The Home-brewers Guide to Creating a Beer Recipe

Dee Kupa
www.homebrewtechniques.com
The home-brewers guide to creating a beer recipe

Contents
1. Introduction ........................................................................................................................................... 2
2. How do you calculate the amount of Malt required? .............................................................................. 3
   2.1. What is the LDK value of your malt? ................................................................................................. 3
3. How do you create a more complex grist recipe? .................................................................................... 6
4. Calculating the colour of your brewing recipe ....................................................................................... 8
   4.1. A brief history of beer colour analysis. ............................................................................................... 8
   4.2. Calculating Beer Colour .................................................................................................................... 10
5. How do you work out the Bitterness value of your beer? ...................................................................... 13
   5.1. What are hops? .................................................................................................................................. 13
   5.2. Equations, equations and more equations! ......................................................................................... 14
6. Summary .................................................................................................................................................. 17
1. Introduction

As home brewers the more we brew the more experience we gain and the more our confidence in our own ability to brew great beer grows. We perhaps start off brewing using malt extract, we then progress to full grain mashing and ultimately onto developing our own recipes. For me the most satisfying and interesting part about home brewing is developing my own recipes rather than using those that are published in most home brewing books. Although these published recipes are perfectly acceptable, in fact they are mostly very good, developing your own brewing recipes really gives you the freedom to innovate and express yourself as a brewer. It also allows you to dig deeper into beer styles and what is required to brew certain styles of beer.

The question is how to move from using someone else’s recipe to developing your own recipes for your own unique beer. Hopefully in this brief guide I hope to show you how easy it is to create a recipe and give you the confidence to try it for yourself.

By the end of this guide you will hopefully be able to:

1. Calculate the amount of malt you need.
2. Be able to use different malt types.
3. Estimate the colour of your beer.
4. Calculate the quantity of hops required to achieve a particular bitterness value.

That’s quite a bit to cover so let’s get started by looking at how we work out how much malt to use.
2. How do you calculate the amount of Malt required?

First off we will start looking at the malt side of the recipe and how we calculate the quantity of malt we need to use to meet a target original gravity (OG).

For me the first part of generating a recipe is to consider the type of beer I want to brew, which indicates things such as target OG, bitterness and colour. To calculate the quantity of malt required we need to decide on the final alcohol we want to achieve, which provides us with an initial target OG which we want to achieve in the fermenter.

For example if I want to produce a 4% abv beer, as a rough rule of thumb, I am looking to target an OG of 1.040. If it is a 5% abv beer I am looking to achieve a target OG of 1.050.

The calculations that we employ will therefore all target the initial OG of the beer that we want to brew. Let’s use a worked example for a 5% abv beer, which requires an initial OG of 1.050.

Having decided on an OG, in this case 1.050, how do we work out how much malt to use? The answer to this question is actually easier than you think and involves something often referred to as the LDK value.

2.1. What is the LDK value of your malt?

If you take a look at your malt analysis certificate you will find the analytical parameter IOB extract. Usually this is measured on a coarse or 0.7 mm grind and can be reported on a dry basis or an as is basis. If you take a look at the units that the value is reported in you will notice that it will say something like L deg/kg which stands for Litre Degrees per Kilogram of malt and hopefully you can see why some people refer to this as the LDK value of malt. The figure gives us an idea of the extract that is possible per kilogram of malt used. But how do we use this figure?

The LDK value is actually a very useful figure and provides us with a simple way of calculating the amount of malt required to produce a certain volume of wort at a specific OG.

Going back to our worked example where I want to produce a 5% abv beer. In this example I am targeting an OG of 1.050 and let’s say I want to produce 25 litres of wort. To keep it simple I only want to use a single malt type for my recipe, let’s say ale malt.

To summarise my beer will be:

Beer Type – Ale 5% abv
Target OG – 1.050
Target volume – 25 litres
Malt type used – 100% Ale Malt

The calculation that we use is:

$$\frac{((OG - 1) \times 1000) \times Volume}{LDK}$$

This might look a bit daunting but it is probably a lot easier if we break this calculation down into bite size chunks.

