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NOVEMBER 2009, VOL.15, NO.7

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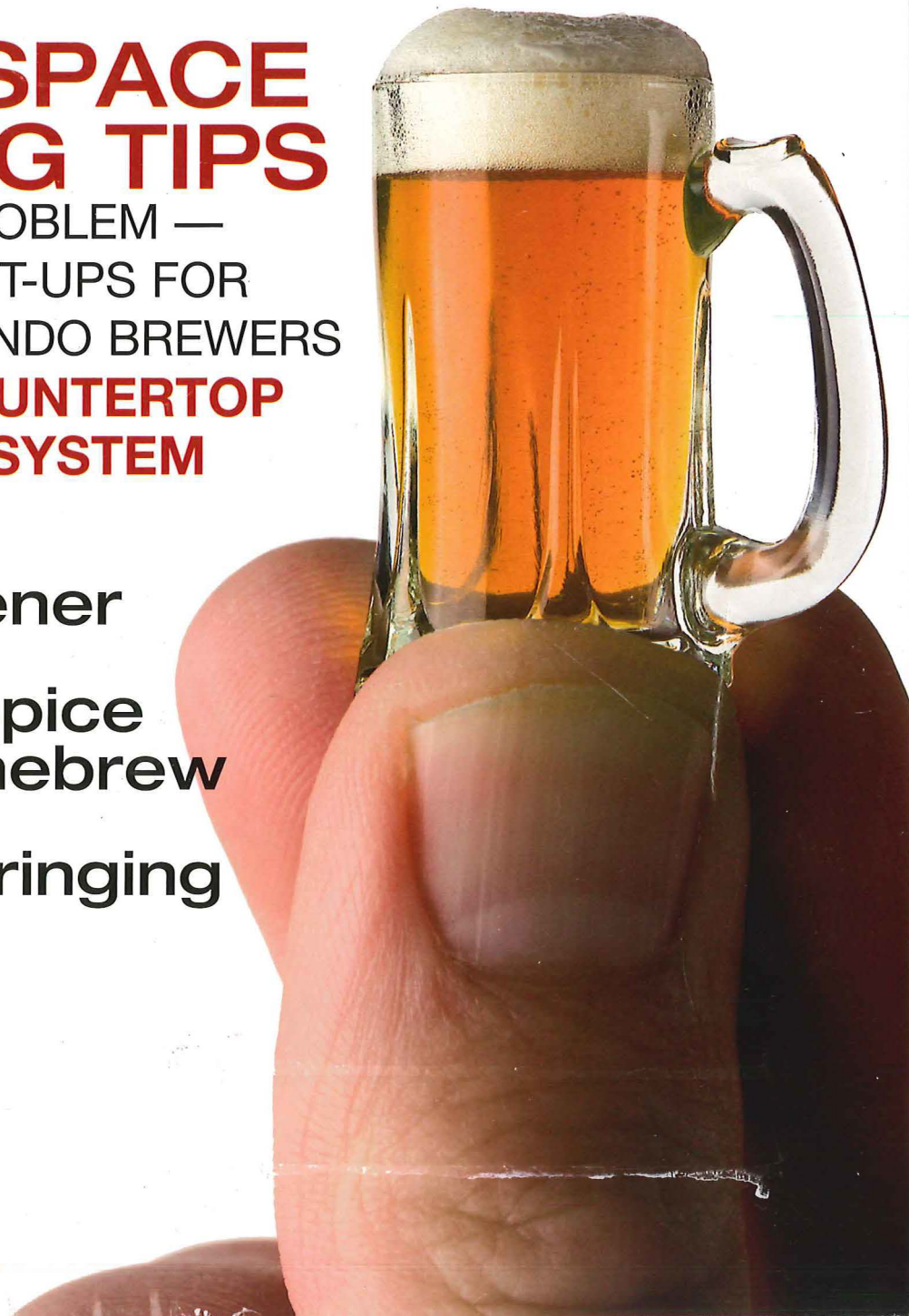

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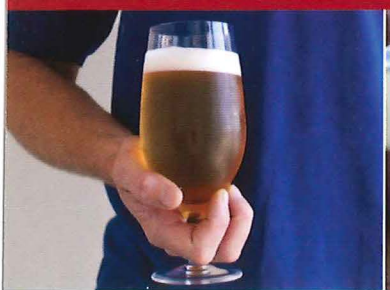

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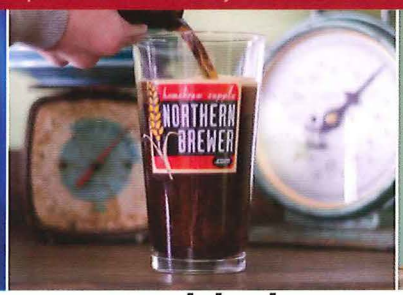

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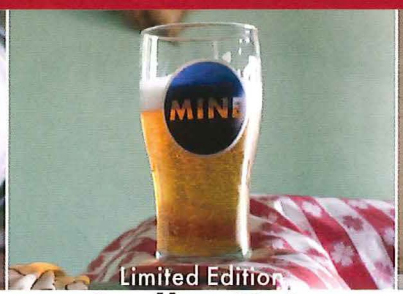

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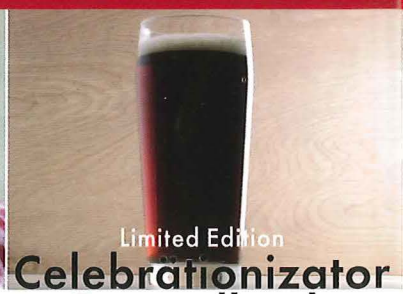

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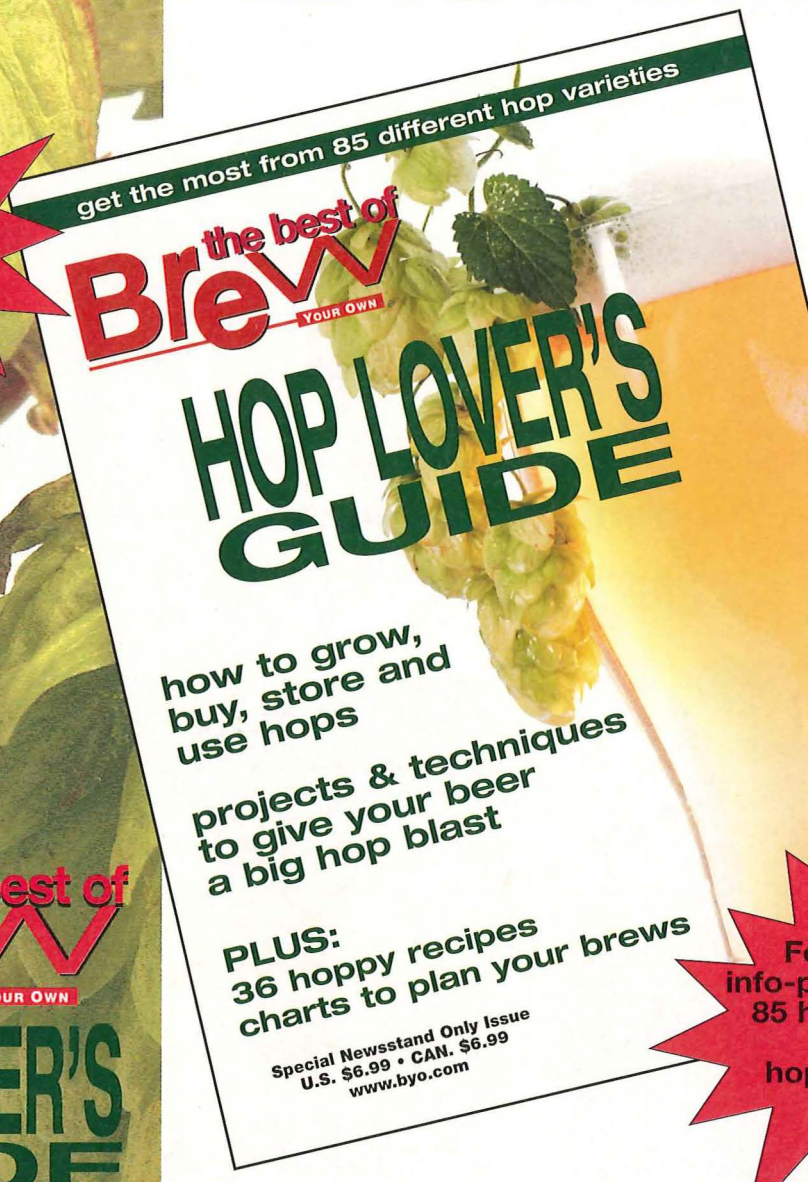

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THE HOW-TO HOMEBREW BEER MAGAZINE

NOVEMBER 2009
Volume 15 Number 7

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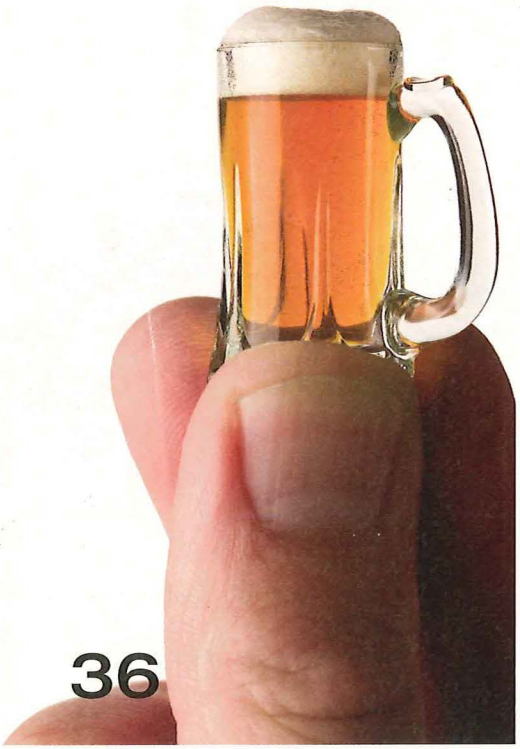

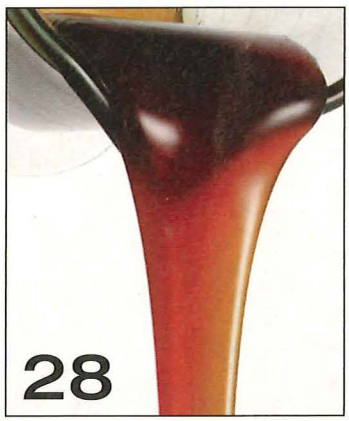

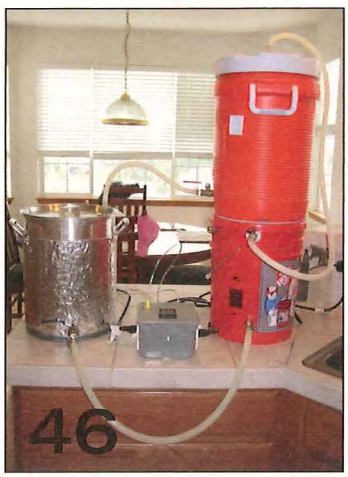

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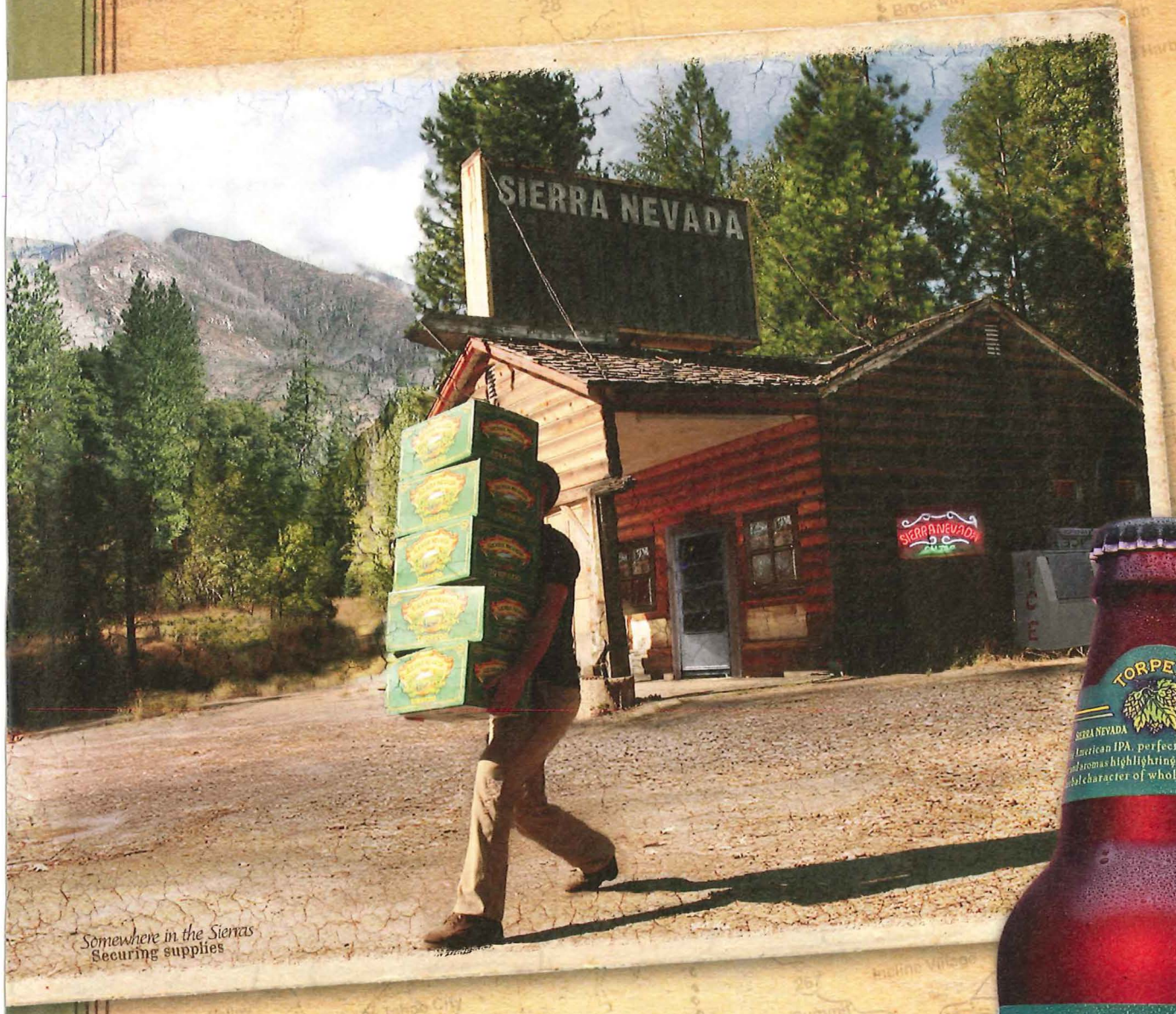

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BYO RECIPE STANDARDIZATION

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

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

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

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

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Cover Photo: **Charles A. Parker**

Mail

Clarification

The article "Sanitizers" by Chris Bible (October 2009) contained some information that was likely misleading to many homebrewers. In the article, Bible states that acid sanitizers react with hard water deposits and are good for use in CIP *(clean in place) operations. Although effective as sanitizers, and used in commercial breweries, the article recommended against their use in home breweries.*

There are many types of acid sanitizers and each has its own advantages and disadvantages. The information in the article referred to some specific, low-foaming acid sanitizers that are commonly used in commercial breweries, but typically not available to homebrewers. Only non-foaming acid sanitizers are recommended for use in CIP *operations and not all acid sanitizers are recommended for use in hard water.*

There is an acid sanitizer available to homebrewers, which we failed to mention, Star San. This product is a no-rinse, foaming acid sanitizer that is safe and effective for use in home breweries. As a foaming sanitizer, it is not recommended for CIP *operations. And, in hard water, the pH of the sanitizer solution may climb above 3, rendering it less effective.*

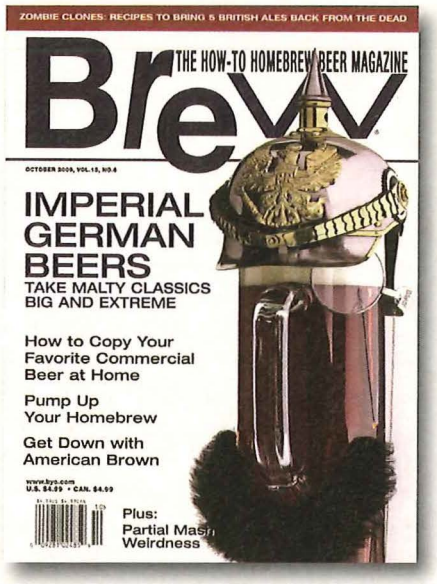
Percarbonate Sanitizer?

Given the importance of sanitation during all aspects of brewing, it was with great interest that I read Chris Bible's article. Most of the brewers I know use OxyClean or other similar product. I was under the impression that these products used percarbonates to sanitize brewing equipment but Mr. Bible's article makes no mention of the mechanism by which percarbonates sanitize. Are percarbonates sanitizers?

Andy Evenson
via email

OxyClean is a cleaner that uses sodium percarbonate as a bleach substitute. Due to its association with bleach (sodium hypochlorite), many homebrewers are convinced that it is a sanitizer. However, it is only a cleaner. Sodium percarbonate-based cleaners do a great job cleaning brewing equipment, however they don't fit the definition of a sanitizer.

When dissolved in water, sodium percarbonate releases hydrogen peroxide and sodium carbonate. Hydrogen peroxide is a strong oxidizer (and bleaching agent) and a solution of this cleaning fluid will likely kill some of the bacteria on surfaces it contacts. However, OxyClean and similar cleaners are not marketed as sanitizers and no information is given as to the concentration and exposure time that would render a surface sanitary. (Some sanitizers also have a temperature requirement.) In contrast, products labelled as sanitizers will give the concentration and contact time required for sanitation.



Cell Culture Safety

I was very interested by your article "Culturing Yeast" in the September issue since I am myself a "yeast culturer."

However, there's something to which I really don't agree. In the article, it's said to immerse the red-hot loop in 70% ethanol. Doing this can really pose a fire hazard. Also, keeping an open container of ethanol next to a burning flame isn't really a good idea for the same reason. As you certainly know, ethanol is very flammable and should not be kept close to any flame for safety reasons. Unless you're in a rush, simply wait 30 seconds to 1 minute for the loop to cool, a few inches from the flame to keep it sterile. This is a much safer way to work.

In addition to the article, you may find it interesting to know that yeast cultures also conserve quite well in a soft agar stab. In our age of high tech lab equipment, this technique is now more or less obsolete since people in laboratories needing long term conservation all have access to ultra-cold freezers to keep their culture. However, not so long ago, when these freezers were not standard laboratory equipment, and a luxury that not all can buy, soft agar stab was one of the methods

Contributors

LUCY SAUNDERS writes about beer and food, in newspapers, magazines and books, such as *Cooking With Beer* (Time Life Books, 1996). She has a degree in Old and Middle English Literature, a certificate in web design, learned baking and pastry at the Cooking and Hospitality Institute of Chicago, apprenticed with pub chefs in London and Brussels and attended the Siebel Institute. On page 28 of this issue, she discusses using malt extract as a cooking ingredient. Malt extract has long been used by bakers to enhance their breads and pastry. With the recipes in the article, you too can put malt on your menu.

TONY PROFERA is a web developer who lives in Charlotte, North Carolina. Tony has been homebrewing since 1994, and enjoys making IPAs, stouts, porters and many Belgian styles of beer. He also began making mead within the past 5 years. Tony's homebrew club, the Carolina Brewmasters, serves beer at the Charlotte Octoberfest Beer Festival from a large, multi-tap bar, complete with a built in Randall. Tony helped build the serving platform and it appeared in the November 2008 issue of *BYO*. In this issue, on page 48, he explains how to build a temperature-controlled fermentation chamber.

JAMIL ZAINASCHEFF is a "stylish" guy. He has brewed every style of beer described in the Beer Judge Certification Program (BJCP) Style Guidelines, discussed every style of beer on his podcast on the Brewing Network and wrote about every style of beer in the book he co-authored with John Palmer, *Brewing Classic Styles* (2007, Brewers Publications). Jamil is also *Brew Your Own*'s "Style Profile" columnist. In this issue, on page 19, he discusses Bohemian Pilsener, the light-colored lager with a hoppy (but not too hoppy) profile. Balance is the key in this beer and Jamil explains how to brew it in style.

microbiologists were using to keep their microorganism cultures for long term storage. Simply put, instead of being grown on the surface of a solid culture medium, the yeast are grown inside a soft gelatine-like medium (it's the same media as for the slants described in the article but with a lower concentration of agar). To inoculate your yeast, you just stick a needle a few time in the soft agar. After 2-3 days, the yeast will form a cloud like colony along the needle path. You then close the tube and keep it in the refrigerator. Although results are strain dependant, all of the strains I conserved this way were viable for at least three years.

The idea here is that the soft agar and closed tube protect the yeast cells from oxidation. The cold temperature, lack of oxygen, and slow nutrient diffusion from the medium to the yeast cells work together to keep the yeast at a very low metabolic rate. They are still alive and growing, but extremely slowly, in a kind of suspended animation. Although this technique has been used extensively in the past for bacteria culture, I didn't find much information for it being used for yeast culture. But, based on my experience, this also works quite well for brewing yeast!

Carl Simard
Quebec City, Quebec

BYO Editor Chris Colby responds: "We at BYO *agree that safety is important, but cooling inoculation loops in 70% ethanol is also standard laboratory practice. If you were streaking many plates, waiting 30 seconds or so in between each plate would take too much time. A red-hot wire loop will not cause a 70% ethanol solution to catch fire. However, if a small amount of agar or other organic material is stuck to the loop and burning, the alcohol will ignite. When this happens in a lab situation, the researcher simply places the lid over the jar of ethanol, snuffing out the blue flames. Likewise, a 70% ethanol solution sitting next to an open flame, such as that from a bunsen burner, will not ignite unless the flame is brought very close to the surface of the liquid. (In contrast, you should never open a jar of methanol in a room with open flames.) In one lab I worked in, a researcher I knew caught his jar of ethanol on fire while streaking plates. In trying to place the lid over the jar, the liquid was spilled and a burning sheet of ethanol dripped onto him. He was badly burned. So, although this is standard practice in laboratories, there is the possibility of injury. Homebrewers who culture yeast should consider if they feel comfortable working with ethanol. An alternate cooling practice is to touch the hot loop to an unused section of agar, although this necessitates opening the plate for a longer span of time.*

Questions, concerns, comments?

Contact us!

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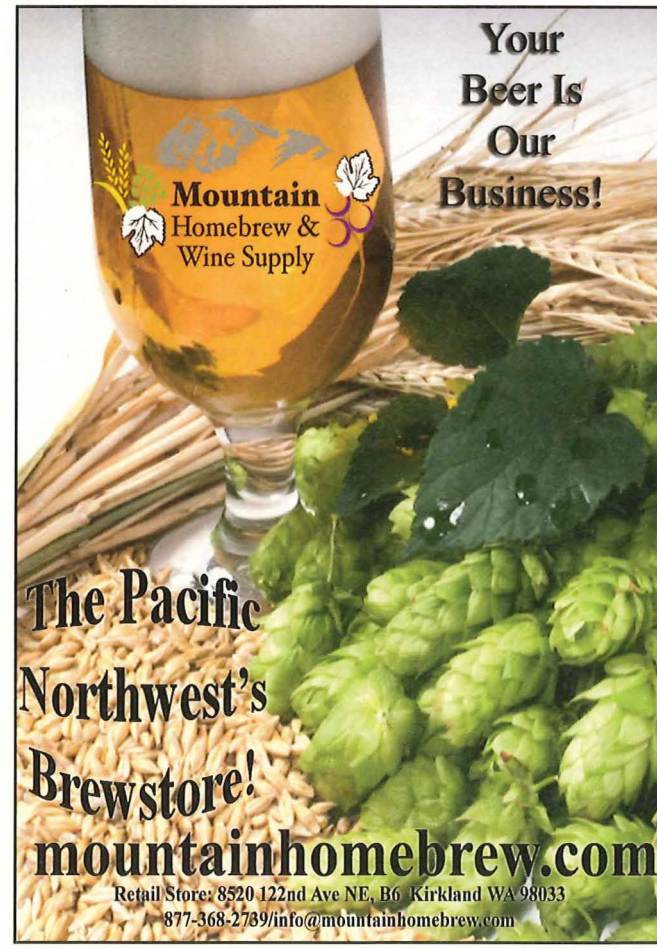

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reader PROJECT: Hop Arch

Ben Kavanagh
Fort Carson, Colorado

I've been homebrewing for close to ten years and always wanted to grow my own hops. Before I came to Fort Carson, where I am stationed with the army, I lived in a duplex in Pittsburgh, so I definitely wasn't growing them there. My parents, Tom and Elaine, live in Hermitage, Pennsylvania, halfway between Pittsburgh and Erie. They own a greenhouse and landscaping business located adjacent to their home and they are always looking for new features to add character to the property, which already includes dozens of woodcarvings, a variety of different gardens and lots of animals, including reindeer, alpacas and peacocks.

Not being the type of people to do anything halfway, my parents decided that a giant, 18-foot-high, 28-foot-wide hop arch would make the perfect entrance to a garden and wooded-trail area in the backyard. The foundation was built by filling 30-inch cardboard tubes with cement, which were then hidden behind custom-built stone pillars. The pillars feature engraved blocks with basic family tree information — a block for each of Tom and Elaine's four children, including their spouses and children's names.

Like many homebrewing projects that are meant to save money, this one ended up being a somewhat costly venture. The initial plan, since my parents had the space, was that they would grow the hops and I would use them for an August-September homegrown hop brewing session. Of course, I now live halfway across the country and it's the first year for a potential harvest. I'm going to have to set my dad up with a hop-drying rack and vacuum sealer so he can mail them to me. But at least it looks cool!

Ben Kavanagh's Cascades hops grow on a homemade hop arch at his parent's property in Hermitage, Pennsylvania. The steel and stone arch is 18 feet high and 25 feet wide.

The blocks in the base of the hop arch feature engravings of the Kavanagh family. There is a block engraved for each of his parent's four children and their families.

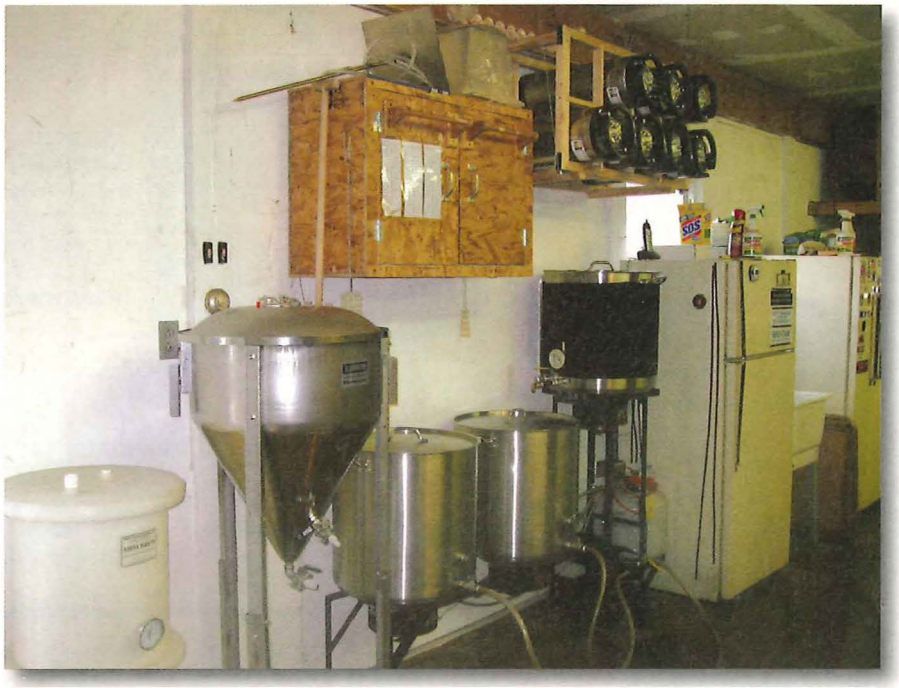
reader HOMEBREWERY

Eric King

Colver, Pennsylvania

I started working on my homebrewery in May 2008. It came to life as a 10-gallon (38-L) system. I had a 12.5-gallon (47-L) boil kettle, a 12.5-gallon (47-L) mash tun, and a 15-L (~4 gal.) converted sankey hot liquor tank. What you see here is my recently upgraded system. I now have 26-gallon (~100-L) kettles, and a 27-gallon (102-L) conical. I keep the 15-gallon (57-L) fermenter for experimental 10-gallon (38-L) batches.

This is a direct fire system, with a burner under each kettle. The burners are Bayou Classic. I use a battery-powered Piezo igniter and a March polysulphone pump to handle wort transfer. I use gravity for sparging. I put the whole thing on casters so on brew days I just wheel it over the floor drain and go. Most of my entire brewery is visible here, with my homemade cabinet, grain mill, homemade inverted keg rinsing stand, keg storage, fermenting fridge, sink and cold beer dispensing fridge.



