EVERY BEER HAS A STORY...
We know that every beer has a story and that every brewer can make their own mark within the industry. That's why we are proud to feature Wise Man Brewing, located in the historic Angelo Brothers building in downtown Winston-Salem, NC, on the front cover of this year’s catalog.

For Wise Man Brewing it all began about 13 years ago in a kitchen. Sam Victory, a PhD chemist by day, bought himself a homebrew kit and started experimenting. The only rules were to have fun, make something tasty and clean up afterwards.

As he got deeper into the hobby, Sam started bringing his brew to social events to share with friends, and soon developed a reputation as an accomplished brewer. After entering competitions and collecting some hardware, friends began to ask Sam when he would open his own brewery. Imagination began to take flight, he shared his idea with friends Jason Morehead and Mike Beverly, and together with their families, they decided to take the leap…this is when Wise Man Brewing was Born!

After 18 months of construction on the 90 year old Angelo Brothers building, on January 28, 2017, Wise Man opened their doors. Soon after, Ryan Jackle was hired as the Head Brewer, who studied brewing, distilling and fermentation at Rockingham Community College. As the brewery has grown, the spirit of discovery and innovation from the homebrewing days will continue to resonate as a Wise Man once said, “Make the beer you wish to see in the world.”

Like Gusmer, Wise Man realizes that producing great beer is both an art and a science. At Gusmer, we have the technical staff and product lines that honor the rich history of the brewing process, while always looking to innovate. The cornerstone of Gusmer Enterprises’ culture is to work diligently in providing an intimate and personal customer experience to each and every individual who buys from us.

We are happy to offer new ground-breaking products including Chr. Hansen’s new line of SmartBev products, mbt Brautechnik brewhouses, Christian Gresser tanks and yeast props, DENWEL inline gas injection systems as well as many more. We know these products and others can help at your brewery and we look forward to working together in helping to make your story-telling beer.

Wishing You Every Brewing Success,

Your Friends at Gusmer Enterprises, Inc.
Gusmer Enterprises
Good Manufacturing Practices (GMP)

To assure our ability to deliver the best quality products, we have designed our production facility and processes to meet higher standards. Our Fresno, California manufacturing facility regularly participates in third party GMP audits by accredited GMP auditors. These third party audits evaluate the effectiveness of our facility’s adherence to the guidelines established in 21 CFR 110 and international legislation, as well as the adequacy of the programs to meet food safety standards, pest control, operational control, personnel practice, maintenance, cleaning and other food industry standards. Gusmer Enterprises is committed to Good Manufacturing Practices and the quality of our products.

Gusmer’s GMP Facility

Gusmer is the proud manufacturer of the following products:

- Oak Avantage® Oak Adjuncts
- Oak-Mor® Oak Adjuncts
- Cellu-Flo Fiber Filter Aids
- Cellu-Stack® Lenticular Filter Cartridges & Filter Housings
- Cellupore CSF Series Filter Sheets
- Carbac® Carbon Filter Media

Gusmer is also proud to partner with the following companies:

- DuPont
- Hamilton BUCHER unipektin
- ABER
- Funke GERBER
- Millipore SIGMA
- Nalco
- PQ Corporation
# Table of Contents

## Information
- Inside Sales & Sales Reps by Area ........................................... 3

## Brewing Products
- Yeast & Bacteria ........................................................................ 4-6
  - Chr. Hansen NEER™ .............................................................. 5
  - Chr. Hansen DIBS CA-1 ......................................................... 6
  - Chr. Hansen LB-1 ................................................................. 6
- MicroElements™ Brewing Nutrients ........................................... 7
- DuPont™ Danisco® Enzymes ...................................................... 8-11
- Processing Aids ........................................................................ 12-15
  - AB Vickers Isinglass and Antifoam ....................................... 12
  - PQ Silica Gels ...................................................................... 13
  - Nalco Colloidal Silica ............................................................ 14
  - BASF Divergan® PVPP ......................................................... 14
  - KICK Carrageenan® Kettle Fining Agents .............................. 15
- Flavor & Color ........................................................................... 16-17
  - PureMalt Concentrates .......................................................... 16
  - DDW Caramel Products .......................................................... 17
- Oak Products ............................................................................ 18-21
  - Gusmer Oak ......................................................................... 18-19
  - Arôbois Oak ......................................................................... 20-21
- Filtration .................................................................................... 22-31
  - Bucher Unipektin ................................................................. 22
  - Cellu-Flo Fiber Filter Aids ..................................................... 23
  - Filter Sheets .......................................................................... 24-25
  - Cellu-Stack® Filters & Housings ........................................... 26
  - MilliporeSigma Filter Cartridges & Housings ....................... 27-31
- Laboratory Equipment ............................................................... 32-39
  - MilliporeSigma Process Monitoring Tools ......................... 32-36
  - Illustrated Guide to Microbes .............................................. 37
  - Spectroquant Spectrophotometer ........................................ 38
  - Funke Gerber FermentoFlash and ColonyStar ..................... 39
- Equipment ................................................................................... 40-49
  - Pacific Ozone Generators ..................................................... 40
  - mbt Brautechnik Brewhouse Equipment ............................... 41
  - Christian Gresser Tanks & Yeast Propagation ...................... 42-43
  - Ponndorf Spent Grain Removal Equipment ....................... 44-45
  - DENWEL Inline Gas Injection & Equipment ....................... 46-47
  - Malek Keg Washing & Filling Equipment .............................. 48-49
- Instrumentation .......................................................................... 50-53
  - ABER Yeast Monitors ............................................................ 50
  - Perlick Sample Valves & Fittings ......................................... 51
  - Hamilton Dissolved Oxygen Meter ...................................... 52
  - Hamilton Inline Process Sensors ......................................... 53
- Analytical Services Panels & Individual Tests ....................... 54-55
- Practical Brewery Formulas & Conversions .......................... 56-57

## Hard Seltzer & Cider Products
- Hard Seltzer Products ............................................................... 58-62
- Cider Processing Products ....................................................... 63-68

---

**Featured Products**

**Brewhouse Technology**
- mbt Brautechnik Brewhouses ................................................. Page 41

**Malt Concentrates**
- PureMalt Crafted ..................................................................... Page 16

**Open Top Fermenters**
- Christian Gresser Tanks ........................................................ Page 42

**Inline Gas Injection**
- DENWEL Wort Aeration ........................................................ Page 46

**Filtration for Seltzer**
- Carbac® Carbon Filter Media ................................................ Page 61
Facility Locations and Technical Sales Representatives
Information & Ordering

To place an order please call us toll free: 866.213.1131

LOCATIONS:

**West Coast**
- **Napa**
  - **Napa Store & The Wine Lab™**
  - 640-D Airpark Road
  - Napa, CA 94558
  - Phone: 707.224.7903
  - Fax: 707.255.2019
  - 8:30-5:00, M-F PST

East Coast
- **Mountainside**
  - 1165 Globe Avenue
  - Mountainside, NJ 07092
  - Phone: 908.301.1811
  - Fax: 908.301.1812
  - 8:00-5:00, M-F EST

**Sonoma**
- **Gusmer Sonoma Store**
  - 9025 Old Redwood Hwy, Suite E
  - Windsor, CA 95492
  - Phone: 707.836.1056
  - 8:30-1:00, 1:30-5:00 *M-F PST
  - *Extended harvest hours, call to inquire

**Fresno**
- **West Coast Manufacturing Facility**
  - 81 M Street
  - Fresno, CA 93721
  - Phone: 559.485.2692
  - Fax: 559.485.4254
  - 8:00-5:00, M-F PST

**Waupaca**
- **Midwest Manufacturing Facility**
  - 1401 Ware Street
  - Waupaca, WI 54981
  - Phone: 715.258.5525
  - Fax: 715.258.8488
  - 8:00-5:00, M-F CST

TECHNICAL SALES REPRESENTATIVES BY AREA:

**Central CA, Nevada**
- Bill Merz (Bakersfield, CA) — 661.330.5294
  - bmerz@gusmerenterprises.com

**Central & Northern CA**
- Greg Sitton (Visalia, CA) — 559.573.4398
  - gsitton@gusmerenterprises.com

**Central Coast CA**
- Neal Duncan (Paso Robles, CA) — 805.206.1625
  - nduncan@gusmerenterprises.com

**Napa County CA**
- Pedro Pereira (Napa, CA) — 707.320.3307
  - ppereira@gusmerenterprises.com

**Sonoma/Mendocino Counties CA**
- Ivonne Dresser (Sonoma, CA) — 707.478.9302
  - idresser@gusmerenterprises.com

**Southern CA, Arizona, New Mexico**
- Mae Lortie (Oceanside, CA) — 760.553.6344
  - mlortie@gusmerenterprises.com

**Northwestern States / Western Canada**
- Chris Webster (Moses Lake, WA) — 509.209.1311
  - cwebster@gusmerenterprises.com

**Colorado, Upper Western States**
- Kevin Kawa (Omaha, NE) — 402.686.9612
  - kkawa@gusmerenterprises.com

**Lower Midwestern States**
- Jill Gallegos (Lago Vista, TX) — 817.676.6506
  - jgallegos@gusmerenterprises.com

**Upper Midwestern States**
- Nate Siats (St. Paul, MN) — 651.491.7220
  - nsiats@gusmerenterprises.com

**Minnesota, Wisconsin, Eastern Canada**
- Tom Mondor (St. Paul, MN) — 715.417.0623
  - tmondor@gusmerenterprises.com

**Great Lakes Region**
- Bryan Forbes (St. Paul, MN) — 651.280.9377
  - bforbes@gusmerenterprises.com

**Northeastern States**
- Matt Pino (Mountainside, NJ) — 609.569.6329
  - mpino@gusmerenterprises.com

**Southeastern States**
- Nathan Krel (Raleigh, NC) — 240.810.2650
  - nkrel@gusmerenterprises.com

For all the latest news, videos and updates follow us on our social media pages.

---

Gusmer Enterprises
Social Media

YouTube  Facebook  Twitter  Instagram  LinkedIn

---
Chr. Hansen SmartBev™
Yeast & Bacteria for Brewing

Fermentation. Redefined.
Chr. Hansen is a global bioscience company that develops natural solutions for the food and beverage industries. Fermentation experts since 1893, Chr. Hansen now brings the largest collection of cultures in the world, along with the most highly skilled fermentation experts to the brewing industry. By combining our innovative concepts with your true brewing skills the industry has elevated its standard. SmartBev™ is Fermentation. Redefined.

Frozen Liquid Yeast (FLY)
FLY is a patented concept that Chr. Hansen uses for the wine and brewing industry to provide the pure and most active yeast for direct pitching. When kept at -50°F, cells are stable for up to 18 months. This means no propagation, no rehydration, and no prolonged acclimatization time needed.

From Freezer to Fermenter in 1 Hour

Thawing - Place in water bath set to 80-85 °F for 1 hour. Temperature should not exceed 85 °F.
Pitching - Pitch the yeast directly into the fermenter, propagator or sterilized transfer equipment.

<table>
<thead>
<tr>
<th>Chr. Hansen SmartBev Products</th>
<th>Format</th>
<th>Species</th>
<th>Temperature</th>
<th>Target Style</th>
<th>Dose</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEER</td>
<td>Frozen Liquid Yeast (FLY)</td>
<td><em>Pichia kluyveri</em></td>
<td>61 - 72 °F</td>
<td>Low &amp; Non-Alcoholic</td>
<td>212 - 425 bbl</td>
<td>NEER is direct inoculation and used to produce full bodied, flavorful, non-alcoholic beers.</td>
</tr>
<tr>
<td>DIBS CA-1</td>
<td>Frozen Liquid Yeast (FLY)</td>
<td><em>Saccharomyces cerevisiae</em></td>
<td>65 - 75 °F</td>
<td>Ales</td>
<td>15 - 20 bbl</td>
<td>DIBS CA-1 is a top fermenting yeast strain used specifically for ale type beers. Direct inoculation, up to 80% attenuation, and consumes maltotriose.</td>
</tr>
<tr>
<td>Harvest LB-1</td>
<td>Freeze-Dried</td>
<td><em>Lactobacillus plantarum</em></td>
<td>68 - 104 °F</td>
<td>Sour Kettle</td>
<td>8 - 10 bbl</td>
<td>Harvest LB-1 is the first pure <em>Lactobacillus plantarum</em> culture selected specifically for sour beers. Direct inoculation, fast acidification pH 3.2 and hop tolerance &lt;8 IBU.</td>
</tr>
</tbody>
</table>
NEER is produced using Chr. Hansen’s proprietary production method which ensures high product performance, consistency and low risk of contamination. The NEER product is delivered on dry-ice as a 1 kg frozen block that, after thawing, can be transferred to the fermentation vessel using the sterile connection tube included in the package. NEER is highly concentrated, 1 bag can be used to inoculate 212-425 bbl of wort and normally finishes fermentation within 3-5 days. Minimal maturation of the beer is required.

**Non-alcoholic Brewing Process Comparison**

Most non-alcoholic beers suffer from inferior organoleptic properties due to the ‘side-effects’ of the physical removal of ethanol or the application of cold-contact with regular brewers’ yeasts. NEER is a traditional brewing solution, which can produce full bodied, flavorful, non-alcoholic beers using our patented *Pichia kluyveri* strain.

### Key Features

- *Pichia kluyveri* strain: Isolated in New Zealand, selected for fermentation characteristics and its ability to only ferment monosaccharides.
- Frozen yeast: Direct pitching for convenience, speed and safety. From freezer to fermenter in 1 hour.
- Fermentation characteristics: Enhanced fruit flavours (esters/thiols) and medium production of polysaccharides for next generation full flavoured, yet fresh alcohol free beer.
- Production benefits: Without production of diacetyl, the concept allows for shortened maturation cycles.

### Chr. Hansen ranked as the most sustainable company in the world

**Topping the 2019 global index of the 100 most sustainable companies**

Chr. Hansen is ranked the most sustainable company in the world by Corporate Knights, a specialized Toronto-based media and investment research firm.

This was announced during the World Economic Forum in Davos, Switzerland, on January 22, 2019, upon the release of Corporate Knights’ 15th annual Global 100 Most Sustainable Corporations in the World ranking. Chr. Hansen scored 100% on the ‘clean revenue’ indicator, reflecting that the company’s products have clear environmental and certain social benefits, as stated in Corporate Knights’ definition.

“We are extremely proud and humble to receive this amazing honor. I believe that one of the reasons why Chr. Hansen has been ranked as #1 is because the world is beginning to understand the power of good bacteria and the impact it can have on some of the major challenges the world is facing, such as food waste, antibiotic overuse and the need for a more sustainable agricultural sector to feed a growing world population while preserving our planet for future generations.”

CEO Mauricio Graber.

---

**Beer Style**

- **Traditional Full Alcohol Beer**
  - Pre-fermentation: Propagation
  - Fermentation: Low/high gravity fermentation
  - Post-fermentation: Maturation, filtering, bottling

- **NEER Beer**
  - Pre-fermentation: No Propagation
  - Fermentation: Direct inoculation of *Pichia kluyveri*
  - Post-fermentation: Centrifugation or filtration, bottling

- **Traditional Low Alcohol Beer**
  - Pre-fermentation: Propagation
  - Fermentation: Interrupted or halted fermentation
  - Post-fermentation: Physical removal of alcohol
Chr. Hansen SmartBev™
DIBS CA-1

DIBS CA-1 is a pure culture of *Saccharomyces cerevisiae* to be used for the production of beer. The culture is a top fermenting strain to be used specifically for ale type beers. The product is delivered as a deeply frozen bag ready for direct inoculation; it does not require re-hydration or acclimatization.

**Main Benefits**
- The new standard is Frozen Liquid Yeast
- Direct inoculation: 1 bag for 15-20 bbl
- High viability over 18 month shelf life at -50 °F
- No propagation or rehydration needed

**Fermentation Characteristics**
- Optimal temperature range: 65-75 °F
- Balanced flavor profile for many ale styles
- Short lag phase; fast fermentation
- Pure and active frozen yeast, no carrier
- Attenuation up to 80% - Consumes maltotriose

---

Chr. Hansen SmartBev™
Harvest LB-1

Chr. Hansen has developed a new freeze dried, direct inoculation culture of *Lactobacillus plantarum*. Chr. Hansen’s Harvest LB-1 is the first pure *Lactobacillus plantarum* culture selected specifically for sour beer production. Harvest LB-1 is a dairy free culture, with high cell viability, that produces clean and crisp flavors and aromas that are great for sour beer.

**Main Benefits**
- Kettle souring in less than 16 hours
- Direct inoculation: 1 pouch for 8-10 bbl
- Freeze-dried, ready when you need it

**Fermentation Characteristics**
- Optimal temperature range: 68-104 °F
- From pH 5.5 to 3.5 in 16 hours
- Fast acidification of wort down to pH 3.2

---

**Harvest LB-1 Sourcing time**
Fastest souring is achieved at low IBU levels. Harvest LB-1 tolerates 8 IBU, which minimizes risk of cross contamination in the brewery.
What is Gusmer MicroElements?
A diverse blend of vitamins, minerals, polypeptides and amino acids that have been identified as essential precursors required to build yeast biomass, with 100% organic nitrogen, all compressed into a convenient tablet form. Gusmer Enterprises has been formulating fermentation nutrients for many years and has developed MicroElements Brewing Nutrients based on the latest fermentation research and with the highest quality, bioavailable ingredients for maximum assimilation by the yeast.

• Consistent Fermentations
• Increase Attenuation
• Improve Filtration
• Maintain Yeast Population Viability
• Virtually No Dust, Easy-To-Use, Tablet Form

A Unique & Notable Nutrient
Unlike traditional yeast nutrient products, which contain a high percentage of inexpensive diammonium phosphate (DAP) and yeast hulls, MicroElements Brewing Nutrients do not contain DAP. Instead, our research team has found that our proprietary blend of pure vitamins, minerals and yeast extract gives superior fermentation performance. Breweries enlisted in product testing noted better yeast flocculation, increased yeast viability, higher RDF’s, increased rates of fermentation and positive sensory evaluation.

In keeping with good sanitation practices, the easy-to-use tablet form allows for accurate dosing and virtually no dust, thus eliminating the risk for airborne contamination in the brewery. All ingredients in MicroElements Brewing Nutrient Tablets comply fully with the Adjunct Reference Manual published by the Beer Institute and adhere to the TTB standards. The product is non-GMO, non-BSE certified and formulated in the USA under GMP conditions.

Application
MicroElements Brewing Nutrient Tablets are designed for use at the kettle or fermentation vessel in all types of brewing, especially high gravity brewing, or in yeast propagation regimes. It is a complete fermentation nutrient supplement. Add tablet(s) during the last 10-15 minutes of boil to fully dissolve prior to knockout.

Pack Size: 1 kg (29 tabs), 5kg (147 tabs)
Dose Rate: 1 tablet / 10 US bbls

Note: When used as recommended, MicroElements Brewing Nutrients will provide at least 30 ppb of zinc.

“The utilization of MicroElements Brewing Nutrient Tablets represents a cost-effective and user friendly approach to supplementing existing nutrient levels in brewery fermentations. When added to our higher gravity experimental beers, we achieved faster attenuation rates, improved yeast viability and lower residual sugar levels than the corresponding controls. I’d have no hesitation recommending their use to brewers seeking optimized yeast performance and improved fermentation management.”

— Damian McConn, Head Brewer
Summit Brewing - St Paul, MN

West Coast: 559.485.2692 / East Coast: 908.301.1811 www.gusmerbeer.com
DuPont™ Danisco®

Brewing Enzymes

DuPont is one of the world’s largest producers of enzymes for the food industry, with multiple production sites throughout the world, as well as R&D and technical support facilities. Gusmer Enterprises is proud to partner with an iconic brand to serve the brewing industry.

Traditional brewing is based on enzymes produced by malted grain. Critical enzymes developed during malting of brewer’s grains include amylases, proteases and cellulases. These same critical enzymes are available in DuPont brewing enzymes from Gusmer, giving you the tools to reduce cost, waste and energy consumption, accelerate production and achieve consistently high quality beer.

**Mashing**

Mashing converts starch to fermentable sugars through the activity of starch conversion enzymes. Starch is composed of glucose molecules linked together in a linear (amylose) or branched polymer (amylopectin). Alpha-amylases randomly hydrolyze α-1,4 glycosidic bonds in starch to produce smaller sugars and fragments of starch called dextrins that contribute to flavor, body and mouthfeel. Beta-amylases act only at the ends of starch molecules and fragments to produce maltose. Glucoamylases break off single molecules of glucose from starch molecules, dextrins and maltose.

The branched points in amylopectin can be broken with pullulanase, a starch-debranching enzyme, allowing amylase enzymes better access to starch molecules. Cellulases break down cell wall complexes to release starch for conversion.

Using specific combinations or blends of all these enzyme types, brewers can control starch conversion to increase extract, achieve target attenuations, balance carbohydrate profile and assure consistency even with varying raw material.

**Wort Separation & Beer Filtration**

Wort separation and beer filtration enzymes - xylanase, beta-glucanase, cellulase, and arabinase - break down non-starch polysaccharides that can interfere with wort separation, clog filters and bind up starch molecules. The composition and amount of cell wall material varies widely depending on degree of malt modification, the source of malt and the growing conditions from year to year. Fruited beers introduce pectin haze and filtration problems that can be prevented with the use of pectinase enzymes. Improving mash separation increases wort quality and can benefit extract yield, as well as lower energy costs.

