

A Contrast and Comparison of the Many Variations of India Pale Ale



Mitch Steele
Brewmaster
Stone Brewing Co.

Objectives

- Review “all things IPA”
- Discuss different IPA styles, including:
 - Historical English
 - Modern Craft
 - Double IPA
 - Dark IPA
 - Session IPA
 - Belgian IPA
 - Wit IPA
 - Fruit and Spice IPA
- Old assumptions vs. new realities
- What’s coming...



Today's Beer Selections

- Stone Delicious IPA
 - American/ “West Coast” IPA
 - Features El Dorado and Lemondrop hops
 - Gluten Reduced
- Stone Go To IPA
 - Session IPA
 - Modified hop bursting
 - Features Mosaic hops

4 periods of IPA Brewing

- London Years late 1700s(George Hodgson and Hodgson's Bow Brewery)
- Burton Years: IPA's heyday in the 1800s
- The Temperance Years: The 1900s when prohibition, temperance movements, wars, taxation, and corporate conglomeration almost killed the style
- The Craft IPA Revolution



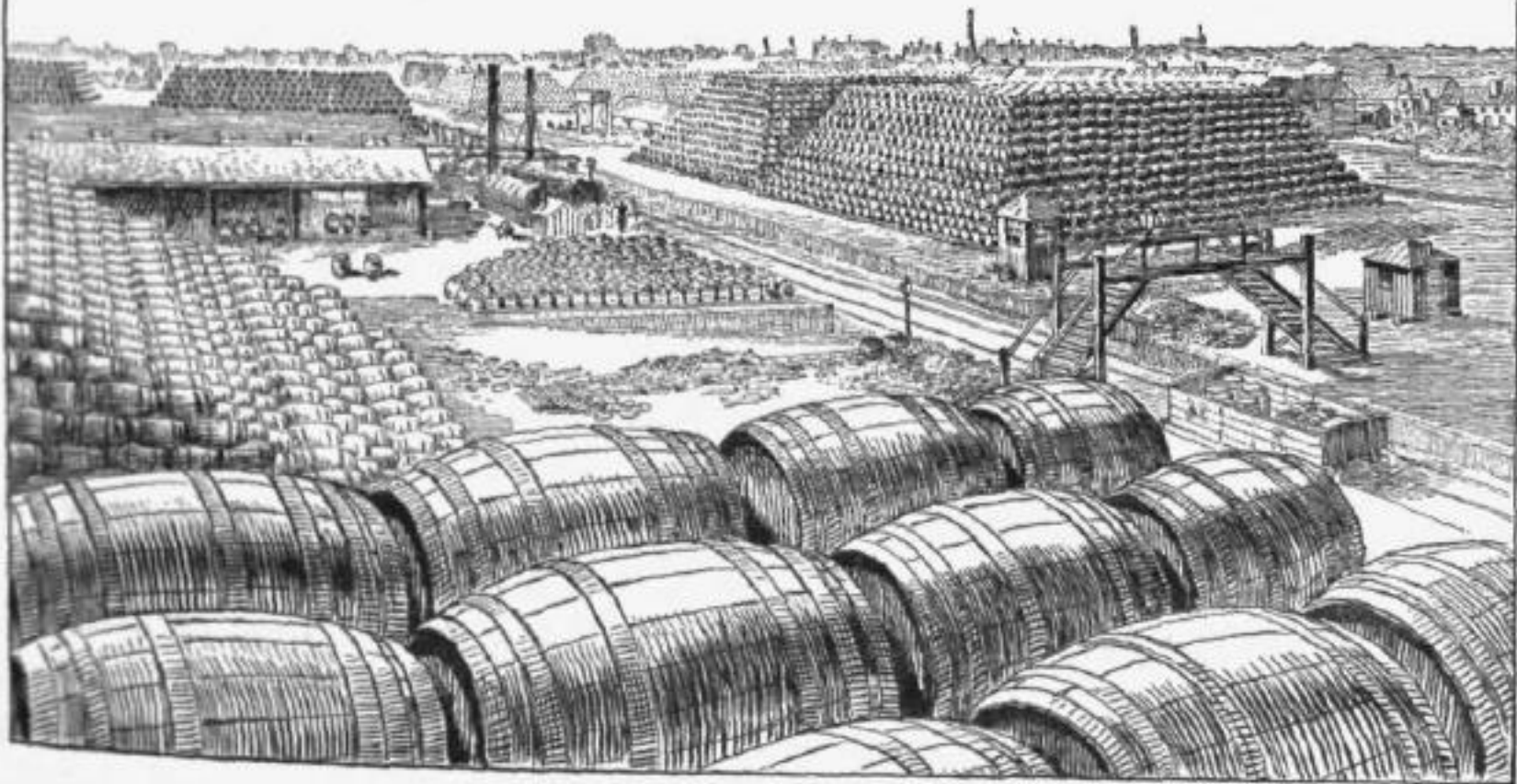
Historical English IPA 1820-1900

- Characteristics:
 - Very pale
 - Very dry
 - 16.25-17.5°P (1.065-1.070 SG) OG
 - 70 IBU
 - Described as “sparkling, champagne-like, with a peculiar, fine flavor”
- Malt: 100% Extra Pale (or White) Malt
- Hops: 100% East Kent Goldings
- Yeast: Burton or London Ale Yeast
 - Mixed culture?
- Water: Very hard water



1800s IPA Brewing procedures

- Burton IPAs
 - Infusion Mash
 - Double/triple mash or sparge
 - Collect worts of different gravities and blend to hit target final gravity (partigyle)
 - Low intensity, long (3 hour) boil (Burton)
 - Hopped at 5-9 pounds/bbl
 - Hopback for straining and trub removal
 - Scottish and American variations
 - **Extra long aging: Up to 1-1.5 years in oak barrels**



HAWKINS' LANE PREMISES.

Summary of IPA Brewing Parameters

IPA RECIPES								
Recipe Guidelines								
	Historical Burton IPA	Scottish IPA	Early 1900's English IPA	Contemporary English IPA	American IPA	Double IPA	Black IPA	
Malts	Pale Malt %	100%	100%	85-95%	85-100%	85-100%	95-100%	88-95%