The first thing you need to do is check your malt analysis certificate and find the IOB coarse extract or LDK value. Generally you should be looking to use the as is value for the coarse extract as this takes into account the moisture content of the malt. It is generally around the 300 litre degree/kilogram or 300 l°/kg.

For this example we will use an IOB coarse extract or LDK as is of 302 l°/kg. To work out the malt required the calculation is as follows:

Malt required = $$\frac{((Original\ Gravity - 1) \times 1000) \times Volume\ wort\ required)}{Coarse\ extract\ as\ is\ or\ LDK}$$

Therefore for our recipe for 25 litres of wort with a gravity of 1.050 the calculation is:

Malt required = $$\frac{((1.050 - 1) \times 1000) \times 25)}{302}$$

Malt required = $$\frac{50 \times 25}{302}$$

Malt required = 4.14 kg

This calculation assumes that we are 100% efficient when we are mashing but this is very rarely the case. Many commercial brewers would aim for at least a 90% brewhouse efficiency which means for every kg of malt that they use they are able to solubilise 90% of all the extractable material in the malt. They compensate for this inefficiency by adding additional malt to achieve the desired wort volume and gravity. There are ways of calculating your brewhouse efficiency but for simplicity we won’t cover this just yet. However, if we work on a brewhouse efficiency of 90% for our home brewing this would mean multiplying the kg of malt figure by 100/90 or 1.11. Therefore the kg of malt required is:

Malt required = weight of malt x brewhouse efficiency

Malt required = weight of malt x (100/ brewhouse efficiency)

Malt required = weight of malt x (100/90)

Malt required = 4.14 x (100/90)

Malt required = 4.6 kg

Using this simple method we now know that the amount of malt required to produce 25 litres of a simple ale with a starting gravity of 1.050 is 4.6 kg. You can make a more complicated grist recipe by
introducing coloured malts and other grains such as wheat and maize as long as you know the coarse extract or LDK value for each of these grain types.

Of course we all want to create recipes with different speciality malts so it would be beneficial to understand how to do this.

Therefore in the next section we will take the process of recipe generation a step further and work out how to introduce other grains to make a more complicated grist recipe.
3. How do you create a more complex grist recipe?

In the last section we looked at how to calculate the weight of malt that we would need to use to achieve a target original gravity in what was a very basic beer recipe. If you remember we wanted to create a 5% abv ale style beer with a target OG of 1.050. This is all very good if all you want to do is to brew a very basic beer. But as home brewers we like to experiment, or at least I do. So what do you do if you want to add something to your recipe other than just pale ale malt? Say for example you wanted to add a bit of colour to your brew by using coloured malt such as crystal malt. Or how about adding some torrified wheat to improve the head retention of your beer? Fortunately because of our LDK number, or the coarse extract as is, we can start to create a more complicated brewing recipe and use some alternative grain types.

Let us return to our original basic recipe that we used in the last section. If you remember we wanted to brew 25 litres of beer with an original gravity of 1.050. In the original recipe ale malt represented 100% of the grist and we calculated that we needed approximately 4.6 kg because of our 90% brew-house efficiency. Now I want to get a little bit more adventurous with my brewing and would like to have a bit more colour in my beer as well as a more fruity flavour. I know that using crystal malt will give these characteristics that I am looking for. I have also noticed that the beer that I brewed with my original recipe didn’t produce a particularly stable head of foam, and I like a bit of froth on my pint. To rectify the head retention issue I therefore want to put a bit of torrefied wheat into my recipe as this should help improve the foam stability. The first step is to decide the proportion of your extract that is going to come from each of the different grains. For coloured malts such as crystal these are usually added to obtain a particular colour in the final beer. I will not go into how to calculate colour just yet this is covered in a later section in this guide. But generally coloured malt does not represent more than 10% of the grist so for this example I think I will add 5% crystal and 10% torrefied wheat should be sufficient to fix my head retention problems.