Eric, a welder by trade, fabricated the brewing rig for his direct-fire system. He decided to expand when his friends started drinking more and more of his all-grain brews and his 10-gallon (38-L) system couldn't keep up. Lately he keeps three styles on tap at all times.

reader RECIPE: Vanilla Cream Stout

Tim French

Vanilla Cream Stout

5 gallons/19 L (extract)

If you like to brew (or want to get started) and don't have half a day or more to devote to it, try making this easy cream stout. This is a no-boil recipe — quick, simple and damn good! From start to airlock, I'm usually out of the kitchen in an hour. I've paid $10.00 for a six-pack of beer that wasn't even in the same ballpark. This beer is more expensive than you could achieve using other methodologies but brewing beer to save money makes as much sense as buying a boat to cut the cost of a fish dinner! I've also made basically the same recipe bottled using a couple of bottles of chocolate flavoring.

Ingredients

1 can Cooper's Stout beer kit
½ lb. (0.23 kg) malta dextrin
1 lb (0.45 kg) lactose
3 lbs. (1.4 kg) amber dried malt extract
1 vanilla bean (opened and scraped into the wort after fermentation is complete)
invert sugar (use to adjust alcohol to the level you desire)
Cooper's dry yeast
¾ c. corn sugar (for bottling)

Step by step

Heat 2 gallons (7.6 L) of water to steaming. Add extracts and lactose to dissolve.

Mix the wort with 3 gallons (11 L) of cold water in a sanitized fermenter to bring the wort to about room temperature or below 80 °F (27 °C) and pitch the yeast.

Ferment at 68 to 70 °F (20 to 21 °C) for about three days. Let it sit on the trub for two to two and a half weeks. Bottle with ¾ cup of corn sugar.

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http://www.byo.com/component/resource/article/1149

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Troubleshooting Chart

Key: "X". For beers made with malt extract. "AG": For all-grain beers

Problem	Causes
Fermentation does not start	• Inadequate amount of yeast pitched • Wort too hot (yeast stunned/killed) • Wort too cold (yeast dormant) • Fermentation fine, but bucket not sealed (so you can't see bubbles in airlock) • Fermentation already complete (look for ring of "crust" around inside of fermenter)
Stuck fermentation	• Not enough yeast pitched • Inadequate aeration • Wort temperature too low • Yeast strain flocculated early (rousing yeast may help) • Fermentation is finished, not stuck (take a specific gravity to check)
A puckering, tea-like quality, sometimes	• X: steeped grains in too much water (over 3 quarts

Solve a brewing dilemma

Sometimes a batch of homebrew can go awry. Thankfully we have an online chart of common brewing problems. Take a look at our troubleshooting chart and see if there is any way to save the day:

http://www.byo.com/resources/troubleshooting

byo.com BREW POLLS

How much space do you need to brew?

A good amount, like a garage or shed
44%

Not much more than a stovetop
37%

As much as I can get
19%

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replicator
by **Marc Martin**

Dear Replicator,

I grew up in the far northwest corner of Oregon in the town of Astoria. The town's economy was based on fishing and logging and there was no shortage of taverns. The only beer I knew about was from those large mega-breweries and they all tasted the same. Seventeen years ago I moved to Colorado and discovered craft beers. A friend showed me how to homebrew and I have been doing it ever since. A few months ago I went back to Astoria to visit relatives and discovered Fort George Brewing. They brew a spruce ale that is unlike anything I had ever tasted before. It's like a walk in the forest. I am hoping that you can help me figure out how to duplicate it.

Rodney Jenkins
Aurora, Colorado

I am an avid brewer and I have brewed most of the recognized beer styles, but I must admit that ever since I tasted my first Alaskan Brewing Winter Ale the style has intrigued me. Your request sparked my interest again and put the Replicator on the road for another beer research mission.

Jack Harris, the brewmaster and a joint owner met me at the brewery. While enjoying a sampler of their excellent beers he related his background, the history of their unique brewery and the details of the Spruce Budd Ale.

Jack has humble beginnings in the brewing industry. His first job was with the McMenamins organization at their Cornelius Pass Roadhouse in Cornelius, Oregon. In 1990 he was working in their kitchen as a cook when the brewer quit. After only a six-week mentoring period he became the head brewer. After three years he moved on to brew at Mountain Sun in Boulder, Colorado for another three years, then back to the Northwest to brew for nine years at Bill's Tavern at Cannon Beach, Oregon.

Jack had always been intrigued with the idea of brewing old-world style beers with no hops and is a big fan of Stephen Buhner's book *Sacred and Herbal Healing Beers*. Wanting even more brewing latitude, he decided it was time to operate his own brewery. He partnered with Chris Nemlowill and they began looking for equipment and a location. They found a used 8-½-barrel Saaz Brewing Equipment system in Virginia Beach, Virginia and a defunct Ford dealership building in Astoria on a hill overlooking downtown.

They soon discovered that both of these were great finds. The brewing system is fairly rare and very efficient and the building had an incredible history. It was built on the original site of the first American settlement on the Pacific coast, Fort George. With huge windows and massive old growth beams throughout the building was ideal for a brewpub and in March of 2007 it became reality.

Spruce Budd is only one of several unusual beers Fort George has offered. Others include Quick Wit made with lemongrass and elderflower, Spank Stout brewed with Pissila, Anaheim, Jalapeno, and Habanero peppers, Wasabi Ginger Ale and a beer called Divinity, which is made with Olallie berries.

Spruce Budd Ale is Jack's recipe but was actually brewed by his new lead brewer, Spencer Gotter. It was sold out for the year but Jack described it and gave some background. This is a seemingly light beer but with a fair amount of alcohol. It is straw colored with a dense, rocky head. The nose is malty combined with a pleasant pine scent. The Vitamin C in the spruce tips is the main reason old world explorers like Captain Cook carried casks of spruce ale — to prevent scurvy.

Jack recommends harvesting spruce tips in early May. The bright green tips are about one to two inches (2.5 to 5 cm) in length and should be used as quickly as possible or frozen to preserve their flavor. If you can't harvest your own, other sources of frozen tips can be found with an Internet search.

Rodney, you won't have to travel to Oregon for a taste of the Northwest forests because now you can "Brew Your Own" Spruce Budd Ale. For further information about the brewery and their other fine beers visit the website www.fortgeorgebrewery.com or call them at 503-325-7468.

Fort George Brewing Spruce Budd Ale

(5 Gallons/ 19L, extract with grain)
OG = 1.060 FG = 1.012
IBUs = 0 SRM = 4 ABV = 6.2 %

Ingredients

3.3 lbs. (1.5 kg) Muntons extra light, unhopped, liquid malt extract
2.5 lbs. (1.13 kg) Muntons extra light, dried malt extract
2.75 lbs. (1.24 kg) Pilsner malt
5 oz. spruce tips (142 g) (60 min.boil)
5 oz. spruce tips (142 g) (end of boil)
3 oz. spruce tips (85 g) (dry hopped)
½ tsp. yeast nutrient (last 15 minutes of the boil)
½ tsp. Irish moss (last 30 min. of the boil)
White Labs WLP041 (Pacific Ale) or Wyeast 1332 (Northwest Ale) yeast
0.75 cup (150 g) of corn sugar for priming (if bottling)

Step by Step

Steep the crushed grain in 2 gallons (7.6 L) of water at 150 °F (65.5 °C) for 30 minutes. Remove grains from the wort and rinse with 2 quarts (1.8 L) of hot water. Add the liquid and dried malt extracts and bring to a boil. While boiling, add the spruce tips, Irish moss and yeast nutrient as per the schedule. During the boil, use this time to thoroughly sanitize a fermenter. Now add the wort to 2 gallons (7.6 L) of cold water in the sanitized fermenter and top off with cold water up to 5 gallons (19 L).

Cool the wort to 75 °F (24 °C). Pitch your yeast and aerate the wort heavily. Allow the beer to cool to 68 °F (20 °C). Hold at that temperature until fermentation is complete. Transfer to a carboy and add the "dry hopped" spruce tips. Avoid any splashing to prevent aerating the beer. Allow the beer to condition for one week, strain out the spruce tips and then bottle or keg. Allow the beer to carbonate and age for two weeks and enjoy your Spruce Budd Ale.

All-grain option:

This is a single step infusion mash using a total of 12 lbs. (5.4 kg) Pilsner malt. Mix the crushed grains with 3.75 gallons (14.2 L) of 168 °F (75.5 °C) water to stabilize at 150 °F (65.5 °C) for 60 minutes. Sparge slowly with 175 °F (79 °C) water. Collect approximately 6 gallons (23 L) of wort runoff to boil for 60 minutes. The remainder of this recipe and procedures are the same as the extract with grain recipe.

Homebrew CALENDAR

November 7
Portland, Oregon
Oregon Brew Crew's Fall Classic
The 2009 Fall Classic homebrew competition is slated for November 7 at Roots Organic Brewing in Portland. Entries must be received by October 23. For more information, call 503-235-7668 or visit www.oregonbrewcrew.com.

November 7
Cedar Park, Texas
Dig Pub Monster Homebrew Competition
The second annual battle of the big brews (any beer whose starting gravity is 1.0666 or higher). All BJCP styles accepted. Entry fee is $5 per entry, enter as many times as you like. Awards will be given to the top three beers and best in show. More information and registration form is available at www.thedigpub.com

November 14
Lafayette Hill, Pennsylvania
Stoney Creek Homebrewers Amateur Brewing Championship
The second annual homebrew competition organized by the Stoney Creek Homebrewers club. All BJCP-recognized styles of beer, mead and cider are eligible. Dropoff entries will be accepted from October 20 through November 2. Mail-in entries will be accepted from October 18 through October 31. Additional info available at: http://schomebrewers.com/node/11.

November 15
Baltimore, Maryland
MALT Turkey Shoot 2009
The fifth year of the Maryland Ale & Lager Technicians Turkey Shoot homebrew competition is set to take place at the Clipper City Brewing Company on November 15. Entry deadline is November 7. The BJCP-sanctioned event allows homebrewers a chance to "strut" their stuff for cash and compete in numerous categories. More information at http://www.maltclub.org/MALT/Turkey_Shoot.html.

BEGINNER'S block

Your First Mead

by Betsy Parks

Making your first batches of homebrew are also your introduction to the process of alcoholic fermentation. Once you have the basic concept of making beer, you can easily make other fermented beverages, including mead.

Ingredients

Mead is a fermented solution of honey and water, which can be either sparkling or still, sweet or dry. You will need to find a source of high-quality honey to ensure the good finished mead. Most supermarkets or food cooperatives stock at least two or more varieties of honey, or you can find a local producer. Keep in mind that you will need a fair amount — for instance, a 5-gallon (19-L) batch can call for somewhere around 15 pounds (6.8 kg) of honey.

Many meadmakers add yeast nutrients to mead to ensure a complete fermentation as honey alone doesn't have all of the nutrients needed for the yeast to ferment as well as it could. For the best results, choose a complete yeast nutrient for constant, thorough fermentation rather than DAP (diammonium phosphate), which will cause the yeast to rapidly reproduce, but may exhaust that process and start producing undesirable compounds. Some meadmakers, like winemakers, add Campden tablets or potassium metabisulfite before pitching the yeast to lower the chances of contamination by killing wild yeast that are present in unpasteurized honey (or must if making wine). Others, like brewers, heat the unfermented mead to pasteurization temperatures to kill the wild yeast and bacteria.

Many commercial yeast manufacturers carry a variety of yeast strains for making mead. For example, White Labs carries WLP720 Sweet Mead/Wine and Wyeast carries 4184 Sweet Mead and 4632 Dry Mead. You can also use some strains of winemaking yeasts, such as Champagne yeast. For your first batch, choose a recipe that lists a specific strain.

Techniques

For recipes that don't call for using potassium metabisulfite/Campden tablets, the first step is combining honey with water and heating it to around 160 °F (71 °C) to kill any pathogenic bacteria or wild yeasts. While you heat the honey and water, continuously stir the mixture to prevent the honey from collecting on the bottom of the pot and scorching. When the unfermented mead reaches 160 °C (71 °C), take it off of the heat, cover and let it sit for 15 minutes. Next, chill to yeast-pitching temperatures (below 80 °F/27 °C). If you are following a recipe that calls for potassium metabisulfite or Campden tablets, you would skip heating the honey and water mixture to 160 °F (71 °C) and instead combine the ingredients with a Campden tablet or potassium metabisulfite (depending on the recipe and manufacturer's recommendations) and let unfermented mead sit overnight in a loosely covered container.

Once the mead is chilled and sanitized, pitch the yeast. Mead takes time to ferment — as much as two or three months in the primary and six or more months in the secondary fermenter. Because of this longer fermentation, it is a good idea to use a yeast starter to be sure you have a big, healthy population of yeast cells right from the beginning.

Once the fermentation takes off, keep the temperature of the mead constant according to what the recipe recommends. Yeast activity can cause the temperature to rise, which will create undesirable fusel alcohols. Keep the temperature low and be patient. Once the fermentation is finished, you can clarify it by bulk aging until it clears or with a fining agent such as Sparkolloid and bottle.

Web extra:

For more information about making mead, including recipes, check out our online directory:

http://byo.com/stories/list/indices/46-mead

Stainless Service

Proper care for your homebrew equipment

by Betsy Parks

Stainless steel equipment is widely regarded as a good investment for any brewery — home or commercial — because of its ability to resist corrosion, rust and scratches. It is not, however, invincible. In this issue, three pros agree that treating your stainless steel right will pay off with a lifetime of homebrews.

JOHN PALMER, author of *How To Brew* (2000, Brewers Publications) and co-author of *Brewing Classic Styles* (2008, Brewers Publications). In addition to homebrewing, John holds a degree in metallurgical engineering from Michigan Technological University and works as a metallurgist by trade.

Stainless steel relies on surface chemistry uniformity for its corrosion resistance. You might think, "Hey, it's stainless, I don't have to clean it right away. It will be fine if I leave it for a couple days. I'll just pour some water in and let it soak." But if the pot is half full, then it is not uniform and corrosion could occur at the waterline over time. The propensity for corrosion will depend on what is in the water — salts, minerals, cleaning agents, etc. It is generally resistant to most household chemicals with one main exception — chlorine. Chlorine and chlorides can break down the protective oxide layer and start corroding the steel beneath. Once that happens, that breach is no longer stainless compared to the surrounding area and corrosion will accelerate. Biological contamination can also cause an area to be compromised. A chunk of trub can provide a haven for bacteria to hide under, and as they eat the trub, their waste products (often acidic and containing sulfur) can cause corrosion under there away from the oxygen that makes the protective oxides.

Another big problem is too much heat from blowtorch propane burners. Never let stainless steel get cherry red as those temperatures will cause chromium carbide formation that takes the chromium out of the alloy and makes it un-stainless. Lower heat can still be a problem if it causes discoloration. The protective stainless steel oxides are transparent but heat tint (yellow, brown, blue and purple oxides) is not protective and will initiate further corrosion. Heat tint should be removed from the interior of a brewing vessel where exposure to liquids can cause corrosion. Heat tint on the outside of the pot is not desirable, but is less likely to be a problem.

If the stainless gets scratched it can lead to crevice corrosion, so buff or grind out deep scratches. If your thumbnail doesn't get caught in it, then it is probably too small to worry about. For best results, do not use angle grinders or coarse sandpaper to remove scratches. Use fine-grained sandpaper (320 or higher) to smooth out the scratch, and follow up with kitchen cleanser to give it a good polish. Always store your stainless steel clean and dry. Scratches in stainless are really not a big deal for homebrewers because they are more accessible and easier to monitor. In professional breweries using CIP (clean-in-place) systems, it is difficult to actually clean the bottom of scratches.

JOHN BLICHMANN, owner and founder of Blichmann Engineering. John has a BSME (Mechanical Engineering) from Iowa State University and worked for Caterpillar's engine division for fifteen years. He "retired" from an engineering supervisor position to start Blichmann Engineering in 2002. He is a BJCP judge and has been homebrewing for 17 years.

Stainless steel is simply carbon steel with a mixture of chromium (Cr) (10–18% is common) and most of the time Nickel (Ni) where 8–14% is common. Chromium quickly and readily reacts with oxygen to form chromium dioxide (CrO_2), which is an extremely stable and corrosion resistant compound. It is that very property that makes stainless steel resist corrosion. When Cr is exposed to oxygen, a very thin layer of CrO_2 is instantly formed preventing further penetration of chemicals through the layer. When this layer forms, the stainless is deemed "passive." The key in keeping your stainless a shrine of coolness is to properly maintain that protective layer. With that in mind, chlorine, most commonly bleach, is very harmful to stainless. Chlorine will chow through that layer like a teenage boy through a box of Cheerios and begin to cause pits. In these small pits, oxygen can't get back in to replenish the layer and over time this pit can lead to a hole in your equipment. In the case of Iodophor, using the recommended concentration for no more than the prescribed time isn't a problem, but never soak for extended periods. The key thing to maintaining your passive layer is to clean thoroughly and dry completely.

Be very particular about who you let weld on your equipment and what equipment you choose to have welded. Boiling/mashing vessels are not as sensitive to weld quality issues since exposure time is short. But storage and fermenting vessels are exposed for weeks/months, so weld quality is paramount. A tiny bit of weld porosity, cooling crack or oxidized weldment can lead to corrosion and a site for bacterial contamination, so choose a welder wisely. That is a reason we make our conicals weld-free — to avoid issues with weld quality.

ASHTON LEWIS, Master Brewer at Springfield Brewing Company and Process Engineer for Paul Mueller Company in Springfield, Missouri where he helps design brewing systems for commercial breweries large and small. Ashton is also the Technical Editor for *Brew Your Own* and the author of *BYO*'s "Mr. Wizard" column.

In small breweries and home breweries where stainless steel is manually cleaned with abrasive pads and brushes with metal tips, damage is often manifested in the form of scratches to the material. Scratches can be especially problematic when the scratch is made by carbon steel or an abrasive contaminated with carbon steel. These scratches rust because the surface is contaminated with "free iron," meaning that the iron is not part of the stainless steel crystalline alloy structure.

I suggest cleaning stainless equipment with alkaline cleaners, such as caustic and sodium metasilicate, to remove organic soils like yeast and trub. Acid cleaners work well for removing mineral scale. One of the handiest acids to use at home is white vinegar, and periodic descaling is sufficient in most areas. If you brew with really hard water more frequent descaling may be required. Very hard water can leave mineral scale and scale can lead to crevice corrosion, but you really have to neglect your equipment at home to end up with this problem.

Many sanitizers can safely be used on stainless steel, including iodophors, quats, peroxyacetic acid, hot water and bleach. The key with using bleach is to keep the pH high (over 10) by not mixing with acids or using after acid cleaning with minimal or no rinsing of the acid. Stainless equipment is commonly damaged by the improper use of chlorinated cleaners and sanitizers.

Stainless steel can be polished to remove scratches. The best way to do this is to manually polish the surface with an abrasive intended for stainless steel. At Mueller we use a variety of abrasives that are made using silicone dioxide (glass) for the grit. When polishing stainless you need to make sure to polish in the direction of the grain; just like wood, stainless has a grain structure that is clearly visible by observing the surface.

Stains can usually be removed with acid since stains are caused by something on the surface. If you have rust stains the acids that are effective are also dangerous. Nitric acid and hydrofluoric are both excellent for rust removal, but are also both strong, nasty acids. Whenever these types of compounds are considered for use the MSDS should always be read to understand the handling issues.

Stainless is a great material of construction for brewing as evidenced by its widespread use as the preferred material for all brewing equipment in breweries around the globe. Keep it clean and don't scratch; this makes for happy brewers!

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Formulating Recipes

"Help Me, Mr. Wizard"

Making malty brews, handling hefes

by Ashton Lewis

Adding spices

I am making a rye bock and want to add some caraway seed to the boil to give it a little more rye bread-like flavor. My question is how much do I use and when? I have had good results with additions at 50 of a 60 minute boil. A half to an ounce crushed perhaps?

Brian Quinn
Princeton, New Jersey

Thanks for the good question. You are asking about how to approach recipe development. When I try things I have never done before I usually read as much as I can find about what others have done in similar instances. As much as I would like to think that I occasionally come up with a truly original idea, the fact is that with the long history of brewing, chances are that my latest and greatest idea has been proposed and probably tried sometime in the past.

I think caraway seeds (actually the fruit of the plant *Carum carvi*) would add an interesting spicy, anise-like earthiness to your rye bock. Adding them toward the end of the boil is definitely the way to go if you want to retain the nice aroma associated with caraway. I have brewed many spiced beers and have always begun by finding high quality fresh spices from specialty spice houses because I figure that using good ingredients is putting my best foot forward. Almost without exception the intensity of the spices far exceeded my expectations based on the information I consulted before brewing.

Unlike hops, recipes calling for spices do not provide any data, such as alpha acid units, to help the brewer determine how much to use based on the ingredient in hand. Not all spices are created equally and they vary just like hops. Factors such as variety, growing region and age affect spice intensity. Based on experience using, or more correctly over-using, freshly milled and properly stored spices, I now back off of published usage rates by about 50%. If the idea is worth repeating and the spice impact is too low you can always tweak up in the future. But once a beer is over spiced there is not much you can do to rescue the batch. I once remember making way, way too hot chili using habanero peppers and I attempted to dilute the chili with more tomato sauce and crushed tomatoes. The end result was just a bigger batch of way too hot chili. As often is the case, less is more when it comes to using spices.

Major malts

I love malt, so I tried creating a recipe with a huge grain bill (similar to a famous amber from Fort Collins), but ended up with something a little weird. Its hop profile is very low along with its carbonation. It tastes like freshly milled malt smells. I like it, but some might say it's "grainy." Do you have any rule of thumb on balancing a beer?

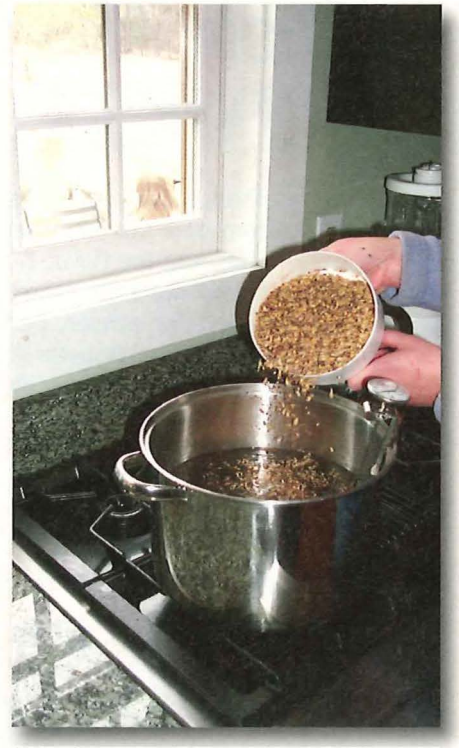
Josh Branson
The Ozarks

In my brewing opinion many beers with an assertive profile of whatever, be it malt, hops, alcohol, yeast character, etc, are often not well balanced beers. This does not have to be the case, but many brewers get a little carried away with the theme ingredient (maybe because of watching too many episodes of *Iron Chef*).

I don't know the specifics of the famous amber from Fort Collins, but can state with a fairly high degree of certainty that Fat Tire does not begin with a "huge grain bill." Fat Tire is not a high alcohol beer and the malt character is more finesse than brute force. *BYO* published a Fat Tire clone in the 150 *Classic Clones* special issue. You can order a copy at www.byo.com/store for more information about this beer. One thing offered by Peter Bouckaert is that you need to use a blend of various paler special malts to get the malt complexity.

I think I can answer this question by explaining one of the beers we seasonally brew at Springfield Brewing Company, our Märzen. This beer has undergone many tweaks since we first opened in 1997. This beer was actually a full-time part of our lineup until I decided to turn it into a seasonal beer to give me more brewing freedom and to also allow me to make fairly large tweaks to the recipe without being too obvious (I find it easier to make big changes when beers are seasonal since there is not this big comparison between two consecutive batches).

I wanted to move the balance away from malt because I thought the beer was too malty and lacked drinkability. By my definition, a beer has drinkability if you can drink a few of the same beer without feeling like you just completed some sort of beer marathon. Not all beers need to have this quality, but I like Märzens that have drinkability. Our original recipe used a blend of Munich malt from North America and some crystal. Progressively the recipe went too far and I was again unhappy with the balance. By 2006 I had tweaked it too much and alas there was



Using lots of malt in a recipe is not the best way to make a malt-forward beer with balance. Try using a blend of malts instead.

too little malt character.

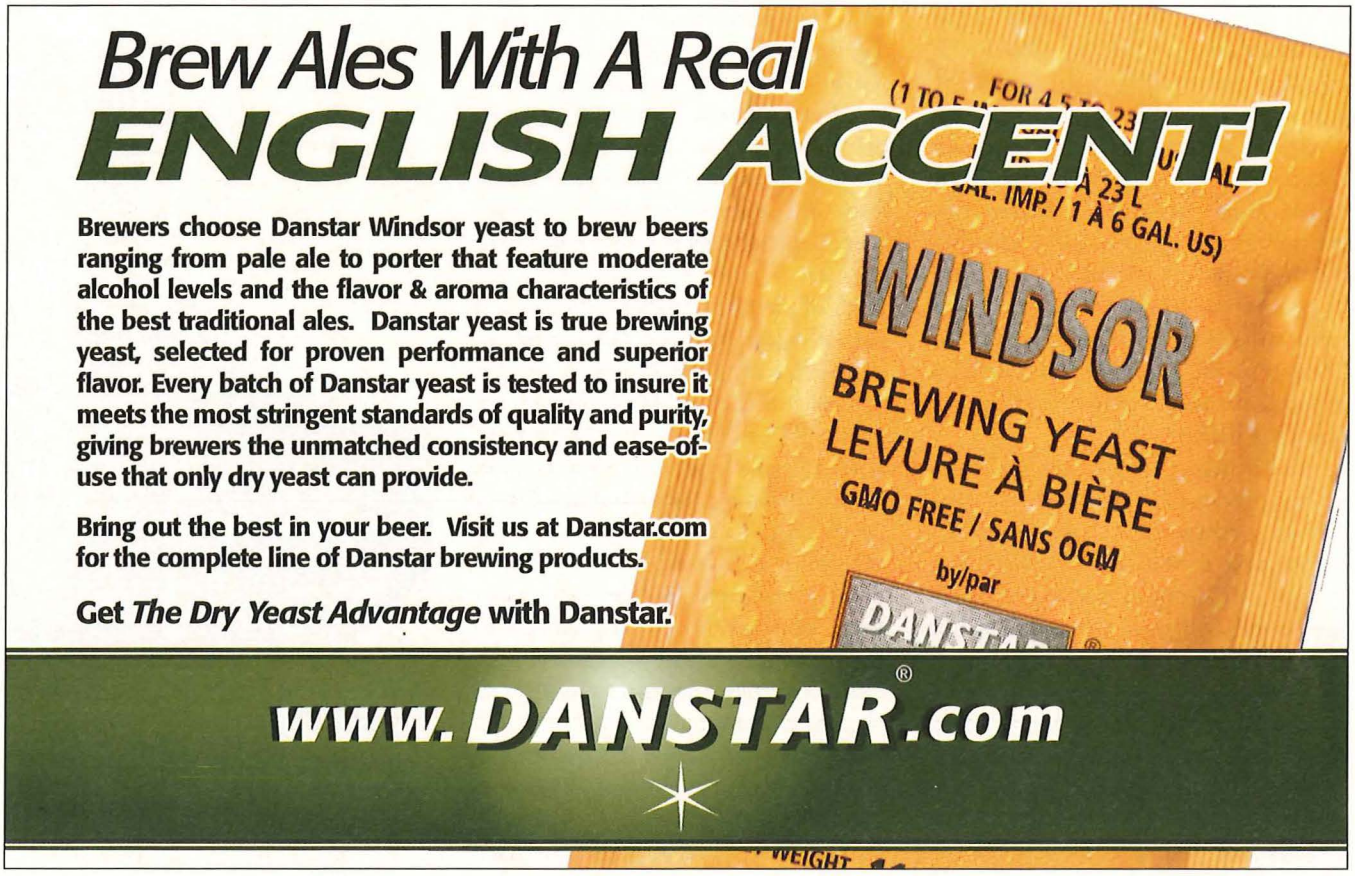
I needed to try something different and was inspired by MTV's show *Pimp My Ride*. Although fuzzy dice and low profile chrome wheels didn't have much to offer my Märzen project, I did get the idea for a major redo and started looking for different malts. I wanted rich malt flavor without excessive sweetness because I don't like sweet beers. The path forward was established after brewing two specials using a blend of Weyermann Munich I and Munich II. These malts have incredible flavor and have enough enzymes, like most Munich malts, to use as the sole malt if so desired. We used a blend of the two with great success and made a big change to our Märzen recipe last year and people really liked the change. This year we tweaked it a little more and I am very happy with the results; the grist bill is made using about two thirds of the total from these two malts.

