warner, Co-founder (with wife Nancy) of Vermont-based Potlicker Kitchen, maker of a growing lineup of jellies made from beer. "That is probably one of the things (jelly users) will be the least likely to do."

With a range of flavors, including Oatmeal Stout, Apricot Ale and Blood Orange IPA, the options for using these beer-based condiments are endless — from barbecue glazes to gooey sauces to pancake toppings. Yet despite the obvious yumminess and practicality of these jellies, the idea to create jelly from beer came to Walter and Nancy almost by accident — or maybe more out of desperation. In 2010 these former archeologists bought a old one-room schoolhouse in Bethel, Vermont with a giant blackberry patch out back.

IT DIDN'T TAKE LONG TO DISCOVER THE SIMPLE TRUTH THAT BETTER BEER MAKES BETTER BEER JELLY. IPAS, PALE ALES — BEERS WITH STRONG FLORAL HOP CHARACTERISTICS, AS WELL AS BEERS WITH MALTIER PROFILES WORK BEST.

Use your favorite homebrew to make a homemade jelly and you can enjoy your beer for breakfast, lunch or dinner for months to come.

Nancy, who was already interested in food preservation through her archeological studies, took up canning as a "hobby" (read: obsession), starting with locally purchased strawberries, and later the blackberries, before moving on to other fruits seasonally available at local farmers markets. Once winter set in, the fruit ran out and Nancy began looking for other foods — like coffee or wine — to turn into jelly.

"We never run out of wine and we never run out of beer," Warner explains. "Nancy had a wine jelly recipe, but she thought, 'If I can make jelly out of wine, I can make jelly out of beer.'"

Nancy worked though a variety of formulas, all adapted from available wine jelly recipes. There was a lengthy period of trial and error with "a lot of long nights and wasted beer," Warner says, before the perfect recipe came into being.

"She came up with something that actually worked," he says, not sounding too surprised by his wife's determination. "It took a couple weeks to get it right."

By late 2012 Nancy was, with Walter's encouragement, setting up at Saturday farmers markets and based on the initial interest and strong sales — plus the fact the pair were "working

Beer jelly can be used for lots of purposes other than spreading on toast. They can be used to round out an unusual cheese plate, or act as an ingredient in savory dishes as a base for dipping sauces or glazes. Above, chicken wings go homebrew with a beer jelly glaze.

around the clock" to keep up with growing demand — she knew beer jelly was a hot product.

"That's how it started," Warner adds simply.

Truly Homebrewed

Nancy and Walter's earliest jelly creations were made with homebrew, and more specifically, the leftover beer found at the bottom of the carboy during bottling. Nancy used whatever a homebrewer-friend could provide, starting with vanilla porter and a brown ale.

As Potlicker's beer jelly began gaining popularity, their homebrewing friend couldn't keep up with their demand and the pair had little choice but to make the switch to making jelly with commercially produced craft beer, including Wolaver's Oatmeal Stout, Otter Creek Black IPA and Long Trail Ale, as well as other regional Vermont brews.

"We made it in the kitchen of the school house and were working almost around the clock at the end of 2012," Warner recalls. "It moved along from homebrew to commercially available beers because we could always get those. That way we weren't restricted to waiting for homebrew."

This created some new challenges (which we'll discuss later in the story), but it didn't take long to discover the simple truth that using better beer makes better beer jelly. IPAs, pale ales — beers with strong floral hop characteristics, as well as beers with maltier profiles work best. Flavorful brews such as Magic Hat #9 and Northshire Sicilian Blood Orange IPA worked a lot better for Potlicker than other average commercial offerings.

"It's beer, it's sugar and it's pectin, (so) your run of the mill beer doesn't make good jelly. Your Budweisers and Coronas, and even Guinness, are not going to make a tasty jelly. That's just beer-flavored jelly," Warner says. "The (beers with) more flavor really come through and make better jelly."

Some of the beers used at Potlicker Kitchen, including seasonal offerings, include: Wolaver's Oatmeal Stout, Otter Creek Black IPA, Long Trail Ale, Harpoon's IPA, UFO White, Pumpkin Ale and Chocolate Stout, The Alchemist's Heady Topper Double IPA, Magic Hat #9, Northshire's Chocolate Stout and Sicilian Blood Orange IPA, and Foley Brothers

Ginger Wheat. They also sometimes make jelly with New Hampshire's Smuttynose Porter.

With the exception of Potlicker's Hefeweizen with Orange Beer Jelly, nothing additional is added to the beer jellies. The beer flavors in these quality brews are more than enough to impart fruity and other flavor characteristics, Warner explains.

Experimental Process

Once Nancy set her mind to making beer jelly, even though, at that time, there wasn't any competition for this product, she was still determined to make the best jelly possible. There were a number of challenges as well as some discoveries — good and bad — the latter frequently made the hard way (to which homebrewers can surely relate).

"When we first started we really didn't know what we were doing," Walter admitted. "It was all just a big experiment."

For starters, once the conversion to bottled beer was in place, the pair initially poured the brew into pitchers the night prior to canning and set them in the fridge to allow the carbonation to "settle out." Soon, however, they discovered that carbonation was not a

HOMEBREW JELLY RECIPE

Potlicker Kitchen's Nancy Warner scaled down her commercial beer jelly recipe for *Brew Your Own*, making it perfectly simple for homebrewers and canners alike.

"This jelly is a little different from our signature beer jelly because it uses apple cider," she says, which as mentioned in the story will help the jelly set up if you can't get your hands on some commercial pectin. The natural pectin present in apple cider helps the beer to properly gel into beer jelly. Liquid pectin is easy to work with and adds "a clarity" to the overall flavor.

"I do not recommend making this as a low sugar jelly or using calcium-based pectin like Pamona's Pectin," Warner cautions. "Reducing the quantity of sugar will affect the quality of the gel and the alternative pectins will change the overall flavor."

Nancy Warner's Beer Jelly quick tips:

Prepare to make your jelly by having all of your equipment and ingredients ready to go and laid out in your work space. You will need six clean 8-oz. glass canning jars and a pot for a hot water bath. See the sidebar on page 50 for the water bath canning process. Before you start making jelly, place your jars in the pot of water and bring it to a simmer. Allow the jars to rest in the hot water until you are ready to use them. Rinse the lids and bands with warm water and set them aside.

In addition to your canning jars and equipment, you will need a large saucepan. As we've already established, jelly has higher acid, so use a non-reactive pan — like stainless steel or enamel — for this recipe. A reactive pan, like aluminum, may leech a metallic flavor into your jelly.

Choose a very tall or large pot as beer jelly will foam up more than the average jelly.

To use homebrew in this recipe, strain any sediment from the wort or beer using a cheesecloth to make sure your jelly is clear.

To test your jelly for completion, familiarize yourself with a spoon test. A spoon test is performed by dipping a spoon into the boiling jelly, removing it and observing the thickness of the jelly left on the back of the spoon. When the liquid has turned to jelly (at about 221 °F/105 °C or 65 °Brix) the liquid will not drip off the spoon so much as it will sheet off. The drips will begin to spread sideways into a sheet of jelly that will slip off the spoon. There is a great illustration of this (with other good jelly info) on the USDA website at http://nchfp.uga.edu/publications/usda/GUIDE%207%20Home%20Can.pdf

Ingredients

3 cups (2 12-oz. bottles) flat beer (stronger flavored beers — porters, stouts, IPAs — work best)
¾ cups apple cider
4 cups granulated white sugar
1 box (6 oz.) Sure-Jell liquid pectin

Step by step

In your large sauce pot (a small stock pot also works well), combine the beer, apple cider and sugar over high heat and stir with a (non reactive) wooden or stainless steel spoon until the sugar dissolves. When the liquid comes to a boil add the pectin. Return the mixture to a boil and cook on high heat for 2 minutes. Test for gel by using a spoon test (see tips and link above). When your jelly has passed the spoon test to your liking, remove the hot jelly from the stove, allow to rest for 2–4 minutes and (optionally*) skim the foam off with a spoon. Ladle the hot jelly into sterilized canning jars, leaving about a ¼ inch of headspace, seal with a lid, and process in a hot water bath for 7 minutes. See the water bath canning instructions in the sidebar on page 50. Allow jars to cool undisturbed overnight. Serve with cheese, over meats and on toast.

*Jelly foam may be poured into jars for that full pint-of-beer effect.

CANNING JELLY

The canning method used for preserving the beer jellies in this story is the "water bath" method. Water bath canning is a good method to use when canning high-acid foods (pH < 4.6) like jelly and also salsa, chutney, relish, tomatoes, etc.). The other most popular canning technique is known as "pressure canning." This method is better used for canning vegetables, meat poultry or seafood as it heats the contents of the jar to 240 °F (116 °C) to eliminate the risk of foodborne illness. In the photo to the right, the pot in the top left shows pressure canning (in a pressure cooker), while the pot in the lower right shows a water bath.

To perform the water bath method of canning, you will need:
- A large saucepan or stock pot that can accommodate all your canning jars and let water boil with a lid on
- Canning jars with lids and bands
- A wooden or non-reactive spoon for stirring
- A ladle or funnel for transferring the jelly into the jars
- An optional jar lifter (as the jars will be hot when you go to fill)

Before you start canning, inspect your canning jars for any nicks or cracks. Even if the jars are new it's a good idea to check them over. A cracked jar can break during the canning process and cause injury and ruin your batch of jelly; a nicked rim can prevent you from getting a proper seal between the jar and the lid.

1. Fill your pot halfway with water and place your jars in the pot. Fill the jars with water from the saucepan to keep them from floating. There are waterbath canning pots that work great for this, which have a wire rack for holding the jars in place and away from the bottom of the pot but owning a special pot is not necessary. If you don't have a special canning pot, simply put a small baking rack on the bottom of the pot under the jars (a homebrewing false bottom works well). Heat the water and jars to a simmer with the lid on and keep them hot until you're ready to fill the jars with your jelly.

2. Prepare your product to be canned (in this case, your homebrew jelly).

3. When you're ready to transfer the jelly, take a hot jar out of the water bath. This is when a jar lifter comes in handy; high-heat brewing gloves work well, too. Pour the water in the jar back into the pot and fill the jar with your jelly, leaving about ¼ of an inch of headspace. Repeat for each remaining jar.

4. Place the lids on the jars, making sure the rims make contact with the sealing agent on the lids. Screw the bands onto each jar until they are moderately tight.

5. Place the closed jars back into the pot of water, put the lid on the pot and bring it to a boil for the processing time listed in the recipe. When the processing time is up, turn off the heat and open the lid. Let the jars sit for a few minutes to acclimate to the air temperature.

Photo by Istockphoto

Water bath canning (lower right) is the canning method best used for preserving high acid foods like jelly, jam, salsa, and tomatoes.

6. Take the jars out of the pot and leave them to rest overnight. The next morning, check the seals on the lids: They should not pop up and down when you push on them in the middle, and if you remove the band and try to take off the lid you should feel some resistance.

For more about the water bath method (and other canning processes), visit the Ball® Canning website: http://www.freshpreserving.com/tools/waterbath-canning or http://www.freshpreserving.com/getting-started

~ Betsy Parks

factor to be worried about.

