Use of Kalsec® Craft Brew Solutions™

Ideas and Equipment for Dosing
Background

Advanced dosing systems are not necessary to use Kalsec® Craft Brew Solutions™ (K-CBS). Satisfactory results can often be obtained without the added expense. However, for more consistent dosing and improved results, some form of dosing system is preferred for post-fermentation addition of hop solutions.

Kalsec® does not design specific dosing systems; however, we are pleased to pass along our knowledge and experience on dosing systems for design reference.

• We have seen that brewers who take the time to design and install excellent dosing systems have the best chance of success with K-CBS – both from performance and economic standpoints.

• In fact, the cost of an excellent installation will more than pay for itself over the long term.
Dosing Strategies

- **Tank Addition**
  - Used when a dedicated dosing system is not available
  - Add K-CBS to empty maturation, pre-filtered beer, or filtered beer tank
  - Add beer from the bottom to help disperse into solution
  - After tank is full, transfer to another empty beer tank for even better mixing

- **Direct Injection - recommended**
  - Typically add prior to Kieselguhr (DE) filter or final filter
  - Inject into the beer stream, preferably before a pump for better mixing
  - Dose proportional to beer flow
  - Use precise dosing equipment designed for low dosing rates
Location – *Recommended Dosing Point*

- Dosing after high gravity dilution will give greater accuracy and most likely also higher bitterness utilization.
- Most brewers dose K-CBS approximately 2 – 3 meters prior to the Kieselguhr (DE) filter feed pump, prior to the filter inlet. The filter feed pump helps provide good mixing.
  - Do not dose K-CBS while the Kieselguhr (DE) filter is in recirculation mode.
  - The dosing pump must be designed to overcome the Kieselguhr (DE) filter inlet pressure, which will increase during the filter run (assuming filter is operated at constant flow rate with increasing differential pressure).
- If there are any other filters; i.e., trap filter, the K-CBS can be dosed prior to this trap filter. However, greater consistency is typically achieved the closer to the fermentation process as possible.
Location – *Relative to CO_2 Injection*

- The distance between an in-line CO_2 injector and the point of K-CBS injection should be great enough that the K-CBS is not dosed into some undispersed CO_2 gas in the line.

- Small bubbles of CO_2 may cause K-CBS precipitate formation and reduce utilization.

- Typically the K-CBS injection point should be greater than approximately 2 meters after CO_2 injection.
Example Dosing Schematic – with D.E. Filter

- Filter Feed tank
- Recirculation Line
- Bright Beer tank
- D.E. Filter
- Check valve
- Proportional mass flowmeter
- Metering pump
- K-CBS dosing tank
Dosing Tank — *Design Considerations*

- Do not use CO₂ to cover the K-CBS solution in the dosing vessel since precipitation will likely occur.
- N₂ can be used if desired.
- Most brewers do not provide any gas cover because oxygen has a low solubility in K-CBS.
- Any sort of dosing tank level indicator is going to be difficult to use because of the possibility of K-CBS build-up:
  - Floats would be the worst.
  - Pressure-sensors or RF-capacitance probes are questionable.
  - Load cells might work the best.
Materials of Construction

• Austenitic stainless steel is preferred
  – 304 = S30400
  – 304L = S30403
  – 316 = S31600
  – 316L = S31603
  – CF8M = cast stainless steel
• It is not recommended to use aluminum, brass, copper or carbon steel
• Food-grade Polypropylene and PTFE (Teflon®) are preferred over other types of plastic (e.g. low density polyethylene, Kynar®, PVDF, etc.)
• PVC and ABS are not recommended
Dosing Pump and Lines

- An appropriately sized and accurate dosing pump, like the small volume pumps used in pharmaceutical applications, can work well.
- The dosing pump needs to be designed to pump K-CBS directly proportional to flow; that is, a signal is received by the pump from a mag flowmeter on the beer line to dose K-CBS exactly proportional to the beer flow. Both the mag flowmeter and pump must be sized appropriately.
- The dosing pump should be appropriately sized to dose the correct amount of K-CBS for the beer line capacity and have the flexibility to dose the range of K-CBS planned. Design to add at least 30 – 40% more effective material for flexibility.
- The dosing line size is based on the volume of K-CBS added, with proper diameter to maintain reasonable line velocity. It is best to minimize the length of the dosing line.
- Many brewers install a 3 – 5 mm nozzle for good injection and mixing at the point of injection into the beer line.
Dosing System CIP

Design Considerations

• CIP the dosing system with the same frequency as CIP of the beer lines.
• Cleaning devices such as a spray ball or small cleaning jet that provide impingement cleaning on all surfaces of a tank are recommended.
• Fill/drain method does not effectively clean the surface of the dosing tank.
• The best CIP systems allow no liquid level to accumulate in the bottom of the vessel; i.e. free-draining, so the bottom gets cleaned.
• The flow is pulsed in the best CIP systems to provide blasts of cleaning solution to assist in cleaning all surfaces.
• An extended CIP using 95% ethanol or alkaline ethanol may periodically be required to penetrate a long-time accumulation of soil; i.e., every 3-4 months.
• Chemical composition, residency time, and temperature are critical CIP variables.
Dosing System CIP

Cleaning Chemicals

- Straight sodium hydroxide without a surfactant blend will not effectively clean K-CBS from all surfaces, in our experience the following is recommended:

  - **Caustic:**
    - Kalsec® range is between 14 - 18% concentration depending on the K-CBS to be cleaned
    - **Risil Mat® by Ecolab** is effective

  - **Acid:**
    - Kalsec® uses ~20% concentration
    - **Citric Acid** is effective
Dosing System CIP

