

Triangular Wave Technologies, Inc. (TWT®)

# Energy Efficient Technology for Fluid Environments

**HARD WATER PROBLEMS SOLVED EASILY!**

**Your Simple and Safe Solution!**

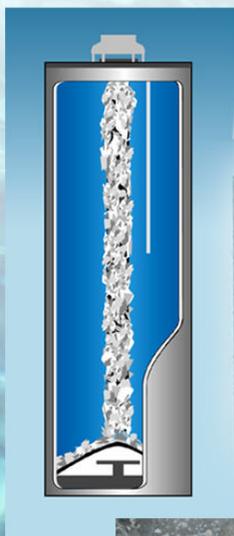
**SAVE ENERGY, MONEY AND IMPROVE THE OPERATING EFFICIENCY OF YOUR HEATING SYSTEM WITH DOWNSTREAM BENEFITS**

**PROTECTION FOR NEW EQUIPMENT**

TWT provides new equipment with the ability to enhance the product benefits and features.

**TREATMENT FOR EXISTING EQUIPMENT**

Retrofit existing equipment to improve its operating efficiency and life cycle.



*TWT® Microprocessor Deposit Control Systems represent a significant breakthrough in electro-magnetic technology. This technologically advanced electronic deposit controller provides continuous scale and bio-film control for all fluid based systems.*



**CHEMICAL-FREE  
HARD WATER CONDITIONING  
& TREATMENT SYSTEMS**



**Chemical-Free  
Deposit Control Systems**

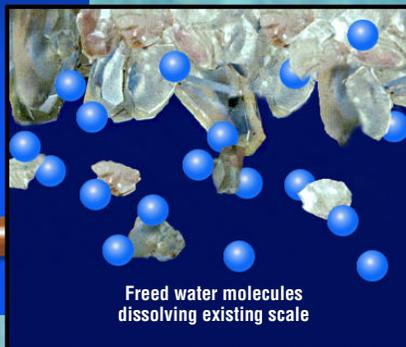
**TWT® Deposit Controller  
TWT-5C8-472  
Designed for pipes  
1" or less in diameter**

**TWT-CSE-0227  
Copper Pipe  
Signal Enhancer**

**Onsite Solenoid Coil Wrap**



**CHEMICAL-FREE**



**Freed water molecules  
dissolving existing scale**



# Water quality has a direct effect on the energy consumption and efficiency of all Residential, commercial and industrial water-fed equipment

## Introduction—

*Manage your heating cost and protect the investment in your home or office*

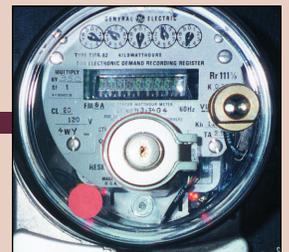
- This presentation is designed to communicate the concepts of an energy and water-saving technology. This technology forms the foundation of a class of equipment that, due to the important efficiencies it provides, should play a significant role at the vanguard of energy management programs and activities.
- The goal is to impress upon those working in the field the value of making these concepts a part of the everyday considerations that make up energy management initiatives and programs.

## Topics of Discussion

- Water quality has a direct effect on the energy consumption and efficiency of all industrial, commercial, and residential water-fed equipment
- Energy-Efficient equipment and appliances allow improved outcomes
- Energy-Efficiency devices and systems take a very important next step in obtaining best results and should be part of Best Practices

## Energy-Efficient Equipment

- EnergyStar and other efficiency and improvement programs raise consciousness, achieve positive results
- Rebates and subsidies encourage their use
- But ...operating efficiency will still diminish based on water quality conditions



# Residential, Commercial, Industrial

## ■ Scale

### 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 cooling 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, bacteria, algae, chemical additives, and process components themselves. Some of the materials can grow; such as bacteria, algae, fungus, 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.



**Triangular Wave Technologies, Inc. Versatile  
Fluid Management Products & Systems Are The Solution!**

# WATER BASICS *Hard Water Problems Solved Easily!*

## ■ Ground Water

Ground water is water trapped beneath the ground. Rain that soaks into the ground, rivers that disappear beneath the earth, and melting snow are but a few of the sources that recharge the supply of underground water. Because of the many sources of recharge, ground water may contain any or all of the contaminants found in surface water as well as the dissolved minerals it picks up during its long stay underground.