Similarly, during the boiling process the beer tends to foam up. They used commercial anti-foaming additives for a while until that too was considered needless. The solution: Each gallon and a half batch (the pair originally used four bottles of beer to create eight to 10 bottles of jelly) is split into two 40-quart stainless steel pots. The foam stops about an inch shy of the lip.

Warner also says that much of the experimentation went into determining the exact proportions of each ingredient to use — numbers he would not divulge — so that each jelly sets up properly and wouldn't be too runny. Your own individual homebrews may behave differently, so use a pectin calculator, like the one online at Ball® Canning at http://www.freshpreserving.com/tools/pectin-calculator, to do the math.

"We like to say that instead of using grape juice or 'kid' juice, we use 'adult' juice, which is beer. It's just like any other jelly recipe except we're using beer instead of fruit juice," he says. "It's pretty straightforward. Start off with the beer. Then add the pectin and then the sugar. First, the beer goes into a boil. You bring down the boil, add the pectin, and bring back to a boil. Lower it again and add the sugar and boil once again."

One difference, Nancy said in a separate interview, is that she uses commercial pectin. This helps the jelly thicken properly, something the average hobby beer jelly maker might otherwise struggle with. "You can't get the jelly to firm up enough with store-bought pectin," she explains, suggesting the use of a high-pectin apple cider to promote thickening.

Getting back to the idea of beer for breakfast, those desiring to spread their beer jellies on the morning toast have little worry of arriving at work buzzed. The cooking process removes almost all of the alcohol, leaving less than half a percent of alcohol per jar.

"It's a sweet tasting jelly with the beer background flavor," Walter confirms. "It comes to a boil three times, and that reduces the alcohol."

Now, everyone can raise a toast (or piece of toast) to that! BYO

BUILD AN All-Electric Homebrewery

When I started thinking about a return to homebrewing, after a nearly-15-year hiatus, I started my research diligently to see what has changed since I got out of the hobby for a variety of reasons. During my first stint, I brewed 10-gallon (38-L), all-grain batches using traditional propane burners with a keggle and a converted Igloo drink cooler for a mash tun. I knew I wanted to make things a bit easier this time around so I wouldn't spend my day hauling and lifting heavy pots full of nearly boiling water, but I had no idea what was in store for my new setup.

My friends and family will tell you that I am a bit of a research nut, so it was no surprise to them that once I decided to build a new homebrewing system, I spent a significant amount of time on the Internet looking at systems and equipment that other people are currently using. I was expecting to see more of the same as I had been using in the past, with maybe a few new ideas thrown in; what I wasn't expecting to find was an all-new way of brewing using electrical water heater elements along with varying levels of automation to control the amount of heat being applied. I was instantly impressed and amazed at the brewing systems I saw, and knew almost instantly that electric brewing was the way I wanted to go. Being from Minnesota, electric brewing instantly made sense to me: I could recall many times in the past when my homebrew friends and I spent hours standing on cold cement in a frozen garage with the door halfway up while brewing, wearing winter jackets and hats. The thought that I could brew indoors, in a climate-controlled environment, all while not having to listen to the jet engine sound of a propane burner, finalized my decision and set the wheels of progress in motion. Here is my system from start to finish — hopefully it will inspire you to build your own!

Story by **Trent Neutgens**
Photos by **Christine Neutgens**

The heat used for boiling water and wort in Trent's all-electric system comes from inside the hot liquor tank (HLT, above) and the boil kettle in the form of two ultra low watt density (ULWD) water heater elements. The devices are installed using tri-clover fittings.

tip

When choosing heating elements to use for your own electric system build, know that "ripple" style elements have more surface area than straight elements, thereby reducing (but not eliminating) the risk of scorching.

By installing and wiring the heating elements this way, the electric parts of the element are enclosed for safety and the kettle is grounded. This design also ensures that your vessels are sanitary as no trub or debris can gather, and the parts can be removed for cleaning.

The Basics

Most of my build is fairly standard, utilizing a pair of Chugger pumps, three stainless steel vessels, and a RIMS (recirculating infusion mash system) tube all on a single-tier stand, much like the common "Brutus" style of builds. But instead of propane burners installed underneath the kettles, both the hot liquor tank (HLT) and the boil kettle have 240v 4500w ULWD (ultra low watt density) water heater elements installed inside of them as the heat source (see photos, left).

The nice thing about going all electric is that the heating element is in direct contact with your water or wort, so the efficiency of your heating method is much higher than utilizing an external source such as a propane burner (see photo, bottom). This efficiency does have its drawbacks in that you need to be very careful not to scorch your wort due to that direct contact. That is why having a ULWD, or at least a LWD (low watt density), element is so important: These "ripple" style elements have more surface area than a short, straight element, thereby reducing the risk of scorching, but not eliminating it entirely. The third heating element is a 240v 1500w LWD element in a stainless steel RIMS tube that is made specifically for that task by www.brewhardware.com.

I designed the system to utilize tri-clover fittings for the installation of the heating elements, which was made easy once again with the help of www.brewhardware.com. In addition to their RIMS tube, which has tri-clover ferrules on each end (see photo on the top of the next page), they also carry ferrules for installing in your kettle, as well as enclosures for the actual element itself that make installation simple and the results extremely professional looking. Using this type of system, the electric parts of the element are enclosed for safety, and with proper wiring, it also ensures that your kettle is grounded. An added benefit is that they are sanitary, as they lack any threads where trub and debris can hide, and they are easy to remove for inspection and cleaning purposes.

All of the fittings on the kettles

including the triclover ferrules and stainless steel bulkheads were installed professionally in the kettles utilizing tungsten inert gas (TIG) welds. This can be more difficult and expensive to accomplish than using weldless bulkheads and/or soldering, but I had the option available to me so I chose to go with the more permanent solution in hopes that it would reduce leaks and make the system look more professional. Neither way is right or wrong, and many successful systems have been built using all options. In that same vein, I went with fully stainless steel three-piece ball valves, which make them easy to disassemble and clean, ensuring no foreign matter gets into your wort/beer (see bottom photo, right). Another advantage to the three piece valves that people don't always realize is that when installing a standard one-piece ball valve in a welded fitting, you can sometimes end up with your handle upside down, or on the side when the valve is fully tightened into the fitting. Most times, you can adjust this somewhat, using more force or additional Teflon tape, but if the difference is too great, you simply have to live with a handle out of place. When using a three-piece valve, you can disassemble the valve after tightening it, and rotate the body in 90-degree intervals to get the handle as close to the 12 o'clock position as possible. It may be a minor thing, but the cost wasn't outrageously more than the alternative, and this added benefit did come in to play on several of my valves when I was assembling the system. To finish out the plumbing, I went with quick disconnect camlock fittings on all kettle, pump, chiller, RIMS tube input and outputs, as well as on all hose ends (see the camlock and fittings photo on page 58). This makes moving hoses around a simple process and always provides a nice liquid tight seal.

As you can see, most of the equipment in my system is fairly standard, and not much different than what you see in a "traditional" gas fired brewing system (see the sidebar for the equipment rundown on page 59). If you ignore the heating elements in the HLT and brew kettle, as well as the shiny stainless steel tube on the lower rail of my stand for a moment, you wouldn't notice much difference from systems you have probably seen many times on the pages of this magazine, or even brewed on yourself. Both the HLT and mash tun are 15-gallon (57-L) stainless steel pots that are available almost everywhere. The boil kettle is a 20-gallon (76-L) pot of the same make, as I felt the added capacity may be beneficial, now that I was going to brew indoors, in helping prevent any boil overs that would possibly make a large mess on an indoor floor. As you'll see later, this probably wasn't necessary as the boil was nicely controlled using my automation system, and I never experienced a rapid out of control boil. But possibly in the future, I may be able to step up to 15-gallon (57-L) batches depending on the grain bill, at which point I would be limited only by the capacity of the mash tun.

For the stand, I built a Brutus-esque rectangular structure to accommodate my three vessels, with a lower rail for mounting the RIMS tube and

In addition to the two hot water heater elements, this system utilizes a stainless steel RIMS (recirculating infusion mash system) tube. The RIMS element has a tri-clover ferrule on each end for easy installation as well as disassembly for cleaning and sanitizing.

Trent chose to utilize stainless steel three-piece ball valves for his setup, which are easy to disassemble and clean. The advantage to choosing three-piece ball valves over one-piece ball valves is that you run less of a risk of installing the handles out of place.

To finish out the plumbing on the system, Trent installed quick disconnect camlock fittings on all of the kettle, pump, chiller, RIMS tube input and outputs as well as on all hose ends.

The quick disconnects give Trent the ability to quickly and securely attach the tubes between his brewing vessels, as well as detach them for easy cleaning and sanitizing.

The camlock fittings and quick disconnects provide a nice tight seal between vessels, and make the process of moving liquid and hoses around Trent's homebrewery simple.

the pumps. I fabricated it myself out of 2-inch square 16-gauge steel using a MIG welder. You can approach the stand a lot of different ways depending on your system and space. I chose to use a similar design as Lonnie McAllister's Brutus Ten basic stand (https://byo.com/store/byo-special-issues/build-brutus-10-plans): I have four each 66-inch rails, four each 36-inch legs, and eight each 13.5-inch cross beams. If you know how to weld — great! If not, this is a job for the local weld shop. Before you build your stand, make sure that you size everything to accommodate the size of your kettles. This stand shape is not necessary, however, I just like how it looks. Another easier option if you don't want to build a stand from scratch is to source a stainless steel work table from a restaurant supply store. Look for one with a shelf underneath the tabletop for mounting your RIMS and pumps. Unlike a gas-fired system, your stand doesn't need space below the vessels for a heat source as the elements are in the vessels themselves. You just need a surface, like stainless steel, that can be exposed to heat from inside the kettle.

Control Box

The biggest difference between a traditional gas-fired brewery and the system you see here really comes down to the "brains" of the system. In my case, this brain consists of a unit called a BCS-460, which was developed and produced by a company called Embedded Control Concepts. When I say this unit is the brains of the system, I am not exaggerating; the built-in logic and control over nearly all steps of the brewing process gives a person complete control, and allows for a repeatable brew process as well. The BCS-460 is accessible through its built-in Web interface and can be controlled via temperature probes in your systems, processes you design and develop, as well as buttons and timers built in to the Web interface. All of these inputs then are able to control both the heating elements as well as the pumps, using relays within the control panel. Pumps are set to an either on or off setting, while the heating elements can

Electric Homebrewery Components

Hot Liquor Tank: 15-gallon (57-L) stainless steel pot with 240v 4500w ULWD (Ultra Low Watt Density) water heater element

Mash/Lauter Tun: 15-gallon (57-L) stainless steel pot with false bottom and Blichmann AutoSparge

Brew Kettle: 20-gallon (76-L) stainless steel pot with 240v 4500w ULWD (Ultra Low Watt Density) water heater element and a hop spider by www.arborfab.com

All thermocouples (TC) and bulkheads are custom TIG welded into the kettles

RIMS Tube: Brewhardware.com 12-inch kit with 1500w element (http://www.brewhardware.com)

All heating elements are 240v style. The element enclosures utilize 1.5-inch tri-clover fittings, made by brewhardware.com

Pumps: 2 Chugger stainless steel inline pumps

Chiller: CFC chiller by JaDeD brewing (http://jaded-brewing.com/products/the-jaded-cfc)

Brew Stand: DIY MIG welded stand made from 2"x2" 16-gauge steel

Custom DIY stainless steel exhaust hood

Fermenter: Stout 14.5-gallon (55-L) stainless steel

Control Panel: DIY project

Main Control: BCS460 Brewery Control System (BCS) (http://www.embeddedcontrolconcepts.com)

BCS, SSRs, contactors, switches, buttons, relays, temperature probes and enclosure sourced from http://www.ebrewsupply.com/

Panel wired to allow for both BCS and manual control of all pumps and heating elements. It is fully customizable allowing for pumps and heating elements to be controlled via Web interface.

be controlled more precisely using PID-like algorithms to reach and hold a specific temperature, as well as a power percentage mode which allows you to maintain a nice easy rolling boil without it getting out of hand, which often leads to a boilover.