Example Kalsec® CIP Cycle

- **Pre Rinse** - Remove heavy contaminants
  - Temp: 70°C
  - Duration: 1 minute @ 150 gpm
- **Caustic Wash** - Clean/Dissolve any residual product
  - Temp: 70°C
  - Concentration: 14-18%
  - Duration: 1 Hour @ 150 gpm
- **Mid Rinse** - Water rinse residual caustic out of the vessel
  - Temp: 10°C
  - Duration: 1 minute @ 150 gpm
- **Citric Acid Rinse** - Neutralization and passivation
  - Temp: 50°C
  - Concentration: ~3%
  - Duration: 1/2 Hour @ 150 gpm
- **Final Rinse** - Remove any residual CIP cleaning solutions from the vessel
  - Temp: 10°C
  - Duration: 5 minutes @ 150 gpm
- **QC Validation**
  - Rinse water is sampled and analyzed by QC prior to releasing the vessel
EXAMPLES

Equipment for Dosing (with pictures)
Syringe Dosing System
New Era Syringe Pump

NE-1002X Programmable Microfluidics Syringe Pump

Model: NE-1002X
Suggested List Price: $1500 USD

Description:

- The smoothest microfluidic syringe pump on the market
- Advance Per Step: 4.252232 Nanometers
- Holds 1 syringe up to 60 mL (140 mL partially filled)
- Infusion rates from 0.008 mL/hr (0.5 µL syringe) to 2545 µL/min (140 mL syringe)
- Available in 2 channel version (Model NE-4002X)
- Easy-to-use keypad interface
- Space Saving Chassis: Foot print size of only 5 3/4" x 8 3/4"
  Won't take up unnecessary space on your laboratory or production bench
- Dispensing accuracy of +/- 0.5% and reproducibility of +/- 0.2%
- Includes all the advanced functions and programming features of the 1000 Series
- Includes the X Upgrade Smooth Linear/Gradient increasing and decreasing pumping feature
FMI Dosing Pump

Ceramic Dispensers & Metering Pumps Since 1959!

- No Valves to clog, hang up or service.
- One moving part - the piston.
- Accuracy better than ± 1%
- = Drift-Free Operation.
- Precision Dispensing - CV of 0.5% or better.
- Flow rates from microliters to 4600 ml/min (71.8 gal/hr).
- Positive Displacement up to 100 psig back pressure
- Viscosity Independent - Unaffected by viscosity of fluids.
- Millions of Maintenance-Free Cycles.
- Inert, corrosion resistant fluid path - ceramic & fluorocarbon standard.
- Self-priming to 15 feet, vertical lift.
- Instant Reversibility - Will pump in either direction.
- Large Selection of drives - fixed, variable, pneumatic, stepper, and hazardous duty.
- Delivery from Stock - No waiting time.

OPERATION

The valveless pumping function is accomplished by the synchronous rotation and reciprocation of the ceramic piston in the precisely mated ceramic cylinder liner.

One complete piston revolution is required for each suction/discharge cycle as shown.

The piston always bottoms for maximum fluid and bubble clearing.

Valveless Metering Pumps and Dispensers

Call: 800-223-3388
ProMinent Dosing Pump

Concept PLUS Series

NSF Certified to NSF/ANSI Standard 50

Overview
Details
Technical Data
Info/Downloads

Quality, reliability and the best value!
The ProMinent® Concept Plus series covers a capacity range of 0.20 to 3.94 GPH (0.74 to 14.9 LPH) at pressures up to 232 psi (16 bar). Its compact construction and features make it ideal for use in flow proportional or on/off control applications. The Concept Plus mounts easily onto a tank or wall bracket.

Benefits (Delete this text)
- Certified to NSF/ANSI 50 & 61 (acrylic or PVDF liquid ends)
- Low cost opens up opportunities in the most basic applications
- PVDF wetted ends eliminate compatibility concerns
- Integral bleed valve prevents "loss of prime"
- Lowest maintenance costs in its class

NSF Certified to NSF/ANSI Standard 50

Overview
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Gamma/ L Diaphragm Metering Pump

Overview
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The gamma/ L is the world’s first calibrateable pump of its performance class. The metered quantity is directly displayed in gph. The large illuminated LCD display makes sure that all displayed variables are simple to read. The integrated 2-week Process-Timer (optional) offers an extremely wide range of application possibilities.

Benefits
- No metering errors: direct clear text settings and feed rate monitoring.
- Cost and space-savings thanks to integrated 2-week process timer. The intelligent alternative to the time switch.
- Easy-to-read values thanks to the large backlit LC display — even in tricky viewing conditions.
- Problem-free connection to interface complex process feed systems with optional PROFIBUS®-DP interface.
- Level monitoring of the chemicals via an input for a two-stage float-type level switch with early warning function.

ProMinent Fluid Controls, Inc.
136 Industry Drive
Pittsburgh, PA 15275
ph: 412-787-2484
fax: 412-787-0704
sales@prominent.us
Watson-Marlow – 720 Series Pump

The Flexibility of the pump control panel will allow for:

– pro-ration of extract addition to beer, 2 different ratios can be programmed
– multiple hose diameters can be used for additional flow rates for additional pro-ration percentages
– pump can be programmed to batch a programmed volume of the extract at a given flow rate
Installation A –

Pail used as dosing vessel
Installation A –

_Pail used as dosing vessel_
Installation A – CIP vessel
Installation B – Dosing Tank
Installation B – Dosing Pump
Installation B – Dosing Nozzle

3 – 5 mm