When it comes to balancing a beer there are some rules of thumb about IBU/OG ratios that a lot of brewers find useful. But I think this sort of rule points you in the right direction and not much else. The real trick to balancing hard-to-balance styles like Märzen or "Fort Collins Amber" is experimentation. I know I reference music too often in my columns, but I really do think recipe development and musical composition have a lot in common. A tenor sax player, Brandon Mezello, has played at our brewery for about nine years and I talk to him a lot about his process of improvisation. Like most musicians he listens to a lot of music. We both agree that the process of coming up with a great beer or a great solo begins by developing an idea and then playing with things until you finally get it. Brandon has been working on a funky little techno piece with composition software for years and is still making changes here and there. Sometimes you have to resort to old-fashioned trial and error to get the balance and flavor just right.

"Sometimes you have to resort to old-fashioned trial and error to get the balance and flavor just right."

Hefe handling

I decided to brew my first batch of American-style hefeweizen recently. The recipe that I loosely followed recommended only a primary fermentation, which would speed up the time from brew to keg. When I say that I loosely followed the recipe, I mean that I used the hop variety, IBUs and brewed to the original gravity. I did a mini-mash with 2 lbs. (0.9 kg) of wheat malt and 3 lbs. (1.4 kg) of German Pils malt. I boiled 1 lb. (0.45 kg) of dried malt extract with wort collected from the mini mash along with



the hops. A 3.3 lb. (1.5 kg) can of Briess liquid wheat malt extract was added late. I pitched White Labs WLP320 (American Hefeweizen) yeast from the tube (no starter) to the oxygenated wort and there was no excessive lag time before fermentation was well under way. After seven days in the fermenter, I still had noticeable activity so my beer ended up in the fermenter for sixteen days. I transferred to a keg and carbonated in the fridge at 12 psi for three days. The problem is that all of the yeast seemed to have fallen out of suspension before I kegged. In fact my beer is pretty darned clear. I have heard commercial brewers add yeast again at packaging time to get the appropriate amount in suspension. Can homebrewers make a hefe with a good concentration of yeast cloudiness? Should I have racked my beer sooner instead of letting fermentation finish completely?

Keith Dawson
Lewiston, Idaho

It sounds to me that your recipe and brewing approach was fairly typical for brewing an American-style hefeweizen. In my experience the key to brewing cloudy beers is using yeast strains with low flocculation. One of the pioneering beers of this style is Widmer Hefeweizen. That beer is made with a yeast strain with really low flocculation and the concentration of yeast cells is relatively high when the beer is packaged.

One "trick" to brewing this type of beer is pitching with enough yeast to ensure a rapid fermentation. After fermentation is complete a brief aging period before packaging helps ensure a good cell density in the package. But yeast does settle in the keg or bottle and it helps to gently rock the keg or bottle before serving to move yeast that has settled back into solution.

I am surprised that the beer you brewed using the White Labs American Hefeweizen strain turned out clear since that strain is described as having low flocculation properties. The yeast is even described as the strain used for Oregon-style weizen, which I interpret to be "Widmer yeast." You may want to try this again and use a higher pitching rate in order to shorten your fermentation time and also give you a higher yeast density before packaging. I do not suggest packaging before fermentation is complete. If you wait until the specific gravity is steady and allow a couple of days for diacetyl and acetaldehyde reduction, you will be fine to package.

Aged hops?

My grandfather asked during a recent visit if I would want an old grain mill of his. When we went down in the basement to get it, we came across a couple homebrew kits from 1986! Along with bulging cans of malt extract, corn sugar bricks and white envelopes labeled "bottom fermenting beer yeast" were a few ounces of Cluster hop pellets. Tan and smelling of brown sugar and wet cardboard (my roommate proclaimed they smelled like his grandpa's house) I wondered if this was a bit more than the "aged hops" called for in lambics. Will these hops that

were grown and crushed into pellets while I was learning how to walk have any positive affect on a lambic-style homebrew, or are they well and truly past even their "aged" prime? Any chance those bulging cans of malt extract are good for any brewing application?

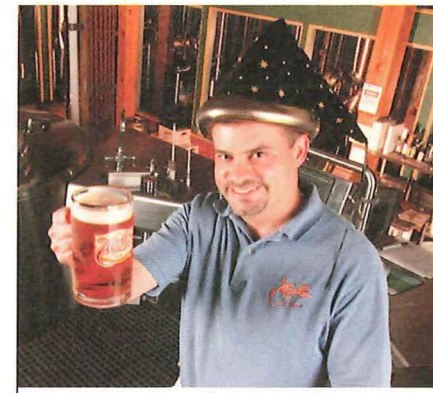
Ross Druckenmiller
Brighton, Massachusetts

In general, good beer begins with good ingredients. Malt extract darkens over time and the flavor of the extract in that old can probably tastes very, very unusual. While it could be used as a fermentable, the resulting beer will probably disappoint. Speaking of fermentation, you may want to remove the temptation of using the old yeast hidden under the lid of the homebrew kit in question and go ahead and flush it down the toilet because you sound dangerously close to making a batch of beer with this old kit!

The hops are indeed well aged, but probably not what you read about in books about lambics. My assessment about the stories you read about aged hops going into lambics translates into lambic brewers not wanting hoppiness in their beers because bitter and sour clash. Aged hops do add compounds to the lambic wort that inhibit the growth of certain spoilage bacteria. This seems contrary to a style that epitomizes beer spoilage, but one must remember that lambics contain a specific range of microbes and that there is a pattern to what can be incorrectly perceived as randomness.

I must confess that I have never been to Belgium and my knowledge of these beers is limited, although I did have the pleasure of drinking some of Jean-Xavier Guinard's experiments at UC-Davis. With that being said, old hops smelling of must and mildew have no place in the brewery. Lambics are not the result of reckless and accidental brewing methods.

Enjoy your discovery for what it may be worth, but don't put too much hope in any beer you brew with the old malt and hops.



Brew Your Own Technical Editor Ashton Lewis has been answering homebrew questions as his alter ego Mr. Wizard since 1995. A collection of his Wizard columns have been released in *The Homebrewer's Answer Book*, available online at brewyourownstore.com. Ashton works by day as Master Brewer at Springfield Brewing Company and also designs commercial brewing systems for Paul Mueller Company in Missouri.

Do you have a homebrewing question for Ashton? Send inquiries to *Brew Your Own*, 5515 Main Street, Manchester Center, VT 05255 or send your e-mail to wiz@byo.com. If you submit your question by e-mail, please include your full name and hometown. In every issue, the Wizard will select a few questions for publication. Unfortunately, he can't respond personally. Sorry!

Bohemian Pilsener

Crisp, balanced and spicy

by Jamil Zainasheff

Czech or Bohemian-style Pilsener is one of those styles that many new brewers want to learn to brew perfectly. While still crisp like other Pilsener-style beers, Bohemian-style Pilsener has a spicy hop character and a nice, rich, complex maltiness. Bohemian-style Pilsener usually has a bit more malt sweetness than German-style Pilseners, which helps counter the substantial hop bitterness, making it a more balanced, well-rounded beer.

Back in 1842 Bohemian Pilsener was the first clear, pale-colored beer. Even though it was the palest beer back then, Bohemian Pilsener tends to be slightly richer in color than many "modern" Pilsner beers. It ranges from very pale gold to a deep burnished gold. Just as the measure of what is the lightest colored beer style has shifted over time, today there is also a shift occurring when it comes to describing beer styles. What was "high gravity" and "hoppy" just ten or fifteen years ago, means something different on today's beer menu. With the advent and popularity of styles such as Imperial IPA and the hop/alcohol creep that has occurred (mainly on the west coast of the US) over the past few years, the beer that the average brewer or drinker has in mind when you say "hoppy" has shifted. When I started brewing, the material I read often described Bohemian Pilsener as a hoppy beer. While Bohemian Pilseners should have an obvious hop flavor and aroma, don't expect a big, bursty hop aroma or over-the-top flavor. Obvious but integrated is perhaps a better way to describe the hop character of Bohemian Pilsener. The BJCP style guidelines describe the hop character as a complex and pronounced spicy, floral hop bouquet. That is a good description, but don't think it means a bold hop character. Bohemian Pilsener is rich, but not heavy. Bitter, but not without balance. Hoppy, but without covering up the malt. Clean, but not without fermentation character. The malt character is bready and in balance with the hop flavor, hop aroma, and hop bitterness. Not too bold on either front, these characteristics are just strong enough to be obvious to the drinker. When tasting a well made Bohemian Pilsener, all of these flavors seem to end at the same time in the finish.

I prefer a nice continental Pilsner malt for brewing Bohemian Pilsener. You can use other pale malts if you have no other option, but the light, grainy taste of high quality Pilsner malt is right on target for this style. That is all you need for a great Bohemian Pilsener. You can enhance the malty flavors with a small addition of Vienna, light Munich or melanoidin malt, but keep the percentage to less than 5% of

Continued on page 21

BOHEMIAN PILSENER by the numbers

OG:	1.044–1.056 (11–13.8 °P)
FG:	1.013–1.017 (3.3–4.3 °P)
SRM:	3.5–6
IBU:	35–45
ABV:	4.2–5.4%

RECIPE

Bohemian Pilsener

(5 gallons/19 L, extract)
OG = 1.056 (13.9 °P)
FG = 1.016 (4.2 °P)
IBU = 40 SRM = 4 ABV = 5.3%

Ingredients

8.0 lb. (3.6 kg) Briess Pilsen liquid malt extract
4.83 AAU Czech Saaz hops (1.38 oz./39 g at 3.5% alpha acids) (60 min)
5.8 AAU Czech Saaz hops (1.67 oz./47 g at 3.5% alpha acids) (30 min)
2.9 AAU Czech Saaz hops (0.83 oz./24 g at 3.5% alpha acids) (10 min)
2.9 AAU Czech Saaz hops (0.83 oz./24 g at 3.5% alpha acid) (0 min)
White Labs WLP800 (Pilsner Lager), Wyeast 2001 (Urquell) or Fermentis Saflager S-23 yeast

Step by Step

Making an extract version of this beer couldn't be easier if you have access to Briess Pilsen malt extract. The Briess Pilsen extract contains both Pilsner malt and Carapils. Use an appropriate amount of dried extract if you can't get the liquid version. If you can't get Briess extract, any fresh, high quality light color extract made from Pilsner malt will work well. Always choose the freshest extract that fits the beer style.

Add enough water to the malt extract to make a pre-boil volume of 6.5 gallons (25 L) and the gravity is 1.044 (10.9 °P). Stir thoroughly to dissolve the extract and bring to a boil.

The total wort boil time is 90 minutes. Add the first hop addition with 60 minutes remaining in the boil. The other hop additions are at 30, 10, and zero minutes left 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 20 grams of properly rehydrated dry yeast, four packages of liquid yeast or one package of liquid yeast in a 9-liter starter.

Ferment around 50 °F (10 °C) until the yeast drops clear. With healthy yeast, fermentation should be complete in two weeks or less, but don't 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 the finished beer to a keg and force carbonate or rack to a bottling bucket, add the 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 mellow some of the flavors and improve the beer. Serve at 43 to 46 °F (6 to 8 °C).

Bohemian Pilsener

(5 gallons/19 L, all-grain)

OG = 1.056 (13.9 °P)
FG = 1.016 (4.2 °P)
IBU = 40 SRM = 4 ABV = 5.3%

Ingredients

10.75 lb. (4.8 kg) Durst continental Pilsner malt (or similar) 2 °L
0.75 lb. (340 g) Briess Carapils® malt (or similar) 2 °L
4.83 AAU Czech Saaz hops (1.38 oz./39 g for 3.5% alpha acid) (60 min)
5.8 AAU Czech Saaz hops (1.67 oz./47 g for 3.5% alpha acid) (30 min)
2.9 AAU Czech Saaz hops (0.83 oz./24 g of 3.5% alpha acid) (10 min)
2.9 AAU Czech Saaz hops (0.83 oz./24 g of 3.5% alpha acid) (0 min)
White Labs WLP800 (Pilsner Lager), Wyeast 2001 (Urquell) or Fermentis Saflager S-23 yeast

Step by Step

Mill the grains and dough-in targeting a mash of around 1.5 quarts of water to 1 pound of grain (a liquor-to-grist ratio of about 3:1 by weight) and a temperature of 154 °F (68 °C). Hold the mash at 154 °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 1.044 (10.9 °P).

The total wort boil time is 90 minutes, which helps reduce the SMM (S-methyl methionine) present in the lightly-kilned Pilsner malt and results in less DMS (Dimethyl Sulfide) in the finished beer. Add the first hop addition with 60 minutes remaining in the boil. The other hop additions are at 30, 10, and zero minutes left 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 20 grams of properly rehydrated dry yeast, four packages of liquid yeast or one package of liquid yeast in a 9-liter starter.

Ferment around 50 °F (10 °C) until the yeast drops clear. With healthy yeast, fermentation should be complete in two weeks or less, but don't 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 the finished beer to a keg and force carbonate or rack to a bottling bucket, add the 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 mellow some of the flavors and improve the beer. Serve at 43 to 46 °F (6 to 8 °C).

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the grain bill. You don't want to overdo the clean, restrained malt flavors of this beer and you never want to add things like caramel malts. The sweetness and flavor of caramel malts add the wrong character. There is one exception, which is head and body forming dextrin malts such as Carapils. These malts have very little flavor impact, but it is best to keep these between 0 and 10% of the grist.

Extract brewers should use a Pilsner-like malt extract that attenuates in the range of 70% or more. Most light-colored extracts will attenuate fairly well and should be close enough. There are several good Pilsner or pilsner-type extracts out there, so finding one should not be too difficult for most brewers.

> "You don't want to overdo the clean, restrained malt flavors of this beer and you never want to add things like caramel malts."

Historically, a brewer would use a decoction mash when brewing a Bohemian Pilsener and some breweries still use this time proven method with under-modified malts. While a decoction mash might produce some subtle differences, I find that high quality continental Pilsner malt and a single infusion mash will produce a beer every bit as good as the best commercial examples and even a best of show winner. It is far more important to pay attention to fermentation, sanitation and post-fermentation handling than worrying about decoction. If you've ensured that all of those other aspects of your process are flawless, then maybe it is time to worry about decoctions. Of course, there are still breweries in the Czech Republic that brew their Pilsener with a decoction mash. Tony Powell, Head Brewer at Fish Brewing Company is also a big proponent of decoction. He reports that on a recent trip to Europe he found a number of brewers still passionate about decoction mash as a critical component of their process. If you want to brew this style in a traditional manner also, go with a double decoction, open fermentation and a minimum of 45 days of lagering.

I like to avoid any work I really don't have to do, so I prefer a single infusion mash. I target a mash temperature range of 152 to 156 °F (67 to 69 °C). If you are making a lower gravity beer, use the higher end of this temperature range to leave the beer with a bit more body. While this may seem like a fairly high mash temperature, keep in mind that lager yeast will consume more of the tri-saccharide maltotriose than the average ale yeast. While we don't want bock-like body, we do want the fully attenuated beer to still have a fairly full mouthfeel.

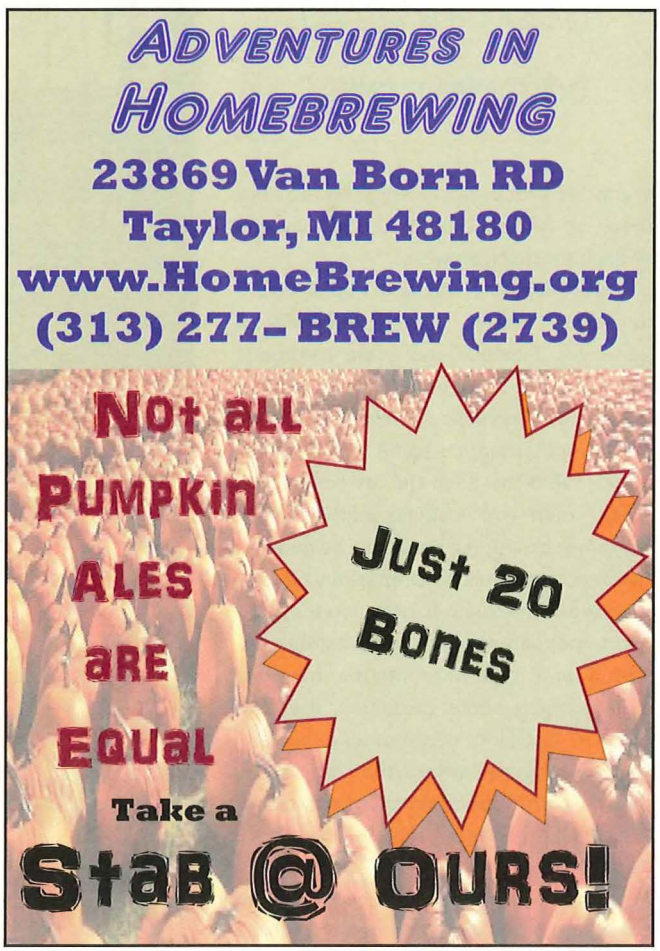
I've never been a proponent of messing with brewing water needlessly, but for Bohemian Pilsener I make an exception. Many commercial breweries typically use water with a low mineral content and it makes a significant difference.

You can make a fine example of the style with most water, but low carbonate water helps match the character of the classic examples. You can build your water from scratch, but if your water has moderate alkalinity and you just want to get in the ballpark, try mixing your filtered tap water 50/50 with reverse osmosis or deionized water. If you have highly alkaline water, use a 25/75 mix of tap to reverse osmosis or deionized water. It is important not to use all reverse osmosis or deionized water with no mineral additions, as it lacks the buffering capacity and necessary minerals for all-grain brewing and for ideal fermentation.

In this style, hop flavor and aroma should always be present and should range from low to moderate. I really like using Czech Saaz hops, though sometimes they're hard to source. While many consider Czech Saaz hops a must in this style, you do have some flexibility. The trick is to select hops with that same spicy character. You don't want anything fruity or citrusy. Some decent substitutions are Tettnang, US Saaz, Polish Lublin, Sterling, Sladek, Ultra and Vanguard. If you can't source one of those substitutions and are determined to brew, you can get away with Hallertau, Spalt, Perle or Tradition. It is really the overall impression that matters. The big picture is that you want moderate hop character and a firm bitterness, but both should complement and integrate well with your malt and yeast choices. The balance of bittering versus malt sweetness should always be to the bitter side. You want a firm bittering presence, one that is obvious but not harsh. The bitterness to starting gravity ratio (IBU divided by OG) ranges from 0.6 to 1.0, but I like to target around 0.7 to 0.8.

A good Bohemian Pilsener isn't as clean as your typical German or American Pilsner. There aren't obvious fermentation flaws or anything "unclean" about the beer, but there is a very subtle background note of fermentation-derived compounds that add a certain fullness and interest to the beer. Some may point out the BJCP style guide's acceptance of diacetyl in this style. Yes, I suppose that is acceptable in very small amounts, but I don't think it is something to shoot for. In many cases I believe it may not be present at the brewery, but it is instead a fault that develops in the package with the oxidation of alpha-acetolactate into diacetyl over time.

You can ferment Bohemian Pilsener with almost any lager yeast, though my favorites are White Labs WLP800 Pilsner Lager and Wyeast 2001 Urquell. Other excellent strains are White Labs WLP802 Czech Budejovice Lager Yeast and Wyeast 2000 Budvar Lager, 2124 Bohemian Lager, and 2278 Czech Pils. You need around 400 billion clean, healthy cells to properly ferment 5 gallons (19 L) of this beer, which is double what you would use for an equivalent strength ale. For a simple, non-stirred



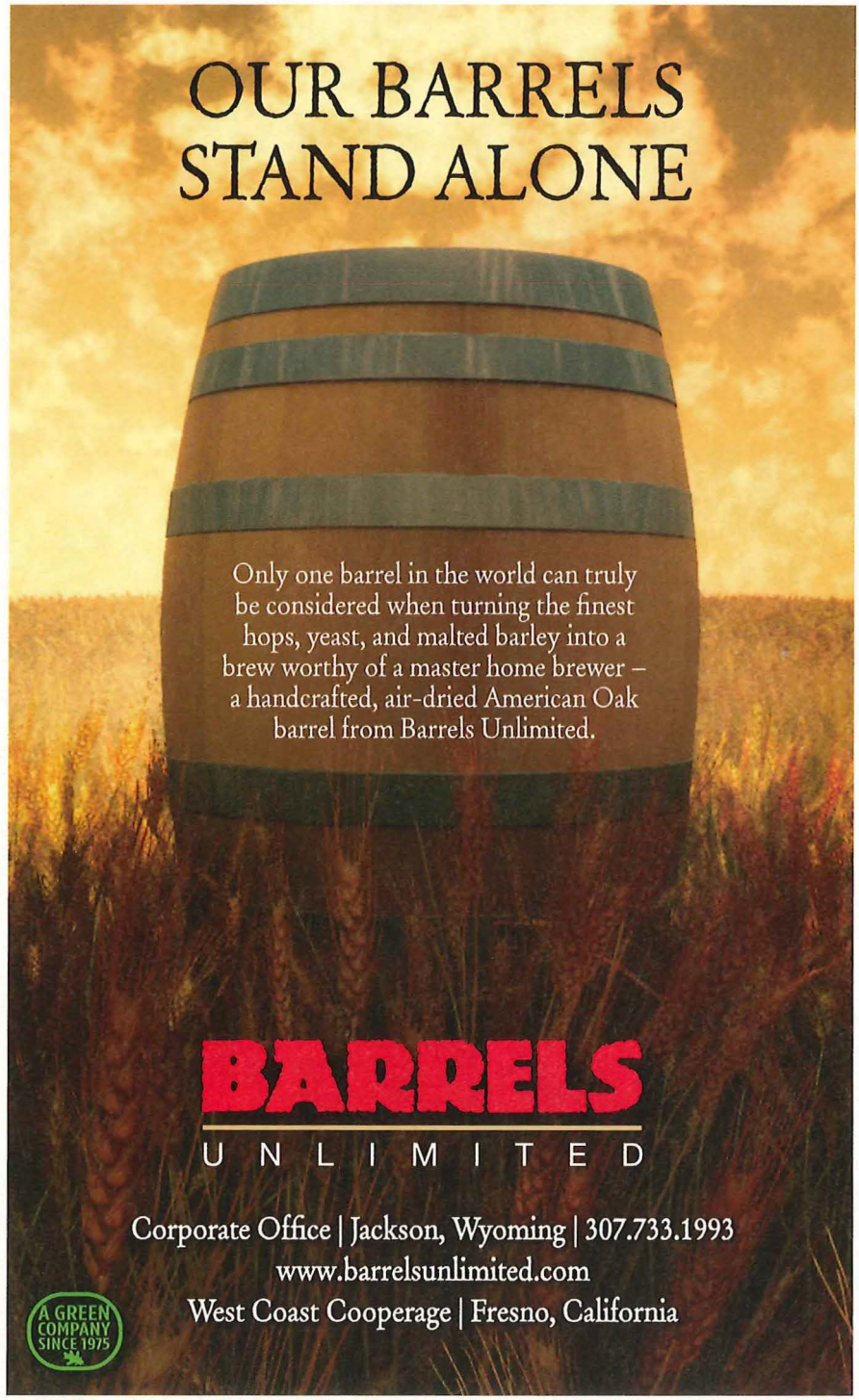
starter, one package of liquid yeast in 2.3 gallons (8.7 L) will result in the right amount of yeast. If you're not making a starter, you'll need about four packages of liquid yeast. If you're using dry yeast, use approximately ¾ ounce (20 g) of fresh, properly rehydrated yeast.

When making lagers, I like to get the wort down to 44 °F (7 °C), oxygenate and then pitch the 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. This

"Some may point out the BJCP style guide's acceptance of diacetyl in this style. In many cases I believe it may not be present at the brewery, but is instead a fault that develops in the package with the oxidation of alpha-acetolactate into diacetyl over time."

results in a clean lager, with very little diacetyl. The idea is to reduce the diacetyl precursor alpha-acetolactate, which the yeast create during the early phase of fermentation. With a warmer environment, the yeast form more alpha-acetolactate and the finished beer contains more diacetyl. Given time and the proper conditions, active yeast will convert the diacetyl to other compounds with a higher flavor threshold, but the lower the initial amount of diacetyl, the less there will be in the final beer. If you start or ferment your lager warmer, you will need to do a diacetyl rest during the last part of fermentation. To perform a diacetyl rest, warm your beer up about 10 °F (6 °C) until fermentation is complete and the yeast have had a chance to eliminate the diacetyl. In any case, don't rush things. Good lagers take time and they ferment slower than ales, especially when fermented cold. Once the beer has finished fermenting, a period of lagering for a month or more at near freezing temperatures can improve the beer.

Jamil Zainasheff is host of Can You Brew It, *a show about cloning your favorite commercial beers and* Brew Strong, *a show that answers technical questions about brewing. Both can be found on the Brewing Network. He writes the "Style Profile" column in every issue of* Brew Your Own.



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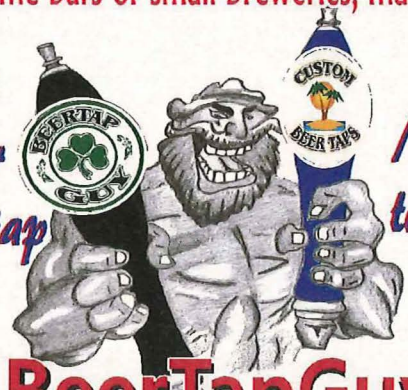

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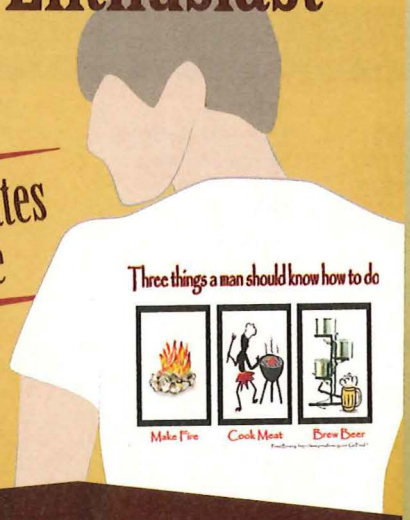

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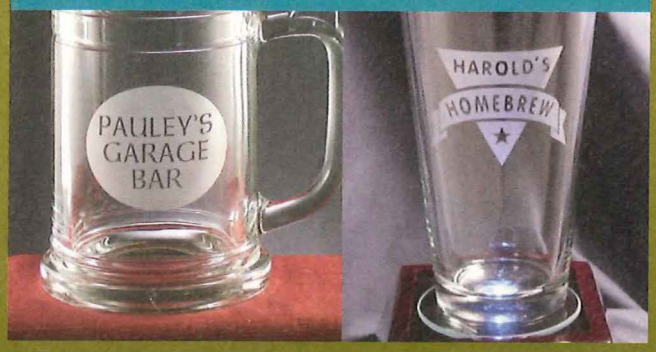

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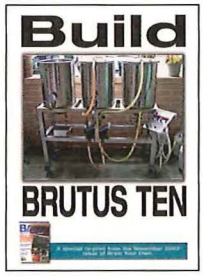

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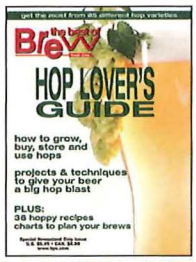

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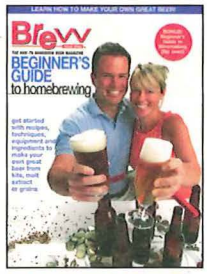

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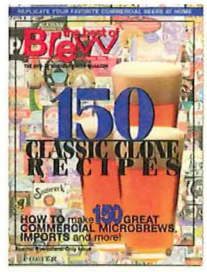

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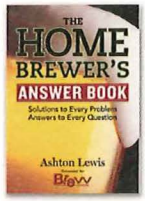

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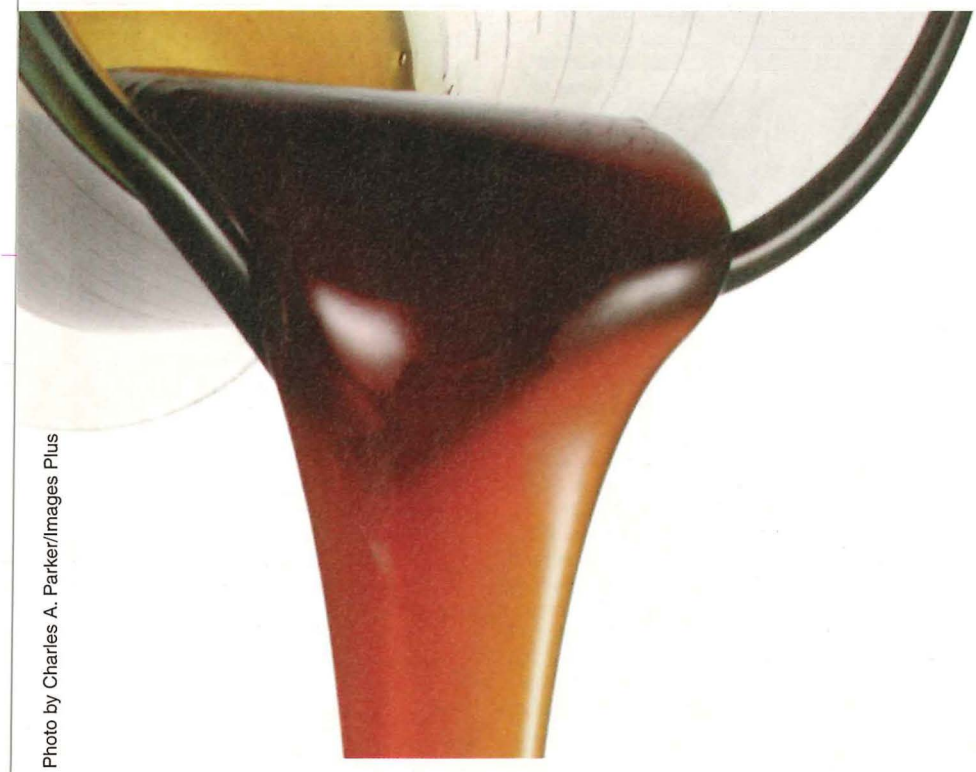
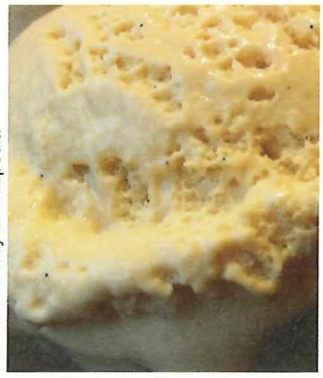


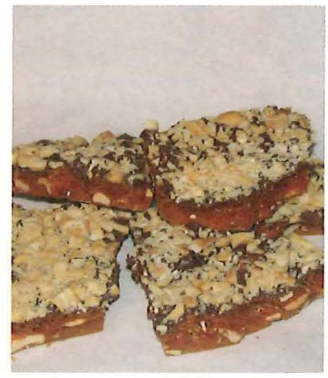
Photo by Charles A. Parker/Images Plus

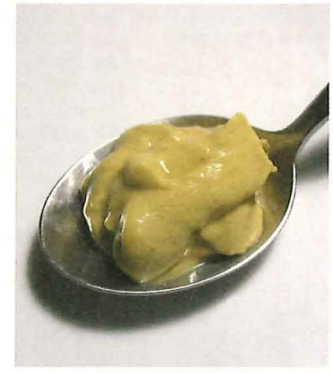
We North Americans crave sweets, but often we're told to eat foods that are natural and good for us. Homebrewers know the sweet secret of malt extracts – they can add sweetness and flavors ranging from caramel to chocolate to our creations – and they're good for you, too.