Wiring the Box

The build of the control panel, which houses the Brewery Control System (BCS) and all of the automation controls, is easily the most complicated part of the build. Fortunately I was not breaking new ground; others had been here before me, and several of them have documented their builds quite nicely. One such person is Kal Wallner, the creator of the website www.theelectricbrewery.com, and while he uses a bit of a different method for automation control, his website and the eBook he has produced are wonderful sources of information and inspiration for anyone who wants to go electric. Another key player in my ability to get things done is Paul Muth, a retired IBM technician/technical manager who goes by the handle of P-J on the homebrew forums found at www.homebrewtalk.com. In my opinion, his wiring diagrams are the benchmark by which all others are judged when it comes to wiring up anything homebrew related. Fortunately for me, he already had a diagram posted that would fit into my plans with minimal modifications (see the wiring diagram on page 60 and 61).

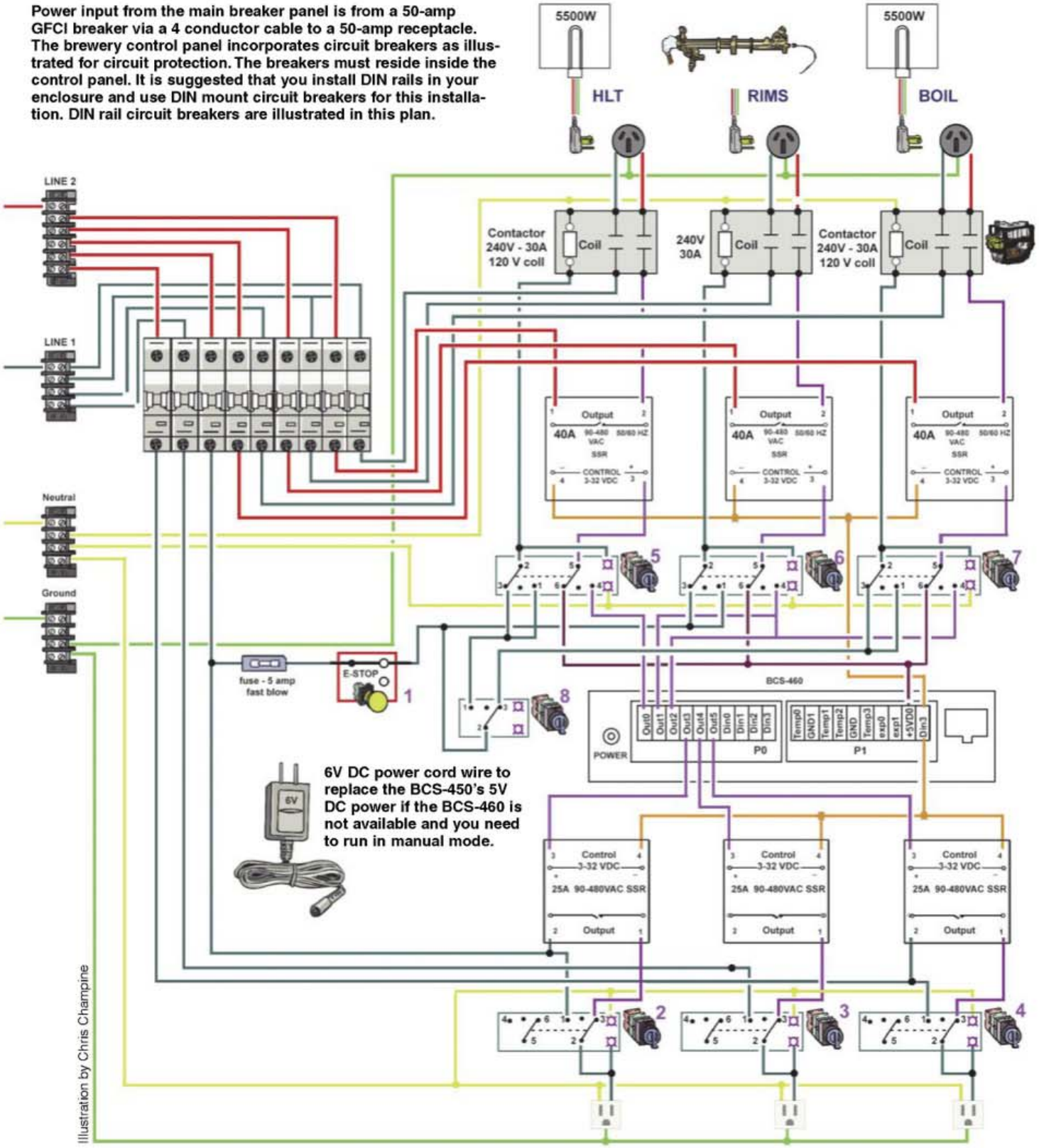
In addition to the BCS-460, there are several other key components needed to build an electric brewery panel. The first one is the key to safety when electricity and liquids are used together, and that is Ground Fault Circuit Interrupter (GFCI) protection. For my application, the easiest and best-priced option was to install what is commonly known as a spa panel. These are used primarily for hot tub/pool installations, and are available at most hardware stores, as well as through many online retailers. Most often they are cheaper than installing a GFCI circuit breaker into your power panel, and they can be wired easily into your electric homebrew system. In my case, I was using my existing clothes dryer circuit, so I simply wired the spa panel up to a cord that would plug in to that outlet, and then the panel for the brewery itself was hardwired out the other side of the spa panel. This gave me ground fault protection as well as an easily accessible breaker that could be used to disconnect all power from my control panel if I needed.

The panel itself started out as steel National Electrical Manufacturing Association (NEMA) enclosure that is approximately 16 inches wide, 16 inches tall and 8 inches deep (40 cm x 40 cm x 20 cm). This will house the BCS-460 as well as all other necessary components. There are many ways you can go with your enclosure, from a simple setup with a few buttons, to those including digital displays for temperatures and timers, all the way to the most elaborate setups that include touchpads on the front of the panel itself. Most of the enclosures will be somewhere in-between, and mine is no exception. I decided to forego any displays on the control panel itself, and instead rely on an external source such as a laptop or tablet. A simple combination of buttons and switches give me all the control I need to augment the BCS Web page control.

At the very top of the panel (see photo, page 61), we start with a large red button, which is an emergency shut off. This button works by diverting a small amount of current to the ground line, which will instantly trip the GFCI breaker and shut off all power to the panel. The button isn't used for normal on/off operations, but is nice to have in case of an emergency, since it is best practice to keep all doors to both the main and spa panel shut,

Electric Brewery Wiring Plans

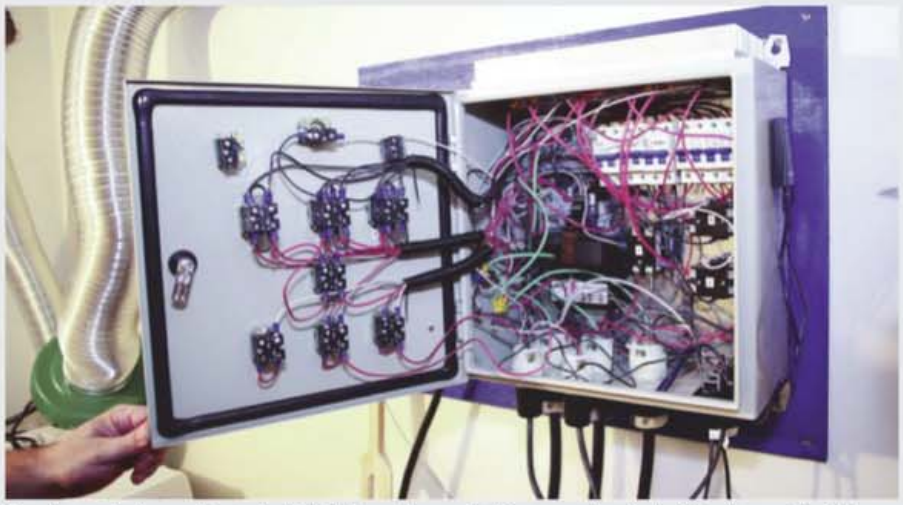
Power input from the main breaker panel is from a 50-amp GFCI breaker via a 4 conductor cable to a 50-amp receptacle. The brewery control panel incorporates circuit breakers as illustrated for circuit protection. The breakers must reside inside the control panel. It is suggested that you install DIN rails in your enclosure and use DIN mount circuit breakers for this installation. DIN rail circuit breakers are illustrated in this plan.



thereby restricting access to the GFCI breaker. On each side of the emergency shut off are two key switches, which I do not use at this time. The intention of these key switches was two-fold: One was to control power to just the BCS unit, which would allow me to turn it on without risk of firing any elements and/or pumps to facilitate programming the BCS ahead of time for my next brew; the other keyed switch was to be used to power everything else, so in order to brew, both keys would need to be turned on. After installing them I felt at this point they were unnecessary, as I could use the breaker on the spa panel for on/off, and if I needed to use just the BCS, it was only a matter of ensuring a few switches were in the correct orientation prior to energizing the panel.

The next row of switches controls power to the heating elements, with each element having its own switch for control. The bottom rows of switches are the same, but are used for the pumps in the system, and currently only two of these are in use. As you can see, each of these six switches have three positions: Manual, off, and BCS. While in the standard BCS position, all control over the elements and pumps is done through the BCS and the Web interface. This is the standard position for normal operations, but the nice thing is that I can bypass the BCS and turn a switch to the manual position, which will then turn that pump or element on fully. This is handy if I need

The "brains" of the electric homebrewery come from a unit called a BCS-460, which is produced by a company called Embedded Control Concepts. The unit is controlled via a multitude of processes, switches, relays, and temperature probes incorporated in the system.



Trent's control panel is a steel NEMA enclosure that is approximately 16 inches wide, 16 inches tall and 8 inches deep (40 cm x 40 cm x 20 cm). This houses the BCS-460 as well as all of the other necessary components needed to control the brew system.

