

Diesel's Brewing Spreadsheet allows you to handle all the tasks of your brewing operation. Robust recipe formulation allows you to configure all the factors used in the equations, providing the brewer with the flexibility to modify the formulas based on his/her own system and experiences. Recipe storage and historical snapshotting are both achieved with the click of a button. Calendar planning shows the fermentation schedule of up to 7 recipes at a time. Inventory management is available not just for ingredients but for your Brewhouse, Brewpub and Packaging operations. Financial tracking and analysis of past purchases, and a separate financial sheet for planning future purchases are fully integrated with ingredient inventory management; with the click of a button you can add a recipe to purchasing, mark it purchased, update the inventory when a purchase is received or subtract a recipe from inventory once it is brewed. Additionally, you can click a button to export a recipe to a file with a specified name for sharing with friends, who can then import the recipe into their main Recipes file.

I initially began building this sheet for two reasons. First I was tired of using a bunch of software packages and spreadsheets to handle all my brewing tasks and wanted to combine it into one file. I almost did it. Instead, this is a package of two files. One is the main Brewing file and the other is where Recipes are stored. I did this because it keeps the Brewing file's tab list short enough to have all tabs displayed without scrolling. Second, I wanted to know what was going on in all the calculations and how certain results were determined. Since I built the sheet, I know it completely. I built this website in the hopes of making it as transparent as possible to others. Hope this helps, and let me know if you have any questions.

This spreadsheet was created in Microsoft Excel 2007, and it is designed for use on a widescreen (16:10) monitor running a 1680 x 1050 resolution; if you are on a different resolution or aspect ratio I recommend playing with the zoom to get the display the way you want it. Mac Excel 2008 should both work fine. Please send all questions, comments and suggestions to spreadsheet@dieseldrafts.com. OpenOffice and older versions of Excel please consult the FAQ.

The complete feature set for this spreadsheet includes:

- Worksheet – The soul of the spreadsheet, where the main action goes down.
 - Batch Size is set by desired packaged volume of beer. Includes adjustments for post fermentation trub & transfer losses, kettle transfer losses, wort contraction, hops absorption, boil off rate, grain absorption, lauter tun dead space, and kettle dead space
 - Mashing modes include Infusion, Decoction and Direct Heat. Predicts strike water volume & gravity, decoction or additional infusion volumes, mash out and sparge volumes. An indicator of total tun space required is given.
 - Grains are selected in a dropdown that is based upon the Grains tab, all attributes

- of the grains are pulled from there.
- MCU, SRM, GU, Adjusted GU (based on mash efficiency), Weighted Adjusted GU (if extract is added late) are all calculated based on the weight of the grain and it's properties on the grains tab. Extract GU Factor for weighting late additions to boil gravity is user configurable.
 - Hops are selected in a dropdown that is based upon the Hops tab, all attributes of the hops are pulled from there. AA% percentage can be calculated based on hops purchase date, storage method and storage temperature.
 - Utilization can be based on either Rager or Tinseth. FWH, leaf and pellet factors are user configurable. Boil gravity is the average of pre-boil and post-boil gravities.
 - Yeast are selected in a dropdown that is based upon the Yeast tab, all attributes except for inventory are kept on the Yeast tab.
 - Required Cell Count depends on the user configurable ale & lager factors and whether the recipe is set as an ale or lager as well as volume & gravity. Pitch volume depends on the type of yeast preparation and its cell concentration on the Tables tab.
 - Pressure & Priming Sugar are shown for desired level of carbonation. User must set serving temp and choose sugar type (pulled from a select set of entries on the Grains tab). Beer temperature is assumed to be the warmest the beer was during fermentation.
 - OG & FG in specific gravity and plato, ABV%, IBU, SRM, CO2, BUGU & BV are calculated for predicted and measured values and are comparable to two styles in a table. Measurements can be entered using either Specific Gravity or Plato. Styles can be referenced from BJCP or Brewers Association Guidelines.
 - Mash Water Adjustments are based on the concept of residual alkalinity and John Palmer's work. Predictions for adjusting pH, adding enough calcium and magnesium and achieving desired chloride to sulfate ratios are included. City or target profiles may be referenced in the table.
 - Water attributes used in water calculation are pulled from the Water tab.
 - Parti-gyle brewing mode will split the GU between the beers from the mash. The second beer's pre-boil volume is determined by the first beer's pre-boil volume & the parti-gyle ratio. Extracts and other ingredients added are specific to each beer, only mashed grains are split.
 - Macro buttons are available to:
 - (all macros work on Recipes file tabs as well)
 - Export the Worksheet to the Recipes file as a new tab or to overwrite an existing tab.
 - Export the Worksheet to a specified file for sharing.
 - Archive the Worksheet to a JPEG file.
 - Add the grains, hops and yeast in the recipe which are not currently in stock to the Purchasing tab.
 - Subtract the grains, hops and yeast in the recipe from the inventories on

- o the Grains, Hops and Lab tabs.
 - Toggle the Gravity Mode between Plato or Specific Gravity (so you can enter measurements either way).
 - Fix Names - If you open a Recipes file on its own, the lookups of grain, hops and yeast attributes will not work, clicking this button will fix that.
 - Reset the Worksheet to a clean starting position.
- o Printable Report in B&W.
- o Ample room for note taking.
- Calculators – A collection of calculators useful in a brewing operation
 - o Temperature, Volume, Mass & Pressure conversions
 - o Specific Gravity to Plato & the other way around
 - o Refractometer Correction based on starting & ending readings, calibration available with reference to a hydrometer
 - o Hydrometer temperature correction
 - o White Labs to Wyeast converter & vice versa
 - o Yeast Pitching Rate Calculator
 - o Yeast Propagation Calculator
 - o Weight of the Volume of a Liquid based on Gravity
 - o Beer Properties based on OG & FG: AA, RA, RE, ABV, ABW, Calories
 - o Beer Properties based on FG from Hydrometer & Refractometer: OG in Plato & SG, RE, ABV, ABW, Calories
 - o Hops Aging calculator for current AA%
 - o AAUs to Ounces
 - o IBU or Ounces based on the other
 - o % Lost based on Hops Stability Index
 - o Boiloff Rate
 - o Area & Perimeter: Rectangle, Circle, Triangle
 - o Surface Area & Volume: Rectangular Prism, Sphere, Cylinder, Cone, Dome, Pyramids 3 & 4 sided
 - o Unit prefix converter
 - o Grain color converter: EBC (old & new), ASBC/SRM, IOB
 - o Grain to Extract and Extract Equivalents
 - o Water Chemistry a la John Palmer
 - o Efficiency based on grains and measured gravities & volumes
 - o Efficiency based on measured gravities & volumes and inputted potential GU
 - o Recipe Scaling based on pounds or percentages, ounces or IBU
 - o Carbonation & Priming
 - o Electrical Heating
 - o Predicting BU required based on gravities and desired BU:GU or BV
 - o Mash Tun Space Required in metric or English
 - o Parti-gyle Adjustments to correct the first beer if it is off
- Calendar – great for planning a brewing schedule
 - o Calendar Display is set by choosing Month & Year

- Up to 7 brews can be displayed at one time, the Worksheet is always displayed
- Macro button will update calendar data from Recipes file
- User can select up to 6 recipes from the Recipes file to display in the calendar
- Calendar shows brew date, primary time, diacetyl rest, cold crash, conditioning and aging times and tap date
- Grains – inventory and grain attributes are stored here
 - Malt Name
 - Maltster
 - Country of Origin
 - Color (ASBC/SRM)
 - Dry Yield
 - Potential (calculated based on dry yield)
 - Stock in pounds
 - Price per pound
 - Notes
 - Priming Factor used for priming sugars
 - Link to store for purchase
 - All the above can be filtered
- Hops – inventory and hops attributes are stored here
 - Hop Type
 - Alpha Acid %
 - Description
 - Commonly used in styles
 - Possible Substitutions
 - Usage as aroma, bittering or dual purpose
 - Stock in ounces
 - Form as pellet or leaf
 - Price per ounce
 - % Lost
 - Date of Purchase
 - Link to Purchase
 - All the above can be filtered
- Yeast – Yeast attributes are stored here
 - Yeast Strain
 - Yeast Name
 - Low Fermentation Temp
 - High Fermentation Temp
 - Low Attenuation
 - High Attenuation
 - Flocculation
 - Alcohol Tolerance
 - Manufacturer's Description & Notes
 - Original Brewery

- Wyeast, White Labs Counterpart
- Price per package
- All of the above can be filtered
- Lab – Inventory of yeast cultures & lab equipment
 - Yeast Strain
 - Generation
 - Parent
 - Date
 - Storage
 - Quantity
 - Unique ID
 - All the above can be sorted
 - Equipment, Notes & Quantity
- Water – Brewery's water profile here is used for Worksheet
 - Brewing Cities' water profiles for reference
 - Alkalinity
 - Hardness
 - Calcium
 - Chloride
 - Chlorine
 - Magnesium
 - Sodium
 - Potassium
 - Iron
 - Manganese
 - Sulfate
 - pH
 - Bicarbonate
- Styles – Based on the BJCP 2008 Style Guidelines, data is used for reference in Worksheet
 - Style Name
 - Link to BJCP & Style #
 - OG range in SG
 - FG range in SG
 - OG range in Plato
 - FG range in Plato
 - ABV% range
 - IBU range
 - SRM range
 - CO2 Volumes range
 - BUGU average
 - BV average
- CO2 – a wide range chart

- Increments in variables are 0.1 CO2 volumes & 1 degree Fahrenheit
- Ranges are 32 to 80 degrees and 0.5 to 5 volumes
- Prints well onto 1 sheet if you have a color printer
- Tables – various reference tables used in Worksheet calculations
 - Yeast Starter Size – based on Jamil's chart in Brewing Classic Styles but this method of starter prediction is no longer used.
 - Yeast Source & Concentration
 - Chloride/Sulfate Balance for water calculations
 - Hops Storage Factors for hops aging calculations
 - Hops Aging Temperature Factors
 - Hops rate k constant based on percent lost
 - Approximate % Lost based on hops variety
 - Sizing Wire & Breakers for reference
 - SRM to RGB for reference
 - SRM to hexadecimal for reference
 - Hydrometer CF for reference
 - CO2 Volumes is residual CO2 in fermented beer
- Formulas - a reference of formulas used
- Brewhouse – inventory for the brewhouse
- Brewpub – inventory for the brewpub
- Packaging – inventory for packaging beer & keg tracking
- Library – inventory of the library
- Recipes – a tab for jotting down in plain text recipes as you receive them
 - Includes a link to launch the external Recipes file
- Purchasing – a financial sheet for planning purchases
 - Item, Price, Quantity, Total, Link, Notes and Category can all be filtered
 - Total Cost of sheet is calculated
 - Categorized costs shown are: equipment, hops, yeast, grain, books, glassware, artwork, memberships, shipping and uncategorized in case something is missing a category
 - Priority Purchasing total depends on the total price being bolded
 - Next Batch costs requires the total price to be italicized
 - Includes a mcmaster partnum link for planning mcmaster purchases
 - Macro button will move selected items to Financial tab when they are purchased
- Financial – a financial sheet for tracking and analyzing purchasing history
 - Item, Price, Quantity, Total, Link, Notes, Category and Date can all be filtered
 - Total Cost of sheet is calculated
 - Categorized costs shown are: equipment, hops, grains, yeast, other ingredients, ingredients combined, books, glassware, artwork, equipment & assests combined, memberships, chemicals, shipping annual average, batch average, unreceived orders and uncategorized
 - Items not yet received are italicized when moved from the Purchasing tab.
 - Macro button will mark items received and add them to the inventory if they are

hops, grains or yeast

- Notepad – a plain text sheet for keeping random notes

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The Worksheet is the soul of this spreadsheet so let's really delve into everything that is going on in there.

Note the paradigm here, the light grey & heavy bordered cells are pieces of data for user entry. The dark grey cells are labels while the medium grey cells are calculated values. Obviously the blue background and yellow bolded text is for titles. I have done this throughout the spreadsheet. The Worksheet, Calculators and Calendars are locked except for the cells that are for user entry in order to prevent accidental change. To unlock the sheets if you want to edit them, like all sheet the passwords are "unlock".

Recipe Name & Overview

This is the first section in the Worksheet. The time is calculated from the mash step times, the boil time and all the time factors. The cost is the sum of the hops, grains & yeast costs from the entire brew session, including any parti-gyle ingredients. Incremental costs for hops, grains & yeast are set in their respective tabs. The fermenter clear date is the brew date plus primary, diaceytl rest and cold crash days. The drink date is the brew date plus the sum of all the fermentation days.

Recipe	Brew Date	Assistant	Time	Cost	Fermenter Clear	Drink Date
			7.75	\$0.00		

Beer Properties & Style Guidelines

Here you can choose two different styles to use as a reference when composing your recipes. All the estimated values will be displayed once all the dependent variables are available. The style dropdowns will initially open in the middle of the list. Scroll up for BJCP Style Guidelines, or scroll down for the Brewers Association Style Guidelines.

Style & Beer Properties	OG	FG	OG °P	FG °P	ABV%	IBU	°SRM	CO2	BUGU/BV
Primary Style Dropdown	∞ ∞	∞ ∞	∞ ∞	∞ ∞	∞ ∞	∞ ∞	∞ ∞	∞ ∞	∞ ∞
Estimated									
Measured						Calories per 12oz:			
Secondary Style Dropdown	∞ ∞	∞ ∞	∞ ∞	∞ ∞	∞ ∞	∞ ∞	∞ ∞	∞ ∞	∞ ∞

Batch Size & Volumes

Next we have the Batch Size section. The recipe is designed on the basis of choosing your Packaged Volume. You also set the losses post fermentation and transfer losses from the kettle, but kettle losses factor is in the equation factors. Fermentation Volume is the sum of packaged volume plus the fermenter losses. Post Boil Volume is the sum of fermentation volume, transfer losses from the kettle, kettle dead space and hops absorption. Pre Boil Volume is the post-boil volume plus contraction losses and the product of the boil off rate and boil time.

Batch Size, Volumes, Losses & Infusions/Decotions			
Packaged Beer Volume	10	0.25	Fermenter Transfer & Trub Losses
Fermentation Volume	10.25	0.25	Transfer Losses from Kettle
Post Boil Volume	10.75	12.5	Pre Boil Volume
Unused Space	-	-	Sparge Water 2 Volume
Strike Water 3 Volume	-	6.14	Sparge Water 1 Volume
Strike Water 2 Volume	-	6.39	Mash Out Volume
Strike Water 1 Volume	0.00	171 °F	Strike Water Temperature °F

The second area in the section separated by the thick horizontal line is the mash & sparging volume section. The layout of this area is dependent upon mash type selected in the equation factors. First let's talk about Infusion Mashing. The Strike Water 1 Volume is just the total grain weight times the mash thickness divided by 4. The Strike Water Temperature calculation is more complex but it is detailed in John Palmer's How to Brew. Similarly the formulas for additional Strike Water Volumes are pulled from Palmer's book, and are dependent upon the Strike Water Temperature factor. The Mash Out volume is to compensate for grain absorption and will get the first runnings up to the proper volume. Sparge Water Volumes will be equal, and 2 or 3 runnings can be configured.