Having decided the proportions I now know that 85% of my extract will come from ale malt, 10% from torrefied wheat and 5% from crystal malt. If I check my analysis certificates for these 3 ingredients I can see that my ale malt has a coarse extract of 302 lº/kg, torrefied wheat is 280 lº/kg and crystal malt is 275 lº/kg.

To work out the amount of each ingredient required you must work it out as if the individual grain ingredient represented 100% of your grist and then multiply out by the actual percentage used in the recipe. Therefore for the ale malt:

\[
\text{Malt required} = \frac{((\text{Gravity} - 1) \times 1000) \times \text{Volume wort required}}{\text{LDK}} \\
\text{Malt required} = 50 \times 25/302 \\
\text{Malt required} = 4.14 \text{ kg} \\
\text{Malt represents 85% of the grist therefore:} \\
\text{Malt required} = 4.14 \times (85/100) \\
\text{Malt required} = 4.14 \times 0.85
\]
The home-brewers guide to creating a beer recipe

Malt required = 3.52

Now we can repeat this for the torrefied wheat bearing in mind that this time the coarse extract for the wheat is 280 lº/kg:

Torrefied wheat required = (((Gravity - 1) x 1000) x Volume wort required)/ Coarse extract as is

Torrefied wheat required = 50 x 25/280

Torrefied wheat required = 4.46 kg

Torrefied wheat represents 10% of the grist therefore:

Torrefied wheat = 4.46 x (10/100)

Torrefied wheat = 4.46 x 0.1

Torrefied wheat = 0.45 kg.

And finally we can calculate the crystal malt component:

Crystal malt required = (((Gravity - 1) x 1000) x Volume wort required)/ Coarse extract as is

Crystal malt required = 50 x 25/275

Crystal malt required = 4.55 kg

Crystal malt represents 5% of the grist therefore:

Crystal malt required = 4.55 x (5/100)

Crystal malt required = 4.55 x 0.05

Crystal malt required = 0.23 kg.

If you remember this has all been calculated assuming a brewhouse or mashing efficiency of 100%.

If we use the brewhouse efficiency that we used last time of 90% then all we do is multiply the calculated weight by 100/90 or 1.11. Therefore for the three ingredients the required weight is:

Ale malt required = 3.52 x 1.11

Ale malt required = 3.9 kg

Torrefied wheat required = 0.45 x 1.11

Torrefied wheat required = 0.5 kg

Crystal malt required = 0.23 x 1.11

Crystal malt required = 0.25 kg

There you have it a brewing recipe for a 5% abv ale style beer using 85% ale malt, 10% torrefied wheat and 5% crystal malt.
4. Calculating the colour of your brewing recipe.

How do you work out the colour of your beer? This is a key consideration especially when you are adding coloured malt into your home brew recipes. If you are not to over shoot and add too much coloured malt to your grist recipe it is useful to have a method to calculate the colour contribution of a certain quantity of malt. It is also useful to have an idea of the likely end colour of your beer.

Therefore it is a very important consideration for a home brewer – but how do you work out the colour of your beer?

Working out the colour of your beer should be easy and in some respects it is. However, before we discover how to calculate the colour of beer it is perhaps worth considering the history of colour measurement in beer, which is convoluted to say the least as well as being just a little bit subjective.

4.1. A brief history of beer colour analysis.

The first quantitative method for measuring colour in beer was devised by Joseph William Lovibond in Greenwich in 1893. The method he developed involved comparing beer samples to standardised coloured glass discs.

A bit like the paint colour charts you get from your DIY shop the Lovibond method involved matching your beer sample against various glass discs that had a known colour value. The glass disc that best corresponded to the colour of the beer therefore gave the colour value of the beer.

The Lovibond method became the standard method for determining colour until 1950 when L.R. Bishop proposed the use of a revised set of coloured glass slides. Bishop’s revised system of colour determination was adopted as the standard method for beer colour analysis by the European Brewing Congress (EBC) and therefore the standard method of analysis for European brewers.

