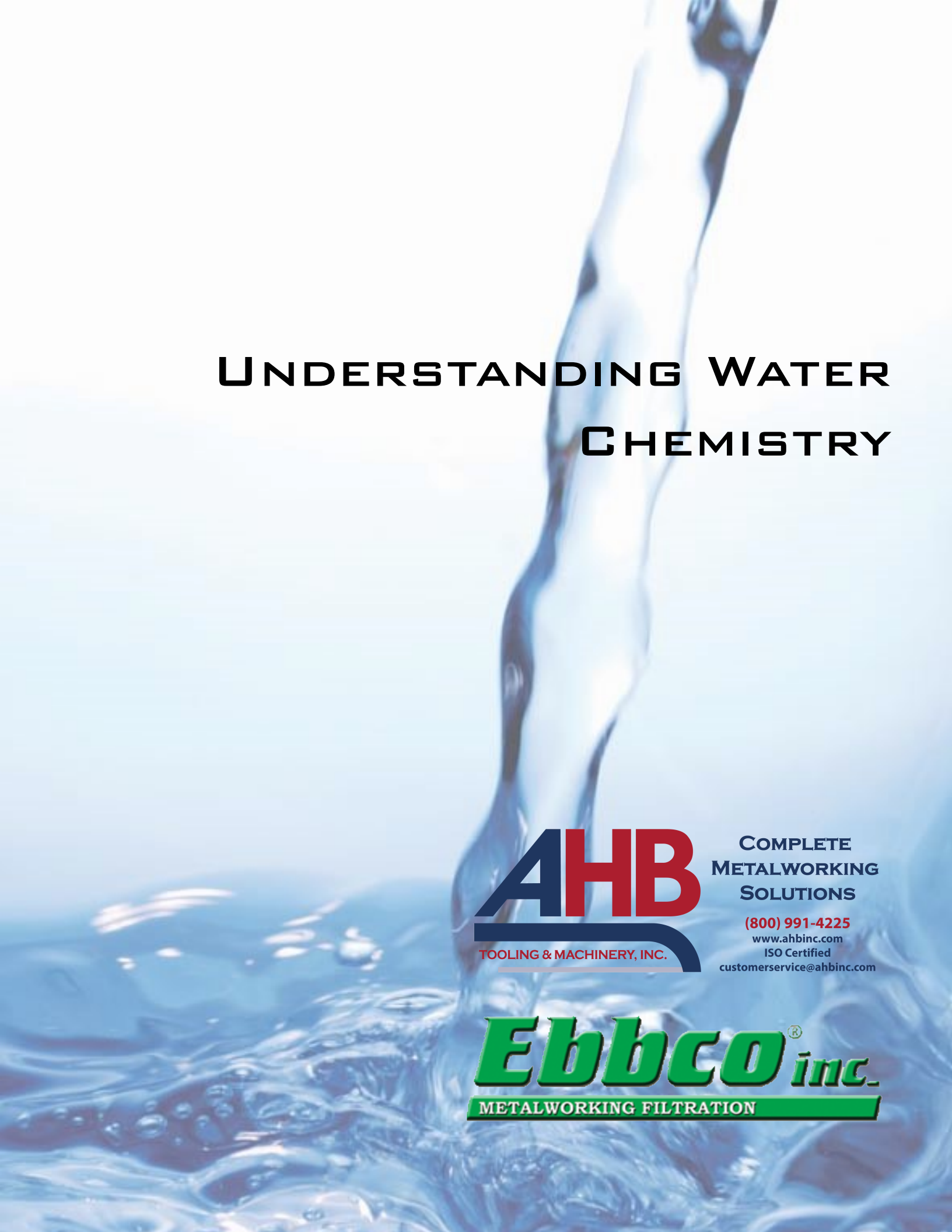
Understanding Water Chemistry



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Understanding water treatment is essential in being able to properly apply a water treatment solution for Coolant Mixtures. Proper Coolant: Water Ratio can prolong the life of the Fluid and the Machine Tool, provide a better part finish and a cleaner work environment.