**Fermentation Enhancement**

Proper modification of barley during conversion to malt is necessary to produce enzymes, soluble protein, simplified carbohydrates, flavor and color. The enzymes produced during malting break down the grain endosperm, a protein-starch matrix, into smaller proteins and amino acids and further release starches. Under modified or poorly modified malt lack those enzymes. Supplemental protease and peptidase enzymes increase soluble protein and free amino nitrogen (FAN) in wort for yeast to thrive.

**Diacetyl Control**

Traditional methods to reduce diacetyl require rests under warm conditions, with extended maturation times. Diacetyl rest can be shortened with enzymatic degradation of vicinal diketones (VDK’s), the precursors to diacetyl. Addition of alpha-acetolactate decarboxylase allows for shorter and more consistent maturation periods.

“We use a high percentage of flaked adjuncts in these “hazy” IPAs. The transfers from tun to kettle were always a nightmarish 3 to 4 hours when a typical transfer takes 50 minutes. LAMINEX® C2K has turned that around to a normal transfer of 50 minutes for a 15 bbl batch.”

— Andrew Kalinoski, Assistant Brewer
Sycamore Brewing - Charlotte, NC

DuPont liquid enzymes are available in a variety of pack sizes, ranging from jerricans to drums to IBC totes. Contact your Gusmer representative for availability and lead times.
**Liquefaction & Cereal Cooking - Supplemental enzymes break down starch and reduce mash viscosity for more consistent mashing. Add to cereal cooker for faster liquefaction.**

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMYLEX® 5T</td>
<td>Thermostable bacterial α-amylase</td>
<td>• Excellent adjunct liquefaction for a faster viscosity break</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Allows for use of low water to grist ratio</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Efficient starch liquefaction for reduced processing costs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Broad pH tolerance</td>
</tr>
<tr>
<td>Dose (kg/MT of grist)</td>
<td>Dose (ppm of grist)</td>
<td>Optimal Temperature Range</td>
</tr>
<tr>
<td>In the cereal cooker: 0.1 - 0.6</td>
<td>100 - 600</td>
<td>70 - 90 °C (158 - 194 °F)</td>
</tr>
<tr>
<td>In the mash: 0.05 - 0.20</td>
<td>90 - 200</td>
<td></td>
</tr>
<tr>
<td>Application: Add to cereal cooker before cooking or into the mash.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| AMYLEX® 4T    | Thermostable bacterial α-amylase  | • Rapid viscosity reduction at high solid concentrations               |
|               |                                  | • Allows for the use of high temperature gelatinization starches        |
|               |                                  | • Can be used with high adjunct levels                                 |
| Dose (kg/MT of grist) | Dose (ppm of grist) | Optimal Temperature Range | Optimal pH Range | GM Derived |
| In the cereal cooker: 0.25 - 0.5 | 250 - 500 | 74 - 90 °C (165 - 194 °F) | 5.5 - 6.3 | Yes |
| In the mash: 0.2 - 0.3 | 200 - 300 |                                                                 |
| Application: Add to cereal cooker before cooking or into the mash. |

| AMYLEX® BT2   | Thermostable bacterial α-amylase  | • Rapidly reduces viscosity for efficient starch liquefaction          |
|               |                                  | • Can be used for medium or high gelatinization temperatures            |
|               |                                  | • Great for brewers that want organic approval                         |
| Dose (kg/MT of grist) | Dose (ppm of grist) | Optimal Temperature Range | Optimal pH Range | GM Derived |
| In the cereal cooker: 0.4 - 0.8 | 400 - 800 | 70 - 90 °C (158 - 194 °F) | 6.1 - 6.8 | No |
| In the mash: 0.01 - 0.05 | 10 - 50 |                                                                 |
| Application: Add to cereal cooker before cooking or into the mash. |

**Raw Material Optimization - Enables the use of difficult and gluten-free grains or significant levels of adjuncts. Achieve high performance brewing with locally available raw materials.**

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALPHALASE® AP3</td>
<td>α-amylase, β-glucanase &amp; protease</td>
<td>• Allows for high barley brewing (up to 60%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Fast liquefaction at low water to grist ratio</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Provides consistent levels of FAN</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Optimize extract yields without undesirable impacts on foam, fermentation or flavor profile</td>
</tr>
<tr>
<td>Dose (kg/MT of grist)</td>
<td>Dose (ppm of grist)</td>
<td>Optimal Temperature Range</td>
</tr>
<tr>
<td>In the cereal cooker: 0.1 - 0.5</td>
<td>100 - 500</td>
<td>34 - 90 °C (93 - 194 °F)</td>
</tr>
<tr>
<td>In the mash: 1.0 - 2.0</td>
<td>1000 - 2000</td>
<td></td>
</tr>
<tr>
<td>Application: Add to mash at mashing in or right after.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

“Gusmer helped us on our journey to create low calorie, low carb beers. Our Gusmer technical rep guided me through the process of using TGA Mash. We saw an immediate improvement in the fermentation and reduction of carbohydrates and were able to quickly go to market with a range of new brands.”

— Ian VanGundy, Brewmaster
R&D Brewing - Raleigh, NC
### Attenuation Control

**Product:** DIAZYME® X4  
**Description:** Glucoamylase  
**Benefits:**  
- Maximize hydrolyses of starch into fermentable sugars  
- Achieve RDF > 83%  
- Minimizes residual carbohydrates

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Benefits</th>
</tr>
</thead>
</table>
| DIAZYME® X4 | Glucoamylase | • Maximize hydrolyses of starch into fermentable sugars  
- Achieve RDF > 83%  
- Minimizes residual carbohydrates |

- **Dose (kg/MT of grist):** 0.5 - 10  
- **Dose (ppm of grist):** 500 - 1000  
- **Optimal Temperature Range:** 56 - 76 °C (133 - 169 °F)  
- **Optimal pH Range:** 3.5 - 5.5

**Application:** Add directly to mash or right after at mashing in.

### DIAZYME® TGA MASH

**Description:** Glucoamylase  
**Benefits:**  
- Maximize starch conversion  
- Minimize residual carbohydrates  
- Provides a high degree of attenuation  
- Suitable for application in mash or at fermenter

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Benefits</th>
</tr>
</thead>
</table>
| DIAZYME® TGA MASH | Glucoamylase | • Maximize starch conversion  
- Minimize residual carbohydrates  
- Provides a high degree of attenuation  
- Suitable for application in mash or at fermenter |

- **Dose (kg/MT of grist):** 1.5 - 7  
- **Dose (ppm of grist):** 1500 - 7000  
- **Optimal Temperature Range:** 49 - 68 °C (120 - 154 °F)  
- **Optimal pH Range:** 3.7 - 5.5

**Application:** Add to mash at mashing in or right after at mashing in.

### DIAZYME® P10

**Description:** Pullulanase  
**Benefits:**  
- Improves attenuation by de-branching amylpectin  
- Increases fermentable carbohydrates with low impact on sugar composition  
- Use with DIAZYME® X4 or DIAZYME® TGA MASH for increased RDF

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Benefits</th>
</tr>
</thead>
</table>
| DIAZYME® P10 | Pullulanase | • Improves attenuation by de-branching amylpectin  
- Increases fermentable carbohydrates with low impact on sugar composition  
- Use with DIAZYME® X4 or DIAZYME® TGA MASH for increased RDF |

- **Dose (kg/MT of grist):** 0.5 - 2.0  
- **Dose (ppm of grist):** 500 - 2000  
- **Optimal Temperature Range:** 45 - 70 °C (113 - 158 °F)  
- **Optimal pH Range:** 3.7 - 5.0

**Application:** Add to mash at mashing in or right after for attenuation improvement. If using at the fermenter, add with DIAZYME® FA for RDF improvement. Use at temperatures below 65 °C (149 °F).

### DIAZYME® FA

**Description:** Fungal α-amylase  
**Benefits:**  
- Increase fermentable carbohydrates, mainly maltose  
- Assists in removing haze due to residual starch  
- Improves attenuation and fermentation rate

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Benefits</th>
</tr>
</thead>
</table>
| DIAZYME® FA | Fungal α-amylase | • Increase fermentable carbohydrates, mainly maltose  
- Assists in removing haze due to residual starch  
- Improves attenuation and fermentation rate |

- **Dose (kg/MT of grist):** 0.5 - 1.5  
- **Dose (ppm of grist):** 500 - 1500  
- **Optimal Temperature Range:** 38 - 58 °C (95 - 136 °F)  
- **Optimal pH Range:** 3.1 - 6.4

**Application:** Add cold wort when temperature cools to below 60 °C (140 °F) before or with pitching of yeast or during fermentation. Add in conjunction with DIAZYME® P10 for RDF improvement.

### Fermentation Enhancement

**Product:** ALPHALASE® NP  
**Description:** Protease  
**Benefits:**  
- Increase soluble proteins and FAN levels for optimal fermentation performance  
- Allows for high adjunct inclusion to mash and the use of under modified malt

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Benefits</th>
</tr>
</thead>
</table>
| ALPHALASE® NP | Protease | • Increase soluble proteins and FAN levels for optimal fermentation performance  
- Allows for high adjunct inclusion to mash and the use of under modified malt |

- **Dose (kg/MT of grist):** 0.1 - 0.3  
- **Dose (ppm of grist):** 100 - 300  
- **Optimal Temperature Range:** 44 - 76 °C (111 - 168 °F)  
- **Optimal pH Range:** 6.0 - 8.0

**Application:** Add directly to mash or right after at mashing in.
<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Benefits</th>
<th>Dose (kg/MT of grist)</th>
<th>Dose (ppm of grist)</th>
<th>Optimal Temperature Range</th>
<th>Optimal pH Range</th>
<th>GM Derived</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAMINEX® MaxFlow 4G</td>
<td>β-glucanase &amp; xylanase</td>
<td>• Maximum β-glucan breakdown and reduces risk of off flavor formation</td>
<td>0.05 - 0.40</td>
<td>50 - 400</td>
<td>46 - 78 °C (115 - 172 °F)</td>
<td>5.2 - 6.4</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Reduces risk of filter bed collapse</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Robust choice for high gravity brewing and different brewing equipment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LAMINEX® 750</td>
<td>β-glucanase</td>
<td>• Active at elevated temperatures up to 90 °C</td>
<td>0.05 - 0.30</td>
<td>50 - 300</td>
<td>62 - 90 °C (144 - 194 °F)</td>
<td>3.5 - 5.5</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Reduce viscosity and β-glucan levels to improve separation and filtration</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Highly effective for wheat inclusions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LAMINEX® C2K</td>
<td>β-glucanase, cellulase &amp; xylanase</td>
<td>• Reduce viscosity and reduce risk of haze from non-starch polysaccharides</td>
<td>0.5 - 0.30</td>
<td>50 - 300</td>
<td>46 - 70 °C (115 - 158 °F)</td>
<td>3.4 - 6.1</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Excellent for rye (60% or higher) beers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LAMINEX® BG2</td>
<td>β-glucanase, cellulase</td>
<td>• Reduces wort viscosity and β-glucan level</td>
<td>0.1 - 0.4</td>
<td>100 - 400</td>
<td>52 - 75 °C (126 - 167 °F)</td>
<td>3.5 - 5.5</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Improved starch utilization and lessens risk of haze from non-starch polysaccharides</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LAMINEX® Super 3G</td>
<td>β-glucanase &amp; xylanase</td>
<td>• Consistent mash separation and improved beer filtration</td>
<td>0.05 - 0.25</td>
<td>50 - 250</td>
<td>46 - 75 °C (115 - 167 °F)</td>
<td>3.0 - 7.0</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Increase capacity due to faster throughput</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Reduces risk of haze from non-starch polysaccharides</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Application: Add directly to mash or right after at mashing in.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Diacetyl Control - Manage diacetyl by eliminating the precursors of vicinal diketones (VDK’s).

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Benefits</th>
<th>Dose (g/HL of grist)</th>
<th>Dose (ppm)</th>
<th>Optimal Temperature Range</th>
<th>Optimal pH Range</th>
<th>GM Derived</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALPHALASE® Advance 4000</td>
<td>α-acetolactate decarboxylase</td>
<td>• Breakdown VDK precursors for short and consistent maturation periods</td>
<td>0.5 - 1.0</td>
<td>5 - 10</td>
<td>25 - 50 °C (77 - 122 °F)</td>
<td>4.4 - 7.5</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Keep diacetyl levels below the flavor threshold</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Shorten or eliminate diacetyl rest</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Optimize capacity and reduce processing times</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Application: Add to cooled wort before pitching yeast.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Cask Ale Preparation

Cask ale is a traditional offering associated with beers brewed in the British Isles. Today’s brewers are producing cask ale in casks, which are kegs that can accept side bungs and a keystone tap at the end of the keg. Primary fermented beer, at a temperature of approximately 45°F and a yeast cell count of at least one million cells/ml, is transferred into the cask, along with auxiliary finings and a priming sugar. Auxiliary finings are silicates, alginates or isinglass added for thorough clarification and stabilization of the beer by agglomerating and settling yeast and other insoluble solids. The priming sugar, usually sucrose, is added to adjust the fermentable extract to the appropriate level. The beer is allowed to “condition” in the cask at the retail outlet. The finings settle out and the carbonation is controlled with the use of spiles (soft spiles allow the CO₂ to escape, hard spiles plug the bung and allow the product to carbonate). The cask is then tapped through the keystone, which is positioned above the sediment, allowing clear conditioned beer/ale to be dispensed.

AB Vickers

Finings and Antifoam

AB Vickers is the premier name in isinglass auxiliary finings. With roots in the United Kingdom, AB Vickers fully understands the tradition of isinglass finings for both brewhouse and cask conditioning applications. AB Vickers is also a major supplier of antifoam to the brewing industry. Gusmer Enterprises is proud to offer AB Vickers’ isinglass finings and antifoam in North America.

Cryofine (CRY 151)

Cryofine is purified isinglass in a convenient powder form. It is added to beer at the end of fermentation to speed maturation and improve filtration and clarity by fining out yeasts and protein particulate. For the purposes of rapid dissolution, enhanced performance, and long shelf life, the isinglass in Cryofine has been pre-hydrolyzed and freeze-dried. Cryofine also contributes to the actions of both silica gels and PVPP. Cryofine is regularly used in cask conditioned beers as auxiliary finings for solids settling and clarification.

Pack Size: 1 lb
Dose Rate: 1 - 5 g/hl; 0.4 - 2 oz/10 US bbl

Foamsol S (FCS 130)

Foamsol S silicone antifoam is an inert polymer which is highly effective in foam suppression in both the kettle and fermenter. Foamsol S preserves foam-positive proteins which contribute to the head retention quality of beer. One of the most important benefits of Foamsol S is increased iso-α-acid utilization from hops. Controlling foam in the fermenter will retain iso-α-acid and allow a reduction of up to 15% of the kettle hops. Other benefits include increased kettle and fermenter utilization, as well as eliminating the loss of product from foam during fermentation.

Pack Size: 25 kg
Dose Rate: 1 - 8 ml/hl; 0.03 - 0.3 oz/10 US bbl
Beer Stabilization

Protein & Polyphenol Control

Chill haze stabilization is an important consideration for beers that are distributed throughout a territory and require any degree of shelf stability. Most retailers and consumers expect clarity and no post-bottling sedimentation in beer on a consistent basis, and with today’s flavorful and wide varieties of beers, the potential for instability exists. Through the use of either silica-based stabilizing agents or PVPP (polyvinylpolypyrrolidone) polymer-based stabilizing agents, chill haze stabilization can be achieved without affecting flavor, aroma, body or head retention. These stabilizing agents are widely used, economical and readily available through Gusmer Enterprises.

Chill haze is caused by the natural reaction of “sensitive proteins” (proteins rich in proline) and polyphenols, both of which are inherently found in beer. These sensitive proteins and polyphenols agglomerate to form larger colloids which are insoluble at cold storage and serving temperatures. The instability results in a precipitation which creates cloudy beer or bottle sediment. Stability of the beer can be achieved by removing either the sensitive proteins or the polyphenols, so that the two cannot so readily react with each other. Silica-based stabilizers, whether amorphous solids or colloidal liquids, used in the brewing process have a small particle size (8 nm to 16 microns) and are highly porous with typical surface areas from about 300 m²/g to more than 1,000 m²/g. These specially engineered silica particles are hydrophilic due to coverage of their surface by hydroxyl (silanol) groups. It is the interactions of proline with these silanol groups that enable the selective adsorption of sensitive proteins from beer. PVPP polymer-based stabilizers are approximately 50 microns in size and have a high affinity for flavonoid polyphenols via hydrogen and hydrophobic bonding. Both forms of stabilizing agents are ultimately removed from the beer through centrifugation or filtration. The choice to use either a silica-based stabilizer or a PVPP polymer-based stabilizer is up to the brewer, and for beers that are more difficult to stabilize, the use of both agents may synergistically result in stabilization.

**PQ Corporation**

**BRITESORB® A100 – (Silica Hydrogel)**

Silica Hydrogel is an amorphous silica powder, which is non-dusting and free flowing, and has a moisture content of approximately 65%. BRITESORB A100 works through size exclusion. The surface of BRITESORB A100 is engineered with a moderately sized porosity, which selectively allows for the internal adsorption of haze-forming proteins while retarding the entry of larger, foam-positive proteins. An excellent choice for chillproofing lighter style beers, BRITESORB A100 has a high permeability factor that allows for faster filtration rates and longer filter runs.

- **Particle Size:** ~ 16 um
- **Dose Rate:** Beer up to 65% malt
  - 40-50 g/hL (~10-12 lb/100 US bbl)
- **Dose Rate:** Beer more than 65% malt
  - 50-70 g/hL (~12-17 lb/100 US bbl)
- **Contact time:** 20 minutes
- **Permeability:** 0.15 D’Arcy
- **Sizes:** 50 lb bags

**PQ Corporation**

**BRITESORB® D300 – (Silica Xerogel)**

Silica Xerogel is an amorphous, free flowing powder of approximately 5% moisture content. Pound for pound, it is a more effective stabilizer than Silica Hydrogel. BRITESORB D300 utilizes the same adsorption principals as A100, but in addition, BRITESORB D300 is activated by a patented process that increases its affinity for sensitive protein. This typically allows for short contact times and reduced dose rates. A good candidate to stabilize difficult brews, BRITESORB D300 has a good permeability factor and can be used in conjunction with PVPP.

- **Particle Size:** ~ 12 um
- **Dose Rate:** Beer up to 70% malt
  - 25-40 g/hL (~6-10 lb/100 US bbl)
- **Dose Rate:** Beer more than 70% malt
  - 40-60 g/hL (~10-15 lb/100 US bbl)
- **Contact time:** 5 minutes
- **Permeability:** 0.05 D’Arcy
- **Sizes:** 40 lb bags
**NALCO**

**Nalco 1072 – (Kieselsol or SilicaSol)**

Nalco 1072 kieselsol is a liquid colloidal suspension of silicon dioxide, which is extremely effective in chillproofing and has been used in production of “vegan-friendly” beers. The resulting silica/protein complexes form relatively compact sediment cakes (tank bottoms) that aid in separation (through filtration) from the stabilized beer. Nalco 1072 is a ready-to-use solution that offers convenience in use.

- **Particle Size:** ~ 8 nm
- **Dose Rate:** 200-500 ppm
- **Contact Time:** ~ 8 hr
- **Sizes:** 5 USG pails, 55 USG polydrums

**BASF**

**Divergan® F and Divergan® RS PVPP (Polyvinylpolypyrrolidone)**

Gusmer is a major distributor of Divergan F to the beer industry. Manufactured by BASF, Divergan F is used throughout the world to chill haze stabilize beer. BASF’s unique polymerization process produces the purest polyvinylpolypyrrolidone, which more selectively adsorbs the polyphenols that can cause instabilities. There is evidence that Divergan F also helps to stabilize flavor through the reduction of flavonoid polyphenols, which are particularly prone to polymerize into products of higher molecular weight and potential bitter flavor. Divergan F works quickly, and its short contact time means it can frequently be dosed inline, but it can also be dosed in a batch method.

Divergan RS is a regenerable PVPP, which works in the same manner, but offers some economies to larger facilities that are set up to regenerate it.

- **Particle Size:** ~ 50 um
- **Dose Rate: Beer up to 65% malt**
  - Alone: 10-30 g/hL (~2.5-7.75 lb/100 US bbl)
  - With Silica: 10-20 g/hL (~2.5-5.0 lb/100 US bbl)
- **Dose Rate: Beer more than 65% malt**
  - Alone: 25-40 g/hL (~5-10 lb/100 US bbl)
  - With Silica: 10-30 g/hL (~2.5-7.75 lb/100 US bbl)
- **Contact time:** 5 minutes
- **Polyphenol removal effectiveness:** 55% of mass
- **Divergan F Sizes:** 20 kg drums
- **Divergan RS Size:** 20 kg drums

**Preparation of Stabilizers**

**Kieselsol:** These solutions come ready-made and can be added as described in the dosing section below.

**Hydrogel/Xerogel/PVPP:** The amorphous powder should be mixed with deoxygenated water at a 10% w/w ratio. (1 kg powder: 10 liters DAW or ~8 lb: 10 USG DAW). The use of a CO₂ sparger in the slurry water will help to deoxygenate the water.