	Crystal Malts used	no	no	none	15-40L	10 to 60L	10 to 20 L	10 to 20 L
	Typical crystal %'s	na	na	na	0-10%	3-15%	0-5%	5-10%
	Adjuncts %'s	none	none	Maize, sugar	maize, sugar	none	Dextrose, Candi Sugar	none typically
	Roasted Malts	none	none	none	Munich	Munich	none	Dehusked Black Malt, Black Malt Extract
	Typical %'s	na	na	na	0-10%	0-10%	none	3-7%
Mashing	Mash conversion Temperature	148-150	150-154	152-154	150-155°F	148-153°F	148-150°F	148-153°F
	Mash Conversion Time	120 minutes	120-180 minutes	90 minutes	15-30 minutes	15-60 minutes	60-120 minutes	15-120 minutes
	OG °P (SG)	15.0-18.75 (1.060-1.075)	14.0-17.5 (1.056-1.070)	12.5-15 (1.050-1.060)	12.5-18.75 (1.050-1.075)	12.5-18.75 (1.050-1.075)	18.75-22.5 (1.075-1.090)	14.0-18.0 (1.056-1.072)
	Fermentability	High!	High!	High!	70-80%	75-82%	80-86%	75-82%
	Target TG °P(SG) abv target	0.75-5 (1.003-1.020) 5-7%	0.75-3.0 (1.003-1.012) 5-7%	2.5-4.0 (1.010-1.016) 4-6.5%	3.0-4.5 (1.012-1.018) 5-7%	2.5-4.0 (1.010-1.016) 6.3-7.5%	2.0-3.75 (1.008-1.015) 7.5-10.5%	3.0-4.5 (1.012-1.018) 6-7.5%
	Typical Hopping Rates							
Hopping	Pounds per barrel	5.0-6.0	1.25-3.0	1.0-2.0	.75-2.5	.75-2	3.5-8	1.5-4
	Ounces per gallon	2.6-3.2	0.65-1.6	0.5-1.1	.4-1.3	.4-1.1	1.8-4.2	0.8-2.1
	Recommended hop varieties	East kent Goldings	East Kent Goldings	East Kent Goldings, Fuggle	EKG, Fuggle, Target, Sovereign, Styrian Golding	The 4 C's, Citra, Simcoe, Amarillo, Sterling	The 4 C's, Citra, Simcoe, Amarillo, Sterling, Nelson Sauvin	The 4 C's, Citra, Simcoe, Amarillo
	Dry Hop (lbs/bbl)	1	1	.25-.5	1	.4-1	.75-3	1-2
	Multiple Dry-hops	occasionally in casks	not typical	not typical	not typical	not typical	Common	TBD
	IBU in finished beer	~70	~70	~50	40-60	50-80	70-100+	50-90
Comments	Long, low intensity wort boil, 2-3 hours. Age 12 months or more		most gravities dropped to 10-12 °P after WWI, below 10 after WWII	Based on GABF guidelines. Real examples are all over the map.	More recent versions moving to less crystal malt			