Due to the different characteristics of ground and surface water, it is important that you know the source of your water. Of the 326 million cubic miles of water on earth, only about 3% of it is fresh water, and 2% of that is frozen. Only 1/2 of 1% of all water is underground; about 1/50th of 1% of all water is found in lakes and streams. The average human body is about 70% water. You can only survive five days or less without water.

## ■ Hard Water: What is hard water?

Waters that contain dissolved minerals, such as calcium and magnesium above certain levels are considered "hard water" because water is considered a "solvent", i.e., over time it can break down the ionic bonds that hold most substances together, it ends to dissolve and gather up small amounts of whatever it contacts. For instance, in areas of the world where rock such as limestone, gypsum, fluor spar, magnetite, pyrite and magnesite are common, well water is usually very high in calcium content, and therefore considered "hard".

Hard water is the most common problem found in the average home. Hard water is water that contains dissolved hardness minerals above 1 grain of hardness per gallon (GPG\*) or about 17 parts per million of hardness.

## ■ What are hardness minerals?

Calcium, manganese and magnesium are the most common.



Pounds of Scale Removed from a Hot Water Plumbing and Heating Systems

## ■ How do you measure hardness?

Parts per million or grains per gallon are the most common unit to measure hardness. One part per million (PPM) is just what it says: out of one million units, one unit. Grains, or grains per gallon (GPG) is a weight measurement taken from the Egyptians; one dry grain of wheat, or about 1/7000 of a pound. It takes 17.1 PPM to equal 1 GPG.

## ■ Why should hard water concern me? Problem

For many uses, it would not matter. For instance, to put out fires, wash the mud off the streets or float your boat, water would have to be pretty hard to cause a problem. But for bathing, washing dishes and clothes, shaving, washing your car, and for most commercial and industrial uses, as well as others, hard water is not as efficient or convenient as soft water.

For instance:

- When hard water is heated, the hardness minerals are re-crystallized to form hardness scale. This scale can clog your pipes and hot water



Scaled Tube Bundles Above



Scaled Hot Water Pipe

heater, causing premature failure, and necessitating costly repairs or even replacement.

- For many industrial uses, the hardness minerals interfere with the industrial or commercial process, causing inferior product.

\*Grains per gallon

# Hard Water Problems Solved Easily!

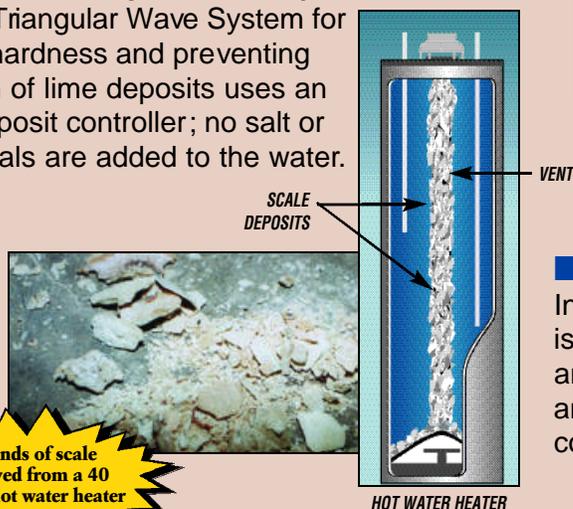
## Need to Enhance Water Quality, and Improve Operating Efficiency and Life Cycle of Vertical Hot Water Heater/Boiler Systems Control Scale Deposits Bio-film • Corrosion Algae and Colloids In Your Fluid-Fed Equipment

The build up of scale deposits is a common and costly problem in Hot Water Heaters and Boilers in the residential, commercial environments. The higher costs of maintaining and cleaning heaters and boilers can be attributed to the continuous cleaning of scaled surfaces or to the increased energy and operating costs due to the poor conductivity of the fluid pipe. For example, a 2.0 mm scale layer can induce a 47% decrease in overall heat transfer. Moreover, scale deposits narrow the inner diameter of piping, increasing the amount of energy required to pump the water through the system.

- Removes Existing Scale on Heat Exchangers Over Time, Which Improves Heat Transfer for Greater Efficiency
- Eliminates Deposits in Pipes, and Fixtures
- Controls Scale and Bio-fouling in Water Fed Appliances
- Reduces Equipment Replacement & Downtime

## Suffering from the scaling effects of hard water? *Solution*

If your water tests over 1 GPG hardness, you should condition it with a **Triangular Wave Deposit Control System**. The Triangular Wave System for neutralizing hardness and preventing the formation of lime deposits uses an electronic deposit controller; no salt or other chemicals are added to the water.



