

BEST PRACTICES GUIDE ADVANCED HOP BITTER PRODUCT HANDLING & DOSING

Tim Kostelecky – John I. Haas, Inc.



The descriptions and procedures outlined below provide for the conditions for achieving optimal utilization and performance in the use of Barth-Haas Group Advanced Hop Bitter Products, for both brewkettle addition and post-fermentation addition. These products include Isohop[®], Redihop[®], Tetrahop Gold[®], Hexahop Gold[®], and Hexahop 95[®].

MATERIAL TRANSPORT AND STORAGE

Advanced products may lose bitterness potential and substantially increase the risk of precipitation if proper procedures are not followed for the transport and storage of the material. Of particular importance is the temperature range in which the products should be stored. Products can be adversely affected when:

1. Stored at temperatures above recommendations. This can result in an accelerated degradation of bitter compounds over time, resulting in the loss of product bittering potential.
2. Stored at temperatures below recommendations. This can result in a higher risk of product precipitation, in which solid particulates can form and require additional handling.
3. Storage temperatures are widely variable. Even if storage temperatures are kept within recommended limits, temperature consistency within a few degrees is best. This will ensure the optimum product stability.

Incidences of temporary high temperatures, although not optimal, will have only a minor effect on product performance, e.g. staging product in the brewhouse at high temperature prior to use. However, exposure of the products to cold temperatures can result in excessive product precipitation and, if freezing conditions exist, the precipitation that may occur can be difficult to reverse.

RECOMMENDED TEMPERATURE RANGE FOR TRANSPORT AND STORAGE OF SPECIFIC PRODUCTS:

Isohop[®] 3 – 8 °C.
Redihop[®] 15 – 25 °C.
Tetrahop Gold[®] 15 – 25 °C.
Hexahop Gold[®] 15 – 25 °C.
Hexahop 95[®] 15 – 25 °C.

BEST-BY DATES

The best-by date is defined as the date until which that the product should perform satisfactorily without concern for product quality if stored according to recommendations.

The best-by date is NOT an expiration date, and the product may be perfectly suitable for usage past the best-by designation. It is merely the date at which the normal degradation of the components in the product can affect the bitterness potential and physical stability of the product. For many months beyond the best-by date, these deficiencies, if they occur, can be overcome with adjustments to the dosing rate or by taking means to re-solubilize the product. However, as time progresses past the best-by date, these issues will become increasingly difficult to resolve and the product will become unusable.

Although the performance of the advanced products will diminish past the best-by date, the product will not adversely affect beer quality beyond the loss of bittering potential and dosing issues related to any precipitation that may exist.

If questions arise regarding the suitability of the product, whether in regard to temperature extremes or best-by designation, please contact your BHG sales and/or technical representative.

DOSING EQUIPMENT DESIGN

There are many successful designs for advanced product post-fermentation dosing, but there are many points to take into consideration for optimal product performance and utilization. A properly designed dosing system will ensure trouble-free performance of the product and provide a high level of product utilization and consistency in the final beer product. We highly recommend that the brewer take appropriate measures to provide a high quality and precise dosing system

that will ultimately repay a return on investment in optimum product utilization and performance.

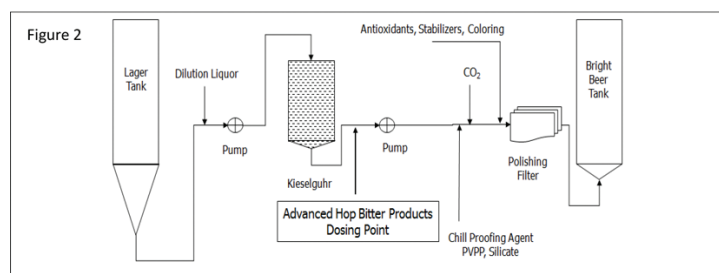
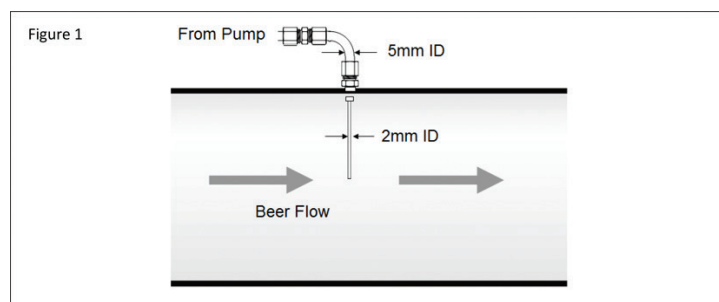
Important factors to consider when designing a dosing system:

1. Have the dosing system close to the point of injection into the beer line. This facilitates ease of use and cleaning, as well as the control of the product – limiting the excess residing in the dosing piping.
2. Use a high-precision, positive displacement pump. This should be designed to accurately regulate the flow of product, typically in the liters per hour range of operation.
3. Use narrow hard piping from the pump to the point of injection, typically no wider than 5 to 8 mm internal diameter. This piping should be insulated or temperature controlled by the use of heat tape to protect the hop product from the cold conditions of the cellar environment.
4. A separate product holding vessel is preferred, capable of heating and regulating the temperature of product to prevent the precipitation of the product. Typically, 30 degrees C is adequate.
5. Flow rate and duration of injection is best controlled by an automated system that ensures a precise delivery of product over at least 70% of the beer transfer.
6. A system should be in place of the periodic cleaning of the product holding tank, pump and dosing lines, either by manual means or an automated system. Please refer to the cleaning and sanitizing section of this document.

INJECTOR DESIGN AND OPTIMAL POINT OF INJECTION

One of the most important aspects to be aware of in hop product dosing is that the hop acids that are being introduced into the beer stream are not very soluble in beer, and then so only at low concentrations. Conditions must be provided to create an environment at the hop product/beer interface in which the hop acids are quickly dispersed into a high volume of beer. It is also important to note that hop acids, introduced into a hostile beer environment, will preferentially adhere to any solid surfaces available, whether it is suspended solids in the beer, or the beer line or tank surfaces.

1. The injection point into the beer should be through a very narrow “dip tube” or “quill” approximately 2 mm internal diameter extending into the middle of the beer line, away from pipe surfaces (Fig. 1).
2. Dosing is best done immediately prior to a bend in the beer line, an in-line pump, or a static mixer to quickly disperse the injected hop product into the beer.
3. Dosing should occur in a low suspended-solids environment which is best done AFTER the primary beer filtration, typically Kieselguhr filtration (Fig 2).
4. Hop acids are more soluble in lower gravity beer; therefore it is best to have the dosing point AFTER water rectification in a high-gravity brewing system (Fig 2).
5. Hop acids are more soluble in high pH; therefore it is best to have the dosing point PRIOR to CO₂ injection (Fig 2).



PRODUCT DILUTION PROTOCOL

It is recommended that the Advanced Hop Bitter Products be dosed undiluted into the beer. This should be no problem with a low-volume precision pump and small piping. Adding a dilution step introduces potential for error and, if not diluted carefully, may cause precipitation in the product. We have seen that fewer problems are encountered with systems in which no dilution

is performed; therefore we discourage the practice.

However, if dilution is necessary, the following protocol is necessary:

1. Dilute post-fermentation hop products using only deionized or distilled water solutions. Metal ions in municipal or well water interact with hop acids forming insoluble complexes. These insoluble complexes can plug injection lines and result in poor hops utilization.
2. Adjust the pH of the deionized water with a potassium base only. Prior to dilution, buffer the deionized water with potassium carbonate if possible. A 0.1% potassium carbonate solution should adjust the pH of the water to about 11.0. Potassium hydroxide can also be used to adjust the pH. Never use sodium based to adjust the pH of deionized water; caustic soda or sodium hydroxide form insoluble complexes with most hop acids.

3. In cool cellar or filter room conditions, some advanced hop products may need to be warmed prior to and during an injection to the temperature at which they are completely soluble. A heated vessel and heat-taped injection lines will help to maintain optimal temperatures. Contact your Technical Sales Representative for additional information regarding the optimum conditions for the hop product of your choice.
4. Isohop® dilutes best when its final concentration is roughly 1%. Redihop® dilutes best when its final concentration is less than 0.5% Tetrahop Gold® dilutes best when its final concentration is roughly 1%. Hexahop Gold® dilutes best when its final concentration is less than 0.5%. Hexahop®95 dilutes best when its final concentration is less than 1%.

