BEER Fizz-ics

World of Beer, Tampa, Fla., stores kegs in a long, narrow cooler, tapping 50 brews through the wall to the bar. Another 12 travel through trunk lines to an upstairs bar serving an outdoor patio. The system is from Micro Matic.

Photos by Steve Williams

Simple laws of physics govern draft beer dispensing; here's what you need to know to spec a system that will work *and* save you money.

By Michael Sherer, *Senior Contributing Editor*

At the World of Beer tavern across the street from Tampa Int'l. Airport, Tampa, Fla., like most WOB stores, stacked beer kegs of various sizes line two walls of a 40-ft.W x 6-ft.D walk-in cooler behind the bar; a narrow path between them gives bartenders and staff access to the entire cooler. While some are back-ups stored there until needed, at least 50 are tapped, ready for bartenders to pour from a faucet/tap in the bar. More than a dozen of the kegs in the cooler are tapped for a second-floor bar that services an outdoor deck as well.

WOB also carries 500-plus beers in bottles, as you might expect from a tavern with a name like World of Beer. But why 50-plus beers on tap? Draft beer tends to be fresher than bottled beer, so it often tastes closer to what the brewer intended, which is one of WOB's objectives. And since purchasing draft beer in kegs is essentially buying in bulk, it's less expensive per ounce than bottled beer, with the potential for greater profit per glass. If the beer isn't dispensing properly, though, WOB—or your operation—stands to lose money literally down the drain.

"Our primary goal is delivering consistent quality in the draft beers we serve," says Dave Reid, COO, World of Beer Franchising, Tampa. "And we want to reduce waste and maximize beer profit in the process. I love showing off our beer coolers. But when people see the state-of-the-art draft system with beer lines that prevent oxygen permeation and flavor transfer, onsite blended-gas management for various styles of beer, the temperature monitoring and CO2 sensor

alarms, and all of this is topped of with 304-grade stainless contact throughout to ensure the quality of brew is delivered as the brewer intended, they realize this is serious draft beer."

Direct Or Remote

There are essentially two systems that dispense draft beer from a keg into a glass—direct and remote. Direct-draw systems dispense beer directly from kegs in an undercounter cooler or a walk-in behind the bar. In both cases, lines through the counter or the wall to the tap are relatively short, less than a couple feet in most cases, and no more than 5 ft. In remote systems, beer travels through lines as long as 300 ft. or more from kegs stored in walk-in coolers to bars or service areas. The following Gallery, page 32, focuses on remote beer dispensing systems.

While there are variations on the theme, the laws of physics apply to them all. That means when you get right down to it, there's really only one way to get beer from a keg to a glass—through a line or tube of some kind with a faucet turning the flow on and off.

Beer isn't water, however. It's a living, naturally carbonated beverage and a perishable food product. A number of factors will affect not only its quality, but how consistently it dispenses from a tap. Temperature, distance from keg to tap, size and cleanliness of the line that carries the beer, materials used to make the line as well as the tap or faucet, gas used to force beer out of the keg through the line, and the pressure of that gas all interact with the beer in some way.

You don't have to be a rocket scientist to design, spec and install a beer dispensing system, but a good understanding of the principles involved will help you assess whether suppliers know what they're trying to sell you and how to install it properly. First, take a look at which type of system will best suit your needs.

Direct draw from undercounter kegs limits the number of beers you can put on tap to the amount of cooler space you can put in your bar area. It also limits the size of the kegs you purchase (small ⅙-barrel mini kegs and even ¼-barrel pony kegs can help you offer more variety in the same space), and impacts how often you have to replenish kegs. Direct draw through the wall obviously requires advance planning and design, fine for new construction but probably not an option in existing stores. Remote systems give you a lot of flexibility, but also require planning to determine where to run beer lines, where to locate power packs to chill the beer lines, and how much walk-in space you have for beer kegs.