When Decoction Mashing is selected the layout of the area changes. Instead of strike water volumes we now have Decoction Volumes. They are calculated based on the Decoction Temperature set in the equation factors. A triple decoction is possible for a 3 step plus a mash out. Initial strike water and mash out and sparge water volumes are still calculated the same. In a Direct Heated Mash there are no decoction or infusion volumes to calculate.

Decoction Volume 3	0.00	-	Sparge Water 2 Volume
Decoction Volume 2	0.00	12.53	Sparge Water 1 Volume
Decoction Volume 1	0.00	6.39	Mash Out Volume
Strike Water 1 Volume	0.00	171 °F	Strike Water Temperature °F

Mashing Schedule & Measurements

The Mash Schedule is configured in this section. Only the Tun Space Required is a derived value, everything else is a user input. The Mash Efficiency is the predicted value based on your previous measurements. The second & third steps are grayed out in this image because the mash is configured for only one step. When a 2 step or 3 step mash is selected the appropriate cells will light up. The Boil Time set here is a factor in calculating the gravities and first wort hopping utilization.

Mash Efficiency, pH, Temperatures & Timing			
Mash Step Time 1		150 °F	Step Temperature °F
Mash Step Time 2			Step Temperature °F
Mash Step Time 3			Step Temperature °F
Mash Efficiency	75%	0.0	Tun Space Required
Boil Time	90		Measured Mash pH

The the left of the Mash Schedule is where you enter your measured values for the mash & volumes. The Brewhouse Efficiency is calculated based on the Final Beer Volume. Use the Mash Efficiency calculated here for predicting future batches.

Measurements: Efficiency, Temp & Volume			
Total Runoff Volume			Mash Temp 1 °F
Total Runoff Gravity			Mash Temp 2 °F
Mash Efficiency			Mash Temp 3 °F
Fermenter Volume			Kettle Volume
Brewhouse Efficiency			Final Beer Volume

Fermentation Schedule

Not all of the fermentation stages need to be filled in. As soon as one of the Days values is entered the date calculations at the top will work, and as soon as one of the temps is filled the Priming Sugar calculation will work. These timeframes are also used for the Calendar tab allowing you to plan your brewing schedule to optimize fermenter times & cold storage.

Fermentation Schedule	Temp °F	Days
Primary Fermentation		
Diacetyl Rest		
Cold Crash		
Secondary Conditioning		
Aging (includes carbonating)		

Carbonation

Forced Carbonation Pressure is based upon the Serving Temp & desired CO2 Volumes. The Beer Temperature is the highest temp reached in the fermentation process. The Priming Sugar cell is a dropdown to choose which type of sugar you will use to prime and the result is measured in grams. You can set the Beer Gas Percentage of CO2 in the case that you will be serving with a beer gas mixture. Set to 100% for pure CO2.

Carbonation		
CO2 Volumes		
Serving Temp °F		
Beer Temperature °F	0 °F	
Priming Sugar	grams	
%CO2 of Beer Gas	100%	PSI

Grains, Extracts, Adjuncts, Spices, Etc.

This is the Main Ingredients Section. The first column is where you choose the ingredients. The data is pulled from the Grains tab. Enter your grains, extracts, sugars, ciders, honey and all fermentables here. Also tracked here are boil ingredients like Whirlfloc, spices, yeast nutrients, etc. The pounds column is pretty straight forward, however for the other types of ingredients be sure to use consistent units, like 1 Whirlfloc tablet, or 1 oz of coriander. This will keep the cost calculations accurate. In order to keep mash & boil calculations from

getting messed up use the Late column to set how the ingredient is treated. Mash is obviously for grains that will be put into the mash. No means the ingredient is not a late addition to the boil; this is primarily for extract that is added at the beginning of the boil for gravity calculations. Yes is for stuff you will add the boil late, and it will affect gravities based on the Extract GU Factor. Skip is used for ingredients that will be added post-boil. Steep is for when you are making an extract batch and will steep specialty grains, they will have no impact on OG.

Malt, Extract & Adjuncts	Maltster	Origin	Pounds	%Weight	°L / MCU	Potential	GU (Adj.)	Late?
								Mash
								No
								Yes
								Skip
								Mash
								Mash
								Mash
								Mash
								Mash
								Mash
								Mash
								Mash
Cost: \$0.00			0		0			0

Pounds are only added up for the mash, the MCU are summed but Morey's formula is used for predicting SRM of the beer. GU is the total potential gravity units provided by the grain, Adjusted GU is the total potential times the predicted mash efficiency, and the sum below the Late column is Weighted Adjusted GU which takes into account the late extract addition. BTW, I use Yes if I'm dumping sugar into the boil at like 15 minutes. The individual values for each WAGU is actually hidden in the spacing between the Malt & Hops sections.

If Parti-gyle Brewing is enabled, then the mash ingredients will be used to calculate the runnings gravities, and the extract will be divided up between the brews based on the ratio & the parti-gyle tables. Then the non-mash fermentables added in this section will affect the first beer based on its Yes, No, Skip setting. Just like I hid some individual values before, there are values way over on the right if parti-gyle is used that are out of view.

Hops Additions

The Hops section is fairly straight forward but there are some special cases. The dropdown is driven by the varieties in the Hops tab. If Hops Aging is enabled, then the AA% displayed will be based on the Hops

Storage Method, Temperature and Date Purchased. At the bottom of the Utilization column is a dropdown for choosing between the Tinseth and Rager methods. Utilization factors in the average of pre & post-boil gravities, whether the hops are leaf or pellet and if the hops are first wort hops. In order to mark a hops as First Wort Hops in the time cell enter "FWH". Similarly for Dry Hopping enter "dry hop".

Hops	% AA	Ounces	Time	IBU	Utilization
Cost: \$0.00					Tinseth

Originally I had the option of composing the recipe in either Ounces or IBUs (with the ounces calculated for your additions). When I added the hop absorption factor I ran into a situation where I have a circular reference with the IBUs. If I can resolve this circular reference then the feature will be restored.

Yeast & Starter

For the sake of the width of this webpage I'm splitting the Yeast section into two screenshots.

Yeast	Temperature	Attenuation	Flocculation
Ale	Required Cell Count:		Yeast Preparation:
Cost: \$0.00			

I built the space for two yeast strains to be listed, for those times when you primary with one but the finish it

off with another. The dropdowns are pulling their data from the Yeast tab. Choose Ale or Lager in the dropdown to get the appropriate Required Cell Count which is dependent up on the Original Gravity & Fermentation Volume, as well as the ale & lager factors. The Starter Volume is predicted based the Yeast Preparation's cell density in the Tables tab, as well as the required cell count. The # of Packages is for calculating the Cost. Note that the average attenuation for the strain is used when calculating Final Gravity. If two strains are used the one with the higher average is used.

Styles & Notes					Name
Stirplate Starter	# of Packages:	<input type="text"/>	Starter Volume (mL/vials):	<input type="text"/>	Dry Yeast (grams): <input type="text"/>

Notes

There are 3 sections for taking Notes. One after the main recipe items, one after the water chemistry and one after the parti-gyle section.

Notes

Water Chemistry - Adjusting Mash pH & Minerals

Again I'm breaking up the Water Chemistry section for the sake of the width of this webpage.

The Source Water Attributes are pulled from the Water tab. The Alkalinity is a dropdown allowing you to work in Alkalinity as CaCO₃ or Bicarbonate (ppm) modes. The Target Water Attributes are available for you to

enter optionally as a reference. The Diluted Water Attributes shows the results of dilution and the Final Water Attributes are what your resulting mash water will be. If a final value is too low it will be highlighted dark grey, if it is too high it will be highlighted in light blue. Next to the Final column is a dropdown for optionally referencing a specific Brewing City Water Profile. The Added column shows how much of each attribute has been added with salts or acids. The additions of gypsum or Epsom salts for a bitter balance or calcium chloride for a more malty balance are just suggestions for how to with the Chloride/Sulfate Balance if it is not already how you want it.

Source	Water Attributes	Target	Diluted	Final	Added
6.7	Calcium (ppm) (50-150)		7	7	0
2	Magnesium (ppm) (10-30)		2	2	0
13.15	Alkalinity as CaCO3		13	13	0
9	Sodium (ppm) (0-150)		9	9	0
14	Chloride (ppm) (0-250)		14	14	0
5	Sulfate (ppm) (bitter 50-150, 150-350 very bitter)		5	5	0
7.3	Water pH	Distilled Dilution:	0%		
6	Effective Hardness		6	6	0
7	Residual Alkalinity as CaCO3		7	7	0
6	Estimated Low SRM		6	6	Add gypsum or epsom salt for a more bitter balance.
11	Estimated High SRM		11	11	
Very Malty	Chloride to Sulfate Balance		Very Malty	Very Malty	

The suggestions for increasing adjust mash pH will appear in the lower right hand part of the page. If Magnesium is low an appropriate amount of Epsom Salt will be suggested to achieve 10 ppm of Magnesium for yeast health. If Calcium is low a notice will be displayed. The additions are not suggested to hit a specific Residual Alkalinity, but rather to get within the suggested range based on the SRM of the beer. Enter how much of each salt you plan to use to the left of the salt name measured in grams.

		Salt & Acid Additions				
		2.74	Conc. %	Used	Estimated	Acid Type
	Chalk CaCO ₃					
	Gypsum CaSO ₄ *2H ₂ O	2.74	37%		1	Hydrochloric
	Calcium Chloride CaCl ₂ *2H ₂ O	2.28	88%		0	Lactic
	Epsom Salt MgSO ₄ *7H ₂ O	1.79				
	Baking Soda NaHCO ₃		acid additions are in mL			
	Table Salt NaCl		salt additions are in grams			
0	Added Bicarbonates HCO ₃	Add some epsom salt for magnesium. Add gypsum or calcium chloride to assist mash enzymes but watch Cl/SO ₄ balance, or use chalk if pH is low.				
0	Contributed Hardness					
0	(low) Missing Additional Residual Alkalinity (high)	0	Mash pH too high. Lower with calcium chloride or gypsum. Do not use chalk even if calcium levels are low. Gypsum is better for malty beers, calcium chloride for lagers and bitter beers.			
0	(low) Total Additional Residual Alkalinity Needed (high)	0				
80	(low) Missing Additional Effective Hardness (high)	21				
80	(low) Total Additional Effective Hardness Needed (high)	21				
-73	Target Low RA	Target High RA				

Parti-gyle Brewing Sessions

Once again I'll split the Parti-gyle screenshot for the sake of the width of this page.

The Parti-gyle Section is basically just a condensed version of the main sheet. Mash ingredients here are not affected by the mash efficiency but instead by the Encore Efficiency. This is for when you throw in some grains after the first runnings. Extracts and other non-mash fermentables and ingredients entered here affect the second boil and resulting beer. The costs here are included in the total sum, both here and at the top. The Volumes are completely derived from the First Beer Pre Boil Volume and all the various losses & dead space factors, etc.

Parti-gyle Second Runnings Beer										
Recipe	Cost	Fermenter Clear	Drink Date	Packaged Volume					Pre Boil Volume	
	\$55.14			Fermentation Volume					Post Boil Volume	
Style & Beer Properties	OG	FG	OG °P	FG °P	ABV%	IBU	°SRM	CO2	BUGU/BV	
Primary Style Dropdown	∞ ∞	∞ ∞	∞ ∞	∞ ∞	∞ ∞	∞ ∞	∞ ∞	∞ ∞	∞ ∞	∞ ∞
Estimated							3			
Measured							Calories per 12oz:			
Secondary Style Dropdown	∞ ∞	∞ ∞	∞ ∞	∞ ∞	∞ ∞	∞ ∞	∞ ∞	∞ ∞	∞ ∞	∞ ∞
Malt, Extract & Adjuncts	Maltster		Origin	Pounds	%Weight	°L / MCU	Potential	GU (Adj.)	Late?	Hops
									Mash	
									Mash	
									Mash	
									Mash	
									Mash	
									Mash	
									Mash	
									Mash	
									Mash	
									Mash	
									Mash	
Cost: \$0.00			0		2		(0)	0		
Yeast	Temperature	Attenuation	Flocculation			Styles				
Ale	Required Cell Count:		Yeast Preparation:			Stirplate Starter		# of Packages:		
Cost: \$0.00										

The dropdown to Enable Parti-gyle Brewing is on the far right at the top of the section. Next to it is the Parti-gyle Volume Ratio which can be either 1:1 or 1:2. In this screen shot you can see when I had the feature for composing via Ounces or IBU, but currently that feature is disabled.

is defined as the printable area of the Worksheet, therefore, you can just choose print from the menu and only black & white report will be printed. I didn't bother taking a screenshot of this.

Macros: Recipe Exports, Inventory Managment, Toggle Gravity, Etc.



There are 5 Macro Buttons and all of them work from tabs in the Recipes file as well as on the Worksheet.

The first button will Export the Worksheet to the Recipes file. You will be prompted for a tab name in the Recipes file. If the tab name does not exist a new tab will be created. If the name does exist you will be asked if you want to overwrite the existing tab. If you cancel at any time the export will be aborted. If the Recipes file does not exist, you will be asked if you want to create it. This button is also used to "Import a Shared Recipe".

If you have a shared recipe file created by the "Export for Sharing" button, then just put that file into the same folder as your Brewing & Recipes files, open it and click this button to "import" the recipe into your main Recipes file. Let me know if this doesn't make sense.

The second button allows you to Export a Recipe for Sharing. It works exactly like the first button, except that it asks you for a target filename first. You only need to give the file name not the extension as .xlsm will be added to whatever you specify. You can export as many recipes into a file for sharing as you wish. If someone gives you a file that they created with this button, you can place it in the same folder as your Brewing & Recipes files and then use the first button, "Export to Recipes", in order to "import" a recipe into your main Recipes file.

The third button will Archive the Worksheet to a JPEG image file. You will be prompted for a file name. Enter a name without the file extension, meaning "Pale Ale" instead of "Pale Ale.jpg" The JPEG can be saved directly to a subfolder in the structure by entering a name like "Recipes\Brown Ale". If the folder does not exist, you will be asked if you want to create it.

The fourth button will Add the Ingredients to the Purchasing tab. First it will check to see if there is ample stock. Only missing items are added to the Purchasing tab, or if there is not enough in stock, the difference will be ordered. The order will be italicized as the "Next Batch" sum on the Purchasing tab.

The fifth button will Subtract the Ingredients from the Inventory. The inventories affected are the Grains, Hops and Lab tabs. If there is some of an ingredient in stock but not enough, it will be zeroed out.

The sixth button will Toggle the Gravity Mode. It will change the OG & FG columns at where the Style, Estimated and Measured values are displayed. Use the toggle to chose whether you will be entering your measured values in Specific Gravity or Plato.

The seventh button will Fix the Name References on the current sheet to match those on the Worksheet in the Brewing file. When you open the Recipes file by itself, the lookups for grains, hops, yeast, etc. will not work. This button will temporarily open the Brewing file so that the data in recipes will be accurate. It will also update all names that reference the Brewing file to match the references currently used on the Worksheet tab. Extremely useful in development, but maybe less so in production.

The eighth button is the Reset Worksheet button. Like all buttons a confirmation dialog allows you to cancel out of the macro. This button only works on the Worksheet tab in the Brewing file, it will not reset a tab in the Recipes file. This is a safety precaution to prevent losing a recipe. The export function can overwrite a tab so there is no need to reset it first.