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Water Chemistry

The most effective way to understand water treatment equipment is to have a basic knowledge of water chemistry. This allows one to understand a water quality report and make educated decisions on what water treatment is needed for the application. A water quality report will list a breakdown of what minerals are found in the water and will display the overall water quality in parts per million (PPM), or total dissolved solids (TDS). These metrics are all a measure of dissolved solids and can be used to determine the conductivity/resistivity of the incoming water source.

Water Conductivity

Water conductivity is defined as the measurement of the ability of a water sample to conduct electricity. This is used as a measure of the concentration of dissolved solids that have been ionized in water.

Units of Water Conductivity

1/Ω (1/Resistance)

TDS (Total Dissolved Solids)

PPM (Parts Per Million)

µS/cm (Microsiemens per centimeter)

GPG (grains per gallon)

Water Conductivities			
Solution	**Microsiemens**	**gpg**	**ppm**
Totally Pure Water	0.055		0.036
Typical DI Water	.1		0.064
Distilled Water	0.5		0.32
RO Water	50-100	1.5-2.9	30-65
Domestic “Tap” Water	500-800	14.6-23.4	100-510
Potable Water (Max)	1,055	30.9	675
Sea Water	56,000	1,637	35,900
Brackish Water	100,000	2,924	64,100

Conductivity vs Resistivity

When the ionic concentration is very low in high purity water applications, the measured conductivity falls below a value of one microsiemen per centimeter. In order to express this value as a whole number, the resistivity scale is often used; conductivity and resistivity are inversely proportional. For example: the reciprocal of 0.10 microsiemens [or $1/(0.10 \times 10_6 S/cm)$] is then $10 \times 10_6$ ohmscm or 10 MegOhm. Either unit of measurement can be used to state exactly the same value.

Conductance, Resistance and Dissolved Solids

Conductance	Resistance		Dissolved Solids
Microsiemens	Ohms	Megaohms	PPM
.0833	12,000,000	12.0	.0530
.100	10,000,000	10	0.064
0.125	8,000,000	8	0.080
0.167	6,000,000	6	0.107
0.2	5,000,000	5	0.128
0.25	4,000,000	4	0.160
0.5	2,000,000	2	0.321
1	1,000,000	1	0.641
2	500,000	0.5	1.282
4	250,000	0.25	2.564
5	200,000	0.2	3.205
6.67	150,000	0.15	4.274
8	125,000	0.13	5.128
10	100,000	.10	6.410
12.50	80,000	0.08	8.013
14.29	70,000	0.07	9.158
16.67	60,000	0.06	10.684
20.00	50,000	0.05	12.821

Understanding a Water Quality Report

Blaser Swisslube Inc.
31 Hatfield Lane, Goshen, New York• Tel. (845) 294-3200• Fax (845) 294-3102

Laboratory Test Report

Current Sample No: 91731

Customer	PRECISION MACHINING COMPANY	**Location**	NORTH BRANCH, MI	**Received**	03/07/2019
System	SOFTENED PLANT (CITY) WATER	**Dist**	AHB	**Completed**	03/08/2019
System ID	PMCSPCH2O	**SalesRep**	Borgacz, Dan	**Startup**	
Sump Size (gal)		**Area Mgr:**	R. Youngblood	**Age (wks)**	

Examinations	Ranges	Current	Previous	Previous
Sample Number		91731		
Sample Date		03/05/2019		
Product		Water		
Aspect		Transparent		
Color		Colorless		
Odor		Odorless		
pH		7.7		
Specific Conductivity	< 1.00 mS/cm	0.53		
Magnesium (ppm MgCO3)		0		
Calcium (ppm CaCO3)		0		
Hardness XRF (MgCO3+CaCO3)		0		
Chloride	< 40 ppm	* 90		
Sulfate	< 40 ppm	36		
Nitrite	< 20 ppm	0		
Nitrate	< 50 ppm	0		

Softened city water. Water softeners do not remove chloride or sulfate. This water should be further treated by reverse osmosis or deionization prior to mixing Blasocut or Vasco emulsions. Discuss lab data with your Blaser Area Manager or local Blaser Distributor Rep.