However, because this is a visual method, that is a human has to decide which colour slide best matches the colour of the beer, the method is highly subjective. This means that the colour analysis can be quite inconsistent from one lab technician to another and certainly between different laboratories.

To take account of the inconsistencies of this visual method US brewers use the Standard Reference Method (SRM), which rather than using a human to judge the colour, uses a spectrophotometer instead to gain a value of beer colour.
To perform this method the beer sample is placed in a glass cuvette which goes into the spectrophotometer. The absorbance of the sample is then measured at a wavelength of 430 nm and the colour calculated using the spectrophotometer value and taking into account the path length of the cuvette and any dilution factors that may have been used on the original sample. The EBC have also adopted a spectrophotometric method but because of slight method differences the EBC colour is roughly twice the SRM colour. To be precise the EBC colour is 1.97 times the SRM colour. Therefore a colour of 8 on the SRM is:

$$EBC\ colour = 1.97 \times SRM$$

$$EBC\ colour = 1.97 \times 8$$

$$EBC\ colour = 15.76$$

However, I really don’t think that there is much need to go to this level of precision and the colour can be quoted as 16 EBC.

There are still issues involved with the spectrophotometric methods and the main issue is if the beer has a slight haze or turbidity issue. If it does have a haze the colour reading can be impacted.

This is more important when it comes to the analysis of malt for its colour. When determining malt colour the malt sample is mashed and a wort produced. It is the wort which is then analysed for colour. The problem is that very often the wort will be hazy which impacts on the assessment of colour.

To account for this in the EBC method there is a requirement to measure the sample in a spectrophotometer at 700 nm to see if there is a haze. Generally if the absorbance value at 700 nm is greater than 0.02 the beer sample is deemed to have a slight haze. If the sample does have a haze it therefore needs to be either filtered or centrifuged to remove the haze before the colour is read on the spectrophotometer.

As you can see there are some issues with trying to measure and understand the colour of the beer that we want to make. This is especially true when it comes to the measurement of hue. The subtle variations in the hue that the human eye can see, which give us copper red or chestnut brown beers for example, cannot be easily translated into a single number. I would therefore suggest that when you calculate the colour of your beer this can only be used as guidance for the rough level of colour. However, by experimenting with the colour values that you get and the type of coloured malts that you use in your recipes you will quickly gain experience as to what colour value you are likely to achieve.

The table below gives you a very rough idea of the colour spread from 2 – 40 SRM or 4 – 80 EBC.

<table>
<thead>
<tr>
<th>SRM</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>6</th>
<th>9</th>
<th>12</th>
<th>15</th>
<th>18</th>
<th>20</th>
<th>24</th>
<th>30</th>
<th>40</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBC</td>
<td>4</td>
<td>6</td>
<td>8</td>
<td>12</td>
<td>18</td>
<td>24</td>
<td>30</td>
<td>36</td>
<td>40</td>
<td>48</td>
<td>60</td>
<td>80</td>
</tr>
</tbody>
</table>
4.2. Calculating Beer Colour

Now having gone through some of the complications of analysing colour it is worth considering our original question – How do you work out the colour of your beer?

For this calculation you can use either the EBC colour or the Lovibond colour of the malts that you want to use. The colour values of the malt that you are using should be clearly stated on the certificate of analysis that you asked for when you purchased the malt.

To estimate the colour of your beer you need to know the colour value of the malt that you will be using, the weight of malt and the volume of beer you want to make. Using this we can work out the Malt Colour Value or MCU.

Therefore going back to our original simple recipe where we were making 25 litres of beer at 5% abv using 100% ale malt.

The recipe calls for 4.6 kg of ale malt which has a colour of 7 EBC or approximately 3.5 Lovibond.