User Configurable Equation Factors

Equation Factors	
0.04	Wort Contraction
0.43	Contraction Losses
0.015	Boil Off Rate
0.20	Grain Factor
0	Grain Absorption
11.25	HopAbsorptionFact.
0	Hops Absorbtion
0.13	LT Dead Space
0.25	Kettle Dead Space
Direct Heat Mash	
1	# of Mash Steps
No	3 Runnings?
70 °F	Grain Temp
5 °F	Temp Loss to Tun
0.2	InfusionTempFactor
200	Factor Not Used
170	Mash Out Temp
1.00	Mash Thickness
1.00	Mash 2 Thickness
1.00	Mash 3 Thickness
0	Total Mash Volume
1.000	Pre-Boil Gravity
1.1	FWH Adjustment
1	Leaf Hop Factor
0.92	Pellet Hop Factor
No	Use Hops Aging

Sealed in barrier, no O2	
20 °F	Hops Temperature
0.2	Extract GU Factor
60	Preparation Time
25	Milling Time
60	Strike Heating Time
15	Dough In Time
60	Sparge Time
	Sparge 2 Time
	Sparge 3 Time
20	Chill Time
15	Transfer Time
30	Aeration Time
90	Cleaning Time
100	Yeast Cells per Vial (billions of cells)
0.75	Ale Pitch Rate
1.5	Lager Pitch Rate
20	Dry Yeast Cell Count (billions/gram)

The Wort Contraction factor is used in calculating the Contraction Losses which are used when calculating Post Boil Volume from Pre Boil Volume.

The Boil Off Rate is also used in calculating Post Boil Volume. You can use the calculator to figure out your boil off rate.

The Grain Factor affects Grain Absorption which is used for Mash Out & Sparging Volumes.

HopAbsorptionFactor only applies to Leaf Hops and affects Hops Absorption which of course affects Fermenter Volume.

LT Dead Space is for the Lauter Tun and affects Mash Out & Sparging Volumes.

Kettle Dead Space affects Fermentation Volume.

Infusion Mash is the Mash Type Dropdown which sets the Mashing Mode.

The # of Mash Steps enables calculations for the specified number of steps.

3 Runnings configures whether 2 or 3 runnings will be used.

Grain Temp is the temperature of your grain storage for Strike Water Temp calculation, which is also affected by the Temp Loss to Tun and InfusionTempFactor.

The Infusion Temperature is also the Decoction Temperature (label changes based on mode) and it

affects Additional Infusion Volumes or Decoction Volumes.

The Mash Out Temp affects the Third Decoction Volume.

The Mash Thickness affects various Volumes and allows you adjust for Multiple Infusions.

Total Mash Volume does not include space for grain, it is just Mash Water Volume.

Pre-Boil Gravity is the predicted value until the user enters the measured value and then that is used.

FWH Adjustment, Leaf Hop Factor and Pellet Hop Factor all affect Utilization.

Use Hops Aging enables the adjustment of AA% based on hops storage and purchase date.

The Sealed in barrier, no O2 is the Hops Storage Method.

The Hops Temperature is the temperature at which they are stored.

The Extract GU Factor is used for Weighting the Adjusted GUs for Pre-Boil Gravity.

The various times just allow for you to predict your workload, you can rename them as you like.

Yeast Cells per Vial is no longer used, hmmm.

Ale & Lager Pitch Rates are in millions of cells per milliliter.

Dry Cell Count is used for determining how many grams are needed.

Parti-gyle Factors	
12.5	Total Runoff Volume
0	Total Mash Color
0	First Beer MCU
0	Second Beer MCU
	Total Mash Gravity
0	First Beer Mash GU
0	Second Beer Mash GU
	Pre Boil Gravity PG
15%	Encore Efficiency
	ContractionLossesPG
0	HopsAbsorptionPG
0.02	Boil Off Rate PG
0.25	Kettle Dead Space PG
0.25	Kettle Transfer Losses
0.25	Fermenter Losses
90	Total Boil Time PG
	Chill Time PG
	Transfer Time PG
	Aeration Time PG

Parti-gyle Factors are only used when Parti-gyle Brewing is Enabled.

Total Runoff Volume is pretty obvious.

Total Mash Color is MCU, which is then split based on the Tables into First Beer & Second Beer MCU.

Total Mash Gravity is used for doing the Tables look up to get the split GU.

Pre Boil Gravity PG is the Second Beer's Pre Boil Gravity.

Encore Efficiency affects the GU from any grains tossed into the mash after the first runnings.

The ContractionLossesPG isn't actually used... hmmm.

The HopsAbsorptionPG uses the same factor, and is the volume for only Leaf Hops.

Boil Off Rate PG because you probably will use a separate system for the second beer.

Same with Kettle Dead Space PG, Kettle Transfer Losses and Fermenter Losses.

Total Boil Time PG is needed for Utilization of FWH & Gravity calculations.

The Calculators tab contains a collection of tools that are useful in a brewing operation.

The first column contains a set of conversion calculators. The usage of each is the same. You enter the value in the light grey box and the conversions are displayed to the right.

Temperature Conversions			
Farenhieght	is equal to	Celsius	Kelvin
212.0 °F	=	100.0 °C	373.2 K
Celsius	is equal to	Farenhieght	Kelvin
100.0 °C	=	212.0 °F	373.2 K
Kelvin	is equal to	Celsius	Farenhieght
373.2 K	=	100.0 °C	212.0 °F

Mass / Weight Conversions			
Ounces	Grams	Pounds	Kilograms
88	2494.758	5.5	2.494745
Pounds	Kilograms	Ounces	Grams
1	0.45359	16	453.59232
Grams	Ounces	Kilograms	Pounds
50	1.760563	0.05	0.1100352
Kilograms	Pounds	Ounces	Grams
2.5	5.5	88	2500

Volume Conversions			
Gallons	Liters	Barrels	fl. Oz
0.2	0.757	0.0064516	25.6
Liters	Gallons	fl. Oz	Pints
3	0.792602	101.4531	6.340819
fl. Oz	mL	Gallons	Liters
22	650.617	0.171875	0.6505469
mL	fl. Oz	Gallons	Pints
750	25.3575	0.1981055	1.5848438
Barrels	Gallons	Liters	Pints
1	31	117.335	248

Pressure Conversions			
PSI	atm	kPa	bars
14.7	1.000276	101.32269	1.0135356
atm	PSI	kPa	bars
1	14.696	101.295	1.01295
kPa	PSI	atm	bars
1000	145.08	9.869	10
bars	PSI	atm	kPa
25	362.5965	24.68	2500

At the top of the next column are a set of calculators useful for dealing with gravity measurements. Conversion between Specific Gravity & Plato usage should be straight forward. The Refractometer Correction used for figuring out the ending gravity from just refractometer readings. If you have a calibrated hydrometer you can correct your calibrate your refractometer. The Hydrometer Correction calculator currently only supports adjusting hydrometers that are calibrated at 59 °F.

Specific Gravity ↔ Plato		
SG	converts to	°P
1.093	=	22.2
°P	converts to	SG
14.8	=	1.060

Refractometer Correction	
Starting Brix Reading	14.3
Starting Gravity	1.058
Ending Brix Reading	6.5
Ending Gravity	1.006
Apparent Extract	1.5
Refractometer Calibration	
Calibrated Hydrometer SG	
Refractometer Brix Reading	
Refractometer Correction Value	1
blank the values if you don't perform calibration	

Hydrometer Correction		
Sample Temp	40 °	Fahrenheit
Calibration Temp	59 °	Fahrenheit
Measured Gravity	1.056	SG
Actual Gravity	1.055	SG
multiple calibrations not yet supported		

Yeast Pitching Rate	
Yeast Preparation	Stirplate Starter
Wort OG in °Plato	14.1 °
Wort Volume (gal)	10.5
Ale or Lager?	Lager (1.5 mcpmLpdP)
Desired Cell Count	841 billion
Pitch Volume (mL)	3362
White Labs/Wyeast, enter # of packages for Volume	

The Yeast Pitching Rate calculator is based on the data posted by MB Raines on the Maltose Falcons site. The Yeast Preparation dropdown determines the cell concentration of the culture you are preparing. Pitching rate is determined by the Original Gravity & Volume of the wort as well as if the beer is an ale or lager.

The Yeast Propagation calculators allow you to plan the growth of your culture. The calculators are divided top & bottom. The top one allows you to work backwards from what your required cell count is going to be. After setting the cell count & yeast preparation the Pitch Volume will be displayed. You can enter your

starting culture size to figure out how many cells you have to begin with. Then you can play with the growth factors to figure out how big each step will be.

Yeast Propagation							
Required Cell Count	800	billion	1600	Step	400	2	Growth Factors for each step affect growth to the next step.
Yeast Preparation	Stirplate Starter		800	Step	200	2	
Pitch Volume	3200	mL	--	Step	--	2	
Culture Size (bil cells)	1	100		Step			
Starting Culture	White Labs Vials			Step			
calculates backwards from required cell count			mL		bil cells		
Culture Size (bil cells)	1	100	1600	Step	400	4	Growth Factors for each step affect growth to the next step.
Starting Culture	White Labs Vials		3200	Step	800	2	
Required Cell Count	841	billion		Step			
Yeast Preparation	Stirplate Starter			Step			
Pitch Volume	3364	mL		Step			
calculates forwards from starting culture			culture size/pitch volume = WL/WY vials/packs, wort mL, slurry grams				

The bottom calculator is for working forwards from a starting culture. You can set the required cell count and yeast preparation to know how big you need to get, and you starting culture type and size and then play with the growth factors to get the step sizes you want.

The various attributes can be calculated for your beer based on either the Original Gravity and Final Gravity measurements, or the Final Gravity measurements of a both a hydrometer & refractometer.

Beer Properties							
OG °P	FG °P	AA	RA	RE °P	ABV	ABW	Calories
19	5.6	71%	58%	8.0	7.4%	5.9%	262
FG Hyrdro	FG Refrax	OG °P	OG SG	RE °P	ABV	ABW	Calories
1.007	6.5	14.3	1.058	6.4	6.7%	5.1%	215
calories are per 12 fluid ounces							

A handful of useful calculators include figuring out the weight of a liquid by its gravity, converting to or from base units, figuring out your boil off rate for the Worksheet's equation factor, and finding the counterpart to a White Labs or Wyeast strain.

Weight of a Volume of Liquid			
fl. Oz	SG	gives us	Ounces
512	1.093	→	582.00
Gallons	SG	gives us	Pounds
11	1.093	→	100.031

Boiloff in Gallons/Minute			
Starting Volume	Ending Volume	Boil Time	Boiloff Rate
6.5	5.5	60	0.017

Unit Prefix Converters		
Prefixed	Remove Unit Prefix	Base Units
15	kilo	15000
Base Units	Add Unit Prefix	Prefixed
3785	kilo	3.785

top calculator multiplies by 10^{power}, bottom divides

White Labs ↔ Wyeast	
Yeast Strain	Counterpart
White Labs WLP007	Wyeast 1098

For hops calculations there are a trio of tools. The Hops Aging calculator allows you to input the AA% of your hops & their % Lost along with your storage methods. If you don't know the % Lost of your hops, you can use generic values for a variety in the second calculator. If a hops you purchased lists a Hops Stability Index (HSI) this can be converted into % Lost. If recipe uses AAU you can convert that into ounces. The IBU Calculators interact. The four values of AA%, Time, Gravity & Volume are used by both, setting the Ounces will calculate IBU and setting the IBU will calculate Ounces.

Hops Aging						
AA%	% Lost	Days	Temp	°F	Storage Methods	AA% Now
4.80%	50%	1850	10 °		Sealed in barrier, O2 present	1.42%
if % left is given subtract it from 100 for % lost, if HSI is given use converter below						
Hops Variety	AA%	Temp	°F	Days	Storage Methods	AA% Now
Tettnang Tettnanger	4.80%	10 °		365	Sealed in barrier, no O2	4.23%
if hops stability is unknown use this calculator for generic varietal values						

AAUs to Ounces of Hops			
AAUs	AA%	requires	Ounces
15	8.90%	→	1.69
IBU Calculators			
AA%	Time	Ounces	IBU
8.9	60	2	25.2
Gravity	Volume	IBU	Ounces
1.052	12	25.2	2.00
HBUs = AAUs		Tinseth used for IBUs	

HSI to % Lost		
HSI	equals	% Lost
0.7	=	49%
converter needs verification		

The Dilution calculator will give you the final volume & gravity of two mixed liquids.

Dilution					
Volume 1	Gravity 1	Volume 2	Gravity 2	Volume	Gravity
3	1.050	4	1.014	7	1.023
volumes in gallons, gravities in specific gravity, 1.000 for water					

The Carbonation & Priming calculators are down low near the bottom of the sheet. Setting the Serving Temp & Desired CO2 Volumes will calculate the Forced Carbonation Pressure. If %CO2 is left blank, 100% is

assumed. Setting the Volume of Beer, Temperature of Beer, Priming Sugar Type and Desired CO2 Volumes will calculate the required grams of sugar to carbonate.

Carbonation & Priming					
Volume of Beer	gallons	5	Serving Temperature	39	%CO2 of Gas
Temperature of Beer	°F	38	Desired CO2 Volumes	2.9	100%
Corn Sugar (dextrose)		91.0	Force Carbonation Pressure	16.01	0% N2
use grams for sugar, and PSI for pressure, only works if priming factor is set for sugar					

Grain Color		
EBC	converts to	ASBC
17.5	=	9
ASBC	converts to	EBC
8.4	=	17
IOB	converts to	ASBC
17	=	8
EBC (old)	converts to	ASBC
17.5	=	7
ASBC	converts to	EBC (old)
8.4	=	21
use old EBC for references prior to 1991		

There are a couple of Grain calculators. The first shown on the right will convert between the various grain color systems. ASBC is the same thing as SRM. EBC recently changed their method so both converters are given.

The second calculator gives approximate conversions between extract types and from grains to extracts.

Extract & Grain			
DME	0.8	LME	1.00
LME	1	DME	0.80
Grain	1	LME	0.75
Specialty	1	Extract	0.89
converters need verification			

There are 2 Geometry tools. The first is for two-dimensional shapes and will calculate Area & Perimeter. The second is for three-dimensional shapes and will calculate Surface Area & Volume.

Area & Perimeter					
Shape	Height or Radius	Width or Base	Third Side	Area (unit ²)	Perim. (unit)
Rectangle for squares	1	2	N/A	2	6
Circle	1	N/A	N/A	3.1416	6.283185
Triangle use side lengths	3	2	2	1.9843	7
if triangle area reads N/A the triangle dimensions are not possible					

Surface Area & Volume					
Shape	Height	Width or Base	Length or	Surface Area	Volume
Rectangular Prism	1	2	3	22	6
Sphere	enter radius:		1	12.566	4.18879
Cylinder	5	N/A	2	87.965	62.83185
Cone (right circular)	4	N/A	3	75.398	37.69911
Dome radius of curvature	1	N/A	2	12.566	5.235988
Pyramid (4 sided)	5	4	4	not done	26.66667
Pyramid (3 sided)	6	3	3	not done	9
use consistent units, surface area is unit squared, volume is unit cubed					

The Efficiencies calculators allow you to figure out efficiency in two different ways. First, you can input the various grains used and their weights. Enter the measured gravities and volumes and the Mash Efficiency and Brewhouse Efficiency will be displayed. Alternatively, instead of using grains use the calculator in the lower right corner and input the Total Potential Gravity Units.

