

# **THE RIGHT WATER FOR METAL WORKING FLUIDS**

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**WE TREAT WATER – “DIFFERENTLY”**

# The Most Common Cutting Fluid Problems



# ISSUES WITH MACHINE COOLANTS



# IMPORTANT WATER QUALITY PARAMETERS

- pH
- Total Hardness ( Ca & Mg)
- TDS ( Total Dissolved Solids)
- Suspended solids & Turbidity
- Chloride
- Sulphate
- Phosphates
- Bacteria, Fungi, yeast & Algae

These above properties can affect corrosion protection of the metalworking fluid, residue properties, foam, emulsion stability for semi-synthetics and soluble oils, susceptibility to microbiological attack, charge density of both true solutions and emulsions, filtering properties and wetting.

# **The Right Water Chemistry: Understanding The Aqueous Influence Upon Metalworking**

**Appearance: Clear and water-  
white, free of all debris**

**Odor: None**

**pH: 7.0 - 8.5**

**Hardness: 125 - 200 ppm**

**Total Alkalinity: 25 - 100 ppm**

**Turbidity: < 5 ntu**

**Bacteria: None**

**Fungi (both yeasts and molds):  
None**

**Chlorides: < 20 ppm**

**Sulfates: < 40 ppm**

**Phosphates: < 40 ppm**

# **BENEFITS OF USING RIGHT WATER QUALITY**

- **Save money on fluid purchase and disposal costs**
- **Reduce machine downtime due to fluid related problems**
- **Optimise intervals between fluid changes**
- **Minimise problems associated with product quality thus rejection, rework and save on production cost**
- **Improve your working environment and environmental performance**
- **Perform better than your competitors by reducing manufacturing cost and increase customer retainership**

# WATER TREATMENT TECHNOLOGIES

## CONVENTIONAL TECHNOLOGIES

- **WATER SOFTENER** – REMOVES ALL HARDNESS AND DOES NOT REDUCE TDS, CHLORIDE, SUPHATES AND OTHER DISSOLVED SALTS
- **DEMINERALISING PLANT** – COMPLETELY REMOVES (> 99%) ALL DISSOLVED SALTS – THE TREATED WATER IS AGGRESSIVE DUE TO VERY LOW IONIC/SALT CONTENT, USES HAZARDOUS ACIDS AND ALKALIES FOR REGENERATION AND GENERATES WASTE WATER THAT ARE DIFFICULT TO DISPOSE, CANNOT HANDLE HIGH TDS FEED WATER, THROUGHPUT AND TREATED WATER QUALITY DEPENDS ON FEED WATER CHARACTERISTICS.
- **REVERSE OSMOSIS** - COMPLETELY REMOVES (> 98%) ALL DISSOLVED SALTS – THE TREATED WATER IS AGGRESSIVE DUE TO VERY LOW IONIC/SALT CONTENT, LOW PH OF PURIFIED WATER , USES TREATED WATER QUALITY DEPENDS ON FEED WATER CHARACTERISTICS. TECHNOLOGY IS NOT WATER EFFICIENT SINCE THE RECOVERY IS LOW AND WASTES A LOT OF WATER, PROCESS CONTROL AND CLEANING IS MANUAL. MEMBRANES ARE PRONE FOR SCALING, FOULING ETC.

## NEW TECHNOLOGY

**CAPDI – CAPACITIVE DEIONISATION** – LATEST ENVIRONMENT FRIENDLY GREEN TECHNOLOGY WHICH ADDRESSES ALL THE SHORCOMINGS OF COVENTIONAL TECHNOLOGIES MENTIONED ABOVE.