**Agitation:**
- **Hydrogel/Xerogel** – Agitate slurry for at least 20 minutes prior to addition.
- **PVPP** – Agitate slurry for 1-2 hours prior to addition.

**Dosing of Stabilizers**

**Inline Method:** The kieselsol, hydrogel/xerogel or PVPP slurries are dosed proportionally into the beer stream by means of a metering pump. The products are allowed to react with the beer. Depending upon contact time required for each product, a buffer tank may be utilized. Resultant sediments should be removed via filtration depending on the requirements of the specific stabilizer.

**Batch Method:** Add the kieselsol or hydrogel/xerogel/ PVPP slurries into the product while filling the finishing tank. Add the stabilizing agent proportionally during the fill or as a single shot method through the spray ball arm. Once the stabilizing agent has reacted with the respective protein or tannin, it will settle to the bottom of the tank as sediment. Settling times vary due to tank geometry and stabilizer/protein/tannin complex size. The stabilized beer can be separated from the sediment prior to filtration and any leftover sediment is easily removed during CIP. Inadvertent over-dosing or contact time of several days causes no negative effects in the beer.

For more information on beer chill haze stabilization and the use of stabilizing agents, please contact your Gusmer representative.
KICK Carrageenan® Kettle Finings

KICK Carrageenan kettle finings are an effective way to improve flocculation and clarity in the kettle and throughout the rest of the brewing process. The active ingredient in KICK Carrageenan is kappa carrageenan, a high molecular weight polysaccharide derived from red seaweed. When added near the end of the boil, kappa carrageenan binds to haze-forming proteins and other small particles and flocculates rapidly, resulting in improved wort and beer clarity.

**KICK Carrageenan G (Granular)**

KICK Carrageenan G is composed of 100% granular carrageenan. It is produced at a larger particle size to encourage easier handling and dosing. Add KICK Carrageenan G 20 minutes prior to the end of boil to fully activate the kappa carrageenan – no hydration necessary.

- Water Viscosity @ 1.5% – 400-800 cps
- Color – Cream to Light Tan
- Particle Size – 90% through 10 Mesh
- Moisture – Less than 12%

**KICK Carrageenan T and Micro-T (Tablets)**

KICK Carrageenan tablets are composed of highly refined kappa carrageenan. The tablet format provides a convenient dosing method that encourages rapid delivery of the active ingredient to the kettle. KICK Carrageenan tablets are manufactured using high quality materials, resulting in a product that is odorless and non-dusting. Add KICK Carrageenan tablets 5 minutes prior to the end of boil.

- Water Viscosity @ 5% – 10-30 cps
- Color – White
- Tablet Weight – KICK T 28-31g, KICK Micro-T 0.8-1.1g
- Moisture – Less than 5%

<table>
<thead>
<tr>
<th>Item</th>
<th>Dose Rates</th>
<th>Package Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>KICK Carrageenan G</td>
<td>10-60 ppm (1-6 g/HL)</td>
<td>10 KG Box</td>
</tr>
<tr>
<td>KICK Carrageenan T</td>
<td>1 Tablet / 5 Barrels</td>
<td>10 KG Box</td>
</tr>
<tr>
<td>KICK Carrageenan Micro-T</td>
<td>1 Tablet / 5 Gallons</td>
<td>1 KG Box</td>
</tr>
</tbody>
</table>

**Dose Rate Optimization**

For more information on how to conduct a dose rate optimization trial, please watch this video on dose rate optimization.

**Video Customer Testimonial**

Damian McConn, Head Brewer
Summit Brewing Co. - St. Paul, MN

KICK Carrageenan is Kosher Parve certified, please contact Gusmer Enterprises for more information.
PureMalt Crafted
Traditionally Brewed Malt Concentrates

PureMalt has a proud history over 800 years in the making, located on the banks of the river Tyne in Haddington, East Lothian, Scotland. The PureMalt Products, Ltd. site has been home to a mill, a maltings and ultimately a roasthouse and brewery to facilitate the production of the company’s current line of products.

**PureMalt Crafted Line**
The PureMalt Crafted line is a diverse range of traditionally brewed malt concentrates. PureMalt can be used for color adjustments, flavor profile, or restoring body, foam and mouthfeel. All of the PureMalt products are traditionally brewed with the finest Scottish malted barley and are then gently concentrated into the final products.

**Key Features**
- Cost effective solutions for color adjustment
- Distinct color hues and flavor profiles for brand creation through late addition to beer
- Can also be used to formulate low alcohol or no alcohol beers

### PureMalt Crafted Range

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Color Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maitland Pale</td>
<td>Made from the finest Scottish pale malt; Pale Straw in color, with a clean, malty flavor.</td>
<td><img src="#" alt="Color" /></td>
</tr>
<tr>
<td>Aitchison's Caramel</td>
<td>Made from the finest Scottish Cara Malt; Gold in color, with a sweet caramel malt flavor.</td>
<td><img src="#" alt="Color" /></td>
</tr>
<tr>
<td>Countess Crystal</td>
<td>Made from the finest Scottish Crystal Malt; Ruby-Garnet in color, with a dark caramel flavor.</td>
<td><img src="#" alt="Color" /></td>
</tr>
<tr>
<td>Montgomerie Chocolate</td>
<td>Made from the finest Scottish Roast Malt; Brown in color, with mocha, coffee and chocolate flavors.</td>
<td><img src="#" alt="Color" /></td>
</tr>
<tr>
<td>Hogarth Roast</td>
<td>Made from the finest Scottish Roast Malt; Black in color, with a savory roast flavor.</td>
<td><img src="#" alt="Color" /></td>
</tr>
<tr>
<td>Bruce's Black</td>
<td>Made from the finest Scottish Roast Malt; Pitch Black in color, with a smooth roasted flavor.</td>
<td><img src="#" alt="Color" /></td>
</tr>
</tbody>
</table>

**Dose Rates:** PureMalt products can be dosed in a range from 0.5% – 5% depending on the product being used and the desired effect in the finished beer.

**Pack Size:** 5 kg Bag-in-Box
DDW, The Color House
Caramel for Brewing

Caramel in the Brewing Process
A valuable brewing ingredient for more than a century, caramel contributes to the character of beer on every continent. Caramel provides color, flavor and consistency to beer. It also has applications in a variety of related products, including cider and non-alcoholic malted beverages.

What is Caramel?
Caramel results from the controlled heat treatment of carbohydrates, typically glucose syrup. The glucose and food-grade catalysts are used to facilitate the browning process and provide stability. The finished beer caramel, a long polymer chain, is a positively-charged colloidal solution and is therefore stable in beer, which also has a net positive charge. Caramel is inert, physically stable when stored properly and has bacteriostatic properties.

Why Use Caramel?
Caramel is a great way to adjust beer color throughout any part of the brewing process. Caramel allows you to adjust color in the kettle, as late as final filtration or in the serving tank. With caramel you can darken your beer without adding the astringent flavors associated with dark malt.

Dosage
Dosage will vary by style. Traditional ales require 0.02% or more of caramel coloring to add color. Certain dark beers, including some stouts and bocks, might require a higher caramel dosage. Lagers require less caramel to obtain color consistency than other types of beers (typically 0.01%). Adjusting a lager type beer to a bock beer color would require an addition of 0.05-0.075%.

Caramel Product Selection
Gusmer offers six different grades of caramel color to the brewing industry. Most products come in 5 gallon pails, 55 gallon drums or 275 gallon totes. (The total weight may vary from product to product depending on the density of the material.)

<table>
<thead>
<tr>
<th>Caramel Product</th>
<th>Color Intensity</th>
<th>Color IOB (Typical)</th>
<th>Color EBC (Typical)</th>
<th>Hue Index (Typical)</th>
<th>Percent Solids</th>
<th>Feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>#310</td>
<td>.055 – .065</td>
<td>17,000</td>
<td>16,000</td>
<td>5.7</td>
<td>74%</td>
<td>Emkamalt – yellow tone</td>
</tr>
<tr>
<td>#305</td>
<td>.070 – .080</td>
<td>20,500</td>
<td>19,000</td>
<td>5.6</td>
<td>74%</td>
<td>Slight sweet and spicy accent</td>
</tr>
<tr>
<td>#304</td>
<td>.070 – .080</td>
<td>20,500</td>
<td>19,000</td>
<td>5.6</td>
<td>74%</td>
<td>For malt or pilsner</td>
</tr>
<tr>
<td>#303</td>
<td>.127 – .133</td>
<td>35,000</td>
<td>34,000</td>
<td>5.5</td>
<td>65%</td>
<td>Available globally</td>
</tr>
<tr>
<td>#301</td>
<td>.106 – .111</td>
<td>31,500</td>
<td>29,800</td>
<td>5.5</td>
<td>66%</td>
<td>Most widely-used beer caramel globally</td>
</tr>
<tr>
<td>#300</td>
<td>.080 – .090</td>
<td>24,500</td>
<td>22,000</td>
<td>5.6</td>
<td>74%</td>
<td>Popular in North America</td>
</tr>
</tbody>
</table>

Contact Gusmer Enterprises about DDW technical tips for caramel in the brewing process and test methodology.
Gusmer Enterprises
Oak Products

Oak-Mor® and Oak Avantage® Offer a Complete Line of Oak Adjuncts for Brewing

Gusmer’s oak adjuncts offer the ability to supplement oak character in beer without investing in and maintaining extensive wood cooperage cellars. Our American oak lends itself perfectly to barley wines, imperial stouts or an authentic IPA. Use our French oak to provide the oak character associated with lambics, while still keeping any wild yeast or bacteria safely enclosed in a stainless steel vessel.

As a producer of granular oak and oak chips for the beverage industries for over 30 years, our commitment to quality and consistency is uncompromising. Only the highest quality American and French oak from premium heartwood qualify for our oak program. Our proprietary toasting process brings out very distinct oak attributes such as vanilla, butterscotch, clove, smoke and others. These oak adjuncts are added directly to tanks or barrels for a brief extraction period. The full flavor and aroma is typically extracted from the oak in 3-5 days. The oak can be easily removed by decanting or filtering the beer after extraction.

Consistent and predictable results are the hallmark of Gusmer’s oak program. Our adjuncts allow brewers more options to compliment flavors and aromas, tactile characteristics and color stabilization.

Application and Dosage

Finishing: Add directly to the brite beer tank to compliment beer flavor and aroma during storage.

Barrel Supplementation: Add directly to neutral barrels to renew oak flavors and aromas.

Dose Rate Range: 70-300 g/bbl (for oak flavors and aromas that range from subtle background notes to bold oak character as determined to be optimal for that particular beer)

Blending Beer: Dose the oak at a high rate directly into a smaller volume of beer to make a concentrated blending beer for precise blending back into larger finished brews at the brite beer tank or barrels.

Dose Rate Range: 2,500-5,000 g/bbl

Oak samples are available upon request, please contact your Gusmer representative.
## Oak Product Chart

<table>
<thead>
<tr>
<th>Item</th>
<th>Description and Dose Rates</th>
<th>Flavor Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>Premium Oak-Mor® American Granular Oak</td>
<td><strong>Premium Oak-Mor</strong> is made from select American white oak. This granular oak has undergone a light toasting that provides a smooth, rich flavor. Sack Size: 40 lbs (18.1 kg)</td>
<td><img src="image1" alt="Flavor Components Diagram" /> [Butterscotch] <img src="image2" alt="Flavor Components Diagram" /> [Coconut, Butter] <img src="image3" alt="Flavor Components Diagram" /> [Spicy, Leather] <img src="image4" alt="Flavor Components Diagram" /> [Vanilla] <img src="image5" alt="Flavor Components Diagram" /> [Clove] <img src="image6" alt="Flavor Components Diagram" /> [Spicy, Clove]</td>
</tr>
<tr>
<td>Toasted Oak-Mor® American Granular Oak</td>
<td><strong>Toasted Oak-Mor</strong> is sourced from select American white oak that has been processed to a medium plus toast level. This granular oak offers notes of vanilla, coconut and subtle spicy clove. Sack Size: 40 lbs (18.1 kg)</td>
<td><img src="image1" alt="Flavor Components Diagram" /> [Butterscotch] <img src="image2" alt="Flavor Components Diagram" /> [Coconut, Butter] <img src="image3" alt="Flavor Components Diagram" /> [Spicy, Leather] <img src="image4" alt="Flavor Components Diagram" /> [Vanilla] <img src="image5" alt="Flavor Components Diagram" /> [Clove] <img src="image6" alt="Flavor Components Diagram" /> [Spicy, Clove]</td>
</tr>
<tr>
<td>Oak Avantage® American Granular Oak</td>
<td>This is the true alternative to toasted American barrels in a granular form. This seasoned oak has been air dried for 18 months before being granulated to a uniform particle size and toasted. Sack Size: 44 lbs (20 kg)</td>
<td><img src="image1" alt="Flavor Components Diagram" /> [Butterscotch] <img src="image2" alt="Flavor Components Diagram" /> [Coconut, Butter] <img src="image3" alt="Flavor Components Diagram" /> [Spicy, Leather] <img src="image4" alt="Flavor Components Diagram" /> [Vanilla] <img src="image5" alt="Flavor Components Diagram" /> [Clove] <img src="image6" alt="Flavor Components Diagram" /> [Spicy, Clove]</td>
</tr>
<tr>
<td>Oak Avantage® American Oak Chips</td>
<td><strong>Oak Avantage</strong> American Oak Chips can be easily managed within a stainless steel brewery environment. This oak produces flavors and aromas of vanilla and spice, with very slight coconut and butterscotch. Sack Size: 25 lbs (11.3 kg)</td>
<td><img src="image1" alt="Flavor Components Diagram" /> [Butterscotch] <img src="image2" alt="Flavor Components Diagram" /> [Coconut, Butter] <img src="image3" alt="Flavor Components Diagram" /> [Spicy, Leather] <img src="image4" alt="Flavor Components Diagram" /> [Vanilla] <img src="image5" alt="Flavor Components Diagram" /> [Clove] <img src="image6" alt="Flavor Components Diagram" /> [Spicy, Clove]</td>
</tr>
<tr>
<td>Oak Avantage® French Granular Oak</td>
<td><strong>Oak Avantage</strong> French Granular Oak is sourced from the highest quality oak in Central France. After aging for 18 months, seasoned staves are granulated to produce a uniform particle size. The oak is toasted by a unique drying process to create delicate flavors and aromas. Sack Size: 44 lbs (20 kg)</td>
<td><img src="image1" alt="Flavor Components Diagram" /> [Butterscotch] <img src="image2" alt="Flavor Components Diagram" /> [Coconut, Butter] <img src="image3" alt="Flavor Components Diagram" /> [Spicy, Leather] <img src="image4" alt="Flavor Components Diagram" /> [Vanilla] <img src="image5" alt="Flavor Components Diagram" /> [Clove] <img src="image6" alt="Flavor Components Diagram" /> [Spicy, Clove]</td>
</tr>
<tr>
<td>Oak Avantage® French Oak Chips</td>
<td><strong>Oak Avantage</strong> French Oak Chips are sourced from the highest quality oak in Central France. These oak chips come from seasoned staves which produce a clean and sophisticated oak impression that is typical of French Oak. Sack Size: 55 lbs (25 kg)</td>
<td><img src="image1" alt="Flavor Components Diagram" /> [Butterscotch] <img src="image2" alt="Flavor Components Diagram" /> [Coconut, Butter] <img src="image3" alt="Flavor Components Diagram" /> [Spicy, Leather] <img src="image4" alt="Flavor Components Diagram" /> [Vanilla] <img src="image5" alt="Flavor Components Diagram" /> [Clove] <img src="image6" alt="Flavor Components Diagram" /> [Spicy, Clove]</td>
</tr>
</tbody>
</table>
Arôbois

Oak Products

Arôneo Range French Oak Chips

Arôbois established in 1997, is one of the pioneers of oak adjuncts in France. Gusmer is proud to partner with them to offer the Arôneo range of French oak chips. The Arôneo range is a high performance range of French oak chips with intense flavors and aromas, and is available in four distinct profiles. These chips can make a remarkable contribution in terms of structure, mouthfeel, color, flavor and aroma.

Arôneo Oak Blocks 47

Introducing the new line of oak products from Arôbois! Arôbois has developed a range of oak blocks, "Blocks 47", produced from the highest quality French oak. The wood is of cooperage grade, with natural seasoning and maturation carried out in the open air for a period exceeding four years. Available in Balance and Intense.

<table>
<thead>
<tr>
<th>Features of Arôbois</th>
<th>Benefits of Arôbois</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arôbois products are only made from new, cask-grade oak coming from the heartwood of the oak tree.</td>
<td>These oak meet cooperage quality standards.</td>
</tr>
<tr>
<td>High quality French oak, with a variety of flavor profiles.</td>
<td>Delivers reliable and consistent results in beer from batch to batch.</td>
</tr>
<tr>
<td>Four proprietary grades with distinct French oak characteristics are available.</td>
<td>Provides a broad range of unique products to control and adjust flavor complexity, aroma and tactile characteristics of finished product.</td>
</tr>
<tr>
<td>Rejuvenate or enhance French oak character in barrels during aging.</td>
<td>Reduces maturation time.</td>
</tr>
<tr>
<td>Replace barrel aging in some instances.</td>
<td>Reduces cost of new barrel purchase.</td>
</tr>
</tbody>
</table>

Application and Dosage

Finishing: Add directly to the brite beer tank to compliment beer flavor and aroma during storage.

Barrel Supplementation: Add directly to neutral barrels to renew oak flavors and aromas.

Dose Rate Range: 70-300 g/bbl (for oak flavors and aromas that range from subtle background notes to bold oak character as determined to be optimal for that particular beer)

Blending Beer: Dose the oak at a high rate directly into a smaller volume of beer to make a concentrated blending beer for precise blending back into larger finished brews at the brite beer tank or barrels.

Dose Rate Range: 2,500-5,000 g/bbl
## Arôbois Oak Chips Selection

<table>
<thead>
<tr>
<th>Item</th>
<th>Description and Dose Rates</th>
<th>Flavor Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweet (Douceur)</td>
<td>Sweet French Oak Chips offer aroma with overtones of vanilla, toasted bread, caramel and spice, adding to mouthfeel evenly with a rich sweetness. Available Sizes: 55 lbs (25 kg) 18 kg Infusion Bag* *(3) - 6 kg Infusion Bags</td>
<td>![Flavor Components Image]</td>
</tr>
<tr>
<td>Balance (Equilibre)</td>
<td>Balance French Oak Chips offer a greater impact by adding silky tannins across the profile. Aromas are lightly enhanced with hints of caramel, gingerbread and licorice. Available Sizes: 55 lbs (25 kg) 18 kg Infusion Bag* *(3) - 6 kg Infusion Bags</td>
<td>![Flavor Components Image]</td>
</tr>
<tr>
<td>Fresh (Fraicheur)</td>
<td>Fresh French Oak Chips are another wonderful mouthfeel enhancer contributing to length and volume. Fresh highlights the fruit and “freshens” with aromas of vanilla, spice and caramel. Available Sizes: 55 lbs (25 kg) 18 kg Infusion Bag* *(3) - 6 kg Infusion Bags</td>
<td>![Flavor Components Image]</td>
</tr>
<tr>
<td>Intense</td>
<td>Intense French Oak Chips contribute significant aromas of gingerbread, almond, licorice and cocoa. Intense adds to mouthfeel evenly with a little more weight on the finish. Available Sizes: 55 lbs (25 kg) 18 kg Infusion Bag* *(3) - 6 kg Infusion Bags</td>
<td>![Flavor Components Image]</td>
</tr>
</tbody>
</table>

## Arôbois Oak Blocks 47 Selection

<table>
<thead>
<tr>
<th>Item</th>
<th>Description and Dose Rates</th>
<th>Flavor Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balance (Equilibre)</td>
<td>Balance French Oak Chips offer a greater impact by adding silky tannins across the profile. Aromas are lightly enhanced with hints of caramel, gingerbread and licorice. Available Size: 18 kg Infusion Bag* *(3) - 6 kg Infusion Bags</td>
<td>![Flavor Components Image]</td>
</tr>
<tr>
<td>Intense</td>
<td>Intense French Oak Chips contribute significant aromas of gingerbread, almond, licorice and cocoa. Intense adds to mouthfeel evenly with a little more weight on the finish. Available Size: 18 kg Infusion Bag* *(3) - 6 kg Infusion Bags</td>
<td>![Flavor Components Image]</td>
</tr>
</tbody>
</table>

*Dose rates are application dependent. Please contact a Gusmer representative for more information.*
Bucher Unipektin
Filtration Systems

Gusmer Enterprises is proud to be the North American partner for Bucher Unipektin. The company had humble beginnings in St. Gallen, Switzerland in 1938 and has grown to be the world’s leading manufacturer of off-the-shelf and turn-key filtration systems for the beverage industries. In 2013 the engineering division of Filtrox was acquired by Bucher Unipektin. Bucher Unipektin is well-known for their candle filters for pre-coat filtration with kieselguhr, perlite or PVPP, and they also develop, design and manufacture other advanced technologies such as ceramic crossflow filters, horizontal pressure leaf filters for beer and other beverage industries.

PRECOAT FILTERS - CANDLE FILTERS

**SYNOX® 2.0**

The SYNOX 2.0 stationary candle filter system offers excellent value for all kinds of precoat filtration within a hygienic environment utilizing the industry standard STABOX candles. Typical applications include filtration of beer, wine, and all clear beverages, as well as liquid food components such as gelatine, sugar syrup, edible oil and the like. The system can be configured for kieselguhr/perlite or PVPP use.

