



# Brewing Water

Adjusting the chemistry of your brewing water is an advanced technique that can improve the quality of your beer. This poster has general guidelines to help brewers make these adjustments.

Water Type Chart		
Type	Carbonate CO <sub>3</sub>	Sulfate SO <sub>4</sub>
Soft	<50	<50
Mod Sulfate	50-100	50-200
Mod Carbonate	50-200	50-100
Hi Sulfate	50-200	>200
Hi Carbonate	>200	50-200

Popular Brewing Salts	
Calcium Sulfate (Gypsum)	CaSO <sub>4</sub>
Sodium Chloride (Non-Iodized Salt)	NaCl
Calcium Carbonate (Chalk)	CaCO <sub>3</sub>
Magnesium Sulfate (Epsom Salts)	MgSO <sub>4</sub>
Sodium Bicarbonate (Baking Soda)	NaHCO <sub>3</sub>
Calcium Chloride	CaCl

Ion	Beer Contribution**
Sulfate	Accentuates hop bitterness, making bitterness seem drier and more crisp. A concentration over 400ppm however, the resulting bitterness can become astringent and unpleasant. Sulfate is only weakly alkaline and does not contribute to the overall alkalinity of water. It is recommended that the source water below rather than higher in sulfate because it can always be added, and is not readily removed.
Chloride	Helps accentuate the malt sweetness and fullness of beer but levels greater than 250ppm in most beers tastes pasty or salty. Levels above 300ppm are said to affect yeast health. Elevated chloride levels may lead to a mineral or salty flavor when combined with sulfate or sodium.
Calcium	Enhance hop flavor and reduce haze. 50mg/ml also helps to improve flocculation and reduce the extraction of tannins and silicates. (Zymurgy mar/apr 2015)
Magnesium	Accentuate flavor with a sour bitterness when present in brewing water at concentrations approaching 40mg/ml. Magnesium is a key nutrient for yeast health, only 5ppm is needed.
Sodium	Low levels of sodium (<150ppm) acts to improve mouthfeel and fullness in pale beers. Ales seem to be less affected by this than lagers.

About the Sulfate-to-Chloride Ratio**	
This ratio is important to the balance of beer and may be more important than the actual amounts. This balance is the hoppy-to-fullness or dryness-to-fullness of the beer. High levels of either ion can be mineral or harsh.	
Remember that ppm and mEq are different measurements, meaning a ratio of 30:30 ppm and 300:300 ppm are not equivalent. There is a minor difference.	
Suggested minimum level of sulfate is 50ppm with a maximum of around 500ppm	
Suggested minimum level of chloride to affect beer is 50ppm with a maximum around 200.	

Brewing Profiles						
Style or Region	Calcium	Magnesium	Sodium	Carbonate	Sulfate	Chloride
	Ca <sup>+2</sup>	Mg <sup>+2</sup>	Na <sup>+1</sup>	CO <sub>3</sub> <sup>-2</sup>	SO <sub>4</sub> <sup>-2</sup>	Cl <sup>-1</sup>
Alt	30-50	2-10	20-30	0	70-120	35-50
Bitter	60-120	10-12	15-40	0	180-300	25-50
Bock	55-75	2-10	40-65	60	35-55	60-90
Brown Ale	15-30	10-12	40-60	0	35-70	60-90
Dark Lager	75-90	10-12	35-60	90	35-70	60-90
Doppelbock	75-85	0	40-70	90	35-55	60-110
Dortmunder	60-85	0	45-60	0	140-215	70-90
Dry Stout	50-120	10-12	10-30	60-80	18-35	18-40
Light Lager	35-55	2-6	20-30	0	80-130	25-55
Märzen	30-60	0	25-40	0	70-140	45-60
Mild	25-70	10-12	30-40	0	95-160	50-70
Munich Dark	50-80	10	1-15	60	15-35	2-20
Pale Ale	90-150	18-20	17-30	0	300-425	30-55
Pilsener	5-10	1-10	2-3	5-15	5-6	5-10
Porter	50-70	10	40-50	60	35-55	60-80
Scottish	20-40	20	12-40	0	50-90	18-40
Sweet Stout	55-85	4	10-25	60-90	18-40	18-30
Weizen	15-30	0	5-15	0	35-75	10-20
Burton-on-Trent	265-295	45-60	30-55	200-300	635-725	25-35
Dortmunder	225-260	25-40	60-70	180	120-140	60-80
Dublin	105-115	4-10	6-12	250-300	55	19
Edinburgh	120-140	25-35	55-65	350	140-220	20-40
London	50-70	5-15	50-100	125-150	60-75	18
Munich	75-80	18-20	1-8	145-165	6-10	1-2
Pilzen	7	1-2	2-4	9-14	5-6	5
Vienna	190-200	60	8	120-125	125	12