# WATER TREATMENT PROCESS COMPARISON

EQUIPMENT	SOFTENER	DEMINERALISERS	REVERSE OSMOSIS	CAPACITIVE DEIONISATION
PURIFICATION TECHNOLOGY	ION EXCHANGE	ION EXCHANGE	MEMBRANE	ELECTRO ADSORBPTION
PROCESS	BATCH	BATCH	CONTINUOS	SEMI BATCH
REMOVES	HARDNESS	DISSOLVED SALTS	DISSOLVED SALTS	DISSOLVED SALTS
ADDS	SODIUM IONS TO WATER	NONE	NONE	NONE
SUITABILITY	LOW TDS /HARDNESS WATER	LOW TO MODERATE TDS (700 PPM) WATER	MODERATE TO HIGH TDS WATERS	MODERATE UP TO 3000 PPM TDS WATER
END USE SUITABILITY	NO	LIMITED	LIMITED	IDEAL PROCESS
TARGET IMPURITY REMOVAL EFFICIENCY	> 98%	> 95-99%	> 95-99%	25-95% TUNABLE
PROCESS EFFICIENCY	MODERATE- EQPT AND OPERATION DEPENDANT	MODERATE- EQPT AND OPERATION DEPENDANT	POOR TO MODERATE EQPT. AND OPERATION DEPENDANT	VERY GOOD FULLY AUTOMATIC OPERATION WITH DYNAMIC PROECSS CONTROL AND MINIMUM OPERATOR INTERVENTION
WATER EFFICIENCY	75-90% RECOVERY FEED HARDNESS DEPENDANT	75-90% RECOVERY FEED WATER CHARACTERISTICS DEPENDANT	40-75% RECOVERY FEED WATER CHARACTERISTICS DEPENDANT	60-95% RECOVERY FEED WATER CHARACTERISTICS AND TREATED WATER SPEC. DEPENDANT



OPERATION	MANUAL/SEMI/ FULLY AUTOMATIC	MANUAL/SEMI/ FULLY AUTOMATIC	MANUAL/SEMI/ FULLY AUTOMATIC	MANUAL/SEMI/ FULLY AUTOMATIC
PROCESS CONTROL	SIMPLE BUT EQUPT DESIGN DEPENDANT	MODERATE- EQPT AND DESIGN DEPENDANT	COMPLEX	SIMPLE DYNAMIC CONTROL
CHEMICAL REQUIREMENT	COMMON SALT FOR REGENERATION	HCL & NAOH FOR REGENERATION	REQUIRES COAGULANT AIDS, CHLORINE, SMBS, ANTISCALANT, NAOH ADDITIONS DEPDNING ON FEED WATER CHARACTERISTICS	LOW ONLY FOR CLEANING
PRETREATMENT REQUIREMENT	SIMPLE	SIMPLE	CRITICAL & ELABORATE WATER FEED WATER DEPENDANT	SIMPLE GOOD FILTRATION
FLEXIBILITY TO HANDLE CHANGE IN FEED WATER CHARACTERISTICS	LIMITED	LIMITED	LIMITED	HIGH

SIDE EFFECT-1	EXCESS SODIUM WILL LEAD TO CORROSION	TREATD WATER LOW IN MINERAL IS AGGRESSIVE AND CAN LEACH METALS, CAUSES CORROISON AND FOAMING WHEN MIXED WITH COOLANT	TREATD WATER LOW IN MINERAL IS AGGRESSIVE AND CAN LEACH METALS, CAUSES CORROISON AND FOAMING, NEEDS pH ADJUSTMENT	NONE
SIDE EFFECT-2	POSSIBILITY OF EXCESS NACL GOING ALONG WITH SOFT WATER IMMEDIATELY AFTER REGENERATION STEP			NONE
WASTE DISPOSAL	HIGH - BRINE DISPOSAL	HIGH - ACIDIC/ALKALINE WASTE WATER	HIGH - HIGH TDS LARGE QTY WATER	LOW
OPEX	LOW - MODERATE	MODERATE - HIGH	HIGH	LOW
CAPEX	LOW	LOW - MODERATE	MODERATE - HIGH	HIGH
SPACE REQUIREMENT	LOW	MODERATE	HIGH	LOW
EASY OF OPERATION	YES	NO	NO	YES WITH REAL TIME REMOTE MONITORING
CIP	OCCASIONAL RESIN CLEANING	OCCASIONAL RESIN CLEANING	REGULAR - MANUAL CLEANING OF MEMBRANES WITH SPECIALITY CHEMICALS, LONGER DOWN TIME	LOW COST MINERAL ACID FULLY AUTOMATIC CLEANING



- Soft water can impact the performance of all fluids by contributing to foam formation. This is especially true for synthetics in grinding operations and semi-synthetics and soluble oils in both machining and grinding applications.
- Foam can drastically impact fluid performance by contributing to poor wetting and coverage properties, affecting lubrication, cooling and proper film coverage for in-process corrosion protection.
- Foam can also hamper fluid detergency contributing to poor swarf handling and filtering.
- Dense foam formation can lessen filtering capabilities of a system by altering indexing mechanisms and the creation of poor filter beds.
- Foam can also suspend tramp oils, preventing skimmers and other mechanical devices from effectively removing them. Tramp oils can act as a matrix, becoming finely suspended on a dense bed of foam. This further stabilizes a dense foam layer.
- Excessive foam can also lead to housekeeping issues, overflowing system barges and return lines such as floor troughs.
- Foam can also cause pump cavitation, creating excessive wear and premature mechanical failure.

