YORK INTERNATIONAL CORPORATION

York Enhancement Services

Presents

“ED 2000”

Electronic Anti-Fouling System

Electronic Anti-Fouling System

An Innovative Solution

To Prevent

Mineral Precipitation Fouling

Benefits

- **Save Money**
  - **Reduce Energy Costs**
    - **Maintain Head Pressure or Condenser Approach Temperature**
  - **Extends Life of Condenser Tubes**
    - **Eliminates Chemical Cleaning of Tubes**
  - **Save Water**
    - **Increase Cycles of Concentration**
  - **One - Two Year Payback**

Product Overview

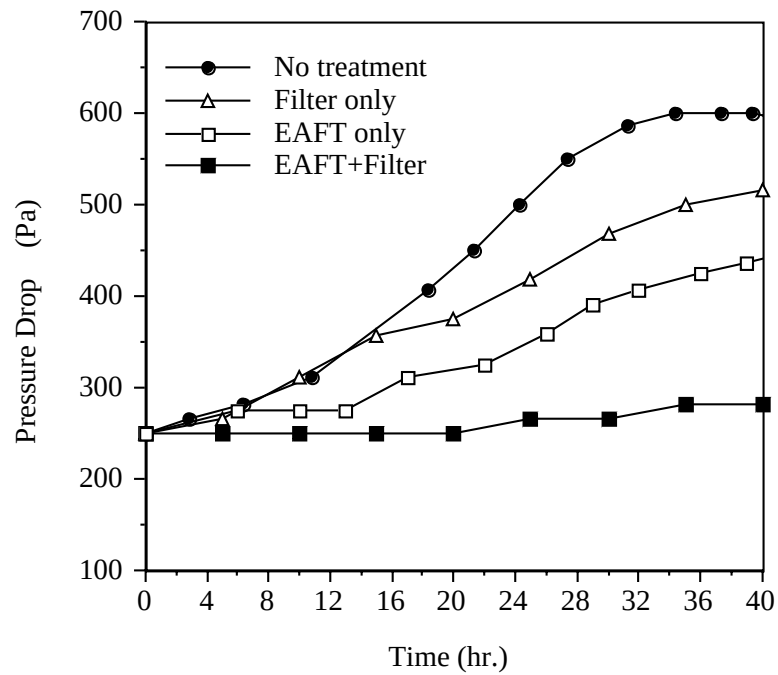
- **Developed & Tested at Drexel University**
  - **Theory Established**
  - **Lab Validated**
  - **Field Validated**
- **Improvements Patented**
- **Reliable & Consistent Performance**

Product Validation

- International Journal of Heat & Mass Transfer
- Compact Heat Exchanger Conference
- 1999 ASHRAE Conference
- York International
- API Heat Transfer
- Alfa Laval Thermal

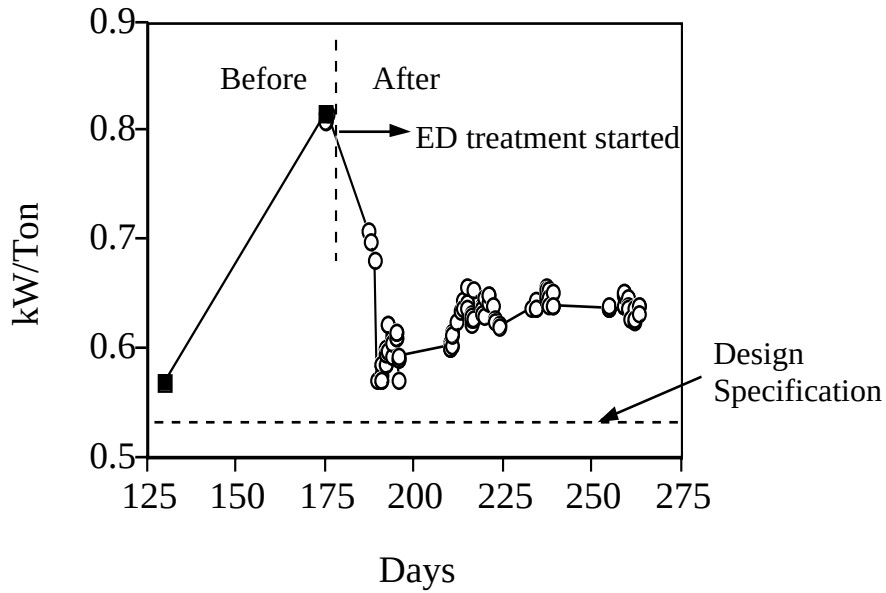
ED 2000 Laboratory Validation

- International Journal of Heat and Mass Transfer
  - Use of ED 2000 with filtration
  - 1000 ppm
  - 1.5 gpm
  - 26-80 degrees C