American Craft IPA

- American malts
- American hops:
 - 4 C's
 - New varieties
 - 2, 3+ hop additions in brewhouse
 - Dry hop-.75-1.5 lbs/bbl (11-22 grams/gallon)



Classic “Old School” IPA vs “New School” IPA

- Old School

- 4 C’s hopping (Cascade, Chinook, Centennial, Columbus)
- 15-16°P (1.060-1.064 SG)
- 6.5-7.5% abv
- 55-70 IBUs
- Crystal malts 5-10% medium color
- Munich Malts
- Dry Hop .5-1 lbs/bbl (7-15 grams/gallon)

- New School

- What’s the new hop?
- Hop Bursting
- 16-18 °P (1.064-1.072 SG)
- 7-8% abv
- 70+ IBUs
- No crystal malts or lightest color versions at small %
- Small amounts colored malts
- Dry-hop 1-2 lbs/bbls (15-30 grams/gallon)



East Coast vs West Coast

- Conventional Wisdom:
 - East Coast IPAs have:
 - more influence from English beers
 - More crystal malt (amber colored)
 - Lower bitterness: 45-60 IBU
 - More malt/hop flavor balance
 - West Coast IPA's have:
 - American ingredients
 - No crystal malt
 - High bitterness-70 IBUs or more
 - Strong dry-hop intensity. Trend is 2#/bbl (29 grams/gallon)
 - Drier, more hop forward taste