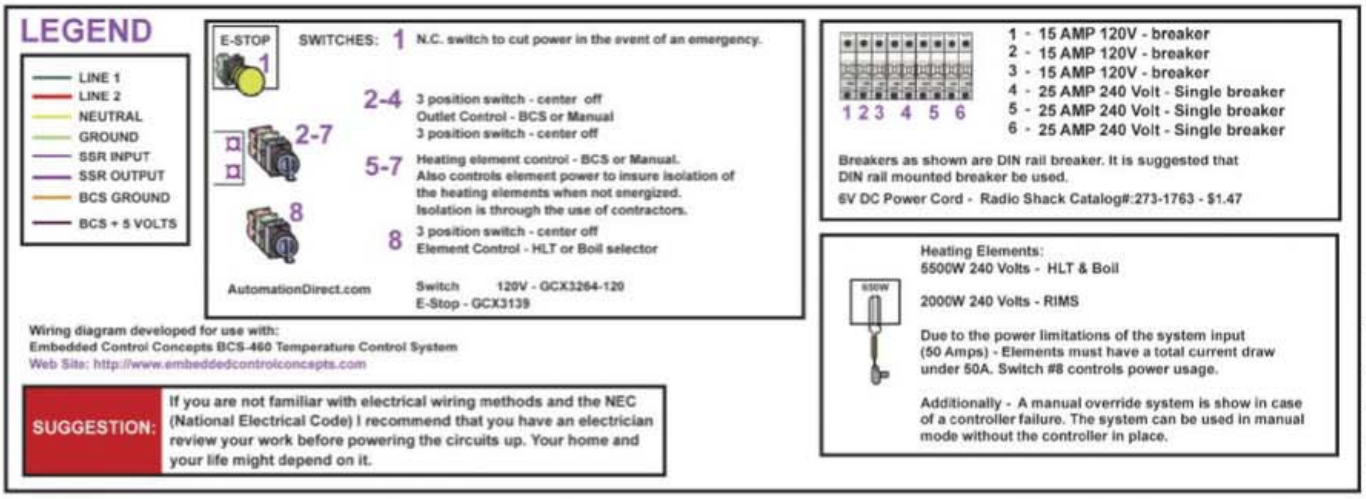


Illustration by Chris Champine

to fire an element for a short time in order to heat up some water for cleaning, or if I need to run a pump for a short time in order to clean some lines, or simply empty one of my kettles. When I was first building my unit, I didn't think I would use this manual mode much, but now that I have had it I feel it is an invaluable tool in the cleaning process, and it has some benefits during the brew process as well, including ensuring you get every last drop of valuable wort while reducing the risk of running your pumps dry for extended periods of time.

The final switch on the panel, which is in the center of the panel, is a necessary safety feature if you are using anything less than a 50-amp circuit to run your brewery. This switch ensures that there is no way that both of the larger, 4500w in my case, heating elements can be fired at the same time. Since each element has the capability of pulling close to 20 amps, if I had processes set up within BCS that would fire both elements at the same time, I would easily blow the circuit breaker in my main power panel, which has a max of 30a. So in order for one of the main heating elements to fire, not only does the switch for that element need to be either set on manual or BCS, but the middle switch must also be set to that particular element.

Power itself is controlled through a series of normally open switches, solid state relays and heavy duty contactors, as seen in the wiring diagram (on page 60). **Note:** If considering a project like this, please seek the assistance of a professional; you are dealing with large current draws that have the ability to cause serious harm and even death. Each of the heating elements has a dedicated contactor, which ensures absolutely no current leaks through the circuit when it is supposed to be off. A solid state relay (SSR) is used over a standard coil relay due to the speed at which they can operate, but they can leak small amounts of current, which is why a licensed contactor is necessary. The BCS, as well as a Proportional Integral Derivative (PID), can cycle quite quickly in order to keep the temperature at your set point; the SSR is built to better handle these quick switching operations. The tradeoff for this is the amount of heat the SSR will produce, so you need to be able to deal with it properly. For my build I decided to go with a large heatsink mounted to the top of my enclosure, which is 6 inches wide and 14 inches long (15 cm x 45 cm) to help dissipate all that extra heat. This heatsink was tapped, and all six SSRs were mounted directly to it, with a thin layer of thermal paste applied to assist in heat transfer. Finally each circuit is protected by its own internal DIN mounted circuit breaker, appropriately sized for the element used, while ensuring the wire used is adequate for the circuit and expected draw.

Web Interface

The BCS Web interface (see photo below) gives you a good amount of information at a glance, where you can quickly view your current temperatures, as well as what process or processes are currently running. The interface also displays timers that you can configure, as well as buttons to stop all the processes completely, or simply step to the next process you had previously designed. The BCS-460 has four temperature inputs, four discreet inputs, and six discreet outputs used for controlling your pumps, heating elements, your fermentation chamber, or even your keezer, if you desire. They also have a BCS-462 that increases both the number of inputs and outputs available for even more automation if you want it.

The Process

For my system, I have a temperature probe setup in the output of the HLT, (see photo page 64) which is used to control the HLT heater element while heating up both my strike and sparge water. I can supplement this heater by running the water through my RIMS tube, and firing the heater in the tube, as well giving me 6000w of heating to reduce the amount of time it takes to get up to temperature. Once the water is up to strike temperature, I pause the system using the BCS web interface, and pump the water into the mash tun. The grain is then added and stirred until everything is mixed thoroughly. At this point, the necessary sparge water is then added to the HLT, run through one of the pumps, and heated to sparge temperature using the HLT heating element (see the sidebar on page 65 for the process).

Meanwhile, the mash can proceed utilizing the second pump, with flow going thru the RIMS tube for tempera-

The BCS-460 unit that Trent chose for his system has a Web-based interface where he can glean lots of information at a glance. This includes current temperatures as well as running processes. You can also configure timers as well as buttons to completely stop all processes.

The temperatures in the boil kettle and mash tun are monitored and controlled by two temperature probes installed in the front of the vessels, which report back to the BCS-460. This allows Trent to precisely control his mash temperatures and increase them for mash out.

Following the mash, the sparge water moves from the HLT to the mash tun using the first pump, while wort is extracted from the mash tun into the brew kettle using the second pump. A Blichmann AutoSparge (center) helps ensure that the mash tun doesn't overflow.

tip

This design lets you sparge as fast as the grain bed will allow, or conversely let you pull back if you want to go slower and extract more sugars. If you do not install an auto sparging device, keep a close eye on the mash tun.

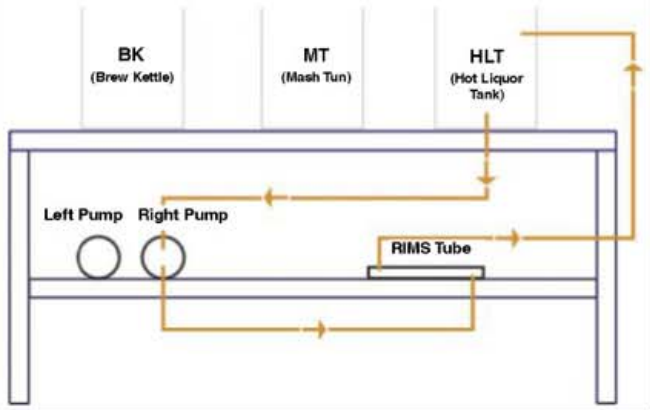
ture stability, and back into the mash tun through the Blichmann AutoSparge (see photo at bottom left). Temperature is monitored by temperature probe in the output of the mash tun, and increased as needed by the heating element in the RIMS tube. A standard false bottom in the mash tun prevents grain from escaping, while the constant circulation using the pump sets the grain bed nicely, and allows for a nice clear recirculation. With the temperature control of the BCS, it allows me to precisely hit my mash temperatures, and hold them throughout the entire mash. I can increase the temperatures as needed for any steps or for a mash out if so desired.

The next step in my process is the sparge, where almost every piece of the brewery is in use at once. Water is moved from the HLT to the mash tun using the first pump, while wort needs to be extracted from the mash tun and pumped into the brew kettle using the second pump. Flow is controlled using ball valves on the output side of each pump, and the Blichmann AutoSparge helps ensure that the mash tun doesn't overflow, and will restrict flow into the mash tun if the level gets too high. I can sparge as fast as the grain bed will allow, or I can throttle it back and take longer if I want, to try and extract as many of those valuable sugars as possible.

Once I have sparged enough wort to ensure that the heating element in the boil kettle is fully submerged, I can then start the process of heating the wort up to a boil. This is another advantage I find with the BCS controlled electrical way of brewing: I don't need to wait until the sparge is complete; I can start heating the wort early in the process, and by the time I am done with the sparge, the entire contents of the brew kettle are nearly at boiling temperatures. When the boil does start, this is another point that the control offered by the BCS really shines. As a brewer who has previously used a gas-fired brewery, even if it was a long time ago, I still vividly remember the smell and the mess caused by the inevitable boilover. The

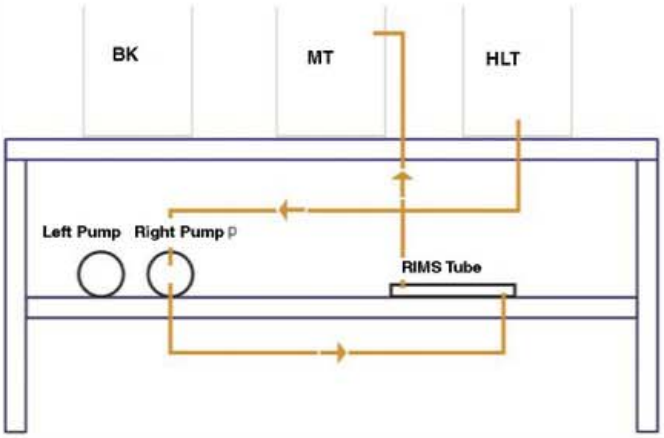
The Electric Brewery Process

Step 1: Heating Strike Water



Step 2: Mash In

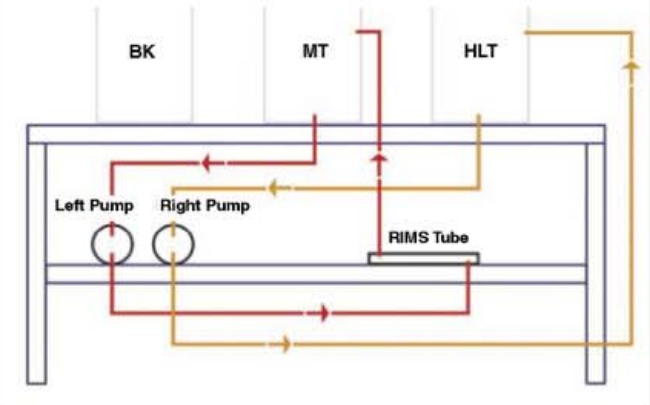
Transfer water from HLT to MT using RIMS tube to maintain water temperature while transferring. Add grains to MT to mash in.



Step 3: Mashing

RIMS/MASH using left pump and RIMS tube to maintain temperature during enture mash schedule and/or step mash.