Malt extracts are naturally nutritious sweeteners, contributing colors ranging from buttery gold to dark brown and black, to recipes – whether beer, baked goods, cereal, crackers, desserts, barbecue sauces, marinades, pancakes, waffles, malt vinegars and more.

Brewery-grade malt extract can be used both for brewing and cooking. Malt extract begins by soaking the whole grains in water and allowing the grains to sprout or germinate. The sprouted grain is then dried and kilned. The grain, now malt, is then crushed and stirred into hot water in the mash. After mashing, the liquid wort is separated from the grain solids and concentrated.







Photos courtesy of Wikipedia

MALT ON THE MENU

an EXTRA USE for MALT EXTRACT

Judie Giebel, technical services, Briess Malts & Ingredients Co., Chilton, WI, explains, "If we're making liquid malt extract (LME) we cook it to 86 percent solids, and if we are making dry malt extract (DME) we dehydrate the liquid syrup to form solids that are then ground into powder." Dried malt extract is not hopped because the dehydration removes hop compounds.

Homebrewers often use malt extracts that have been hopped to create a specific beer style. But home cooks use malt extracts, or malt syrups, for sweetness without a sugary edge, compatible with savory breads, crackers, vegetables, mustards and sauces. The flavor of malt extract makes it a wonderful match with nuts, mocha, cocoa and chocolate.

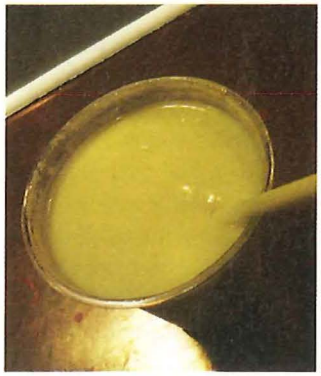
In the 1800s, malt was a staple of nutritional tonics, and malt syrups were thought to be especially good for babies. Malt-enhanced energy drinks such as the original form of Ovaltine were popular in England and Europe in the 1900s. But don't confuse pure malt extract with malted milk, which is made of a blend of malt extract, wheat flour and whole milk. The malted milk powder used in fountain drinks was the invention of William and James Horlick, patented in Racine, Wisconsin in 1883.

Beer ice creams benefit from a swirl of caramel malt extract added to the ice cream maker as it freezes. "Briess' CBW Sparkling Amber can be used in ice cream for smoothness," says Judie Giebel. However, too much malt extract or wort can create a soft-serve, oozy texture to the dessert, so a light swirl is all that's needed.

"It's a little tricky to make a smooth, creamy malt ice cream from reduced wort," said Darren Chadderdon, a former chef at Gordon Biersch's Palo Alto brewpub in a phone interview. "If there is too much, it will interfere with the fine ice crystal formation that you want in a frozen dessert." Guar gum is a natural ingredient that helps stabilize the crystal formation — I sometimes add just a little guar gum to the custard base of frozen malted custard, to keep the dessert smooth and creamy in texture.

Giebel says, "Light LME (nondiastatic, made from base malt) is a wonderful natural sweetener not only for ice cream (as it helps control crystallization), but also in any food that can benefit from low sweetness plus malty flavor (breads, crackers etc.). Caramel LME (nondiastatic, made from base and caramel malts) is excellent in pizza crust and other breads and shaped rolls. At a usage rate of about 3%, it not only adds a hint of great flavor but enhances fermentation and improves browning and crumb. Dark LME (nondiastatic, made from base and dark roasted malts like black malt) can provide natural color to hearth breads, sauces, gravies and all sorts of foods."

Malt extract is a favorite secret ingredient of many professional bakers and pastry chefs. Diastatic malt powder or barley



malt extracts are often used in professional bakeries to add nutrition, improve crumb texture and appearance, and enhance the keeping quality of the finished loaves. Breads that require second rises (pumpernickel, rye and other hearth breads) can benefit from a small dose.

That's because professional bakers evaluate bread by many characteristics beyond flavor and freshness. Breads are judged by their volume, symmetry, crust color, crust crispness, break and shred, grain, texture, aroma and mouthfeel. Many bakers agree that adding diastatic malt to bread dough will contribute to yeast baking success.

Unlike most brewery-grade malt extracts that you find at your local homebrew shop, diastatic malt contains natural enzymes, mainly amylases and proteases. This type of malt acts as a dough conditioner. It helps soften the dough, adds to the elasticity for shaping the dough (especially important in pizza crusts and crackers). In addition, the amylase also breaks starch down into sugars, which helps feed the yeast and aids in browning. The proteases break the proteins in the flour down into amino acids, aiding yeast growth, as well as improving the flavor and aroma in breads. You can find diastatic malt powder at baking supply stores. If an extract is diastatic, it will say so on the label.

Just replace a tablespoon of sugar or sweetener in your favorite bread recipe with a half-teaspoon of diastatic malt powder. Add malt extract to the warm water used to dissolve the yeast, stir till blended, and mix it into the dough for the first rise. "Just don't use too much or the dough will lose its structure and liquify," says Giebel.

But beware of adding too much malt extract or diastatic malt powder, since the increased yeast activity can cause problems. As homebrewers know, carbon dioxide and alcohol are the normal byproducts of yeast metabolism. Though alcohol is delightful in beer, it is less so in dough. The bread will be "overproofed," a baker's term that translates into gummy, sticky dough that's difficult to handle, and upon baking, yields a loaf that smells of alcohol, with a dense, unpalatable crust.

Non-diastatic malt is added simply as a sweetener or adding malt body, a hint of caramel color and flavor. With that in mind, be sure to use dried malt extract or unhopped malt extract.

The most abundant sugar in (nondiastatic) malt extract is maltose. Maltose is roughly half as sweet as glucose, a third as sweet as sucrose (table sugar) and about a fifth as sweet as fructose. It is roughly twice as sweet as lactose. You can use that as a rough guide if you are substituting malt dried extract for refined sugar in a recipe.

Malt extract also makes a superb natural substitute for sugar in marinades and barbecue sauces, as it contributes to browning, without the rapid burn or flare-ups from refined sugar. Malt in marinades will turn even the palest lobes of boneless, skinless chicken breasts into a golden-browned and appetizing entrée.

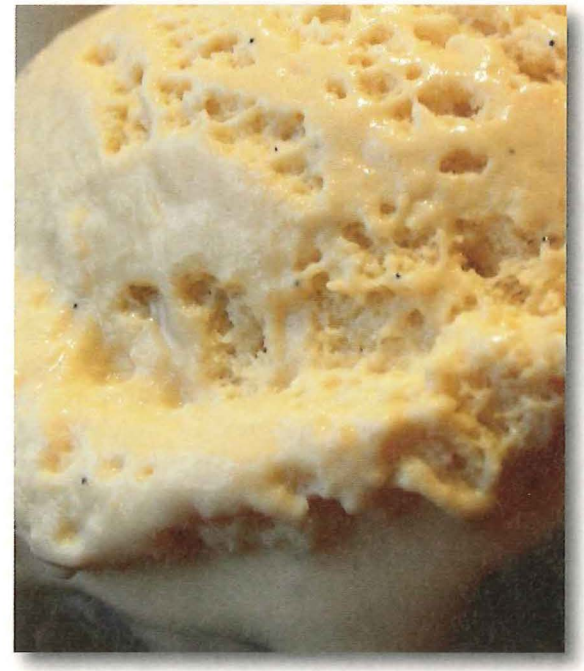
If you are adventurous, you can also make wort reductions from wort you collect from your all-grain brews. Wort boiled at atmospheric pressure cannot be condensed to the density of commercial malt extract without severely darkening it. However, you can make light syrups from wort and calculate the sugar content based on the specific gravity (see recipes). Here are some recipes to inspire you to put malt on the menu.

RECIPES

MALTED ICE CREAM

Ingredients

2 cups heavy cream
½ cup milk



4 oz. (~100 mL) dark beer
(such as a bock or schwarzbier)
2 tbsp. barley malt syrup
½ cup cane sugar
¼ cup powdered milk
4 egg yolks
Whole vanilla bean, cut into two, inside seeds removed (about ½ tsp. seed paste)
pinch of salt (less than ⅛ tsp.)
¼ tsp. guar gum (optional – helps ice cream ripen and crystallize smoothly)

Step by Step

In a large stainless-steel mixing bowl, whisk together cream, milk, beer, barley malt syrup, sugar, powdered milk, egg yolks, vanilla bean paste and a pinch of salt. Whisk until smooth. Place 2 cups water in a large, 2-quart heavy saucepan and bring to a boil over high heat. Reduce heat to low, and when water is simmering, place the mixing bowl over the pan – the base of the bowl should fit securely inside the pan, but not sit in the hot water as the custard should be heated by steam alone. Whisk the egg-beer-cream mixture continually over the steam until the blend is thickened and

temperature reaches 180 °F (82 °C). Do not let water boil or the mixture will curdle. Remove from the heat and add guar gum if desired. Whisk well to blend, and then pour the custard through a fine mesh sieve into a large glass bowl. Cool until lukewarm, and then cover and chill for 4 hours or overnight. Freeze the custard in an ice cream maker, according to the manufacturer's instructions. Place the frozen ice cream in a large, resealable container and freeze for 6 hours, or until solid enough to scoop. Makes 1 scant quart.

Note: David Lebovitz, in his cookbook, *The Perfect Scoop* (Ten Speed Press, 2007), recommends the addition of chopped malted milk balls to his version of malted ice cream, made with malted milk powder instead of barley malt extract. You can also spread the soft ice cream on sliced thin stout brownies to make ice cream bars, topped with malt chocolate ganache, assembled, sliced and frozen until firm.

MALT CHOCOLATE GANACHE

Ingredients

3 oz. (85 g) semisweet chocolate
¼ cup whipping cream

1 tbsp. dark malt extract
⅓ cup powdered sugar, sifted

Step by Step

Melt chocolate in microwave on high (100% power) 2 minutes, then stir until completely melted, and stir in cream and malt extract. Beat with electric mixer on high speed until fluffy, then gradually add powdered sugar to get a thicker frosting.

Makes ½ cup.

SPICED MALT-NUT CRUNCH

Ingredients

½ cup butter
3 tbsp. dark malt extract

2 tbsp. light corn syrup
½ cup dark brown sugar
¼ cup cane sugar
½ tsp. baking soda
1 tsp. ground ginger
1 tsp. ground black pepper
1 tsp. salt
1 cup shelled raw peanuts
1 cup shelled raw almonds
¼ cup ground caramel malted barley (optional)
4 cups popcorn

Step by Step

In a large heavy Dutch oven over medium heat, combine the butter, malt extract and sugar. Stir until butter melts and mixture begins to boil. Reduce heat to low and continue cooking, without stirring, for 5 minutes.

Preheat oven to 300 °F (150 °C). In a small bowl, mix together baking soda, ginger, pepper and salt. Remove pan from heat and stir in baking soda and spices, stirring well to blend evenly. Hot syrup will foam a bit. Stir in nuts and ground malted barley if using, mix well, and then stir in popcorn to coat evenly. Scrape mixture onto parchment-lined baking sheet and spread evenly.

Bake 15–20 minutes, stirring with a long-handled wooden spoon so mixture toasts evenly and remove from heat. Break into chunks once cool. The mixture will be a little sticky.

Makes 6 cups.

MALTY MUSTARD

Ingredients

¼ cup brown sugar
1 cup dark ale

2 tbsp. brown mustard seeds
2 tbsp. powdered mustard
½ cup apple cider vinegar
2 shallots (peeled and minced)
1 tsp. salt
½ tsp. finely ground black pepper
2 egg yolks
2 tbsp. butter (melted)

Step by Step

Blend all ingredients in a blender or food processor on high until smooth. Spoon mixture into the top of a double boiler. Cook over simmering (not boiling) water until thickened and steaming, about 10 minutes, whisking often to prevent curdling. Let cool to room temperature, scrape mustard into a resealable, sterilized glass jar. Chill before serving. Mustard keeps, refrigerated, for up to 2 weeks.

Makes 2 scant cups mustard.

MALTY MANGO MARINADE

This piquant blend of fresh mango, pureed with Pilsner, lemon zest, and herbs, adds flavor and moisture to white, bland fish such as cod or had-

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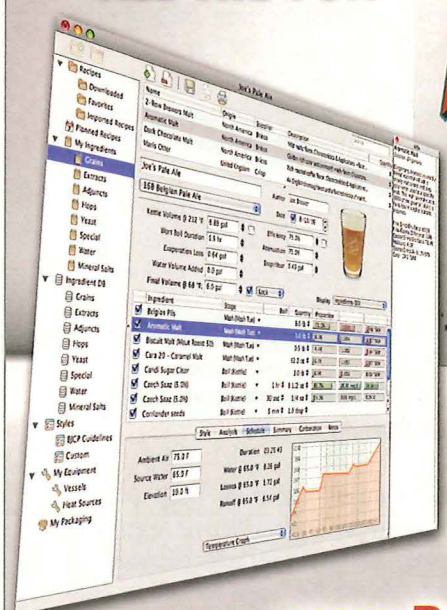

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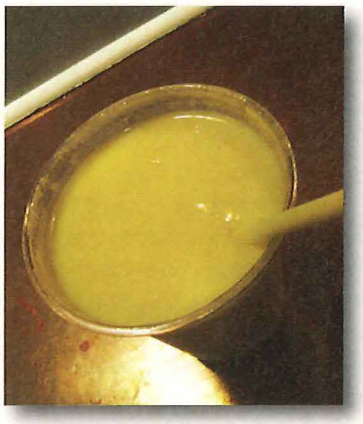
dock. Punch up the seasonings if using this marinade with a more robust, oily fish such as bluefish or shark.

Ingredients

¼ cup olive oil
12 oz. (355 mL) Pilsner beer



1 tsp. minced lemon zest
½ cup diced mango
2 tsp. minced summer savory (fresh)
½ tsp. pink peppercorns
1 tsp. lemon juice
1 tbsp. barley malt extract
1 tsp. minced green scallion tops or chives (fresh)
1.5–2.0 lbs. (0.68–0.91) fish filets

Step by Step

Mix all the ingredients in a blender. Pour over fish placed in a glass or other nonreactive dish. Cover and chill for at least 1 hour. Grill for 2 to 3 minutes per side, depending on the thickness of filet or until fish is opaque throughout and golden on the surface. Serve immediately.

PORTER PORK PAINT

Ingredients

½ cup butter
1 cup diced sweet onion
¼ cup malt vinegar
Juice of 1 lemon
¼ cup barley malt extract
¼ cup Worcestershire sauce
3 tbsp. mild or hot paprika

2 tbsp. dry mustard
1–2 tsp. white pepper
12 oz. (355 mL) Porter

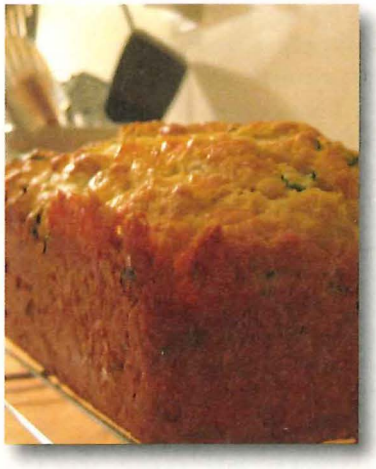
Step by Step

Combine all ingredients in a medium (two-quart) nonreactive saucepan and simmer 20 minutes. Puree with hand-held stick blender, or let cool and puree in a standard blender. Excellent on pork ribs. Yields about 3 cups.

MALTED HERB-CHEESE BREAD

Ingredients

2 ½ cups self-rising flour
¼ cup whole wheat flour



12 ounces amber ale
1 tbsp. dried dill weed
3 tbsp. ricotta cheese
2 tbsp. melted butter
1 tbsp. malt extract

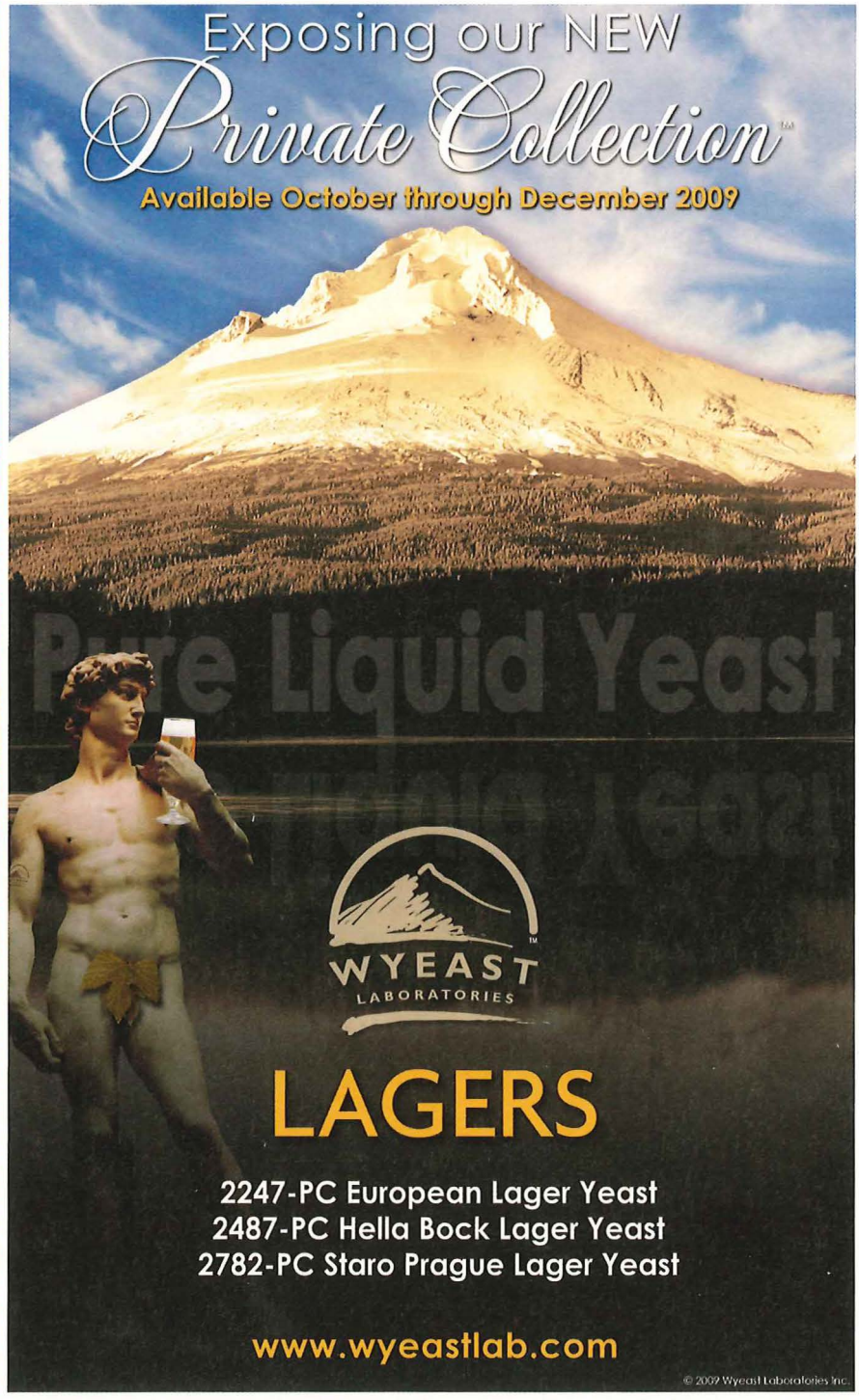
Step by Step

Preheat oven to 375 °F (190 °C). Mix all ingredients in a large mixing bowl, by hand with a spatula (do not use an electric mixer). Mix just until batter forms. Scrape sides of bowl, stir, and scrape batter into a buttered bread loaf pan. Tap pan on the counter top to settle batter, and smooth top with spatula. Bake 45 minutes, or until loaf is well browned. Let cool 10 minutes before removing from baking pan. Loaf is crumbly in texture, better torn than sliced. Makes one loaf.

MALTED PRETZEL ROLLS

Ingredients

2 cups warm water
(105–110 °F/41–43 °C)
one (¼-ounce) envelope active dried yeast



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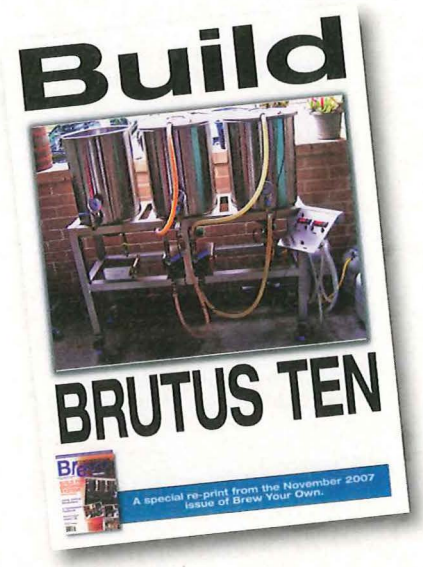

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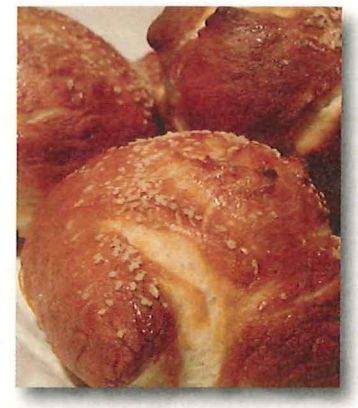


4.5 to 5 cups bread flour
2 tbsp. cane sugar
½ tsp. finely ground salt
2 tbsp. canola oil, divided
Kosher salt or pretzel salt (for topping)
6 cups water
3 tbsp. baking soda
2 tbsp. dark malt extract

Step by Step

For best results, use a stand mixer to prepare the pretzel dough. Place 2 cups of warm water in the bowl of a stand mixer and stir in the yeast. Set aside for 5 minutes, or until the yeast bubbles.

Place flour, sugar, and ½ tsp. salt in a large bowl and whisk well until fluffy. Once yeast is ready, secure the bowl on the stand mixer, attach the dough hook, and add flour all at once. Mix on low until dough forms, then increase to medium to knead the dough until smooth, about 6–8 minutes.

Form dough into a ball, place in a large mixing bowl, oiled with 1.5 tbsp. canola oil, and turn ball to coat evenly in oil. Cover with a clean, damp tea towel, and let rest in a warm place until dough doubles, about ½ hour. Line a baking sheet with parchment paper, coat paper with remaining vegetable oil, and set aside.

Punch down the dough and knead for 2 minutes. Divide dough in half, in half again, and

repeat until you have 16 pieces; form into rectangular or oval rolls. Place rolls on the baking sheet and cut four 2-inch diagonal slashes across the top of each. Cover with a damp towel and let dough rise in a warm place until almost doubled in volume, about 15 to 20 minutes.

Preheat oven to 425 °F (220 °C) and bring 6 cups water to a boil in a large 2-qt. (2-L) saucepan over high heat. Stir baking soda and malt extract into boiling water. Using a slotted spoon, place doughy rolls, two at a time, in the boiling malted water. Turn and stir so rolls don't stick together, and boil about 30 seconds on each side. With the slotted spoon, remove rolls, drain, and place on the baking sheet, cut side up. Repeat with remaining dough rolls. Sprinkle the boiled rolls well with kosher or pearl salt. Bake 12 to 15 minutes, or until well browned. Let the bread cool to lukewarm and serve.

HOMEMADE MALT SYRUP

Ingredients

malted barley (your choice)

Step by Step

When making an all-grain beer, mash as usual and recirculate. Making a thick, single-infusion mash and not adding any water to mash out will help you make a thicker extract. Collect some of the first runnings, before any sparge water has been added. Measure the volume of this wort and its specific gravity. Boil the wort gently until it thickens, stopping before it darkens excessively or starts tasting like scorched sugar. You can estimate the percentage of sugar in your malt extract by multiplying the initial volume times the density measured in °Plato. Divide this product by the final volume of the syrup. This number is the approximate percentage of sugar in the condensed syrup.

DIASTATIC WORT

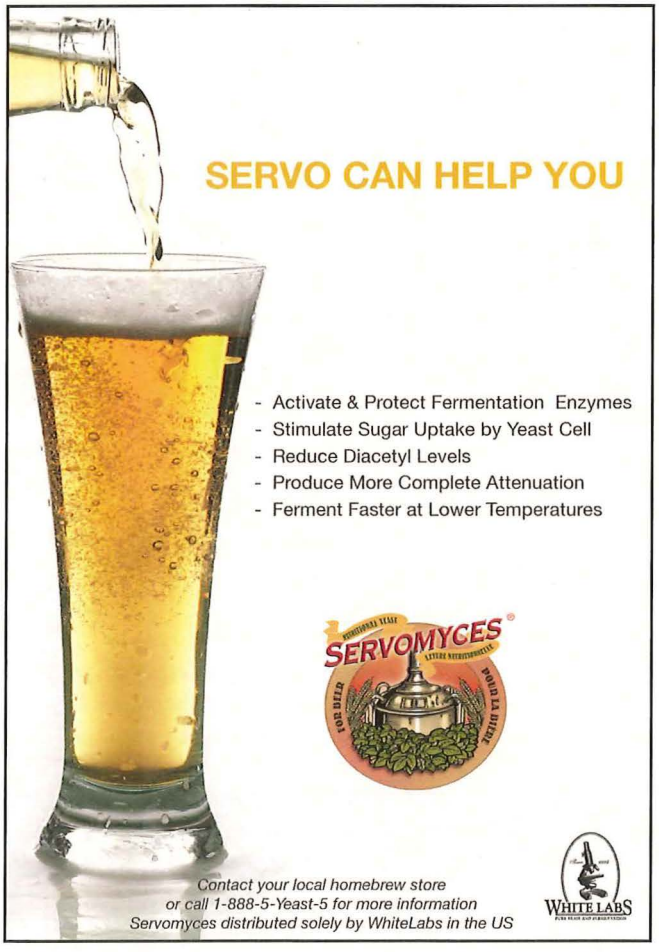
Ingredients

domestic 2-row or 6-row malt
water (w/ Ca^{2+} > 100 ppm)

Step by Step

Mash the grains in a thick mash at 148 °F (64 °C) for 20 minutes. Do not raise the temperature for a mash out. Recirculate and draw off clear wort. Do not boil. Cool wort and use within a few hours of making it. (Otherwise, it will turn sour.) The density of your solution (in °Plato) gives the approximate sugar content (as a percent). You can substitute this for a small amount of the liquid called for in any bread recipe.