Pounds of scale removed from a 40 gallon hot water heater

## Energy Savings Mechanism

The primary energy savings result from a decrease in energy consumption in heating or cooling applications. This savings is associated with the prevention or removal of scale build-up on a heat exchange surface where even a thin film (1/32" or 0.8 mm) can increase energy consumption by nearly 10%. Examples of savings resulting from the removal of calcium-magnesium scales are shown in **table**. A secondary energy savings can be attributed to reducing the pump load, or system pressure, required to move the water through scale-free, unrestricted piping.

### U.S. Department of Energy thickness of scale accumulation increases energy consumption by:

1/32"	8.5% increase
1/16"	12.4% increase
1/8"	25.0% increase
1/4"	40.0% increase

In energy-intensive industries, the impact can be significant, easily affecting the bottom line.



## TWT® Deposit Control Technology

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.

# TWT the Ultimate in Chemical-Free Water Treatment & Conditioning— Prevents Scale Build-up Throughout the Fluid System

TWT, Inc. offers a full range of products & systems designed to address fluid problems wherever fluid flows. From patented deposit control technology to pre and post filtration needs, ionization, iron removal, disinfection, and ultraviolet purification treatment and conditioning, TWT has the versatile, efficient, cost-effective methods to solve your fluid management problems end to end.

## ■ TWT® Patented Deposit Control

Technologically Advanced Method for Water & Fluid Management Providing Comprehensive End-To-End Treatment & Conditioning (chemical-free).

### TWT Patented Deposit Control System—

The basic component in the TWT systems is the deposit controller. It is comprised of a microprocessor, solenoid coil wrap and/or a reaction chamber. The microprocessor is a patented controller that functions like a small computer to relay a continuous electrical power supply to the solenoid coil and/or reaction chamber. ***The solenoid coil or reaction chamber is wrapped or plumbed into the main water in-take line and/or just before each piece of vital processing equipment,*** and provides a factory-wrapped wire coil forming a solenoid. The solenoid conveys the triangular wave signal at the appropriate power level (as allowed by the model chosen) to the water passing through the chamber. This signal constantly changes the polarity, frequency, and a mplitude of the current entering the water. This triangular wave treatment produces several benefits. It increases the capability of the water to hydrate scale ions and other colloidal particles. In effect, the surface charge of the hydrogen molecules is enhanced and the water is made “wetter”. This “hydrated” water can dissolve unwanted particles, suspend them in solution, and allow them to be easily filtered out or flushed from the system.



TWT-5C8-472 Deposit Controller

Accordingly, the mineral and biological particles that cause scale, deposits, and corrosion are dissolved and washed away. This means that the breeding environments for bacteria, such as bio-film and corrosion, are eliminated. The agitation created in the reaction chamber also disrupts the conditions essential for the normal reproduction of bacteria and they die, thus allowing them to be harmlessly flushed out of the system.

## ■ Copper Pipe Signal Enhancer

Copper pipes, although acceptable, are one of the more difficult of materials to work with. To overcome this...TWT has developed its Copper Pipe Signal Enhancer. This unit is placed between the Deposit Controller and the solenoid coil on the copper pipe. The function of the signal enhancer is to provide a proper impedance match and to ensure maximum energy transfer between the controller and the solenoid, which, in turn, ensures enhanced treatment of the fluid.

Magnetic pipe materials such as steel, galvanized steel, iron, ductile iron or cast iron become shields and prevent the proper energy transfer to the fluid path. For magnetic pipe applications we offer a full line of factory wrapped wire coil Reaction Chambers.



TWT-CSE-0227 Copper Pipe Signal Enhancer

TWT products are designed to provide comprehensive solutions to water and fluid management problems. The Copper Pipe Signal Enhancer and its equivalent for the magnetic pipe environment, TWT Reaction Chambers, offer the answer to limited signal penetration, ensuring optimal results. The copper signal enhancer is a passive signal / impedance matching circuit. This device provides a power boost to the conditioning signal in copper pipes.

**Special Note:** Copper pipe signal enhancers are to be used on copper pipes only.

All TWT products and systems are shipped with easy to follow application and installation instructions (owners manual).