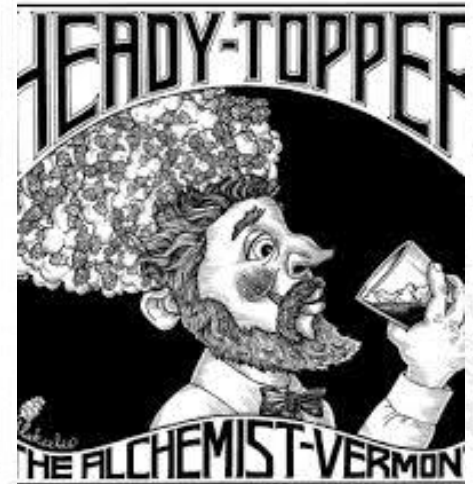


2012 IPA ANALYSIS

<i>Region</i>	<i>ABV</i>	<i>Color (SRM)</i>	<i>Final Gravity (SG)</i>	<i>Final Gravity (°P)</i>	<i>OG (SG)</i>	<i>OG (°P)</i>	<i>ADF</i>	<i>IBU</i>
California	6.65	7.3	1.00919	2.4	59.87	15.0	83.92	60.5
California	7.44	8.7	1.01432	3.7	70.7	17.7	78.68	61.8
California	7.99	10.8	1.00741	1.9	67.8	17.0	88.5	68.1
California	7.25	7.7	1.0086	2.2	63.63	15.9	85.81	75.3
California	7.53	15.9	1.01172	3	58.77	14.7	82.07	78.1
California	6.7	14.1	1.01123	2.9	62.33	15.6	81.1	45.6
California	7.66	10.6	1.00803	2.1	66.04	16.5	87.21	65.9
California	6.5	8.7	1.01188	3	61.51	15.4	79.76	48.6
California	7.82	7.9	1.01028	2.6	69.45	17.4	84.41	65.5
California	6.9	9	1.0116	2.9	64	16.0	81.88	75
West Coast	6.25	8.6	1.01007	2.6	57.87	14.5	81.78	60.5
Pacific Northwest	6.04	7.1	1.01057	2.7	56.84	14.2	80.54	45.65
Pacific Northwest	6	10	1.0168	4.2	61	15.3	72.4	50
Pacific Northwest	6.8	12	1.0176	4.4	67	16.8	73.8	80
Rocky Mountain	6.71	7.9	1.00861	2.2	59.71	14.9	84.89	63.45
Rocky Mountain	7.5	12.1	1.01236	3.2	69.2	17.3	81.21	60.4
Rocky Mountain	6.81	7.1	1.00559	1.4	57.43	14.4	89.82	65.6
Rocky Mountain	7	9.5	1.0128	3.2	66	16.5	80.5	60
Midwest	7.5	8.5	1.0136	2.5	68	17.0	80	87
Midwest	5.95	10	1.0184	4.6	62	15.5	70.3	55
East Coast	7.3	10	1.0108	2.7	66	16.5	83.6	48
Northeast	5.9	8.6	1.0116	2.9	62	15.5	81.29	42
Northeast	6.74	8.4	1.01091	2.8	62.29	15.6	81.64	69.45
Northeast	6.65	10.9	1.01343	3.4	64.15	16.0	78.03	57.3
Northeast	6.84	17.3	1.01278	3.3	64.87	16.2	79.32	47.3
Northeast	7.3	10	1.0083	2.1	63.66	15.9	86.32	70.7
Northeast	5.73	10.3	1.00827	2.1	52.3	13.1	83.49	49.1
Northeast	6.87	7.4	1.01126	2.9	63.82	16.0	81.05	53.9
Northeast	7	14	1.014	3.5	64.8	16.2	78.4	70
England	7.4	7	1.012	3	67	16.8	82	75
England	5.3	10.7	1.012	3	53	13.3	77.4	50
England	5.6	13.2	1.009	2.25	52.5	13.1	82.9	40
England	5.59	13.9	1.01091	2.8	53.94	13.5	78.86	59.65
England	5.31	10.7	1.00986	2.5	50.79	12.7	79.74	46.25

The “New” East Coast IPA ?

- Wheat malt 5-20%
- Unfiltered
- Chill haze and yeast content
- Hopped like West Coast IPA
- American hops-newer varieties
- Southern Hemisphere hops???



Imperial/Double IPA

- 18 °P+
- 8-10% abv
- No crystal malts
- Mash: Low temp/long conversion-Dry!
- Sugars can be used to boost abv
- Neutral yeast strain
- Hop 1.5-2 lbs/bbl (22-30 grams/gallon) in dry hop
- Hop schedules:
 - Multiple BH additions: Target 90+ IBU
 - 1-2 dry hop charges



Triple IPA

- >10% abv
- 100+ IBU
- Commercial examples:
 - Pliny The Younger
 - Knee Deep Simtra
 - Green Flash Green Bullet
 - Alpine Exponential Hoppiness
 - Stone RuinTen IPA
 - DFH 120 minute IPA (18% abv!)
- Quadrupel IPA??? Hop Wine?



Black/Brown IPA

- Formulate like a classic IPA or Double IPA with a small addition of dark malt
- To mill or not to mill?
- Malts to avoid:
 - Black Patent
 - Chocolate
 - Roast Barley
- Malts to use 3-5%:
 - Carafa dehusked black malt
 - Midnight wheat.
 - Pearled black barley
 - Sinamar



Session IPA

- Just a hoppy pale ale??
- 9-11 °P starting gravity
- 4.5% abv or less
- Hop like an IPA or Double IPA
- Avoiding thin character?
- Malt choices:
 - Limit crystal?
 - Carapils?



Wheat/Rye IPA

- Standard IPA recipe using wheat or rye as a large % of the base malt
- Provides additional malt complexity
- Flaked or torrified versions
- Lautering issues?



Coffee IPA

- Apparent disconnect, but coffee pairs well with citrusy hops-Citra, Centennial, Mandarina Bavaria
- Hot side addition
 - Mash-whole beans 2.5 lbs/bbl (37 grams/gallon)
 - Late kettle or whirlpool steep 1 lb/bbl (15 grams/gallon)
- Cold Side addition
 - Cold Steep in chilled beer 1lb/bbl (15 grams/gallon)
- Addition rates for non mash additions: 10-20 grams/gallon



IPA w/ Tea

- Traditional teas-Green Tea, Black Tea
- Earl Grey-Bergamot
- Flavored teas
- Hot side vs cold side
- Addition rates: 20-30 grams/gallon



Belgian IPA

- 2 brewing techniques:
- Brew an IPA and ferment with Belgian yeast
- Brew a Triple or Belgian Golden and hop the crap out of it
- Both work!