Many remote beer dispensing system makers manufacture the beer chiller and the taps and work with other component makers to create and install the entire system that gets the beer from the keg to the tap. Key pieces include **1)** the chiller, **2)** the gas mixer, **3)** the lines and trunk lines. *Courtesy of Glastender.*

1

2

3

Beer is best stored in its own walk-in at 38°F, but some companies, including Chill-Rite (pictured), guarantee beer is at 32°F at the tap even if coolers are warmer.

What You Need

The components of a good beer dispensing system are essentially the same for both direct draw and remote systems, though remote systems require a few extra items. Here are common elements:

- **Reliable refrigeration** is a must. Beer is best stored and dispensed at 38°F (though you'll find manufacturers tout systems that dispense closer to 29°F to 32°F; the beer will ideally warm to 38°F by the time it reaches the customer, see "Ice: Friend Or Foe?"). Some ales are brewed to be served at slightly warmer temperatures of 42°F-44°F or even 50°F, but should still be stored at 38°F. Brewers also recommend storing beer in its own cooler if possible rather than in a walk-in with food. Health code requires food to be stored at 41°F or below, and though you may set your walk-ins at 38°F, employees are often in and out of food walk-ins, raising the temperature.

Why is temperature control so important? Every two-degree rise in beer temperature equals a 1 psi loss in CO2 pressure, and liquid heats up four times faster than it cools.

Dispensing Innovation

Even though the physics of beer dispensing are fixed, manufacturers continue to innovate in the category. A few of the developments include:

- **Bottom-up glass fillers.** Invented nearly a decade ago, this beer dispensing system fills beer cups from the bottom several times faster than traditional taps with no excess foaming. They're ideal for super high-volume operations such as stadium concessions.
- **Growler dispensers.** Fast-flow bottle and growler fillers give operators and especially brewpubs and local breweries the opportunity to sell their draft beer in bottles and growlers for take-home consumption where legal. Some dispensers are fully automated for self-serve operation; customers simply put the container in a chamber, select one of four beers and push a button. The unit fills and caps the container.
- **Beer infusers.** These beer columns or towers have chambers that can be loaded with flavorings such as fruits, vegetables, coffee, chocolate, herbs and spices to modify the flavor of a craft or specialty beer. They're often designed in a way that the beer on tap can be drawn through the infuser or on its own so customers can compare tastes.
- **Self-serve taps.** RFID technology has made it possible to give a legal-age drinker a special wrist band that "unlocks" through-the-wall direct-draw taps to deliver the beer they choose. The tap automatically sends the beer style and amount dispensed to a POS machine to add the beer to the customer's bill. Some manage inventory and report which beers sell best when and to whom.
- **Multi-temp nitro stations.** A new multi-temperature, nitrogen-powered beverage station gives operators the ability to sell several beverages, including wine, beer and cold-brewed coffee from the same dispensing unit.

Ice: Friend Or Foe?

Americans like ice-cold beverages, especially beer, to the point where manufacturers make "frozen" beer towers and operators store beer mugs and glasses in freezers to chill them below 32°F. But is iced beer good for you or your customers?

Frozen beer towers have specially designed cold plates through which glycol chilled to a constant 28°F-29°F circulates. Ambient humidity condenses and freezes on the tower's metal surface. Though it has more to do with looks than keeping beer at proper pouring temperature, the cold tower often does end up chilling beer at the tap below 38°F. So, why is that a bad thing?

The colder beer is, the more CO2 it absorbs, and the flatter it pours. Without a good foam head, you're wasting beer profits. Customers also don't like flat beer. On top of that, if they do drink ice cold beer, the added CO2 in the beer will start to release as soon as the beer warms in their stomachs, making them feel full, so they won't drink as much beer.