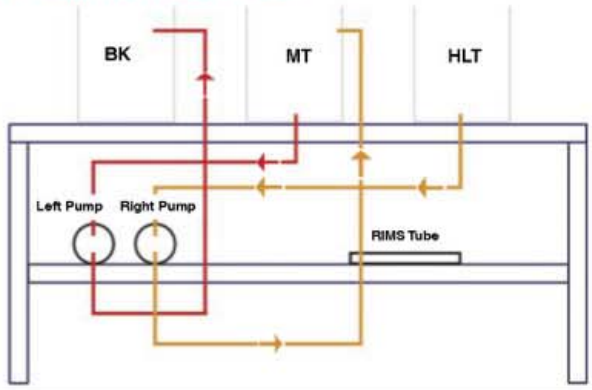
Gold color path is for heating of sparge water. Utilizes heating element in HLT as well as right pump to prevent stratification.



Step 4: Sparge Process

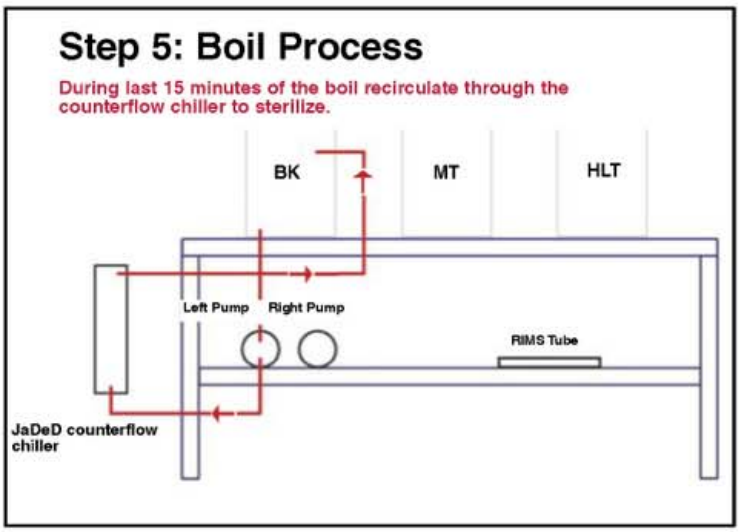
Flow is controlled via output of right pump. Blichmann sparge arm in MT ensures water level doesn't get too high, preventing overflows.

Heating element in BK is started once it is covered by at least 1 inch (2.5 cm) of wort.



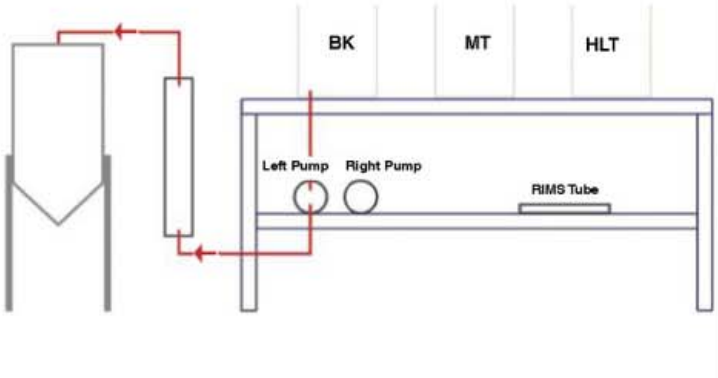
Step 5: Boil Process

During last 15 minutes of the boil recirculate through the counterflow chiller to sterilize.



Step 6: Final Transfer

The finished wort is then pumped through the counterflow chiller with the left pump and into your fermenter.



Illustrations by Chris Champine

The BCS system allows a great deal of control over the temperature of the heating elements in the vessels, which allows for a controlled boil in the kettle. This means less unintended boilovers — a better system for brewing indoors where there are no hoses for cleanup.

fact that the BCS controlled the boil so well was an unintended but welcomed bonus (see photo above).

Electric Brewing Beats Gas

Overall, the brewing process on my electric system isn't that much different than what you would normally expect from a gas-fired setup. One big difference, however, is convenience. It has been a long time since I brewed on my old propane-based brewery, but I distinctly remember being completely exhausted at the end of the day. The process of lugging gallons of water around, the loud droning noise of the propane burners, as well as the constant heat they put out normally led to me being hot, wet, and exhausted at the end of the day, and inevitably, many times, I skipped cleaning things up until the next day.

My new system is easier, quicker and overall a lot less mess to clean up. Not all of that can be attributed to the electric setup; simply adding a pump or two to a gas-fired system can make your brew day much easier, but I really feel for my situation — this truly is the best in class for me. I know the next time I have a brew day scheduled, and Mother Nature decides to rain (or snow) on me, I will be thankful for my indoor electric brewery. I'm looking forward to how wonderful brewing year round in the comfort of my temperature controlled basement will be.

Inspiration and Thanks

For this project and story, I'd like to thank Kal Wallner at www.theelectricbrewery.com; Bobby at www.brewhardware.com for sharing his knowledge and numerous products used in this build, including TC and Camlock fittings, tubing, temperature probe adapters and many other unique products; and the incredible people and the wealth of knowledge at the www.homebrewtalk.com forums.
I also want to give a special thanks to Homebrewtalk.com user Paul Muth (aka P-J) for creating excellent wiring diagrams and the incredible wealth of information he provides. He has posted numerous wiring diagrams that have helped so many people while expecting nothing in return but respect. BYO

Related Links:

Not ready to build a large-scale all-grain electric brewing system? Try something a little smaller: A homemade electric, temperature-controlled brewery that all fits on a countertop. A 3-gallon (11-L), 2-vessel solution for small-scale brewing.
http://byo.com/story1933

Photo courtesy of Walter Koenig

HOW DID HOPS GET IN OUR BEER?

by Horst Dornbusch

A short history of *Humulus lupulus*

There are some 350,000 known plant species on earth, but only one of them, *Humulus lupulus*, the hop plant, has become the universal flavoring agent for beer. Sure, brewers occasionally use other flavorings in their beers, such as coriander, passion fruit, or orange peel. Statistically, however, the perennial, herbaceous, creeping, climbing weed that we call hop is "it!" That begs the question: How did hops — among all those plants — rise to such an august position in the global culture of beer? Here is the story of when, where, and how that happened.

The Dawn of Beer

As best we know, our species, *Homo sapiens*, started fermenting beverages in the Stone Age, right after (or even before?) the so-called Neolithic Revolution, some 12 thousand years ago. For humans, that revolution marked the threshold between the fog of prehistory and the bright light of civilization. Back then, humans traded hunting and gathering ways for a better life in settlements built on agriculture, politics, administration, technology, and an economy . . . and the ferments that our ancestors started to make then are still with us today! Just as then, our modern alcoholic beverages are still based on only four starchy/sugary liquids: Saps, honey, fruit juices, and grain extracts. Tequila, for instance, is a distilled ferment of blue agave sap; mead is a fermented honey solution; wines are fermented fruit juices; and fermented extracts of grain (any grain) are beers. We do not know exactly how the ancients made their beers, but archaeological finds clearly suggest that baking and beer making were practiced side-by-side, and that bread — probably mixed with some enzyme-rich grains — was the most important ingredient in early mashes. Popular beer flavorings, especially in ancient Egypt, included dates, honey, mandrake roots, and ginger; and fermentation — and bread leavening — was obviously spontaneous, by airborne microbes.

The Botanical Origins of Hops

Humulus lupulus — Latin for the "slinking little wolf" — seems to have evolved quite apart from beer in what is now Mongolia. From there, it spread throughout the temperate zones of the northern hemisphere, roughly between 35° and 55° latitude. Botanically, hops belong to the family of *Cannabinaceae*, which also includes hemp and marijuana. An individual hop plant can live 20 years or longer. Today, we distinguish between five broad varieties of hops: *Humulus lupulus var. lupulus*, which is native to Eurasia and is the key genetic source of virtually all modern commercial hops. Then there is *Humulus lupulus var. cordifolius*, also known as *Humulus lupulus var. Miquel Maximowicz*. It is native to the temperate zones of the Far East, including Japan. *Humulus lupulus var. lupuloides* is native to eastern and central North America, while *Humulus lupulus var. neomexicanus* is native to western North America. Finally, there is *Humulus lupulus var. pubescens*, which is native to the midwestern and eastern United States.

All these varieties except for *var. lupulus* are considered "wild." They are less important as cultivars for beer than as contributors of genetic material to the development of new commercial hop varieties. Professor Ernest Salmon at Wye College in Kent, England, for instance, bred the popular Bramling Cross, in 1927, from a female Bramling (a traditional Golding variety) and a male seedling of a wild hop — probably a lupuloides type — from the Canadian province of Manitoba. Other English crossover cultivars with wild Manitoban genetic stock are Bullion and Brewers Gold.

Beer Flavors Before Hops

In beer's long history, brewers have flavored their ferments with all sorts of ingredients — some harmless, some revolting, some delicious, some psychedelic, and some even poisonous. These include, in alphabetical order: Anise, artemisia, bark, bay leaf, beans,

Photo by Horst Dornbusch

Before hops, beer was often flavored with a mixture of herbs and spices known as a "gruit." The composition of gruit mixtures varied from region to region based on the local flora.

birch branches, blackthorn, blueberries, caraway, chalk, cherries, chicken blood, cinnamon, coriander, cranberries, cumin, currants, dates, eggs, elderberry, fennel, figs, gale, ginger, grains of paradise, heather flowers, ivy, juniper, lavender, liquorice, mandrake root, marjoram, meadowsweet, milfoil, mint, molasses, mugwort, mushrooms, myrtle, nettles, nuts, oak leaves, orange peel, oxen bile, passion fruit, peaches, pears, peas, pomegranate, pumpkin, reeds, rosemary, sage, strawberries, soot, yarrow, woodruff, and wormwood (vermouth) . . . and this is probably just a partial list!

In central Europe, in the first 1,000 years AD, however, beer flavorings gradually became standardized, as beer recipes were built repeatedly on particularly pleasant combinations of fresh or kiln-dried herbs and spices — known as gruit, grut, gruyt, grüssing, or graut. The exact composition of gruit mixtures varied from one region to the next, mostly because of differences in the local flora. In northwestern Europe, for instance, gruit mixes based on gale were apparently especially popular, in part because gale thrives well in the wetlands of what is now the Rhineland, Westphalia, The Netherlands, and Belgium. Farther south, on the other hand, rosemary-based mixes — often referred to in old-German texts as "Porsch" or "Porst" — were more common. In Scandinavia, beer flavors were mostly juniper-based; and in Russia, they were mostly mint-based. See the photo, above, for an idea of what gruit mix looks like.

During the High Middle Ages, in central Europe, gruit compositions even became well-guarded secrets. Gruit production became strictly regulated; and selling gruit became a highly lucrative privilege, usually granted to the church. The oldest known document referencing a gruit privilege dates from 974 AD. In it, the German Emperor Otto II granted the gruit right to a church in Liège, in present-day Belgium. It was against this socio-economic and political background of a closely held, herb-based trade in beer flavors that the humble hop flower staged its unstoppable conquest of the world's favorite fermented beverage — first in small steps, then with a vengeance.

