

IMPROVE THE QUALITY & TASTE OF YOUR WATER

Triangular Wave Technologies Fluid Management Systems

Your Simple And Safe Solution – Residential • Commercial • Industrial

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HEAVY SCALE BUILDUP



To understand how to solve water-related problems, it is necessary to understand what causes these problems. Although water is basically H₂O (a simple combination of hydrogen and oxygen), by its very nature it is

highly receptive to many other substances that complicate and contaminate this simple mixture.

THERE ARE THREE BASIC CAUSES OF WATER/FLUID RELATED PROBLEMS

Scale

ENCRUSTED TUBE BUNDLES



- Problems:
- Loss of heat transfer efficiency
 - Flow restriction in pipes and frozen valves
 - Back pressure increases energy needed to pump
 - Reduced reaction vessel capacity
 - Localized corrosion
 - Visible surface scale objectionable

Adverse Water Chemistry

- Problem:
- General corrosion

Biofilm

- Problems:
- General corrosion
 - Biocorrosion (both general and local)
 - Sludge
 - Disease and odors
 - Bacteria, Algae, Fungus, etc.

The End Results of Water Problems

- Wasted water • Ruined equipment • High energy costs
- Productivity losses • Product contamination or quality problems
- Disease and odor in the water environment

Materials That Deposit on Equipment and Cause Water/Fluid Problems

Materials may be animal, vegetable, mineral, or corrosive water chemistry. The sources of the materials include: pollution, wind borne dirt, algae, chemical additives, viruses and bacteria that occur abundantly in the natural environment, and process components themselves. Some of the materials can grow, such as bacteria, algae, fungus, etc. A growing list of man-made poisons includes pesticides, herbicides, chemical fertilizers, auto emissions, industrial waste, etc.

Treatment

Scale, Adverse Water Chemistry & Biofilm Can Cost You Money!

Untreated fluid used in boilers, hot water systems, cooling towers and other fluid related equipment contains dissolved salts, gases and traces of many minerals and metals. These elements are the direct cause of scale buildup in pipes and equipment. If left untreated, scale buildup can increase fuel costs, repair and ongoing cleaning costs, downtime and may eventually result in significant equipment replacement.

The bottom line is that if the problem-causing materials are controlled, then 85% to 90% of the problems are eliminated. Treatment options include **removal** and **control**.

- Removal involves physical or chemical cleaning, filtration, ion exchange, softening, demineralization, reverse osmosis.
- Control involves adding chemicals or ozone, or electro-magnetically conditioning the water.

What do I have to Know

Selecting a system that meets your needs is an important step. However, it is not as simple as reading a few ads for various filters and other treatment systems, or looking at a few samples, and/or industry catalogs.

The most effective fluid treatment systems utilize a variety of both removal and control methods depending upon the specific nature of the system/water being treated and its intended use. These combinations of techniques can be deployed to effectively solve your specific problems and can be designed to function together in a way that will enhance the effectiveness of each component in achieving the desired results.

Selecting a System for Your Needs

A comprehensive approach to selecting a fluid treatment system includes:

- Testing your water or fluid to determine the specific problems in it and your area
- Selecting the system and/or components of a system that will solve these problems
- Installing and monitoring your system
- Periodically re-testing to insure that your old problems are being treated and controlled, and that new problems have not developed.

Installing and Monitoring Your System

A qualified engineer, plumber (and sometimes an electrician) is often required to install the system you select. It is recommended that you carefully review the owners manual and other literature accompanying your various components, and develop a thorough understanding of what you have. This little bit of extra effort is well worth your time and attention. Then prepare a service schedule (put it on your calendar) to insure that you are replacing filters, UV lamps, or other components as recommended by the manufacturer.

Testing

Although the testing approach may seem bothersome, it is like a good routine physical by a health-care specialist. Avoiding this step is to assume that "what you don't know won't hurt you." Sorry, but it will! Avoiding the truth may result in health problems and costly repairs to your plumbing system and other equipment.