Reason for Testing: water

Commented By: D. Sewell

Definitions

Calcium

Calcium (Ca) is the measure of calcium carbonate ($CaCO_3$) contained in the sample. Calcium carbonate is commonly found in ground water. Total water hardness is normally

Chloride

Chloride is formed when the element chlorine (a halogen) gains an electron or when a compound such as hydrogen chloride is dissolved in water or other polar solvents. Chloride salts such as sodium chloride are often very soluble in water.

Chlorine and Chlorination

Chlorine gas (Cl_2) is widely used as a cheap and effective sanitizer for water. Bacteriological contamination is unlikely to occur if free chlorine levels are kept around 0.4 – 0.5 ppm. If used to treat drinking water, chlorine helps to offset the harmful effects of iron, manganese, sulfides and ammonia.

Magnesium

Magnesium (Mg) is expressed on most water hardness reports as $CaCO_3$. This expression is to normalize magnesium atomic number (12) to calcium atomic number (20), this is to express the total water hardness as parts per million of $CaCO_3$.

Nitrate

Nitrate is a compound that is formed naturally when nitrogen combines with oxygen or ozone. Nitrogen is essential for all living things, but high levels of nitrate in water can be dangerous to health, the amount of nitrate (NO_3) in water is an important issue in many parts of the world due to nitrates entering groundwater and streams due to runoff of agricultural fertilizers or through organic pollution. In unpolluted water nitrate is rarely above 1 ppm so higher levels may indicate contamination. If measurements are given as Nitrate-N this means the nitrogen contained in the nitrate compound is free nitrogen. Free nitrogen is unbound nitrogen which can form harmful nitires. To convert nitrate to nitrite, multiply by 4.4, so 1 ppm Nitrate-N (NO_3-N) is the same as 4.4 ppm nitrite (NO_2).

Nitrite

Nitrites are a salt or ester anion of nitrous acid, which can be naturally or artificially occurring in groundwater. Nitrites come from fertilizers through run-off *water*, sewage, and mineral deposits. ... Unfortunately it can also stimulate the grown of bacteria when introduced in high levels into a body of *water*.

pH

pH is an approximate indication of the acidity or alkalinity of water. pH is a logarithmic expression of the inverse of the number of hydrogen ions (H^+) present in a solution. Low pH water often indicates increased corrosion potential or acidity in the sample. For drinking water pH should ideally be between 6.8 and 8.5.

Sulfate

Sulfate is sometimes called vitriol, SO_4, or the salt of sulfuric acid. Most of the sulfate in water comes from dissolved minerals, namely sodium sulfate (salt cake), magnesium sulfate (Epsom salts) and calcium sulfate (gypsum). Sulfate can also come from fertilizer or sewage treatment.

Total Dissolved Solids (TDS)

When reviewing water reports, the most important information to look for is the total dissolved solids or TDS. The TDS is the sum of all ions dissolved in the raw water. As seen in Table 4, the TDS is greater than the sum of all recorded minerals on the report. The conductance is also a good indicator of water quality 1.56 uS/cm (conductance) = TDS. Other ions can be present in water which are not shown on the report such as aluminum, boron, manganese, potassium, and many others.

Total Hardness

Hardness is the amount of calcium and magnesium in the sample water. By convention hardness is given as amount of calcium carbonate ($CaCO_3$) although it actually measures magnesium as well.

Water Treatment

DI Resin

DI Resin works by an ion exchange of the supply water, removing all ions contained within the water. Each cubic foot of DI resin is capable of removing 12,000 grains per cu.ft. of dissolved minerals.

Using two types of ions, anions (-) and cations (+), the resin contained within the bag has a mixture of hydrogen (H) and hydroxide (OH) ions. The hydrogen exchanges with the cations and the hydroxide with the anions thus the output is pure water (H2O).

Anions are negatively charged ions or non-metals (examples are carbonates, bicarbonates, sulfates, chlorides, nitrates and silica).

Cations are positively charged ions or metals (examples are calcium, magnesium, sodium, potassium, iron and magnesium).

Water Purity Monitoring

A Conductivity light is a visual indication of the acceptability of the water quality. When the water resistance is greater than 50 Kohm, the lamp will light green. When the resistance falls below the 50 Kohm the lamp will light red. This red lamp is an indication that the Resin would need to be serviced and that other service may be required on the system.


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