Efficiencies							
Grain	Pounds	Potential	GU	PreBoil Gravity	1.048	Volume	10
Pilsner (Best)	14	1.037	522	Original Gravity	1.052	Volume	9
				Mash Efficiency	92%		
				Brewhouse Efficiency	90%		
calculators below do not rely on the grain selections							
				PreBoil Gravity	1.048	Volume	10
				Original Gravity	1.052	Volume	9
				Total Potential Gravity Units	522		
				Mash Efficiency	92%		
				Brewhouse Efficiency	90%		
potential GUs = weight of grains × potential of grain			522	volumes in gallons, package volume for brewhouse eff.			

If you've composed a recipe and want figure out how many IBU to give the beer to achieve a certain BU:GU or Balance Value this can be done. BV requires Final Gravity while BU:GU does not.

Predicting BU based upon BU:GU or BV					
1.057	Original Gravity (SG)	0.9	BU:GU Value	IBU	51.3
1.007	Final Gravity (SG)	1.5	Balance Value	IBU	30.0
BU:GU is dependent upon OG, BV is dependent upon OG & FG					

Calculating the Mash Tun Space Required can be done in English or Metric units. To change the units just use the drop where "Weight of Grains (lbs)" is shown.

Mash Tun Space Required		
Weight of Grains (lbs)	Mash Thickness (qts/lb)	Volume (gals)
14	1.1	4.97
remember to add dead space to results		

The Electrical Heating allow you to figure out how long it will take achieve a certain temperature with a given heating element. You can figure out your actual wattage based on the voltage used. Minimum Breaker size can be calculated from Watts & Voltage demands. Finally, for those of us who are money watchers, you can calculate the Cost as well.

Electrical Heating					
6	Gallons	50 °F	Starting Temp	System Efficiency	95%
1500	Watts	212 °F	Target Temp	Time to Temp (min)	100
Wattage Correction		Minimum Breaker		Cost	
1500	Element Rated Watts	Watts	1500	Watts	1500
120	Element Rated Voltage	Voltage	120	Minutes	12
100	Actual Voltage	Minimum Breaker	15	\$/kWh	\$0.06
1042	Actual Wattage			Cost	\$0.18
CAUTION: Formulas were taken from another spreadsheet and have not been verified as safe					

A Water Chemistry calculator is available based on Palmer's spreadsheet. Enter your Target SRM in the top left of the tool. Enter the Source Water Attributes in the first column, and if you desire to reference a certain water profile you can enter it into the Target Water Attributes in the second column. The Alkalinity as CaCO₃ is a dropdown which allows you to switch to Bicarbonate (ppm) instead. Based on the Target RA range at the top, enter in your Target Residual Alkalinity in the big box in the lower middle of the tool. Enter your Mash Volume in the first column near the bottom. Once all that data is entered you can play with the Dilution, Salt Additions and Acid Additions on the right to achieve a Final Water Profile as listed in the middle column that is desired. At the very bottom of this tool are two converters allowing you to calculate Bicarbonate ppm from Alkalinity as CaCO₃ and vice versa.

Water Chemistry - Big Ups to John Palmer

8	Target SRM	Target Low RA	-25	34	Target High RA	Dilution	0%		
Source	Target	Water Attributes	Diluted	Final	Additions	Chalk CaCO3			
6.7	250	Calcium (ppm) (50-150)	7	7	0	Gypsum CaSO4*2H2O			
2	25	Magnesium (ppm) (10-30)	2	2	0	Calcium Chloride CaCl2*2H2O			
13	451	Alkalinity as CaCO3	13	288	275	Epsom Salt MgSO4*7H2O			
9	70	Sodium (ppm) (0-150)	9	136	127	Baking Soda NaHCO3 14			
14	100	Chloride (ppm) (0-250)	14	14	0	Table Salt NaCl			
5	280	Sulfate (ppm) (bitter 50-150, -350 very bitter)	5	5	0	Contributed Hardness 0			
7.3	Water pH					Added Bicarbonates (HCO3) 336			
6	193	Effective Hardness	6	6	Target	Acid Additions			
7	258	Residual Alkalinity as CaCO3	7	282	Residual	Acid Type	Conc.	Used	Estimated
6	26	Estimated Low SRM	6	28	Alkalinity	Hydrochloric	33		0
11	31	Estimated High SRM	11	33	256	Lactic	88		0
Very Malty	Very Bitter	Chloride to Sulfate Balance	Very Malty	Very Malty		used & estimated volumes are in mL			
8	Mash Volume (gallons)	Additional Alkalinity Needed		249	Additional Effective Hardness Needed		0		
to set target RA, use the target water profile to calculate target RA when trying to replicate a city, or use a number in the RA range when brewing a specific SRM beer									
Converters:	Alkalinity as CaCO3 → Bicarbonate as ppm		17.6	21	Bicarbonate as ppm → Alkalinity		550	451	

Recipe Scaling is a bit complex. Obviously you enter in the Grains & Hops like you would on the Worksheet using dropdowns in each row. The quantities of the grains can be expressed as Pounds or Percentages, just use the dropdown to choose which mode to use. The Late column is the same as the Worksheet. Either Tinseth or Rager can be used for calculating IBU, and either Ounces or IBU can be used for the quantities of hops. Other inputs required are the original Recipe Mash Efficiency and the Original Volume, the New Mash Efficiency and Target Volume, the Original Pre Boil Volume and the New Pre Boil Volume, and the Boil Time of the recipe and the new scaled batch. The quantities for ingredients will be expressed in pounds for grains and ounces for hops.

Recipe Scaling											
Grains	Pounds	Potential	Late?	GU	Adj. GU	Weighted Adj. GU	% Adj. GU	New Adj. GU	New GU	New % Weight	New Pounds
Pilsner (Best)	14	1.037	N	522	391	391	61.50%	205	273	60.87%	7.33
Vienna (Best)	6	1.037	N	224	168	168	26.36%	88	117	26.09%	3.14
Rye Malt	2	1.029	N	58	43	43	6.83%	23	30	8.70%	1.05
Extra Light dry extract	1	1.045	Y	45	34	7	5.31%	18	24	4.35%	0.52
			N								
			N								
			N								
			N								
			N								
			N								
Recipe Mash Efficiency	75%	New Mash Efficiency			75%	Original Pre-Boil Volume		12	Total Pounds		12.05
Original Volume	10.5	Target Volume			5.5	New Pre-Boil Volume		7	Original Gravity		1.061
volumes are post-boil, set pre-boil volumes above for utilization calculations							New Boil Time	90	Recipe Boil Time		90
Hops	Tinseth	Ounces	Time	AA%	IBU	Utilization	New Utilization		New Ounces		
Northern Brewer (German)		2	60	8.00%	21.5	20.2%	20.6%		1.09		
Hallertauer Tradition (German)				4.50%							
Hallertauer Tradition (German)				4.50%							
Hallertauer Tradition (German)				4.50%							
Hallertauer Tradition (German)				4.50%							
Hallertauer Tradition (German)				4.50%							
Hallertauer Tradition (German)				4.50%							
Hallertauer Tradition (German)				4.50%							
Hallertauer Tradition (German)				4.50%							
Hallertauer Tradition (German)				4.50%							
scaling calculators rely upon equation factors in the worksheet including ExtractGU, FWH, Leaf & Pellet hops, fHopsAging, hops storage, hops temperature											

Parti-gyle Adjustments allow you to swap wort or top off the first beer with some wort from the second beer in order to hit your target gravities and volumes for the first beer. Depending upon how much volume each beer has, it's gravity and the targets for those values, one of the two adjustments will be suggested (and the other one will be hidden). Additionally, if you need to top off the first beer with water after adjusting the worts, that will be displayed along with how much water to add.

Parti-gyle Adjustments				
First Beer Target Volume	5.59	Swap an equal volume of wort from each beer.		
First Beer Measured Volume	5.6	Gallons of wort to swap:	1.07	
First Beer Target Gravity	1.084			
First Beer Measured Gravity	1.094			
Second Beer Target Volume	5.59	boil-off first beer to reach targets		
Second Beer Measured Volume	5.65		Gallons	Gravity
Second Beer Target Gravity	1.052	Final First Beer:	5.60	1.084
Second Beer Measured Gravity	1.041	Final Second Beer:	5.65	1.051
the goal of adjustments is to hit first beer target pre-boil gravity				

Unit Powers		
Y	yotta	24
Z	zetta	21
E	exa	18
P	peta	15
T	tera	12
G	giga	9
M	mega	6
k	kilo	3
h	hecto	2
da	deka	1
da	deci	-1
c	centi	-2

Lastly I'll mention a reference chart for the various unit prefixes & powers. The number represents the power of 10 that a unit is multiplied by when using the prefix.

m	milli	-3
μ	micro	-6
n	nano	-9
p	pico	-12
f	femto	-15
a	atto	-18
z	zepto	-21
y	yocto	-24
unit = × 10 ^{power}		

For example,

kilometers (km) = meters × 10³

megawatts (MW) = watts × 10⁶

milliliters (mL) = liters × 10⁻³

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The Calendar tab is very useful for planning a brewing schedule. The yellow highlighted date symbolizes today. To change the display of the Calendar, click on the Month or Year dropdowns. Inside of each date's cell are 7 rows for displaying a recipe's timeline. You can see in this screenshot that a Brew Day was on 2/23/2009, and Primary was continuing.

Month: February			Year: 2009			
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
2/1/2009	2/2/2009	2/3/2009	2/4/2009	2/5/2009	2/6/2009	2/7/2009
2/8/2009	2/9/2009	2/10/2009	2/11/2009	2/12/2009	2/13/2009	2/14/2009
2/15/2009	2/16/2009	2/17/2009	2/18/2009	2/19/2009	2/20/2009	2/21/2009
2/22/2009	2/23/2009	2/24/2009	2/25/2009	2/26/2009	2/27/2009	2/28/2009
	Brew Day	Primary Fermentation	Primary Fermentation	Primary Fermentation	Primary Fermentation	Primary Fermentation

To choose which recipes are shown in the display use the dropdown in each color filled cell. The color will correspond to colored rows in the Calendar display. The Worksheet is not a dropdown and allows the Worksheet's schedule to always be shown in the Calendar. After choosing a recipe from the dropdown the Brew Date & Drink Dates will be shown, along with their Fermentation Schedule.

				American Brown	British Pale	Belgian Strong	Worksheet
				1/21/2009	1/22/2009	2/23/2009	3/25/2009
				1/31/2009	1/31/2009	3/23/2009	4/20/2009
Primary				8	7	18	25
Diacetyl Rest				0	0	2	0
Cold Crash				1	1	1	0
Secondary				0	0	0	0
Aging				1	1	7	0

Update Calendar from Recipes File

There is a table below the recipe selections that contains the recipe names and their data. This data drives the dropdowns for the recipe selection. In order to update this data from the Recipe file, just click this button. It will parse through the Recipes file and fill the data table on the Calendar tab. It will create a separate entry for each beer in a parti-gyle session.

The Grains tab is an inventory tab as well as where the attributes of each ingredient are stored.

Each column can be filtered. The Potential is calculated from the Dry Yield. If a Link is included it will be added to the Purchasing sheet when adding a recipe's ingredients as the next batch.

Malt Name	Malster	Origin	Color	Dry Yield	Potential	Stock	Price	Notes	Priming Factor	Link
American 2 Row (Rahr)	Rahr	US	1.7	79.0%	1.036		\$1.50			

In addition to grains other ingredients are stored here, such as Whirlfloc tablets, Citrus Zest, Corriander, Yeast Nutrient.

For extracts, honey, cider and other fermentables that are not-mashed, the SUGARS tag in the notes prevents them from being affected by the Mash Efficiency in calculations on the Worksheet.

For sugars that are Priming Sugars include the type of sugar in the Priming Factor column.

The Hops tab handles the inventory and attributes of the hops varieties.

Change the AA% based on the hops you have in stock. If a Link is set it will be added to the Purchasing sheet when a recipe is added as the next batch. If the Date & % Lost are set then Hops Aging calculations can be enabled.

Hop Type ▾	Alpha Acid ▾	Description ▾	Used In ▾	Substitutions ▾	Usage ▾	Stock ▾	Form ▾	Price ▾	% Lost ▾	Date ▾
Admiral (UK)	14.75%	Known for its bittering potential.	Ale	UK Target, UK Northdown, UK Challenger	Bittering				15%	
Ahtanum	5.50%	Used for its' aromatic properties and moderate bittering.	Lagers, American ales		Finishing	4	Pellet		30%	
Amarillo	9.80%	A new US variety with a citrus-like aroma similar to Cascade, but with a higher alpha acid content.	Ale, IPA	Cascade, Centennial	Dual Purpose	15	Leaf	\$2.00	15%	

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The Yeast lab includes all the attributes of various yeast strains, but the inventory is kept in the Lab tab.

You can filter on any column. The All the attributes are collected from the manufacturer's site, except for eth Brewery & Counterparts which are based on the Yeast Strain guide on Jamil's site.

Yeast	Name	Low Temp	High Temp	Low Attenuation	High Attenuation	Flocculation	Alc. Tolerance	Notes	Brewery	Counterpart	Price
White Labs WLP001	California Ale	68 °F	73 °F	73%	80%	Medium	High	This yeast is famous for its clean flavors, balance and ability to be used in almost any style ale. It accentuates the hop flavors and is extremely versatile.	Sierra Nevada	Wyeast 1056	\$6.75

The Lab tab is used for tracking your yeast cultures.

The Yeast Strain is a dropdown based on the strains in the Yeast tab.

Yeast Strain	Generation	Parent	Date	Storage	Quantity	UID

This tab also offers space for keeping an inventory of lab equipment.

Equipment	Quantity	Notes

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The Water tab is where you enter your water report's information.

Parameter	Low	High	Middle
Alkalinity as mg/L CaCO ₃	8.7	17.6	13.15
Hardness as mg/L CaCO ₃	17	34	25.5
Calcium mg/L (ppm)	4.9	8.5	6.7
Chloride mg/L (ppm)	8	20	14
Chlorine Residual, free mg/L (ppm)	0.01	1.35	0.68
Magnesium mg/L (ppm)	1	3	2
Sodium mg/L (ppm)	6	12	9
Potassium mg/L (ppm)	0.5	0.8	0.65
Iron micrograms/L (ppb)	20	550	285
Manganese micrograms/L (ppb)	6	261	133.5
Sulfate mg/L (ppm)			5
pH of water	6.6	9.1	7.3
Bicarbonate ppm	11	21	9

The data entered here is used for determining the Source Water Attributes on the Worksheet. If you have a single number instead of a range, you can just enter it in the Middle column and replace the averaging formula.

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The Styles tab contains two set of guidelines. The first is based upon the 2008 BJCP Style Guidelines. The numbers of each style are clickable links to the BJCP website. This tab is for reference and also for the Worksheet to display style properties.

STYLE	Link	OG (SG)		FG (SG)		OG °P		FG °P		ABV%		IBU		SRM		CO2		BU/GU	BV
		Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	average	Balance Value
1. LIGHT LAGER																			
Lite American Lager	1A	1.028	1.040	0.998	1.008	7.1	10.0	-0.5	2.1	2.8	4.2	8	12	2	3	2.5	2.8	0.29	0.93
Standard American Lager	1B	1.040	1.050	1.004	1.010	10.0	12.4	1.0	2.6	4.2	5.3	8	15	2	4	2.5	2.8	0.26	0.66
Premium American Lager	1C	1.046	1.056	1.008	1.012	11.4	13.8	2.1	3.1	4.6	6.0	15	25	2	6	2.5	2.8	0.39	0.92
Munich Helles	1D	1.045	1.051	1.008	1.012	11.2	12.6	2.1	3.1	4.7	5.4	16	22	3	5	2.3	2.7	0.40	0.90
Dortmunder Export	1E	1.048	1.056	1.010	1.015	11.9	13.8	2.6	3.8	4.8	6.0	23	30	4	6	2.4	2.7	0.51	1.08

The second set of guidelines is based upon the 2009 Brewers Association Beer Style Guidelines.