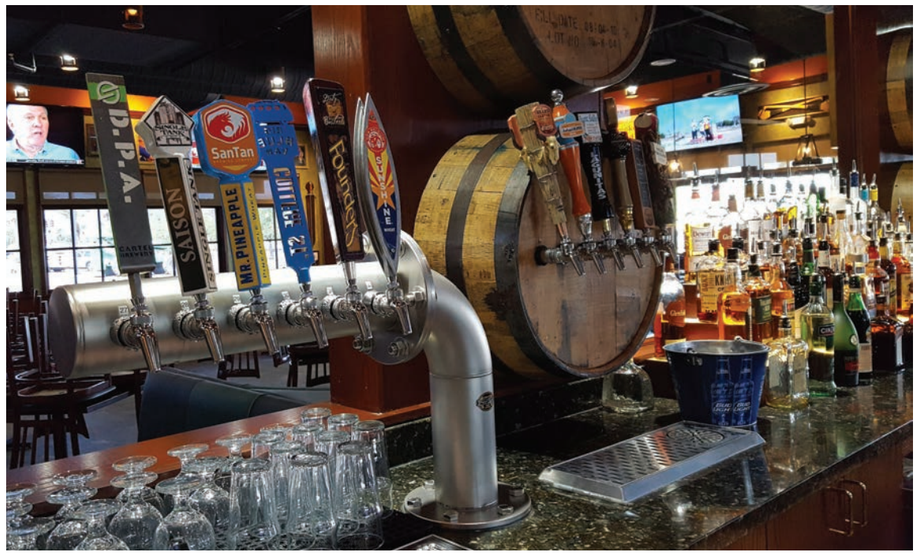
As far as iced glasses or mugs go, the frosty exterior is a great marketing tool. But ice crystals on the inside of a glass have jagged edges that cause beer to excessively foam as it pours from the tap, again costing you money. To properly prepare any glass for beer, but especially glasses that you've kept in a cooler, you should actually install a glass rinser by your taps. A quick press of an inverted glass on the rinser gives the glass a 15-psi squirt of water, preparing it for a refreshing glass of not-quite-ice, but pretty cold beer. (Glass rinsers cool down glass and make it smoother so there's less friction when beer fills it.)

Save the froster for your margaritas and frozen daiquiris, but skip it for beer glasses.

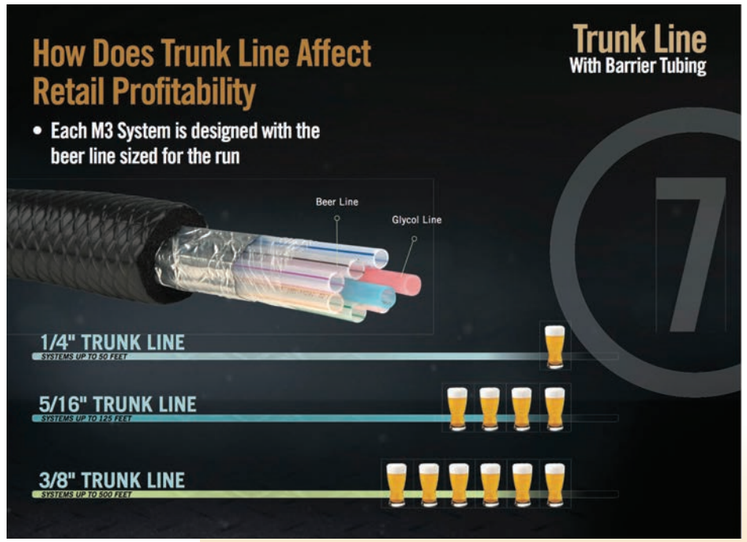
That means that a keg left out at ambient temperature for 15 minutes will take one hour to cool back down to 38°F. A keg that warms up to 44°F will take *18 hours* to cool back down to 38°F. And the warmer the beer, the more its carbonation will want to escape (see "Physics of Foam").