Lucy Saunders is the author of "Cooking with Beer" *(Time Life Books, 1996).*



Story by **TERRY BADMAN**

SCALE BREWING BIG IDEAS FOR SMALL SPACES

NOT EVERYONE IS BLESSED WITH A LOT OF SPACE to allocate for homebrewing. Homebrewers who live in the suburbs or country may have a two-car garage, carport or driveway in which to set up their collection of brewing vessels. They may even have a basement large enough to brew in. Apartment dwellers, though, may only have space for a fold-up futon, a mini-fridge and a 10-inch TV set.

"I brew small-scale to make the most of what I have available with the resources God has given me," said Casper, Wyoming, resident Rich Weaver. "(But) sometimes it feels so small it makes me tense."

Weaver has lived in his teensy apartment for eight years. His landlord won't let him install an extra refrigerator because it would trip the breakers. The fire extinguisher outside his apart-

"Bigger isn't always better. Sometimes a brewery with a small footprint will better fit your needs — and maybe even help you brew better beer"

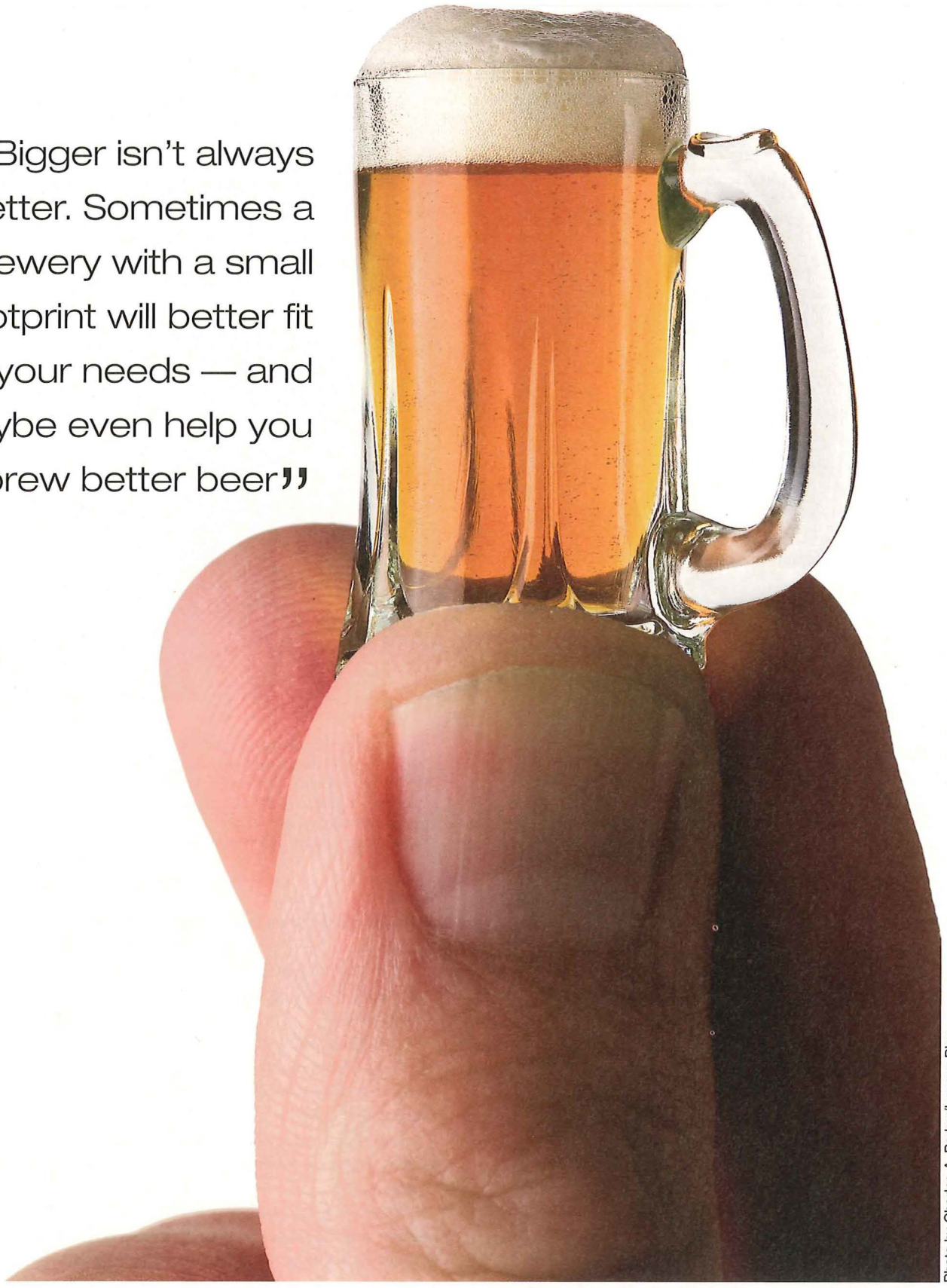


Photo by Charles A. Parker/Images Plus

A SMALL, BALANCED SETUP

For most of graduate school, I lived in a one-bedroom apartment in Allston, Massachusetts — i.e. Boston's "student ghetto." Towards the end of my studies, I was brewing 5.0–6.0 gallon (19–23 L) all-grain batches, but my apartment had brewing equipment scattered everywhere. If I had known what I know today, I would have scaled down and freed up more living space — and maybe even brewed better beer as a result. So, for graduate students everywhere — and anyone else living in a cramped apartment — here are my recommendations for a balanced, 3.0-gallon (11-L) brewing system. This equipment is all geared for efficiently brewing, conditioning and serving 3.0-gallon (11-L) brews.

Mashing: A 5.0-gallon (19-L) Gott or Rubbermaid cooler can serve as the mash/lauter tun. You can place the grains in a large nylon steeping bag and use the cooler without any modifications. Or, better yet, you could install a manifold (see page 48). With a 5.0-gallon (19-L) mash tun, you can easily mash up to 10 lbs. (4.5 kg) of grain — enough to make 3.0 gallons (11 L) of wort at a specific gravity of 1.080, assuming 65% extract efficiency.

Boiling: A 20-qt. (19-L) stainless steel "lobster pot" would work well as a brewpot for 3.0-gallon (11-L) all-grain batches. You could collect 4.0 gallons (15 L) of pre-boil wort and, with a watchful eye when the boil starts, avoid boilovers. Additionally, a smaller boil volume would translate to a more vigorous boil on an underpowered student apartment stove.

Fermentation: A 5.0-gallon (19-L) carboy or food-grade bucket would serve as a primary fermenter. You could skip secondary fermentation, or use a 3.0-gallon (11-L) carboy for conditioning if you needed to free up the "big" carboy. Simple cooling methods, such as the wet T-shirt approach, are more effective at this volume than for 5.0-gallon (19-L) brews.

Packaging: Small, student apartments usually come with small refrigerators. Some space-saving packaging options include two 6-L Tap-a-Draft bottles, two 5-L mini-kegs or a Party Pig (2.25 gallons/8.5 L). The last two would also require a few 22-oz "bombers" for the last bit of beer. Fewer bottles to fill means fewer hassles, and more time to enjoy your beer.

- Chris Colby

Ray Snyder (Kelowna, British Columbia) brews 1-gallon (3.8-L) batches using mostly ordinary kitchen equipment. His efforts yield 11 12-oz. (355 mL) bottles per brewing session. For most homebrewers, 1-gallon (3.8-L) batches are only brewed when making an experimental beer with a very expensive special ingredient or when doing a split batch experiment.

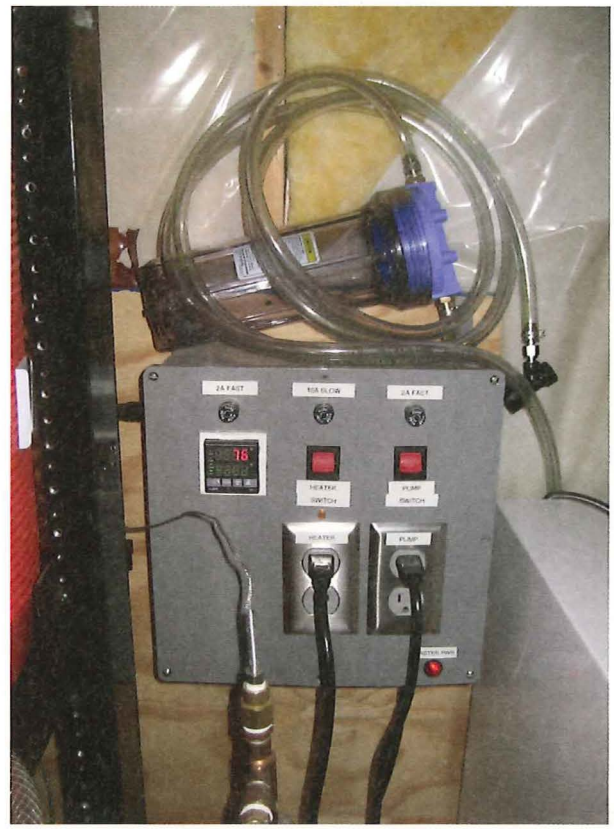
ment door hasn't been inspected in nearly a decade — and yet, he still brews.

With limited space, Weaver built a brew rack for all of his extract and partial mash brewing essentials on the most logical place he had, his stove.

"My setup only cost $15 as most of the equipment was donated by a very special friend," Weaver said. "I have to change the kitchen faucet to adapt to the brass bottle washer . . . but everything is right there when I need it."

Bob Nihart, a 48-year-old business owner from Spring Lake Park, Minnesota, chose a different place to brew – in his basement's tiny utility room.

"The room is 8-feet by 8-feet (2.4 x 2.4 m), but with all the shelves, water heater, and other stuff packed in there, I have about a 5-feet by 5-feet (1.5 X 1.5 m) space to work in," Nihart said. "(My



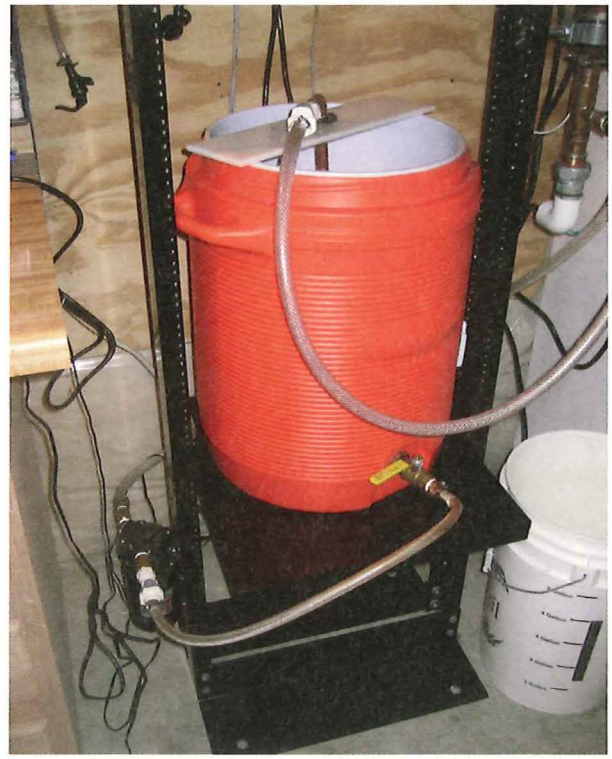
brewing) footprint is 19 inches by 24 inches (48 X 61 cm) and could easily fit inside a hall closet."

Nihart's all-grain system, which features a pair of 10-gallon (38-L) coolers, an Ebay-purchased pump, a RIMS heater and temperature control system that he designed, cost him about $400 to build. He also built the rack system that supports the tun, HLT, pump and RIMS by hand.

"I built it so I didn't have to continually tear down the system every time I used it," he said. "When I'm done brewing, everything goes back onto the rack and it's up and out of the way."

Some small-scale homebrewers, like retired police officer Ray Snyder, have even fewer options.

"I brew my beer in 1-gallon (~4-L) batches on my kitchen stove, using regular cooking pots and utensils," Snyder said.



Bob Nihart's (Spring Lake Park, Minnesota) brewery occupies only 19 inches by 24 inches (48 X 61 cm) in his utility room. Nihart's brewery is a RIMS (recirculated infusion mash system), based on two 10-gallon (38-L) coolers — HLT on top, mash/lauter tun on the bottom — a pump, and a heater. It cost about $400 to build.

NO-BOIL KIT SOLUTION

One of the easiest and most compact ways for space-conscious homebrewers to brew a great beer is by using beer kits. These kits come complete with all the ingredients you need to get started and don't usually require a great deal of extra space or supplies (though you'll need your own bottles or kegging set-up). Some kits also call for the addition of dried malt extract so be sure to read the instructions prior to brew day.

Even simpler are pre-hopped extract kits that don't require a wort boil. Extract-based no-boil kits only need a couple of gallons of water heated to the appropriate temperature and then the hopped malt extract added. Steeping time can be as short as 15 minutes and a quick cooling only calls for the addition of more water. The no-boil method can produce a very light colored brew, and the need to worry about levels of hops or specialty malts is already taken care of by the extract manufacturer. Kits are also designed to produce a specific style of beer, so all you'll need to know to start brewing is what type of beer you'd like to make. Additionally, many no-boil extract kits can produce a nice base for fruit beers or sour ales.

Equipment required for a no-boil brew requires little more than what's probably already in your kitchen. A 3–5 gallon (11–19 L) capacity cooking pot, quick-read thermometer, sturdy and sanitizable spoon, hot stovetop, and an all-in-one canned extract beer kit is all you'll need to start. Other essential items, such as equipment sanitizers, a fermenting bucket, bottles and bottle caps can be found at your neighborhood homebrew shop.

Here is a list of the most commonly available no-boil pre-hopped kit brands and their websites:

Barons: www.winexpertusa.com/beer3
Brew House: www.thebrewhouse.com
Brewferm: www.brewferm.com
Coopers: www.cascadiabrew.com
Muntons: www.muntons.com

"Accept, appreciate and maximize the space."

Hailing from Kelowna, British Columbia, Snyder has been homebrewing for 20 years, using a combination of extracts and grains in the cramped quarters of his kitchen.

He boils batches of brew in a small pasta pot and grinds grains in a manual stainless steel cereal mill, which attaches snuggly to the edge of his countertop.

"After primary fermentation . . . I rack into a 1-gallon (~4-L) glass jug and leave it for a few weeks to finish fermenting and clear," Snyder said. "I then bottle. Each batch gives me 11 'stubby' bottles."

Weaver has his own set of brewing problems to deal with.

"(I can't do) lagering and kegging, because I can't have another refrigerator," Weaver said. "(No) all-grain, as the apartment is too small to brew that long in here."

And then there are issues like litter boxes.

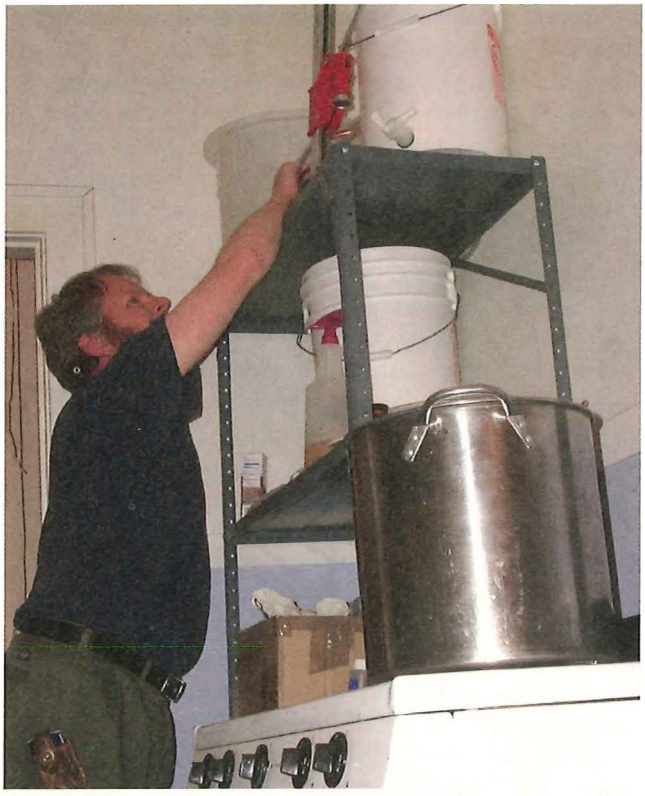
"I was a little worried about the smell of the cat box during brew time," Weaver said. "I thought, 'I wonder if that will make my beer taste catty?"

Fortunately for Weaver, it didn't. Space constraints can be the biggest obstacle to overcome for small-scale homebrewers, but they still find ways around it.

"Based on the space available, I needed a vertical system which also helps with sparging. This is done entirely by gravity," Nihart said. "This system allows me to really brew whatever I want. I can't think of any limitations other than batch size."

Small scale breweries can be as simple as a collection of pots and buckets or as complex as almost any "full-size" homebrewery. See page 46 for a 3.0-gallon (11-L), 2 vessel, temperature-controlled brewery for all-grain brewing.

Refrigerator space can also present a problem for apartment dwellers. See the sidebar on page 42 for different packaging options for batches smaller than 5.0 gallons (19 L).



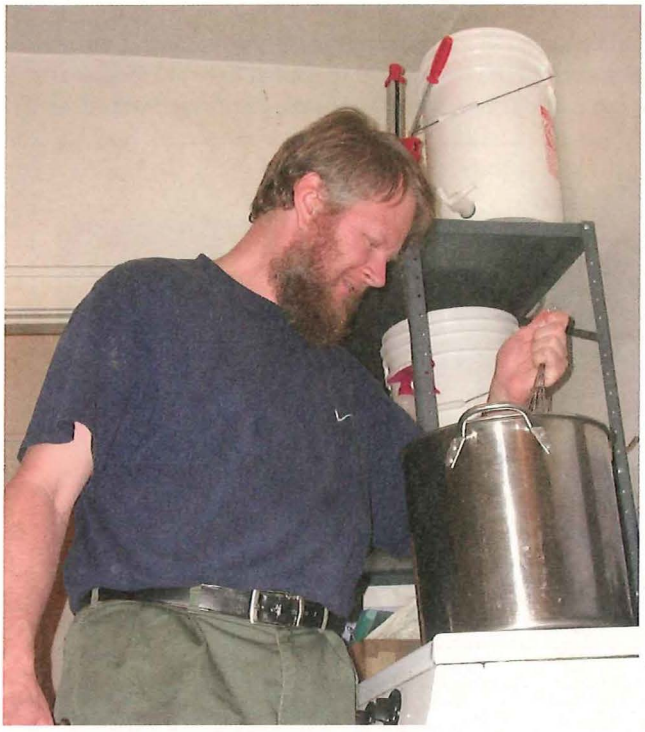
The Pros of Small-Scale Brewing

There's an old adage that says "bigger is better." And while Texans and Hugh Hefner may attest to this philosophy, it isn't true of everyone.

"I can experiment with many recipes," Snyder said of small-batch brewing. "It allows me to spend the time brewing and due to limited fridge space, I can have a small selection of a variety of beers."

"I have the room to build a large 10-gallon (38-L) system, but I would only be able to brew half as many batches of beer," Nihart said. "The benefit (of small-scale brewing) is primarily making more different types of beer and refining other recipes that are good, but not great."

Like the Beatles, Rich Weaver (Casper, Wyoming) gets by with a little help from his friends. With most of his equipment donated by a friend, he was able to assemble his system for only $15. As with Nihart's brewery, Weaver's solution was not to scale down, but to build up. His shelving unit allows the hot liquor tank (HLT) and mash/lauter tun (for partial mash brews) to be stacked vertically above the stove, where the brewpot resides. In order to brew all-grain beers on your stovetop, your stove must be able to bring at least 6 gallons (23 L) of wort to a rolling boil.



VACU-BREW SYSTEM

Photo courtesy of MOREBEER!

There's a new small-space equipment package designed for all-grain brewing on a kitchen countertop that uses a vacuum pump to move liquid from one vessel to the next. The kettles are modified with clamps, special gaskets and custom stoppers to be airtight so that they can hold a vacuum. A vacuum pump draws liquid from the 5-gallon (19-L) hot-liquor tank into the 8-gallon (30-L) mashtun, for the mashing process, and then into the 8-gallon (30-L) boil kettle. Once the boil kettle is full, the special gasketed lid is removed to perform a standard boil on a stovetop. Then post boil, the lid is replaced and the vacuum pump moves the liquid through the included wort chiller. This new Vacu-Brew counter-top system was just released by MoreBeer! and costs about $500.

Besides the encouragement to brew more frequently, there are a few other benefits to brewing less than the typical 5.0 gallons (19 L). So, even if circumstances are forcing you to scale down in quantity, in some cases you may be able to scale up the quality of your homebrew.

If your kitchen stove is your heat source, it may not have the "juice" to bring 6.0 gallons (23 L) or more of pre-boil wort to a vigorous boil; or, even if it does, it may take a long time to do so. On a kitchen stove, boiling smaller amounts of wort allows you to bring the wort to a boil faster and sustain a more vigorous, rolling boil.

The smaller volume also helps when cooling. Not only can you cool faster, but you might not need a wort chiller. With cool tap water and about 6 lbs. (~3 kg) of ice, you can cool 3.0 gallons (11 L) of wort in your sink or bathtub in a reasonable amount of time — less than an hour if you attend to the cooling. Begin by letting your brewpot sit, covered, in cool tap water. When the cooling water heats up noticeably, drain the sink or tub and add new water. Once the cooling of the wort slows, add new tap water and the ice. Stirring the ice-water bath frequently and gently swirling the wort in your brewpot will speed the cooling process.

Perhaps the biggest advantage to brewing smaller batches is that you may not need to make a yeast starter to pitch an adequate amount of yeast. Liquid yeast packages from both White Labs and Wyeast contain over 100 billion cells. If you are brewing 3.0 gallons (11 L) of average-strength ale, this puts you in the ballpark of the optimal pitching rate — and keep in mind that the usual "1 million cells per mL per degree Plato" rule is meant for repitched, not lab-raised, yeast.

Additionally, if your apartment stays at a reasonable "room temperature" all day, temperature control over ale fermentations can easily be managed by using the wet T-shirt method. At

PACKAGING OPTIONS FOR SMALL BATCHES

4.0 gallons (15 L)
43 12-oz. (355 mL) bottles
30 17-oz (500 mL) wheat beer bottles
23 22-oz (650 mL) "bomber" bottles
15 1-L swing top "torpedo" bottles
(with 5 oz./150 mL left over)
7 2-L "growlers"
(with about 1.4 qt./1.4 L left over)
3 5-L mini-kegs
(with 5 oz./150 mL left over)
2 6-L Tap-a-Draft bottles
(with about 3.2 qts./3 L left over)
2 2.25-gallon (8.5-L) Party Pigs
1 5-gallon (19-L) Cornelius keg

3.0 gallons (11 L)
32 12-oz. (355 mL) bottles
23 17-oz (500 mL) wheat beer bottles
18 22-oz (650 mL) "bomber" bottles
11 1-L swing top "torpedo" bottles
(with 12 oz./355 mL left over)
5 2-L "growlers"
(with about 44 oz./1.3 L left over)
2 5-L mini-kegs
(with about 44 oz./1.3 L left over)
2 6-L Tap-a-Draft bottles
1 2.25-gallon (8.5-L) Party Pig
(with 3.0 qts./2.8 L left over)
1 3-gallon (11-L) Cornelius keg

2.0 gallons (7.6 L)
21 12-oz. (355 mL) bottles
15 17-oz (500 mL) wheat beer bottles
12 22-oz (650 mL) "bomber" bottles
8 1-L swing top "torpedo" bottles
4 2-L "growlers"
1 5-L mini-keg
(with 88 oz../2.6 L left over)
1 6-L Tap-a-Draft bottle
(with 54 oz../1.6 L left over)
1 2.25-gallon (8.5-L) Party Pig
1 2.5-gallon (9.5-L) Cornelius keg

1.0 gallon (3.8 L)
11 12-oz. (355 mL) bottles
8 17-oz (500 mL) wheat beer bottles
6 22-oz (650 mL) "bomber" bottles
4 1-L swing top "torpedo" bottles
2 2-L "growlers"

Safety Note:
When bottle conditioning beer in larger glass bottles, such as growlers, be sure they will hold the pressure without cracking. Some thin-walled growlers may not be the best choice for bottle conditioning highly-carbonated homebrews.

Likewise, most 1.0-gallon (3.8-L) jugs are not suitable for holding beer at any carbonation level.

smaller volumes, the higher surface-to-volume ratio means this method is increasingly more effective. The flip side of this argument is, if the temperature in your apartment varies quite a bit throughout the day, then temperature control becomes increasingly problematic at smaller volumes.

Scaling down isn't always the solution for brewing in a small space. The big downside to scaling down is, of course, that you brew less beer each brewing session. And brewing a small amount of beer takes roughly the same time as brewing a larger volume. However, for some stovetop brewers, scaling down to 3 gallons (11 L) from 5 gallons (19 L) will mean a greater boil vigor, quicker cooling, elevated pitching rates (if they don't make yeast starters) and better temperature control during fermentation — all factors that lead to better beer.

Tips for Small Scales

So what tricks of the trade come in handy when homebrewers take the plunge into small-scale brewing? When the time comes to decide on a system design, one word comes immediately to mind for Nihart: vertical.

"Many small spaces can be used if you stack items on top of each other," Nihart said.

A vertical three-tier brewing setup is a common method used by homebrewers to work around space constraints, but it certainly isn't the only option. And, when working with a vertical set-up, keep safety in mind. Be sure that an inadvertent tug on the tubing from your hot liquor tank or mash/lauter tun won't cause it to come crashing down, potentially drenching you in hot water or upsetting your brewpot.

"I just use everyday kitchen items and appliances," Snyder said. "I only needed a few things, which are carried by all homebrewing stores." He even developed a quick, cheap and easy way to chill wort.

"After the boil is finished, strain wort into the fermentation pail and add a frozen, sanitized, 2-liter plastic bottle of water," Snyder said.

Snyder said temperatures are much easier to control in his 1-gallon (3.8-L) batches. Nihart recommends brewing near an easily accessible water source.

"You need (water) to mash, sparge,

"Brewing is a journey," says Weaver. And, like numerous homebrewers all over the world, he isn't about to let cramped quarters prevent him from exploring the world of brewing. Don't think of limiting space as a reason to quit homebrewing — be creative!

and clean," he said. "Make sure the tun and brewpot are portable. I have a long hose that connects to my RIMS system so I can flush it in place. The other items have to be portable so I can wash them out in a sink."

As with any scale of homebrewing, brewers improvise with the equipment they use. Even an essential Thanksgiving holiday kitchen utensil has its advantages in a small-scale environment.

"To minimize wasted malt extract, pull up hot water from the brewpot using a turkey baster and rinse the malt extract interior, pouring all the residual extract into the brewpot." Weaver said.

Weaver said he maximizes extraction efficiency from grains during partial mashes by removing the grain bag from the brewpot and placing it on a kitchen strainer, which is then placed back on the brewpot. After that, he takes a turkey baster and pulls hot wort out of the brewpot and uses it to rinse the grains over the pot a few times.

"I like to call this the modified vorlauf maneuver for partial mashers," Weaver said.

Do It All Again?

Knowing what they know about brewing in cramped quarters, Weaver, Nihart and Snyder agree that there's little, if anything, they'd do differently if they had to start again small from scratch.

"Keeping all things equal as far as batch size goes, I am very happy with the way my system works. It's fairly automat-

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"The American Brewers Guild Craftbrewers Apprenticeship program more than opened the door for me into the craft brewing industry. I was hired at Bohemian Brewery in Midvale, UT to brew double decocted lagers before I had even finished the program, and have been Head Brewer here since shortly after. The Guild was able to provide me with everything I needed from fundamental knowledge to experience, backed up with a substantial alumni network. My career in the brewing industry would not be where it is today if it had not been for the American Brewers Guild."

— Bobby Jackson
Head Brewer, Bohemian Brewery
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ed and easy," Nihart said.

"I might look for a different electrical controller, one that would allow for even easier programming of heat regulation, but that is about it."

Snyder agreed, "If I had to do it all again I would do it exactly the same as I'm doing it now. It can't be any simpler."

Over his years mastering homebrewing in his little apartment, Weaver developed a sort of mantra for future small-scale brewers to follow.

"Accept, appreciate and maximize the space." Weaver said.

"Keep it simple and enjoy the processes involved," he said. "Brewing is not a destination. Brewing is a journey. Just say 'no' to insipid beer."

Although it sometimes seems that the homebrewing world revolves around 5.0-gallon (19-L) batches, homebrewers brew at almost every imaginable scale. Suburban or rural brewers, with some space at their disposal, may scale up to 10 gallons (38 L), 15 gallons (57 L) or beyond. Conversely, if your space is limiting, there is nothing wrong with brewing batches smaller than 5.0 gallons (19 L). This will not adversely affect your beer — in fact, in some cases (such as being saddled with a wimpy apartment stove), your beer may even improve. And, no matter what scale you choose, remember that some homebrew is always better than no homebrew.