# Applied Benefits of Triangular Wave Technology

- **A class of fluid treatment equipment that takes water and energy conservation to the next level**
- **Salt and Chemical FREE water conditioning, environmentally friendly technology**
- **Easily retrofitted to existing equipment, easily installed with new equipment to maintain and improve operating efficiency**
- **Protection for new equipment: TWT provides new equipment with the ability to enhance it's features and benefits**
- **Chemical-Free Deposit Control Products & Systems**
- **Improving Operating Efficiency & Life Cycle of Equipment**
- **Control Scale Deposits/Bacteria Corrosion/Algae and Colloids in Pipes, Fixtures and Equipment**
- **Reduced energy & water consumption**
- **Reduced operating costs**
- **Requires NO Maintenance**
- **Non-Invasive**
- **Pennies per day to operate**
- **Cost effective**
- **Reduce and/or eliminate repair cost**
- **Guaranteed**

## ■ Benefits for Cooling & Heating Applications

The constant battle of monitoring cooling and heating systems will become a thing of the past. Balancing the water chemistry on a daily or weekly basis is not necessary with the Triangular Wave System. Cleaning of the systems will be much easier, involving a pressure wash one or two times per year, rather than extensive manual brushing and acid washing. When water systems are clean and free of deposits, heat transfer is at its most efficient. Scale and biofilm are great insulators, that are eliminated. Also scale buildup in pipes creates increased roughness and reduced flow area. Clean pipes mean less energy is needed to drive the pumps.

Energy costs may be reduced by up to 30%. Many municipal sewer agencies penalize and charge fees to users, because their blowdown contains hazardous chemicals, which the agencies must treat. Without chemicals in the blowdown, those fees can be avoided.

**Unpolluted discharge from blowdown and bleed= environmental compliance. The workplace is safer, because the staff is not handling toxic chemicals.**

Cooling and heating systems are large investments that need to be protected. The Triangular Wave System reduces corrosion, deposits, and harmful chemicals, all of which allow the equipment to meet or exceed life cycle expectations.

## ■ Treatment for Existing & New Equipment

Installed along with new and existing equipment to improve its operating efficiency and life cycle.

TWT Deposit Control Systems enhance other treatment technologies as well, including chemicals, separators, ozone, ultraviolet, and other filtration systems, keeping them clean and enhancing their operation. In this way, their full treatment benefits are realized, with reduced maintenance.

## ■ Energy-Efficiency Devices & Systems

Consider using TWT Deposit Control Systems in conjunction with any fluid treatment systems as a complementary technology. For further details on how you can leverage the TWT Deposit Control benefits, please contact us.

TWT treatment equipment is a reusable investment and retains its value, if you move your facility or re-engineer your plumbing system, TWT equipment moves with you.

# Applied Benefits of Triangular Wave Technology

- Non-chemical scale reduction and control allows treatment without creating a new set of problems
- Triangular waveform guarantees effective signal penetration
- Reduced biofilm, therefore reduced:
  - Bacteria growth
  - Corrosion
- Improved heat transfer efficiency
- Reduced energy & water consumption
- Extended capital equipment lifecycle, investments protected
- Reduced maintenance, labor
- Reduced operating costs
- Achieves a clean, scale & biofilm-free fluid delivery environment

## Combined Benefits of Energy-Efficient and Energy Efficiency Systems

- Best Practices, Best Results . . .
- Install triangular waveform deposit control technology with:
  - Existing equipment – retrofit
  - Extends equipment lifecycle
  - Energy and water waste
  - Improves performance
  - Cost effective and pays for itself in less than one year
- Replacement EnergyStar or other energy-efficient equipment, Maintains its ability to meet its EER, Extends its lifecycle, Reduces energy and water waste

*The return on investment of a TWT Deposit Control System is undeniably significant from operational, economical and safety points-of-view*

**DON'T WAIT...contact TWT today at [www.triangularwave.com/](http://www.triangularwave.com/)  
[www.twtwatertreatment.com](http://www.twtwatertreatment.com) or email us [info@triangularwave.com](mailto:info@triangularwave.com)  
for information on what TWT System will meet your specific application needs!**



**We sincerely thank you for your time and interest in our products and systems, and look forward to being a valued part of your operation.**

**Conserve Water, Save Energy...Non-Chemical, Safe, Cost-Effective Water Treatment Systems**

**TWT® The Ultimate in Alternative Energy, Water Treatment & Conditioning**

**Go Green - \$ave Green!**

