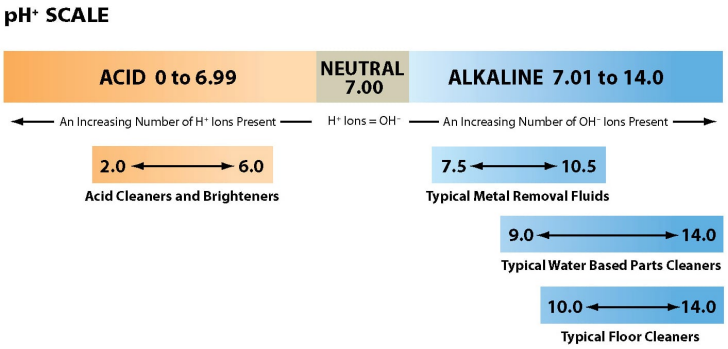
Technical Bulletin

Master Fluid SOLUTIONS®

Characteristics of Metalworking Fluids - pH+



To a chemist or a mathematician, pH+ is a symbol that represents a concept that is defined as the activity of hydrogen ions in a solution expressed as a negative logarithm. This scale is unit-less, with 0 being the most acid, 14 the most alkaline or basic, and 7 being neutral. In this symbol, the small “p” is the mathematical symbol for the negative logarithm, and the “H”, or more properly the “[H+]”, is the chemical symbol for a hydrogen ion. As you recall, logarithms are a way of expressing the value of a number as an exponent so the actual pH number or value is the value of the hydrogen ion activity expressed as a “common“ or base 10 log, e.g. log10. So, for all practical purposes, the pH number is the number of digits to the right of the decimal place (these are negative logs, so no need to show the "–" in writing the pH value). It is important to note that because we are dealing with logarithms, a pH of 8 is 10 times as alkaline as one with a pH of 7, and 9 is 100 times as alkaline, etc; so sometimes even relatively small changes in pH can be significant.

Maybe a less theoretical but more practical way of looking at the pH question is to say: Acids or acidic systems have an excess of H+ ions – basic systems are short of H+ ions or have an excess of OH– ions – neutral systems, those with a pH of 7, have a balance between the number of H+ and OH– ions based on their activity.

The “optimal” pH for any given working solution or situation is driven by the specifics of the situation and the fluid. The optimum pH for the fluid in your shop may well be determined by the specific fluid in use, its concentration, and many other issues of use.

The following chart shows the approximate pH of some common materials and the pH value of some typical MWF formulations and components. These numbers are offered for reference only, not to be used as specifications, etc.

Hydrogen Ion Concentration	pH+	Typical Examples	MWF Examples
1.00	0	Sulfuric, nitric, battery acid	
0.1	1	Stomach acid	Acid cleaners/derusters
	1.0-3.0		KATHON® 886MW, a biocide
0.01	2	Lemon juice, vinegar	
0.001	3	Grapefruit or orange juice soda	
0.0001	4	Tomato juice, acid rain	
0.00001	5	“soft” water - black coffee	
0.000001	6	Urine - saliva	
	6.0-7.0		BUSAN® 77 a biocide
0.0000014	6.4	Blood	
0.0000018	6.8	“Average” human skin	
0.0000001	7	Triple Distilled Water	
	7.5-9.0		Typical soluble oil working solutions
0.00000001	8	Sea water	Organic degreasers
	8.5-10.0		Typical semisynthetic working solutions
0.000000001	9	Baking soda	Light duty in-process cleaners
	9.0 – 10.5		Typical synthetic working solutions
0.0000000001	10	The Great Salt Lake – Milk of Magnesia	Water-based corrosion inhibitors
	10.2		AMP 95, a common MWF amine
	10.5		TEA, a common MWF amine
	10.7		MEA, a common MWF amine
0.0000000018	10.8		GROTAN®, a biocide
0.00000000001	11	Household ammonia solution	Moderate-duty parts cleaners
0.000000000001	12	Soapy water	Heavy-duty parts cleaners
0.0000000000001	13	Household bleach or oven cleaner	Heavy-duty parts cleaners
0.00000000000001	14	Liquid drain cleaner	Very heavy-duty parts cleaners
	14	Concentrated Sodium and potassium hydroxide (NaOH or KOH)	

NOTES:

1. In the laboratory, pH is most often measured with a pH meter, which is the most accurate method if proper techniques are used. In the field, pH paper is often used and while it is not as accurate on a theoretical level, it is normally close enough for most metalworking fluid work. When measuring pH in used working solutions, things like dye and tramp oil can seriously

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compromise the accuracy of results, so good technique and a healthy dose of common sense are recommended.

2. When measuring pH of solutions, the concentration of the material can significantly affect both the measured pH and the solution's ability to maintain that pH.
3. Over time, used metalworking fluids tend to have their pH drift down towards neutral so if the pH of a used MWF solution is higher than a new one, investigation is indicated.

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