Wit IPA

- 2 brewing techniques:
- Brew an IPA, ferment with Wit yeast, and add coriander and orange peel
- Brew a Wit and hop the crap out of it
- Both work!
- Chamomile



IPL-India Pale Lager

- Standard IPA recipe, except:
 - Pilsner malt
 - Lager yeast
- Classic IPA hops or German hops?
- Imperial Pils



Brett IPA

- Primary fermentation with Brett:
 - Victory Wild Devil, Evil Twin Femme Fatale, Crooked Stave Hop Savant, SuperFriends IPA
- Secondary Fermentation with Brett:
 - Avery Brett IPA, Stone Enjoy After IPA
- Wood Age?
- Brett Drei, bruxellensis, clausenii, anomalus, Trois



IPA w/ other ingredients

- Chocolate/cacao:20-60 grams/gallon
- Coconut: Use lots-4-5lbs/bbl (58-88 grams/gallon). Hot and cold side
- Spices: 5-10 grams/gallon starting point
 - Jasmine
 - Juniper
 - Ginger
 - Hibiscus
 - Sage
 - Lemon Verbena
 - Mint



Fruit IPA

- Citrus
 - Peel: 2-10 grams/gallon 1.5#/bbl. Double that if using fresh peel.
 - Juice or juice concentrate 1-2-5 gallon/bbl (4-8-20 oz/gallon) or for concentrate: 1/3-2/3 gallon/bbl (1-3 oz/gallon)
- Stone fruits and berries (peach, Apricot): Old rule of thumb-1 lb/bbl.
 - Juice addition rate 1-2-5 gallon/bbl or 1/3-2/3 gallon/bbl
 - Puree-10-25 pounds/bbl (5-12 grams/gallon)
- Peppers-Habanero, Jalapeno, etc:
 - 1/3 to 1+ lbs/bbl
 - Highly variable



What else is coming-trends

- Estate IPAs
- Hop Regionalization
- “IPA-ify” other classic beer styles?
- Hopy Lagers
- Barrel aged IPA
- Marijuana IPA?



QUESTIONS?????

STONE BREWING CO.



1878 English Military Specifications for purchased IPA

- IPA had to be brewed with 100 percent malt.
- • OG had to be 15 °P (1.060 SG) minimum.
- • Hops had to be used at 20 pounds per quarter minimum (about 4–5 pounds per barrel), plus 11 pounds new hops in the dryhop in barrels.
- • Beer had to be casked not more than 21 days after brewing.
- • Casks were required to be made from well-seasoned Baltic or Bosnian oak staves, free from sap, strong, stout, and well made. Casks had to be steamed at a temperature of not less than 230° F (110° C), and the staves were required to be one inch thick.
- • Beer had to be brewed between November 1 and May.
- • Beer for bottling was to be kept on hand for 9–12 months before bottling and to have one summer and one autumn fermentation before bottling.



WATER ANALYSIS DIFFERENT BREWING REGIONS (all in ppm, or mg/L)

	Pilsen	Munich	Dublin	Dortmund	London	Burton- on - Trent	Milwaukee	St. Louis	Stone
Calcium	7	75	117	260	90	300	35	26	22.1
Sulfate	3	10	54	283	58	640	18	80	16.5
Magnesium	2.5	19	4	23	4	60	11	8	8.88
Sodium	32	10	12	69	24	54		19	38
Chloride	5	2	19	106	18	36	5	23	
Hardness	27.78	265.59	308.94	744.53	241.44	996.6	132.71	97.88	91.8
Alkalinity	23	253		300		236		21	43

STONE BREWING CO.



9 recipes

No. 25. **EAST INDIA PALE ALE.**—Gravity, 24.0. ^{Lbs. T.} Sale Price, 60s. per barrel.
January, Monday, Atmosphere, 40 to 48 degrees.
Liquor, Burton Well, hard. No. 3 Analysis.