Periodically Re-test and Evaluate Performance

Simply owning a water treatment system does not guarantee that your water will be safe forever. In addition to monitoring your system and providing for replacement of parts, you also need to periodically test and re-evaluate the quality of the water coming into your system to determine if changes or upgrades are needed. The ultimate responsibility is yours.

TRIANGULAR WAVE TECHNOLOGIES, INC. CHEMICAL-FREE FLUID MANAGEMENT SOLUTIONS

TWT provides all the methods and components necessary for a comprehensive approach to water and fluid treatment. We recommend that you apply components from the filtration, deposit control, purification and disinfection categories (as needed) to obtain the highest levels of results. At the core of the product line is our patented TWT Deposit Control technology, around which you should deploy products from the rest of the treatment methods.

The Triangular Wave System represents a significant breakthrough in electro-magnetic technology. The triangular wave has made possible the use of electromagnetic technology in applications of all sizes, from residential to large commercial and industrial applications. As an advanced system for controlling scale and bio-fouling, it is applicable with once-through and recirculating HVAC, heating and process cooling systems, as well as agricultural, industrial processing, wastewater, and other fluid-based systems.

This State-of-the-Art electronic deposit controller provides continual scale and bio-film control in fluid systems resulting in reduced maintenance and more efficient operation. The Triangular Wave System utilizes unique and proprietary treatment and design processes.

Patented Triangular Wave Technology

The Triangular Wave System represents an advanced method for controlling scale and bio-fouling. The electronic deposit control technology uses a signal coil that is wrapped around a pipe in the plumbing system being treated. The signal coil produces an extremely small time-varying magnetic field inside the pipe. The resulting induced, oscillating electric field provides the necessary molecular agitation for chemical-free scale prevention and removal.

- Polarity changes from positive to negative many thousands of times per second.
- Frequency varies from 2,000 cycles per second to 7,000 cycles per second. That range of frequency is wide enough to affect the water and the materials in the water.
- Amplitude varies from 25 millamps to 250 millamps. This means that the water molecules and the materials in the water are being subjected to a wide range of field forces.

The entire Triangular Wave Signal is repeated 30 times each second. When the current reaches the solenoid, a constantly changing electro-magnetic field is formed. That field induces a constantly changing voltage in the fluid. This process ensures proper fluid treatment results and increased operational efficiency.

In effect, a clean, corrosion-free delivery system is restored and maintained in an environmentally safe and chemical-free manner. The result is clean pipes and tubing with no biofilm and reduced bacterial contamination.

Benefits of the Triangular Wave System

PREVENTS SCALE BUILD-UP

- Scale particles in the water receive an enhanced surface charge that causes them to repel each other and from the walls of the equipment

ELIMINATES TOXIC CHEMICALS/SALTS

- No recurring chemical expense
- No handling and storage of hazardous chemicals on site
- No hazardous salt contamination

REDUCES CORROSION

- Reduces bio-corrosion by preventing the formation of bio-growth on vessel surfaces where bacteria can attack the metal

- With higher concentration ratios and TDS, the pH will be higher and there will be much less tendency for corrosion
- Prolongs life cycle of equipment
- Increase operating efficiency of equipment

CONTROLS ALGAE AND BACTERIA

- Bacteria and algae must attach to something before they can feed and reproduce; The Triangular Wave System keeps the bacteria, algae, and their food dispersed in the water, off of surfaces, and away from their biofilm breeding ground
- Without biofilm to house and protect it, biological growth can not feed or reproduce, resulting in greatly reduced biological activity
- Within hours the biofilm will die, too