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The CO2 tab is a chart for easy reference. The CO2 Volumes range is 0.5 to 5, and the increment is 0.1 Volumes. The Fahrenheit range is 32 to 80, and the increment is 1 degree. The sheet prints well onto one page if you have a color printer.

Desired CO2 Volumes - Resultant Pressure is in PSI

		0.5	0.6	0.7	0.8	0.9	1	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3	3.1	3.2	3.3	3.4	3.5	3.6	3.7
Temperature in Fahrenheit	32	-10.95	-9.98	-9.01	-8.04	-7.07	-6.11	-5.14	-4.18	-3.22	-2.26	-1.30	-0.34	0.62	1.57	2.52	3.48	4.43	5.38	6.32	7.27	8.22	9.16	10.10	11.05	11.99	12.92	13.86	14.80	15.73	16.66	17.60	18.53	19.47
	33	-10.80	-9.81	-8.82	-7.84	-6.85	-5.87	-4.89	-3.91	-2.93	-1.95	-0.97	0.00	0.98	1.95	2.92	3.89	4.86	5.82	6.79	7.75	8.72	9.68	10.64	11.60	12.55	13.51	14.46	15.42	16.37	17.32	18.27	19.22	20.17
	34	-10.65	-9.64	-8.63	-7.63	-6.63	-5.63	-4.63	-3.63	-2.63	-1.64	-0.65	0.35	1.34	2.33	3.32	4.30	5.29	6.27	7.26	8.24	9.22	10.20	11.17	12.15	13.12	14.10	15.07	16.04	17.01	17.98	18.94	19.91	20.88
	35	-10.49	-9.46	-8.44	-7.42	-6.40	-5.38	-4.37	-3.35	-2.34	-1.33	-0.32	0.69	1.70	2.71	3.72	4.72	5.72	6.72	7.72	8.72	9.72	10.72	11.71	12.71	13.70	14.69	15.68	16.67	17.65	18.64	19.62	20.60	21.58
	36	-10.33	-9.29	-8.25	-7.21	-6.17	-5.14	-4.10	-3.07	-2.04	-1.01	0.02	1.04	2.07	3.09	4.12	5.14	6.16	7.18	8.20	9.21	10.23	11.24	12.25	13.26	14.27	15.28	16.29	17.29	18.30	19.30	20.30	21.30	22.29
	37	-10.17	-9.11	-8.05	-7.00	-5.94	-4.89	-3.84	-2.79	-1.74	-0.69	0.35	1.40	2.44	3.48	4.52	5.56	6.60	7.63	8.67	9.70	10.74	11.77	12.80	13.82	14.85	15.88	16.90	17.92	18.94	19.96	20.98	22.00	23.01
	38	-10.00	-8.93	-7.85	-6.78	-5.71	-4.64	-3.57	-2.50	-1.44	-0.37	0.69	1.75	2.81	3.87	4.93	5.99	7.04	8.09	9.15	10.20	11.25	12.29	13.34	14.39	15.43	16.47	17.51	18.55	19.59	20.63	21.67	22.70	23.73
	39	-9.84	-8.74	-7.65	-6.56	-5.47	-4.39	-3.30	-2.22	-1.13	-0.05	1.03	2.11	3.19	4.26	5.34	6.41	7.48	8.55	9.62	10.69	11.76	12.82	13.89	14.95	16.01	17.07	18.13	19.19	20.24	21.30	22.35	23.40	24.44
	40	-9.67	-8.56	-7.45	-6.34	-5.24	-4.13	-3.03	-1.93	-0.83	0.27	1.37	2.47	3.56	4.66	5.75	6.84	7.93	9.02	10.10	11.19	12.27	13.36	14.44	15.52	16.60	17.67	18.75	19.83	20.90	21.97	23.04	24.11	25.17
	41	-9.50	-8.37	-7.24	-6.12	-5.00	-3.87	-2.75	-1.63	-0.52	0.60	1.72	2.83	3.94	5.05	6.16	7.27	8.38	9.48	10.59	11.69	12.79	13.89	14.99	16.09	17.18	18.28	19.37	20.46	21.55	22.64	23.73	24.82	25.91
	42	-9.32	-8.18	-7.04	-5.89	-4.75	-3.61	-2.48	-1.34	-0.20	0.93	2.06	3.19	4.32	5.45	6.58	7.70	8.83	9.95	11.07	12.19	13.31	14.43	15.55	16.66	17.77	18.89	20.00	21.11	22.21	23.32	24.43	25.53	26.63
	43	-9.15	-7.99	-6.83	-5.67	-4.51	-3.35	-2.20	-1.04	0.11	1.26	2.41	3.56	4.71	5.85	7.00	8.14	9.28	10.42	11.56	12.70	13.83	14.97	16.10	17.23	18.37	19.49	20.62	21.75	22.87	24.00	25.12	26.24	27.35
	44	-8.97	-7.79	-6.61	-5.44	-4.26	-3.09	-1.91	-0.74	0.43	1.60	2.76	3.93	5.09	6.26	7.42	8.58	9.74	10.89	12.05	13.21	14.36	15.51	16.66	17.81	18.96	20.11	21.25	22.40	23.54	24.68	25.82	26.96	28.09
	45	-8.79	-7.59	-6.40	-5.20	-4.01	-2.82	-1.63	-0.44	0.75	1.93	3.12	4.30	5.48	6.66	7.84	9.02	10.19	11.37	12.54	13.72	14.89	16.06	17.22	18.39	19.56	20.72	21.88	23.04	24.20	25.36	26.52	27.67	28.82
	46	-8.61	-7.39	-6.18	-4.97	-3.76	-2.55	-1.34	-0.14	1.07	2.27	3.47	4.67	5.87	7.07	8.27	9.46	10.65	11.85	13.04	14.23	15.42	16.60	17.79	18.97	20.15	21.34	22.52	23.69	24.87	26.05	27.22	28.39	29.55
	47	-8.42	-7.19	-5.96	-4.73	-3.51	-2.28	-1.05	0.17	1.39	2.61	3.83	5.05	6.26	7.48	8.69	9.91	11.12	12.33	13.53	14.74	15.95	17.15	18.35	19.56	20.76	21.95	23.15	24.35	25.54	26.73	27.93	29.12	30.30
	48	-8.24	-6.99	-5.74	-4.49	-3.25	-2.01	-0.76	0.48	1.72	2.95	4.19	5.43	6.66	7.89	9.12	10.35	11.58	12.81	14.03	15.26	16.48	17.70	18.92	20.14	21.36	22.57	23.79	25.00	26.21	27.42	28.63	29.84	31.03
	49	-8.05	-6.78	-5.52	-4.25	-2.99	-1.73	-0.47	0.79	2.04	3.30	4.55	5.81	7.06	8.31	9.56	10.80	12.05	13.29	14.54	15.78	17.02	18.26	19.49	20.73	21.96	23.20	24.43	25.66	26.89	28.12	29.34	30.57	31.79
	50	-7.85	-6.57	-5.29	-4.01	-2.73	-1.45	-0.17	1.10	2.38	3.65	4.92	6.19	7.46	8.72	9.99	11.25	12.52	13.78	15.04	16.30	17.56	18.81	20.07	21.32	22.57	23.82	25.07	26.32	27.57	28.81	30.06	31.30	32.53
	51	-7.66	-6.36	-5.06	-3.76	-2.46	-1.17	0.12	1.42	2.71	4.00	5.29	6.57	7.86	9.14	10.43	11.71	12.99	14.27	15.55	16.82	18.10	19.37	20.64	21.91	23.18	24.45	25.72	26.98	28.25	29.51	30.77	32.03	33.28
	52	-7.46	-6.15	-4.83	-3.51	-2.20	-0.89	0.43	1.74	3.04	4.35	5.66	6.96	8.26	9.57	10.87	12.17	13.46	14.76	16.05	17.35	18.64	19.93	21.22	22.51	23.80	25.08	26.36	27.65	28.93	30.21	31.49	32.76	34.02
	53	-7.26	-5.93	-4.59	-3.26	-1.93	-0.60	0.73	2.06	3.38	4.71	6.03	7.35	8.67	9.99	11.31	12.62	13.94	15.25	16.57	17.88	19.19	20.49	21.80	23.11	24.41	25.71	27.01	28.31	29.61	30.91	32.21	33.50	34.78
	54	-7.06	-5.71	-4.36	-3.01	-1.66	-0.31	1.03	2.38	3.72	5.06	6.40	7.74	9.08	10.42	11.75	13.09	14.42	15.75	17.08	18.41	19.73	21.06	22.38	23.71	25.03	26.35	27.67	28.98	30.30	31.61	32.93	34.24	35.53
	55	-6.86	-5.49	-4.12	-2.75	-1.39	-0.02	1.34	2.70	4.06	5.42	6.78	8.14	9.49	10.85	12.20	13.55	14.90	16.25	17.59	18.94	20.28	21.63	22.97	24.31	25.65	26.98	28.32	29.65	30.99	32.32	33.65	34.98	36.29
	56	-6.65	-5.27	-3.88	-2.50	-1.11	0.27	1.65	3.03	4.41	5.78	7.16	8.53	9.91	11.28	12.65	14.02	15.38	16.75	18.11	19.48	20.84	22.20	23.56	24.91	26.27	27.62	28.98	30.33	31.68	33.03	34.38	35.72	37.05
	57	-6.45	-5.04	-3.64	-2.24	-0.83	0.56	1.96	3.36	4.75	6.15	7.54	8.93	10.32	11.71	13.10	14.48	15.87	17.25	18.63	20.01	21.39	22.77	24.15	25.52	26.89	28.27	29.64	31.01	32.37	33.74	35.10	36.47	37.82
	58	-6.24	-4.81	-3.39	-1.97	-0.55	0.86	2.28	3.69	5.10	6.52	7.93	9.33	10.74	12.15	13.55	14.95	16.36	17.76	19.16	20.55	21.95	23.34	24.74	26.13	27.52	28.91	30.30	31.68	33.07	34.45	35.84	37.22	38.59
	59	-6.02	-4.58	-3.14	-1.71	-0.27	1.16	2.59	4.03	5.46	6.88	8.31	9.74	11.16	12.58	14.01	15.43	16.85	18.26	19.68	21.09	22.51	23.92	25.33	26.74	28.15	29.56	30.96	32.36	33.77	35.17	36.57	37.97	39.35
	60	-5.81	-4.35	-2.89	-1.44	0.01	1.46	2.91	4.36	5.81	7.26	8.70	10.14	11.59	13.03	14.46	15.90	17.34	18.77	20.21	21.64	23.07	24.50	25.93	27.35	28.78	30.20	31.63	33.05	34.47	35.89	37.30	38.72	40.12
	61	-5.59	-4.12	-2.64	-1.17	0.30	1.77	3.24	4.70	6.17	7.63	9.09	10.55	12.01	13.47	14.92	16.38	17.83	19.29	20.74	22.19	23.63	25.08	26.53	27.97	29.41	30.86	32.30	33.73	35.17	36.61	38.04	39.47	40.89
	62	-5.37	-3.88	-2.39	-0.90	0.59	2.07	3.56	5.04	6.52	8.01	9.48	10.96	12.44	13.91	15.39	16.86	18.33	19.80	21.27	22.74	24.20	25.67	27.13	28.59	30.05	31.51	32.97	34.42	35.88	37.33	38.78	40.23	41.67
	63	-5.15	-3.64	-2.13	-0.62	0.88	2.38	3.89	5.39	6.89	8.38	9.88	11.37	12.87	14.36	15.85	17.34	18.83	20.32	21.80	23.29	24.77	26.25	27.73	29.21	30.69	32.16	33.64	35.11	36.58	38.05	39.52	40.99	42.44

The Tables tab is a locked tab of tables that are used in various formulas throughout the spreadsheet.

Yeast Source	Concentration	Viability
Dry	620	80%
White Labs Vials	100000	
Wyeast Smackpack	100000	
Shaken Starter	60	95%
Aerated Starter	92	98%
Stirplate Starter	250	100%
concentration in billions/L or millions/mL		

The Yeast Source table is used for calculating the volume of starters based on the concentration. Data is referenced from MB Raines's page on the Maltose Falcons.

Chloride/Sulfate Balance	
Ratio	Balance
0.000	Very Bitter
0.501	Bitter
0.768	Balanced
1.300	Malty
2.010	Very Malty

The Chloride Sulfate Balance table is used in the Water Chemistry calculations on the Worksheet and Calculators tabs. Referenced from John Palmer's spreadsheet.

CO2	
°C	Vol
0	1.7
2	1.6
4	1.5
6	1.4
8	1.3
10	1.2
12	1.12
14	1.05
16	0.99
18	0.93
20	0.88
22	0.83

Residual CO2 based on temperature of fermented beer. Used in calculating the amount of priming sugar to use.