"Keep it simple and maximize the space."

Terry Badman is an editorial intern at Brew Your Own.

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Story by **JEFF KARPINSKI**

build a COUNTER TOP ALL-GRAIN BREWING SYSTEM

SPACE-SAVING AUTOMATED THREE-GALLON (11-L) BREWERY

> "**Living way out in the sticks,** the only beer **drinker in the house,** 'standard' 5-gallon (19-L) batches were just **too much beer for me.**"

There is often a common progression in homebrewing. Brewers begin making extract beer in a pot on the stove. Next comes steeping grains to tweak the flavor of the beer. For many, this is followed by the lure of all-grain brewing and the addition of a simple mash/lauter tun to their brewing setup. By this point, the homebrewer is hooked and begins eyeing full brewing systems with cryptic names like RIMS or HERMS, all while devising ways to hide the bills from the spouse.

My evolution in brewing was no different, but after a year of doing all-grain using nothing more than a 24-quart (23-L) 120V electric kettle I had built, a 5-gallon (19-L) cooler mash/lauter tun (MLT), and a small pot to heat strike water on the stove, I knew my ultimate brewing system would be different.

This electric, 3.0-gallon (11-L), two-vessel, temperature-controlled brewery can be built for less than $500. It uses a pump to move the wort between vessels and fits easily on a kitchen countertop. It is based on homebrewer Lonnie McAllister's Brutus 20 design.

Living way out in the sticks, the only beer drinker in the house, "standard" 5-gallon (19-L) batches were just too much beer for me. Three gallons (11 L) seemed to be my personal sweet spot — enough so that I wasn't killing myself brewing all the time, yet not so much that I'd get bored drinking the same beer. I also realized, being a creature of comfort, I wasn't about to move my brewing to the garage, far away from my TV and recliner! Still, I coveted the "big boy" systems and the reproducibility they offered. Then I saw Lonnie McAllister's Brutus 20 system.

Many know Lonnie from his spectacular 10-gallon (38-L) Brutus 10. Lonnie's Brutus 10 system and instructions on how to build it can be found in the November 2007 issue of BYO. The November 2007 issue is sold out, but you can still order the Build Brutus Ten plans special reprint from www.byo.com/store. Lonnie also has an unorthodox Brutus 20 experiment. He called it CRDFM — (Constant Recirculation Direct Fired Mash). Two pots, two pumps, and two heat sources. It certainly was compact. What was obviously missing from the system was the hot liquor tank (HLT). The Brutus 20 was essentially a two-vessel, no-sparge brewing system. After mashing in at a high liquor-to-grist ratio, wort is pumped from the mash/lauter tun (MLT) to the kettle, where it is heated and pumped back to the top of the grain bed. In this way, the mash temperature can be maintained or raised. When the mash is over, the wort is already clear from being recirculated. So, at that point, all you need to do is shut off the return flow to the grain bed and the kettle can be filled.

I can hear the mash efficiency addicts screaming already. During my first year of all-grain brewing, I beamed with pride at my frequent 90% mash efficiency, yet still had this nagging feeling my beers weren't all they could be. They were quite good, but tasted like, well, homebrew.

Then I read about and started tinkering with thin mashes — mashes with 2.0 qt./lb. (~4 L/kg) liquor-to-grist ratios and even higher. These thin mashes made for so much first-runnings that my sparge volume dropped to as little as a gallon (3.8 L). My mash efficiency dropped dramatically into the 75–80% range, but something strange happened — my beers became amazing. No more "homebrew" flavors (perhaps because, in my quest for high efficiency, I was oversparging and extracting excessive amounts of tannins from my malt). I finally realized what Lonnie knew all along, "This ain't a grain race here; it's about beer man!"

Whereas your efficiency will likely go down if you switch to no-sparge brewing, the tradeoff here is a brewing system with a smaller "footprint" — two vessels instead of three and one heat source (in the kettle) instead of two (for the kettle and hot liquor tank) or more. This may be more important to some brewers than a few extra percentage points of extract efficiency.

By the early fall of 2008, my mind was made up. I spent a good bit of time drawing sketches, thinking about the Brutus 20 and how to scale it down to 3–4 gallons (11–15 L) for indoor brewing. I quickly realized by leveraging gravity I could simplify the system further, eliminating one pump and burner. (Lonnie's

1. Mash/Lauter Tun (MLT): A ⅜" ball valve is fitted to the outside of the cooler. Inside, stainless steel braid (from a washing machine connector) connects to both ends of a ⅜" T-connector. The lid is fitted with ⅜" fittings.

2. Kettle: A 120-V, 2,000-W heating element is installed in the aluminum pot. A ball valve drains the kettle. If you choose to install a PID controller, a thermocouple will monitor the temperature. A sight glass can also be installed.

Brutus 20 was a one-level system, necessitating two pumps. On his system, both vessels had burners.) So I was left with the following: An electric kettle to heat the wort. A pump to push the heated wort to the top of the MLT. Gravity to drain the MLT back into the kettle. CRDFM! My final eureka design moment came when I thought about chilling. My immersion chiller worked well enough, but it was very hands-on. Could my ultimate brewing system have chilling integrated into it? I needed a housing for the pump and a way to lift the MLT above the kettle, so why not use a bucket? Pump fits well enough in the bottom of a bucket, but there's a lot of wasted space. Would a counterflow chiller (CFC) fit in there as well? Bingo! Plus, if I permanently plumbed the CFC onto the pump output, that would eliminate several plumbing changes during the brew session, reducing mess – always an important factor for brewing indoors.

Finally, a little automation can aid any brewing system in the temperature control department and this one is no different. Fortunately, the electronics used here are extremely simple – a PID controller, a thermocouple to read the kettle temperature, a solid state relay (SSR) to drive the kettle heating element and a couple combo switch/outlet plugs from the hardware store. Having good temperature control takes the stress out of brewing.

OK, enough theory, how does this thing actually work? It's probably easiest to describe both by stepping through a typical brew session.

Fill the kettle with 4.0 gallons (15 L) or so of water and set the PID to strike temperature plus 2 °F (1 °C) to account for loss of heat to the CFC and a slight temperature overshoot in the MLT. Begin full system recirculation as PID set temperature approaches to pre-heat the mash/lauter tun (MLT). Once the PID set temp is reached, close the MLT valve and allow it to fill to the desired mash infusion volume. Shut pump off, add any water mineral adjustments and double-check strike temperature with a thermometer. Dough in once everything looks good.

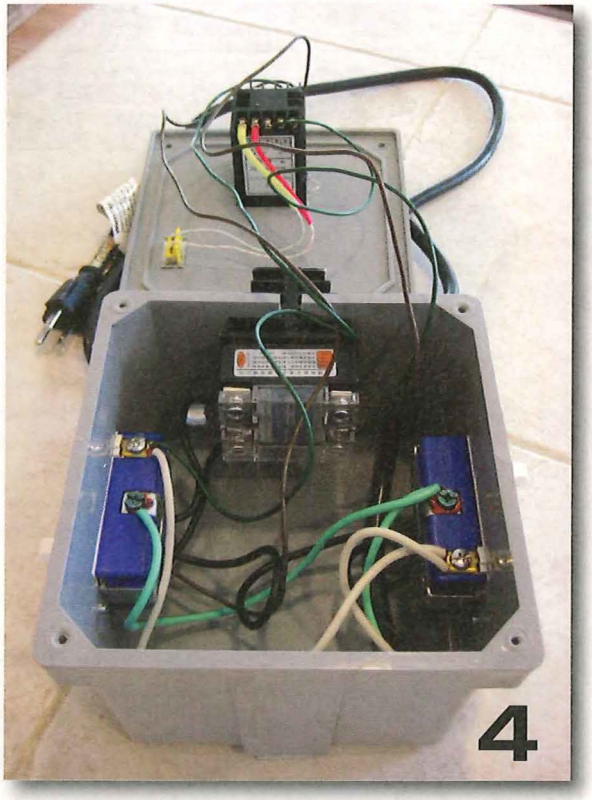
Calculate the balance of water needed to meet the desired pre-boil volume. For example, if the mash infusion was 2.25 gallons (8.5 L) into 6.0 lbs. (2.7 kg) of grain, and I expect a loss of 0.1 gallon/lb. (0.83 L/kg) due to grain absorption, then there should already be 1.65 gallons (6.2 L) in the system. Assuming a desired pre-boil volume of 4.5 gallons (17 L), I should fill the kettle to 2.85 gallon (11 L). Set the PID to 170 °F (77 °C), the mash out temperature.

Once the mash is complete, begin recirculation by closing the CFC valve, opening MLT valve partially, and re-opening CFC valve to balance MLT inflow with outflow. This normally takes a couple minutes of fiddling and a re-check every 10 or so minutes during the recirculation. I've got a sight glass on the kettle to help monitor this. Recirculate for 30 minutes or until the full system recovers to 170 °F (77 °C), whichever takes longer.

Shut the pump off and open all valves fully to allow wort to fall back to kettle. Switch the PID to manual mode, 100% output to begin the boil. Once the boil starts, you are done with MLT for

3. Chiller and Pump bucket: The chiller is built by encasing copper tubing in a garden hose and fitted to the bucket. Four holes are drilled in the bucket to provide cooling air for the pump.

4. PID Controller: This looks complicated, but the instructions that come with the controller are good. If you are uncomfortable working with electrical wiring, hire an electrician. Also, the system could be controlled manually.



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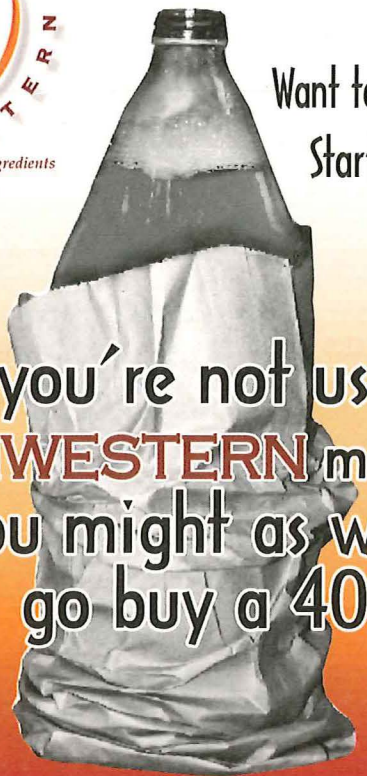

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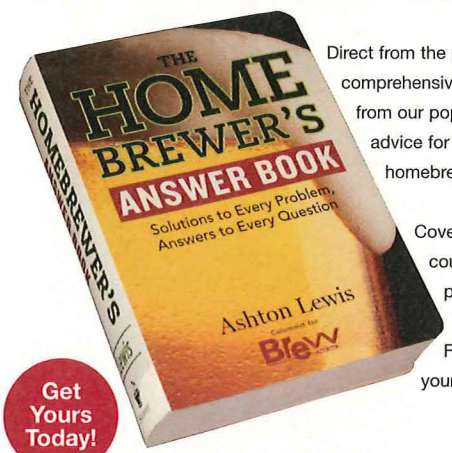

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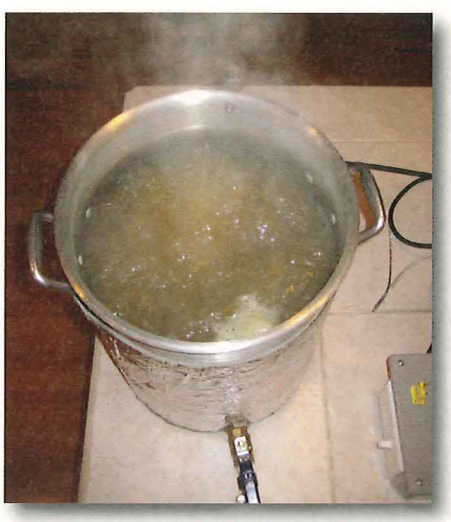
now, so remove and clean it if you are so motivated. At boil end, the kettle element gets shut off, the kettle lid goes back on and the CFC output gets plumbed to the kettle lid. Turn the pump on to allow hot wort to circulate and sanitize the CFC and pump.

While sanitizing, hook up CFC to a cold water source and dump lines to the sink. After 5–10 minutes, begin cool water flow through CFC.

After the wort is chilled, shut off the pump and momentarily raise the CFC bucket above kettle level to allow all the wort to flow back into kettle. Close kettle-out valve and it's now ready to dump into the fermenter.

From this point on, all that's left is clean-up. I rinse out the kettle and restore the system to a chill configuration so I can recirculate hot Oxyclean solution through the kettle and CFC for 10 minutes. I dump



After the mash, the wort is recirculated through the MLT and kettle (which initially holds some 170 °F water). The wort is heated to mash-out temperature while recirculating. The water heater element boils the wort.

and repeat with rinse water and I'm done. Rolling the CFC bucket counter-clockwise above the sink about a dozen times drives out any remaining water in the coils and it's ready to put up. Beer time!

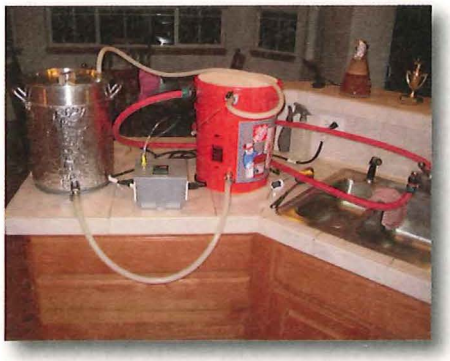
I get asked a lot of questions about my "weird" brewing system. Here are some of the most common ones:

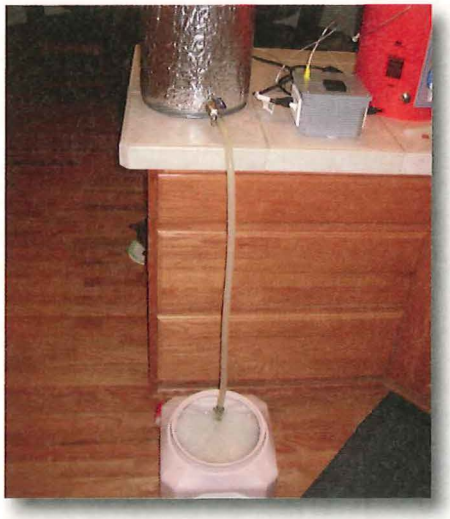
"Can you brew high gravity beers? Doesn't your extract efficiency suffer?"

Not in my experience. In fact, efficiency seems to be impacted more by grist than gravity. Wheat beers seem to want to drop into the low 70% range while the last barleywine I did hit 74%.

"Could this be scaled up to do 5-gallon (19-L) batches?"

When I built my electric kettle, I did a lot of boil tests and found I wasn't happy with anything beyond 5.0 gallons (19 L) using a





After the boil, hot wort is pumped through the CFC to sanitize it. The wort then returns to the kettle. Then, cooling water is applied while the wort is still circulating. Once cool, the wort flows to the fermenter.

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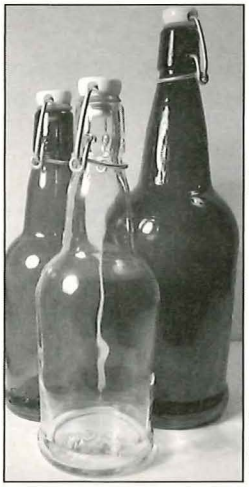

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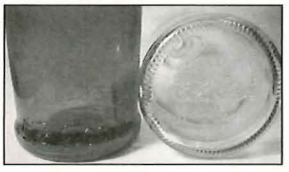

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Jeff Karpinski with his brewery. At this time, he has brewed 20 batches with the system and wouldn't change a thing.

single 120V 2KW element. Running two elements off separate 20A circuits (most kitchens have at least two dedicated to small appliances), or using a 240V element are possible options. Kettle geometry also has a big impact. Tall and narrow has less heat loss than short and wide.

Also, consider that a 5.0-gallon (19-L) MLT would be limiting for 5.0-gallon (19-L) batches, especially when brewing high gravity beers without supplementing the grist with malt extract.

"Does the heating element scorch the beer?"
No, I've done everything from Pilsners to barleywine on this system and have never seen or tasted even a hint of scorching.

"Can you do step mashes?"
Sort of. It's more of a ramp than a step however. I've doughed in at 145 °F (63 °C) and recirculated the system up to 158 °F (70 °C) with good results. It takes 15–20 minutes to ramp through the full mash range. It's also certainly possible to simply heat and pump additional water infusions up to the MLT without circulating.

"How do you drain the wort from the CFC *before boiling?"*
I don't. There's not enough wort in there to worry about and it all gets recirculated at the end of the boil anyway during the heat-sterilization of the CFC.

"How long is your brew day?"
Depends on how efficient I am at multitasking, but it generally goes like this: 30 minutes to heat the strike water, 60 minutes to mash, 30 minutes of recirculation and heating to reach mash out temperature, 60 minutes of wort boiling, 20 minutes of chilling and 40 minutes to cleanup.

"Where's the GFCI *(Ground Fault Circuit Interrupter) in your wiring?"*
Excellent point. I always brew in my kitchen where all outlets are already GFCI protected.

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Building the Brewery

Building this system really isn't too difficult and can be done in a weekend or two. The wiring is straightforward – particularly if you've done any household wiring like adding an outlet. The PID comes with great directions for its hookup. I used a drill and jigsaw for cutting out the component holes in the electronics box. Hole cutters sized for the ½" and ⅜" nipples as well as one large enough for the water heater element are needed, as well as a file to clean up rough edges on the holes.

Possibly the most challenging part of this project is sweating the copper fittings for the counterflow chiller. A propane torch, solder and flux are needed here. There's plenty of great plumbing how-to articles online if you've never messed with soldering copper before.

Lastly, be sure to have plenty of Teflon pipe tape on hand when assembling the weldless spigot and sight glass on the kettle. This will insure leak-free fittings.

The materials list (which can be viewed online at www.byo.com) covers everything used in the system, except fender washers and hose clamps. Lots of both are needed. Just get a big bag each of stainless clamps for ⅜" and ⅝". Fender washers are used to shim up various bits around the ⅜" nipples. Get a bunch of zinc ones and at least two stainless ones for the insides of the kettle and MLT lids. The 120V 2KW water heater element can be tricky to find. Lowe's and Home Depot around these parts carry only 1,500W ones, but Ace Hardware carries 2,000W in 120V. So, what's the bottom line on building a Countertop Brutus 20? As I built mine gradually over the winter and leveraged many parts from my scrap bins, I can't say exactly. A rough run of the numbers leads me to believe this system could be built from scratch for $400–500, worst case.

I've now run roughly 20 brews through my system since completion and absolutely love it. I still learn little tricks and process improvements along the way, but I haven't changed the hardware one bit. Countertop small-batch all-grain brewing is here to stay – in my house at least!

Lastly, I must give a big tip of the hat to Lonnie Mac. I definitely owe you a brew the next time you pass through Colorado!

This is Jeff Karpinski's first article for Brew Your Own *magazine.*

For more information on various elements of this brewery, the following BYO articles may be helpful:

"Build a Counterflow Wort Chiller," by Reg Pope (Jan./Feb. 2006) describes how to build the type of chiller described here. "Brewing on Autopilot with PID Controllers," by Marlon Lang (November 2003) gives more information on using PID controllers in brewing. "Two Simple RIMS," by Thom Cannell (December 2001) gives instructions for installing an electric heating element in a brewing vessel.

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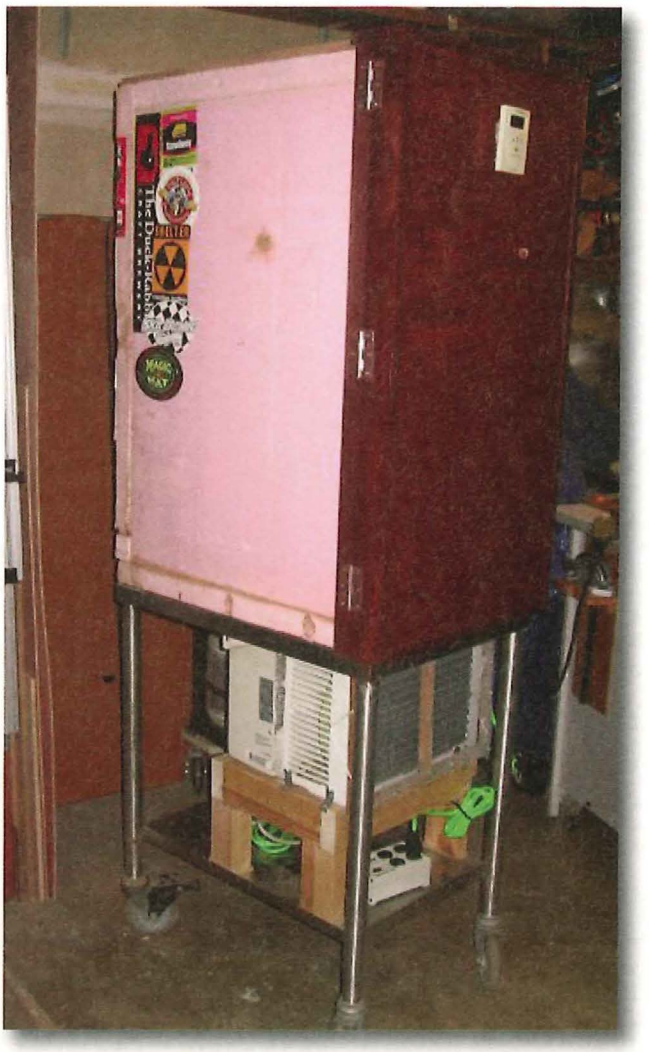
Story by **TONY PROFERA**

BUILD A FERMENTATION CHAMBER

GET CONTROL OVER YOUR FERMENTATION TEMPERATURES

> "The temperature a beer is fermented at influences the beer's characteristics"



AS HOMEBREWERS, WE KNOW THAT THE STEPS IN CRAFTING A FINE HOMEBREW TYPICALLY INVOLVE RECIPE FORMULATION, GATHERING INGREDIENTS AND AT LEAST SEVERAL HOURS OF BREWING TIME TO CREATE THE PRECIOUS WORT. ONCE WE PITCH THE YEAST TO THAT WORT, THE NEXT STEP IN THE PROCESS IS FERMENTATION. CONTROLLING THE FERMENTATION TEMPERATURE IS CRITICAL TO ULTIMATELY CREATING A QUALITY BEER. MOTHER NATURE (AND THE INTERIOR OF MOST OF OUR HOMES) CANNOT BE RELIED ON TO PROVIDE THE CONSISTENT TEMPERATURES REQUIRED FOR OPTIMAL FERMENTATION. THE PREMISE IS SIMPLE: CONTROL THE BEER'S FERMENTATION TEMPERATURE AND THE RESULTING HOMEBREW WILL BE BETTER AND MORE CONSISTENT

AS A RESIDENT OF THE SOUTHERN U.S., TEMPERATURES FOR MOST OF THE YEAR ARE TOO HIGH TO CONDUCT A PROPER FERMENTATION SCHEDULE FOR THE HOMEBREWS AND MEADS I MAKE. LIKE MANY HOMEBREWERS, IT'S ADVANTAGEOUS FOR ME TO BREW AND FERMENT MY BEER IN THE FAMILY TWO-CAR ATTACHED GARAGE. ONE OPTION FOR CONTROLLED FERMENTATION IS TO USE A CHEST FREEZER. DUE TO SPACE CONSIDERATIONS, THIS IS NOT AN OPTION FOR ME. ALSO, THE THOUGHT OF LOWERING FULL 6.5-GALLON (25-L) CARBOYS INTO A CHEST FREEZER MAKES MY BACK HURT JUST THINKING ABOUT IT. MY SOLUTION WAS TO BUILD AN INSULATED CHAMBER THAT COULD HOLD TWO 6.5-GALLON (25-L) CARBOYS WITHOUT TAKING UP MUCH WALL SPACE. A SMALL, 6,000 BTU ROOM AIR CONDITIONER, PURCHASED FROM A LOCAL YARD SALE, IS USED TO COOL THE INTERIOR OF THE CHAMBER.

BUILDING A FERMENTATION CHAMBER IS STRAIGHTFORWARD. IT CAN BE SIZED TO HOLD AS MANY CARBOYS AS YOU'D LIKE AND BE CONFIGURED TO FIT IN THE SPACE AVAILABLE. FIRST, HOWEVER, LET'S REVIEW TEMPERATURE CONTROL.

> "In the proper temperature range, no off flavors or aromas are produced."

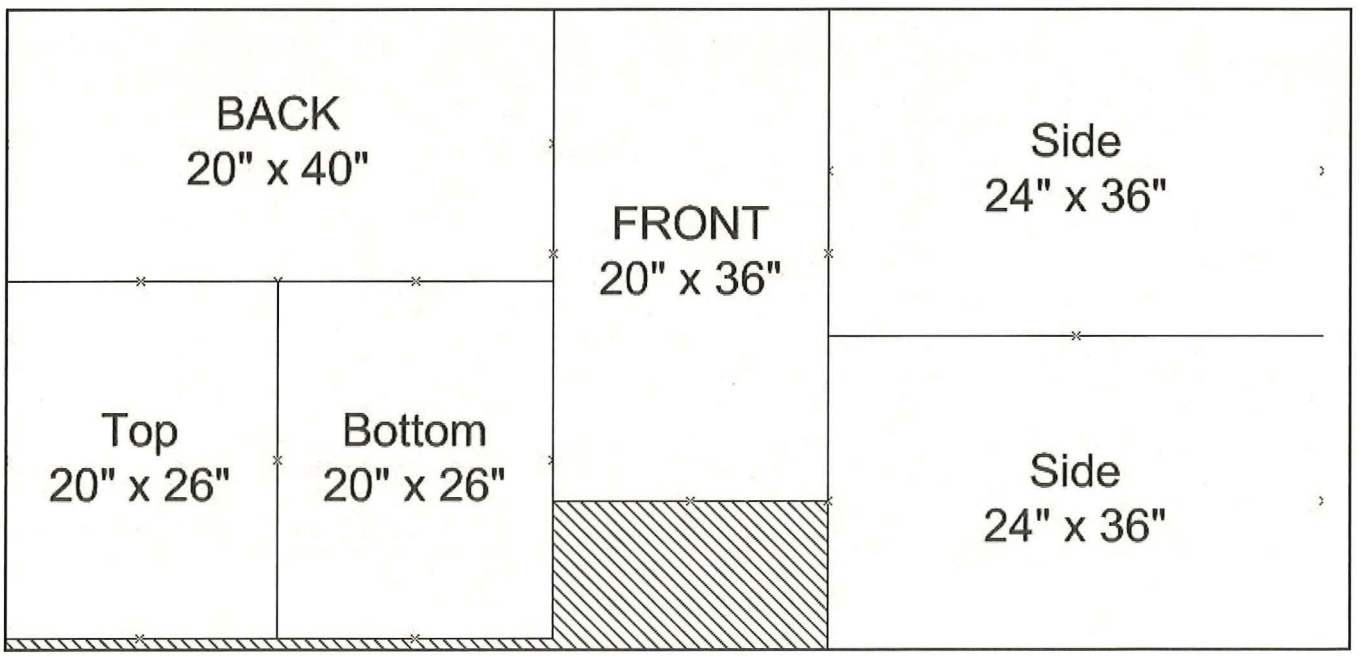
MAJOR BUILD COMPONENTS:

(1) Sheet 2" Rigid Insulation Board (Owens Corning Extruded Polystyrene)
Large Tube Clear RTV Cement
Box of 4" Nails
Used 6,000 BTU Air Conditioning Unit
Metal Shelf Grating and Wooden Framework
(6) ½" x 11" Threaded Rod, Bolts, and Washers (legs for shelf)
Johnson Controls Temperature Controller
Wood & Nails (for door and door frame, A/C support shelf, A/C guard)
Rigid screening (for A/C guard)
(3) 4" Door Hinges
(2) Door Clasps
1" Roll Window Insulation (pre-glued one side)
Power Strip
Digital Thermometer with Remote sensor (optional)
Metal (or wood) table as base

Top: The front of the chamber is covered in wood paneling. A thermometer allows the temperature inside the chamber to be checked without opening the door.

Bottom: The inside seams of the chamber are sealed with RTV cement. The temperature probe for the external thermostat can be seen coiled in the upper right part of the chamber. The A/C unit is positioned so the "outside" side of the unit is pointing towards the front of the unit. This ensures that too much heat doesn't build up between the unit and the wall.

FERMENTATION CHAMBER INSULATION SHEET PATTERN LAYOUT



> "Beer fermentations that are run too warm result in beer that is overly estery."