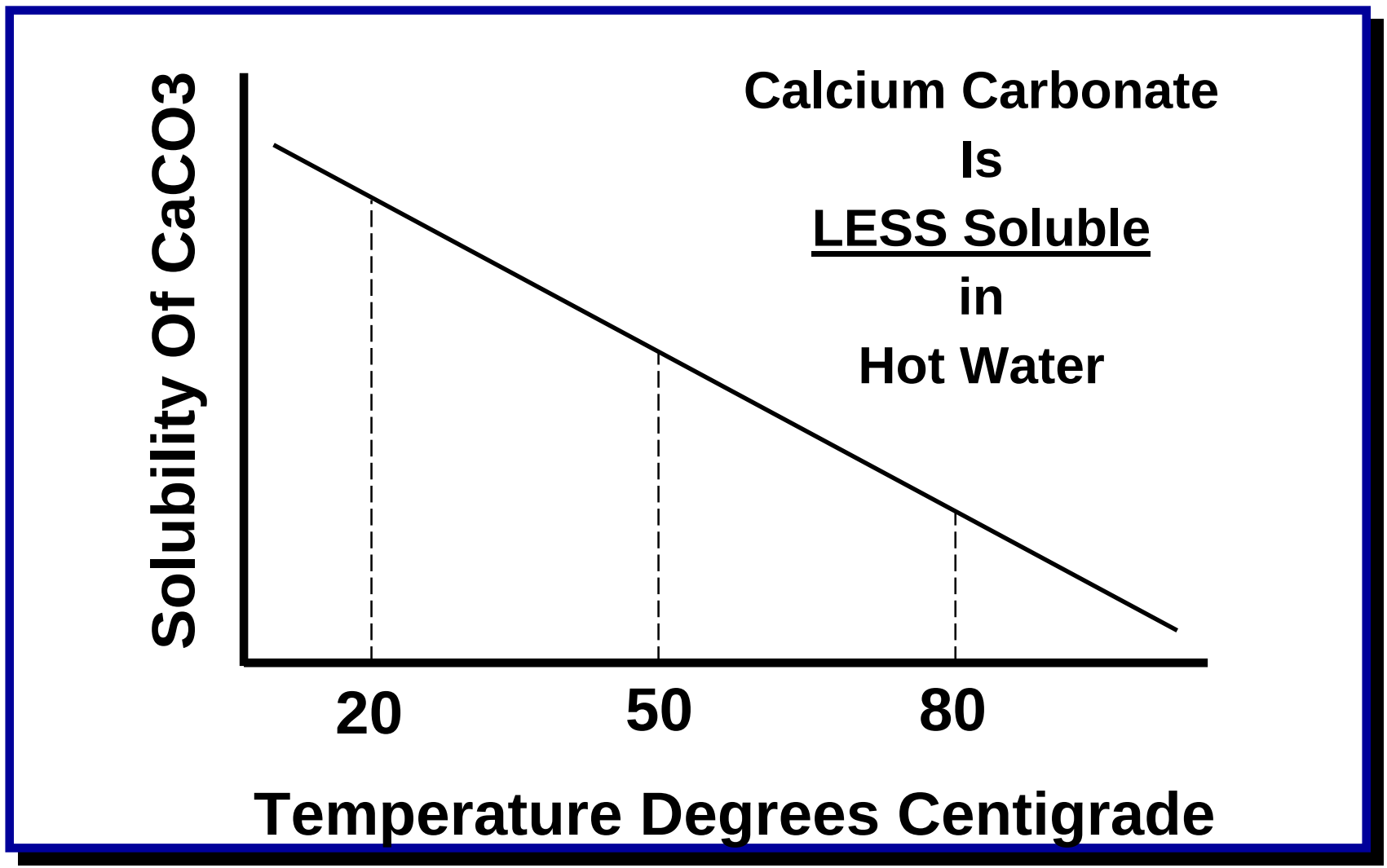


ED 2000 Field Validation

- Results Reported at the 1999 ASHRAE Meeting
  - Use of ED 2000
  - 450 ton chillers
  - 1200-1500 hours
  - With and without ED 2000



How Does Scale Form ?