The Discovery of Hops by Humankind

There is quite a debate about the first mention of hops in the annals of human history. One common misperception holds that Pliny the Elder, who died in Pompeii during the Vesuvius eruption of 79 AD, is responsible for the first reference to hops — not as a flavoring for beverages but as a food (probably in the form of hop's edible rhizomes?). "*Appetitur posito vilis oliva lupo*," he is supposed to have written. This is often translated as "with hops even the humble olive is a delight." It sounds as if the Romans already treasured the plant that has since become dear to brewers around the world.

However, if you dig deeper, there seem to be several problems with this interpretation. First, the author of this accolade to hops is probably not Pliny the Elder, but one of his contemporaries, Marcus Valerius Martialus, in his *Epigrammata* (epigrams), which, thanks to the wonders of http://books.google.com, are now accessible online. In volume II, book XXVII, lines 4 to 6, Martialus states: "*Hyblaeis apibus Corsica mella dabit; sed tamen et parvae nonnulla est gratia Musae; appetitur posito vilis oliva lupo.*" Using my rusty Latin, this should translate literally as "While the bees of Hybla [a place in Sicily] will give you Corsican honey, nonetheless, there is [still] some small gift of the Muse: the cheap olive becomes appetizing through added hop [*posito lupo*]." (For the original, see http://archive.org/stream/epigramswithengl02martuoft/epigramswithengl02martuoft_djvu.txt.)

The second issue relates to the identity of lupus ("wolf"). Martialus probably refers to a plant commonly known in ancient Rome as *lupus salictarius* ("willow wolf"). Yet, the link between *lupus salictarius* and our *Humulus lupulus* was first postulated only in the Renaissance by the German herbalist Leonhart Fuchs. In his *De Historia Stirpium Commentarii Insignes* (Significant Commentaries on the History of Plants), published in Basel, in 1542, Fuchs postulates that *lupus salictarius* is "Hopffen," which is the

German word for hop, but he does not furnish any proof.

For more reliable references to "our" hops, we must skip a few centuries past the Roman Empire into the "dark" ages. A good summary of the emerging cultivation of the hop plant during that period can be found in an 1859 book by C. G. Rehlen. In *Geschichte Der Handwerke Und Gewerbe* (History of Craft and Trades), Rehlen points to a document from 736 AD — issued by Pippin III, the soon-to-be king of the Franks and father of Charlemagne — as the earliest post-Roman reference to what we now know as hops. That document surfaced in Geisenfeld, a village in the Hallertau region of Germany, which is now the world's largest contiguous hop growing area. The chronologically next reference to hops, also according to C. G. Rehlen, is in *Consuetudines Corbeienses* (The Customs of Corbie), penned in the Picardie region of northwestern France, in the year 822, by the Benedictine Abbot Adalhard of Corbie. In it, the good abbot exempts his abbey's millers from having to perform work in the hop gardens.

Another reference from that time, combining beer and hops for the first time in a single term, is in a collection of rules and laws called *Collectio Capitularium*, written between 800 and 827 AD by an advisor to Charlemagne, Abbot Angesisus of the Benedictine Abbey of Fontanelle, near Rouen, in France. Angesisus states (*drum roll!*) that his monastery was entitled to receive tributes in the form of "*sicera humulone*" — Latin for hopped strong liquor or beer — from the surrounding peasants! Should we consider Angesisus' sicera as the true forerunner of our modern French farmhouse ale, the Bière de garde? In addition, hop gardens on monastery grounds are mentioned in documents from the Abbey of Freising near Munich, between 859 and 875 AD.

These 9th-century references to monastic hop gardens confirm what we also know from such later chronicles of monastic life as *Casus sancti Galli* (The Chronicles of the Abbey of Saint Gall, in present-day Switzerland), written by Abbot Ekkehard IV in the first half of the 11th century. There is no doubt that the learned Benedictine monks of central Europe started to add hops to their gruit well before the turn of the millennium. They probably discovered the virtues of hops in beer by accident as they experimented with a wide range of hitherto untested beer ingredients. Initially, the Benedictines seem to have used hops only as one of many components in their gruit. Over time, however, hops must have become an ever more important portion of monastic gruit mixes, because, within a span of about three centuries, hops gradually emerged as the sole flavoring in most central European monastery beers.

Hops Victorious

Perhaps the most consequential historical reference to hops in beer is a small passage in a book by Hildegard von Bingen, a 12th-century abbess, physician, composer, brewster, and adviser to the German Emperor Frederic Barbarossa. Her work is *Liber simplicis medicinae* (A Book of Simple Medicines). Hildegard wrote it in 1153, but it was first printed only in 1533 — that is, after Gutenberg — under the title of *Physica* (The Physical World). In it, Hildegard describes the medicinal value and beverage application of the "hoppo" plant as "a hot and dry herb, with a bit of moisture," which "is not of much use for a human being, since it causes his melancholy to increase, gives him a sad mind, and makes his intestines heavy." Importantly, she observes that hoppo "*putredines prohibet in amaritudine sua*." One Latin expert, Pricilla Throop, translates this as "its bitterness inhibits some spoilage in beverages to which it is added making them last longer." (See Throop's *Hildegard von Bingen's Physica*, Healing Arts Press, Rochester, Vermont, 1998, page 36.)

There you have it, for the first time ever — and from a famous brew nun, no less: Hops are great preservatives in beer! In subsequent centuries, Hildegard's writing had an enormous influence on the thinking about hoppo; and it promoted its use especially among literate cloistered brewers and brewsters. Attesting to hop's inroads in continental European brewing, King Louis IX of France even mandated, as early as 1268, that, in his realm and henceforth, no beer was to be brewed without hops. In 1280, Bishop Albertus Magnus, in his *De vegetabilibus* (About Vegetables), made the additional observation that hops loosens "thick humidities" in humans — an obvious reference to hop's diuretic properties.

Hildegard even had several plagiarists who paraphrased her observations about hops. One such was Konrad von Megenberg, a naturalist who, between 1348 and 1350, compiled the first natural history in the German language. In this tome *Buch der Natur* (The Book of Nature), von Megenberg echoed Hildegard's description of hops almost verbatim. "Humulus," he states, "has a significant growth in length and spreads its bines over trees and walls, where it grows, like the blackberry bushes that are called *Vepres* in Latin. The hop flower acts warming and drying and retains this property for a long time. It also brings about a thinning of the tough juices in the human body and elsewhere." Importantly for beer, von Megenberg asserts, just like Hildegard, that the hop plant "penetrates liquids, called *Liquores* in Latin, and preserves them in their power, so that they do not spoil or rot, as long as one adds only the hop blossoms to them. The hop plant itself, however, makes the belly heavy, its only good qualities being in its blossoms." (My translation from old German.)

Not just medieval monastic brewers on the European Continent, but secular ones, too, soon switched from gruit-flavored to hop-flavored beers. Especially the mercantile brewers in such cities as Bremen, Brunswick, Einbeck, Hamburg, and Hanover in the north of Germany, who supplied beer as a trading commodity to the Hanseatic League, embraced the preserving qualities of hops and brewed their ales with nothing else. By the 14th century, therefore, flourishing and lucrative hop markets had developed in many cities, especially in Nuremberg, not far from the Hallertau in Bavaria.

Hop growing and trading quickly became so profitable that the plant was dubbed "green gold."

In Bavaria, hops finally won out completely over all other beer flavorings, because its exclusive role in brewing was elevated to a feudal edict that seems reminiscent of King Louis' decree in France about two-and-a-half centuries earlier. To wit, in 1516, Duke Wilhelm IV of Bavaria famously mandated that ". . . henceforth, everywhere in our cities, towns and in the country no beer may contain more pieces than only barley, hops, and water." Thus, the final death knell of brewing with gruit in Bavaria was a law that simply forbade it; and, as everybody knows, this 1516 edict is now considered the foundation of the modern German Beer Purity Law, the Reinheitsgebot.

Hops in England

Brewers on the British Isles, on the other hand, unlike their brethren on the Continent, were much slower in adopting the use of hops as a flavoring in their ales. Only in the 16th century, after Flemish immigrant farmers had brought hop cultivation to Kent in England during the Hundred Years' War that waged between England and France from 1337 to 1453, did English brewers gradually catch on to the "manifold vertues" (sic) of hops. This is what we learn from the botanist and herbalist John Gerard in his 1,480-page opus magnum, *Herball, or Generall Historie of Plantes,* published in 1597. Gerard describes the effects of the introduction of hops on English brewing on pages 884/885 (old English spelling preserved): "The manifold vertues in Hops do manifestly argue the holsomeness of Beer above Ale; for the Hops rather make it a Physical drinke to keepe the body in health than an ordinarie drinke for the quenching of our thirst . . . The buds or first sprouts which come forth in the Spring are vsed to be eaten in sallads . . . The floures are vsed to season Beere or Ale with, and too many do cause bitternesse thereof."

In much of England, however, probably because, "too many [hops] do

cause bitternesse," many brewers continued to make ales without hops for another century or two. Just as Gerard tells us, they called their malt-based beverages without hops "ales," while they called their brews with hops "beer." This is obviously very different from our modern understanding of "beer" as an umbrella category for both hopped top-fermented ales and hopped bottom-fermented lagers. Interestingly, the old, hop-related distinction between ales and beers persisted in England well into the 18th century. Even the very first *Dictionary of the English Language*, published by Samuel Johnson, in London, in 1775, preserves the old definitions. In this seminal work, Johnson still declares that "beer" is a "liquor made from malt and hops," while "ale" is a "liquor made by infusing malt in hot water and fermenting the liquor" — that is, without hops . . . a distinction that was already becoming obsolete as Johnson put it into his dictionary.

Hops in the United States

In the New World, hops for beer making were introduced shortly after the arrival of the first settlers from England in the early 17th century. Instead of using native North American hops, the colonists brought with them rhizomes of hop varieties they had known back home; and they planted these wherever they went. During the colonial period, therefore, hops were cultivated up and down the entire Eastern Seaboard, from Virginia to Maine; and, as settlements moved west, so did hop farming. By the early 1800s, Upstate New York had emerged as the new country's major hop-growing region. A few decades later, hop farms also sprang up in Wisconsin and in much of the northern Midwest. One of the classic American hop varieties that evolved in those early days was Cluster, believed to be a derivative of old, imported Dutch and English stock that had probably picked up some genetic material from native American varieties. Another strain that was perhaps also cultivated for a while in the United States was Farnham, an heirloom variety from the early 18th century, which

was widely grown in and around the city of Farnham in Surrey, England. Farnham hops, however, are highly susceptible to downy mildew, which is why they have virtually disappeared from modern hop portfolios.

As the country developed farther westward, hop growing, too, moved farther west, mostly because the cold spring climate and high humidity in the Eastern and Midwestern hop-growing regions favored mildew diseases and aphid infestations. Eventually, around the beginning of the 20th century, hop cultivation had reached the Pacific Northwest. Initially, until about 1980, Northern California was a significant hop cultivation area, producing several hop varieties, including Ivanhoe, which is believed by some to be an heirloom descendant of Nugget and/or Cluster. Today, however, the American hop industry is centered almost entirely in Washington State (especially in that state's dry Yakima Valley), Oregon, and Idaho. Each year, these three states are now responsible for more than one-third of the world's entire hop harvest. Roughly the same amount also comes from Germany; while about one quarter comes from a small group of countries that includes China, the UK, the Czech Republic, Slovenia, Poland, Australia, New Zealand, and France.