Sizes: 12 m² (60 hl/hr) – 237 m² (1185 hl/hr)

**SECUJET® 2.0 is now M-SYNOX BF**

The M-SYNOX BF is a mobile candle filter with the candles hanging from a top plate. The design of the filter and the usage of the same STABOX candles (25 mm diameter) make it the small version of the large SYNOX filters but with the ease of “plug and play”. The M-SYNOX BF was designed for the needs of today’s craft brewers.

Sizes: 6.4 m² (16-32 HL/hr) – 11 m² (27-55 HL/hr)

PRECOAT FILTERS - HORIZONTAL PRESSURE LEAF

**FOM® 110 DGR**

The FOM 110 DGR is a stationary filter with centrifugal sludge discharge. It can be configured in manual or fully automated versions.

Sizes: 9.1 m² (45 HL/hr) – 33 m² (165 HL/hr)
Gusmer Enterprises
Cellu-Flo Fiber Filter Aids

On pressure leaf filters, the basis for all good filter cakes is a sound precoat, and Gusmer has been manufacturing the filter precoat materials that are used in beer filtration for decades. Gusmer’s Cellu-Flo filter aids are widely used throughout the industry as a precoat because of their ability to form a fibrous matrix on the filter screens that provides a proper site for filter cake formation. This fibrous matrix also serves to protect the filter screens, virtually eliminates bleed-through, adds cake stability and allows for a quick and clean cake release at the end of the filter cycle.

Cellu-Flo filter aids are available in many different fiber length distributions and formulations, including both cotton and wood pulp formulations, uncharged and charge modified formulations.

**Cellu-Flo RW and SL Series**
For Pressure Leaf Filters

- Widely used for coarse and polish beer filtration applications as a precoat and bodyfeed adjunct
- Derived from carefully selected softwood and hardwood cellulose and available in different fiber length distributions

**Cellu-Flo CLR and CLS Series**
For Pressure Leaf Filters

- The best choice for ultrafine beer filtrations. Used as a precoat and bodyfeed adjunct
- A must if preparing beer for subsequent sterile filtration
- Derived from pure cotton linters cellulose and available in uncharged and charge modified (high zeta potential) versions and different fiber length distributions

Cellu-Flo fibers are available in bags and bulk pack totes. Contact your Gusmer representative for the optimal dosage rate and grade selection for your filtration application.
Gusmer Enterprises

Cellupore CSF Filter Sheet Series

Gusmer Enterprises’ latest developed range of filter sheet media, the Crystalline Silica Free (CSF) filter series, has been designed and formulated to be free of crystalline silica* yet offer the same outstanding performance of conventional filter sheet media. Gusmer’s CSF gradient density filter sheets are a composite of the finest cellulose pulps and crystalline silica free filter aids. Produced with a controlled porosity, the CSF filter sheets have superior throughput capacity and excellent retention capabilities. The CSF series can be relied on to remove micron and submicron particulate such as gross solids, haze constituents, yeast, bacteria and colloids on a consistent basis while preserving color, aromas and flavors in beverage products.

*Based on OSHA mixture exception of <1% crystalline silica for natural DE.

### Application Guide

<table>
<thead>
<tr>
<th>Filtration Type</th>
<th>Filter Grades</th>
<th>Possible Applications</th>
<th>Recommended Flow Rates gal/hr/ft² (liter/hr/m²)</th>
<th>Maximum Flow Rates gal/hr/ft² (liter/hr/m²)</th>
<th>Maximum Differential Pressure (psid)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coarse Filtration</td>
<td>CSF-XC (extra coarse)</td>
<td>Arrest Fermentation, Gross Clarification, Fining Agent Removal, Bioreduction</td>
<td>24 - 32 (978 - 1304)</td>
<td>30 - 40 (1222 - 1630)</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>CSF-SC (standard coarse)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polish / Clarifying</td>
<td>CSF-SP (standard polish)</td>
<td>High Degree of Clarification, Fining Agent Removal, Bioreduction</td>
<td>8 - 24 (326 - 978)</td>
<td>20 - 30 (815 - 1222)</td>
<td>45</td>
</tr>
<tr>
<td>Filtration</td>
<td>CSF-SP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sterile /</td>
<td>CSF-SF (standard fine)</td>
<td>High Degree of Clarification, Bioreduction, Membrane Filtration Preparation</td>
<td>3 - 12 (122 - 489)</td>
<td>10 - 15 (407 - 611)</td>
<td>21</td>
</tr>
<tr>
<td>Preamembrane Filtration</td>
<td>CSF-UF (ultra fine)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

![Filter Grades](image1)

![Permeability](image2)
Application Notes for Sheet Filter Presses

**Operation**
Typically, a filter press consists of a series of plates equipped with inlet and outlet ports. Depending on the type of press, the ports may be internally or externally ported. When the press is closed and tightened through manual or hydraulic means, the plates, gasketed ports and sheets are closed to form a tight seal for feed and filtrate passage. The unfiltered product passes through the inlet ports of the plate to the depth filter sheet. The depth filter sheet separates the undesired contaminant and allows the cleaned product to flow to the outlet plate. The outlet plate distributes the cleaned product to the discharge or outlet port.

**Advantages of Filter Presses**
- Very versatile – full range of filtration applications
- Large filter area and ability to increase additional surface area with more plates
- Flexible, modular design with ability to conduct two stage filtrations
- Good process scalability from bench to production scale
- Consistent and reliable filtration results
- Low maintenance costs

**Troubleshooting**
Similar to other separation and filtration equipment, regular cleaning, maintenance and inspections should be conducted on filter presses. There are a number of common problems that can be resolved with regular inspection, maintenance and training.

<table>
<thead>
<tr>
<th>Potential Issue or Concern</th>
<th>Result</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worn gaskets at inlet or outlet plates</td>
<td>Product loss</td>
<td>Replace gaskets. Use supplier information for proper thickness.</td>
</tr>
<tr>
<td>Insufficient press clamping</td>
<td>Product loss</td>
<td>Properly tighten press with manual or hydraulic closure. Use of leverage bar may be needed.</td>
</tr>
<tr>
<td>Misaligned filter sheets</td>
<td>Lower throughput, product loss</td>
<td>Depth filter sheets may be placed in wrong direction. Place cockled or rough side of filter towards the inlet plate. Align sheet parallel with plate.</td>
</tr>
<tr>
<td>High pressure/excessive flow rates</td>
<td>Less efficient filtration (premature blinding, less retention, contaminant break-through, product loss)</td>
<td>Ensure consistent product flow at recommended flow rate and differential pressure for filter grade.</td>
</tr>
</tbody>
</table>

**Filter Press Flow Diagram**
(top view)
Gusmer Enterprises

**Cellu-Stack® Filters**

Gusmer Enterprises’ Cellu-Stacks are a convenient way to utilize depth filtration media in an enclosed system. Offered in many Gusmer media grades, these stack filters can be used for coarse, fine and presterile filtration in numerous filtration applications.

- Full range of filter media grades with high adsorptive and retention properties
- Clean and safe filtration method when dealing with elevated pressures, temperatures, etc.
- Convenient operation with short setup or changeover times
- Small process footprint
- Designed to conform with GMP
- Highly economical with minimal maintenance and low operating costs
- Protection of filtrate against spoilage in an enclosed depth filtration system

**Gusmer Enterprises Cellu-Stack® Housings**

Gusmer Enterprises also offers a complete line of Cellu-Stack filter housings designed as a cost-effective system for high capacity liquid filtration applications. The versatile sanitary housing line accommodates either 12” or 16” diameter Cellu-Stack filter cartridges with the effective filtration surface area ranging from 17.7 ft² - 152 ft². All housings are available in 1, 2, 3, or 4-cartridge versions, which can be modified with the use of Cellu-Stack adapters to accept fewer cartridges for partial batch runs or other applications requiring fewer cartridges. ASME stamped housings are also available if required.

**Cellu-Stack Application Notes:**

- Place a quick acting check valve at the housing outlet to avoid integrity breaches that can be caused by backpressure
- Double check that all cartridge gaskets are in place and in good condition to ensure optimal sealing
- If filter life is not fully exhausted by a single filtration, DO NOT remove used filters from the housing for storage between uses. Instead, used filters can be stored IN the housing by following these steps:
  - Shut Down: After completion of the filtration cycle, sanitize the filters with the same method used to prepare the filters (i.e. steam or hot water flush)
  - Storage: Drain the housing, apply 2 psi gas pressure (i.e. CO₂, nitrogen) while the housing is still warm (to avoid a vacuum upon cooling) and close all ports
  - Restart: When restarting for another filtration cycle, repeat the sanitization procedure just as you would for normal filter preparation

**Stack Specifications**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Operating Temp.</td>
<td>176 °F (80 °C)</td>
</tr>
<tr>
<td>Steam in Place - 3 cycles</td>
<td>253 °F (123 °C)</td>
</tr>
<tr>
<td>Max. Differential Pressure</td>
<td>30 psid (2.1 bar)</td>
</tr>
<tr>
<td>Recommended Rinse Volume</td>
<td>2.5 gal/ft² (100L/m²)</td>
</tr>
</tbody>
</table>

Contact your Gusmer representative for the optimal grade selection for your filtration application.
For over 50 years, MilliporeSigma has supplied breweries around the world with microbial management solutions to monitor and remove microorganisms and other contaminants from beer. Trusted as the “gold standard” by generations of brewers, MilliporeSigma products for clarification, pre-sterile and sterile filtration will ensure microbial stability while maintaining quality, clarity, flavor and aroma. Gusmer is proud to offer a full range of MilliporeSigma products, including those for filtration and microbial monitoring at bottling and throughout the brewery.

**Total Cost of Filtration**

An efficient facility must operate on a Total Cost of Filtration basis. This method of operating recognizes that superior filter performance will yield better process economics over time.

A Total Cost of Filtration approach also recognizes that factors influenced by filter performance are often more costly than the filters themselves. These factors include:

- Filter cartridge cost
- Beer lost or damaged
- Bottling line downtime and labor
- Cleaning and sterilization water and chemicals
- Quality assurance personnel and materials
- Product holds
- Product spoilage and recalls

A high quality filter cartridge is key to maximizing total throughput and reducing the total cost of filtration.

**What sterile membrane is best for your process?**

The membrane is the most important component of a cartridge filter. There are a variety of different membrane options available to the brewing market with polyvinylidene fluoride (PVDF) and polyether sulfone (PES) being the most common. MilliporeSigma’s PVDF cartridge filters provide many critical advantages over those with PES membranes.

The Vitipore II PVDF final membrane offers:

- Lowest protein and color binding
- Highest membrane area and number of pleats per device
- Most throughput
- Only major symmetric beverage membrane
- Higher membrane robustness and stress tolerance
- Most reliable integrity testing

The Vitipore II Plus offers an additional 0.5 µm mixed cellulose esters prefilter layer in the same device. Click on the QR code to download the MP 04 Application Brief for more information on PVDF and PES membranes.
MilliporeSigma Filters
Popular Grades & Configurations

Sterile Filtration Applications – Vitipore® II & Vitipore® II Plus

Constructed with Durapore® polyvinylidene fluoride (PVDF) membrane, the Vitipore II and Vitipore II Plus cartridges have been engineered to meet the rigorous and varied conditions of beverage filtration, sterilization and cleaning regimens. MilliporeSigma’s sterile membrane filters have a solid reputation for high flow rates and long service life, with a very low affinity for protein and pigment binding. No other cartridge gives as much throughput as the Vitipore II Plus. Available in 0.22 µm, 0.45 µm, 0.65 µm and 1.0 µm (absolute) pore size.

Prefiltration and Clarification Applications – Bevigard™ M, Polygard® CR & Clarigard

MilliporeSigma’s dual-layer 1.2 µm over 0.5 µm Bevigard M prefilter offers the tightest protection of sterile membrane filters.

The Clarigard is a wrapped prefiltration cartridge that offers an efficient combination of high dirt holding capacity and high retention to protect final filters in streams that may have a large concentration of small particles.

Polygard CR clarification filters are an ideal bottling filter when sterile filtration is not required. The high dirt loading capacity of the Polygard CR makes it a reliable trap filter. The Polygard CR is available in pore size ratings up to 100 µm. MilliporeSigma has dozens of other prefiltration and clarification cartridges that can be matched to specific applications.

Gas Filtration Applications – Aervent®

Sterile filtration of gases can be crucial to maintaining microbial stability on a bottling line. The Aervent features a highly hydrophobic (water repelling) PTFE 0.2 µm membrane that allows for high gas flow rates, prevents wetting and maintains a sterile barrier.

<table>
<thead>
<tr>
<th>Part Number</th>
<th>10 inch</th>
<th>20 inch</th>
<th>30 inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitipore II Plus</td>
<td>0.45 µm</td>
<td>CVPB71PK1</td>
<td>CVPB72PK1</td>
</tr>
<tr>
<td></td>
<td>0.65 µm</td>
<td>CVPY71PK1</td>
<td>CVPY72PK1</td>
</tr>
<tr>
<td>Clarigard</td>
<td>0.5 µm</td>
<td>D00571S01</td>
<td>D00572S01</td>
</tr>
<tr>
<td>Bevigard M</td>
<td>0.5 µm</td>
<td>CWSC71SB1</td>
<td>CWSC72SB1</td>
</tr>
<tr>
<td>Polygard CR</td>
<td>0.5 µm</td>
<td>CRA571006</td>
<td>CRA572006</td>
</tr>
<tr>
<td></td>
<td>1.0 µm</td>
<td>CR0171006</td>
<td>CR0172006</td>
</tr>
<tr>
<td></td>
<td>3.0 µm</td>
<td>CR0371006</td>
<td>CR0372006</td>
</tr>
<tr>
<td></td>
<td>5.0 µm</td>
<td>CR0571006</td>
<td>CR0572006</td>
</tr>
<tr>
<td></td>
<td>10.0 µm</td>
<td>CR1071006</td>
<td>CR1072006</td>
</tr>
</tbody>
</table>

MilliporeSigma Filter Cartridge Configuration

MilliporeSigma filter cartridges are available in 10, 20 and 30-inch lengths and Code 7, Code F, Code 5 and Code 0 configurations. For specific recommendations or information, please contact your Gusmer representative.
Installation

- Assure that the housing, pressure gauges, valves, gaskets and o-rings are in good working order (housing o-rings should be replaced on a regular basis).

- Carefully remove the cartridge from the packaging material and inspect. Use caution when opening the filter bag – scissors are recommended. Each filter cartridge is stamped with the grade and comes with a quality certificate in the box. Verify that the correct filter is being installed for the intended application.

- Wet the o-rings with water and install into the housing, being careful not to roll the o-rings upon installation.

- Run ambient temperature water* through cartridges under a little back pressure to fully wet out the filter media.

Sterilization & Cleaning

- MilliporeSigma recommends the use of hot water* (180 °F for 30 minutes) for sterilization of filters and filter housings (time period starts when the housing outlet comes to temperature). Once the proper temperature is reached, take care to use only a low hot water flow and low differential pressure.

- Each hot water cycle should always be preceded and followed by an ambient water* rinse cycle.

- If hot water is not available, the filters are compatible with a wide range of sanitation chemicals. Please consult your Gusmer representative for specific information.

- Ensure that filter housings remain vented during cleaning and sterilization.

- It is recommended to start each cleaning cycle with at least 5 minutes of cold water flow. Temperature should then be gradually increased to its final cleaning temperature (typically 180 °F). A longer warm water rinse is beneficial to cleaning. Filters should never be contacted with a temperature above 135 °F without first rinsing with cold/warm water* to achieve maximum throughput.

- Some filters can be backflushed. Please consult your Gusmer representative for specific information.

- Avoid pressure shocks and water hammer especially during cleaning/sanitation with hot fluids.

*Use filtered, softened water for wetting, cleaning, and sterilization to avoid fouling the cartridges.
Application Notes For MilliporeSigma Filters (continued)

**Operation**
- Differential pressure (inlet minus outlet pressure) should be monitored regularly. Differential pressure increases as the filters plug, eventually leading to a loss of flow through the filter. Differential pressure increases exponentially. It may take many weeks to reach 80% plugged, but only a few hours for the final plugging to occur.
- A common practice at breweries is to terminate the filtration and clean or change the cartridge(s) when the differential pressure reaches 30 psi.
- Operate the process at the lowest, consistent flow rate to have a positive effect on filter performance. A higher face velocity leads to faster plugging.
- Avoid pressure shocks and water hammer on the line.
- Ensure that the top of the housing dome is periodically vented during production to remove any gas buildup that may overlap the filters.

**Integrity Testing**
- Integrity testing is only conducted on final membrane cartridges and is conducted per the recommended specifications of the manufacturer for the specific membrane used. Integrity testing is conducted after the sanitation cycle, both prior to and after the bottling run. There are a few different methods for integrity testing, of which the bubble point and pressure hold methods are the most common. The bubble point method is recommended for housings with three or less cartridges and the pressure hold method is recommended for housings with greater than three cartridges. Please consult your Gusmer representative for detailed information on integrity testing methods and specifications.
- Every MilliporeSigma sterile membrane filter cartridge is integrity tested by MilliporeSigma twice prior to packaging. Damage caused to cartridges by shipping, installation or process improprieties, or housing and valve issues are usually manifested as gross integrity test failure.

**Cartridge Storage**
- Intermediate storage (overnight or over a weekend) can be done in the filter housing. Flush the filters with warm water, sterilize the housing and pressurize with 5 psi of nitrogen. The nitrogen keeps the housing under a positive pressure.
- Long-term storage is best done outside of the filter housings. Four inch PVC piping capped at both ends is frequently used to store the individual cartridges in a solution of 350 ppm sulfur dioxide that has been adjusted to a pH of 3.5 with citric acid. This solution should be tested every month and replaced as necessary. Ethanol at approximately 40% may also be used for long term storage. Remove o-rings from the cartridges prior to storage and store the o-rings in a clean and dry place.
- Reinstall the o-rings, rinse, sterilize and integrity test stored cartridges prior to resuming bottling filtration.
Application Notes For MilliporeSigma Filters (continued)

MilliporeSigma Bevliner™ Filter Housings

MilliporeSigma’s Bevliner T-line configured filter housings are economical, high quality, sanitary housings used throughout the beverage industry. Bevliner housings are available in the appropriate size for any application and are both CE and ASME compliant, meeting all design and manufacturing standards.

Each Bevliner housing comes complete with a sight glass assembly including two vent valves and dual-scale pressure gauge, support legs, ball valve, tri-clamp end cap and the required clamps and gaskets for the included accessories. Please inquire about choosing the right MilliporeSigma Bevliner housing for your application.

Materials of Construction

- All metal surfaces in contact with product are 316 stainless steel
- Seals are silicone (internal inlet / outlet connection seal to housing is PTFE, Teflon polymer)

Surface Finish

- Mechanical polish (MP) – All housing stainless steel wetted parts are mechanically polished: Ra <0.8 μm (<32 microinches)

Gusmer keeps some models of Bevliner housings in stock, ready for immediate shipment. Contact your Gusmer representative to discuss favorable lead times on Bevliner housings.
MilliporeSigma
Microbial Monitoring Tools

Gusmer Enterprises and MilliporeSigma have combined efforts to bring the brewing industry the necessary tools to conduct microbiological process monitoring at critical points throughout the brewing process. Our line of process monitoring tools is designed for convenience, cost effectiveness and quality. These tools are essential to help ensure product safety and microbial stability at all critical points, such as fermentation, storage, filtration and bottling. From simple setups to advanced systems, these tools are designed to fit into the monitoring regimes of every facility and are easy enough for any microbiological skill level. Ensure the quality and safety of your beer throughout production with MilliporeSigma process monitoring tools from Gusmer.

Membranes for Microbial Plating

**EZ-Pak® System**

The EZ-Pak system is the perfect solution for upscale, fast-paced processing. This cost-effective system uses presterilized, ready-to-use EZ-Pak membranes on a patented support system, the EZ-Pak Curve. Using this system will ultimately result in higher productivity, higher throughput and reduced risk of accidental contamination.

**EZ-Pak® Curve**

The EZ-Pak Curve membrane dispenser from MilliporeSigma features a motion activated sensor for automatic and hands-free dispensing of a sterile membrane for micro plating or filterability work. The dispenser uncovers and maintains the membrane in the horizontal position until the operator retrieves it with forceps for loading onto the manifold. The design allows for fast and easy loading of EZ-Pak membrane bands. Compatible with all current EZ-Pak membranes.

**S-Pak®**

Smaller volume labs may prefer the S-Pak, individually wrapped and pre-sterilized membrane filter disks. Disposable Microfil® funnels can be purchased bundled with both EZ-Pak and S-Pak filters for easy ordering. MilliporeSigma’s Microfil manifold is specifically designed for ease of use with funnels.