The calculation we use to work out the colour value for our beer is:

\[ \text{MCU} = \frac{\text{weight of malt (in lbs)} \times \text{malt colour (inLovibond)}}{\text{volume (in gallons)}} \]

To convert our recipe from kg and litres into US gallons and lbs we use the following conversion factors:

1 litre = 0.264172 US gallons
1 kg = 2.20462 lbs.

Therefore:

25 litres = 6.6 gallons
4.6 kg = 10.1 lbs

Therefore the MCU will be:

\[ \text{MCU} = \frac{10.1 \times 3.5}{6.6} \]

\[ \text{MCU} = 5.3 \]

To calculate this as an EBC colour you need to multiply the MCU by 1.97. Therefore an EBC colour for this recipe will be:

\[ \text{EBC colour} = 5.3 \times 1.97 \]

\[ \text{EBC colour} = 10.4 \]

There you have it, that is how we calculate the potential colour of beer. However, sadly it is not quite as simple as that.

What happens if we want to use different types of malt in our recipes and also use coloured malt?
The home-brewers guide to creating a beer recipe

In this case we have to work out the individual MCU for each malt type and then add them together.

Let’s take a look at the more complicated recipe we calculated which used ale malt, torrefied wheat and crystal malt.

If you remember for this recipe we required:

Ale malt = 3.9 kg (8.6 lbs)
Torrefied wheat = 0.5 kg (1.1 lbs)
Crystal malt = 0.25 kg (0.5 lbs)

For these individual ingredients the colour values are:

Ale malt = 3.5 lovibond
Torrefied wheat = 2 lovibond
Crystal malt = 140 lovibond

Therefore to calculate the MCU for each of these components we use the calculation below:

MCU = weight of malt (in lbs) x malt colour (in lovibond) / volume (in gallons)

For the ale malt this will therefore be:

Ale malt MCU = (8.6 x 3.5) / 6.6
Ale malt MCU = 4.6

For the crystal malt this will therefore be:

Crystal malt MCU = (0.55 x 140) / 6.6
Crystal malt MCU = 11.7

For the torrefied wheat this will therefore be:

Torrefied wheat MCU = (1.1 x 2) / 6.6
Torrefied wheat MCU = 0.33

The total MCU for the recipe is therefore:

Total MCU = 4.6 + 11.7 + 0.33
Total MCU = 16.6 Lovibond

Or as an EBC colour this will be:

EBC colour = 16.6 x 1.97
EBC colour = 32.8
Hopefully you have followed the calculation this far and you are happy with the colour value calculated.

There is one last thing to take into consideration and that is the simple issue that light absorbance is not linear so when we are measuring the colour with a spectrophotometer this need to be taken into account. The calculated value above would be fine if the colour of the beer was between 1 – 5 units on the SRM. However, between 6 – 8 SRM the estimate of colour starts to breakdown and we need to adjust for this. We therefore need to apply the Morey equation which is below:

\[ \text{Colour} = 1.4922 \times (\text{MCU}^{0.6859}) \]

Therefore if we insert our colour of 16.6 into this equation we get the following:

\[ \text{Colour} = 1.4922 \times (16.6^{0.6859}) \]

\[ \text{Colour} = 1.4922 \times 6.86 \]

\[ \text{Colour} = 10.2 \]

And as an EBC colour we again must multiply by 1.97.

\[ \text{EBC colour} = 10.2 \times 1.97 \]

\[ \text{EBC colour} = 20.1 \]

There we have it a simple, ok not so simple, calculation of how to measure the potential colour of your beer. Remember this value comes with some caveats which are:

1. The colour methods are not fantastic
2. The colour does not take into account the subjective quality of colour hue
3. The brewing process has an impact on colour. For example when you boil your wort the colour is likely to darken due to interactions between proteins and sugars to give highly coloured compounds.

Next up we will consider how to calculate the quantity of hops required to achieve a particular bitterness in your finished beer.
5. How do you work out the Bitterness value of your beer?

I hope that you have stayed with me so far.