Adhering To Condenser Tubes

Electrostatic Attraction

Dissolved Calcium Ions $Ca^{++}_{2} + 2HCO_{3}$

↓ **Uncontrolled Precipitation**

Insoluble Crystals $CaCO_{3} + H_{2}CO_{3}$

↓ **Scale Build-up**

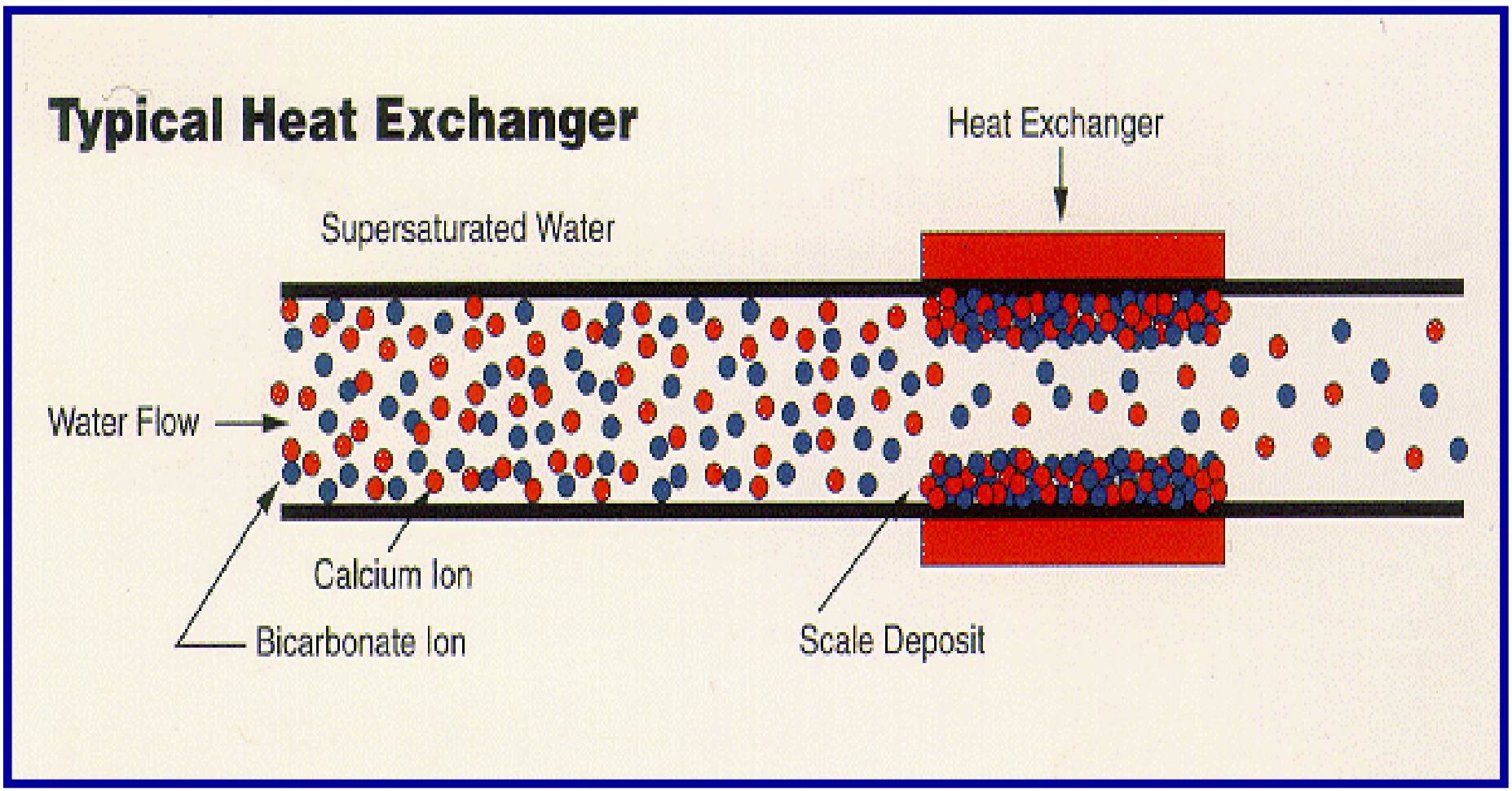
Scale

Positively Charged Calcium Salts

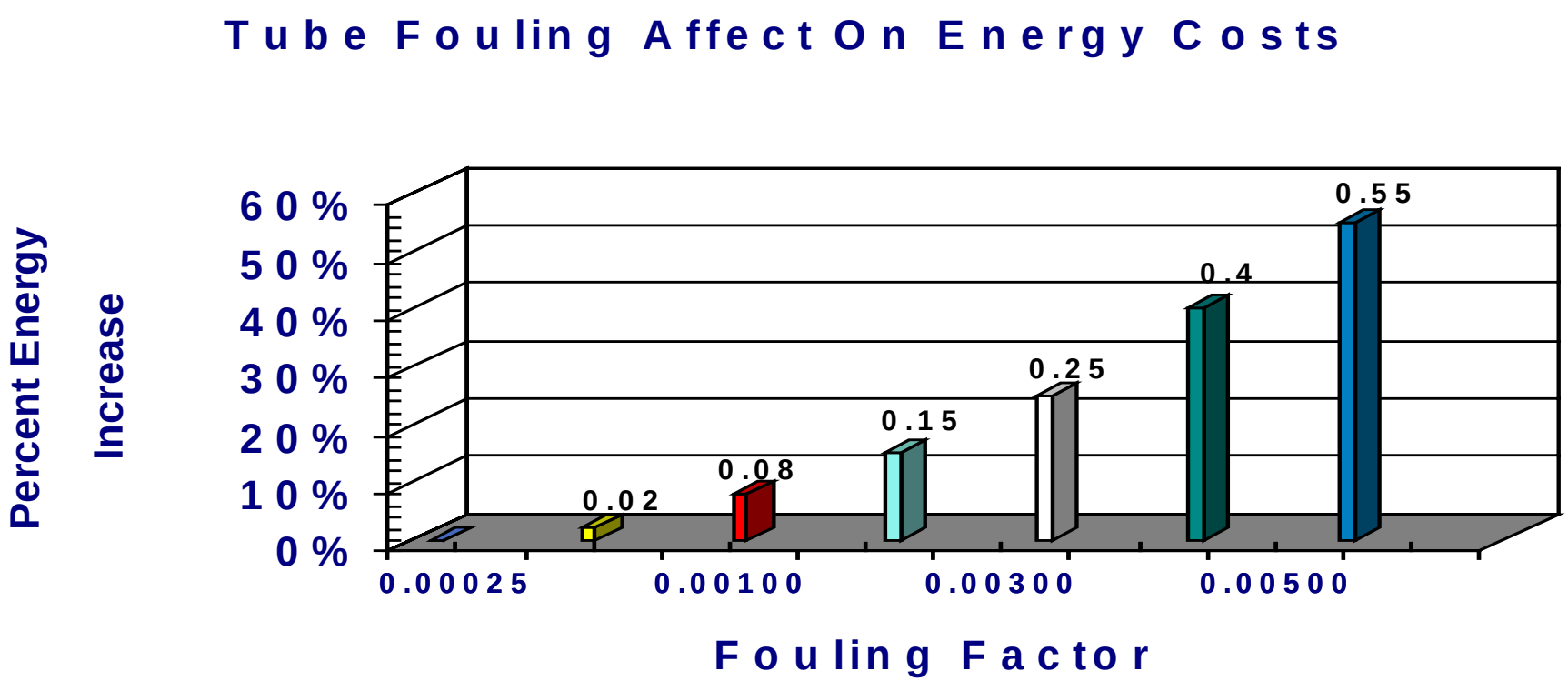
Stick To

Negatively Charged Metal Surfaces

Uncontrolled Precipitation



Additional Energy Costs Due To Condenser Tube Fouling

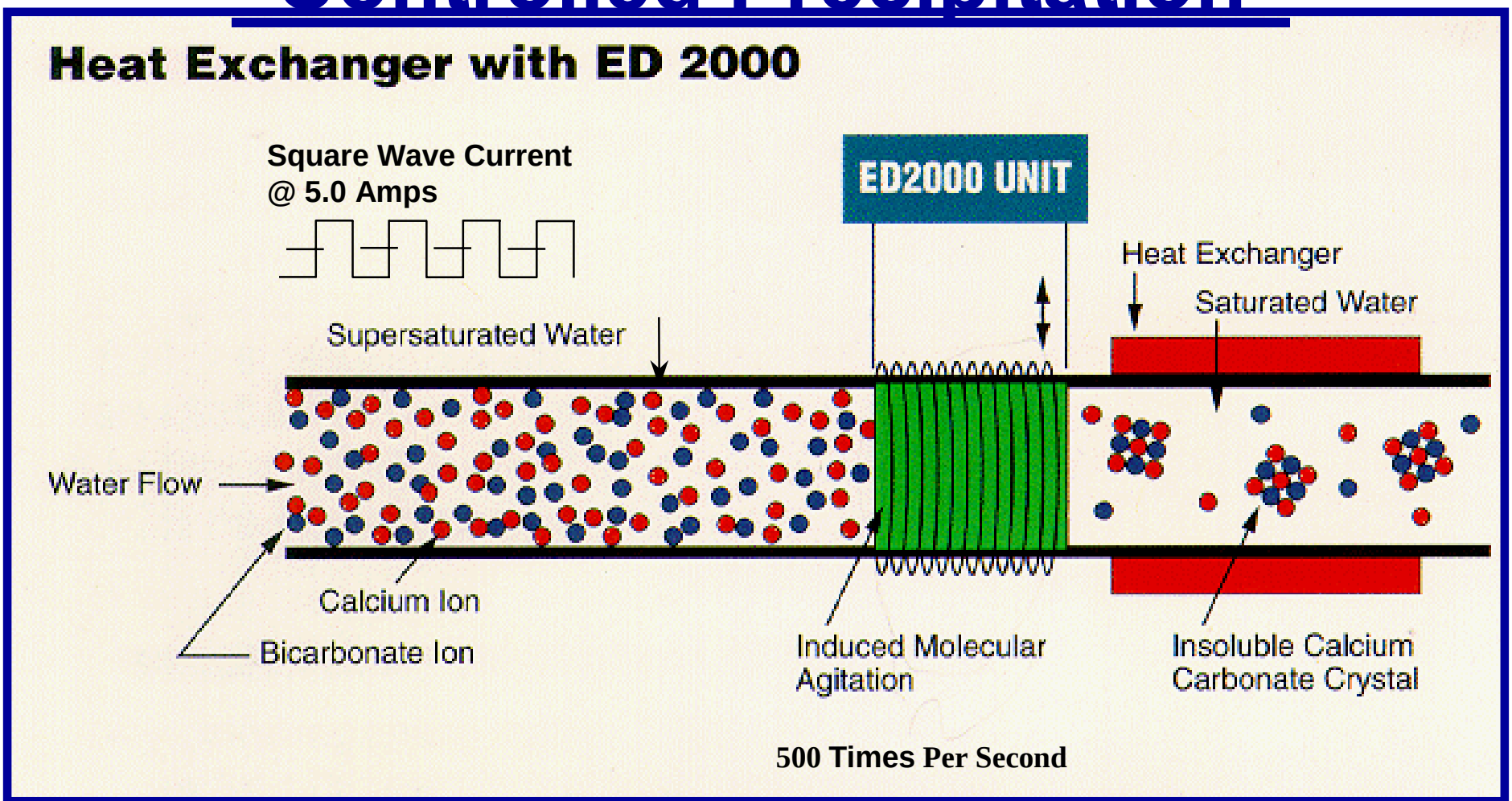


What Is The New Technology ?

- **Solenoid Induced Molecular Agitation**