### EZ-Pak Membranes

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Item Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSP000814</td>
<td>EZ-Pak filters 0.45 µm black gridded</td>
<td>600</td>
</tr>
<tr>
<td>EZHAWG474</td>
<td>EZ-Pak filters 0.45 µm white gridded</td>
<td>600</td>
</tr>
<tr>
<td>EZAABG474</td>
<td>EZ-Pak filters 0.8 µm black gridded</td>
<td>600</td>
</tr>
<tr>
<td>EZAAWG474</td>
<td>EZ-Pak filters 0.8 µm white gridded</td>
<td>600</td>
</tr>
</tbody>
</table>

### EZ-Pak with Disposable Microfil Funnels

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Item Description</th>
<th>Funnel</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>MZHAWG101</td>
<td>EZ-Pak filters 0.45 µm white gridded</td>
<td>100 ml</td>
<td>150</td>
</tr>
<tr>
<td>MZHAWG251</td>
<td>EZ-Pak filters 0.45 µm white gridded</td>
<td>250 ml</td>
<td>150</td>
</tr>
<tr>
<td>MZHABG101</td>
<td>EZ-Pak filters 0.45 µm black gridded</td>
<td>100 ml</td>
<td>150</td>
</tr>
<tr>
<td>MZHABG251</td>
<td>EZ-Pak filters 0.45 µm black gridded</td>
<td>250 ml</td>
<td>150</td>
</tr>
</tbody>
</table>

### S-Pak Membranes

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Item Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>HAWG047S6</td>
<td>S-Pak filters 0.45 µm white gridded</td>
<td>600</td>
</tr>
<tr>
<td>HABG047S6</td>
<td>S-Pak filters 0.45 µm black gridded</td>
<td>600</td>
</tr>
<tr>
<td>AAWG047S6</td>
<td>S-Pak filters 0.8 µm white gridded</td>
<td>600</td>
</tr>
<tr>
<td>AABG047S6</td>
<td>S-Pak filters 0.8 µm black gridded</td>
<td>600</td>
</tr>
<tr>
<td>RAWG047S6</td>
<td>S-Pak filters 1.2 µm white gridded</td>
<td>600</td>
</tr>
</tbody>
</table>

### S-Pak with Disposable Microfil Funnels

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Item Description</th>
<th>Funnel</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIHAWG100</td>
<td>S-Pak filters 0.45 µm white gridded</td>
<td>100 ml</td>
<td>150</td>
</tr>
<tr>
<td>MIHABG100</td>
<td>S-Pak filters 0.45 µm black gridded</td>
<td>100 ml</td>
<td>150</td>
</tr>
<tr>
<td>MIHAWG250</td>
<td>S-Pak filters 0.45 µm white gridded</td>
<td>250 ml</td>
<td>150</td>
</tr>
<tr>
<td>MIIAWG100</td>
<td>S-Pak filters 0.8 µm white gridded</td>
<td>100 ml</td>
<td>150</td>
</tr>
<tr>
<td>MIRAWG100</td>
<td>S-Pak filters 1.2 µm white gridded</td>
<td>100 ml</td>
<td>150</td>
</tr>
<tr>
<td>MIRAWG250</td>
<td>S-Pak filters 1.2 µm white gridded</td>
<td>250 ml</td>
<td>150</td>
</tr>
</tbody>
</table>

### Hardware

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Item Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>EZCURVE01</td>
<td>EZ-Pak Curve dispenser</td>
<td>1</td>
</tr>
<tr>
<td>XX6200006P</td>
<td>MilliporeSigma filter forceps</td>
<td>3</td>
</tr>
</tbody>
</table>
MilliporeSigma Microbial Monitoring Tools (continued)

**Integrated Filtration Devices for Microbial Monitoring**

Integrated filtration devices offer a pre-sterilized and easy-to-use solution for microbial plating, eliminating the need for cleaning, autoclaving, and assembling reusable devices.

**Monitor 55-Plus™**

MilliporeSigma’s Monitor 55-Plus features a 55 mm membrane, 100 mL funnel, cellulose pad, and petri dish – all in one device. The funnel portion is removable, after which the device can be incubated as a standard petri dish. The Monitor 55-Plus fits stoppered manifolds and is suitable for liquid culture media.

**EZ-Fit™ Filtration Unit**

MilliporeSigma’s EZ-Fit Filtration Unit features a 47 mm membrane on a unique stackable base.

The BLUE base units include a cellulose pad and integrated petri dish that can be incubated as an all-in-one unit. These units are suitable for liquid culture media.

The PINK base units do not include a cellulose pad, allowing you the option to remove the membrane from the unit and incubate in a standalone petri dish. These units are suitable for liquid or granular culture media.

Both units come with 100 mL or 250 mL funnels with fill level indicators and can be used with a stoppered manifold or MilliporeSigma’s EZ-Fit manifold tulip.

---

**Monitor 55-Plus**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Item Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>JBRMHWG05505</td>
<td>Monitor 55-Plus HAWG white grid</td>
<td>50</td>
</tr>
<tr>
<td>JBRMHBG05505</td>
<td>Monitor 55-Plus HABG black grid</td>
<td>50</td>
</tr>
<tr>
<td>JBRM00005505</td>
<td>Monitor 55-Plus adapter for No. 8 Stopper</td>
<td>5</td>
</tr>
</tbody>
</table>

**EZ-Fit Filtration Unit**

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>EFHAW100I</td>
<td>48</td>
</tr>
<tr>
<td>EFHAW250I</td>
<td>48</td>
</tr>
<tr>
<td>EFHAB100I</td>
<td>48</td>
</tr>
<tr>
<td>EFHAB250I</td>
<td>48</td>
</tr>
<tr>
<td>EFHAW10MS</td>
<td>48</td>
</tr>
<tr>
<td>EFHAW25BS</td>
<td>48</td>
</tr>
<tr>
<td>EFHAB10MS</td>
<td>48</td>
</tr>
<tr>
<td>EFHAB25BS</td>
<td>48</td>
</tr>
</tbody>
</table>
MilliporeSigma offers a full line of all manifold types, reusable glassware, including filtering flasks and filter holders, classic vacuum pumps and other accessories for every lab setup.

### Glassware & Hardware

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Item Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>XX1004700</td>
<td>Glass filter holder with clamp</td>
<td>1</td>
</tr>
<tr>
<td>XX2004718</td>
<td>Neoprene No 8 stopper - 3/8&quot; hole</td>
<td>5</td>
</tr>
<tr>
<td>XX1014705</td>
<td>1 L vacuum filtering flask</td>
<td>1</td>
</tr>
<tr>
<td>XX1014744</td>
<td>4 L vacuum filtering flask</td>
<td>1</td>
</tr>
<tr>
<td>XX7100004</td>
<td>Silicone tubing 3/16&quot; ID, 140 cm</td>
<td>1</td>
</tr>
<tr>
<td>WP6111560</td>
<td>Chemical Duty Vacuum/Pressure Pump, 115volt</td>
<td>1</td>
</tr>
</tbody>
</table>

### EZ-Fit™ Manifolds

The first truly plug-and-play manifold compatible with multiple formats of filtration tulips. The EZ-Fit manifold is ultra-sanitary, low profile, and operates with quick connect fittings for easy disassembly or adaptation to meet a variety of needs. No tools are needed for disassembly and all areas are easily cleaned. Works with all formats of reusable or sterile disposable funnels or membrane holders.

### EZ-Stream™

The EZ-Stream vacuum filtration pump is specifically designed for microbiology analysis. The compact design is ideal for both the work bench and the laminar flow hood. The vacuum is provided by a maintenance-free diaphragm. Check valves allow liquids to run directly through the pump. There is no need to use any waste containers normally associated with traditional air pumps or an in-house vacuum, eliminating the need for repeated emptying of heavy waste containers. The EZ-Stream has also been optimized for maximum noise reduction during operation.
Granulated (Dehydrated) Media

MilliporeSigma’s premium granulated media is now available in North America. Granulated media offers several key advantages over traditional dehydrated media including:

- Each granule contains the exact ingredient proportions
- No settling or separation of media ingredients that can lead to inconsistent tests
- Faster dissolution

MilliporeSigma specifies the highest performance criteria available on the market in its media quality certificates.

Many other media formulations and versions available.

### Granulated Media

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Item Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.10130.0500</td>
<td>Potato Dextrose Agar</td>
<td>500 g</td>
</tr>
<tr>
<td>1.05463.0500</td>
<td>Total Plate Count Agar</td>
<td>500 g</td>
</tr>
<tr>
<td>1.10673.0500</td>
<td>Orange Serum Agar</td>
<td>500 g</td>
</tr>
<tr>
<td>1.05443.0500</td>
<td>Nutrient Broth</td>
<td>500 g</td>
</tr>
<tr>
<td>1.05450.0500</td>
<td>Nutrient Agar</td>
<td>500 g</td>
</tr>
<tr>
<td>1.10661.0500</td>
<td>MRS Broth</td>
<td>500 g</td>
</tr>
<tr>
<td>1.10660.0500</td>
<td>MRS Agar</td>
<td>500 g</td>
</tr>
<tr>
<td>1.05397.0500</td>
<td>Malt Extract Broth</td>
<td>500 g</td>
</tr>
<tr>
<td>1.00467.0500</td>
<td>RBC Agar</td>
<td>500 g</td>
</tr>
<tr>
<td>1.10866.0500</td>
<td>WL Nutrient Agar</td>
<td>500 g</td>
</tr>
</tbody>
</table>

### Liquid Media and Petri-Pad® Petri Dishes

Ready to use 2 ml plastic ampoules of sterile liquid media save time and effort when you only have a few samples to culture. No need to prepare media, simply uncap the ampoule and squeeze the sterile media into a Petri-Pad Petri dish’s absorbent pad. Petri-Pad sterile 47 mm Petri dishes, with pre-loaded pads, come fully assembled and ready to use. The pads conveniently absorb 2 ml of liquid media to instantly prepare it to receive an EZ-Pak or S-Pak membrane filter for culturing.

### Culture Media

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Item Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>MHA00PRY2</td>
<td>Preservative-Resistant Yeast Broth</td>
<td>50</td>
</tr>
<tr>
<td>MHA00BSM2</td>
<td>Brettanomyces Broth</td>
<td>50</td>
</tr>
<tr>
<td>MHA00P2N</td>
<td>Wallerstein Nutrient Broth</td>
<td>50</td>
</tr>
<tr>
<td>MHA00P2M</td>
<td>m-Green/Schaufus Pottinger</td>
<td>50</td>
</tr>
<tr>
<td>MHA00P2D</td>
<td>Wallerstein Differential Broth</td>
<td>50</td>
</tr>
<tr>
<td>MHA00P2SM</td>
<td>Yeast and Mold Selective Broth</td>
<td>50</td>
</tr>
</tbody>
</table>

*Note: Ampoules need to be stored at 2-8 °C*

### Petri-Pads & Dishes

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Item Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>PD20047S0</td>
<td>Petri-Pad dish with pad</td>
<td>150</td>
</tr>
<tr>
<td>PD20047S5</td>
<td>Petri-Pad dish with pad</td>
<td>600</td>
</tr>
<tr>
<td>PD2004700</td>
<td>Petri dish</td>
<td>150</td>
</tr>
<tr>
<td>PD2004705</td>
<td>Petri dish</td>
<td>600</td>
</tr>
</tbody>
</table>
Gusmer is proud to announce a new offering from MilliporeSigma, the MVP Icon. The MVP Icon is an innovative tool that rapidly detects and records the presence of adenosine triphosphate (ATP), a molecule found in all living cells such as yeast or bacteria, including those in food and beverage residues.

Swab a surface in the brewery, activate the swab’s sampling device, and record the measurement in seconds. An indication of the level of ATP present on any given surface provides an indication of cleanliness and the efficacy of cleaning processes. Routine monitoring of ATP levels at critical points in the brewing process can provide the opportunity to optimize cleaning and sanitation protocols and prevent sanitation-based quality problems before they start.

Unique to the MVP Icon is MilliporeSigma’s validated Zones of Cleanliness system. This system is an easy to understand quantitative indication of cleanliness, using a 0-5 scale. A result below 2.5 is considered a “Pass”, a result between 2.5-3.0 indicates trace amounts of ATP, and a surface with a result above 3.0 should be cleaned again and retested. Although the MVP Icon can also be configured to read in Relative Light Units (RLU), the Zones of Cleanliness system simplifies the monitoring process and provides convenience to brewery sanitation programs.

The MVP Icon can also be used in conjunction with the MVP Icon Dashboard Software, a PC based application that provides a status snapshot of your sanitation program by generating analytical trending and performance reports. The software also allows you to establish and monitor a testing schedule, providing you with assurance that your HACCP program is properly managed.
Illustrated Guide to Microbes and Sediments in Wine, Beer and Juice
by Dr. Charles G. Edwards

One of the most useful books for beverage microbiology. A “must-have” for microscopic examination and visual identification of microorganisms and sediments in wines, beers and juices!

*Illustrated Guide to Microbes and Sediments in Wine, Beer and Juice* is a microscope companion book that includes over 30 different species of yeast, bacteria and mold commonly associated with beverages, as well as frequently encountered sediments. This book is an extensive compilation of photographs and reference information printed on durable, spill-resistant paper and spiral bound so the pictures lie flat when in use with a microscope.

The microorganisms were obtained from culture collections located around the world. Each organism is featured in three photographs: (1) a typical colony grown on commercially available culture media, (2) a color stain, and (3) a phase contrast view of the microorganisms grown in wine, beer or juice.

This volume includes translations of the following languages: English, French, German, Italian, Spanish and Chinese. Therefore, it is an essential resource for brewers worldwide. It’s a comprehensive reference book that will quickly become a standard for any technical brewing library.

Published by WineBugs LLC, 2006
MilliporeSigma Spectroquant

Introducing the first complete product line for brewing spectrophotometric analysis

No longer do you have to use a general purpose spectrophotometer for your brewing needs, leaving you to calculate IBU’s or other relevant brewing specifications on your own. No more creating your own protocols that must be adapted to various manufacturers’ chemicals. No guessing at how one supplier’s reagents and another supplier’s equipment will affect the protocols you’ve developed. No longer do you have to look for two, three or more sources for chemicals and test reagents.

The Spectroquant line is the first turnkey solution, featuring a spectrophotometer and software package specific to brewing. Results are given in brewing units with no conversions or calculations needed. Corresponding chemicals and reagents from MilliporeSigma offer the most consistent and highest quality test materials from a single source. Validated step-by-step protocols developed according to EBC, MEBAK and ASBC methods for use with the Spectroquant line mean you have everything needed to run any beer analysis right out of the box*.

- Prove Spectrophotometer
- Brewing Software
- Validated Protocols
- MilliporeSigma Chemicals*

<table>
<thead>
<tr>
<th>Analysis</th>
<th>Sample Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>α-Acids</td>
<td>Beer and Wort</td>
</tr>
<tr>
<td>Anthocyanogens, Harris and Ricketts method</td>
<td>Beer and Wort</td>
</tr>
<tr>
<td>Bitterness</td>
<td>Beer and Wort</td>
</tr>
<tr>
<td>Iron, spectrophotometric</td>
<td>Beer</td>
</tr>
<tr>
<td>Color, spectrophotometric</td>
<td>Beer and Wort</td>
</tr>
<tr>
<td>Flavonoids</td>
<td>Beer</td>
</tr>
<tr>
<td>Free Amino Nitrogen, Ninhydrin method</td>
<td>Beer and Wort</td>
</tr>
<tr>
<td>Total Carbohydrates</td>
<td>Beer and Wort</td>
</tr>
<tr>
<td>Total Polyphenols</td>
<td>Beer and Wort</td>
</tr>
<tr>
<td>Iso-α-Acids</td>
<td>Beer and Wort</td>
</tr>
<tr>
<td>Copper, Cuprethol method</td>
<td>Beer</td>
</tr>
<tr>
<td>Nickel</td>
<td>Beer</td>
</tr>
<tr>
<td>Photometric Iodine test</td>
<td>Beer and Wort</td>
</tr>
<tr>
<td>Reducing Power, spectrophotometric</td>
<td>Beer</td>
</tr>
<tr>
<td>Thiobarbituric Acid Number (TAN)</td>
<td>Beer, Wort, &amp; Congress Wort</td>
</tr>
<tr>
<td>Vicinal Diketones (Diacetyl, 2,3-Pentadione)</td>
<td>Beer</td>
</tr>
<tr>
<td>Steam-Volatile Phenols</td>
<td>Beer and Malt</td>
</tr>
</tbody>
</table>

*MilliporeSigma chemicals, reagents, and cuvettes are sold separately. Contact your Gusmer technical representative for more details.
**Funke Gerber**

**FermentoFlash**

*The device for the automatic analysis of beer*

- Easy 5-key operation
- Automatic calibration
- 1 minute measuring time
- Recording printer included

**Measurement principle**
The beer sample (10 ml) is brought into the measuring cells by means of an integral pump. Alcohol content, extract and density are measured by using thermal measuring effects. Derived constituents such as wort original gravity (Plato), apparent extract, real extract, alcohol (abv & abw), specific gravity and osmotic pressure are also determined.

**Calibration**
The device may be calibrated by using a corresponding reference beer. You can store 18 different sets of calibration data (for example pilsner, strong beer, non-alcoholic beer). You can also change from one product to another without having to undertake a new calibration.

<table>
<thead>
<tr>
<th>Constituent</th>
<th>Measuring Range</th>
<th>Repeatability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol</td>
<td>0.00% to 15.00%</td>
<td>± 0.02%</td>
</tr>
<tr>
<td>Extract</td>
<td>0.00% to 10.00%</td>
<td>± 0.04%</td>
</tr>
<tr>
<td>Apparent Extract</td>
<td>0.00% to 10.00%</td>
<td>± 0.04%</td>
</tr>
<tr>
<td>Original Wort</td>
<td>0.00% to 20.00%</td>
<td>± 0.04%</td>
</tr>
<tr>
<td>Density</td>
<td>0.95 to 1.05 g/cm³</td>
<td>± 0.0002 g/cm³</td>
</tr>
<tr>
<td>Osmotic Pressure</td>
<td>Calculated value</td>
<td>---</td>
</tr>
</tbody>
</table>

Reference beer analysis can be conducted at our analytical laboratory in Napa, CA.

---

**Funke Gerber**

**ColonyStar**

*Colony Counter*

With a pressure-sensitive light field, direct and indirect illumination, adjustable brightness and variable color field display and acoustic counting feedback, the ColonyStar has every feature required for easy and reliable colony counting. The ColonyStar reads Petri dishes up to 145 mm, and includes a reducing insert for smaller Petri dishes.
Pacific Ozone
Ozone Generators

The Pacific Ozone PC16 and PC25 portable ozone generators are complete integrated ozone solution generation systems built to withstand the rigors of sanitation at commercial food and beverage processing facilities. Ozonated water generated on site, as required, eliminates the need to store, handle and dispose of harsh sanitizing chemicals.

Ozone (O₃) is a naturally occurring, broad spectrum oxidizing agent that readily disintegrates organic material. When dissolved in water, it is an ideal sanitizing agent for food and beverage applications since it has the ability to disrupt cell wall membranes in microorganisms such as bacteria, yeast, mold, fungus, spores, viruses and biofilms faster than hot water, steam or chlorine. Produced when three oxygen atoms form a short-lived and unstable molecule (O₃), ozone will naturally revert back to atmospheric oxygen (O₂) after a brief period of time. Apply ozone enriched water (1-3 ppm ozone dissolved in ambient temperature water) as a sanitizer to the inside and outside surfaces of tanks, kettles, barrels and kegs, or on tools, conveyors, walls, floors and drains. Wet equipment surfaces with a low pressure spray of ozonated water and allow the surface to remain wet for a few minutes or more. Ozonated water leaves no harmful residue on contact surfaces and requires no rinsing – thus reducing water use.

The PC series of ozone generators deliver a reliable and consistent supply of ozonated water at the workable flow rate range required to support good sanitation practices. An output of 1-3 ppm ozonated water, at a flow rate of 10-30 gpm*, gives the concentration/time (CT value) required for good log reduction of cells in mixed microbial populations.

Comprised of four key components, the PC series generators include feed gas preparation, ozone generation, mass transfer and control/monitoring, all in one integrated system.

- **Feed Gas Preparation** – concentrates atmospheric oxygen for efficient conversion to ozone
- **Ozone Generation** – high energy fields in patented Floating Plate Technology™ reactor cells convert oxygen to ozone gas
- **Mass Transfer** – ozone gas is dissolved into a stream of water; excess ozone gas is destroyed
- **Control/Monitoring** – maintains correct ozone concentration for application

The standard PC16 and PC25 deliver a stable output of ozonated water that is easily controlled by the operator. With the available proportional control option, the PC16 and PC25 have the ability to adjust the output of ozonated water, while proportionately maintaining the desired concentration of ozone.

*With typical water quality conditions

---

**PC16 Dissolved Ozone Output**

- **Optimal Flowrate Range**

```
GPM (Gallons Per Minute) | Dissolved Ozone
-------------------------|-------------------
0                        | 0.0
5                        | 0.89
10                       | 1.68
15                       | 2.36
20                       | 3.04
25                       | 3.72
30                       | 4.41
35                       | 5.09
```

**PC25 Dissolved Ozone Output**

- **Optimal Flowrate Range**

```
GPM (Gallons Per Minute) | Dissolved Ozone
-------------------------|-------------------
0                        | 0.0
5                        | 1.33
10                       | 2.66
15                       | 3.99
20                       | 5.33
25                       | 6.66
30                       | 8.00
35                       | 9.33
```

*Note: Municipal water supply, ambient temperature 60°F and water temperature 60°F for both trials.*
mbt Brautechnik
Brewhouse Technology

Founded in 2005, with headquarters in Bavaria, Germany – mbt Brautechnik GmbH has proven to be a high quality solution provider for the small-to-mid sized craft brewers, specializing in a full range of brewhouses.

mbt Brautechnik has a broad range of capability and can offer brewhouse solutions in standard configurations or in fully customized layouts and in a range of control from manual to fully automated. With such flexibility and attention to detail, it is no surprise that mbt has delivered projects, from simple to sophisticated, all over the world!