Basic Water Adjustments By Style*							
Adjustments are tsp/5gallons							
Beer Style	Water Type	Gypsum	Salt	Chalk	Epsom Salts	pH	Water Suggestion
IPAs, US Pale Ales,	Soft	2	0.25	0	1	7	OK to Use
	Mod Sulfate	1.25	0.25	0	1	7	OK to Use
Brown Ales, Imperial Stouts	Mod Carbonate	1.5	0.25	0	1	7	OK to Use
	Hi Sulfate	0.5	0.25	0	1	7	OK to Use
	Hi Carbonate	1	0.25	0	1	7	OK to Use
Bitter	Soft	1.5	0.25	0	0	7	OK to Use
	Mod Sulfate	1	0.25	0	0	7	OK to Use
	Mod Carbonate	1.25	0.25	0	0.25	7	OK to Use
	Hi Sulfate	0	0.25	0	0.25	7	OK to Use
Pale Ale, Burton-on-Trent	Hi Carbonate	0.75	0.25	0	0.25	7	OK to Use
	Soft	3.5	0.125	2	2	7	OK to Use
	Mod Sulfate	3	0.125	1.5	2	7	OK to Use
	Mod Carbonate	3	0.125	1.5	2	7	OK to Use
Pale Ale London	Hi Sulfate	2	0.125	1.5	2	7	OK to Use
	Hi Carbonate	3	0.125	0.5	2	7	OK to Use
	Soft	0.25	0.25	2	0.25	7	OK to Use
	Mod Sulfate	0	0.25	1	0	7	OK to Use
Mild Ale	Mod Carbonate	0	0.25	0	0	7	OK to Use
	Hi Sulfate	0	0.25	0	0	7	OK to Use
	Hi Carbonate	0	0.25	0	0	7	OK to Use
	Soft	0.75	0.33	0.25	0.25	7.2	OK to Use
Brown Ales, English and Irish Ales	Mod Sulfate	0	0.33	0.25	0.25	7.2	OK to Use
	Mod Carbonate	0.25	0.33	0.25	0.25	7.2	OK to Use
	Hi Sulfate	0	0.33	0	0	7.2	Dilute 1:1 with Distilled Water
	Hi Carbonate	0	0.33	0	0	7.2	Dilute 1:1 with Distilled Water
Scottish Ales & Wee Heavy	Soft	0.33	0.5	0	0	7.2	OK to Use
	Mod Sulfate	0	0.5	0	0	7.2	OK to Use
	Mod Carbonate	0	0.5	0	0	7.2	OK to Use
	Hi Sulfate	0	0.5	0	0	7.2	Dilute 1:1 with Distilled Water
Scottish Ale, Edinburgh	Hi Carbonate	0	0.5	0	0	7.2	Dilute 1:1 with Distilled Water
	Soft	0.25	0.125	0	0	7	OK to Use
	Mod Sulfate	0	0.125	0	0	7	OK to Use
	Mod Carbonate	0	0.125	0	0	7	OK to Use
Porter, Robust and Brown, Barleywine, ESB	Hi Sulfate	0	0.125	0	0	7	Dilute 1:1 with Distilled Water
	Hi Carbonate	0	0.125	0	0	7	Dilute 1:1 with Distilled Water
	Soft	0.25	0.25	1	0	7.2	OK to Use
	Mod Sulfate	0.25	0.25	0	0	7.2	OK to Use
Sweet, Cream or Oatmeal Stout	Mod Carbonate	0.25	0.25	0	0	7.2	OK to Use
	Hi Sulfate	0	0.25	0	0	7.2	Dilute 1:1 with Distilled Water
	Hi Carbonate	0	0.25	0	0	7.2	Dilute 1:1 with Distilled Water
	Soft	0.125	0.125	1.25	0	7.2	OK to Use
Dry Stout, Schwartzbier, German Dunkel, Export Stout	Mod Sulfate	0	0.125	0	0	7.2	OK to Use
	Mod Carbonate	0	0.125	0	0	7.2	OK to Use
	Hi Sulfate	0	0.125	0	0	7.2	Dilute 1:1 with Distilled Water
	Hi Carbonate	0	0.125	0	0	7.2	OK to Use
Irish Dry Stout	Soft	0	0	2	0.25	7.2	OK to Use
	Mod Sulfate	0	0	2	0	7.2	OK to Use
	Mod Carbonate	0	0	2	0	7.2	OK to Use
	Hi Sulfate	0	0	2	0	7.2	Dilute 1:1 with Distilled Water
Bohemian Pilsener, Trippel, Wit, Kölsch, Helles, Belgian Golden Ales, Saison, Bière de Garde	Hi Carbonate	0	0	2	0	7.2	Dilute 1:1 with Distilled Water