Hops Storage Factors	
Not sealed or sealed in poly bags	1
Sealed in barrier, O2 present	0.75
Sealed in barrier, no O2	0.5

Hops Aging			Hops k rate		Hops General % Lost	
°C	°F	TF	%L	rate const		
20	68	1	10	0.00059	Cascade	50
19	66.2	0.96	11	0.00065	Centennial	37
18	64.4	0.91	12	0.00071	Chinook	32
17	62.6	0.87	13	0.00077	Cluster	17
16	60.8	0.83	14	0.00084	Crystal	49
15	59	0.79	15	0.0009	East Kent Goldings	45
14	57.2	0.76	16	0.00097	Eroica	40
13	55.4	0.72	17	0.00104	Fuggie	37
11	51.8	0.66	18	0.0011	Galena	15
10	50	0.63	19	0.00117	German Spalter	45
9	48.2	0.6	20	0.00124	Hallertauer (US)	45
8	46.4	0.57	21	0.00131	Hallertauer Hersbrucker	40
7	44.6	0.55	22	0.00138	Hallertauer NB	25
6	42.8	0.52	23	0.00145	Hallertauer Mittlefrueh	46
5	41	0.5	24	0.00152	Hersbrucker (US)	50
4	39.2	0.48	25	0.0016	Liberty	55
3	37.4	0.46	26	0.00167	Mount Hood	45
2	35.6	0.44	27	0.00175	Nothern Brewer (US)	20
1	33.8	0.42	28	0.00183	Nugget	25
0	32	0.4	29	0.0019	Perle (US)	15
-1	30.2	0.38	30	0.00198	Pride of Ringwood	44
-2	28.4	0.36	31	0.00206	Saaz (Czech)	50
-3	26.6	0.35	32	0.00214	Spalt (US)	50
-4	24.8	0.33	33	0.00222	Strisselspalt (France)	35
-5	23	0.32	34	0.00231	Styrian Goldings++	37
-6	21.2	0.3	35	0.00239	Tettnang Tettnanger	42
-7	19.4	0.29	36	0.00248	Tettnanger (US)	42
-8	17.6	0.27	37	0.00257	Willamette	37
-9	15.8	0.26	38	0.00266		
-10	14	0.25	39	0.00275		
-11	12.2	0.24	40	0.00284		
-12	10.4	0.23	41	0.00293		
-13	8.6	0.22	42	0.00303		
-14	6.8	0.21	43	0.00312		
-15	5	0.2	44	0.00322		
-16	3.2	0.19	45	0.00332		
-17	1.4	0.18	46	0.00342		
-18	-0.4	0.17	47	0.00353		
-19	-2.2	0.17	48	0.00363		
-20	-4	0.16	49	0.00374		
-21	-5.8	0.15	50	0.00385		
-22	-7.6	0.14	51	0.00396		

Tables used in doing the calculations related to Hops Aging

-21	-5.8	0.13	50	0.00385
-22	-7.6	0.14	51	0.00396
-23	-9.4	0.14	52	0.00408
-24	-11	0.13	53	0.00419
-25	-13	0.13	54	0.00431
-26	-15	0.11	55	0.00444
-27	-17	0.11	56	0.00456
-28	-18	0.11	57	0.00469
-29	-20	0.1	58	0.00482
-30	-22	0.1	59	0.00495
			60	0.00509
			--	--

Parti-Gyle Gravities					Parti-Gyle Extracts					Parti-Gyle Color Values				
Total Batch OG	1:2 Ratio		1:1 Ratio		Total Batch op	1:2 Ratio		1:1 Ratio		Total Batch	1:2 Ratio		1:1 Ratio	
	1/3	2/3	1/2	1/2		1/3	2/3	1/2	1/2		1/3	2/3	1/2	1/2
1.050	1.075	1.038	1.067	1.033	12	18	9	16.9	7.1	3	4.5	2.3	4.2	1.7
1.051	1.077	1.038	1.068	1.034	12.2	18.3	9.2	17.2	7.2	4	6	3	5.6	2.4
1.052	1.078	1.039	1.069	1.035	12.4	18.6	9.3	17.5	7.3	5	7.5	3.8	7	2.9
1.053	1.080	1.040	1.071	1.035	12.6	18.9	9.4	17.8	7.4	6	9	4.5	8.5	3.5
1.054	1.081	1.040	1.072	1.036	12.8	19.2	9.6	18	7.6	7	10.5	5.3	9.9	4.1
1.055	1.083	1.041	1.073	1.037	13	19.5	9.7	18.3	7.7	8	12	6	11.3	4.7
1.056	1.084	1.042	1.075	1.037	13.2	19.8	9.9	18.6	7.8	9	13.5	6.8	12.7	5.3
1.057	1.086	1.043	1.076	1.038	13.4	20.1	10.1	18.9	7.9	10	15	7.5	14.1	5.9
1.058	1.087	1.044	1.077	1.039	13.6	20.4	10.2	19.2	8	11	16.5	8.3	15.5	6.5
1.059	1.089	1.044	1.079	1.039	13.8	20.7	10.3	19.5	8.1	12	18	9	16.9	7.1
1.060	1.090	1.045	1.080	1.040	14	21	10.5	19.7	8.3	14	21	10.5	19.7	8.2
1.061	1.092	1.046	1.081	1.041	14.2	21.3	10.6	20	8.4	16	24	12	22.6	9.4
1.062	1.093	1.047	1.083	1.041	14.4	21.6	10.8	20.3	8.5	18	27	13.5	25.4	10.6
1.063	1.095	1.047	1.084	1.042	14.6	21.9	10.9	20.6	8.6	20	30	15	28.2	11.8
1.064	1.096	1.048	1.085	1.043	14.8	22.2	11.1	20.9	8.7	22	33	16.5	31	12.9
1.065	1.098	1.049	1.087	1.043	15	22.5	11.2	21.1	8.8	24	36	18	33.8	14.1
1.066	1.099	1.050	1.088	1.044	15.2	22.8	11.4	21.4	9	26	49	19.5	36.7	15.3
1.067	1.105	1.050	1.089	1.045	15.4	23.1	11.5	21.7	9.1	28	42	21	39.5	16.5
1.068	1.102	1.051	1.091	1.045	15.6	23.4	11.7	22	9.2	30	45	22.5	42.3	17.6
1.069	1.104	1.052	1.092	1.046	15.8	23.7	11.8	22.3	9.3	35	52.5	26.3	49.4	20.6
1.070	1.105	1.053	1.093	1.047	16	24	12	22.6	9.4	40	60	30	56.4	23.5
1.071	1.107	1.053	1.095	1.047	16.2	24.3	12.1	22.8	9.6	45	67.5	33.8	63.5	26.5
1.072	1.108	1.054	1.096	1.048	16.4	24.6	12.3	23.1	9.7	50	75	37.5	70.5	29.4
1.073	1.110	1.055	1.097	1.049	16.6	24.9	12.4	23.4	9.8	55	82.5	41.3	77.6	32.3
1.074	1.111	1.056	1.099	1.049	16.8	25.2	12.6	23.7	9.9	60	90	45	84.6	35.3
1.075	1.113	1.056	1.100	1.050	17	25.5	12.8	24	10	65	97.5	48.8	91.7	38.2
1.076	1.114	1.057	1.101	1.051	17.2	25.8	12.9	24.3	10.1	70	105	52.5	98.7	41.2
1.077	1.116	1.058	1.113	1.051	17.4	26.1	13.1	24.5	10.3	75	113	56.3	106	44.1
1.078	1.117	1.059	1.104	1.052	17.6	26.4	13.2	24.8	10.5	80	120	60	113	47

Parti-gyle tables for doing the parti-gyle calculations.

1.077	1.116	1.058	1.119	1.051
1.078	1.117	1.059	1.104	1.052
1.079	1.119	1.059	1.105	1.053
1.080	1.120	1.060	1.107	1.053
1.081	1.122	1.061	1.108	1.054
1.082	1.123	1.062	1.109	1.055
1.083	1.125	1.062	1.111	1.055
1.082	1.123	1.062	1.109	1.055
1.083	1.125	1.062	1.111	1.055
1.084	1.126	1.063	1.112	1.056
1.085	1.128	1.064	1.113	1.057
1.086	1.129	1.065	1.115	1.057
1.087	1.131	1.065	1.116	1.058
1.088	1.132	1.066	1.117	1.059
1.089	1.134	1.067	1.119	1.059
1.090	1.135	1.068	1.112	1.060
1.091	1.137	1.068	1.121	1.061
1.092	1.138	1.069	1.123	1.061
1.093	1.140	1.070	1.124	1.062
1.094	1.141	1.071	1.125	1.063
1.095	1.143	1.071	1.127	1.063

17.6	26.4	13.2	24.8	10.5
17.8	26.7	13.4	25.1	10.6
18	27	13.5	25.4	10.7
18.2	27.3	13.7	25.7	10.9
18.4	27.6	13.8	25.9	11
18.6	27.9	14	26.2	11.1
18.8	28.2	14.1	26.5	11.2
19	28.5	14.3	26.8	11.3

80	120	60	113	47
85	128	63.8	120	50
90	135	67.5	127	52.9
95	143	71.3	134	55.9
100	150	75	141	59
110	165	82.5	155	64.7
120	180	90	169	70.6
130	195	77.3	183	76.4

Formula References & Explanations

Yeast:

Yeast Starter Size Table based off of Jamil's table in Brewing Classic Styles, p. 290. (Actually no longer used in calculations.)

Cell count of starter preparation are based upon the data presented by MB Raines here: http://www.maltosefalcons.com/tech/MB_Raines_Guide_to_Yeast_Culturing.php

Yeast starter size is the final starter size that is made, of course you can decant and just pitch the slurry on stirplate starters. However you need to step up to the final volume, so be it. If you just pitch packages, the starter size is the # of packages

Desired cell count is calculated based on .75 million cells per mL per °P for ales, and 1.5 million cells per mL per °P for lagers.

Malt:

Morey's Formula is used to calculate SRM: <http://www.brewingtechniques.com/brewingtechniques/beerslaw/morey.html>

$SRM = 1.4922 [(MCU) ^ 0.6859]$ where MCU is calculated by $MCU = \text{WeightofGrain} * \text{LovibondofGrain} / \text{VolumePostBoil}$

the MCU values are hidden next to the Lovibond displayed in the worksheet, final value is shown at the bottom.

Current EBC to SRM, SRM to Current EBC - Designing Great Beers, Daniels, p. 44

$EBC = SRM * 1.97$, $SRM = EBC / 1.97$

Old EBC to SRM, IOB to SRM - New Brewing Lager Beer, Noonan, p. 11

$ASBC = (EBC+1.2)/2.65$, $ASBC = ((IOB/0.8)+1.2)/2.65$

Calculating Potential from Dry Yield: _

$Potential = ((46.31 * \text{Dry Yield}) + 1000) / 1000$

Converting from points/kg/L to Dry Yeild:

Dry Yield = Points/kg/L / 386.5

References for Dry Yield formulas:

<http://www.brewingtechniques.com/bmg/noonan.html>

<http://brewingtechniques.com/library/backissues/issue1.3/manning.html>

If you cannot find the properties of your grains from the malster, defaults can be used from this page:

<http://www.carolinabrewmasters.com/06Aprgrains.html>

Malt information for different maltsters can be found here: <http://www.brewingtechniques.com/bmg/adm.html>

Briess, Castle, Crisp, Durst, Gambrinus, Gilbertson & Page (OIO), Global, Rahr, Simpsons & Weyermann data:

<http://www.brewerssupplygroup.com/malt/>

Cargill, Dingemans, Gambrinus, Gilbertson & Page (OIO), Meusdoerffer, Pauls, Warminster data:

http://www.specialtymalts.com/tech_center/

Hops:

IBU formulae for Rager, Garetz and Tinseth can be found at: <http://www.realbeer.com/hops/FAQ.html#units>

Tinseth Hops Formulas:

IBUs = decimal alpha acid utilization * mg/l of added alpha acids

Metric Units

mg/l of added alpha acids = (decimal AA rating * grams hops * 1000) / liters of wort

Non-Metric Units

mg/l of added alpha acids = (decimal AA rating * ozs hops * 7490) / gallons of wort

The decimal alpha acid utilization is calculated using Tinseth's two empirical factors: the Bigness factor and the Boil Time factor.

Decimal Alpha Acid Utilization = Bigness Factor * Boil Time Factor

The Bigness Factor accounts for reduced utilization due to higher wort gravities.

Bigness factor = $1.65 * 0.000125^{(\text{wort gravity} - 1)}$

The Boil Time Factor gives the varying utilization based on boil time:

Boil Time factor = $(1 - e^{(-0.04 * \text{time in mins})}) / 4.15$

Rager Hops Formulas:

%UTILIZATION = $18.11 + 13.86 * \text{hyptan}[(\text{MINUTES} - 31.32) / 18.27]$

According to Rager, if the gravity of the boil exceeds 1.050, there is a gravity adjustment (GA) to factor in:

GA = $((\text{BOIL_GRAVITY} - 1.050)) / 0.2$

otherwise,

GA = 0

Metric Units

IBU = $((\text{GRAMS OF HOPS}) * \%UTILIZATION * \%ALPHA * 1000) / (\text{VOLUME(litres)} * (1 + \text{GA}))$

Non-metric Units

IBU = $((\text{OUNCES OF HOPS}) * \%UTILIZATION * \%ALPHA * 7462) / (\text{VOLUME(gallons)} * (1 + \text{GA}))$

Hops AA% Deterioration during storage formulas and tables: <http://www.brewingtechniques>.

com/library/backissues/issue2.1/garetz.html

Future Alpha Acid Percentage = $A * 1/e(k * TF * SF * Days)$

Where A is the AA% rating when you bought the hops, k is the constant in that corresponds to the hops %Lost, TF is the temperature factor, SF is the storage factor and Days is the numbers of days since purchase.

Hops specifications can be found at the following locations:

http://www.freshops.com/usda_hop_desc2.html

<http://www.skotrat.com/go/default/brewing-info/hops-hop-specifications/>

http://www.brewerylane.com/hops_profiles.html

<http://www.kotmf.com/articles/hopslis.php>

<http://www.yakimachief.com/hopvarieties/hopvar.html>

<http://www.nzhops.co.nz/varieties/index.html>

Mashing:

Infusion equations can be found in John Palmers' How to Brew p.170

Initial Infusion Equation

Strike Water Temperature $TW = (0.2/R)(TS-TG) + TS$

where TW = temp of strike water, R = mash thickness in quarts per pound or liters per kg, TS = desired mash step temp, TG = temperature of the grains, temps can be C or F but use 0.41 for C

this does not account for heat lost to tun, increase the .2 if necessary for heat loss to the tun

Mash Infusion Equation

$Wa = (T2-T1)(0.2G + Wm) / (Tw-T2)$

where Wa = amount of water to add in quarts or liters, Wm = amount of water in mash, T1 = initial mash temp, T2 = target mash temp, Tw = temp of infusion water, G = amount of grains in pounds or kg, temps can be C or F

Predicted Mash Efficiency is used to adjust the gravity units from the grains for predicting boil gravity, extracts are not affected by mash efficiencies and they are tagged in the grains tab as

sugars in the notes column. Extracts added late will be multiplied by a factor of .2 creating a weighted gravity unit value for predicting pre-boil gravity, not sure where I first picked up this factor. Pre-boil gravity of course affecting other calculations such as hops utilization and thus IBU.

The purpose of the number below the late addition dropdowns is a weighted adjusted gravity unit value for calculating pre-boil gravity and thus hops utilization values. Really just for approximating the better utilization that would come from adding extract late when doing an extract brew. Also, if you are going to use fermentables that won't be included in the boil, you can include them in recipe for predicting OG, but since they aren't in the boil (like cider) the boil gravity is more accurate. The skip is also used to remove "pounds" value for when your entering in non-fermentable ingredients like whirlfloc, spices, etc. The "pounds" value there is used for calculating the prices, just use consistent units in the grains tab for that ingredient to accurately calculate the costs.

For the strike water temperature predictions adjust the Infusion Temp Equation Factor up or down in the same direction, meaning if you're undershooting your temps then increase the factor and if you're overshooting then decrease it.

For the boil off factor, run a water test in your system and use the boil off rate calculator to determine the rate.