  - **New Control Circuitry**
    - **Square Wave Current**
    - **Constant Oscillating Current Wave**
  - **Innovative Coil Application**
    - **Off-set Design**
    - **Enclosed Pre-Wrapped Coil**

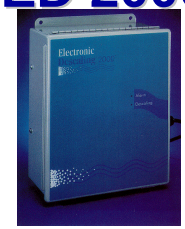
How Does It Work?

"Controlled Precipitation"



Solenoid-Induced Molecular Agitation

ED 2000



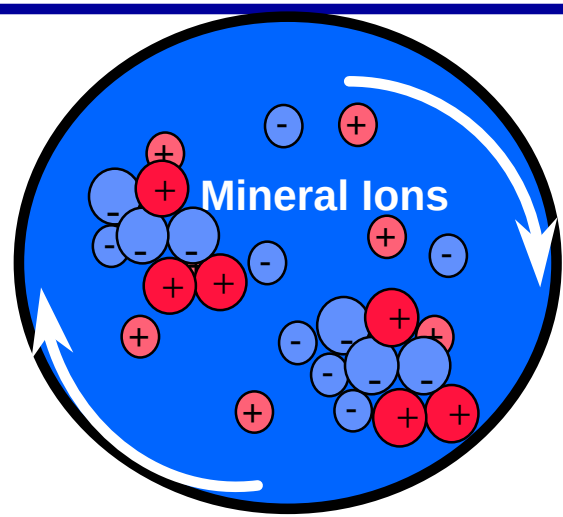
End View of Condenser Pipe w/ Water

Solenoid (Off-set Coil)

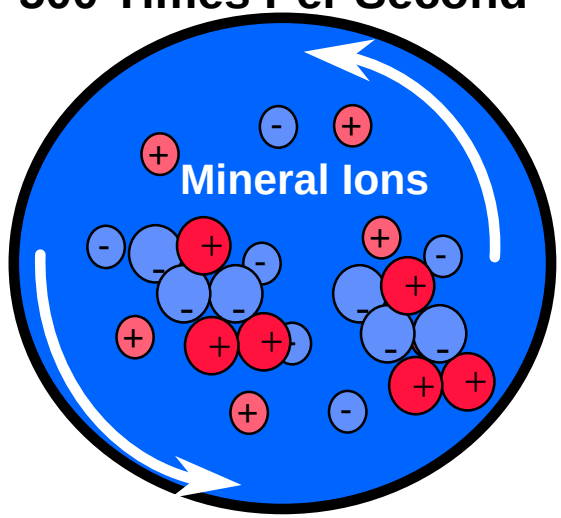
Square Wave Current

@ 5.0 Amps

Solenoid-Induced Molecular Agitation
(Oscillating Electric Field)