	Soft	0	0	0	0	7	OK to Use
	Mod Sulfate	0	0	0	0	7	OK to Use
	Mod Carbonate	0	0	0	0	7	OK to Use
Light Lager, German Pilsner, Maibock, Fruit Beer, Cream Ale	Hi Sulfate	0	0	0	0	7	Use Bottled Water
	Hi Carbonate	0	0	0	0	7	Use Bottled Water
	Soft	0.75	0.25	0	0	7	OK to Use
	Mod Sulfate	0	0.25	0	0	7	OK to Use
Dark Lager	Mod Carbonate	0	0.25	0	0	7	Dilute 1:1 with Distilled Water
	Hi Sulfate	0	0.25	0	0	7	Dilute 1:1 with Distilled Water
	Hi Carbonate	0	0.25	0	0	7	Use Bottled Water, soft water additions
	Hi Carbonate	0	0.25	0	0	7	Use Bottled Water, soft water additions
Munich Dunkel	Soft	0.33	0.25	1.5	0	7.2	OK to Use
	Mod Sulfate	0	0.25	0.25	0	7.2	OK to Use
	Mod Carbonate	0	0.25	0.25	0	7.2	OK to Use
	Hi Sulfate	0	0.25	0.25	0	7.2	Dilute 1:1 with Distilled Water
Märzen, Rauchbier, Vienna	Hi Carbonate	0	0.25	0.25	0	7.2	Dilute 1:1 with Distilled Water
	Soft	0	0.25	1	0.25	7.2	OK to Use
	Mod Sulfate	0	0.125	0.25	0	7.2	OK to Use
	Mod Carbonate	0	0.125	0.25	0	7.2	OK to Use
Bock	Hi Sulfate	0	0.125	0.25	0	7.2	Dilute 1:1 with Distilled Water
	Hi Carbonate	0	0.125	0.25	0	7.2	Dilute 1:1 with Distilled Water
	Soft	0.25	0.33	1	0.25	7.2	OK to Use
	Mod Sulfate	0	0.33	0	0	7.2	OK to Use
Doppelbock	Mod Carbonate	0	0.33	0	0	7.2	OK to Use
	Hi Sulfate	0	0.33	0	0	7.2	Dilute 1:1 with Distilled Water
	Hi Carbonate	0	0.33	0	0	7.2	Dilute 1:1 with Distilled Water
	Soft	0.25	0.5	1.5	0	7.2	OK to Use
Alt	Mod Sulfate	0	0.25	0	0	7.2	OK to Use
	Mod Carbonate	0	0.25	0	0	7.2	OK to Use
	Hi Sulfate	0	0.25	0	0	7.2	Dilute 1:1 with Distilled Water
	Hi Carbonate	0	0.25	0	0	7.2	Dilute 1:1 with Distilled Water
Dortmunder	Soft	0.5	0.25	0	0	7	OK to Use
	Mod Sulfate	0	0.125	0	0	7	OK to Use
	Mod Carbonate	0	0.125	0	0	7	OK to Use
	Hi Sulfate	0	0.125	0	0	7	Dilute 1:1 with Distilled Water
Weizen	Hi Carbonate	0	0.125	0	0	7	Dilute 1:1 with Distilled Water
	Soft	0.33	0	0	0	7	OK to Use
	Mod Sulfate	0	0	0	0	7	OK to Use
	Mod Carbonate	0	0	0	0	7	OK to Use
Dunkel Weizen	Hi Sulfate	0	0	0	0	7	Dilute 1:1 with Distilled Water
	Hi Carbonate	0	0	0	0	7	Dilute 1:1 with Distilled Water
	Soft	0.33	0	0	0	7.2	OK to Use
	Mod Sulfate	0	0	0	0	7.2	Dilute 1:1 with Distilled Water
Dubbel, Old Bruin, Abbey Ale, Belgian Strong Dark Ales,	Mod Carbonate	0	0	0	0	7.2	Dilute 1:1 with Distilled Water
	Hi Sulfate	0	0	0	0	7.2	Use Bottled Water, soft water additions
	Hi Carbonate	0	0	0	0	7.2	Use Bottled Water, soft water additions
	Soft	0	0	0	0	7.2	OK to Use

References:  
Szamatulski, Szamatulski. Beer Captured. Maltose Press, 2011. Print.  
Palmer, Kaminski. Water. Brewers Publications, 2013. Print.