# EMULSION SPLITTING

- As hardness increases, it can readily and negatively affect the emulsion stability of semi-synthetics and soluble oils.
- The formation of hard water soaps between calcium and magnesium ions and anionic components (typically fatty acid based emulsifiers) can radically alter emulsion particle size. This will rapidly lead to visible signs such as scum formation and lose emulsions (cream and free oil present).
- Both semi-synthetics and soluble oils are impacted by calcium soaps. Semi-synthetics are especially hampered by high magnesium levels. Hardness levels can build up in water stored for use as well in metalworking fluid systems due to aqueous evaporation.
- Many systems can lose from 5 – 25% of their water on a daily basis, depending upon system size, openness to plant environment, time of year, geographical location, plant conditions (air temperature and circulation patterns) and metalworking fluid temperatures as the water circulates.
- Continual aqueous makeup with hard water will contribute to rapidly escalating levels of hardness in the system. Resulting emulsion instability in semi-synthetic and soluble oils will lead to corrosion problems, susceptibility to emulsification of tramp oils and microbiological attack, poor tool life, improper surface finish, foam and filtering problems. Hardness levels must be regulated and there must be RIGHT water types utilized to maintain system hardness values at reasonable levels for proper metalworking fluid performance.

# ODOUR & RANCIDITY

- Odour & Rancidity is caused by microbial growth in the coolant
- Microbiological contamination, bacterial and fungal growth can significantly impact on the performance life of both the water and metalworking fluid, leading to lubrication, corrosion and fluid stability problems.
- Microbiological contamination can also lead to health problems such as respiratory irritation or dermatitis among plant personnel exposed to the contaminated fluid.
- This growth can be monitored via a number of methods including bio strips, plate counts and dissolved gas methods such as HMB. It is very important to monitor this parameter as a quick response such ***as controlling incoming water quality***, adjusting coolant concentration or the appropriate and correct additive/biocide addition can often prevent a serious crisis.

# NEW DEVELOPMENTS

Water quality has always been important, however there two recent developments that have made water quality even more important:

1.) Coolant formulators are often presented with changes in raw materials driven by economics and sources of supply. For example, the recent closing of a U.S. sulfonate (emulsifier and corrosion inhibitor chemical) plant has forced metalworking manufacturers to reformulate many products. The new formulas may not be as effective in all water quality conditions.

2.) Regulatory compliance issues and waste treatment costs have driven users to make metalworking fluids last longer and extend dumping time frames giving water contaminants more time to build up and create problems.

This means that formulators must enhance their products with higher levels of stability and use newer technology additives. They must communicate regularly with their customers to observe performance and meet the demand for better fluid economics.

# CapDi

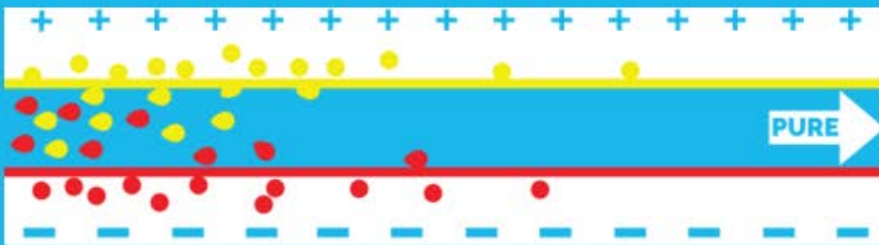
## CAPACITIVE DEIONISATION

SIMPLE – FLEXIBLE – TUNABLE - RELIABLE

### 2 STEP PROCESS

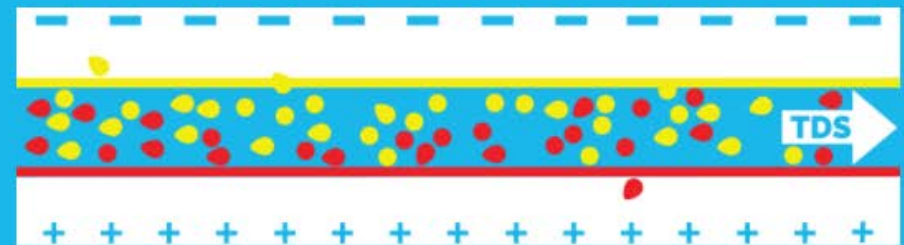
CapDi<sup>®</sup> is a simple 2-step process wherein water flows between electrodes, where the electrode surfaces are separated from the water by ion-selective membranes that allow positive or negative ions to pass.