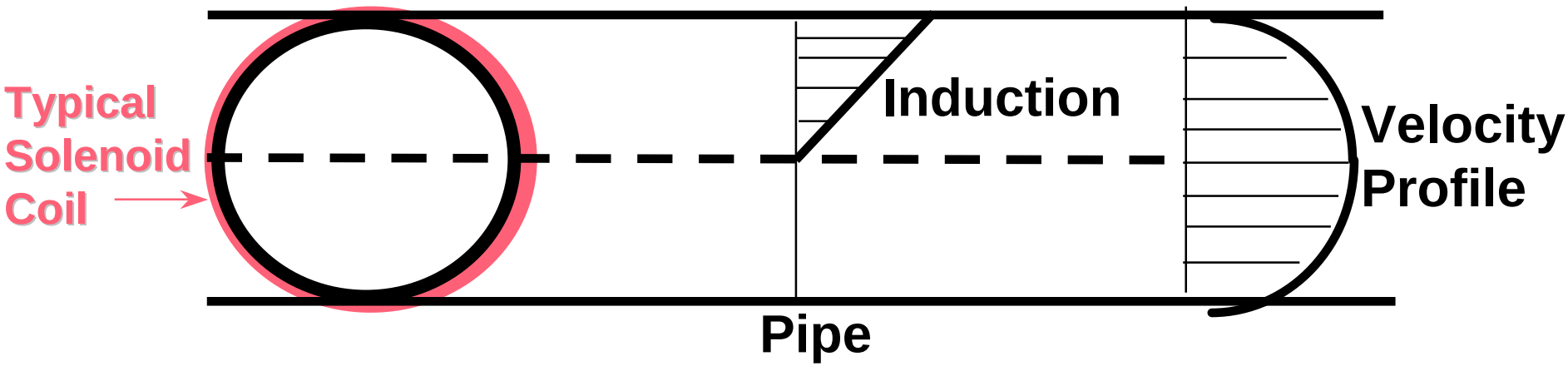


500 Times Per Second



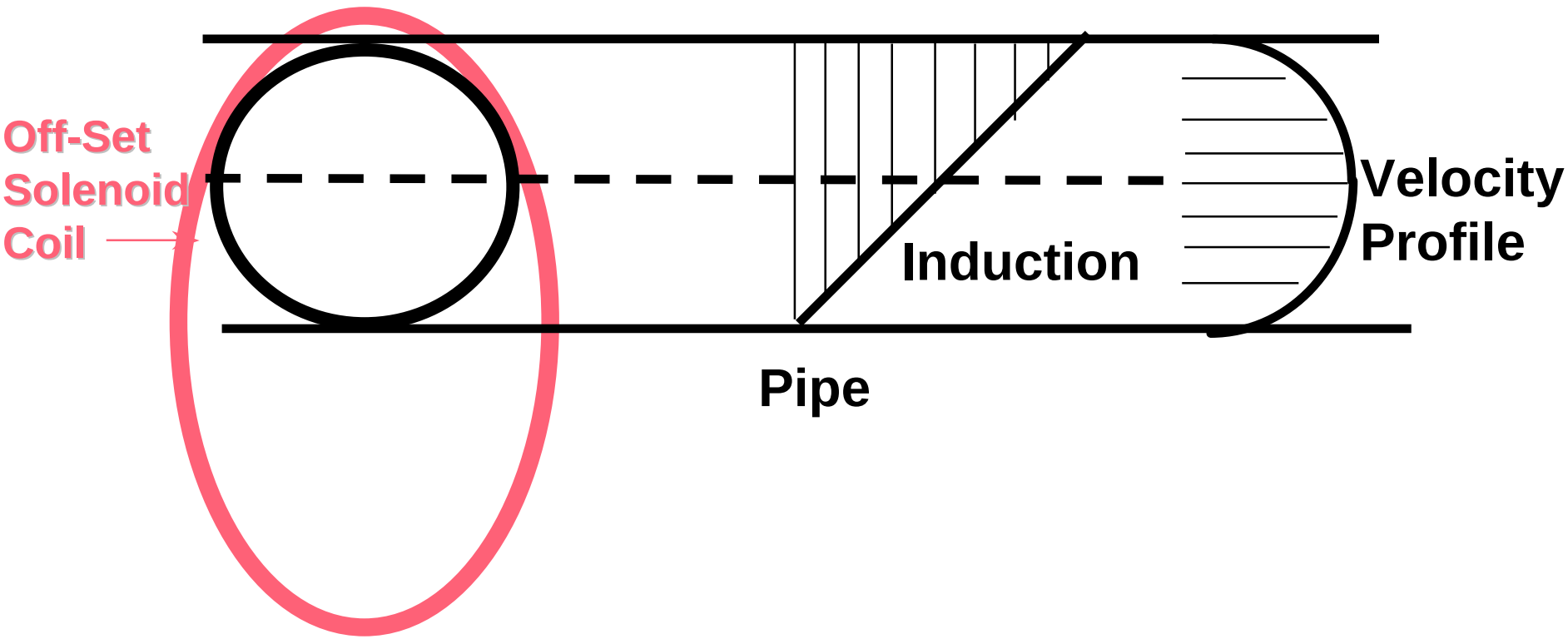
Typical Coil

Induction is Zero at the Center of Pipe, where Flow-Velocity is Maximum



Off-Set Coil

ED 2000 has 700% Better Treatment by using an Off-Set Coil



How is it Different?

- Magnets
- Electronic Systems
- Mechanical Systems
  - Auto Tube Brushing
  - Ball Systems