Hop Heritage

It took the confluence of three factors in the Middle Ages — monastic experimentation; mercantile economic interests; and feudal edicts — to turn beer from a haphazardly flavored fermented malt beverage with roots dating back to the dawn of civilization into a more or less uniform drink of hops and malt. That transition occurred in central Europe, within the span of a few centuries, around the turn of the first millennium. Eventually, the perfect antimicrobial and flavor marriage between hops and malt found universal favor, first on the European Continent, next in England, then in the New World, and finally in the entire world. Only after hops had replaced all the other beer flavorings, did beer emerge as a drink that we would still recognize as such today. BYO

techniques

by Terry Foster

Into the Dark

Brewing with dark sugars

At present, IPAs and saisons are all the rage. Or, to put it another way, it's all about the hops and funky yeasts. The only thing I object to in that is the word "all," because it ignores a whole raft of other beer flavors and the ingredients that supply them. In particular, I am thinking of sugars, which are essential to beer production. Of course, the most important sugars are those naturally present in beer worts, such as maltose, glucose, sucrose and maltotriose. But what about sugars added separately?

> "Brewers often have an antipathy to adding sugar to their brews, even though such additions have been common in commercial brewing for over a hundred years."

Brewers often have an antipathy to adding sugar to their brews, even though such additions have been common in commercial brewing for over a hundred years. Invert sugar (sucrose inverted by chemical hydrolysis to glucose and fructose) has been widely used in British brewing sometimes as a brew extender to permit producing a greater volume of beer than would normally be possible with a given size of mash tun and kettle. More often its use as a "nitrogen diluent" has been heavily promoted; one purpose of sugar addition is that for the same original gravity (OG) it reduces the amount of protein material in the beer and prevents or limits chill hazes.

In the US, sugar (usually derived from corn) has been widely used for the same purpose, in particular because it permitted the use of malts from 6-row barley, which is generally higher in protein content than that from 2-row barley. And if you think that this applies only to modern beers, and not to that good old stuff they brewed prior to Prohibition, think again. I am lucky enough to have in my hands early 19th century brewing books from a Connecticut brewer, in which all of the ales used both sugar and flaked corn as adjuncts.

Nowadays, home and craft brewers generally think in terms of beers produced solely from malt, with the use of any kind of adjunct being frowned upon. Cane or corn sugars may be used in limited amounts to increase the alcohol level of a beer, or to "dry out" a beer. By that I mean that because these sugars are fully fermentable the beer will have a lower finishing gravity and will be a little drier on the palate than would otherwise be the case. A classic example of this is the brewing of Belgian dubbel and trippel ales (in this instance the brewers use candi sugar, which is a very pure form of sugar from beets), although it also comes in colored, lightly caramelized forms that can also add color and flavor to the beer. Other sugars are also permissible when added purely for flavoring purposes, notably honey and maple syrup. In one style (milk or cream stout) the use of lactose, a sugar that is not fermented by brewing yeasts, is mandated. Here the lactose gives a full, luscious flavor to a beer low in alcohol relative to its original gravity. Then, of course, there are various types of brown sugars, which are relatively unrefined and mainly get their color from the presence of some molasses in them, so they can add flavor to a beer.

I have seen many references in the brewing literature to the effect that brown sugars can be used for flavoring purposes in brewing, but rarely have I seen a recipe where such sugars are used. So the purpose of this article is to give such a recipe, and the sugar in question is muscovado, perhaps the darkest of such crude sugars. Molasses, of course, is the crudest product from sugar cane, and is only partly fermentable, containing about 50% sugar. It is very strongly flavored

Photo courtesy of Wikipedia

and nowadays is generally regarded as unsuitable for brewing purposes, although it was widely used in this country in the 17th and 18th centuries when it would have been cheaper and more readily available than barley malt. Indeed, none other than George Washington left behind a recipe for beer that incorporated molasses.

Muscovado is made by heating the raw juice from sugar cane until it has been sufficiently concentrated by evaporation to begin the sugar crystallization process. The crystals are separated from the cooled mixture by various methods, all of which basically drain off the other liquor (molasses) from the dark brown muscovado crystals. My research indicates that this sugar is made commercially in only two places, Mauritius and the Philippines. It is, however, available in this country, although I haven't seen it in homebrew supply stores I have checked. However, Amazon offers muscovado from several suppliers, including the British company from whom I bought my sample. None of these were cheap, the prices varying around $7–8 per pound.

Why did I opt for muscovado? Well, partly for historical reasons, since it is about as close to molasses as you can get and yet is still mostly sugar, so it might cast a little light on how those early colonial beers tasted. But, more importantly, I used it because I had picked up some on a whim while on a trip to Britain and decided to make a brew with it just to see how it would turn out. I also felt that as a low-refined sugar it would offer more flavor to the beer than lighter sugars, such as Demerara sugar (which is actually refined sugar with a small proportion of added molasses). Of course, there was a risk in this that if the molasses flavor were too strong it would dominate the beer, so I had to formulate the recipe carefully in order to minimize this potential problem. Besides, this was to be an experiment so there had to be some risk, didn't there?

Formulating the recipe

First and foremost I was not going to make a beer to fit any style guidelines, but merely one that would show off the effect of the sugar. Something dark seemed to fit the bill, and I had in the back of my mind brews like Theakston's Old Peculier, a beer based on an ancient recipe, or Manchester Star, a beer brewed from an 1884 recipe by J.W. Lees in consultation with Garrett Oliver of Brooklyn Brewery, or even just a strong dark mild. Anyway, it was not going to be any kind of clone, but rather a beer that would stand on its own hind legs.

I decided I wanted a beer of fairly high OG so there would a reasonable amount of alcohol to help balance any residual sweetness from the sugar. I thought 1.065–1.067 (15.9–17.1 °P) would be about right, but before deciding on a malt bill, I had to allow for the sugar addition. I reasoned that sucrose gives a gravity of 1.046/lb./gallon or about 9 gravity points for 1 lb. in 5 gallons (19 L), so my 1.1 lb. (500 g) muscovado would add about 10 points in 5 gallons (19 L). So the malts would have to give a total specific gravity (SG) of 1.055–1.060. Note that this does not mean

that muscovado is totally fermentable as is sucrose. In case the muscovado had significant moisture content I did check the gravity of the wort both before and after the sugar addition and the increase was indeed 10 gravity points.

For the malts, I wanted to use as a base about a 2:1 mixture of 2-row pale and 8 °L Munich malt, using the latter to give a little bit more body than if I used pale malt alone. And I wanted this mixture to make up about 70% of the total grain bill to allow for the other malts, starting with a little less than 10% each of Vienna and Victory® malts, to add some nutty and biscuit flavors. Then about 5% caramel 60 °L malt to add some caramel sweetness and palate fullness, followed by about 2% of Briess Blackprinz® de-bittered black malt to give a hint of roast character without harshness. And finally, I slipped in about 4% of Briess Carabrown® malt to add some licorice note in the background. I also opted for a relatively high mash temperature of 152–154 °F (67-68 °C) to make sure the beer did not finish too dry on the palate.

My choice of hops was to go for bittering only, and at a modest level of about 30 IBU with East Kent Goldings. This is a beer that is definitely *not* all about the hops! And lastly, I chose to use a London ESB yeast as this gives a slight fruitiness, a medium level of attenuation, and flocculates well. So, after all that folderol here is the recipe, which I simply called Dark Planet with no reference to any style:

Dark Planet
(5 gallons/19 L, all-grain)

OG = 1.067 FG = 1.016
IBU = 31 SRM = 40* ABV = 7%

*This is the malt contribution only, the actual color will be darker due to the sugar

Ingredients

6.5 lbs. (2.95 kg) 2-row pale malt
3 lbs. (1.4 kg) Munich malt (8 °L)
1 lb. (0.45 kg) Vienna malt
1 lb. (0.45 kg) Briess Victory® malt (28 °L)
0.5 lb. (0.23 kg) caramel malt (60 °L)
0.25 lb. (0.11 kg) Briess Blackprinz® malt (500 °L)
0.5 lb. (0.23 kg) Briess Carabrown® malt (55 °L)
1.1 lb. (0.5 kg) muscovado sugar (0 min.)
8.1 AAU East Kent Goldings hops (90 min.) (1.1 oz./32 g at 7.2% alpha acids)
Wyeast 1968 (London ESB), White Labs WLP002 (English Ale) or Lallemand Windsor yeast
⅔ cup corn sugar (if priming)

Step by Step

Mash the grains at 152–154 °F (67–68 °C) with 14 qts. (13 L) water and let rest one hour. Run off and sparge with hot water at 160–170 °F (71–77 °C) to collect around 6 gal-

lons (23 L) of wort. Boil for 90 minutes, with hops added at start. When done, turn off heat and add sugar, stirring well to make sure it is properly dissolved (be careful when stirring wort this hot). Rack from trub, cool to 65–70 °F (18–21 °C) and pitch yeast; ferment at same temperature for 5–7 days before racking to secondary. Leave it in the secondary for 1–3 weeks before bottling or kegging.

Extract version

I can't give you a tested recipe since I haven't tried to make this beer with malt extract. I would suggest eliminating the brown malt and Vienna malt and simply steeping the other grains. You can get extracts made from a 50:50 mix of pale and Munich malts, and this will work well here.

Dark Asteroid

(5 gallons/19 L, extract with grains)

OG = 1.067 FG = 1.016

IBU = 31 SRM = 40* ABV = 7%

*This is the malt contribution only, the actual color will be darker due to the sugar

Ingredients

6 lbs. (2.7 kg) Munich liquid malt extract
0.8 lb. (0.36 kg.) dried malt extract
1 lb. (0.45 kg.) Briess Victory® malt (28 °L)
0.5 lb. (0.23 kg) caramel malt (60 °L)
0.25 lb. (0.11 kg) Briess Blackprinz® malt (500 °L)
1.1 lb. (0.5 kg) muscovado sugar (0 min.)
8 AAU East Kent Goldings hops (90 mins) (1.1 oz./32 g at 7.2% alpha acids)
Wyeast 1968 (London ESB), White Labs WLP002 (English Ale) or Lallemand Windsor yeast
⅔ cup corn sugar (if priming)

Step by Step

Place all the milled grains in a muslin bag, add to 2 gallons (7.6 L) of water at 165 °F (74 °C), and keep at 150–155 °F (66–68 °C) for 30 minutes to 1 hour. Remove the bag, rinse with hot water, and combine this water with that from the partial mash. Stir in the malt extract and bring to a boil. Add hops and boil 90 minutes. The remainder of this recipe procedure is the same as the all-grain version.

How does it taste?