OG 1066.7
FG 1031.4

MALT.—New Burton White Quarters.
50

HOPS.—Choice East and Mid Kent Pounds.
1470

1200 lbs. for the Copper, 270 lbs. for the Casks.
29½ lbs. per quarter, 8½ lbs. per barrel.

Boil the Liquor overnight, allowed to cool down.

FIRST MASH.

B. F. G.
Heat in Tun, 165 degrees, 3.0.0 per quarter, 150 barrels.
Mashed, Stood 2 hours. Tap heat, 150 degrees.
First Copper of Wort. 600 pounds of Hops.

SECOND MASH.

B. F. G.
Heat in Copper, 180 degrees, 3.0.0 per quarter, 150 barrels.
Mashed, Stood 1 hour. Tap heat, 165 degrees.
Second Copper of Wort. 600 pounds of Hops.

The Hops boiled in the first wort, not returned to the Copper; the second wort turned on to the first wort hops.

B. F. G.
Total Liquor for the Gyle, 6.0.0 per quarter, 300 barrels.

Bar. Bar. Bar.
First Wort in Copper, 113; boiled, 2 hours; out, 104; wasted, 9
Second do. 137; " 2 " " 127; " 10

First Wort in Square, 58 degrees, gauged, 80 barrels, 700 lbs. Yeast.
Second do. 58 " " 100 "

STONE BREWING CO.



First Wort,	Lbs. T.	Bar.	Lbs. T.
	34.0	X 80 =	2720.0
Second do.	16.0	X 100 =	1600.0
		180	)4320.0 (24.0 per barrel.

	Lbs. T.
50 quarters)	4320.0 (86.4 per quarter.
Total Extract.	

Fermentation—

Tuesday,	6 p.m.	...	64 degrees.	Lbs. T.
Wednesday,	10 a.m.	...	72	,, 11.3

Cleansed into 4 barrel casks on Stillions (not Unions). Saturday racked into delivery casks, $1\frac{1}{2}$ pounds of hops per barrel, put in dry. Shived; no porous spiles required.

168 Barrels; Heat, 57 degrees; Weight, 7.5 per barrel.

Gyle	...	...	...	...	...	Barrels.
						168
Drawings	...	...	...	...	...	3
Yeast and Waste	...	...	...	...	...	9
						180

Dring and Fagé Saccharometer.

This Gyle was brewed at Burton, by my Instructor, in olden times, when the Ales, from that locality, were *perfect* in every sense of the word.

I was not present, but this is a correct copy from his *Brewing Book*; in those days only the best East and Mid Kent Hops were used.

The large quantity of Hops, used at that time, for the reason, that E. I. A. was in those days Bitter Ale, now the quantity is what suits the pocket of the Brewer.

Liquor without Carbonate of Lime, half the quantity of Hops would give as much bitter.



AMSINCK'S No 25 EAST INDIA PALE ALE

- **Brewing liquor:** hard Burton Water, boil for 15 minutes and let cool to strike temperature
- **Malt Bill:** 100% New Burton White Malt
- **Mashing:**
 - Double mash system
 - No sparging
 - 1st mash:
 - 165°F (74°C) strike temperature
 - 1.3 qts water/pound malt (2.7:1)
 - Hold 2 hours. Expected temp drop to 150°F
 - 2nd mash
 - 1.3 qts 180°F (82°C) water/pound malt
 - Hold 1 hr, Expected temp drop to 165°F (74°C)



AMSINCK'S No 25 EAST INDIA PALE ALE

- **Hopping:** East and Mid Kent Goldings split evenly among the 2 boils: 2.5 oz/gallon (5 lbs/bbl)
- **Boil:**
 - 1st wort: boil 2 hours with 50% of hops. Transfer through a hop back and leave the hops in the hopback.
 - 2nd wort: Boil 2 hours with the rest of the hops. Run wort over 1st hops in hopback.
- **Fermentation:**
 - Combine worts
 - Pitch at 58°F and allow free rise to 72°F over 4 days
 - Rack at about 7°P. Cask at 7 days.



AMSINCK'S No 25 EAST INDIA PALE ALE

- Dry-Hop: 0.77 oz/gallon (1.5 lbs/bbl) EKG
- Age extended time on dry hops
- Analytical targets:
 - OG 16.8°P (1.067 SG)
 - TG 3°P (1.012 SG)
 - IBU ~159 Calculated
 - ABV ~7%