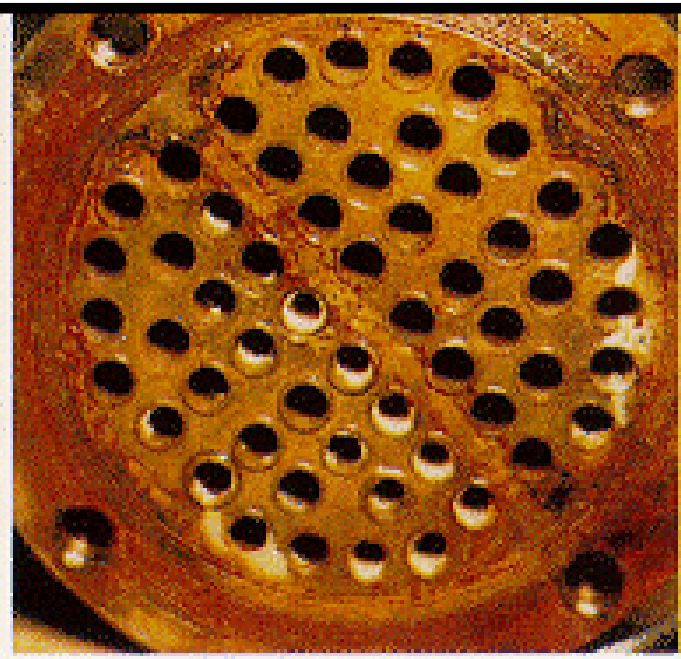
Test Tube Results

- **Tubes *Before* and *After***

  Installation of ED 2000

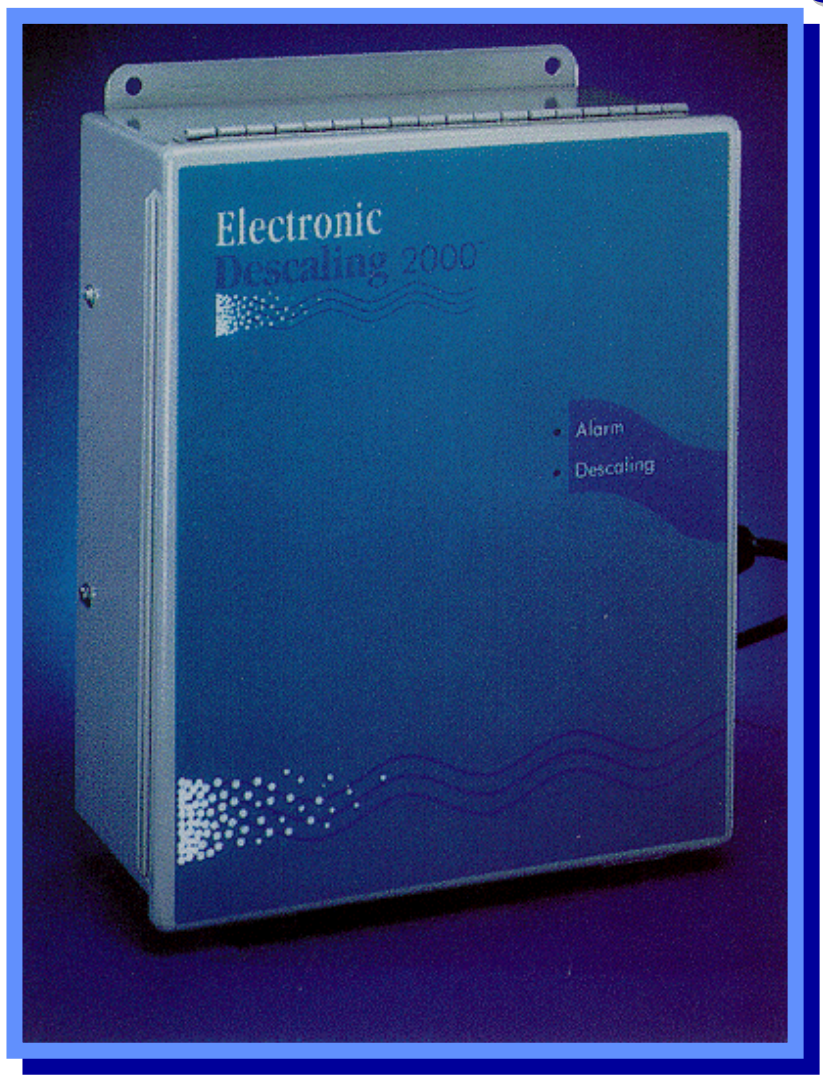
Tube Bundle

Scale on Tube Bundle



After Installation
of ED 2000

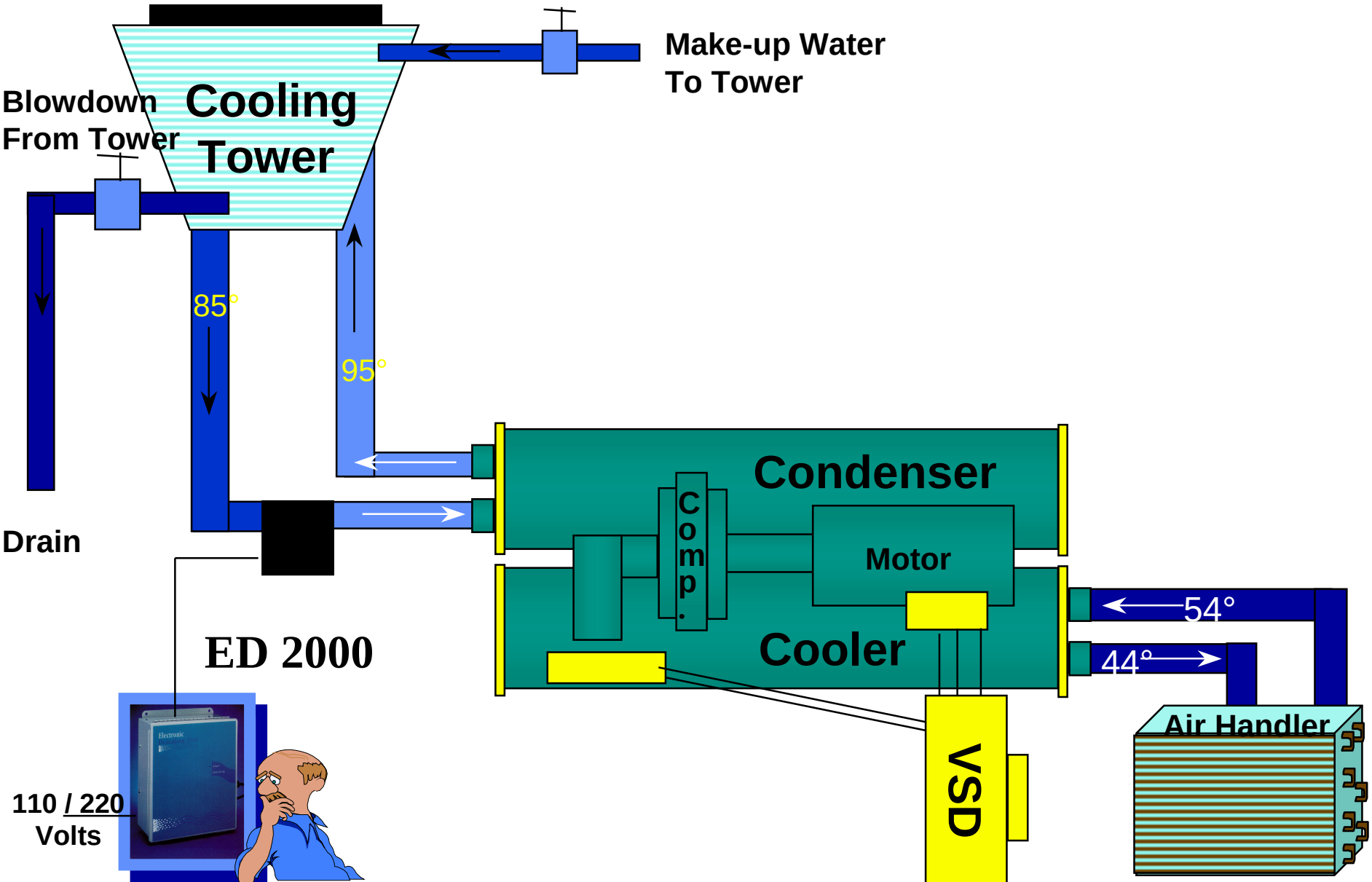
ED 2000
Electronic Anti-Fouling System



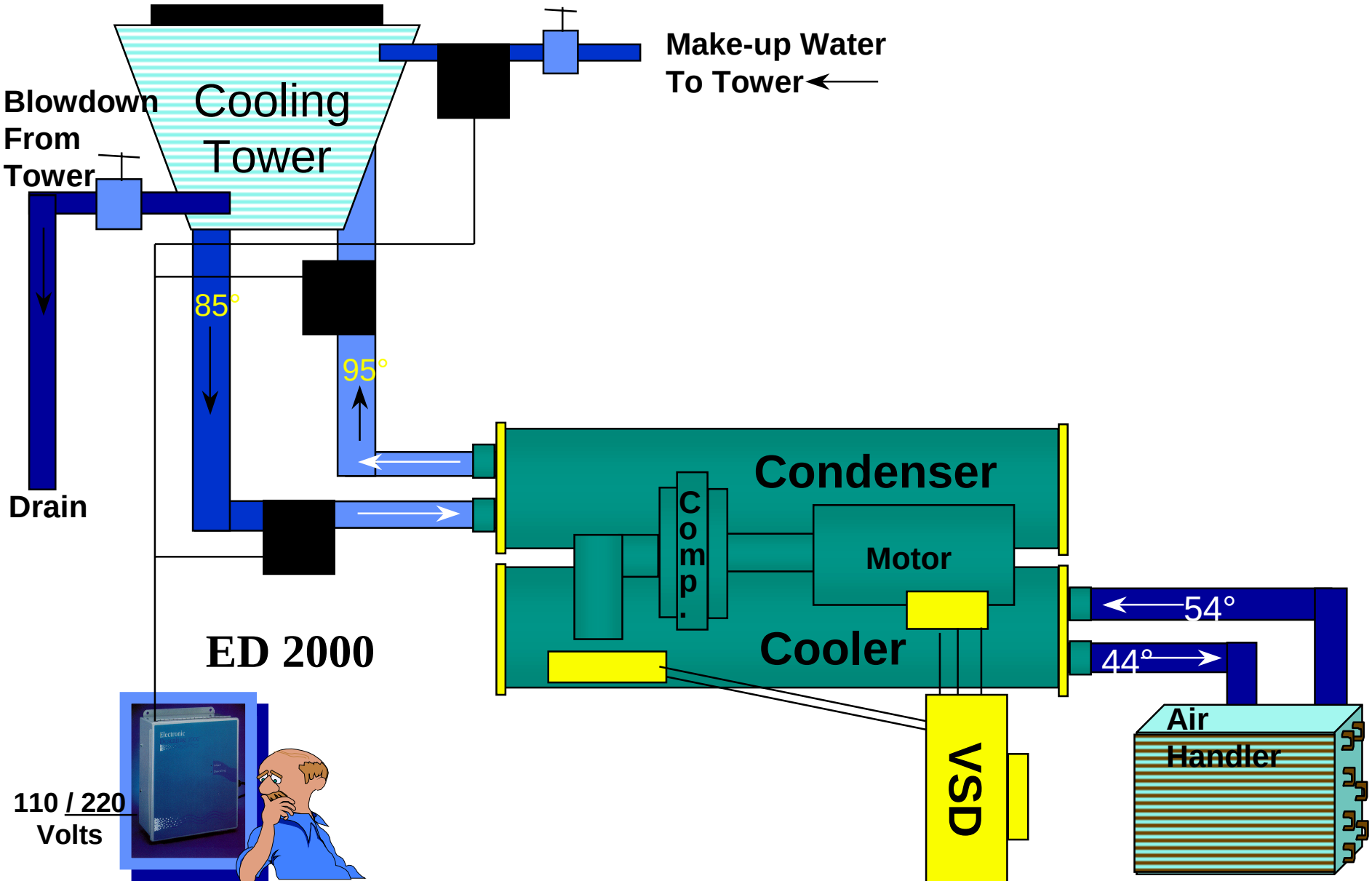
ED 2000 Coil & Enclosure

