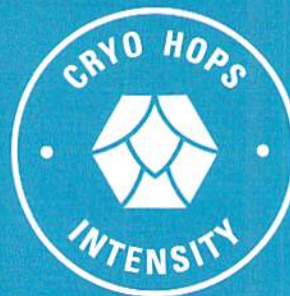




**YAKIMA CHIEF HOPS®**

# CRYO HOPS®

## PRODUCT OVERVIEW SHEET



### THE CRYO HOPS® PROCESS

CRYO HOPS is an industry-leading, patented, cryogenic process used to separate whole cones into two components—concentrated lupulin and bract. Each component of the hop is preserved using extremely low temperatures in a nitrogen-rich environment during the entire process, from separation to pelleting. This patented process displaces oxygen throughout the system, increasing product quality and reducing the oxidation of the lupulin.

### WHAT ARE CRYO HOPS® PELLETS?

CRYO HOPS brand pellets are the concentrated lupulin of whole-leaf hops containing resins and aromatic oils. They are designed to provide intense hop flavor and aroma, enabling brewers to efficiently dose large quantities of alpha acids and oils without introducing astringent flavors or vegetative material.

### INTRODUCING CRYO HOPS® PELLETS INTO BEER

CRYO HOPS pellets can be utilized anywhere whole-leaf hops and hop pellets are traditionally applied.

**KETTLE:** Late additions only; early kettle additions should be avoided to prevent boiling out the intense aroma characteristics.

**KNOCKOUT:** Due to fine particle size, there is low risk of clogging heat exchangers.

**WHIRLPOOL:** Whirlpool additions are an excellent way to increase aroma and reduce trub load from large, late additions.

**FERMENTER:** Use in the fermenter is an excellent way to increase aroma while reducing trub loss. CRYO HOPS pellets will settle out during normal conditioning and can be fined, filtered or centrifuged as normal.

### RECIPE ADAPTATION

Regardless of application, CRYO HOPS pellet beers showcase pronounced juicy and resinous flavors with reduced grassy characteristics. As a result, some brewers recommend using CRYO HOPS pellets in conjunction with T-90 hop pellets to ensure the complexity and flavors of the whole hop cone are retained.

To assess the benefits of CRYO HOPS pellets, YCH recommends adapting any recipe by substituting 40g of CRYO HOPS pellets and either 25g of T-90 or 15g of American Noble Hops™ pellets for every 100g of T-90 used. The larger the substitution, the larger the potential yield increase.

Creating new recipes with CRYO HOPS pellets is an excellent (and safe) way to showcase hops in innovative beers and styles. As a starting point for recipe formulation or modification, the estimated dosing rate of CRYO HOPS pellets is 40-50% of T-90 hop pellets by weight.

### BENEFITS OF UTILIZING CRYO HOPS® PELLETS

CRYO HOPS pellets are processed in an ISO-9001-certified production facility with limited opportunities for oxidation, and monitored to meet quality specifications.

- Controlled, cold-chain nitrogen-rich production environment
- Uniform particle-size distribution
- Minimalist handling for intentional preservation of the lupulin glands
- Nearly twice the resin content of T-90 hop pellets
- Higher quality contribution of hop flavor and aroma
- Reduced vegetal and polyphenol flavor
- Greater sustainability in packaging, shipping and storage
- Increased yield through reduced brewhouse and cellar trub
- Cost savings and net increases in revenue per batch

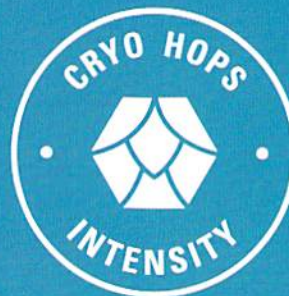
ADDITION	CURRENT RECIPE	CRYO HOPS® PELLETS
60 or 90 Minutes	CO <sub>2</sub> Hop Extract / T-90 Hop Pellets	CO <sub>2</sub> Hop Extract / T-90 Hop Pellets
15 Minute	T-90 Hop Pellets	T-90 Hop Pellets
Whirlpool	1 lb / bbl T-90 Hop Pellets	0.4 lb / bbl CRYO HOPS Pellets & either .25lb T-90 Pellets or .15lb American Noble Hops™ Pellets
Dry Hop	1 lb / bbl T-90 Hop Pellets	0.4 lb / bbl CRYO HOPS Pellets & either .25lb T-90 Pellets or .15lb American Noble Hops™ Pellets

*An example substitution for a Double IPA hop bill. Actual data will vary per brewery and beer recipe.*



# CRYO HOPS®

## PRODUCT OVERVIEW SHEET



Cryo Hops brand pellets can be utilized in the brewery as a full, or partial, replacement for whole-leaf hops and T-90 hop pellets. It is twice as concentrated as T-90 hop pellets and should be dosed at 40-50% of T-90 hop pellets by weight.