- **Pressurizing gas.** Since beer is naturally carbonated, CO2 is the first choice to pressurize beer kegs and fill the headspace as the keg is depleted. CO2 alone can't always do the job, though. For especially long runs from keg to tap, you may need an additional pressure source that won't be absorbed into the beer. The best source is nitrogen. Nitrogen is available in tanks on its own or pre-blended with CO2.
- **Nitrogen generator.** If you have several long runs or also serve nitrogenated beers such as Guinness, you may want to buy or lease a nitrogen generator, which separates nitrogen from air. Often, operators back up a generator with at least one tank of pure nitrogen just in case the generator goes down.
- **Gas blender.** These units mix nitrogen and CO2 in percentages pre-set by the manufacturer, and you can get blenders with two or three pre-sets. The Brewers Association recommends a 70/30 blend of CO2/N2 for most long runs, and a 25/75 blend for nitrogenated beer. But the association also says that the exact blend depends on your dispensing system. (A calculator is available on its website, *brewersassociation.org*.) Blenders automatically shut off when they sense either gas running out.
- **Regulators.** Most kegs are pressurized at about 14 psi, depending on the beer, your altitude (figure on raising that number about 1 psi for every 2,000 ft. you are above sea level), and beer temperature. Pressure in CO2 tanks is as high as 1,200 psi. Regulators deliver the right pressure to the keg. Better regulators have two pressure gauges, one to let you know how much CO2 remains in the tank and the other to monitor the pressure delivered to the keg.
- **Gas lines.** Lines for CO2 (and nitrogen) are typically made of vinyl, and often colored to set them apart from beer lines. For longer runs and/or higher pressures braided vinyl is stronger and less susceptible to rupture or leaks.
- **CO2 detector.** CO2 is best stored separately from kegs. But even in a walk-in with a large number of kegs, the potential for CO2 build-up increases as a result of leaks in faulty lines or regulators. A CO2 detector will alert you to higher than normal levels of the gas before employees pass out or get injured.
- **Beer lines.** Vinyl also is typically used to make short-run beer lines as it's flexible and easy to replace. Vinyl barrier tubing replaced old single-wall polyethylene lines on long runs some time ago to prevent migration of oxygen and contaminants into the beer flowing through the line. Plain vinyl and poly lines should never be used on long runs anymore. More recently, manufacturers introduced a new nylon-coated poly line (nylon serves as a barrier, making these lines more than simply single-wall vinyl/poly lines, and fine for long runs), which makes

When it comes to tap décor, the sky is the limit. Purveyors can match everything from old Irish pubs to super sleek 007-worthy tap towers. *Courtesy of Perlick.*



Courtesy of Micro Matic.



Easy Money

Beer profits can easily vanish down the drain. Here's a simple way to generate more sales. Don't simply settle for the size beer line a supplier sells. Here's why: 50 ft. of ¼-in. line contains about 15 oz. of beer; the same length of 5/16-in. tubing contains 25 oz.; and ⅜-in. line contains 37.5 oz. Every time you clean the lines, that's how much beer you lose in the process. At an average price of $5 per pint for draft beer, you're losing about $0.31 per ounce in sales for every ounce you flush from the lines.

If your runs are less than 50 ft., for example, why would you want to use a standard ⅜-in. line? The 22.5-oz. difference the ⅜-in. line contains versus the ¼-in. line is not just $7 in lost sales, but potentially $7 in lost profit.

Using a different example, let's say you have 10 beer lines that run 100 ft. from walk-in to tap. Using 5/16-in. line instead of ⅜-in. on those runs would save 250 oz. per cleaning. If you clean your lines every two weeks as you should, you'll save 6,500 oz. of beer in a year. At $0.31 an ounce, you'll have generated an additional $2,015 in revenue. Easy money.

the inside walls of the line as smooth as glass, helping prevent microbial growth in the lines providing an even stronger barrier against migration.

The most common size line used in dispensing systems is 3/8-in. in diameter, but sizes include 5/16-in. and a relatively new 1/4-in. line. The size you choose will depend on the length of your runs from keg to tap—1/4-in. line works well up to 50 ft.; 5/16-in. can be used on runs up to 125 ft.; and 3/8-in. up to 300 ft.