- Up to 20” Pipe Diameter
- Prewrapped Solenoid Coil
  - UL Rated NEMA 12 Enclosure
- ABS Weather Resistant Enclosure
  - Optional SS Enclosure
- 110 / 220 Volts
- Installs in Less Than 1 Hour on a Simple Installation

ED 2000 Installation

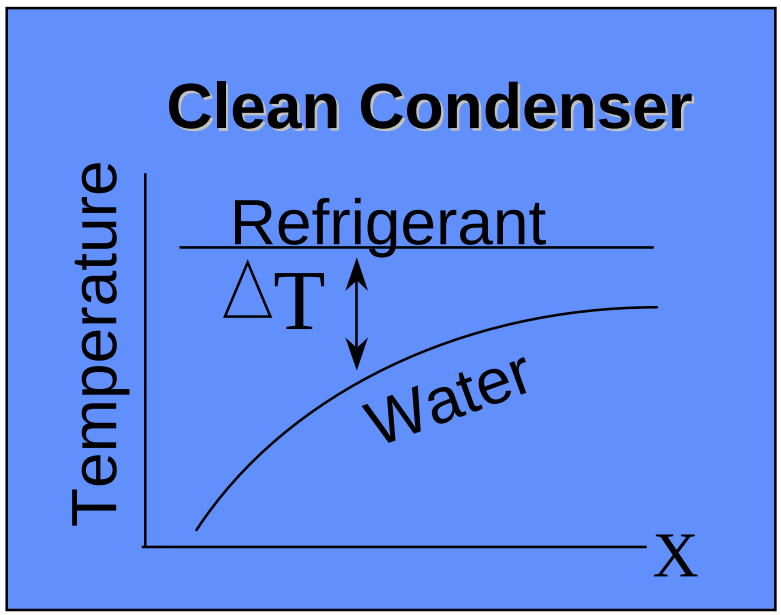


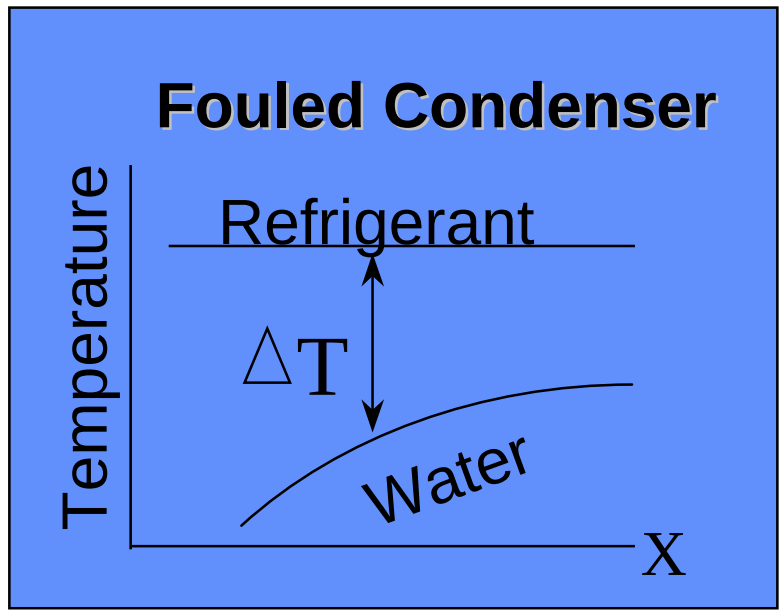
ED 2000 Installation



How Do I Know It Is Working?