DOSING PROTOCOL

As mentioned above, dosing is best performed with a full-strength product without dilution, and that the product is injected into the beer stream at a slow steady rate that exceeds 70% of the beer transfer time. An example is, if a beer transfer is scheduled to take 60 minutes, the dosing of the hop product should be extended over a period of at least 42 minutes.

This ensures that when the product is dosed into the beer, the concentration of the hop acids at the injection point is kept to a minimum, which will provide optimum utilization.

CLEANING AND SANITATION

Because of the tendency for hop acid resins to stick to surfaces and build up, it is recommended that an ethanol solution (> 50% EtOH in water) rinse be performed at the end of each dosing, either directly into the beer stream or diverted to the drain. If possible, it's best to rinse directly to the beer steam to ensure proper flushing of the injection dip-tube. Depending on the size of the dosing system, this can typically be accomplished by replacing the hop product solution with the ethanol solution and flushing approximately 100 to 500 ml of the ethanol solution through the system. The rinsing solution then can be left in the system until the next hop dosing is performed. The ethanol solution is a very good solvent for cleaning hop resins, and this procedure should keep the system running trouble-free.

An alternative to ethanol solutions is the use of a dilute potassium hydroxide solution (approx. 0.1 molar) for rinsing the system, but this is not as effective as the ethanol solution, and a more frequent periodic cleaning may be required. If using a caustic solution as a rinse, it is important to follow with a generous flush of distilled/deionized water.

For periodic cleaning and maintenance, the system can be flushed with a caustic solution at a strength that is typically used for CIP cleaning, and can be performed during the scheduled CIP cleaning of the beer lines. Potassium hydroxide is preferred, because sodium-based caustic solutions may leave some residual sodium following the cleaning which may form insoluble complexes with the hop acids when dosing is next performed.

Acids should not be used for cleaning the dosing system. Hop acids are insoluble at low pH and will tend to stick to any available surfaces.

FREQUENTLY ASKED QUESTIONS:

The hop product has a slight resinous precipitate formed on the bottom of the original package. What should I do?

A slight precipitate adhering to the bottom of the product jug is not uncommon and will not affect the quality of the product nor be problematic in dosing. Carefully decant the liquid from the jug into your dosing vessel. Any particulate material that gets into the vessel will be dissolved if the vessel is heated to approximately 30 deg. C. and agitated. If you dose directly from the original jug, the precipitate can be re-dissolved by heating the jug and contents to approximately 50 deg. C. with gentle agitation.

How soon should the hop product be used once the original package is opened?

If stored at cool temperature, the product should be used within a few days, or a week at most. For longer storage, the headspace in the jug should be flushed with nitrogen and then resealed. DO NOT use air or CO2 to flush the headspace.

What if a hop product dosing vessel is used?

How long can it be stored there?

Often, dosing vessels are heated to a temperature of about 30 deg. C. or more. This will help the product stay in solution, but over time, will result in a drop in the concentration of bitter components in the solution. If the product is not to be used

within a couple of days, the temperature should be reduced and, if the vessel can be sealed, the headspace can be flushed with nitrogen. This will allow the product to be stored for about two weeks. The product should be heated and agitated again prior to the next dosing cycle. The dosing vessel is not a good long-term storage device for the hop product, and care should be taken to utilize the product efficiently to reduce the occurrence of excess volume stored between dosing cycles that lasts more than a couple of days.

Can I combine different hop products, e.g. Redihop and Tetrahop Gold, into the same dosing vessel and dose them into the beer simultaneously?

Yes you can, but be aware that when combining the products, you are essentially diluting both and affecting the concentrations of the components. Care should be taken to determine the proper ratios of the hop acids and calculate the dosing volumes and rates required. No other materials or solutions other than the post-fermentation hop bitter products should be dosed simultaneously.