Temperature Control for Homebrewers

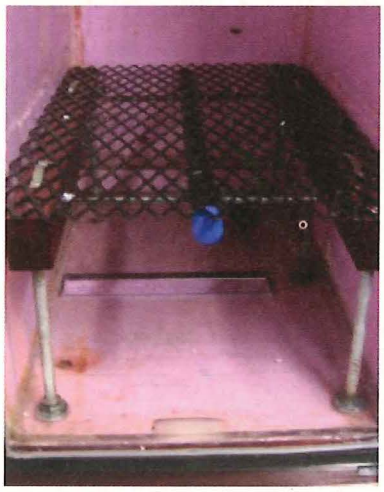
The temperature a beer is fermented at influences the beer's characteristics. At the proper temperature, pitch rate and level of aeration, fermentation starts quickly, proceeds in an orderly fashion and finishes at a reasonable final gravity. In the proper temperature range, no off flavors or aromas are produced (unless the beer is contaminated for some reason).

Beer fermentations that are run too warm result in beer that is overly estery. Fermentations at very high temperatures produce "fusel oils" — higher alcohols that cause the beer to taste "hot" and produce headaches in those who drink the beer. Fermentations that run too cool are slow to start, proceed sluggishly and frequently stop short of the expected level of attenuation. Individual yeast strains have their

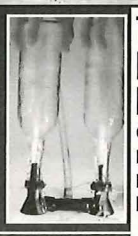
Top: The air conditioning unit sits below the chamber, supported by a small wooden table.

Bottom left: A metal grate, with a 1" pipe added for extra strength, supports the carboys inside the chamber, allowing for better air circulation.

Bottom right: Airflow from the air conditioning unit is directed into the chamber with insulation.



the Science behind the Art.



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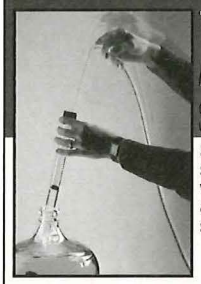

The Auto Siphon
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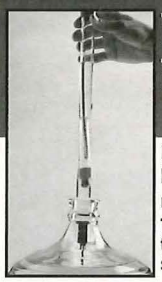

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own suggested fermentation temperatures. Most ale strains fall in the 65–72 °F (18–22 °C) range. Lager strains usually do best at 50–55 °F (10–13 °C). Some Belgian yeasts are meant to be used at temperatures up to 85 °F (29 °C).

Pitching rate and aeration also influence how a fermentation proceeds. In fermentations where the temperature is likely to move outside of the recommended range, pitching an adequate amount of yeast and aerating well becomes even more important.

There are a number of ways that homebrewers control the temperature of their fermentations. Let's review the most common methods.

Passive Control

The most common method of controlling fermentation temperatures, especially for beginning homebrewers, is passive control. Many homebrewers simply wait for the cooler months of the year and place their fermentation buckets or carboys in the basement or some cool spot in the house or garage. (Some Belgian beers can be brewed successfully in warmer months) This can work well for ales, and even lagers under the right circumstances. However, a sudden change in the weather can spoil your plans.

Wet T-shirt

The wet T-shirt method involves draping your fermenter, usually a carboy, with a wet T-shirt. Frequently, a small reservoir of water is placed next to the carboy, with the T-shirt dipping into it. Alternately, the whole carboy may be placed in a picnic cooler or garbage can with water in the bottom. Water evaporates from the T-shirt, cooling the carboy. As water evaporates, more water is wicked up from the reservoir to replace it. A fan can blow air across the T-shirt to increase the rate of evaporation.

The wet T-shirt method is surprisingly effective when the ambient temperature is 5–8 °F (~2.5–4 °C) over the desired fermentation temperature and the air is dry. In an air-conditioned room, the wet-T-shirt method can allow a homebrewer to brew ales in the prescribed temperature range.

When using the wet T-shirt method, use an old T-shirt you don't plan on wearing again and change the shirt every few days. If you don't, it will begin to mildew.

Fridge or Freezer

The wet T-shirt method is a low-cost, low-tech method of cooling beer fermentations. However, it has its limitations. Although you can cool a carboy by several degrees Fahrenheit, you're still relying on the ambient temperature (and humidity) to be in an appropriate range. And, fine-scale control over the fermentation temperature is hard to achieve.

Another common method is to use a refrigerator or freezer, controlled with an external thermostat, as a fermentation chamber. The external thermostat reads the temperature inside the fridge or freezer and turns it on when it exceeds the set point selected by the user. When the temperature drops a few degrees below this set point, the thermostat cuts off power to the cooling unit.

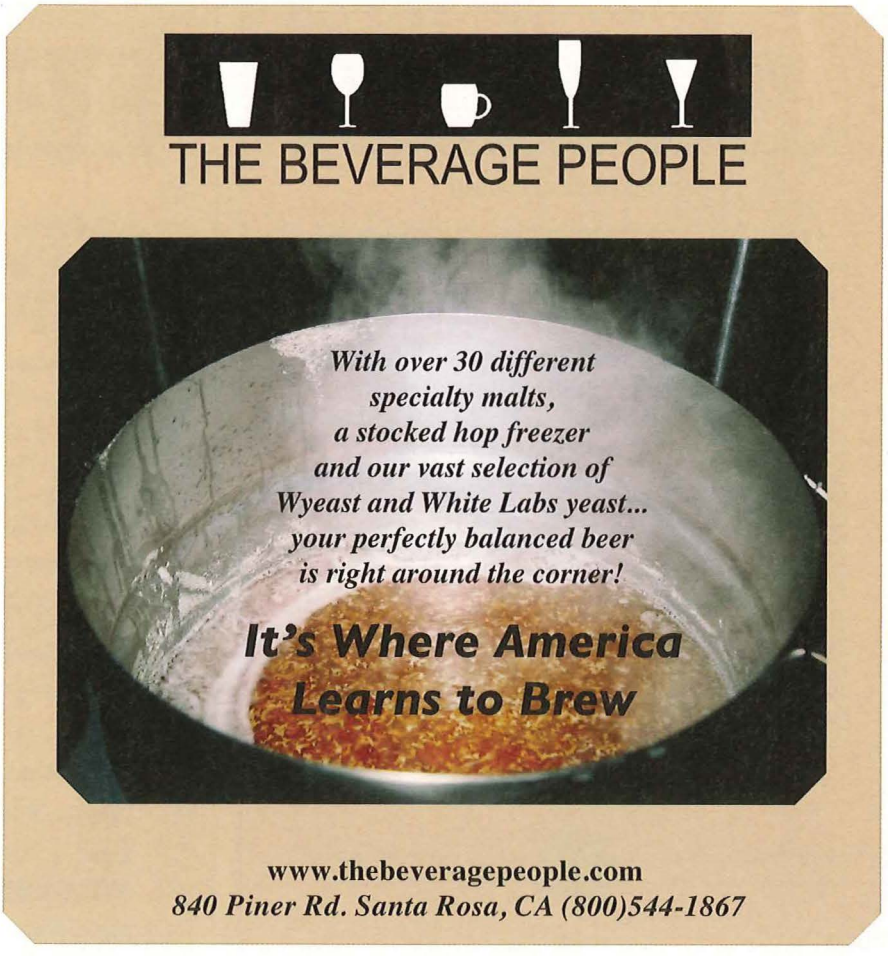
A fridge or freezer set up like this allows the homebrewer to brew ales or lagers and hold the temperature within a few degrees of whatever value he wishes, no matter what the ambient temperature.

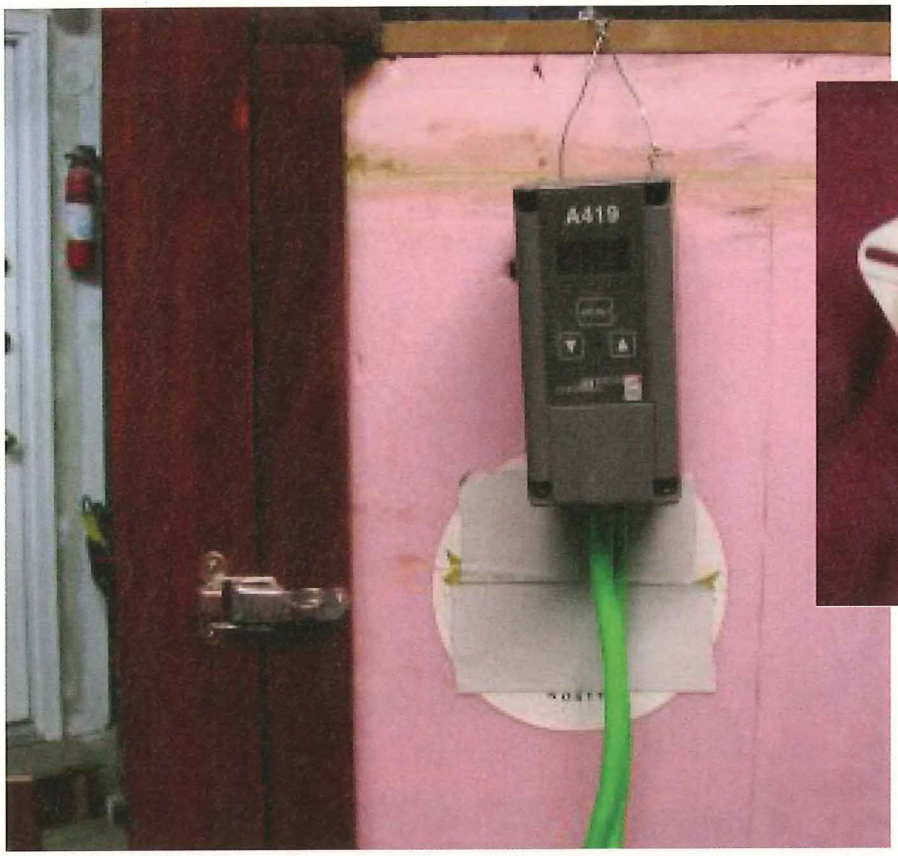
Glycol-Jacketed Fermenters

Some conical fermenters are sold with their own temperature controls built in. When the temperature of a fermentation rises above the set point, chilled glycol is moved through tubes surrounding the vessel, cooling it. Glycol-jacketed fermenters allow you to set the temperature of fermentation. In a chest freezer fermentation chamber, all your carboys will experience the same temperature.

Why Build a Fermentation Chamber?

With all the temperature control options available to homebrewers — especially the chest freezer option — why build a fermentation chamber? There are a few good reasons. First, for many homebrewers, Thier chest freezer serves not only as a fermentation chamber, but also as a serving unit. Once beers are fermented and kegged, the temperature is lowered and beer is stored at serving temperature in the freezer. Building a separate fermentation chamber allows the homebrewer to dedicate the chest freezer to serving, and not have to wait until their latest keg is done before brewing their next batch. In addition, whereas chest freezers come in a





The Johnson Control's external thermostat reads the temperature inside the chamber and supplies power, or not, to the air conditioning unit as required. Installing a vent for a clothes dryer may improve the flow of cold air within the chamber.

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few basic shapes, you can build your fermentation chamber to fit the space you have available. My chamber holds two carboys, one in front of the other. Yours could hold two or more side-by-side, or stacked on top of each other — whatever you have space for in your brewery.

Here's how I built my fermentation chamber, and ideas for how to improve it in the future.

Overview of the Build

The chamber is constructed from a single sheet of 2" (5 cm) pink Owens Corning extruded polystyrene rigid insulation board. The panels were cut using a long, very sharp razor knife using a long metal straight edge as a guide.

The panels are glued together with RTV cement. I found several of the commercially available "insulation cements" from the big box store to be inadequate. Long nails were used to hold the panels together while the RTV cement dried. Once dry, a thin bead of clear RTV cement was run on all the interior corners of the chamber to fill any air leaks, and add rigidity. A wooden frame was attached to the door panel, and on the edge of the chamber opening to permit hinges to be installed. Two metal clasps were installed to allow the door to close securely. 1" (2.5 cm) window insulation strips were cut and attached to provide a tight seal on the inside of the door face.

The chamber sits on top of a salvaged commercial stainless steel table obtained from the local recycle center. A wooden 2" x 4" (5 X 10 cm) table would also have done the job as well, but I like the way the stainless steel looks and the price was right. The stainless steel table's bottom shelf has a wooden platform that supports the air conditioner. The air conditioning (A/C) unit is attached to the support shelf with metal strapping.

The A/C unit is turned 180 degrees so the back faces out the front of the chamber. This permits any heat generated by the A/C to escape and be dissipated out the front instead of being directed towards the wall. A rectangular 1" (2.5 cm) wooden frame with galvanized screening protects the air conditioner's cooling fins from damage.

A 5" (13 cm) grinder (with metal cutting blade) was used to carefully cut a rectangular 2" x 11" (5 X 28 cm) rectangular hole cut into the table top. In retrospect, drilling 4 holes and using a jigsaw with a metal cutting blade might have been easier. A matching hole was cut into the bottom insulation of the chamber floor. The air conditioner's vents are directed up through the holes in the table and chamber. Small pieces of leftover insulation were fit around the A/C vents to assist in directing the flow up into the chamber, and provide a near airtight seal.

The bottom of the chamber is bonded to the top of the stainless steel table with clear RTV cement.

A metal grate shelf sits inside the chamber 9 ½" (24 cm) off the bottom and is supported by wooden sides and threaded rod legs. The 1" (2.5 cm) length of pipe running under the shelf grating was installed to keep the shelf from flexing

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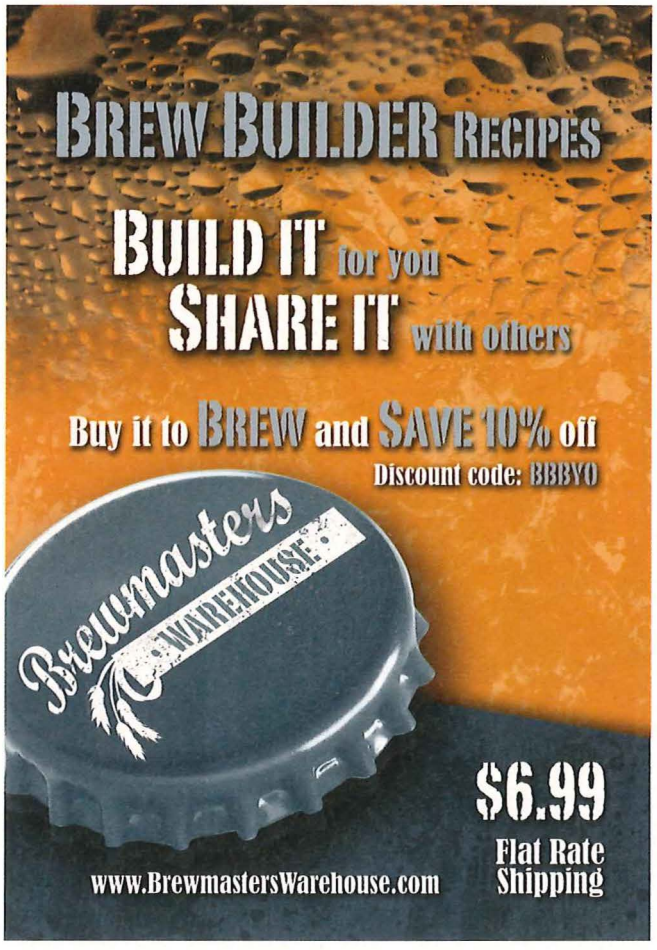


under the weight of two full carboys. Elevating the carboys off the bottom permits incoming cooled air to circulate around them more effectively. In operation, the A/C's power is set to "On/High Cool." It is plugged into a Johnson A419 Temperature Controller, which electronically decides when to power the A/C unit on and off.

The controller's temperature sensor probe runs through the insulation and is taped to the side of one of the carboys. This makes the controller have a more accurate reading of the beers actual temperature than simply measuring the air space inside the chamber. When the controller senses the temperature has risen, it completes the circuit and the air conditioner powers on. Once the set point temperature is reached, the controller opens the circuit and the A/C unit powers off. Additionally, an inexpensive digital thermometer is attached to the front of the door and the remote sensor is run through the door and hangs down. It is used to give a quick reading of the actual air temperature outside and inside the chamber without the need to open the door.

You might ask "How does such a DIY solution work?" So far, it performs surprisingly well. With 95+ °F (35+ °C) daytime summer high temperatures, the chamber's interior remains nearly constant (within 1.5–2.0 °F/0.75–1.0 °C of set point). By constructing the chamber walls from 2" (5 cm) thick rigid insulation board, there is very little heat gain in the chamber over time. During the hottest parts of the day, the A/C unit will run for a few minutes to reach the set temperature then shut off and hold temperature for between 20–30 minutes. More importantly, our household electric bill has not increased enough to be noticeable. When the A/C unit fails, I can simply find another used unit as replacement without the need to replace the chamber and controls. As always, I like to make upgrades to my projects to boost performance and functionality. Future upgrades for consideration include:

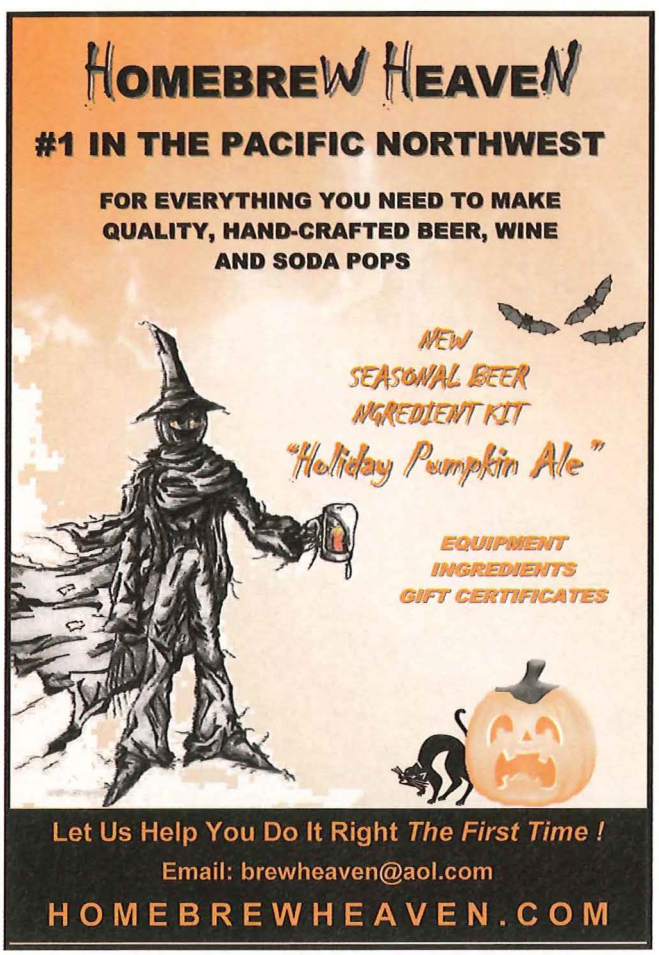
•Encasing the remaining portions of the exposed chamber with thin foil insulation sheeting and ½" (1.3 cm) oak veneered plywood. This will give it a more "old time" icebox appearance, protect the foam board insulation, and improve the "R" factor.

•Modify the A/C unit to push colder air. The A/C unit will need minor internal modification to allow it to push the colder air needed to ferment lagers.

•Replace the metal grate shelf with a wooden rack made from vented hardwood slats.

•Install a dryer vent through the back of the chamber wall to improve the cool air flow from the A/C unit by reducing back pressure.

Tony Profera is a Web developer by trade and a frequent contributor to Brew Your Own. *He is a member of Carolina* BrewMasters, *Charlotte, North Carolina and his last story about building a club kegorator appeared in the November 2008 issue of* BYO.



Seasoned Brewing

Experiment with herbs and spices

Story by Jon Stika

Every homebrewer knows that hops is the treasured herb of beer, but some may not know that beer was made with many other herbs, spices and additives long before hops became king of the hill. Before the 16th century, beer was often spiced with a combination of mildly narcotic, bitter and preservative plants such as; mugwort, sweet gale, heather, yarrow, Labrador tea, juniper, ginger, caraway, anise, nutmeg, cinnamon and sometimes, hops. The combination of beer seasonings used over the centuries varied from place to place, but the blend of herbs and spices used to flavor ale was often referred to as gruit. So if you think brewing with strange and exotic herbs and spices is new and unusual, it's not . . . it is actually very old school. Don't be afraid to experiment with unusual ingredients to flavor your beer as it is a practice as old as beer itself. But before you reach for the kitchen spice rack, let's take a closer look at how a little spice might complement your favorite brew.

Getting started

As with any beer you plan to brew, it's good to have a basic recipe as a starting point. Before you consider brewing with spices have a style and flavor profile in mind to begin your experimentation process. Is your goal a light, fruity, earthy brew similar to a Belgian wit; or a heavy, dark, spicy porter or stout? Take a little time to describe in some detail the flavors you want in your seasoned brew so you have a goal to shoot for. Once you have a flavor profile in mind, ask yourself what spices you'll need, what form the spices should be in (such as fresh, whole, dried, ground, crushed, steeped, etc.) how much will be needed and when each spice should be added to the brewing process? When determining what spices you'll need, you need to be familiar with what different spices taste and smell like and their relative strengths. For example; coriander lends a fresh, earthy, subtle spicy component to beer (think Blue Moon). An ounce (28 g) of crushed coriander added at the end of the boil is typical in a five-gallon (19-L) batch of light ale. However, spices such as cardamom or grains of paradise are much more potent and therefore commonly used in quantities less than a few tenths of an ounce in five gallons (19 L) of beer. Visit http://www.byo.com/images/stories/brew spices.xls for a table of information on the use of herbs and spices in brewing beer.

Brewing with herbs and spices can be a fun and easy way to put your own stamp on a beer style. To get the best results, get the freshest ingredients possible and process them yourself.

Sourcing and handling spices

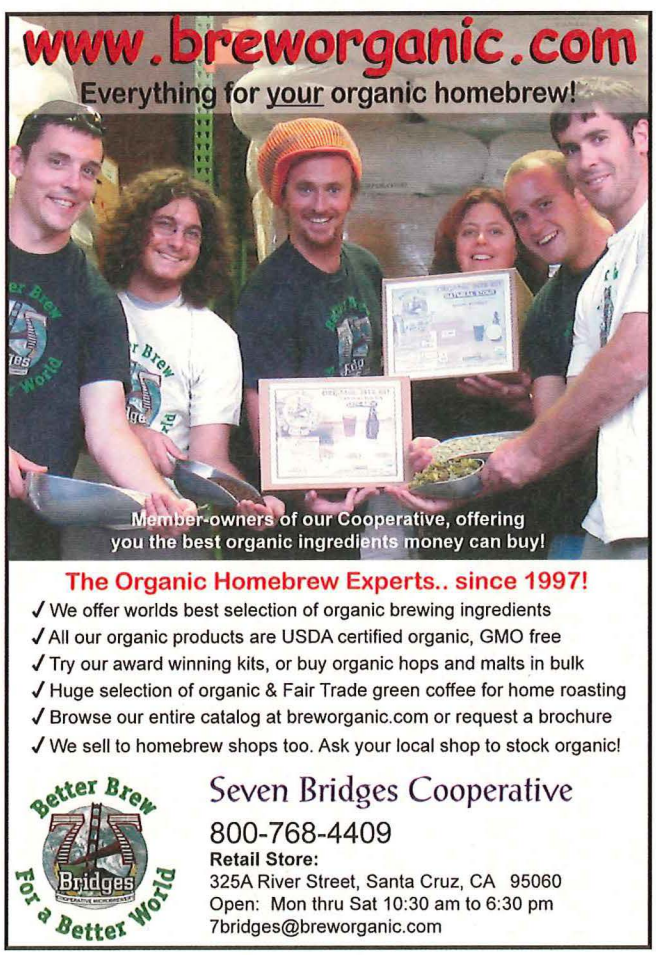
Some of the spices you might consider using in brewing beer may be sitting in your kitchen (such as ground nutmeg) ready to go. However, other flavorings, such as spruce tips, chilies, or ginger may need to be purchased or harvested fresh just before use. So take a look at the spices you plan to brew with and determine where you will get them and the form they need to be in beforehand. Your preferred homebrew supplier is a good place to start when sourcing specialized brewing spices, otherwise you may need to check your local supermarket, a specialty food supplier, or even grow the plants yourself.

Purchase any spices that are not going to be used as their whole parts ground or crushed, or be prepared to process them yourself. You can crush most spices with a rolling pin by putting them in a zip seal plastic bag and rolling the pin over them. This keeps the spice from popping out from under the rolling pin and across the kitchen counter. This method is how I prefer to crush coriander just before adding it at the end of the boil. Grinding spices can be easily accomplished with an electric spice or coffee mill. If you use a coffee mill, it's a good idea to have one mill for spices and one for coffee to prevent any coffee flavor from getting into your brewing spices. Place the spices to be ground in the mill, secure the cover and run the mill in short increments until the desired grind is achieved. It is best to crush or

grind spices as near to when they will be added to your beer as practical to retain the best flavor and aroma from them. This is why it is best to purchase spices whole and crush or grind them yourself to get the best flavor into your beer.

A few herbs and spices used in brewing may require some special handling prior to use. These include extracts of coffee, spruce and vanilla, and the cutting and toasting of oak. Coffee is best extracted as espresso, where finely-ground coffee is subjected to hot, pressurized water in an espresso machine to produce shots of the famous coffee extract. If you have access to an espresso machine and know how to use it, you're all set . . . if not, you'll have to get your espresso from a local coffee shop. Lately, some brewers have been using a French press to do a cold extraction of coffee, reducing possible bitterness associated with making coffee with boiling water. Ground coffee is placed into the press and steeped in cold water for a day or more, then the coffee extract is utilized in the recipe. Spruce is extracted by placing fresh branch tips in boiling water for an hour, then straining any solids out. The resulting extract can then be used as all or part of the water for the wort boil. Vanilla is extracted by placing the beans in a small glass jar or bottle and covering them with rum, scotch or other distilled spirit of choice for at least two days before adding the extract to the secondary fermenter or finished beer. The distilled spirits will promote extraction which cannot be attained with water alone. To prepare the wood of oak, it should be cut into 1" x 1" cubes or large chips and toasted. Toasting oak is best accomplished over an open wood or charcoal fire (think roasting marshmallows). A pair of long handled tongs or a metal grill works well to hold the chunks of wood over the heat of the coals until the wood takes on a deep brown color. Some black scorching is acceptable, but avoid excessive charring. If you don't want to deal with cutting and toasting oak yourself, it can be purchased already toasted from many homebrewing or home winemaking suppliers.

"Excessive use of a spice can ruin a batch of beer, while not using enough spice means the flavor will be less pronounced than expected."



Adding the ingredients

Perhaps the biggest question when brewing with spices is, "How much do I use?" When making the decision on the quantity of spice to use in your recipe, consider the strength of the spice or herb and when in doubt, use less than you think you'll need. It is much better to have a beer with a too-subtle spice flavor than one with a too-strong spice flavor. Excessive use of a spice can ruin a batch of beer, while not using enough spice means the flavor will be less pronounced than expected. You can always use a little more spice the next time, but can't take it out of a beer after it is brewed. The table at byo.com shows the maximum amount suggested for each spice for a typical five-gallon (19-L) batch of beer. If you have never used a given spice in brewing before, begin with a small amount and take good notes so you can refine your recipe each time you brew.

Measuring out small amounts of spices can be a tricky business if you do not have a scale capable of weighing down to fractions of an ounce (or gram). A tactic I have used to help in these situations is to prepare an ounce of the spice (which I can accurately weigh on my inexpensive home postage scale) in the form it will be used in my recipe, then measure the volume of that ounce in some small increment such as teaspoons (or milliliters). If one ounce of the spice measures one teaspoon then I know that one teaspoon is an ounce, a half teaspoon is a half ounce, a quarter teaspoon is a quarter of an ounce and so on.

Deciding when to add an herb or spice in your brewing process depends upon whether you wish to have the spice's flavor, aroma, or both in the finished beer. Typically, the earlier an herb or spice is added in the brewing process the more flavor will be extracted but also the less aroma will be retained. A spice such as cinnamon might be added during the last thirty minutes of the boil to achieve the desired flavor. However, the subtle aroma of sweetgrass would most likely be lost altogether if it were boiled, and therefore would best be added to the secondary fermenter; similar to dry hopping. In some cases, a particular quantity of an herb or spice might be split, with some added earlier in the brewing process and some later in order to achieve the flavor and aroma profile desired. This is where careful tasting and good note-taking is essential while experimenting with various spices in order to develop a spiced-beer recipe that meets your expectations.

Brewing with herbs, spices or other flavorful ingredients can be a fun way to experiment. Begin by choosing a base style of beer and consider the additional flavors you wish to include in it. Locate the proper kind and form of spices you'll need to pursue those flavors. Go easy on the quantity of each additional herb or spice you decide to add to your brew and carefully consider when each of them will be added during the brewing process. With a little practice you will soon have your own signature spiced beer!

Jon Stika writes "Techniques" in every issue of Brew Your Own.