**COLD PRESSED PELLETS:** To ensure preservation of the essential oils and resins, the production process is conducted at cool temperatures, approximately 30 degrees lower than T-90 pellet production. Cryo Hops pellets perform similar to T-90 hop pellets and have comparable density and dissolving characteristics.

VARIETIES	TYPICAL ANALYSIS*	
	ALPHA**	OIL** (mL/100g)
AHTANUM® BRAND YCR 1	6 - 12%	1.0 - 3.0
AMARILLO® BRAND VGXP01	11 - 17%	1.0 - 3.0
CASCADE	13 - 19%	1.7 - 4.0
CASCADE ORGANIC	11 - 16%	2.0 - 4.0
CASHMERE	14 - 17%	2.0 - 4.0
CENTENNIAL	14 - 20%	2.2 - 4.2
CHINOOK	20 - 26%	1.5 - 4.4
CITRA® BRAND HBC 394	22 - 28%	3.0 - 6.0
CITRA® BRAND ORGANIC	19 - 25%	1.5 - 4.5
COLUMBUS	22 - 28%	3.0 - 6.0
COMET	15 - 17%	1.0 - 3.0
CRYSTAL	6 - 10%	2.0 - 4.0
EKUANOT® BRAND HBC 366	20 - 26%	3.4 - 6.4

VARIETIES	TYPICAL ANALYSIS*	
	ALPHA**	OIL** (mL/100g)
EL DORADO® BRAND	20 - 25%	2.0 - 4.0
HBC 472	14 - 18%	1.0 - 4.0
HBC 586	18 - 22%	2.5 - 4.5
HBC 630	20 - 26%	2.0 - 4.0
HBC 682	20 - 28%	2.0 - 4.0
IDAHO 7® BRAND J-007	20 - 26%	2.0 - 5.0
LORAL® BRAND HBC 291	18 - 24%	2.5 - 5.5
MOSAIC® BRAND HBC 369	21 - 27%	2.0 - 5.0
PALISADE® BRAND YCR 4	11 - 17%	1.5 - 4.0
SABRO® BRAND HBC 438	23 - 29%	2.0 - 4.0
SIMCOE® BRAND YCR 14	21 - 27%	2.2 - 5.2
TALUS® BRAND HBC 692	10 - 14%	1.5 - 3.0
WARRIOR® BRAND YCR 5	23 - 27%	3.0 - 6.0

\* Alpha by UV Spectroscopy & oil by distillation

\*\* Actual alpha and oil percentages will vary based on lot and crop year.

## SAVINGS & SUSTAINABILITY

Cryo Hops pellets are designed with efficiency and savings in mind. The leafy material of the hop cone is removed during production, reducing the amount of plant material in the brewhouse. This translates to less trub loss and results in increased brewhouse yields - simultaneously improving beer quality and the bottom line.

Brewers commonly report yield increases of three to five percent. For every barrel of beer gained, water, malt, utilities and labor are also utilized more efficiently. With half the storage and shipping requirements for Cryo Hops pellets, breweries are able to experience significant savings and gains.\*

	T-90 PELLETS	CRYO HOPS® PELLETS	NET SAVINGS
REVENUE / BARREL	\$250	\$250	-
ESTIMATED YIELD INCREASE	-	5%	-
ESTIMATED YIELD IN BARRELS	100 BBL	105 BBL	-
REVENUE / BATCH	\$25,000	\$26,250	\$1,250
DOSING RATE	100%	50%	-
POUND OF HOP PRODUCT	100 LB	50 LB	-
COST OF HOPS / POUND	\$10.00	\$23.83	-
COST OF HOPS / BATCH	\$1,000	\$1,191.50	\$(191.50)
<b>NET INCREASE IN REVENUE / BATCH</b>			<b>\$1,058.50</b>

\*Savings calculations are for example purposes only. Actual data will vary per brewery and beer recipe and should be re-calculated on actual usage with specific brewing systems and beer recipes.