Decoction Mashing info and formulas: http://braukaiser.com/wiki/index.php?title=Decoction_Mashing

decoction volume = total mash volume * (target temp - start temp) / (boil temp - start temp)
then add 15-20% depending upon the system (this is the decoction factor)

Alternate method for predicting Infusion & Decoction Volumes: <http://brewingtechniques.com/library/backissues/issue4.5/miller.html>

Understanding and Calculating Efficiencies: <http://hbd.org/uchima/tech/efficiency.html>

Beer Properties:

ABW - Principles of Brewing Science by Fix, p. 93

$$ABW = (OE-RE)/(2.0665-0.010665*OE) \quad OE \ \& \ RE \ \text{in} \ ^\circ P$$

Attenuation, Gravity Conversions, Calories: <http://www.realbeer.com/spencer/attenuation.html>
<http://hbd.org/ensmingr/>

Sg -> Plato conversion based on DeClerk's work from A Textbook of Brewing first published in 1957.

$$^\circ P = (-463.37) + (668.72 * SG) - (205.35 * SG^2)$$

Real Extract calculation based on Karl Balling's empirically derived formula provided by George Fix in HBD: <http://hbd.org/hbd/archive/880.html#880-9>

$$RE = (0.1808 \times ^\circ Pi) + (0.8192 \times ^\circ Pf)$$

From ASBC's 1992 Methods of Analysis:

$$\text{cal per 12 oz beer} = [(6.9 \times ABW) + 4.0 \times (RE - 0.1)] \times FG \times 3.55$$

BU/GU is calculated as described by Ray Daniels in Designing Great Beers p. 126

$$BU:GU = IBU/(OG-1)*1000$$

Balance Value (BV) is calculated based on the formulas given here: <http://beercolor.netfirms.com/balance.html>

$$BV = 0.8 \times BU / RTE$$

$$RTE = 0.82 \times FG + 0.18 \times OG$$

$$BV = 0.8 \times BU / ((0.82*FG)+(0.18*OG))$$

Hydrometers & Refractometers:

This appears to be the popular formula for correcting hydrometer samples: <http://hbd.org/brewery/library/HydromCorr0992.html>

Formulas are also explained in this BYO article: <http://www.byo.com/component/resource/article/1343-refractometers>

Refractometer Formulas can be found on the bottom of this page: <http://www.primetab.com/formulas>

Formulas are also explained in this BYO article: <http://www.byo.com/component/resource/>

[article/1343-refractometers](#)

Final Specific Gravity from original and final Brix

$$SG = 1.001843 - 0.002318474 * OB - 0.000007775 * OB * OB - 0.000000034 * OB * OB * OB + 0.00574 * FB + 0.00003344 * FB * FB + 0.000000086 * FB * FB * FB$$

where: SG = estimated specific gravity of the sample, OB = Original Brix, FB = Final Brix

Brix to Index of Refraction

$$RI = 1.33302 + 0.001427193 * B + 0.000005791157 * B * B$$

where: B = measured refractivity in Brix, RI = calculated Refractive Index

Alcohol by weight content from Final SG and Final Brix

$$RI = 1.33302 + 0.001427193 * FB + 0.000005791157 * FB * FB$$

$$ABW = 1017.5596 - (277.4 * SG) + RI * ((937.8135 * RI) - 1805.1228)$$

where: FB = Final Brix, RI = calculated Refractive Index, SG = Final SG

ABV from Final SG & Final Brix (BYO)

$$ABV = [277.8851 - 277.4(SG) + 0.9956(Brix) + 0.00523(Brix^2) + 0.000013(Brix^3)] \times (SG/0.79)$$

Real Extract from Final Brix (BYO)

$$RI = 1.33302 + 0.1427193(Brix) + 0.000005791157(Brix^2)$$

$$RE = 194.5935 + 129.8(SG) + RI[410.8815(RI) - 790.8732]$$

Refractometer calibration is done by measuring the same sample with a calibrated hydrometer & your refractometer. The refractometer's reading is divided by the hydrometer's reading (in Plato) for the correction factor. If you have a high end refractometer, don't bother with using this functionality.

Miscellaneous:

Pressure formula is below the chart, I pulled it off of some other chart I had printed out long ago that wasn't wide enough or incremental enough for me. Scroll left or right, range is 0.5 to 5 CO2 volumes.

Pressure conversion factors: http://wiki.xtronics.com/index.php/Pressure_Conversion_Table

The area and volume calculators are done dimensionless, so be sure you're consistent and use the same units in all fields. Areas will of course be the unit squared and volumes the unit

cubed.

Water profiles collected from: <http://www.beersmith.com/Water/Waters.htm>

All the water chemistry calculations referenced from John Palmer's spreadsheet available at: <http://www.howtobrew.com/section3/chapter15-3.html> (last update used was Oct 2008 v2.4)

Electric Heat calculations are from the spreadsheet found here: <http://suburb.semo.net/jet1024/Electric%20Heat.xls>

$$\text{Time} = ((\text{Gallons} * 8.33 * 453.59237) * (((5/9) * (\text{TargetTemp} - 32)) - ((5/9) * (\text{StartingTemp} - 32)))) / (\text{Watts} * 0.238845896628 * \text{Efficiency}) / 60$$

$$\text{ActualWattage} = (\text{ActualVoltage}^2) / ((\text{ElementRatedVoltage}^2) / \text{ElementRatedWatts})$$

$$\text{Minimum Breaker} = \text{ROUNDUP}(((\text{Watts} / \text{Volts}) * 1.2) / 5, 0) * 5$$

Wort Contraction & Grain Absorption Factors are derived from Designing Great Beers by Ray Daniels, pp. 64-65

4% contraction from boiling to 68°F (20°C), adjust this to be in line with your system

0.2 factor for grains absorbing water (lbs * factor = gallons), again adapt this to your system

Priming Formulas are explained here: <http://hbd.org/ddraper/priming.html>

Priming Rate for Glucose/Dextrose:

$$\text{Rate in g/L} = (v - v0) / 0.27027$$

Priming Rate for Sucrose:

$$\text{Rate in g/L} = (v - v0) / 0.286$$

Parti-gyle brewing adjustments are described by Randy Mosher here: <http://brewingtechniques.com/library/backissues/issue2.2/mosher.html>

<http://www.strangebrew.ca/swig/>

<http://www.hbd.org/carboy/parti.htm>

Calendar Formulas:

DATEVALUE of EOM = (EDATE(DATEVALUE(CONCATENATE(\$D\$1, " 1, ", \$F\$1)), 1) - 1)

DATEVALUE of FOM = (DATEVALUE(CONCATENATE(\$D\$1, " 1, ", \$F\$1)))

DAYS in MONTH = ((EDATE(DATEVALUE(CONCATENATE(\$D\$1," 1, ",,\$F\$1)),1))-(DATEVALUE(CONCATENATE(\$D\$1, " 1, ",,\$F\$1))))

First row is set by the weekday value of the FOM, subsequent rows are set by subtracting the weekday value of the FOM from an index value. Later cells are data validated by checking the index against the days in the month first.

Cell Value =IF(B3="", "", IF(B3<=\$E\$47, "", IF(B3=\$E\$47, "Brew Day", IF(B3<=\$E\$47+\$E\$52, "Primary Fermentation", IF(B3<=\$E\$47+\$E\$52+\$E\$53, "Diacetyl Rest", IF(B3<=\$E\$47+\$E\$52+\$E\$53+\$E\$54, "Cold Crash", IF(B3<=\$E\$47+\$E\$52+\$E\$53+\$E\$54+\$E\$55, "Secondary Conditioning", IF(B3<=\$E\$47+\$E\$52+\$E\$53+\$E\$54+\$E\$55+\$E\$56, "Aging (including carbing)", IF(B3=\$E\$49, "Tap Date", ""))))))))))

Water Chemistry Formulas (mostly based on Palmer's Spreadsheet, need to update formulas here to reflect NaCl):

Palmer's How To Brew section on reading a water report: <http://www.howtobrew.com/section3/chapter15-1.html>

Palmer's How To Brew section on residual alkalinity & mash pH: <http://www.howtobrew.com/section3/chapter15-3.html>

Estimated Low RA = $12.2 * SRM - 122.4$

Estimated High RA = $(SRM - 5.2) * 12.2$

Alkalinity = $(50 * Bicarbonateppm / 61)$

Bicarbonateppm = $61 * Alkalinity / 50$

Effective Hardness = $(Calciumppm / 1.4) + (Magnesiumppm / 1.7)$

Residual Alkalinity as CaCO₃ =

IF(Bicarbonate (ppm),

$(50 * E11 / 61) - K11,$

E11-K11)

Else is Alkalinity as CaCO₃

Estimated Low SRM =

IF(Residual Alkalinity<-69,
0,
Residual Alkalinity*0.082+5.2)

Estimated High SRM =
IF(Residual Alkalinity<-128,
0,
(Residual Alkalinity+122.4)/12.2)

Chloride to Sulfate Balance =
=VLOOKUP(Chlorideppm/Sulfateppm,BalanceTable,2,TRUE)

Dilution Results = (1-Dilution%)*Originalppm/Alkalinity

Volume Source Water =(1-Dilution%)*Mash Water Volume

Volume Distilled Water =Dilution%*Mash Water Volume

Additional Effective Hardness needed =
IF(ResidualAlkalinityPostDilution>ResidualAlkalinityTarget,
IF("Bicarbonate (ppm)",(50*Bicarbonateppm/61),AlkalinityPostDilution)-
ResidualAlkalinityTarget-EffectiveHardness,
0)

Additional Alkalinity Needed =
IF(ResidualAlkalinityPostDilution<ResidualAlkalinityTarget,ResidualAlkalinityTarget-
ResidualAlkalinityPostDilution,0)

Calcium Addition =
(Chalk*105.89+Gypsum*60+CalciumChloride*72)/Mash Water Volume

Magnesium Addition =
Epsom Salt*24.6/Mash Water Volume

HCO3 Addition =
(Chalk*158+BakingSoda*191.88)/Mash Water Volume

Sodium Addition =
BakingSoda*72.3/Mash Volume Water

Chloride Addition =
CalciumChloride*127.47/Mash Water Volume

Sulfate Addition =
 $(\text{Gypsum} * 147.4 + \text{EpsomSalt} * 103) / \text{Mash Water Volume}$

Contributed Hardness =
 $(\text{CalciumAddition} / 1.4) + (\text{MagnesiumAddition} / 1.7)$

Contributed Alkalinity =
 $= \text{HC03Addition} * 50 / 61$

Estimated Hydrochloric Acid-Only Addition =
 $\text{IF}(\text{ResidualAlkalinityPostDilution} > \text{ResidualAlkalinityTarget},$
 $3.785 * \text{MashWaterVolume} * \text{AdditionalEffectiveHardnessNeeded} / 50 / ((13.927 * \text{Bottle\%}^2)$
 $+ (27.319 * \text{Bottle\%}))$
 $, 0)$

Estimated Lactic Acid-Only Addition =
 $\text{IF}(\text{ResidualAlkalinitySourceWater} > \text{ResidualAlkalinityTarget}, 0.88 / \text{Bottle\%} * 3.785 * \text{Bottle\%}$
 $* \text{MashWaterVolume} / 50 / 11.8, 0)$

FinalCalcium = CalciumPostDilution + CalciumAddition

FinalMagnesium = MagnesiumPostDilution + CalciumAddition

FinalAlkalinity as CaCO3 = $\text{IF}(\text{"Bicarbonate (ppm)"}, 50 / 61 * \text{AlkalinityPostDilution}$
 $+ \text{AlkalinityContributed}, \text{AlkalinityPostDilution} + \text{AlkalinityContributed})$

FinalSodium = SodiumPostDilution + SodiumAddition

FinalChloride =
 $\text{IF}(\text{HydrochloricAddition} = 0,$
 $\text{ChloridePostDilution} + \text{ChlorideAddition},$
 $\text{ChloridePostDilution} + \text{ChlorideAddition} + (\text{HydrochloricAddition} * 12 * \text{Bottle\%} / 0.37 * 35.4 /$
 $(\text{MashWaterVolume} * 3.785)))$

FinalSulfate = SulfatePostDilution + SulfateAddition

Final Effective Hardness = $(\text{FinalCalcium} / 1.4) + (\text{FinalMagnesium} / 1.7)$

Final Residual Alkalinity =
 $\text{FinalAlkalinity} - \text{FinalEffectiveHardness} - (50 * \text{HydrochloricAddition} * ((13.927 * \text{HBottle\%}^2)$

$$\frac{+(27.319*HBottle\%)}{(MashWaterVolume*3.785)} - \frac{(50*LacticAddition*LBottle\%/0.88*11.8/}{(MashWaterVolume*3.785)}$$

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The Brewhouse tab is for keeping and inventory of brewing equipment and supplies.

Items:	Quantity	Notes
Brew House:		
Clock		

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The Brewpub tab is for keeping and inventory of brewpub equipment and supplies.

Glassware is kept in a separate listing on the right.

Items:	Qty	Notes		Glassware	Qty
Kegeator:				Diesel Drafts Imperial Pints	4
Fridge				Diesel Drafts Imperial Tulips	4

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The Packaging tab is used for tracking packaged beer.

Kegs can be given unique IDs, and their cleaning/santitation can be tracked along with kegged beers. Age is a derived value based on the date of packaging.

Package ID	Package Type	Quantity	Contents	Date	Age

Additionally, the inventory of packaging supplies and equipment are kept on this tab.

Vessels		
One Gallon Jugs (128 oz)	6	not all have screw tops, brown
Half Gallon Growlers (64 oz)	6	not all have screw tops, clear
Quart Bottles (32 oz)	15	standard pry tops, brown
Pint Bottles (16 oz)	13	grolsch flip-tops, brown
Standard Bottles (12 oz)	5	standard pry tops, brown
Mini Kegs (5 L)	4	bungs included with Philtap System
5 gallon ball lock kegs	12	one liquid dip tub is cut short for use as a bright tank
Bottling Equipment		
Blichman Beer Gun		gift from goose
Bottle Capper		classic red wing hand operated capper
Bottle Washer		screws onto a sink with garden hose adapter
Bottle Caps	many	
Bottle Scrubber		needs replacement!!!
Bottle Filler: Spring		
Bottle Filler: Fermtech		

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The Library tab is for keeping an inventory of books and research materials.

Title	Author	Notes
<u>The New Complete Joy of Homebrewing</u>	Charlie Papazian	2nd Edition
<u>Brewing Classic Styles</u>	Palmer & Jamil	

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The Recipes tab is available to jot down recipes quickly in plain text when receiving them from other sources before you work them up in the Worksheet.

Recipe Name & Ingredients

Amount How Used?

Additionally, there is a butto to launch the external Recipes file.

[Click Here to open external Recipes file](#)

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The Purchasing tab is for planning future purchases.

Like the Financial tab it has some categorized sums at the top like Equipment, Hops, Grains, Yeast, Books, Glassware, etc. These are based on the line item categories of course. There are two macro sums on the sheet, the Priority Purchasing sums any totals that are bolded, and the Next Batch Costs sum any totals that are in italics. Sometimes these sums may not be automatically updating since they are macro sums. The way to force calculation is to click on the sum's cell, hit F2 and then hit enter. This will update the total. The mcmaster link is there for reference and easily building links the parts for when you want to execute the purchase.

The Selected Items Purchased Move to Financial Tab button will call a macro that will take the selected items, move them to the top of the Financial sheet and italicize them. Ingredients that get added to the Purchasing sheet from the Worksheet's macro will be italicized as Next Batch Costs.

Total Cost of Sheet:	\$1,354.17	\$401.87	Equipment Expenditures	Glassware & Barware	\$0.00
Priority Purchasing (bolded):	\$200.90	\$0.00	Hops Costs	Artwork and Promotional	\$0.00
Next Batch Costs (italics):	\$0.00	\$0.00	Grain Costs	Membership & Subscriptions	\$0.00
		\$0.00	Yeast Costs	Shipping Costs	\$0.00
http://www.mcmaster.com/nav/enter.asp?partnum=		\$935.50	Books and Materials	Uncategorized Outgo	\$0.00

Selected Items Purchased
Move to Financial Tab

Like the Financial sheet, you should leave the top two rows blank. The macro on the Worksheet will add ingredients to the top of the sheet starting at Row 10. In order to insert rows manually, select any cell in Row 10, hit Shift-Space, then hit Ctrl-Shift-+ (control shift plus) and hit the plus key as many times as you need rows.