SHORT PAYBACK PERIOD

- The combined reduction of water and chemical costs is enough to pay for the Triangular Wave System in as little as 9 to 18 months
- With the Triangular Wave Treatment, the systems can run at higher concentration ratios, meaning the amount of water removed as blowdown and the corresponding sewer charges are greatly reduced
- With no chemicals being added, the requirements for pretreatment of blowdown are eliminated
- Labor costs for maintaining the chemical systems will be reduced
- Labor costs to clean the vessel surfaces will be reduced
- Costs to replace corroded parts will be reduced
- The Triangular Wave System requires no maintenance
- There is little electrical current flow in an electromagnetic system
- Reduces energy costs

Results of Using the TWT Triangular Wave System

The constant battle of monitoring and cleaning cooling and heating systems becomes a thing of the past:

REDUCED MAINTENANCE

- Balancing the water chemistry on a daily or weekly basis may no longer be necessary
- Cleaning of the vessels is much easier, involving a pressure wash one or two times a year rather than the extensive manual brushing and acid washing traditionally required
- The Patented Triangular Wave System assures effective treatment

REDUCED ENERGY REQUIREMENTS - OBTAIN COST SAVINGS FROM 3% TO 30%

- Water systems are kept free of deposits, allowing heat transfer at its most efficient, and eliminating the insulation caused by the presence of scale and biofilm
- The roughness and reduced flow caused by the presence of scale is eliminated, reducing the energy needed to drive the pumps

REDUCED SEWER, MUNICIPAL, PRE-TREATMENT, AND WATER FEES

- Municipal penalties and treatment fees for chemical content in blowdown of cooling systems are reduced or eliminated, since there are no longer chemicals present; if pretreatment has been in place, it is no longer necessary
- Blowdown itself and its water costs are also reduced because higher TDS ratios are acceptable

REDUCED REPAIR AND REPLACEMENT COSTS

- Recent studies by manufacturers of cooling systems report that equipment that should last up to 20 years is only lasting an average of 8 years. The life cycle of equipment rendered clean and efficient by the TWT treatment systems is significantly extended by the reduction or elimination of biofilm, biocorrosion, scale, and overwork
- The often negative side-effects suffered by equipment from chemicals and sodium used for treatment no longer exist, since the chemicals and sodium are no longer necessary

SAFETY AND HANDLING ISSUES ELIMINATED, ENVIRONMENTAL ISSUES SUCCESSFULLY ADDRESSED

- The workplace and workers are safer because personnel are not handling harsh chemicals
- OSHA issues related to chemical fluid treatment no longer apply, since chemicals are no longer used
- Legislative and regulatory directives regarding commercial and industrial effluent output are more easily met
- Corporate citizenship and environmental support goals are more easily met

THE TRIANGULAR WAVE SYSTEM GIVES OWNERS ALL OF THE BENEFITS OF SOFT WATER WITHOUT THE HARMFUL SALTS

The TWT Deposit Control is a new, revolutionary breakthrough in the treatment of hard water and its effect on water-based applications. The system is non-invasive and non-chemical by design, and is suitable for practically all applications requiring water/fluid treatment.

Sources of Water

Water primarily comes from two sources, the bodies of water on the earth's surface and the subterranean wells which gather groundwater after it is filtered through the top layers of the earth's strata. After the groundwater passes through the uppermost layers of the earth's surface, it contains carbon-dioxide (CO₂), a carbonic acid. In the lower strata of the earth, the carbonic acid-enriched water dissolves lime (CaCO₃) from the subterranean rock and converts it to calcium-hydrogen carbonate. The calcium-hydrogen carbonate is the source of lime deposits and encrustations (scale) which form in water systems.

Hardness in Water

Regardless of the source of water, water typically contains carbon-dioxide (CO₂) and the earth's alkalines, such as calcium and magnesium. The total hardness of water is determined by the sum calcium-hydrogen carbonate, magnesium-hydrogen carbonate and the non-carbonate starches which include calcium and magnesium component solutions. Consequently, the water "hardness" is dependent upon the amount of lime in the water.