Condenser Approach Curves

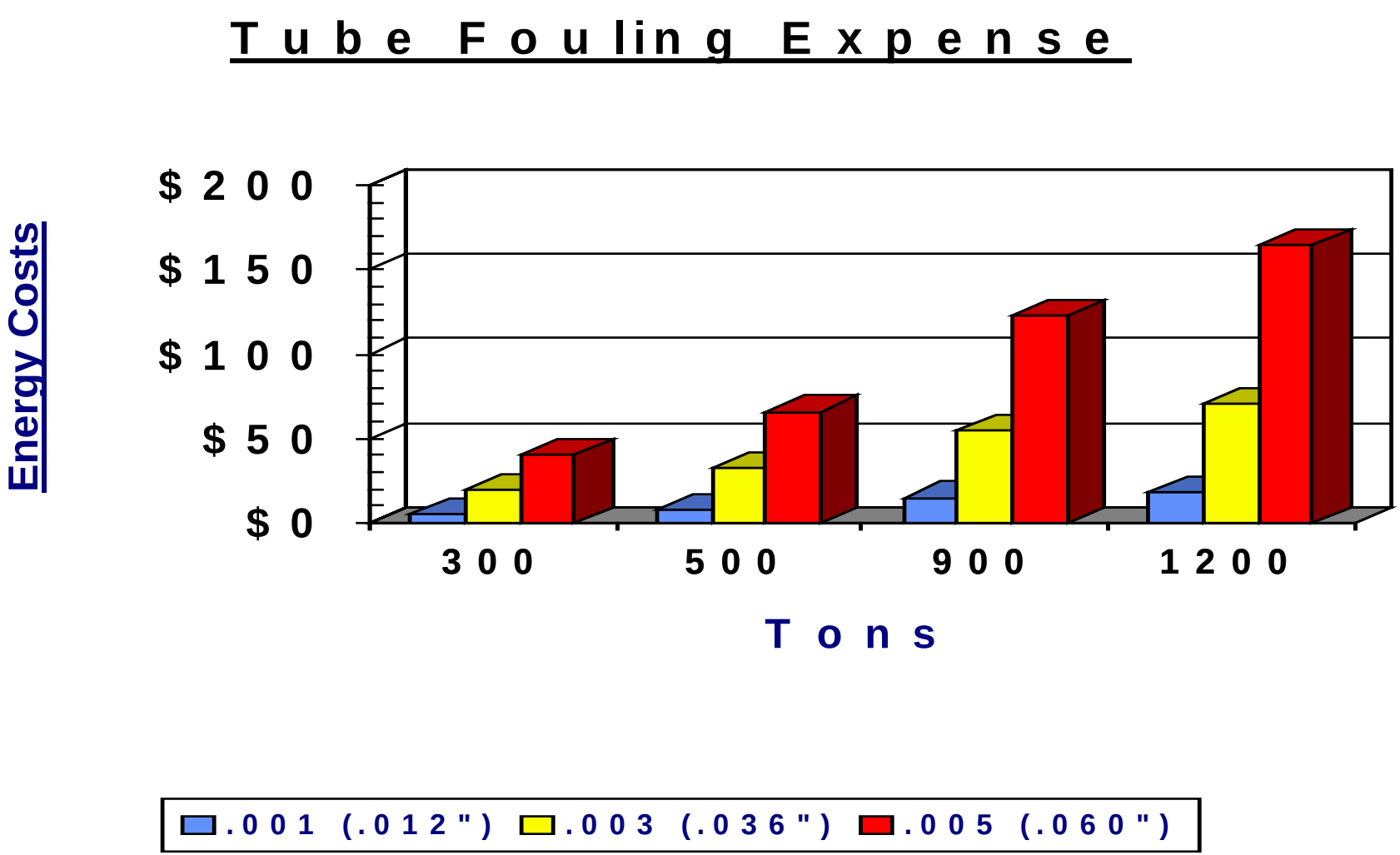




Condenser Approach - The temperature difference between refrigerant and condenser water outlet

A 1 degree increase = 1.5-3% increase in energy cost

Additional Energy Costs Due To Condenser Tube Fouling



Case Study

- **Drexel University, Philadelphia, PA**
  - Two 450 ton YORK Centrifugal Chillers
  - 1500 Running Hours
  - 0.84 kW/ton versus 0.61 kW/ton
  - $0.085 cost per kW/hour
  - $26,507 current cost to operate
  - $19,494 with ED 2000
  - $7,013 savings

Case Study

- **Monroe County Detention Facility, Key West, Florida, USA**
  - **Two 300 ton YORK Centrifugal Chillers**
  - **8732 Running Hours**
  - **0.60 kW/ton versus 0.56 kW/ton**
  - **11 degree increase in condenser approach temperature**
  - **$0.09 cost per kW/hour**
  - **$169,853 current cost to operate**
  - **$156,610 with ED 2000**
  - **$13,243 savings**

Case Study

- **Hilton Hotel, New Orleans, Louisiana**
  - Three 250 ton Centrifugal Chillers
  - No scale inhibitors used
  - Make-up Water Analysis Tower Water Analysis

Calcium Hardness	122 ppm	450 ppm
Alkalinity	150 ppm	360 ppm
Chlorides	88 ppm	630 ppm
pH	7.7	8.8
Conductivity	580	2900

Case Study

Siemens, Newport News, Virginia

Three 700 ton YORK Centrifugal Chillers

- No scale inhibitors used
- Make-up Water Analysis / Tower Water Analysis

Calcium Hardness	180 ppm	160 ppm
Alkalinity	270 ppm	400 ppm
Chlorides	15 ppm	130 ppm
pH	7.71	8.84
Conductivity	410	1165

System Guarantee

- **Three Year Warranty**
  - **Replace**
  - **Repair**
- **One Year Money Back Guarantee**
  - **If installed before end of 1999.**

YORK® Enhancement Services

ED 2000

The

Electronic Anti-Fouling System

For

The Next *Millennium*