It has been a long journey but hopefully you are undaunted and have picked up the basics of calculating a brewing recipe. If there is anything that you are unsure of, check back through the guide and work on a few examples for yourself, create some variables on the recipe above and see if you can calculate them out. If you are still unsure then be sure to visit www.homebrewtechniques.com and drop us an email with your questions.

The next thing that we need to consider is the bitterness of the beer that we want to brew. As you know the bitterness of beer is derived from the hops that we use. However there are a few things that we need to consider so that we can fully appreciate the complexities of hop bitterness. Apologies as this may all be familiar to you but I think it is worth just going over it and refreshing our minds.

5.1. What are hops?

Hops are hardy climbing herbaceous perennial plants growing rapidly during the spring and summer to a height of at least 16 feet (5 m). Although the plant itself is large the brewer only uses a very small part of it – the cone. For the brewer the important constituents of the hop, the resins and oils, are found in the lupulin glands at the base of the hop cone. The resins, and in particular the alpha-acids, are responsible for the characteristic bitterness. It is the oils which provide the wonderful hop aroma and are, for many, what defines the difficult to describe hoppiness of beer. The brewer will select hops on the basis of what they want them to do in their beer. Therefore hops fall into one of three groups depending upon whether they are high in alpha-acids and so good for bitterness, have a good oil composition so would be ideal for aroma or have a little bit of both. The three groups are defined as bittering hops, aroma hops and dual purpose hops. Therefore varieties such as Target and Admiral which contain high alpha-acid levels are classed as bittering hops whereas, East Kent Goldings which contains low levels of alpha-acids but has a good oil composition is an aroma hop.

The oil component of hops range from 0.03% to 3% of the weight of the hop cone, compared to the resins which can constitute up to 15%.

As mentioned above it is the alpha acids which give rise to the characteristic hop bitterness that makes beer so thirst quenching on a hot summers day. However, the alpha acids themselves are not bitter. For the bitterness flavor to occur the chemical structure of the alpha acids needs to be subtly altered in a process called isomerization and it is these iso-alpha acids that are bitter. As you know the process of isomerization is greatly enhanced when heat is applied and this is the reason why we add bittering hops in at the start of wort boiling.
Diagram above shows the isomerisation of hop alpha acids.

However, the process of isomerization during wort boiling is not a precise science and there are many things that can influence the isomerization process. For example the pH of the wort can greatly affect isomerization with a lower pH (<5.3) reducing isomerization and a higher pH (≥ 5.4) enhancing isomerization. Time in boil as well as the age of your hops and the actual alpha acid content can all give rise to wide variations in hop bitterness. Therefore once again when calculating hop bitterness please bear in mind that the number you calculate comes with a slight warning. That warning is that because of the imprecise nature of the brewing process that we are using the calculated bitterness value should be taken as a guide only. The only accurate way of calculating hop bitterness is via laboratory analysis but unless you have access to a fully equipped brewing lab a calculation will have to suffice.

With the warning out of the way let’s consider how we calculate the hop bitterness.

5.2. Equations, equations and more equations!
As you have found out so far from this guide us brewers like our equations and this is certainly true for calculating hop bitterness.

If you do an internet search for how to calculate hop bitterness you will find references to a number of equations. The main equations, most often cited in home-brewing publications, were derived by Rager, Tinseth and Garetz. Each calculates hop bitterness in terms of International Bitterness Units (IBU) in subtly different ways. For example the Rager equation is most often used in extract and partial mash brewing and takes into account the original gravity of the wort. It also seems to give IBU values higher than the other two equations.

The Tinseth equation is favoured by all grain brewers, produces lower IBU values than Rager but is perhaps considered to be the most accurate. We will therefore be using the Tinseth equation for calculating hop bitterness.