Triangular wave technology prevents the formation of lime deposits using an electronic deposit controller, which generates an electronically modulated frequency, and an amplified, triangulated waveform. The wave is then oscillated to change the separation characteristics of calcium and carbonates before they enter the water system, immediately neutralizing the hardness, and functionally "softening" the water. The process is purely physical as it uses no chemical additives.

The Triangular Wave Deposit Control System Will:

- Give the benefits of soft water without adding harmful salt or removing health giving minerals

- Prevent any further hard scale build-up in and on water-fed equipment and fixtures
- Remove the existing scale that is inside the water system over a short period of time
- Soften the existing hard scale around taps, basins, and toilets, etc.
- Reduce soap scum and improve the lather of soap
- Make the water to feel silkier
- Reduce the harsh effects of hard water on skin and clothes
- Reduces water spotting on fixtures and surfaces in contact with the water
- Provides a much more environmentally friendly solution to hard water – no salts or chemicals
- The water will taste better, as pipes will be cleared of both mineral and biological deposits
- Plants that receive the treated water will grow better



The key to the system's success and its unique approach is that different particles respond to different frequencies and amplitudes of the signal. The microprocessor rapidly varies the frequency and amplitude of the signal to deliver the various combinations to treat nearly 100% of the particles in the water.

Bacteria and scale-forming colloids in the water receive a strong boost in their natural surface charge. The particles repel one another and remain in stable suspension, rather than uniting to form scale or colonizing to form biofilm or other system fouling. The Triangular Wave Deposit Control System treats all incoming water as it passes the coil and alters the characteristics of the calcium so that it does not stick and form hard scale. It is important to remember that the calcium is still in the water and will be visible in appliances that are not subject to free flowing water.

Use With a Salt Water Softener

If a salt softener is currently being used, it should be disconnected, and the plumbing bypass valves should be opened/closed, to experience the sole effect of the **Triangular Wave System**. If the softener is not bypassed, the Triangular Wave System should be installed downstream of the softener, or else the calcium held in the ion exchange bed will quickly redissolve, causing a flood of extra-hard water. It is recommended that salt softening be eliminated for the best possible economic and ecological results.

External Scale

It is a good idea to use external scale as a tracking reference to determine whether or not the system is working. Areas to identify for this are:

- Scale around taps, sinks, etc. will begin to soften, provided that the newly treated water is in regular contact with the area. Once softened, these deposits can be removed using a stiff scouring pad, or other appropriate device
- Surfaces in contact or splashed with water become easier to clean
- Scale on showerheads softens and can be removed. During descaling, some deposits may collect inside the nozzle. These can easily be rinsed away
- Water spotting on fixtures and surfaces will begin to diminish

Internal Scale

- As the hot water heating coil is descaled, water heating will become progressively more efficient. The descaled heater coil will heat the water faster. Therefore, it is possible to save considerable energy by reducing thermostat settings
- If the water system was severely scaled, an improvement in water flow also may occur

Important Notes:

- For some time after installation, the unit will be descaling pre-existing scale in the water system. This often results in the water appearing to be harder, and calcium deposits increase in places like showerheads. Once descaled inside, the water system will be scale-free and calcium marks outside the system should easily wipe away. TWT Deposit Control Systems use Molecular Surface Energy Realignments to neutralize the dissolved calcium carbonates that causes hardness. MSER uses the resonant energy forces that are developed on charged particles, the dissolved ions, moving in electro-magnetic fields to alter the molecular surface energy states.

Surface energy states determine how physical crystals form during precipitation. In this case, ionic calcium carbonate is treated so that electrically neutral aragonite is formed rather than calcite, or lime stone. Both calcite and aragonite (CaCO_3) are chemically identical. These two crystals simply have different physical structures and therefore behave differently. One causes hard water and the other does not. Now, soaps will really lather, soap scum is greatly reduced, and the water feels silkier, not oily or slimy as salt softened water commonly does.

- Water Softeners - Water softeners often leave deposits inside a water system; therefore if a softener is in use, allow the Deposit Control System to remove the deposits before the softener is switched off. In that case, leave the softener and the Deposit Control System on together for about 1 or 2 months. Remember, install the TWT deposit Control unit down stream of the water softener, if planning to run them together.