#### PURIFICATION



Feed water passes between oppositely charged electrodes which electrostatically remove dissolved ions, leaving pure water flowing out of the cell.

#### REGENERATION



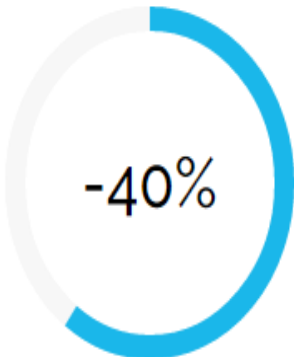
Feed water flushes through the cell at a lower flow rate, while electrode polarity is reversed. Ions are rejected from the electrode surface, concentrated in the flow channel and flushed from the cell before the cycle is repeated.

# INDUSTRIAL SERIES



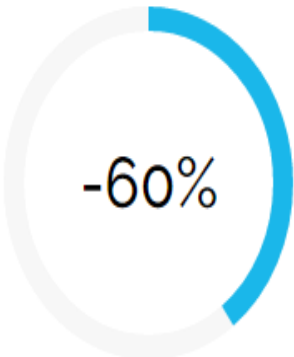


# CAPDI<sup>®</sup> PERFORMANCE



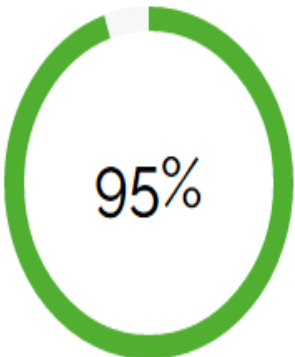
## WATER INTAKE

CapDI reduces intake of fresh water by up to 40%.



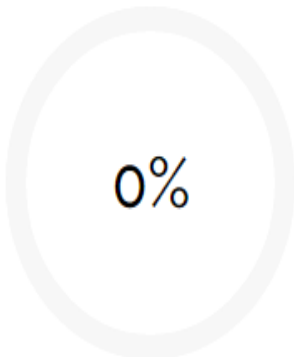
## WASTEWATER VOLUME

Our technology lowers wastewater production by up to 60%.



## WATER RECOVERY RATE

CapDI recovers up to 95% of the water it treats.



## CHEMICAL USAGE

CapDI does not require any chemicals to operate.

# CAPDI<sup>®</sup>

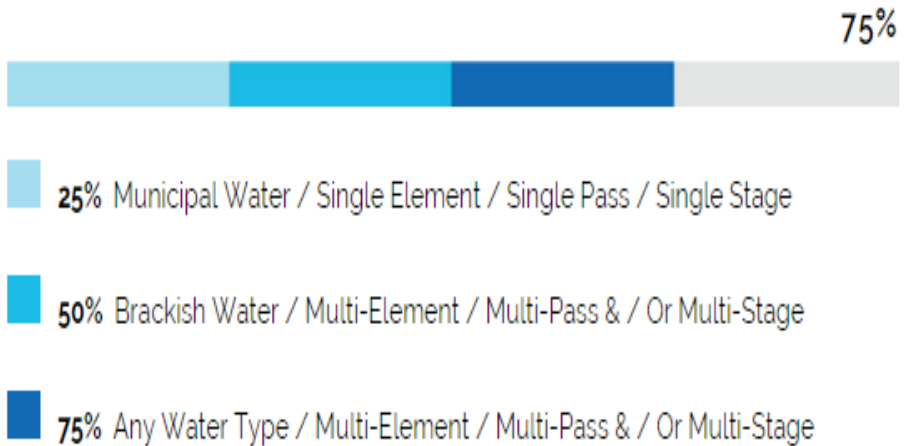
A tunable water deionization technology that is designed to remove dissolved salts from a variety of water sources ranging from tap water and brackish groundwater to industrial process water. CapDI achieves this at a lower economic cost and reduced environmental impact than any other available technology.

Uniquely, CapDI operates at temperatures ranging from 5-60° C, or 40-140° F, on challenging higher turbidity feed waters, with minimal operator intervention. Our technology is environmentally friendly by virtue of its low energy consumption and minimal to no chemical usage, thus allowing any unrecovered water to flow back into the ecosystem safely.

## TREATED WATER RECOVERY



## OTHER MEMBRANE TECHNOLOGIES



## **SCALABLE**

Voltea's technology treats water types ranging from residential consumer appliances to large-scale industrial plants. Our systems are modular, allowing easy expansion to meet any increased water demands.