So what does the Tinseth equation look like? Well it is a bit of a beast so prepare yourself, the equation is:

\[
IBU = \left(1.65 \times 0.000125(G_{gravity} - 1)^{-1}\right) \times \left(1 - e^{-0.04 \times t_{min}}\right) \times \left(\frac{\alpha \%}{100} \times \frac{W_{oz} \times 7490}{V_{gallons}}\right)
\]
Now many home brewers will try and use this equation to get a figure for their IBUs but for me life is too short to worry about the 100% accuracy of the calculation. Therefore I would say please don’t worry about using the above equation because this can be greatly simplified as much of the calculation concerns working out the alpha acid utilisation. Please also bear in mind the only accurate way of determining the IBUs of your beer is by laboratory analysis.

Therefore for the purposes of our recipe I am going to use a much more simplified version of the equation which is:

\[ \text{IBU} = \frac{\text{Weight of hops} \times \text{Alpha acid} \% \times \text{Alpha acid utilisation}}{\text{Volume of wort in gallons} \times 1.34} \]

Or to make it simpler:

\[ \text{IBU} = \frac{W \times AA\% \times U}{V \times 1.34} \]

Where:

- \( W \) = Weight of hops
- \( AA\% \) = Hop Alpha acid content in %
- \( U \) = Hop utilisation
- \( V \) = Volume of wort in gallons

The alpha acid utilisation is very much a moveable feast as there are a number of things that can affect it such as pH and type of hops used i.e. whole hops or hop pellets. Generally the conversion of alpha acids to iso alpha acids is not very efficient so the utilisation is generally quite poor. A typical value for whole hops is 23% and for pellet hops is 30% and it is therefore worth trying these figures in your calculations.

Bearing this all in mind I think it would be sensible to try an example calculation to show you how it works.

Let’s go back to our original recipe for an ale at 5% abv with an OG of 1.050. In this instance I might decide to use 2 oz of whole hops with an alpha acid content of 5%, a utilisation of 23% and I have 25 litres (6.6 gallons) of wort.

Therefore:

\[ W = 2 \text{ oz} \]
\[ AA\% = 5\% \]
\[ U = 23\% \]
\[ V = 6.6 \text{ gallons} \]

Therefore IBU = \( \frac{2 \times 5 \times 23}{6.6 \times 1.34} \)

IBU = 230 / 8.844
The home-brewers guide to creating a beer recipe

IBU = 26

This is all very well but usually we would like to do the calculation around the other way so that we can work out the weight of hops required to give a certain IBU value.

The equation therefore needs to be re-arranged to calculate the weight of hops.

Therefore the re-arranged equation is below:

Weight of hops = (IBU x Volume of wort x 1.34) / (Alpha acid % x Utilisation)

Or

W = (IBU x V x 1.34) / (AA% x U)

Now we have the re-arranged equation let’s try another example. This time I would like to go mad and achieve a bitterness of 100 IBUs in my finished beer. I still want to make 25 litres (6.6 gallons) of a 5% abv ale however, this time I will use a higher alpha hop variety with an alpha acid content of 13% but instead of whole hops I will use pellets instead.

For this example my values are:

IBU = 100

W = ?

AA% = 13%

U = 30%

V = 6.6 gallons

Therefore the weight of hops I require is:

Weight of hops = (100 x 6.6 x 1.34) / (13 x 30)

Weight of hops = 884.4 / 390

Weight of hops = 2.3 oz

This example also illustrates the benefit of using hop pellets and a high alpha acid hop variety for bittering. If I was using my 5% alpha acid whole hops that I used in the first calculation I would need 7.7 oz rather than the 2.3 oz that I have just calculated.
6. **Summary**

Congratulations you have reached the end of this brief guide which aims to show you how to create a brewing recipe. You are now armed with all the necessary information that will help you create your own beer recipes. Ultimately I have tried to make this guide as simple as possible. To do this there are some assumptions that have been made, certainly with respect to the calculation of hop bitterness. Home brewing should be fun and accessible and I feel that if things become too scientific or complicated you lose some of that enjoyment. Therefore please forgive me for those areas where I have perhaps taken a brewing shortcut.

If you have any further questions or queries please go to [www.homebrewtechniques.com](http://www.homebrewtechniques.com) where you will find more tips and techniques to help you brew better beer.