Typical User Experiences . . . Silky Water Feeling

The treated water is immediately altered and will start dissolving scale build-up in the pipes. The scale dissolves one particle at a time, therefore there are few problems with clogging filters or screens in the plumbing system. If a water softener was never used before, the water user will experience a dramatic difference in the "feel" of the water. The water will have a silky feeling, and hair will be "squeaky clean" after a shampoo.

Soap, Scum, and Skin Effects

As the hard water effects of the calcium diminish, you will usually notice:

- A reduction of around 30% in soap and detergents needed
- Less water spotting on fixtures and surfaces in contact with water
- Less scum formed on the bathtub, and an improved soap lather
- A great improvement in skin condition for anyone suffering from dry skin. Even those with normal skin can expect improvements and reduction in the use of hand creams, etc.

Chlorine

It may be smelled as it dissipates in the air, (if the water has been chlorinated) because the **TWT Deposit Control System** reduces the surface tension of the treated water. The chlorine controls organisms inside the plumbing, however, it is not good for people, their hair, skin or internal organs. Therefore, it is ideal to have the chlorine perform its function in the water, and then have it dissipate before drinking or bathing.

Water Taste

Users of the **TWT Deposit Control System** will notice improvement in the taste of their water, due to cleaner pipes and the softening effect. Water used in coffee, drinks, ice cubes, and for cooking will taste better.

Replacing a Salt-Based Water Softener

If a salt softener is replaced, the user may notice the water becoming harder as the scale begins dissolving. Do not worry, this is a consequence of descaling, and the condition will improve

daily as the scale is removed. The plumbing took years to get full of scale; however it only takes a short time to clean it up with the **Triangular Wave System**. This period may be brief for a newer facility, or several months for older facilities with low water usage. It is recommended that water heaters be drained regularly to shorten the descaling process. The shorter the descaling period, the more money will be saved.

First Ninety Days*

Descaling should be complete, and you will be left with:

- Soft feeling water from every tap/system
- Clean pipes
- A savings in energy and detergent expenses
- Cleaner, fresher water for drinking, cooking and processing
- Less water spotting

* Depending on preexisting conditions

Typical Customer Questions . . .

What does a softener do that an electronic deposit control system does not?

- The water softener removes calcium from the water by replacing the calcium with sodium (salt)
- The softener gives a feeling that one cannot get rid of soap from one's body
- The water softener makes skin dry
- The water softener requires that salt be purchased and replaced periodically
- Water softeners contribute to negative environmental conditions and are banned in many communities
- Water softeners require on-going maintenance

What does the Triangular Wave System do that a water softener does not?

- The Triangular Wave System gives all of the benefits of softened water without the salt
- It removes calcium build-up in hot water heaters (Saves energy costs and extends the life of the heater)
- Saves money (No salt purchases)
- Provides salt-free water, a concern for many health conscious people
- Provides clean water, while eliminating the discharge of salt-laden water into the watertable as a result of the normal regeneration cycle of conventional water softeners—it's environmentally friendly
- Reduces the consumption of detergents and shampoos, a big benefit for the environment
- Removes both mineral and biological deposits, but leaves the benefits of the minerals, so water used is cleaner and healthier
- Reduces water spotting on fixtures and surfaces
- Does not require on-going maintenance

If there is a water softener already installed, how should the Triangular Wave System be installed?

Is it possible to use both a water softener and the Triangular Wave System?

It is possible to use both a water softener and the TWT Deposit Control System. The Deposit Controller should be installed "downstream" of the water softener, because it will cause the calcium ions attached to the ion exchange resin to be released back into the water. Because existing scale build-up in the plumbing will be dissolved into the water, the use of a water softener may help to diminish the effects of this increase in hardness. After approximately 1 or 2 months, put the softener on "by-pass".