Item	Price	qty	Total	Link	Notes	Category
Damp Rid	\$15.00	4	\$60.00	Get at Rite Aid, get 3 buckets for fermentation chamber, kegerator and cold storage		equipment

The Financial tab is for tracking expenses and analyzing them.

At the top of the tab there are various sums displayed. The total spending history is the sum of all totals. Batch Average is calculated based on the # of batches set in the cell in the middle. Similarly Annual Average is based on the years set. The Equipment Expenditures, Hops Costs, Grain Costs, Yeast Costs, Other Ingredients, Books and Materials, Glassware & Barware, Artwork & Promotional, Membership & Subscriptions, Chemicals and Shipping totals are summed based on the Category set for each line item. Equipment & Asset Purchase History is the sum of Equipment Expenditures, Books & Materials and Glassware & Barware. The Ingredient Purchase History is the sum of Hops, Grains, Yeast and Other Ingredients. As purchases are added to the Financial they are italicized, and thus marked paid for but not yet received.

Using the Selected Items Received Add to Inventories button will kick off a macro that will remove the italics from the items, and if they are hops, grains or yeast the inventories on the Hops, Grains or Lab tabs will be updated. You do not need to select the whole row, any column or range will work.

Total Spending History	\$5,968.56	# batches	\$3,760.74	Equipment Expenditures	Glassware & Barware	\$381.70
Batch Average	\$117.03	51	\$31.92	Hops Costs	Artwork and Promotional	\$75.24
Annual Average	\$596.86	# years	\$373.87	Grain Costs	Membership & Subscriptions	\$155.00
Equipment & Asset Purchase History	\$4,231.38	10	\$226.45	Yeast Costs	Chemicals	\$50.48
Ingredient Purchase History	\$662.06		\$29.82	Other Ingredients	Shipping Costs	\$760.31
Unreceived Orders (<i>italics</i>)	\$0.00		\$88.94	Books and Materials	Uncategorized Outgo	\$0.00

The guts of the Financial sheet is the data entered, you can filter on any of the values. New purchases are added to the top of the sheet. Always keep lines 10 & 11 empty. The macro on the Purchasing sheet will add new purchases starting at row 11. In order to insert new rows manually, click on any cell in row 11, then hit Shift-Space, then hit Ctrl-Shift-+ (control shift plus) to insert a row, and hit the plus button as many times you need rows.

Item	Price	Qty	Total	Link	Notes	Category	Date
<u>A Handbook of Basic Brewing Calculations</u>	\$49.00	1	\$49.00	https://interactive.asbnet.org/source/Orders/index.cfm?section=unknown&task=3&CATEGORY=BK04&PRODU		books	2/7/2009
<u>Shipping on Handbook of Calcs</u>	\$10.00	1	\$10.00			shipping	2/7/2009

The Notepad tab is just an unformatted plain text tab that is useful for taking down various notes.

This tab contains a link to the Brew Day Checklist file. Mine is a word doc, but change this link to point to whatever file you use. Actually, I create links to various documents I'm working with regularly here, such as a party/wedding planning document.

Known Issues & Quirks:

Be sure to enable macros each time you open the file.

Formatting Sums, on the Purchasing and Financial sheets, were the results are based on the numbers being italicized or bolded, do not always update automatically. To force an update you can highlight the cell, hit F2 then hit Enter.

I have blanked out the stock and the prices, except for the prices of Yeast which should be easy to replace with whatever your cost is, and the prices of the hops and grain varieties used in the example recipes so their price calculations will work. Just update the prices as you buy them. I did this so as to not appear to be promoting any store at the expense of others.

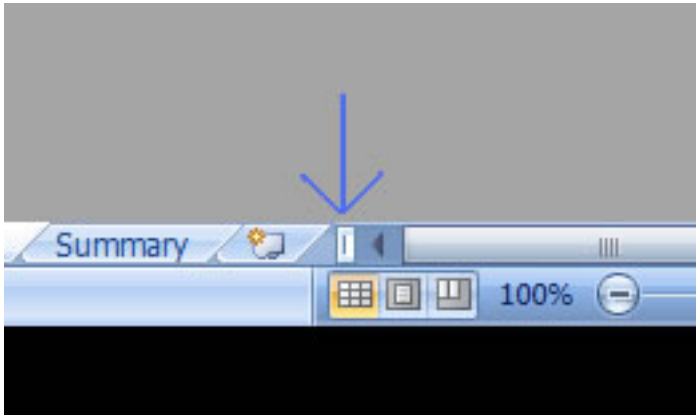
You'll notice there are multiple entries for one kind of malt, this is because I'll purchase from different stores and they carry different maltsters. When entering additional malts be sure to give them a unique name, I just put the maltsters name in parentheses for additional entries of one kind of malt. Same with hops, but I buy all my yeast from one store because I plan the shipping time.

On the Financial tab I have an entry for each category type in use in order to document them. I also have a couple items on the Purchasing tab. Take note that both sheets always leave two blank rows at the top. Just delete the data from the sheets once you see how the work to start tracking your own purchases.

The Packaging tab has a bunch of data in it to show how it might be used. Just blank those and use it as you see fit.

For equivalent grain types like Pilsner, Vienna, etc. from different maltsters I sort them by price cheapest at the top. For types of grains with a run in color like Caramel, Munich, Wheat I'll sort them by color. Like Wheat Malt is sorted first by color type then by price, so all the white/pale/light/standard wheats are at the top but sorted by price.

In order to see all the tabs you can drag the scroll bar itself over to the right. This is also the area where you can adjust the zoom if you're on a different display. Note in the screenshot below where to click and & drag.



Features/Enhancements being explored:

Composing a recipe with hops IBUs for the additions with the ounces calculated. This was working until I implemented hops absorption and I created a circular reference. It appears that this formula really is circular and that I cannot use a macro to just rewrite the formulas like I did to implement the toggle of OG/Plato.

Some sort of "Package Recipe" macro for adding a recipe to the Packaging tab.

Suggesting grain, hops and yeast based on Style dropdowns. Might be a macro popup, choice allowing selection for addition to the worksheet.

Mash Hopping? Does anyone really use this? If so, put in a request and I'll implement a factor for its utilization just like for FWH.

Update "Add to Purchasing" macro to merge duplicate ingredient references in the recipe into one line item on the purchasing sheet.

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Workflow Guide

My workflow with this spreadsheet is to use the Worksheet tab while initially designing a recipe. Once it is close to being solidified I export it to a new tab in the Recipes file. I then continue to work with it in this file as the beer progresses. When the beer is finally done, I lock the tab to prevent accidental modification of the recipe's details. As long as the two files are kept together in the same folder, the recipes will be able to reference the data in the Brewing file. Note that when the ingredient attribute data is updated in the Brewing file, the changes are reflected in all worksheet tabs, this includes locked tabs in the Recipes file so the derived values in that sheet will change. I am okay with this as I will keep updating the recipe tabs with the latest version of the recipe. I will keep making notes as I drink the beer, but to create historical snapshots for each specific brew, when I lock the tab (and am done with that beer) I archive the recipe to a JPEG. I'll always have the latest version of the recipe in the Recipes file, but also will be able to reference historical changes if needed. I name the JPEGs like "Example Ale YYYY.MM.DD.jpg" and everything is easily sorted. You can do simple filename searches to see all brews from one year or month, etc. I don't default to this file name because I will often make a jpeg to send to friends when discussing an upcoming recipe. When I am going to repeat a recipe I will work it up in the Worksheet in the Brewing again using the Recipes file as a reference, and then export it back to the Recipes overwriting the tab. I do this because the Worksheet will be the master record of my brewery, and variables can change so this keeps the data up-to-date.

When I have finished designing a recipe I will add the recipe to the purchasing sheet. There is a button on the Worksheet which will add the grains, hops and yeast to the purchasing sheet if there is not enough stock on hand. This will work from a tab in the Recipes file as well. I will edit the quantities if I'm going to make a bulk buy or merge duplicate entries (which will happen the same ingredient is listed multiple times in a recipe). Once I have bought the ingredients I will use the button on the Purchasing tab to move them over to the Financial tab. They will be italicized there symbolizing that they have not been received yet. I do a lot of shipping orders. Once the ingredients are in stock, I use the button on the Financial tab to mark them received and if they are hops, grains or yeast the inventories will be updated. After brewday, I revisit the recipe and update it for what was actually done, and then subtract it from the inventory with the button on the Worksheet, this of course works for tabs in the Recipes file as well.

While working up a recipe for future planning, I like to use the Calendar tab to efficiently use my fermenter and cold storage space. This feature took some thinking about in order to get a design that I liked and worked. There is a macro for updating the stored data on the sheet from the Recipes file, but the Worksheet tab will always be represented live. This was one feature that I had to have in my spreadsheet, once I tried it in BeerSmith I couldn't be without the ability to look at a calendar for planning.

Frequently Asked Questions

I cannot open the file. Or when it opens I see lots of errors. How come?

Why are so many values in the spreadsheet blank?

How do I do an extract brew in this spreadsheet?

How do I enter Dry Hop additions into the spreadsheet?

How are the IBUs for First Wort Hopping (FWH) additions calculated? How do I modify it?

Why is the tab locked? What is the password?

How do I modify the AA% or other attributes of ingredients? I can't do this in the Worksheet.

I cannot open the file. How come?

This spreadsheet uses the new Open Office XML format that Excel 2007 uses as its default. While you can install a compatibility pack to open these files in older versions of Excel, the formulas in the spreadsheet have too many conditions and I use too many names for the older versions to work. I am investigating the limits of the older versions of Excel and will keep you posted on a downlevel file's progress if we can get around this issue by breaking up the formulas and deleting some names and referring to cells by ID.

I assume that Mac Office 2008 should work almost flawlessly, it's Microsoft's latest version of Excel extending 2007 to the Mac. My guess is that any problems will center around the file system access, especially if you try to use a subfolder when exporting a recipe or jpeg. Let me know if you use this on Mac so I can confirm this or look for resolutions to any problems.

OpenOffice support is ~~not currently planned~~ has been planned due to demand. All of the macros will need to be rewritten, as well as all of the formulas due to the fact that OpenOffice interprets both differently. This work was hopefully further down the line for me than full support for opening an Excel file is for OpenOffice. If you happen to use OpenOffice, check in on [this thread in the forums](#), and let me know you're interested in seeing this built..

Why are so many values in the spreadsheet blank?

Rather than allowing calculation errors to be displayed, I have tried wherever possible to validate the inputs of every formula. So instead of seeing #VALUE or #DIV/0 in the boxes, you should hopefully be just presented with a clean sheet until you have entered in all the data required to calculate the value in that cell. For instance, Estimated FG will not be displayed until you have entered a yeast strain selection, which might not be immediately clear. If you are having trouble with a certain value, please let me know. I can help you out or resolve the issue in the code if there is one. Another not so obvious instance is when you enable Hops Aging you must enter in the % Lost and the Date Purchased in the Hops tab for IBU & Utilization to work. Similarly Utilization requires that some amount of fermentables be added to predict original gravity which is a factor.

How do I do an extract brew in this spreadsheet?

The Grains tab includes extracts in there. Be sure to add the specific ingredients you will be using if they are not already listed, and to modify the attributes to your needs. When composing a recipe in the Worksheet tab, you need to change the "Late?" column's dropdown for your extract addition to be either "Yes" or "No" depending on whether or not you are going to add the extract to the boil at the beginning of the boil (choose "No") or add it later around 15 minutes left (choose "Yes"). To configure how much a late extract addition impacts the Pre Boil Gravity (and thus Utilization) you can adjust the Extract GU Factor in the Equation Factors section.

How do I enter Dry Hop additions into the spreadsheet?

In order to enter in your dry hopping additions, simply enter "dry hop" for the time value on the Worksheet. No IBUs are contributed to the beer when using dry hop additions.

How are the IBUs for First Wort Hopping (FWH) additions calculated? How do I modify it?

In order to use hops as a FWH, simply add "FWH" for the time value of the addition. The default is to assume 10% more utilization than would happen if the hops were added for the entire boil. While utilization actually goes up, some people prefer to have their FWH impact the

IBU calculation like a 20 minute addition. In order to do that you will need to modify the FWH Factor in the Equation Factors section of the Worksheet. Divide 20 by the total time of your boil, and use that result as your factor. The default is 1.1 corresponding to a 10% increase in utilization. If you want to set it similar to a 20 minute addition with a 60 minute boil make it .33, for a 75 minute boil .27, and a 90 minute boil set it to .22.

Why is the tab locked? What is the password?

The password for locked/protected content is "unlock" and locking is used for tabs that are mostly static and I want to prevent accidental modifications from happening (such as previously brewed recipes and chart tabs). I also locked the Worksheet, Calculators and Calendar tabs except for the cells that need to be modified for use in order to prevent accidental modification of the sheets. The equations were compiled from books, the internet, and other brewing spreadsheets and are documented in the Formulas section.

How do I modify the AA% or other attributes of ingredients? I can't do this in the Worksheet.

The attributes of the ingredients are stored in the Hops, Grains and Yeast tabs respectively. These tabs are not locked. To edit AA% go to the Hops tab and change it to match the values you have in stock. If you have multiple types of the same kind of hop (say you have pellets and leaf, or say you have purchased from two different sources) you can add more copies of the same variety too and then modified each one to match. My one word of caution when doing that is to make sure each one has a unique name otherwise the look-ups that check the attributes like AA% will only find the first one, so the names must be unique. You can do something like Cascade '07, or Cascade, P (for pellets) or Cascade, HD (for Hops Direct).

To create a copy of a variety what you do is you go to the Hops tab, click on the hops variety that you want to duplicate. Hit Ctrl-Space to select the whole row, Ctrl-C to copy it, then hit Ctrl-Shift-+ (Control Shift Plus), and this will insert a copy, then change the name of one of them.

If you want to insert a new variety that is not listed, find the spot that you want to insert it and click the variety that will be right below it. Like if you were inserting something called Fast Hops (just making up a variety name) then you would click on First Gold if you want to make it alphabetical, then hit Ctrl-Space to select the whole row, then hit Ctrl-Shift-+ to insert an empty row (same thing as before except without copying first). Then you can go in and fill all the information.

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3/27/2009 - v1.1

Bug Fix: Minor change to the Calendar tab so that the Tap Date is displayed with the correct date (off by one).

3/25/2009 - v1.0

Initial Release

"Your table actually looks a little scary to me." - Jessica

"Awesome spreadsheet, Diesel. I appreciate how much work this has taken having built my own also." - Fred

"My first impression from just looking at the spreadsheet is HOLY \$#!T where do I begin on this thing!!!??" - Thomas

"Wow that is some spreadsheet. How much of your life did you spend making that? Thank you" - SiouxBrewer

"No doubt! That's impressive." - Von KromDom

"That's intense. Great work!" - Eagle106Joe

"I've been playing around with this a bit and I am very impressed with all the details that this covers ... gives promash a run for their money IMO." - ewanzel

"Dude, that's so sweet it gave me computational-wood!" - StormyBrew

"Ha ha, looks like I should stop work on my own, you done everything I have and then some!" - cornixt

"Wow, very impressive, it's like Excel on steroids!!" - Andy

"Holy COW! this is so very thorough it's unbelievable! From an amateur's point of view, i think this is the 'beez neez' of spreadsheets. I'm VERY VERY VERY impressed! thanks!" - Shortz

"Amen to diesel drafts brewing spreadsheet! amazingly done and free! cant beat it!"- David Phinney