The last size is 3/16-in. used for a choker line to restrict beer flow near the tap or faucet to a target rate so it doesn't pour too fast and foam. These short (no more than 5 ft.) but variable-length sections of tubing are attached to the end of long-run barrier lines with a splicer and connected to the hose barb on the end of a faucet shank.

To keep beer cold on longer runs from a remote walk-in, you'll need a few additional components.

- **Glycol lines.** Glycol can be chilled to 28°F without freezing. Run through polyethylene tubing alongside beer lines, the chilled glycol helps keep beer typically at 38°F until it reaches the tap. Usually colored to differentiate them from beer lines—blue on outbound and red on inbound, glycol lines run in a continuous loop.
- **Trunk lines.** These are bundles of beer and glycol lines that are specially assembled so each beer line touches at least one glycol line. The lines should be wrapped in a moisture barrier such as clear Mylar, then a layer of reflective foil and finally with foam insulation. Less expensive trunk line is offered with 3/4-in. insulation. Better bundles are insulated with 1-in. foam, and the entire bundle is secured with PVC tape, which protects the lines from dirt, moisture and pests. Trunk lines come in 300-ft. rolls, which dispensing equipment manufacturers cut to the desired length before shipping to a customer or installer.
- **FOB valves.** Foam-on-beer devices are essentially fuel gauges that detect when a keg is empty and automatically shut off the line. Some designs are wall-mounted; others attach to the keg coupler. They can save you a ton of money on long runs by keeping lines full of beer between kegs without having to clear the line of foam and refill it.
- **Power packs** are small refrigeration units that chill the glycol and hold its temperature between 28°F and 31°F. Sized for the length of the run and number of beer lines, they range in power from 1/3 hp to 2 hp or more. Typically, a single power pack cools as many as eight different beer lines—a bundle with two glycol lines (one outbound and one inbound). Some bundles will have up to 12 beer lines with two glycol loops (four lines).

Power packs, also called line chillers or beer chillers, are available as sealed systems or with open reservoirs of glycol. Sealed systems, in which glycol lines run alongside coolant lines in a heat exchanger plate, may extend glycol life. Reservoirs, however, offer the advantage of immersing the evaporator coils into larger reserves (up to 15 gal. vs. 1 gal. in sealed systems) of chilled glycol for long runs, and keep the compressor from cycling as often, extending its life and making the power pack more efficient.

You need to check glycol solution regularly—about every 18 months—in both types of systems to ensure the concentration is correct. Glycol eventually separates or weakens, making it susceptible to freezing, and has to be replaced. Be sure to always use food-grade glycol in the system, though. Never use antifreeze.

- **Splitters.** You can service two lines—say, a direct-draw wall-mounted tap and a remote bar as WOB does—with a single keg by using a "Y" line splitter.

Pulling It All Together

Okay, so how do you pull all these components together in your operation? There are a lot of component manufacturers out there that offer trunk lines, towers and taps, gas mixers, refrigeration and more, for example. If all you need is direct draw, underbar refrigeration equipment, there are lots of makers to consider. However, if you need a long-draw remote dispensing system, you're likely far better off with a company that designs, manufactures and/or assembles components and coordinates the entire system install than buying a system piecemeal from several companies. The companies in our Gallery at the end of the article can give you an idea of where to start. Then get competitive bids from several manufacturers.

Tapping In

Your kegs are properly stored, your lines in place and correctly chilled, and your supplier and installer have determined the right length of choker line to deliver the desired flow rate to the faucet. The last few feet, even the last few inches are as important to delivering a quality glass of beer as the rest of the system that comes before. Here are the pieces you need to consider:

- **Faucets.** The Brewers Association lists nine basic faucet designs, and identifies the pros and cons of each. Suffice to say there are a lot of different beer taps on the market. A large number are constructed of chrome-plated brass (or plain brass on older models), which can potentially affect the flavor of beer if brass comes in contact with the beer.