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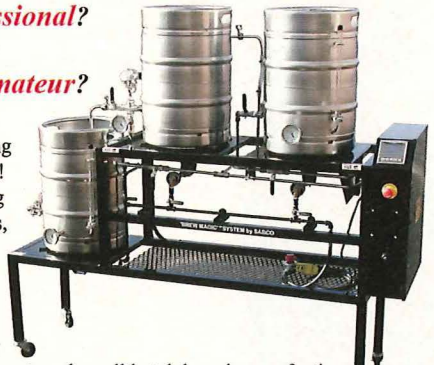

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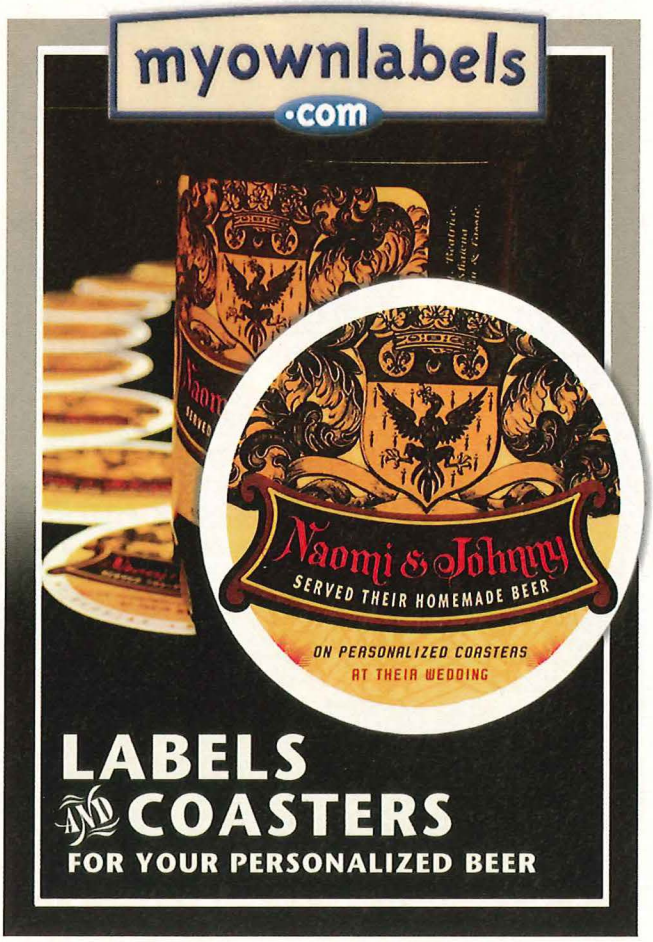


Advanced Brewing

Combustion

Heat generation and use in homebrewing

by Chris Bible

A common way to boil wort in a homebrew system is by using a propane burner. Many different styles are commercially available, but they all have one thing in common: they use the combustion of propane to generate heat. This heat of combustion is transferred to the contents of the brew kettle and eventually the desired full rolling boil is achieved.

The chemical equation that describes the combustion of propane is:

C_3H_8 (propane) + 5 O_2 →
3 CO_2 + 4 H_2O + Heat Energy

The combustion of propane generates 19,928 BTU/lb. of propane burned, assuming that the combustion products remain in a gaseous state. A British Thermal Unit (BTU) is defined as the amount of energy required to increase the temperature of 1.0 lb. of water by 1.0 °F.

Some homebrewers use natural gas as a combustion fuel. Unrefined natural gas is a combustible mixture of hydrocarbon gases that can include methane, ethane, propane, butane, pentane and other compounds. The natural gas that is delivered to homes has been refined and is comprised of nearly pure methane.

A lit propane burner with the proper oxygen to fuel mix will exhibit a stable blue flame with just a touch of yellow at the base.

Methane is a compound comprised of one carbon atom and four hydrogen atoms (CH_4). Methane has a heat of combustion of 21,502 BTU/lb. As with propane, the reaction products of the complete combustion of methane are carbon dioxide and water:

CH_4 (methane) + 2 O_2 →
CO_2 + 2 H_2O + Heat Energy

Since methane has a slightly higher heat of combustion than propane, about 8% less natural gas is required to produce a given amount of heat. A burner can be made to work with either fuel, but in order to operate correctly the combustion gas supply pressures and the ratio of air to fuel must be adjusted appropriately. Regardless of the fuel used, the goal is to produce heat energy.

How much heat energy does it take to generate a full rolling boil? First, the wort must be heated from room temperature to the boiling point of the wort. The amount of heat required to do this is given by:

$Q1 = mC_p\Delta T$

Where:
Q1 = required heat (BTUs)
m = mass of wort (lbs)
C_p = heat capacity of wort (BTU/lb-°F)
ΔT = final wort temperature –
initial wort temperature (°F)

Example:

How much does it take to heat 5.5 gallons (21 L) of wort from 70 °F to 215 °F (21 to 102 °C)? (215 °F/21 °C is typical boiling temperature for wort; this is higher than 212 °F/100 °C because it contains dissolved solids).

We know the density of water is 8.34 lb./gallon, wort heat capacity is 1 BTU/lb. and let's assume a specific gravity of 1.060.

Q1 = [(5.5 gal)(8.34 lb/gal)(1.060)] X
(1 BTU/lb-°F) X (215 °F - 70 °F) = 7,050 BTU

After enough heat is added to the wort to raise the temperature to the boiling point, additional heat energy is required to actually start the boiling process (i.e. change the water from a 215 °F/102 °C liquid into a 215 °F/102 °C gas). About 971 BTU/lb of water is required to do this. This is known as the "heat of vaporization" of water.

The amount of heat required to do this is given by the equation:

$Q2 = mH_{vap}$

Where:
Q2 = energy required (BTUs)
m = mass of water boiled away (lbs)
H_{vap} = heat of vaporization of water (BTU/lb)

Example:
If we have 5.5 gallons (21 L) of 215 °F (102 °C) wort initially in brew kettle and desire a 10% volume loss during boiling, then:

$Q2 = [(5.5\ gal)(0.10)(8.34 lb/gal)] \times (971\ BTU/lb) = 4{,}454\ BTU$

Adding Q1 + Q2 gives: 7,050 BTUs + 4,454 BTUs = 11,504 BTU of heat energy required to generate the much-desired full rolling boil.

But wait! This assumes that 100% of the heat being generated is being transferred into the contents of the brew kettle and this assumption is absolutely incorrect! Not even the best industrial heat transfer system (in a brewery or otherwise) is close to 100% efficient. For a heating system that is typically encountered in a homebrewing setting, very low efficiencies are the rule (typically 20–40% heating efficiency). These system inefficiencies (see Figure 1) can largely be attributed to heat loss due to inefficient transfer from flame to brew kettle; the propane burner also heats combustion air; heat loss from brew kettle contents to surroundings and the heat required to volatilize propane (~149 BTU/lb. propane at 70 °F/21 °C).

Due to these inefficiencies and heat losses, much more than the theoretical amount of heat is required to actually achieve a boil. As an example, for a system that is 25% efficient in transferring the heat of combustion to the brew kettle contents:

Figure 1

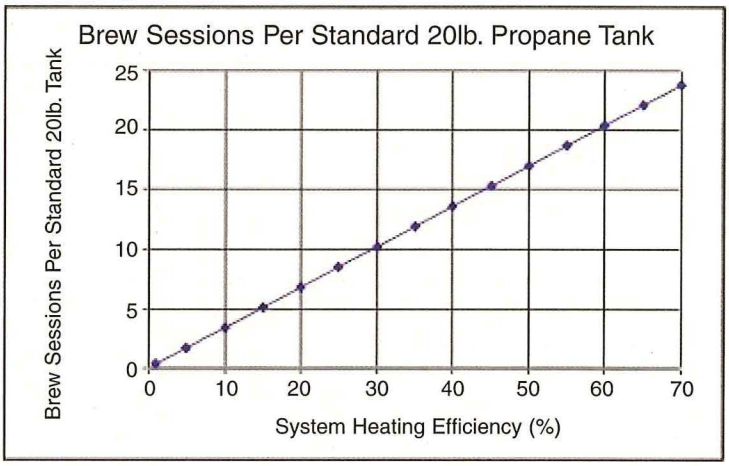


Figure 2

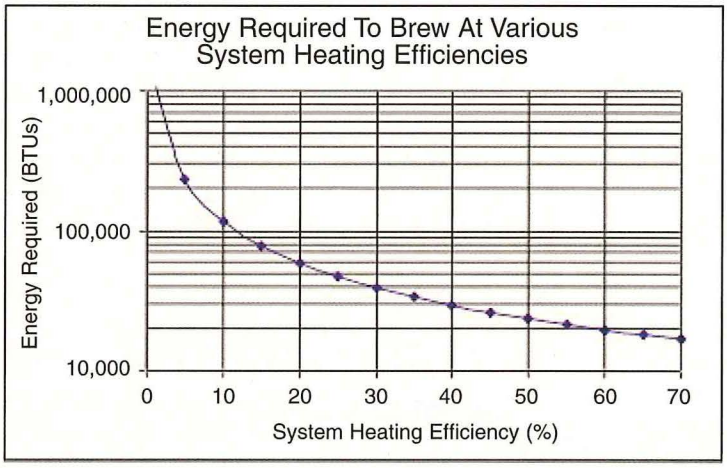
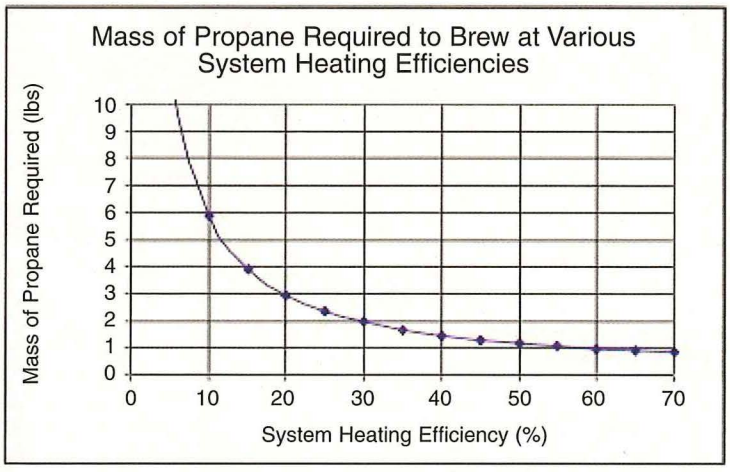


Figure 3



Assumptions for Figures 1 - 3:
5.5 gallon (21 L) initial wort volume • 10% loss during boil • C_p wort = 1.0 BTU/lb. H_{vap} water= 971 BTU/lb • Wort SG = 1.060 • Wort Initial/Final Temp. = 65°F/215°F Propane Heat of Combustion = 19,928 BTU/lb.

(11,504 BTU theoretically required)/(0.25) = 46,016 BTU actually required.

This also means that four times the theoretical amount of fuel must be burned to supply the required heat.

Increasing heating efficiency

As a homebrewer, the only practical ways to improve heating efficiency are to insulate the brew kettle and to use the largest diameter brew kettle that is feasible. Insulation reduces the rate of heat loss from the kettle to the surroundings and a large diameter brew kettle will help minimize losses due to poor heat transfer from the burner flame to the brew kettle.

Minimizing heat loss is generally much less important to a homebrewer than it is to a large commercial brewer. Energy is a significant cost for large commercial breweries. Homebrewers, however, do not brew beer for profit, but rather for the joy of brewing. Very little is gained in the way of brewing joy by fretting over propane use and trying to save ½ lb. of propane per brew-session. Using propane (or methane) to achieve a good boil will ultimately bring joy to the homebrewer as the final product of the brewing process is lifted to the lips and savored!

Adjusting the combustion mix

There are two ways that a brewer can control the flame on a burner. The first is by adjusting the flow rate of fuel to the burner by opening or closing the valve on the line that is supplying the fuel to the burner. More fuel equals more heat.

The second is to manipulate the air intake on the burner assembly to increase or decrease the amount of combustion air that is available to react with the fuel. By adjusting the air-to-fuel ratio, the hottest possible flame can be generated. To produce the hottest possible flame, the goal is to provide exactly enough combustion air to the burner to achieve complete combustion of the fuel, but have minimum excess air going along for the ride. Although having lots of excess air will ensure complete combustion of the fuel, this excess air will cause the flame temperature to be cooler than it could be. When too much air is present, the flame will have a very pale blue color or might even be almost invisible. If the burner is receiving too little combustion air, the combustion of the fuel will be incomplete. When too little air is present, the flame will have a yellow color. If the amount of air is very much restricted, the combustion of the fuel may be inhibited to the point where soot (carbon) is being produced:

Fuel + Inadequate Oxygen →
CO_2 + CO (carbon monoxide) +
C (carbon) + H_2O +
Less Than Maximal Heat

A flame that has the optimum amount of combustion air will have a color that is just slightly yellow very near the base and the rest of the flame will be blue.

Chris Bible is Brew Your Own*'s "Advanced Brewing" columnist.*

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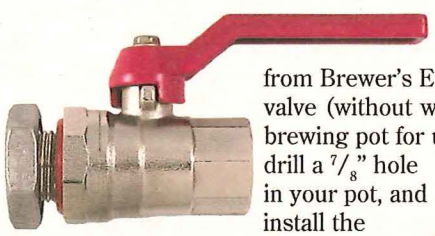

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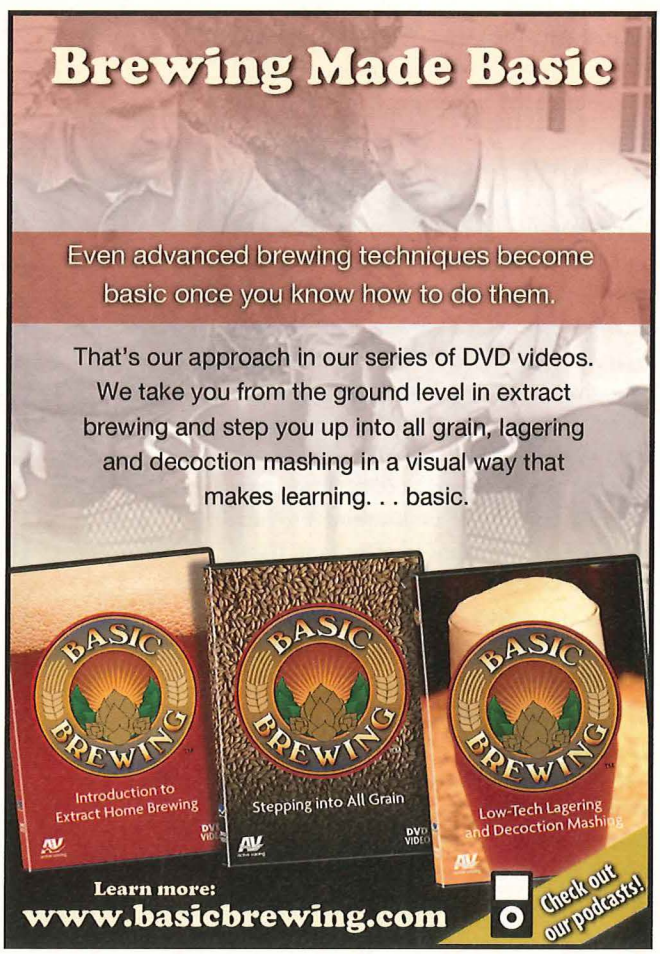


Carboy Projects

Build a carboy dolly and protector

Story and photos by John Zamarra

In this installment of "Projects," we will solve the problem of moving and protecting glass carboys, which are not only expensive, but also prone to breakage if they are wet or handled without caution, or stored against each other on an unstable surface. Full carboys are also heavy and hard to move around a homebrewery without risking injury. Try building these two inexpensive carboy projects and you may be saving yourself some money on buying a new carboy — or at least your back!

CARBOY DOLLY These dollies go along with the carboy protectors on page 71. They are especially useful if you're using 14-gallon (53 L) carboys because they're so heavy, but they also make any size carboy easier to maneuver around your homebrewery.

materials

qty	description
4	2½ inch casters, ready to attach
1	18 x 18½ inch plywood
1	2 x 3 x 8 feet lumber
20	1¼ inch finishing nails
16	8p 2½ inch common nails

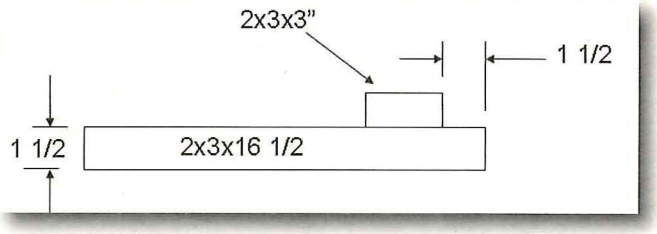
tools

saw
drill
screwdriver

Assembly

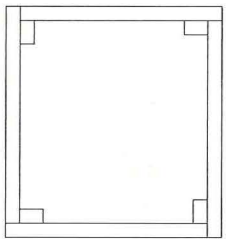
Cut four pieces of 2 x 3 x 16½ inches out of the 8 foot piece. Cut 4 pieces of 2 x 3 x 3 inches from the remaining 30 inch piece of 2 x 3. Place the 2 x 3 x 3" 1½ inches from the end of the 2 x 3 16½ and join them together using two 2½ nails.

FIGURE 1



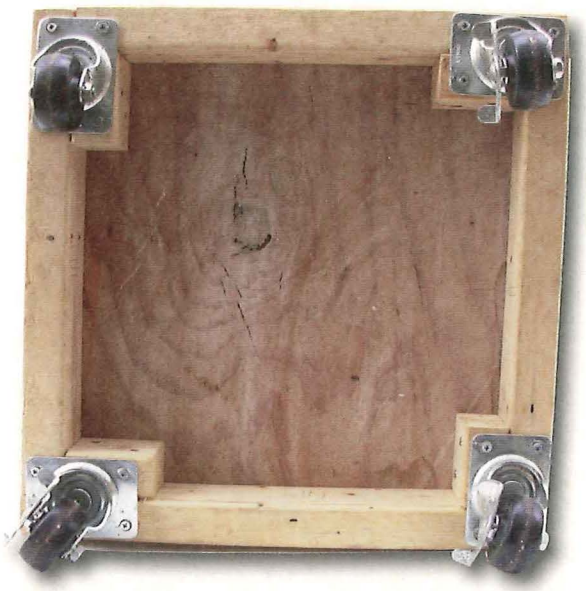
Repeat three times with the remaining pieces. Put two of the above assemblies on a flat surface and join them together using two 2½ inch nails shown in figure 2.

FIGURE 2



Nail the third piece to the first two, and add the fourth piece so they form a square as shown in figure 3.

FIGURE 3

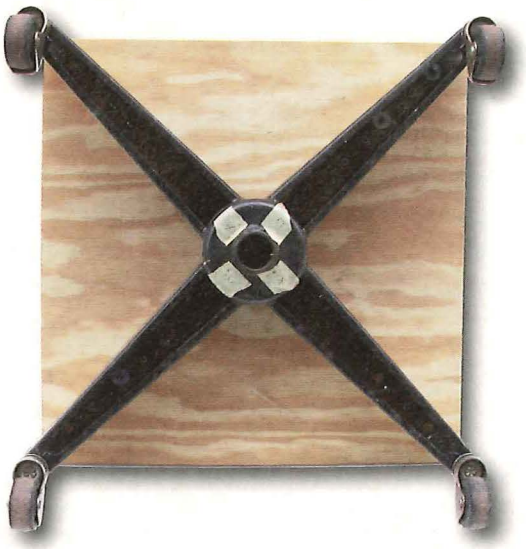


Attach the square of 2 x 3s shown in figure 3 to the 18 x 18 x ½" platform using 1¼ inch finishing nails. Flip it over and attach the casters in each corner using the wood screws that came with the casters (should be 1¼ inch flat head screws). Details shown in figure 4.

FIGURE 4

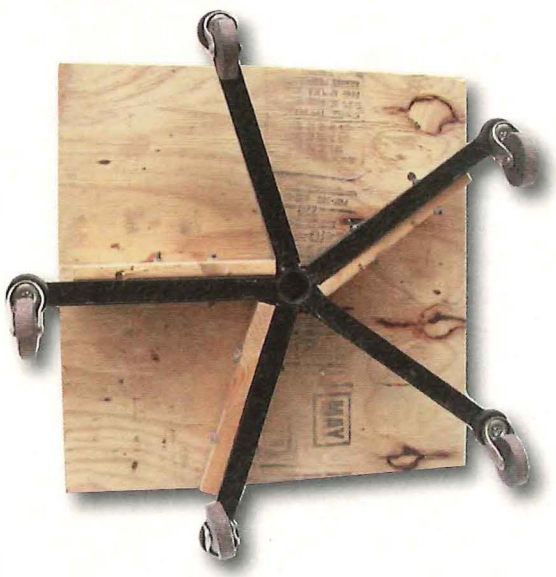
Attach the square of 2 x 3s shown in figure 3 to the 18 x 18 x ½" platform using 1¼ inch finishing nails. Flip it over and attach the casters in each corner using the wood screws that came with the casters (should be 1¼ inch flat head screws).

FIGURE 5



As an alternative to the casters, you can use the legs from a discarded office chair as the rollers. These are attached with sixteen wood screws.

FIGURE 6



If you use chair legs that don't sit flush to the board, as in this five-legged chair, you will have to make some small, triangular pieces of wood as a shim.

CARBOY PROTECTOR

If you've ever had two full carboys of beer tap against each other, you know the sickening feeling as you see 5 or 6 gallons (19 or 23 L) of beer go down the drain after one of those carboys broke. These easy to build protectors are cheap insurance to prevent that kind of catastrophe from happening again. You can build one for less than three dollars.

materials

qty	description
1	14½ x 14½ x ½ inch plywood
2	2 x 2 x 8 ft. lumber
32	#10 x 2½ inch flat head wood screws
8	#8 x 1½ inch flat head wood screws

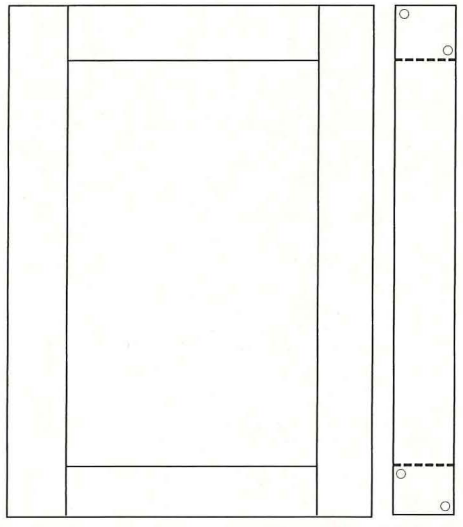
tools

saw
screwdriver
carpenter's square

Assembly

Start by cutting the 2 x 2s into 4 pieces x 19 inches long, and 8 pieces x 11½ inches long. You will be building two rectangles, connecting them together, and screwing them down on a piece of ½-inch plywood. Figure 1 shows the basic rectangle. Insert two #10 x 2½ inch screws in the diagonal pattern shown in the end view.

FIGURE 1



Make two rectangles as shown above. Shown in Figure 2 are the two rectangles ready to be connected to the four remaining 2 x 11½ pieces.

FIGURE 2

Attach the four remaining 11½ inch pieces between the two rectangles. Put the two screws in each corner, between the two diagonal ones. See figure 3. Attach the entire assembly to the 14½ x 14½ base using eight 1½ inch wood screws. Apply a coat of polyurethane and you're done.

FIGURE 3

It's very unlikely that you will break a carboy if you keep it protected in this protector. Plus, it will make your beer handling a lot easier if you use it together with the dolly described on page 69 and 70.

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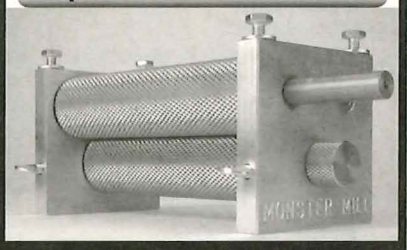

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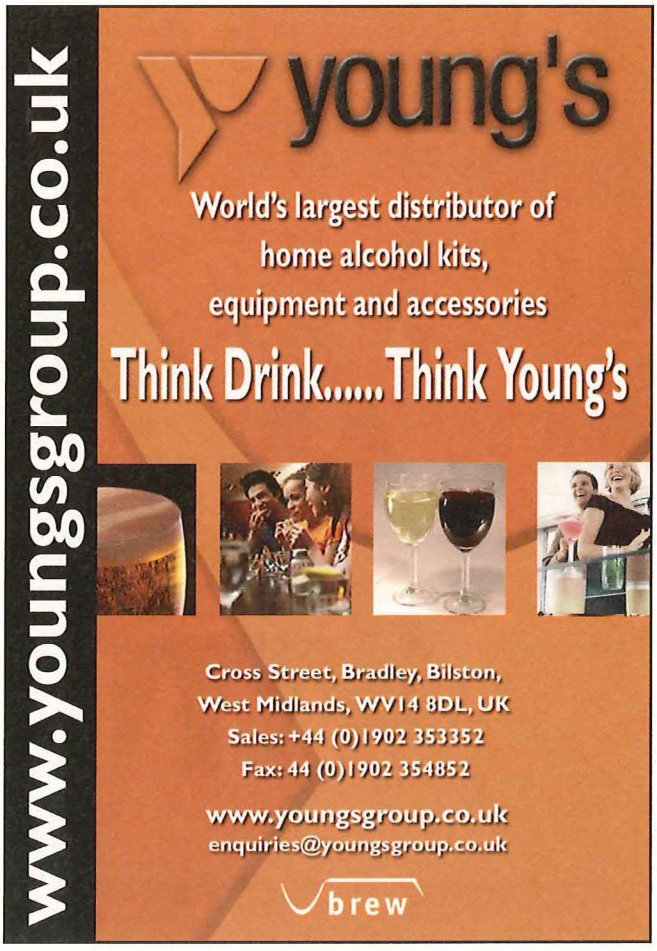

From The Ashes

The beginning of a new homebrewery

Terry Badman • Manchester Center, Vermont

toolmaker and homebrewer Mike Knaub was busy at work when the phone rang.

"My wife called and said I better get home now," he said. "She told me the garage was on fire — that we might even lose the house."

Knaub hopped in his vehicle and sped off to his Mt. Wolf, Pennsylvania home. During the nervous and anxious drive that ensued, he couldn't help but note the irony of what was happening.

"We had fire extinguisher training that morning at work," he said.

By the time he got home, firefighters had contained the blaze. But Knaub's garage and homebrewing headquarters had burned to ashes.

"I was in a state of disbelief," he said. "I'm glad I didn't see it actually burning and fall down."

Having consumed the garage, the fire began to make its way towards his house. Ash and glowing ambers ignited a small bush near the kitchen side of Knaub's house. The flame quickly spread, singeing a portion of the house's vinyl siding before being put out.

"I was about 10 minutes away from losing my home," Knaub said.

It all started earlier that day. Knaub's neighbor was cleaning out an ash pit full of spent scrap wood that had been burned two days prior. The neighbor dumped the ashes behind his barn — 40 feet from Knaub's garage — unaware that they still contained a small amount of hot embers. Mother Nature took over from there. A 30-mph wind stoked the tiny embers to flame. After the barn went up in a fury, a little breeze was all it took to spread the fire to Knaub's garage.

"I actually consider myself blessed and thank the Lord I didn't lose my home that day," he said. "The garage and everything in it is one thing, but to lose your home would've been a lot more tragic."

In addition to losing the garage, which housed his lawn mowers, workbenches, 700-board-feet of black walnut lumber, dozens of assorted tools and other items, the fire also claimed nearly all of Knaub's homebrewing equipment and supplies.

"Wow the list was extensive," said Knaub, counting his brewing losses. "My brewing system, motorized malt mill, 400 lbs. (316 kg) of grain, 7 lbs. (3.2 kg) of hops, chest freezer with a temp control, a side-by-side fridge. Luckily, I only lost 11 gallons (42 L) of beer — a Czech Pilsner and a Munich Dunkel," he said.

While the contents of the garage were covered under Knaub's homeowner's policy, damage estimates came in at more than $60,000 between the garage, house, and landscaping. Insurance would cover roughly half, so he decided to rebuild everything from the ground up himself.

"I'm the general contractor on this job. I built the garage myself about eighteen years ago," Knaub said. "If I had to pay a contractor I would've come up short on the project."

Using the opportunity to start from scratch also allowed Knaub to make adjustments to the design of the old garage, adding a few brew-related improvements during the construction process. He has plans to add a walk-in cooler underneath the stairs ascending to the garage's second floor; a space that he said was underutilized in the past.

He also installed a few flame repellant modifications — just in case.

"The old building was over 100 sheets of plywood and vinyl siding," he said, adding that he used 2-feet by 4-feet girts and purlins with metal siding this time around. "The metal siding and roofing allow a longer contact time before burning."

And while the fire may have been the death of Knaub's trusty garage, it also marked the birth of his new homebrewing hideout, the Phoenix Brewery.

"Naturally with the fire I thought 'what a good name,'" he said. "Like a phoenix rising again from the ashes."

As for what he plans to brew first when everything's settled with his new brewery, it's still up in the air. But that doesn't stop his friends from making the occasional off-color suggestion.

"Another homebrewer I know suggested a smoked porter should be first," he said. "But I'm thinking a Czech Pils or Munich helles."

A garage fire destroyed Mike Knaub's garage, which housed all of his homebrewing equipment. In its place, he built this new structure that he calls the Phoenix Brewery.

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