

## **TEC-1020: WATER QUALITY STANDARDS**

### **1. Overview**

The quality of the inlet cutting water supply is one of the most important factors affecting component life and performance. Waterjet components are subject to stress levels that are sensitive to the effect of compounds in water that can lead to localized damage, like corrosion that can lead to crack initiation failure of metallic pressurized components.

Scale forming constituents result in material buildup, causing erosion. Dissolved solids are abrasive. High pressure seals and orifices are the primary components effected by poor water quality.

### **2. Terminology**

Alkalinity	The acid neutralizing capacity of water, usually expressed as M alkalinity. Several ions contribute to alkalinity and is generally assumed to be due to bicarbonate ( $\text{HCO}_3^-$ ), carbonate ( $\text{CO}_3^{2-}$ ), and hydroxyl ( $\text{OH}^-$ ) ions.
Hardness	Calcium and magnesium salts cause water hardness. Carbonate hardness is usually due to magnesium and calcium bicarbonate; non-carbonate hardness is due to sulfates and chlorides.
pH	An indicator of the acidity or alkalinity of a system represented on a scale of 0-14, with 0-6.9 being acidic, 7 being neutral, and 7.1-14 being basic.
TDS	Total dissolved solids, the sum of all organic and inorganic material dissolved in water.

### 3. Water Quality Standards

Table 1 details the recommended requirements for the inlet cutting water supplied to the intensifier.

**Table 1  
Water Quality Standards**

<b>Constituent (mg/l)</b>	<b>Minimum Requirement</b>	<b>Better</b>	<b>Best</b>
Alkalinity	50	25	10
Calcium	25	5	0.5
Chloride	100	15	1
Free Chlorine	1	1	0.05
Iron	0.2	0.1	0.01
Magnesium as Mg	0.5	0.1	0.1
Manganese as Mn	0.1	0.1	0.1
Nitrate	25	25	10
Silica	15	10	1
Sodium	50	10	1
Sulfate	25	25	1
TDS*	200	100	35**
Total Hardness	25	10	1
pH	6.5-8.5	6.5-8.5	6.5-8.5
Turbidity (NTU)	5	5	1

\* **Note:** Total dissolved solids

\*\***Note:** Do not reduce the TDS beyond this amount or the water will be too aggressive.

#### 4. Common Water Impurities

Table 2 provides a list of common water impurities and their characteristics.

**Table 2**  
**Water Impurities**

Constituent	Chemical Formula	Comments
Alkalinity	Bicarbonate (HCO <sub>3</sub> ) Carbonate (CO <sub>3</sub> ) Hydrate (OH), expressed as CaCO <sub>3</sub>	Acid neutralizing capacity of water. Foaming and carryover of solids, causes embrittlement of steel, can produce CO <sub>2</sub> , a source of corrosion.
Calcium	Ca	When dissolved makes water hard; contributes to the formation of scale.
Chloride	Cl	Adds to solid content and increases corrosive character of water; in relative percentage presence with oxygen induces stress corrosion cracking.
Free Chlorine	Cl <sub>2</sub>	Oxidizing agent; can attack elastomeric seals and damage reverse osmosis (RO) membranes.
Iron	Fe <sup>++</sup> (ferrous) Fe <sup>+++</sup> (ferric)	Discolors water or precipitation; source of scale and erosion.
Magnesium as Mg		When dissolved makes water hard; contributes to the formation of scale.
Manganese as Mn	Mn <sup>++</sup>	Discolors water or precipitation; source of scale and erosion.
Nitrate	NO <sub>3</sub>	Adds to solid content; effect is not generally significant industrially.
Silica	SiO <sub>2</sub>	Causes scale
Sodium	Na	Found naturally; introduced to water in the ion exchange water softening process.
Sulfate	SO <sub>4</sub>	Adds to solid content; combines with calcium to form calcium sulfate scale.
TDS		Measure of the total amount of dissolved matter in water.
Total Hardness	CaCO <sub>3</sub>	Sum of all hardness constituents in water; typically expressed as their equivalent concentration of calcium carbonate; primarily due to calcium and magnesium in solution, but may include small amounts of metal. Carbonate hardness is usually due to magnesium and calcium bicarbonate; non-carbonate hardness is due to sulfates and chlorides.
pH		Intensity of the acidic or alkaline solids in water.

## 5. Water Treatment Guidelines

Hardness, iron and manganese can form deposits and/or cause erosion, affecting cutting efficiency and unscheduled downtime. Affects are especially evident at the nozzle, and high pressure seals are also impacted.

When the other elements are within acceptable levels, in most cases a water softener will satisfy flow rate and capacity requirements.

- Observe the usual hardness, iron and manganese application criteria.
- Use appropriate accessories when the hardness to iron ration is less than 8:1.
- When iron or manganese is the only problem, use properly sized filtering elements with surface active agents for ore retention.

A high level of dissolved solids and chloride can promote corrosion on wetted metal parts. Silica and TDS can contribute to scaling and erosion.

Reverse osmosis (RO) water treatment is recommended when raw water:

- TDS exceeds 200 mg/l or,
- Chloride exceeds 100 mg/l or,
- Silica exceeds 15 mg/l

When TDS is at or below maximum allowable amounts, it cannot be reduced by softening.