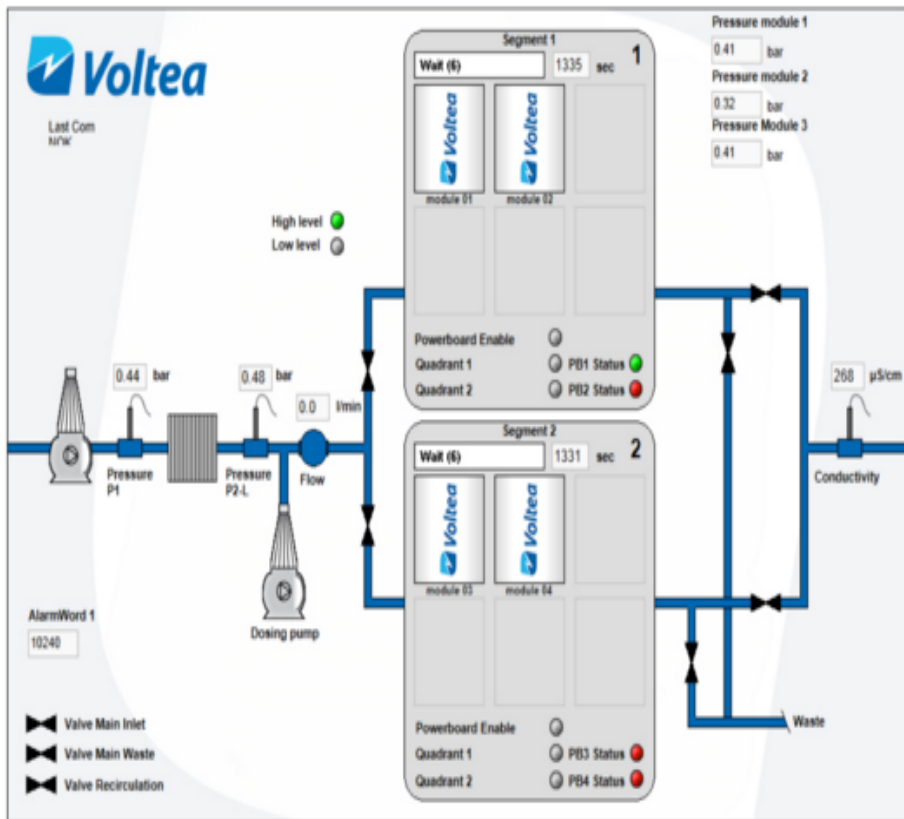
## **TUNABLE**

CapDI is tunable, allowing adjustable TDS reduction between 25 - 95% depending on customer needs, eliminating the requirement for blending to achieve a specific water quality. The customer sets their desired reduction rate and CapDI maintains this level, continually adjusting itself to account for any fluctuations in feed water characteristics.

# PROCESS CONTROL

## DYNAMIC CONTROL

Our Dynamic Control feature enables automated continuous control of your product water quality to account for any variations in feed water. Voltea's CapDI systems are equipped with remote monitoring and control capabilities and once subscribed, customers can enjoy peace of mind that the monitoring of their CapDI systems is by qualified Voltea personnel to ensure optimized system performance.



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## SIZING



FLOW RATE



POWER



TEMPERATURE



TDS

Key factors go into determining the size of the industrial system for a customer. Factors include flow rate, power, water temperature, and TDS removal requirements.

Simple modular design provides the flexibility to treat a few mL/min up to thousands of m<sup>3</sup>/hr in a compact footprint.

### **WE DESIGN OUR SYSTEMS BASED ON THE TYPE OF APPLICATION AND REQUIRED WATER QUALITIES.**

Our equipment improves operational performance and lifetime of a wide range of industrial equipment. Our systems feature tunable deionization of water for industrial and commercial applications, while the compact footprint of Cap Di IS systems design affords simple, containerized deployment.

# SUMMARY

- Good water quality is essential for the proper performance, biostability, and sump life of metalworking fluids.
- Aqueous databases should be maintained and major parameters monitored for all water sources.
- Though a variety of traditional treatment methods such as softening, Ion exchange demineralization, Reverse osmosis are used today for machine coolant charging and make up they are not ideal treatment solution as they have inherent limitations and some time create more problems that solving the problems.
- Ionic's new technology CapDi (Capacitive Deionisation) overcomes many of the short comings and limitations of traditional water treat methods and provides the Right Quality of water suitable for Preparation and make up (Top up) of machine coolants. This is the only technology that can provide 2 different qualities of water – for coolant preparation and then for make up.

# THANK YOU

**FOR FURTHER INFORMATION AND GUIDANCE CONTACT:**

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