**PILOT / R&D / PUB Series**

- Custom designed, linear skid mounted, fully scalable breweries
- Available in manual, semi-automated, or fully automated systems
- Complete turn-key solutions available
- Internal or external boiling
- Sizes: Starting at 1 hl / 1 bbl

**SHOWCASE / INDUSTRIAL Series**

- Classical brewhouses custom designed and built to the specific requirements of the brewer and brewing process
- All vessel configurations possible
- Available in manual, semi-automated, or fully automated systems
- Flexible, customer focused engineering
- Sizes: Up to 50 hl / 50 bbl

**Expansions & Upgrades**

- All sizes possible
- Partial upgrades of components or complete re-working of the brewhouse components
- Replacements or additions of components and vessels
Christian Gresser
Tanks & Open Fermenters

With more than 140 years of experience and now in its fourth generation of family ownership, Christian Gresser Behälter- und Anlagenbau GmbH (headquartered in Bavaria, Germany) offers the world’s finest brewery tanks. The high quality approach of Christian Gresser extends beyond materials, workmanship, fit and finish and into a partnership of trust. Counting some of the world’s most renowned breweries as their customers, Christian Gresser brewery tanks are truly where Aesthetic meets Performance.

**Cylindroconical Fermentation Vessels**
- Standard or custom geometries available
- Dual outlet available
- Internal jacket supply/return routing for a streamlined look
- Sizes: Starting at 1 hl / 1 bbl up to transportation limit

**Open Top Cylindroconical Fermentation Vessels**
- Standard or custom geometries available
- Specialized integrated CIP ring available
- Available with or without yeast collection
- Sizes: Starting at 1 hl / 1 bbl up to transportation limit

**Horizontal Lagering Tanks**
- Sizes: Starting at 1 hl / 1 bbl up to transportation limit

**Brite Beer Tanks**
- Sizes: Starting at 1 hl / 1 bbl up to transportation limit

Video Customer Testimonial
Eric Harper, Brewmaster
Utepils Brewing Co. - Minneapolis, MN

CLICK IMAGE TO VIEW VIDEO
Christian Gresser
Yeast Propagation

Known for superior quality, workmanship and attention to detail, Christian Gresser can offer the perfect solution for your yeast management needs, with patented, proven yeast propagation technology and a track record more than two decades long. Christian Gresser understands that yeast propagation is A Matter of Quality.

Advantages of Yeast Propagation

- Higher viability and vitality compared to dry- and harvest-yeast
- Higher Attenuation
- Faster pH - drop
- Lower amount of fatty acids – better stability
- Faster diacetyl reduction
- Independence from external yeast supply
- Consistent fermentation performance

Standard Yeast Prop Systems

- Sizes Available: 1, 2.5, 5, 7.5, 10, 12.5 and 15 hl
- Available in dual or single tank configuration
- Touch panel HMI for propagation programming
- Optional insulation of tanks available

Custom Yeast Prop Systems

- Sizes Available: 1 hl to 100 hl
- Custom system configurations available

Yeast Storage Tanks

- Sizes Available: Starting at 1 hl / 1 bbl up to transportation limit
- Aeration/agitation available
Ponndorf
Spent Grain Removal

In its fourth generation of family ownership, with more than a century of experience, Ponndorf Anlagenbau GmbH are industry-leading experts in the field of spent grain handling. Offering a full line of pneumatic wet spent grain conveyors, spent grain silo plants and silo discharge units, Ponndorf has the entire spent grain handling process covered. With a line of equipment that combines the simplicity and efficiency that modern brewers desire while providing an easy-to-maintain, robust reliability that never goes out of style, it’s no wonder that Ponndorf equipment can be found in breweries worldwide.

Conveyors - PONYfant ©

- PONYfant is a truly “plug and play” mobile pneumatic wet spent grains conveyor designed for pubs to small breweries.
- Up to 45 kg/min (≤ 100 lbs/min) conveying performance
- Mounted on a mobile frame with lockable casters and integral control cabinet, and include an energy efficient Becker air compressor, 100 ft of pressure hose with outlet discharge adapter and cleaning ball.

Watch the Ponndorf in operation at Ellicottville Brewing Co.

CLICK IMAGE TO VIEW VIDEO

Spent Grain Removal Video

Join now for exclusive content, special offers, and more.

YouTube
Ponndorf Spent Grain Removal (continued)

Conveyors - Stationary Units

- 50 - 650 kg/min (110 - 1,433 lb/min) conveying performance
- Large infeed shaft for defined filling of the conveying screw
- Robust slip on gear mechanism
- Integrated stopper (non-return valve)
- Rinse water socket, manually or electro-pneumatically operated
- Easy pipeline cleaning by means of a cleaning ball
- Reliable operation, low maintenance

Wet Spent Grains Silo Plants

- Up to 400 m³ storage capacities
- Individually constructed and manufactured according to the international safety regulations
- Completely equipped with injection domes, pig ball recovery systems, ladders and all safety railings and access features.

Conveyors - Stationary Units

- • 50 - 650 kg/min (110 - 1,433 lb/min) conveying performance
- • Large infeed shaft for defined filling of the conveying screw
- • Robust slip on gear mechanism
- • Integrated stopper (non-return valve)
- • Rinse water socket, manually or electro-pneumatically operated
- • Easy pipeline cleaning by means of a cleaning ball
- • Reliable operation, low maintenance

Wet Spent Grains Silo Plants

- Up to 400 m³ storage capacities
- Individually constructed and manufactured according to the international safety regulations
- Completely equipped with injection domes, pig ball recovery systems, ladders and all safety railings and access features.

Wet Spent Grains Silo Dispenser Systems

- 500 - 1,100 kg/min (1,102 - 2,425 lb/min) discharging performance
- Robust slip on gear mechanism
- Rinse water socket, manually or electro-pneumatically operated
- Heated options for cold climate operation
- Reliable operation, low maintenance

CLICK IMAGE TO VIEW VIDEO

Ponndorf Video Customer Testimonial

Andy Tveekrem, Brewmaster & Co-Founder
Market Garden Brewery - Cleveland, OH

Wet Spent Grains Silo Dispenser Systems

- 500 - 1,100 kg/min (1,102 - 2,425 lb/min) discharging performance
- Robust slip on gear mechanism
- Rinse water socket, manually or electro-pneumatically operated
- Heated options for cold climate operation
- Reliable operation, low maintenance

CLICK IMAGE TO VIEW VIDEO

Ponndorf Video Customer Testimonial

Eric Harper, Brewmaster
Utepils Brewing Co. - Minneapolis, MN
DENWEL
Inline Gas Injection

Founded in 1997, DENWEL (headquartered in Prague, Czech Republic) designs and manufactures a wide range of specialized equipment and provides engineering solutions dedicated to help brewers optimize their processes.

**Wort Aeration / Oxygenation**

Air or oxygen is injected into wort through the Inline DENWEL Injector, which splits the gas into micro bubbles. The most efficient and instant saturation is achieved with minimal pressure drop and no gas loss. Fully hygienic CIP design. No static mixer or sinter candles needed.

- Available in manual, semi-automated, or fully automated

**Inline Carbonation**

**Inline Carbonation Mobile Manual Unit**

CO₂ is injected into the beverage through the DENWEL Injector, which splits the gas into micro bubbles. The most efficient and instant dissolution of CO₂ is achieved with only minimal pressure drop and no gas or flavor loss. No static mixer, sinter candle or tank with stone is required. Designed for CIP, no parts of the Injector have to be removed for sanitation.

**Inline Carbonation Semi-Automatic Unit**

The Inline Semi-automatic Carbonation Unit is designed for continuous carbonation of beverages, where a precise CO₂ ratio injection maintains carbonation at desired concentration. An integrated pump with a pressure holding valve maintains required pressure for carbonation. Fully hygienic CIP design.

**Inline Carbonation Automatic Unit**

The Inline Carbonation Automatic Unit is designed for continuous carbonation of beverages. The system is PLC controlled and has automatic modes for continuous carbonation and CIP. The selective inline CO₂ analyzer continuously monitors the CO₂ concentration. A high precision control valve accurately adjusts the CO₂ injection, avoiding any over or under carbonation.

**Nitrogen**

The Inline Automatic Nitrogenation Unit is designed for continuous nitrogenation of beverages, where a continuous N₂ analyzer controls gas injection and the required N₂ concentration is always maintained. The N₂ is injected into the beverage through a DENWEL injector, which splits the gas into micro bubbles. The most efficient and instant dissolution of N₂ is achieved with only a minimal pressure drop, no gas loss and a fully hygienic design.

- Available in manual, semi-automated, or fully automated
With a broad offering of process equipment scaled to suit any size brewery, DENWEL can provide the right tools to help you economize, optimize and innovate!

**Water Deaeration**

**Water Deaeration Column Cold**
The Deaeration unit is designed for efficient and reliable deaeration of water under atmospheric conditions. The column is filled with structured packing, enabling a large internal surface which strips out the oxygen to levels below 10 ppb.

- Carbonation of deaerated water
- No vacuum required
- Low CO₂ / N₂ consumption

**Flash Pasteurization - Automatic**
The Flash Pasteurization Automatic Unit is designed for safe, precise and reliable heating of beverages. While reducing pathogenic microorganisms, uniform and gentle treatment is applied to maintain the original taste and appearance of the beverage.

- Gentle and precise heat treatment
- Constant Pasteurization
- Heat recovery up to 96%

**CIP**

**CIP Mobile Unit**
The CIP Mobile Unit can be wheeled to any corner of the brewery to provide reliable CIP performance. CIP sequencing valves are used, so no pipe reconnections are required. Includes sampling valve for concentration check during cleaning and automatic temperature control. The unit can be used with various detergents for cold or hot cleaning.

- Three sizes of caustic and acid vessels
- For tanks, pipes and equipment cleaning

**CIP Compact Unit**
The CIP Compact Unit provides single loop cleaning of pipes, tanks and process technology in the brewery. It includes insulated caustic and uninsulated acid and water recovery vessels. Automatic CIP sequencing with defined temperature, flow or pressure.

- Insulated caustic, uninsulated acid and water recovery vessels
- Automatic CIP sequencing
Malek Brautech

Keg Washing & Filling Equipment

Headquartered in Velbert, Germany, Malek Brautech GmbH is a family owned company now in its second generation. Known for their high-quality keg equipment, Malek offers solutions for breweries of all sizes: from simple, small-scale 15 keg/hr washers to complete, turn-key keg lines with external and internal washing, filling and palletizing capability and capacity up to 1000 kegs/hr. Whether your brewery needs to make the first move away from manual keg cleaning or take a serious jump to large scale keg production, Malek Brautech has the High Performance Engineering, Made in Germany solution for you!

**MONOCLEAN**

The MONOCLEAN semi-automatic keg cleaner is the perfect solution for small-scale and pub breweries with a low keg requirement. Adapted programs for different keg sizes mean the machine cleans reliably and cost-effectively. The integrated detergent container is suitable for the use of alkaline and acid agents and has electrical heating. For simple and reliable filling, we additionally recommend our tap head filler with which up to 20 kegs/hour can be filled.

**TWIN II 1R-F**

The TWIN II 1R-F is a low-cost, semi-automatic, compact machine for cleaning and filling kegs. The system has an integrated detergent container for alkaline or acid agents. For ergonomic handling of filled kegs, the machine is fitted with rollers at the fill station, as well as a keg slide. Our full signal via temperature is integrated, but the machine can also be fitted with an inductive flowmeter. For greatest possible levels of flexibility, the machine is fitted with an adjustable stopper, and it can be converted within just a few minutes to other fitting types with interchangeable format parts.

**TWIN 2000**

The TWIN 2000 keg cleaning machine is a semi-automatic, compact machine with cleaning head and integrated detergent container for alkaline or acid agents. This machine provides ease-of-use for the operator and high levels of flexibility with an adjustable stopper and interchangeable format parts. For simple and reliable filling, we recommend one or more manual filling heads with which up to 30 kegs/hour per unit can be filled. A semi-automatic filling machine based on the TWIN 2000 is also available as an alternative.

**TWIN II 2R-F**

The TWIN II 2R-F is a low-cost, semi-automatic, compact machine for cleaning and filling kegs. The system is available with one or two integrated detergent tanks to enable a caustic processing with higher capacity or caustic and acid processing with the same capacity as the TWIN II 1R-F. For ergonomic handling of filled kegs, the machine is fitted with rollers at the fill station, as well as a kegslide. Our full signal via temperature is integrated, but the machine can also be fitted with an inductive flowmeter. For greatest possible levels of flexibility, the machine is fitted with an adjustable stopper, and it can be converted within just a few minutes to other fitting types with interchangeable format parts.
Malek Brautech Keg Washing & Filling Equipment (continued)

**KEG-SET-NG**
The fully-automatic KEG-SET-NG cleaning and filling machine handles up to 50 kegs/hour. With variants fitted with three or four stations, this system provides reliable cleaning, sterilisation and filling of kegs. Cleaning is with one or two detergents within one cycle, depending on variant, and the system is able to adapt flexibly to customer requirements. It is possible at a later time to cost-effectively increase the capacity to 60 kegs/hour with an additional cleaning module.

**External Cleaners**
Malek Brautech external cleaners for kegs are based upon a modular design and are made in line with your requirements in regards to configuration and capacity. We have the right systems ready for you in every capacity class, regardless of whether you are looking to remove labels, ink labelling or stubborn dirt. Configuration of your machines is individualized with different cleaning zones, high-pressure units, brush stations, automatic or manual dirt removal and much more. We would also be happy to realize custom solutions for you, such as surface sealing of PU kegs. Working in a cost-effective and environmentally-friendly manner with resources is a focus for us at all times.

**VARIOMASTER**
The fully-automatic VARIOMASTER cleaning and filling machine is a linear module machine for handling kegs. It can process 60 to 600 kegs/hour as a single or double line variant. Sturdy construction, good accessibility and low maintenance overhead are standout features of this machine model. Its use of leading edge components means the VARIOMASTER features both a high level of biological safety and an efficient use of cleaning agents. The modular layout of multiple lines operated in parallel means expansion is easy when capacity requirements increase.

**Keg Line Peripherals**
For full automation of our systems and for complimentary tasks, we offer a broad range of accessories.

- Multi-level turner
- Conveyers
- Palletizers
ABER Yeast Monitors

Take Control of Your Yeast

ABER Yeast Monitors are recognized today by the world’s major brewing groups as the most accurate and reliable instruments for the inline measurement of viable yeast cell concentration. ABER’s technology is based on the principle of electrical capacitance and features over 500 brewing installations globally. Today’s modern craft and regional brewers are integrating ABER Yeast Monitors into their existing systems to obtain the benefits of accurate yeast pitching, contributing to consistent fermentations and improved product flavor profiles.

Compact Yeast Monitor

The newest generation of ABER’s inline yeast monitoring tools, the Compact Yeast Monitor, is the only tried and true technology on the market for brewery inline applications. The instruments are designed to be user friendly and are largely maintenance-free.

PerfectPitch

Building on years of success with inline monitors, ABER has now released a turn-key yeast monitoring and pitching solution specifically for craft breweries, the PerfectPitch.

The PerfectPitch is a complete system featuring a yeast monitor and a magnetic flowmeter, with an integrated onboard controller. The unit can be moved and connected inline to the process where needed. The ability to precisely monitor yeast pitching rates helps avoid a whole range of fermentation problems, such as excess diacetyl, increased production of fusel alcohols and esters, risk of stuck fermentation, haze formation and more.

CountStar

The new ABER CountStar is an automated yeast counter that uses safe, traditional dyes. Its simple operation saves time when measuring yeast cell concentration and viability.

CLICK IMAGE TO VIEW VIDEO

ABER PerfectPitch Video Customer Testimonials

John Heine, Production Manager
John Carroll, Head Brewer
Marble Brewing - Albuquerque, NM

Cassandra Ford, Lab / QC Technician
Marble Brewing - Albuquerque, NM

CLICK IMAGE TO VIEW VIDEO

CountStar Video Customer Testimonial

Quinton Sturgeon, QA / QC Lead
Rogue Ale & Spirits - Newport, OR
Perlick

Sample Valves And Fittings

Gusmer Enterprises offers a variety of Perlick products and fittings for your brewery. Below are examples of our most popular items.

**Sampling Valve (Zwickel)**

Perlick’s innovative sampling valve is designed for sanitary sampling applications. The interior of the main body is entirely machined to provide a smooth surface. This smooth surface is easy to clean and improves the valve’s flow characteristics. All materials are FDA approved and the entire valve is autoclavable. A variety of inlet connections are available to meet specific requirements.

- Positive travel stop prevents overclosing the valve to increase seal life
- Stainless steel cap
- Red silicone “O” ring indicates when valve is open and provides positive seal when closed
- Brass chrome-plated stem with double lead thread provides fast, smooth operation (1/8” travel = 1.2 turns)
- Seat Cap - Available in FDA approved EPDM (STD) or silicone
- Type 316LSS Body
- Smooth bore improves flow characteristics and cleaning

**Pigtail**

A Pigtail is an absolute necessity in any brewer’s collection of fittings. These handy devices allow you to sample beer from tanks under pressure, without excessive foaming. The stainless steel coil adapts perfectly to your existing Perlick zwickel and many other types of sampling valves.

**Zwickel Adapter**

Perlick’s zwickel adapter provides a gas and liquid tight seal against the zwickel on your tank. The barbed adapter can be attached to a hose which can be connected to essentially any type of measuring device, or even a small bottle filler.

*Please contact your Gusmer representative regarding other brewery fittings.*
Hamilton

The Beverly

The Beverly portable dissolved oxygen (DO) meter from Hamilton is the most affordable portable meter available on the market. The Beverly incorporates the versatile Visiferm DO ECS probe into a robust all-in-one unit. The Beverly is perfect for checking DO in beverage processing and provides a turnkey solution for QA monitoring.

- Measuring Range: 10 ppb to 25 ppm DO
- Response Time: < 30 seconds
- Operating Temperature: 0 - 80 °C
- Operating Pressure: 0 - 10 bar
- Unit Weight: Approx. 10 lbs
- Continuous Battery Life: 50 hrs
- Construction: Robust, two-part molded design
- Optical DO Probe: Visiferm DO ECS

**Technological Specifications**

- Measuring Range: 4 ppb – 25 ppm (DO)
- Measurement Principle: Oxygen dependent luminescence quenching
- Protection Classification: IP 67
- Operating Temperature: 0 – 80 °C
- Pressure Range: 0 – 10 bar
- Dimensions (B x W x H): 222 x 142 x 322 mm

**Ordering Information**

- Type P/N
- Beverly 817100
- VisiFerm DO B 243090
- ODO Cap P0 242427
- Hoses 817134
- Power Supply 817804
- Wall Unit 817131

**Customer Testimonial**

Pat Daniels, Brewer
Market Garden Brewery - Cleveland, OH

**Click Image To View Video**

Learn more about The Beverly DO meter

**Check DO of bright beer tank prior to bottling**

**Measure DO during or after filtration**

**Measure DO in the bottle or can**

**Check DO of empty bright beer tank**

© 2013 Hamilton Company. All rights reserved.

P/N: 691132/00 — 08/2013

USA: 800-648-5950
Europe: +41-81-660-60-60
To find a representative in your area, please visit hamiltoncompany.com/contacts.
Hamilton Inline Process Sensors

Hamilton Company, one of the pioneers of optical DO measurement, has built a complete portfolio of inline measurement sensors and accessories for the brewing industry. Hamilton’s innovative ARC platform features integrated wireless transmitters, bringing the conveniences of modern wireless technology to inline sensors.

Visiferm and Visitrace mA DO Arc Sensors for Dissolved Oxygen

Monitoring dissolved oxygen is critical throughout the brewery. A low O\textsubscript{2} content during wort aeration can lead to stalled fermentations and the formation of off flavors, while inconsistent aeration can cause rapid changes between aerobic and anaerobic fermentation, stressing yeast. After fermentation, downstream processes must introduce as little oxygen as possible. Real time DO measurement provides the opportunity to make rapid decisions and optimize the brewing process.

Hamilton’s Visiferm DO Arc sensors are capable of measuring a broad range of DO from 10 ppb to 25 ppm for maximum versatility.

Hamilton’s Visitrace mA DO Arc sensors feature enhanced electronics, including integrated Bluetooth communication, and are designed for low end DO measurement, from 0-2000 ppb.

Easyferm Bio HB Arc pH Sensors

Monitoring pH during various points of the brewing process provides the ability to make quick decisions that can impact product taste, color, viscosity, and stability. It can also provide the information required to optimize enzyme usage.

The Easyferm Bio HB Arc sensors feature Hamilton’s HB glass and a pressurized electrolyte, providing the best pH sensor lifespan available in brewing applications.

Easyferm Plus ORP Arc sensors for Oxidation-Reduction Potential

Oxidation-reduction potential measurement can provide insight into its influence on taste, flavor, shelf life, and other factors that affect product quality.

The Easyferm Plus ORP Arc sensors from Hamilton feature a platinum ring and a pressurized electrolyte and can measure potential from -1500 mV to +1500 mV.