Dark Planet is dark brown in color, almost opaque in a pint glass. It is a full-bodied, chewy, satisfying brew. It is not too sweet, and has just enough bitterness to be noticeable but not to intrude. There's also a nice hint of licorice from the brown malt (as intended!), but it does not taste of molasses as such. Overall it is a very well-balanced beer, and one that I shall brew again. BYO

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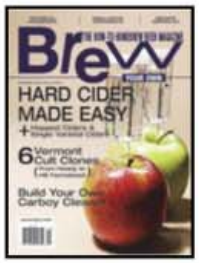

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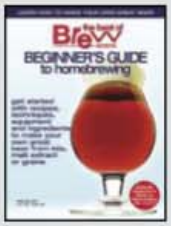

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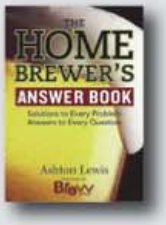

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projects

by Grant Braddish

Apple Scratter

For a fast, consistent grind

Fall in New England conjures up images of brilliant orange and red foliage, arts and crafts fairs, and anticipation of the first frost. While most homebrewers are starting to think about pumpkin ales and holiday cheer recipes, cidermakers are focusing on what apples are coming into harvest. Whether heading out in late August for Paula Reds or Galas, or waiting until a crisp mid-October morning to pick Macoun or Liberty apples, there are dozens of varieties to choose from to make a fresh pressed cider. Personally, I prefer a good mix of apples for my cider. Some tart and some sweet fruit seems to add all the right flavors when drinking fresh juice or fermented cider.

> "I am able to produce an almost applesauce consistency for pressing in my homemade rack and cloth cider press."

For years I would head to orchards, pick from my backyard trees and even shake apples loose from the wild trees in the woods. I borrowed a friend's old fashioned, single-tub press with a hand-cranked grinder or "scratter" to pulp the fruit and squeeze out the juice using a long screw pressing down into a bucket. Every year I would notice how the scratter would create large chunks of apple in the tub that would remain moist even after turning the pressing screw and a using "persuader" (often an old wooden baseball bat) for extra leverage. I figured there had to be a better way. This is the point when tradition was aided by modern technology.

I started researching how production cideries grind their apples and found that it usually doesn't involve some old-timer hand cranking a cylinder with small teeth to break up the apples. In fact, most large-volume cidermakers use an industrially designed, motorized pulverizer. This led me to a small-scale, innovative farmer based in upstate New York who fashioned a 1 horsepower electric farm motor to a disassembled garbage disposal to grind up apples for cider pressing. I first became aware of Herrick Kimball through his home-designed chicken plucker, as I raise broiler chickens every summer. After building a plucker based on his plans, I knew that he was onto something. When I found that he was also a backyard cidermaker, I was pleased to see he had re-thought the old fashioned grinder into a modern version to produce higher yields and with less effort. While Mr. Kimball re-powered his disposal with a separate motor and connected them by a belt, I figured that after spending approximately $100 on a new disposal, why would I remove the built-in motor?

Luckily it has worked for many years and I am able to produce an almost applesauce consistency for pressing in my homemade rack and cloth cider press. In fact, compared to the old days of hand cranking, I'm able to produce almost twice the amount of cider from the same weight of apples.

Materials and Tools:

- ~ 20 feet (6 m) 2x4 lumber
- ~ 18-inch by 18-inch (45-cm by 45-cm) piece of countertop (or plywood)
- Garbage disposal
- Light switch
- Weatherproof light switch housing
- Potable water plumbing pipe with friction fitting for outlet
- 6-8 inches of 1x1 wood trim
- 6 inches of ¼-inch round stock
- 12 feet (3.7 m) 14-gauge outdoor rated extension cord
- Power drill
- Jigsaw

1. COLLECT MATERIALS AND BUILD THE FRAME

I wanted to keep my costs to a minimum, so I searched the rafters of my garage for scrap lumber to build the frame. You could head to your local lumberyard and choose clear oak or other hardwood, but I just grabbed some pine 2x4s to screw and nail together as a frame. I also had a small piece of inexpensive countertop that I cut to house the disposal. Finally, because I would be consuming what came through the disposal, I was more comfortable buying a new stainless steel model.

I built a rudimentary frame from 2x4 lumber to hold my countertop. After measuring the counter, I cut the lumber cross members to allow the counter to fit within the upright legs. The leg height can vary depending on your height, but for mine the legs are about 40-inches (100-cm) long and the crosspieces are approximately 18 inches (46 cm). I screwed small scraps of 2x4 wood to the legs approximately 4 inches (10 cm) down from the top to act as shelves on each leg to place the counter top.

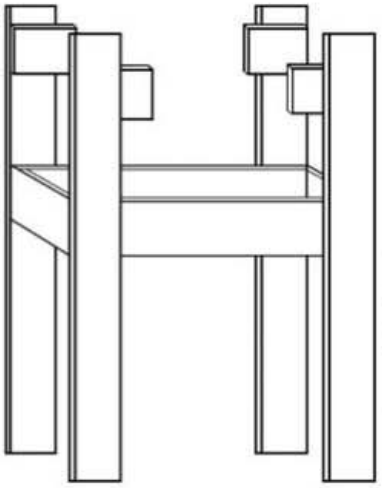

Illustration by Chris Champine

2. CUT TO FIT THE DISPOSAL AND INSTALL

Follow the instructions that come with the disposal to disassemble the mounting flange. Mark and measure your countertop for the proper hole size. I used a jigsaw to cut the countertop and assembled the motor just like it would be in a sink. In fact, if you have a sink and would prefer it to making a countertop, this would work just as well.

3. WIRING AND POWERING THE DISPOSAL

To allow the grinder to be mobile, I power it using a 14-gauge extension cord rated for outdoor use. By cutting off the female power head and stripping back the wires, I was able to connect it directly to the disposal. To allow more control of turning the scratter on and off, I installed a simple in-line light switch in a weather proof housing that I mounted to the frame. NOTE: Electricity and liquid do not mix. I highly recommend using a ground fault circuit interrupter (GFCI) cord connector at the male end to plug into the wall. This ensures that if there is any short due to moisture or juice that the power will stop immediately. In the alternative, only plug your grinder into a GFCI outlet, like those found in kitchens and bathrooms.

4. CREATE AN APPLE "FENCE" TO CORRAL THE FRUIT WHILE PREPARING

While preparing apples for the scratter, I find that cutting them in half allows them to fit in the opening easier. This also provides a flat surface for the shredder teeth to grab hold of so the apples don't just spin around in the grinder. Having a "fence" to ensure that apples tossed on the counter don't fall off saves a lot of time and frustration. I used some scrap 1x4 molding I had and screwed it together at the corners to create the frame. You can screw this to the legs above the countertop or leave it so that it can be removed.

5. ADD A SPOUT FROM FOOD GRADE PLUMBING PIPE

Cider is acidic and you are planning on ingesting it, so locate pipe that is meant for potable water or marked as "food grade." You can add any length, a downspout, or any configuration that works for you. My spout is at a height that a 5-gallon (19-L) pail fits easily underneath for collecting the pomace.

6. USING AND MAINTAINING

I made a 6-inch (15-cm) persuader out of 1x1 stock with a cross guard made of ¼-inch (~0.5 cm) round stock so that I can't drop it all the way into the grinder. The 1x1 allows you to push apples into the flange without risking your fingers! Never put your fingers near the garbage disposal!

I recommend rinsing your apples before pressing. I soak them in a half-barrel of sanitizing solution to kill off most wild yeast and wash off any other microbes. Then I cut the apples in half or quarters so that the teeth have a flat surface to "bite" into the fruit.

Be sure to thoroughly wash the grinder before and after each use. Cover the drainpipe and pour a light soap solution into the grinder. Turn it on for 15–30 seconds and then uncover the outlet to let it drain. Provide a good rinse (or even repeat with sanitizer) to wash away any soap.

If you are storing the grinder where mice or other rodents may want to explore, be sure to cover the inlet and drain during storage. My disposal came with a plastic stopper for the inlet and you can cover the drainpipe with a PVC cap or even a few layers of aluminum foil secured with a rubber band.

A short video of my apple scratter in action can be viewed at http://byo.com/applescratter. BYO

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last call
by Suzi Morales

Love, Homebrewing

. . . and a kegerator in the livingroom

Apparently, the idea of a kegerator in family common areas is a hot topic among homebrewers and their spouses. Recently, I met a woman in a setting having nothing to do with beer. I mentioned in passing that my husband was a homebrewer, and in an instant, we were immersed in a conversation about how our homebrewer husbands wanted to put their kegerators in what we viewed as inappropriate places in the house, hers in the dining room and mine in the living room. "For easy access, right?" I asked.

"Yes!" she exclaimed, going on to describe her husband's kegerator as a homemade "Frankenstein." We both rolled our eyes in exasperation, understanding that a kegerator clearly is not a piece of furniture fit for display in your average middle-class American home. Our husbands disagree.

Any couple probably can tell you it's important to cultivate common interests while maintaining individual hobbies as well. While I can distinguish grains from gravity and ABV from IPA, and I do enjoy the fruits of his labor, brewing falls decidedly into the "individual hobby" category for my husband. And for whatever reason, this hobby seems to be more consuming than others he's had. Let's face it, in the long run, there is no such thing as "dabbling" in homebrewing. As time goes by, and especially as a brewer transitions from extract to all-grain, the equipment becomes larger, and the time commitment more substantial. While some hobbies can be consumed in small bits, it's not possible to pick up and put down a brew-in-progress at leisure.

That's not to say I haven't taken one for Team Homebrew now and again. Once, when my husband tripped over a hose and bruised his knee pretty badly at the beginning of his club's brew day, I ended up doing the leg work for what became his "Bum Knee Stout." (I would be remiss if I didn't mention that his club is the Woodbridge Homebrewers Ale and Lager Enthusiast Society (WHALES) in Woodbridge, New Jersey.) I have taken multiple trips to the brewing supply store when he just couldn't get away from the task at hand. Our son has even celebrated a birthday at the club's annual picnic. Good thing the toddler doesn't know what birthdays are about yet.

Though my husband and I, of course, live in perpetually placid wedded bliss with nary an argument (wink, wink), I can understand how all this brewing enthusiasm might create conflict for a couple. I often compare homebrewing to science fair for grownups, with all of its requisite experimentation and calculations, and the hobby attracts a curious and industrious bunch eager to share their knowledge. For the less educated and enthusiastic significant other, this can be overwhelming, even with the admonition to "relax, don't worry, and have a homebrew."

As a solution, I propose on behalf of all the non-homebrewing significant others out there that we will attempt to understand your hobby and passion and to be as educated as reasonably possible. In turn, please go easy on us. Try not to get too agitated when we glibly pour a stout into a Pilsner glass, and we will attempt to learn why it matters. When we ask you whether our scrapbook page could use a little more embellishment (or, for that matter, for your input on triathlon training, welding, basket weaving, or fill-in-your-significant-other's-hobby-here), please give us your honest opinion. For our part, we will do our best to comment when you ask us about the hints of coriander in your latest creation. Relationships are, after all, about compromise.

But that kegerator in the living room, tucked neatly between the TV and the toddler's play area? You can forget about it. BYO

"Try not to get too agitated when we glibly pour a stout into a Pilsner glass, and we will attempt to learn why it matters."

Photo by Jon Morales

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