Look for all-stainless taps (vs. other metals, which can affect the flavor of beer). *Courtesy of Perlick.*

Physics Of Foam

Draft beer may have more in common with football than simply being a stadium concession staple. The Ohio State University football coach Woody Hayes said that three things happen when you throw a pass and two of them are bad.

Beer is naturally carbonated with carbon dioxide. CO2 is a funny gas, not as in laughing gas, but it constantly wants to slip into or out of solution. When you force beer out of a keg with more CO2, unless conditions such as temperature and pressure are within a specific range, that additional CO2 will want to go into the beer or escape it.

Too warm and CO2 will want to escape solution, and beer will foam. Too much pressure, either from too much CO2 being forced into the keg, a narrow beer line as it approaches the tap, the wrong size beer line, or even a dirty beer line, and beer will foam. A dirty faucet, bad faucet washer, or clogged air vent hole, and beer will foam. Too little pressure (surprise!) also can cause beer to foam.

Ideal conditions for serving draft beer include maintaining temperature of kegs and beer lines at a constant 38°F, and regulating CO2 pressure between 12 and 14 psi for most beers.

Look for all-stainless faucets, ideally food-grade 304 stainless. At a minimum, the faucets should be NSF certified.

• **Beer towers.** With more operations offering a multitude of draft beer, manufacturers make manifolds that accommodate multiple beer lines and an equal number of faucets. These manifolds can be designed into all sorts of configurations from single-faucet columns to "T"s, semi-circular mushroom towers, and straight-line pedestals. Glycol lines also are built into the insulated towers, often running through internal cold plates before continuing to the tap itself, providing the means to keep beer cold all the way to the faucet. The look of these towers can be whatever you envision, from German beer hall to Mos Eisley Cantina, and most manufacturers will custom build them to your exact specifications.

• **Shanks.** These hollow tubes help anchor faucets to beer towers, walls or wherever else you want to mount them. Typically made of either brass or stainless, they vary in length depending on where they're used.

In newer beer tower designs, the shanks screw directly into the cold block. Manufacturers claim they're less likely to leak and provide better cooling at the point of dispense than older designs. In a more common design, a copper tube lies on top of, or is zip-tied to, the faucet shank. The glycol runs through the copper loop, chilling the shank, which serves as an entrance to the tap; the choker line runs through the shank. For direct-draw wall-mounted taps, WOB uses shanks that are 4 in. longer than the wall thickness. The extra length is exposed to the cold air of the walk-in behind the wall, helping keep beer cold to the faucet.

• **Drain Pans.** These may be secured to your bar or built into a beer tower or faucet array. Make sure they're wide and deep enough to catch all the spills from beer pouring, and made from a durable material that's easy to clean such as stainless. Some drain pan assemblies incorporate glass rinsers, which prime pints for perfect pours.

Keep overall system design in mind as you spec your components. Good beer dispensing systems take some forethought and planning—where to run lines and locate refrigeration and gas equipment, for example. Arming yourself with enough knowledge can help you when it comes time to work with suppliers on designs and specs. ***fer***

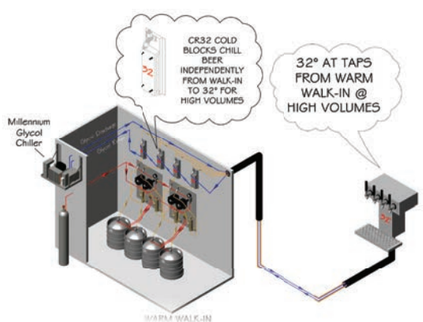
Shanks anchor taps to walls and some system providers recommend extending their length into the ambient cold of the walk-in, reporting the exposure of the metal to cold air aids in cooling the beer to the tap. *Courtesy of Glastender.*