Conducell Arc Conductivity Sensors

Conductivity sensors are used to catch product, control CIP systems and chemical dosing pumps, as well as monitor waste effluent.

Hamilton’s Conducell Arc Sensors feature a 4 pole contacting sensor, stainless steel electrodes, and can measure conductivity up to 300 mS/cm.

Wireless Communication with Hamilton ArcAir

The ArcAir app from Hamilton interfaces wirelessly with an ARC sensor. Remotely monitor and calibrate up to 30 sensors simultaneously on either a computer or a Bluetooth capable device. ArcAir is compatible with Windows and mobile Apple and Android devices.
Chemical and Microbial
Gusmer Analytical Services

Ensure beer flavor, stability, longevity and more by utilizing Gusmer’s analytical services for the brewing industry. Gusmer offers a variety of tests and testing panels, as well as industry expertise and educated recommendations to assist in your brewing process. All tests are performed on site at Gusmer’s well equipped Napa, California laboratory using the latest techniques and technology.

Export your Beer?
Gusmer has TTB certified chemists on staff to perform the required analysis for your exports.

Accurate
Testing is based on the standards set by the American Society of Brewing Chemists (ASBC). Lab accuracy is checked through the International Check Sample Service, provided by the ASBC.

Quick
Typical analysis turnaround is 24-48 hours. Expedited service is available.

Reliable
Gusmer’s longstanding reputation in the industry has shaped this analytical services program for brewing. Gusmer staffs technical brewers and has over 90 years of participation in the brewing industry.

If you have questions regarding samples for analysis or sampling procedures, please telephone the lab at 707.224.7903, extension 306 or 307. The minimum analysis charge is $25. Discounts are available for 5 or more samples of the same test. Please note that all samples for analysis must be sent to the Napa facility (640 Airpark Road, Suite D, Napa, CA 94558).

BEER PANEL ANALYSIS

Basic Beer Panel:
e extracts, alcohol, pH, color, bittering units
Cost: $45 / sample
Volume: 24 oz

Finished Beer Panel:
e extracts, alcohol, pH, color, bittering units, CO₂, air, yeast / mold / bacteria (UBA, MRS)
Cost: $60 / sample
Volume: 24 oz

Stability Panel (Chill Haze):
te tannin and protein content, stability recommendation
Cost: $35 / sample
Volume: 24 oz

Filterability Panel:
pre– and post–NTU readings, filter sheet recommendation
Cost: $60 / single sheet test; $100 / multi-sheet test
Volume: 2 gallons (additional samples needed for multi-sheet test)

Membrane Filterability Panel:
clogging index value to determine if beer is ready for sterile filtration
Cost: $40 / test
Volume: 36 oz
Note: should not be done more than 5 days prior to sterile filtration / bottling
Gusmer Analytical Services (continued)

**MICROBIOLOGICAL TESTS**

*Microscopic Exam*
scan for microbes and debris (plating may be recommended to determine viability)
Cost: $25 / sample
Volume: 2 ml

*Culture, Direct – unpackaged beer*
yeast / mold / bacteria – UBA, MRS
Cost: $25 / sample
Volume: 2 ml

yeast / mold only – UBA
Cost: $20 / sample
Volume: 2 ml

bacteria only – MRS
Cost: $15 / sample
Volume: 2 ml

*Culture, Membrane Filtration – packaged beer*

yeast / mold / bacteria – UBA, MRS
Cost: $40 / sample
Volume: 12 oz

yeast / mold only – UBA
Cost: $25 / sample
Volume: 12 oz

bacteria only – MRS
Cost: $25 / sample
Volume: 12 oz

*Yeast Count Viability*
NucleoCounter
Cost: $35 / sample
Volume: 100 ml

**CHEMICAL TESTS**

*Calories*
Cost: $25 / sample
Volume: 24 oz

*Mineral & Metal Analyses*
iron / copper / calcium / sodium
Cost: $50 / sample
Volume: 50 ml

**PREPARING AND SENDING SAMPLES**

1. In order to ensure the most accurate analysis, please send full (topped) containers of beer optimally packaged for shipping to minimize breakage.

2. Download and submit a completed Analysis Request Form with your samples. A form can be obtained at www.gusmerbeer.com or by calling 707.224.7903.

3. If specific label information is required on the report, please make sure that this information is supplied on the sample request.

4. Samples may be sent via UPS or FedEx. The US Postal Service does not accept alcohol for shipping. Samples may also be dropped off in person.
**Practical Brewery Formulas**

**GEOMETRY**

Circle
- Circumference (C):
  \[ C = 2\pi R \]
- Area (A):
  \[ A = \pi R^2 \]

Sphere
- Area (A):
  \[ A = 4\pi R^2 \]
- Volume (V):
  \[ V = \frac{4}{3}\pi R^3 \]

Cylinder
- Area (A) of curved surface:
  \[ A = 2\pi RH \]
- Area (A) of each base:
  \[ A = \pi R^2 \]
- Volume (V):
  \[ V = \pi R^2 H \]

Cone
- Area (A) of curved surface:
  \[ A = \pi \sqrt{R^2 + H^2} \]
- Area (A) of base:
  \[ A = \pi R^2 \]
- Volume (V):
  \[ V = \frac{1}{3}\pi R^2 H \]

Plain Dished Heads of Cylindrical Tanks
- Volume (V):
  \[ V = 0.1372\pi R^3 \text{ each, approximately} \]
  Where \( R \) = radius of tank, and
  \( 2R \) = radius of dished head

**ATTENUATION**

% Alcohol by weight (a):
\[ a = \frac{0.42 \text{ (OE – AE)}}{2.22} \]
\[ a = \frac{0.52 \text{ (OR – RE)}}{2.22} \]

% Real Extract (RE):
\[ RE = \frac{a + AE}{2.22} \]

% Original Extract (OE):
\[ OE = \frac{a + RE}{0.52} \]

% Apparent Degree of Attenuation (ADA):
\[ ADA = \frac{OE - AE}{OE} \]

% Real Degree of Attenuation (RDA):
\[ RDA = \frac{OE - RE}{OE} \]

% Attenuation
\[ a = \frac{AE}{RE} \]

Abbreviations
- \( a \) = % alcohol by weight
- OE = % Original Extract
- RE = % Real Extract
- AE = % Apparent Extract
- RDA = % Real Degree of Attenuation
- ADA = % Apparent Degree of Attenuation

**EXTRACT**

Convert °P to lbs/bbl:
\[ \text{lb/bbl} = \frac{259 + 0.89°F}{100} \]

**ALCOHOL**

Alcohol by Weight \( x 1.25 = \) Alcohol by Volume

Abbreviations
- \( C \) = circumference
- \( A \) = area
- \( V \) = volume
- \( \pi = 3.14159 \)
- \( R \) = radius
- \( H \) = height

**ATTENUATION**

Brewhouse Efficiency = \[ \frac{\text{Extract Produced}}{\text{Potential Extract}} \times 100 \]

Where Extract produced is found by accurately determining the volume and the “gravity” of the wort collected in the starting tub.

And Potential extract is the sum of the products obtained by multiplying the weights of malt and adjuncts by their respective laboratory “as is” yields (fine grind yield for malt).

**MIXING**

\[ Aa + Bb = Cc \]

Where
- \( A \) and \( B \) = quantities mixed
- \( a \) and \( b \) = corresponding properties
- \( C \) = \( A + B \) = quantity of mix
- \( c \) = property of mix

Example: If 85 bbls of water at 120 °F are mixed with 55 bbls at 212 °F, what is the temperature of the mix?

Let \( X \) = °F of the mix; then

\[ 85 \times 120 + 55 \times 212 = 140 \times X \]

And

\[ X = \frac{10,200 + 11,660}{140} = 156.1 \]

Example: How many bbls of beer of 3.8% and 3.2% by weight of alcohol, respectively, must be blended in order to obtain 650 bbls of beer of 3.6% alcohol?

Let \( X \) = number of bbls of 3.8% beer. Then \( (650 - X) = \) number of bbls of 3.2% beer.

Substituting in formula:

\[ X \times 3.8 + (650 - X) \times 3.2 = 660 \times 3.6 \]

\[ 0.6X = 260 \]

\[ X = 433 \]

Answer: Mix 433 bbls of 3.8% beer with 217 bbls of 3.2% beer.
## Practical Brewery Conversions

<table>
<thead>
<tr>
<th>Metric Unit</th>
<th>Is Equal To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 meter (m)</td>
<td>100 cm</td>
</tr>
<tr>
<td>1 centimeter (cm)</td>
<td>10 mm</td>
</tr>
<tr>
<td>1 millimeter</td>
<td>1000 µm</td>
</tr>
<tr>
<td>1 micron (µm)</td>
<td>1000 nm</td>
</tr>
<tr>
<td>1 kilogram (kg)</td>
<td>1000 g</td>
</tr>
<tr>
<td>1 gram (g)</td>
<td>1000 mg</td>
</tr>
<tr>
<td>1 hectoliter (hl)</td>
<td>100 L</td>
</tr>
<tr>
<td>1 liter (L)</td>
<td>1000 ml</td>
</tr>
<tr>
<td>1 atmosphere</td>
<td>1 kg/sq. cm.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Legal Bushel Weights</th>
<th>Is Equal To (in lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barley</td>
<td>48</td>
</tr>
<tr>
<td>Malt</td>
<td>34</td>
</tr>
<tr>
<td>Caramel Malt</td>
<td>30</td>
</tr>
<tr>
<td>Black Malt</td>
<td>26</td>
</tr>
<tr>
<td>Corn</td>
<td>56</td>
</tr>
<tr>
<td>Rice</td>
<td>58</td>
</tr>
<tr>
<td>Wheat</td>
<td>60</td>
</tr>
<tr>
<td>Syrup</td>
<td>50</td>
</tr>
</tbody>
</table>

### Approximate Caloric Value of Average Beer

<table>
<thead>
<tr>
<th>Calorie Value</th>
<th>Is Equal To (in calories)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 oz.</td>
<td>85</td>
</tr>
<tr>
<td>10 oz.</td>
<td>140</td>
</tr>
<tr>
<td>12 oz.</td>
<td>170</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Percent Equivalents (approximate)</th>
<th>Is Equal To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1%</td>
<td>1.3 Fluid ounces per gallon</td>
</tr>
<tr>
<td></td>
<td>0.62 pounds per cubic foot</td>
</tr>
<tr>
<td></td>
<td>2.6 pounds per U.S. beer barrel</td>
</tr>
</tbody>
</table>

### Metric Equivalent

<table>
<thead>
<tr>
<th>Metric Equivalent</th>
<th>Is Equal To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 U.S. beer bbl</td>
<td>1.173 hl</td>
</tr>
<tr>
<td>1 U.S. gallon</td>
<td>3.785 L</td>
</tr>
<tr>
<td>1 quart</td>
<td>0.946 L</td>
</tr>
<tr>
<td>1 pint</td>
<td>473.2 ml</td>
</tr>
<tr>
<td>12 fl. oz.</td>
<td>354.9 ml</td>
</tr>
<tr>
<td>8 fl. oz.</td>
<td>236.6 ml</td>
</tr>
<tr>
<td>7 fl. oz.</td>
<td>207.0 m</td>
</tr>
<tr>
<td>1 fl. oz.</td>
<td>29.6 ml</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Metric Equivalent</th>
<th>Is Equal To</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.28 ft</td>
<td>1.00 m</td>
</tr>
<tr>
<td>1 ft</td>
<td>30.48 cm</td>
</tr>
<tr>
<td>1 inch</td>
<td>25.4 mm</td>
</tr>
<tr>
<td>1 sq. ft.</td>
<td>929 sq. cm.</td>
</tr>
<tr>
<td>1 cubic ft.</td>
<td>28.32 L</td>
</tr>
<tr>
<td>1 pound</td>
<td>453.6 g</td>
</tr>
<tr>
<td>1 atm</td>
<td>14.7 psi</td>
</tr>
<tr>
<td>1 grain/gal (U.S.)</td>
<td>17.1 ppm</td>
</tr>
<tr>
<td>1 grain/gal (British)</td>
<td>14.2 ppm</td>
</tr>
<tr>
<td>1 lb/100 bbls</td>
<td>38.6 ppm</td>
</tr>
<tr>
<td>1 lb/100 bbls</td>
<td>3.86 g/hl</td>
</tr>
<tr>
<td>1 g/hl</td>
<td>0.258 lbs/100 bbls</td>
</tr>
<tr>
<td>1 hl</td>
<td>0.852 U.S. bbls</td>
</tr>
<tr>
<td>1 L</td>
<td>0.264 U.S. gallons</td>
</tr>
<tr>
<td>1 L</td>
<td>1.057 quarts</td>
</tr>
<tr>
<td>1 m</td>
<td>1.094 yards</td>
</tr>
<tr>
<td>1 cm</td>
<td>0.0328 feet</td>
</tr>
<tr>
<td>1 ml</td>
<td>0.0610 cubic in.</td>
</tr>
<tr>
<td>1 kg</td>
<td>2.2 lbs</td>
</tr>
</tbody>
</table>

### Conversion Factors

<table>
<thead>
<tr>
<th>Conversion Factors</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 U.S. beer barrel</td>
<td>31 gallons</td>
</tr>
<tr>
<td></td>
<td>124 quarts</td>
</tr>
<tr>
<td></td>
<td>246 pints</td>
</tr>
<tr>
<td></td>
<td>3968 oz</td>
</tr>
<tr>
<td></td>
<td>4.144 cubic feet</td>
</tr>
<tr>
<td></td>
<td>7161 cubic inches</td>
</tr>
<tr>
<td></td>
<td>258.70 lbs water at 39.2 °F</td>
</tr>
<tr>
<td></td>
<td>257.16 lbs water at 95 °F</td>
</tr>
<tr>
<td></td>
<td>247.93 lbs water at 212 °F</td>
</tr>
<tr>
<td></td>
<td>271 lbs of 12% wort (approximately)</td>
</tr>
<tr>
<td></td>
<td>262 lbs of beer of 3% AE</td>
</tr>
<tr>
<td>1 U.S. gallon</td>
<td>128 fl. oz.</td>
</tr>
<tr>
<td></td>
<td>8.345 lbs water at 39.2 °F</td>
</tr>
<tr>
<td></td>
<td>8.296 lbs water at 95 °F</td>
</tr>
<tr>
<td></td>
<td>7.998 lbs water at 212 °F</td>
</tr>
<tr>
<td></td>
<td>231 cubic inches of malt liquor at 39.2 °F</td>
</tr>
<tr>
<td>1 quart</td>
<td>57.749 cubic inches</td>
</tr>
<tr>
<td>1 pint</td>
<td>28.875 cubic inches</td>
</tr>
<tr>
<td>1 fl. oz.</td>
<td>1.805 cubic inches</td>
</tr>
<tr>
<td>1 bushel</td>
<td>1.244 cubic feet</td>
</tr>
<tr>
<td>1 cubic foot</td>
<td>1728 cubic inches</td>
</tr>
<tr>
<td></td>
<td>7.48 gal</td>
</tr>
<tr>
<td></td>
<td>62.43 lbs water at 39.2 °F</td>
</tr>
</tbody>
</table>
EVERY SELTZER HAS A STORY...
Yeast Strains
For Hard Seltzer

Gusmer is pleased to introduce interesting and unique strains of yeast that have proven to be strong tools in the production of premium beverages. As a supplier of yeast to the alcoholic beverage industry for decades, Gusmer has many strains of specialized yeast that were selected for their abilities to perform alcoholic fermentations and make positive contributions to the organoleptic profile. We provide yeast strains with proven kinetics and the ability to produce aromatic and mouthfeel constituents, or the inability to produce certain negative metabolites—such as hydrogen sulfide. We work exclusively with Chr. Hansen and Renaissance Yeast, two leaders in the production of yeast for the beverage industry.

Renaissance Yeast

Renaissance Yeast is a leader in the development of classical crossbred (non-GMO) H₂S-preventing _Saccharomyces_ yeast, based on a unique strain of yeast, UCD932, that was recently isolated by the University of California, Davis which is naturally incapable of producing hydrogen sulfide. Renaissance has developed a full range of yeasts bred specifically for their favorable fermentation attributes in hard seltzer. Each strain has a proven lineage, and is metabolically incapable of producing hydrogen sulfide. Hydrogen sulfide, even at levels below threshold, binds delicate aromas. Hard seltzer, produced with Renaissance _Saccharomyces_ strains, that contain no hydrogen sulfide are bright, clean and have outstanding aromas.

### Allegro™

_Saccharomyces cerevisiae bayanus_
- Imparts layers of fresh fruit with aromas such as esters, producing premium fruit forward seltzers
- Moderate fermenter
- Alcohol Tolerance up to 16% v/v, Temp Range: 50 – 82 °F (10 – 28 °C)

### Viva™

_Saccharomyces cerevisiae bayanus_
- Works well under a diverse set of conditions and benefits
- Alcohol Tolerance up to 16% v/v, Temp Range: 50 – 77 °F (10 – 25 °C)

### Avante™

_Saccharomyces cerevisiae_
- Showcases the natural aromatics of fruit w/ hints of apple blossom & caramel
- Noted for strong fermentation kinetics
- Tolerant of high alcohols (up to 17% v/v), Temp Range: 55 – 86 °F (13 – 30 °C)

### Chr. Hansen

Chr. Hansen has developed a yeast program founded both on standard _Saccharomyces_ yeast and non- _Saccharomyces_ yeast. Chr. Hansen yeast gives options to accentuate flavor, aroma and mouthfeel in the production of distinct and high quality hard seltzers.

### Merit™

100% _Saccharomyces cerevisiae_
- Ideal for sparkling base and delicate fruit seltzers with crisp and sharp flavors
- Strong and clean fermentation kinetics
- Tolerant of high alcohols (up to 17% v/v), Temp Range: 50 – 90 °F (10 – 32 °C)
Fermentation Nutrients
For Hard Seltzer
MicroEssentials™ Nutrients

Gusmer’s MicroEssentials™ fermentation nutrients are quickly becoming a standard in fermentation protocols. Known as a reliable tool for strong, healthy and clean fermentations, MicroEssentials nutrients have shown to improve fermentation kinetics, reduce H₂S production and assure complete fermentations. Our nutrients contain all the essential organic and inorganic nitrogen compounds, vitamins, minerals and yeast survival factors in a highly soluble and bioavailable form that yeast require for biomass and cell maintenance. Available in a powder or a time-release tablet.

<table>
<thead>
<tr>
<th>Item</th>
<th>Dose Rate</th>
<th>Description</th>
<th>Application</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MicroEssentials Complete-TR</td>
<td>12-96 g/l (1-8 lbs / 1,000 gal)</td>
<td>Time-release nutrient supplying a rich mixture of organic and inorganic nitrogen, vitamins and trace minerals.</td>
<td>Highly complex nutrient, ideal for most fermentations - added once at the beginning of fermentation. (Product is a white and tan tablet, each with different time release profiles. Dose together 1 to 1)</td>
<td>10 kg (22 lbs) 1 kg (2.2 lbs)</td>
</tr>
<tr>
<td>MicroEssentials Powder</td>
<td>12-96 g/l (1-8 lbs / 1,000 gal)</td>
<td>A powdered form of yeast nutrient supplying a rich mixture of organic and inorganic nitrogen, vitamins and trace minerals.</td>
<td>Highly complex nutrient used during fermentation - multiple addition is recommended when adding 2 lbs / 1,000 gal or more.</td>
<td>25 kg (55 lbs) 5 kg (11 lbs)</td>
</tr>
<tr>
<td>MicroEssentials Prime</td>
<td>24 g/l (2 lbs / 1,000 gal)</td>
<td>100% organic nitrogen source and complex mixture of vitamins and minerals. DAP Free</td>
<td>Ideal for rehydrating yeast and aiding in restarting fermentations</td>
<td>10 kg (22 lbs) 1 kg (2.2 lbs)</td>
</tr>
<tr>
<td>MicroEssentials Trace</td>
<td>0.7 - 2.6 g / hl (25 -100 g / 1,000 gal)</td>
<td>*Pure vitamin and mineral blend for yeast.</td>
<td>Can be used in combination with other products when analysis shows that vitamin or mineral levels are particularly low.</td>
<td>10 kg (22 lbs) 1 kg (2.2 lbs) 100 g (0.22 lbs)</td>
</tr>
</tbody>
</table>

*Complies with TTB 27 CFR 24.250 List

Enzymes
For Hard Seltzer

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diacetyl Control</td>
<td>MANAGE DIACETYL BY ELIMINATING THE PRECURSORS OF VICINAL DIKETONES (VDK’S).</td>
<td>• Breakdown VDK precursors for short and consistent maturation periods</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Keep diacetyl levels below the flavor threshold</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Shorten or eliminate diacetyl rest</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Optimize capacity and reduce processing times</td>
</tr>
<tr>
<td>ALPHALASE® Advance 4000</td>
<td>α-acetolactate decarboxylase</td>
<td></td>
</tr>
<tr>
<td>ATTENUATION CONTROL</td>
<td>OBTAIN MAXIMUM RDF VALUES TIME AFTER TIME, WITH THE USE OF STARCH CONVERSION ENZYMES.</td>
<td>• Maximize starch conversion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Minimize residual carbohydrates</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Provides a high degree of attenuation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Suitable for application in mash or at fermenter</td>
</tr>
<tr>
<td>DIAZYME® TGA MASH</td>
<td>Glucoamylase</td>
<td>• Maximize hydrolyses of starch into fermentable sugars</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Achieve RDF &gt; 83%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Minimizes residual carbohydrates</td>
</tr>
<tr>
<td>DIAZYME® X4</td>
<td>Glucoamylase</td>
<td>• Excellent adjunct liquefaction for a faster viscosity break</td>
</tr>
<tr>
<td>Liquefaction &amp; Cereal Cooking</td>
<td>Supplemental enzymes break down starch and reduce mash viscosity for more consistent mashing.</td>
<td>• Allows for use of low water to grist ratio</td>
</tr>
<tr>
<td>AMYLEX® 5T</td>
<td>Thermostable bacterial α-amylase</td>
<td>• Efficient starch liquefaction for reduced processing costs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Broad pH tolerance</td>
</tr>
</tbody>
</table>
Filtration
For Hard Seltzer
Carbac® Carbon Filter Media

Carbac carbon impregnated filter media is an excellent solution to the hassle and mess of working with loose, powdered carbons. A composite of the finest charge-modified cellulose pulps, premium activated powdered carbon and inorganic filter aids, the Carbac media has been formulated specifically for its ability to adsorb color, aroma and flavor compounds for hard seltzers. It is an excellent tool for the final color, flavor adjustments and complete color removal in hard seltzer. The Carbac carbon impregnated filter media is available to fit any size plate filter press or in a lenticular cartridge form.

