

Targets 5.5% ABV -- 5 Gallons -- 1.055 OG

$$1.055 - x * 131.25 = 5.5\%$$

$$1.055 - x = .0419$$

$$1.013 = x = \text{Target FG}$$

### **Grain**

70% Vienna - Full bodied, golden color.

20% Light Munich - Malty, nutty flavor.

10% Crystal Malt 60 - Sweet caramel flavor, deep golden to red color.

### **Hops**

Tettnang (half boil) - 2 oz

Saaz (end of boil) - 1 oz

### **Yeast**

Imperial Yeast L13 Global - 1 packet

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### **Calculations**

5 gallons x 55 GU = 275 GU of total gravity

#### **Grain Bill**

$$\text{Vienna} = .7 \times 275 = 192.5 \text{ GU}$$

$$\text{Light Munich} = .2 \times 275 = 55 \text{ GU}$$

$$\text{Crystal Malt 60} = .1 \times 275 = 27.5 \text{ GU}$$

*Ingredient gravity/(mash efficiency x maximum extract)*

$$\text{Vienna} = 35$$

$$\text{Light Munich} = 35$$

$$\text{Crystal Malt 60} = 34$$

$$\text{Vienna} = 192.5 / (.65 \times 35) = \mathbf{8.5 \text{ lbs}}$$

$$\text{Light Munich} = 55 / (.65 \times 35) = \mathbf{2.5 \text{ lbs}}$$

$$\text{Crystal Malt 60} = 27.5 / (.65 \times 34) = \mathbf{1.5 \text{ lbs}}$$

#### **Hop Bill**

*AAU = Weight (oz) x % Alpha Acids (whole number)*

$$\mathbf{2 \text{ oz} * 4.5\% = 9 \text{ AAU}}$$

$$\mathbf{1 \text{ oz} * 3.5\% = 3.5 \text{ AAU}}$$

$$\text{IBU} = \text{AAU} \times U \times 75 / V_{\text{recipe}}$$

$$9 \times .17 \times 75/5 = \mathbf{23}$$

$$3.5 \times 0 \times 75/5 = 0$$

*\*Note: Utilization determined based on a 30 minutes (of 60 minute boil) -*

<http://howtobrew.com/book/section-1/hops/hop-bittering-calculations>

#### Water Calculations

Strike water volume = weight of grain \* desired mash thickness

$$12.5 \times 1.3 = 16.25 \text{ quarts} = 4 \text{ gallons}$$

Sparge water volume = weight of grain \* 2

$$12.5 \times 2 = 25 \text{ quarts} = 6.25 \text{ gallons}$$

#### Efficiency Calculations

Potential gravity points = (grain gravity points \* weight) / volume

Brewhouse efficiency = actual gravity points / potential gravity points

$$\text{Vienna} = x/(35) = 8.5 \text{ lbs}$$

$$\text{Light Munich} = x/(35) = 2.5 \text{ lbs}$$

$$\text{Crystal 60} = x/(34) = 1.5 \text{ lbs}$$

$$\text{Vienna} = x = 8.5 \text{ lbs} \times 35 = 297.5$$

$$\text{Light Munich} = x = 2.5 \text{ lbs} \times 35 = 87.5$$

$$\text{Crystal 60} = x = 1.5 \text{ lbs} \times 34 = 51$$

$$5x = 436$$

$$x = 87.2$$

$$62/87.2 = \mathbf{71\%}$$