REMOTE BEER DISPENSING GALLERY

BLIZZARD BEER SYSTEMS

Blizzard Beer Systems serve 29°F beer regardless of the temperature of your walk-in cooler. While other systems focus on maintaining the temperature of the beer from the walk-in to the tap, Blizzard systems lower the temperature of the beer coming from the walk-in. It all starts with the company's unique method of chilling using propylene glycol. A double-wrapped trunk line and a patented tower that doubles as a cold plate help maintain 29°F beer to the glass.

blizzardbeersystems.com



CHILL-RITE

Chill-Rite specializes in building remote beer systems that dispense the keg beer at 32°F, regardless of the keg temperature in the walk-in. Simply put, the kegs may be 40°F, 50°F, 60°F+ while stored in the walk-in cooler, but the Chill-Rite beer system will reduce that temperature in the lines to 32°F. With this precise temperature control, the draft beer does not pour any excess foam. The operator gets every drop of beer from the keg and pours virtually no waste. The operator will dramatically increase profits from selling draft beer when that beer is dispensed through a Chill-Rite beer system. The company guarantees that the beer will pour at 32°F or the system is free.

chillrite32.com

EASYBAR

Easybar offers custom remote draft systems that cater to the needs of a client looking for something unique in the bar area. Easybar builds towers in Bend, Ore., and uses all 304-stainless hardware as well as NSF-certified tubing. Its cold blocks are custom thick aluminum allowing for an extremely cold transfer from the glycol loop. Easybar also specializes in beer monitoring systems that give operators the ability to track what is being poured from their taps over a period of time.

easybar.com

GLASTENDER

Just as the brewery takes great care to brew, store, and distribute kegs to your establishment, a Glastender system is engineered to dispense your draft beer properly, while maintaining brewery freshness. Stainless faucets and shanks allow both wine and beer to be dispensed from Glastender beer towers. The faucets are properly chilled to prevent intermittent foaming problems. Barrier tubing in the beer bundle resists build-up and prevents flavor transfer. An efficient, compact heat exchanger and sealed glycol bath help prevent dilution of glycol over time.

glastender.com

REMOTE BEER DISPENSING GALLERY

MICRO MATIC

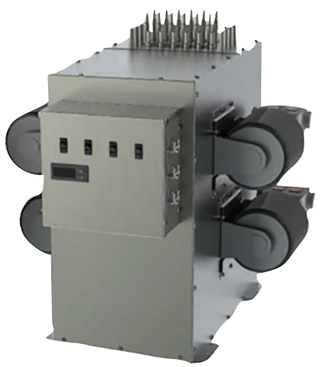
This beer system dispenses exactly what the brewer filled the keg with. Best-in-class trunk line ensures cold beer delivery with vacuum-formed insulation surrounding the beer lines. Beer lines are made from GEN-X tubing with an EVOH gas-barrier layer to protect the beer or wine from oxygen ingress. Each system is engineered with a power pack size based on the Btu load. And 304-grade stainless is the only metal that touches the beer.

micro-matic.com

PERFECTION

Perfection Equipment's unique line of Glycol Chillers has undergone an extensive redesign, improving control, reliability and efficiency. The prior need to seasonally adjust the chillers is no longer required; the chillers now adjust automatically. Perfection's long-draw remote beer systems offer the operator "Proven Performance" with beer pythons engineered for specific regional climate conditions. The totally sealed glycol system requires no open bath, preventing dilution of the glycol.

perfectequip.com



PERLICK

Perlick's ArcticPOUR solves excessive heat load problems on beer temperatures and is the only remote beer system that allows you to remotely dispense 2 different beer temperatures at the tap. You can remotely locate the ArcticPOUR refrigeration deck up to 100 ft. from the glycol bath, indoors or outdoors. The glycol bath flash chiller results in 32°F beer from a 38°F keg. System is ideal for mixed-use (food and kegs) coolers and to deliver dual beer service to indoor and outdoor areas in a hot climate.

perlick.com