Benefits
- Clean and convenient reduction in color, flavor and aroma with consistent results
- A fixed bed of carbon provides improved efficiencies over the use of loose powdered carbon
- Manufactured under strict quality control guidelines to ensure uniform and consistent performance
- Can meet the needs of specific applications through a variety of grades
- Available in a sheet or a Cellu-Stack® lenticular cartridge format
- Grade selection and process optimization support is available through Gusmer’s application laboratories

Available Grades

<table>
<thead>
<tr>
<th>Grades</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1640DC*</td>
<td>Chemically activated wood; ideal for flavor, odor and color removal.</td>
</tr>
<tr>
<td>1640HCX**</td>
<td>Chemically activated pine-wood; especially suited for decolorization.</td>
</tr>
</tbody>
</table>

*Available in sheet form only
**Available in sheet or Cellu-Stack® configurations

Sheet Properties

<table>
<thead>
<tr>
<th>Grade Designation</th>
<th>Thickness (mm)</th>
<th>Mass per unit Area (gsm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1640DC</td>
<td>4.20</td>
<td>1050</td>
</tr>
<tr>
<td>1640HCX</td>
<td>4.20</td>
<td>1300</td>
</tr>
<tr>
<td>1640CRX</td>
<td>3.95</td>
<td>990</td>
</tr>
<tr>
<td>1640CRM</td>
<td>6.10</td>
<td>1400</td>
</tr>
</tbody>
</table>

Note: Test results are typical.

Adsorption Capacity

Mean Pore Size

Challenged with 50 mg/liter methylene blue @ 46 liters/min/sq m. media
Filter Media, Housings & Equipment

Gusmer is one of the largest manufacturers and distributors of filter media, filter housings and filtration equipment to the beverage industries. We offer a complete range of filter sheet media, lenticular cartridge filters, conventional cartridge filters and cross flow filter systems, in a multitude of retention levels for clarification and sterile beverage filtration applications.

Cross Flow Filters

Cross flow filtration is another viable option used in wine and hard seltzer production. Gusmer offers the Bucher Vaslin cross flow filter in numerous sizes, ranging from 200 gph to 9,000 gph. These filters operate at low temperature and low oxygen pick up to fully preserve flavors and aromas. All Bucher Vaslin cross flow filters are fully automated, making the operation simple and user friendly.

Inline Process Sensors

Hamilton Company, one of the pioneers of optical DO measurement, has built a complete portfolio of inline measurement sensors and accessories for the brewing industry. Hamilton’s innovative ARC platform features integrated wireless transmitters, bringing the conveniences of modern wireless technology to inline sensors. For more details please see pg 53.
EVERY CIDER HAS A STORY...

Gusmer Enterprises, Inc.

www.gusmercider.com
sales@gusmerenterprises.com

YouTube 📞 📫 🌐
Yeast Strains
For Cider

Gusmer is pleased to bring the cider industry interesting and unique strains of yeast that have proven to be strong tools in the production of premium beverages. As a supplier of yeast to the alcoholic beverage industry for decades, Gusmer has many strains of specialized yeast that were selected for their abilities to perform alcoholic fermentations and make positive contributions to the organoleptic profile. We feature yeast strains with proven kinetics and the ability to produce aromatic and mouthfeel constituents, or the inability to produce certain negative metabolites – such as hydrogen sulfide. We work exclusively with Chr. Hansen and Renaissance Yeast, two leaders in the production of yeast for the beverage industry, and offer both the traditional Saccharomyces strains and the newly commercialized non-Saccharomyces strains.

Chr. Hansen

Chr. Hansen has developed a yeast program founded both on standard Saccharomyces yeast and non-Saccharomyces yeast. The use of Saccharomyces and non-Saccharomyces yeast, either in a sequential or simultaneous inoculation program, is a proven practice that gives cider producers a wide array of options to accentuate flavor, aroma and mouthfeel in the production of distinct and high quality ciders.

**Prelude™**

100% Torulaspora delbrueckii
- Heavy producer of mannoproteins
- Silky round mouthfeel and increases palate weight
- Alcohol tolerant up to 9% v/v
- Temp Range: 50 – 82 °F (10 – 28 °C)
- Recommended to be used in conjunction with a Saccharomyces sequential inoculation

**Melody™**

60% S. cerevisiae, 20% L. thermotolerans, 20% T. delbrueckii
- Produces full-bodied, rich and viscous fruit ciders
- Tolerant of high alcohols (up to 17% v/v)
- Temp Range: 50 – 90 °F (10 – 32 °C)

**Concerto™**

100% Lachancea thermotolerans
- Accentuates red and black fruit with spicy apple aroma
- For fruit-forward ciders with low alcohol
- Alcohol tolerant up to 10% v/v
- Temp Range: 50 – 82 °F (10 – 28 °C)
- Recommended to be used in conjunction with a Saccharomyces sequential inoculation

**Rhythm**

60% S. cerevisiae, 40% L. thermotolerans
- Suited for ciders fermented with fruit adjuncts to create complex notes of fresh fruit
- Tolerant of high alcohols (up to 17% v/v)
- Temp Range: 50 – 90 °F (10 – 32 °C)

**Merit™**

100% Saccharomyces cerevisiae
- Ideal for sparkling base and delicate fruit ciders with crisp sharp flavors
- Strong and clean fermentation kinetics
- Tolerant of high alcohols (up to 17% v/v)
- Temp Range: 50 – 90 °F (10 – 32 °C)

**Harmony**

80% S. cerevisiae, 10% L. thermotolerans, 10% T. delbrueckii
- Enhances fresh apple nuances of fruit and full-bodied
- Tolerant of high alcohols (up to 17% v/v)
- Temp Range: 50 – 90 °F (10 – 32 °C)
Yeast Strains for Cider
Renaissance Yeast

Renaissance Yeast is a leader in the development of classical crossbred (non-GMO) H$_2$S-preventing Saccharomyces yeast, based on a unique strain of yeast, UCD932, that was recently isolated by the University of California, Davis which is naturally incapable of producing hydrogen sulfide. Renaissance has developed a full range of yeast bred specifically for their favorable fermentation attributes in cider. Each strain has a proven lineage, and is metabolically incapable of producing hydrogen sulfide. Hydrogen sulfide, even at levels below threshold, binds delicate aromas. Ciders, produced with Renaissance Saccharomyces strains, that contain no hydrogen sulfide are bright, clean and have outstanding aromas.

**Fresco™**

Saccharomyces cerevisiae hybrid
- Specifically developed for cider producers
- Imparts a bright apple character and a refreshing crisp finish
- Strong steady kinetics
- Moderate fermenter
- Does not produce H$_2$S
- Alcohol Tolerance up to 15% v/v
- Temp Range: 55 – 95 ºF (13 – 35 ºC)

**Ossia™**

Saccharomyces cerevisiae hybrid
- Produces tropical fruit and hints of pepper and clove
- For the production of organic ciders
- Does not produce H$_2$S
- Alcohol Tolerance up to 16% v/v
- Temp Range: 60 – 86 ºF (16 – 30 ºC)

**Viva™**

Saccharomyces cerevisiae bayanus
- Ideal for sparkling base and round, complex perfumed ciders
- Works well under a diverse set conditions and benefits
- Does not produce H$_2$S
- Alcohol Tolerance up to 16% v/v
- Temp Range: 50 – 77 ºF (10 – 25 ºC)

**Allegro™**

Saccharomyces cerevisiae bayanus
- Imparts layers of fresh fruit with aromas such as esters, producing premium fruit forward ciders
- Moderate fermenter
- Does not produce H$_2$S
- Alcohol Tolerance up to 16% v/v
- Temp Range: 50 – 82 ºF (10 – 28 ºC)

**Avante™**

Saccharomyces cerevisiae
- Ideal for sparkling base and round, complex perfumed ciders
- Showcases the natural aromatics of fruit with hints of apple blossom and caramel
- Noted for having strong fermentation kinetics
- Does not produce H$_2$S
- Tolerant of high alcohols (up to 17% v/v)
- Temp Range: 55 – 86 ºF (13 – 30 ºC)

Gusmer Seminar:
“Research in hydrogen sulfide production during fermentation and how yeast metabolism can change the game”
Dr. Matthew Dahabieh, Head of Research at Renaissance Yeast
Scan Code to view video or go to www.youtube.com/gusmerwine
Cider Processing Enzymes

Enzymes are widely used in apple and pear juice processing and in cider production to improve product quality, yield, and to expedite processing. Macerating enzymes are added to fruit for improved juice extraction and press efficiencies. Pectinases and glucoamylases are used in juice and cider to increase settling and to improve filtration and clarification. Gusmer is pleased to offer both DuPont™ liquid enzymes and BioSelect™ micro-granulate enzymes for cider processing. DuPont is one of the world’s largest producers of enzymes for the food industry, with multiple production sites throughout the world. BioSelect micro-granulate enzymes are GRAS approved and manufactured under an FSSC 22000 food safety system. Gusmer has partnered with leading enzyme producers to bring a comprehensive portfolio of enzyme treatments for juice and cider processing.

<table>
<thead>
<tr>
<th>Item</th>
<th>Application</th>
<th>Benefits</th>
<th>GM Derived</th>
<th>Pack Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>BioSelect® Noir</td>
<td>Maceration</td>
<td>A complex blend of pectinase enzymes with broad side activities used to increase free run fractions and ease juice extraction, leading to faster press cycles.</td>
<td>No</td>
<td>250 g pack</td>
</tr>
<tr>
<td>PEKTOZYMETM Mash</td>
<td>Maceration</td>
<td>Cellulase to break down cell wall for increased yield.</td>
<td>No</td>
<td>20 kg pail</td>
</tr>
<tr>
<td>LAMINEX® BG2</td>
<td>Maceration</td>
<td>A concentrated blend of pectinases to help achieve rapid settling, improve filterability and increase clarity.</td>
<td>No</td>
<td>250 g pack</td>
</tr>
<tr>
<td>BioSelect® Clear</td>
<td>Clarification, pectin degradation</td>
<td>A robust glucoamylase for improved clarity, haze reduction and improved filterability.</td>
<td>No</td>
<td>20 kg pail</td>
</tr>
<tr>
<td>PEKTOZYMETM Clear</td>
<td>Clarification, pectin degradation</td>
<td>A complex blend of pectinase enzymes with broad side activities used to increase free run fractions and ease juice extraction, leading to faster press cycles.</td>
<td>No</td>
<td>20 kg pail</td>
</tr>
<tr>
<td>PEKTOZYMETM Firm</td>
<td>Traditional French &amp; English Ciders (Keeving)</td>
<td>Purified pectin methyl esterase (PME) for use in Traditional French and English Ciders produced with the Keeving process.</td>
<td>No</td>
<td>20 kg pail</td>
</tr>
</tbody>
</table>

Fermentation Nutrients

Gusmer’s MicroEssentials™ fermentation nutrients are quickly becoming a standard in fermentation protocols. Known by cider makers as a reliable tool for strong, healthy and clean fermentations, MicroEssentials nutrients have shown to improve fermentation kinetics, reduce H₂S production and assure complete fermentations. Our nutrients contain all the essential organic and inorganic nitrogen compounds, vitamins, minerals and yeast survival factors in a highly soluble and bioavailable form that yeast require for biomass and cell maintenance. Available in a powder or a time-release tablet.

<table>
<thead>
<tr>
<th>Item</th>
<th>Dose Rate</th>
<th>Description</th>
<th>Application</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MicroEssentials Complete-TR</td>
<td>12-96 g/hl (1-8 lbs / 1,000 gal)</td>
<td>Time-release nutrient supplying a rich mixture of organic and inorganic nitrogen, vitamins and trace minerals.</td>
<td>Highly complex nutrient, ideal for most fermentations - added once at the beginning of fermentation. (Product is a white and tan tablet, each with different time release profiles. Dose together 1 to 1)</td>
<td>10 kg (22 lbs)</td>
</tr>
<tr>
<td>MicroEssentials Powder</td>
<td>12-96 g/hl (1-8 lbs / 1,000 gal)</td>
<td>A powdered form of yeast nutrient supplying a rich mixture of organic and inorganic nitrogen, vitamins and trace minerals.</td>
<td>Highly complex nutrient used during fermentation - multiple addition is recommended when adding 2 lbs / 1,000 gal or more.</td>
<td>25 kg (55 lbs)</td>
</tr>
<tr>
<td>MicroEssentials Prime</td>
<td>24 g/hl (2 lbs / 1,000 gal)</td>
<td>100% organic nitrogen source and complex mixture of vitamins and minerals.</td>
<td>Ideal for rehydrating yeast and aiding in restarting fermentations.</td>
<td>10 kg (22 lbs)</td>
</tr>
<tr>
<td>MicroEssentials Trace</td>
<td>0.7 - 2.6 g / hl (25-100 g / 1,000 gal)</td>
<td>*Pure vitamin and mineral blend for yeast.</td>
<td>Can be used in combination with other products when analysis shows that vitamin or mineral levels are particularly low.</td>
<td>10 kg (22 lbs)</td>
</tr>
</tbody>
</table>

*Complies with TTB 27 CFR 24.250 List
Tannins

StellarTan® tannins from Polyphenolics® are a complete line of grape tannins (condensed tannins) produced from California wine grape varietals that give cider makers the ability to fully optimize the tannin concentration and structure of cider. Located in one of California’s major grape growing regions, Polyphenolics is a leader in development of tannins. Fully developed grapes are carefully selected and put through a revolutionary extraction process that’s gentle and preserves the true nature of the tannins (low temperature / no organic solvents). These tannins solubilize instantly and completely in cider. StellarTan tannins are available as both finishing and fermentation tannins, each chosen for their total phenolic concentration and varying degrees of polymerization, to give a full complement of options when optimizing tannins in cider.

Lysozyme

Lysozyme is a food grade enzyme used in alcoholic fermentations to control the growth of gram positive spoilage bacteria, such as *Pediococcus* and *Lactobacilli*. It can be a useful tool in the stabilization and prevention of unwelcomed organisms, without the reliance on higher levels of sulfur dioxide. Lysozyme does not inhibit yeast growth, therefore it can be used before or during alcoholic fermentation. Bioseutica lysozyme is available in a 500 g and 5 kg package.

Contact Gusmer for dose rates.

Gusmer Oak Products

For more information on Gusmer oak products please see pages 18–19.

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Flavor Components</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Premium Oak-Mor®</strong> American Granular Oak</td>
<td>butterscotch, coconut, vanilla, spice</td>
</tr>
<tr>
<td><strong>Toasted Oak-Mor®</strong> American Granular Oak</td>
<td>butterscotch, coconut, vanilla, spice</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Flavor Components</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Oak Avantage®</strong> French Granular Oak</td>
<td>butterscotch, coconut, vanilla, spice</td>
</tr>
<tr>
<td><strong>Oak Avantage®</strong> American Oak Chips</td>
<td>butterscotch, coconut, vanilla, spice</td>
</tr>
</tbody>
</table>

Arôbois Oak Products

For more information on Arôbois oak products please see pages 20–21.

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Flavor Components</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sweet</strong> (Douceur)</td>
<td>toasted bread, caramel, spice</td>
</tr>
<tr>
<td><strong>Balance</strong> (Equilibre)</td>
<td>toasted bread, caramel, spice</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Flavor Components</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fresh</strong> (Fraicheur)</td>
<td>toasted bread, caramel, spice</td>
</tr>
<tr>
<td><strong>Intense</strong></td>
<td>toasted bread, caramel, spice</td>
</tr>
</tbody>
</table>
Fining Agents & Cellar Chemicals

Gusmer carries the full range of fining agents and cellar chemicals for beverage processing: fining agents for the modification or reduction of specific flavor or aroma compounds, clarification or stabilization of proteins, phenolics and/or color compounds and cellar chemicals for acid additions and microbial stabilization.

<table>
<thead>
<tr>
<th>Chemical / Use</th>
<th>Sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bentonite (Vitiben)</td>
<td>50 lbs</td>
</tr>
<tr>
<td>Kolorfine (caseinate fining agent)</td>
<td>50 lbs</td>
</tr>
<tr>
<td>PVPP (Divergan F)</td>
<td>20 kg</td>
</tr>
<tr>
<td>DAP (Diammonium phosphate)</td>
<td>50 lbs</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chemical / Use</th>
<th>Sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gelatin</td>
<td>5 kg, 25 lbs</td>
</tr>
<tr>
<td>Malic Acid (acid addition)</td>
<td>50 lbs</td>
</tr>
<tr>
<td>Nalco 1072 colloidal silica (to settle gelatin fining and to clarify)</td>
<td>5 gal, 55 gal</td>
</tr>
<tr>
<td>Potassium Metabisulfite (KMBS)</td>
<td>1 kg, 25 kg</td>
</tr>
</tbody>
</table>

*Carbon (removes color / odor problems) *Carbon ships by truck only

Filter Media, Housings & Equipment

Gusmer is one of the largest manufacturers and distributors of filter media, filter housings and filtration equipment to the beverage industries. We offer a complete range of filter sheet media, lenticular cartridge filters, conventional cartridge filters and cross flow filter systems, in a multitude of retention levels for clarification and sterile beverage filtration applications.

Cellupore CSF Filter Sheets

Cellu-Stack® Filter Cartridges and Filter Housings

Filter Cartridges and Filter Housings

Cross Flow Filters

Cross flow filtration is another viable option used in wine and cider production. Gusmer offers the Bucher Vaslin cross flow filter in numerous sizes, ranging from 200 gph to 9,000 gph. These filters operate at low temperature and low oxygen pick up to fully preserve flavors and aromas. All Bucher Vaslin cross flow filters are fully automated, making the operation simple and user friendly.

Microbial Monitoring Tools

Gusmer offers a full line of process monitoring tools for simple and accurate microbiological testing at your facility. Create and operate your own sanitation and quality checks throughout the cider and perry process including post-bottling checks. Everything you need to set up and maintain a very basic regime for microbial testing, on up to advanced testing capabilities. Please see pages 32-36.
To place your order for these products and other processing supplies please contact your local Gusmer Enterprises representative or call your local Gusmer office. Supplemental technical information is available online. www.gusmerbeer.com

**Terms of Sale**
Our terms are Net 30 days for established accounts. For those without an account, cash or credit cards are welcome.

**Credit Cards**
We accept Visa, MasterCard and American Express.

**Return Policy**
We offer credit if products are returned unopened, undamaged within 15 days of shipment. Please call for RA # (return authorization number). A restocking fee may apply.

**Placing Orders**
Most orders are shipped within 24 hours of receipt. You may place your order by telephone or email. Your order will ship from the closest location holding the requested inventory.

**Shipping**
Most orders are sent via UPS. For more detailed information about UPS services and restrictions, go to www.ups.com. Larger shipments are shipped by common carrier.

**Shipping Hazardous Materials**
Hazardous materials are shipped the most economical way possible in accordance with carrier and DOT regulations. Prices normally include packaging; however, special packing charges may be added for hazardous materials. Because of federal and international Hazmat shipping regulations, special DOT-approved shipping boxes and additional paperwork are involved in shipping all chemicals marked “HM.” For this extra handling, there is a $35 surcharge for each Hazmat ground parcel. Only one Hazmat class may be included in each parcel. If an order contains items in more than one Hazmat class, each class must go in a separate package, each with a separate Hazmat surcharge.

**Notes**
All carbon must be shipped by truck. UPS will not handle it.

Gusmer Enterprises, Inc. puts forth this catalog in good faith but makes no guarantee, expressed or implied, concerning the use or misuse of the products or data listed within.

Prices and product offering subject to change without notice.

---

**Gusmer in the Community**
We believe that giving back to our local communities is equally as important as our promise to provide outstanding products and Service with Knowledge®. Our employees and leaders are dedicated to giving back through business and community activities, which help make our cities better places to live and work. Gusmer Enterprises is thrilled to support and contribute to the following organizations who are truly making a difference in our communities.
FOR ALL THE LATEST PRODUCTS, VIDEOS & NEWS

WWW.GUSMERBEER.COM

“Service with Knowledge”® Since 1924