# HYDROPATH

# WHO WE ARE

Windows

KeyShot Shortcut Keys - 1

#### THE BEGINNING

Hydropath was started in 1992 by Dr. Danny Stefanini who, based on his theory of crystallisation, developed the first prototype model for treating limescale within the home.

An early model extensively tested by British Gas Plc at their Watson House Research Station and in the Regions. This showed they could save tens of millions of pounds per year in reduced maintenance. As a result British Gas venture capital partners invested in Hydropath. The investment has since matured, but the commercial relationship continues with British Gas.

The investment allowed the expansion of the company and the development of new products and applications.







#### UNITS FOR ALL SIZES OF PIPES

The same patented technology is used in all of our units:











#### **INDUSTRIES**

#### WITH AN EVER-INCREASING GLOBAL PRESENCE, HYDROPATH TECHNOLOGY IS AVAILABLE IN 68 DIFFERENT COUNTRIES.



#### **APPLICATIONS**

#### **Prevention and Removal of Limescale**

- Increased cooling efficiency
- Lower maintenance costs

#### **Algae and Bacteria Control**

- Prevention of biofouling
- No biocides required

#### Flocculation

- Flocculation
- Reduction in backwashing



#### BENEFITS

EFFICIENCY

Heat transfer improves, saving energy

DOWNTIME

Cleaning is less frequent and easier



EQUIPMENT LIFESPAN

Equipment works better for longer

#### **CHEMICALS**

Protection for your system without harmful chemicals

# THE HYDROPATH SIGNAL

1 by darcas

#### THE HYDROPATH SIGNAL

- The Hydroflow signal is a decaying sine oscillation
- Around 120 kHz
  - 2000 times faster than mains!
- Pulse separation time varies to work in a range of situations
- Extremely low power
  - 1.2 W domestic (£1.50 /yr)
  - ~20W Commercial



#### **APPLYING THE SIGNAL**

How do we get a signal into the pipe? Start with a transformer...

Make secondary single loop...

Make loop bigger...



#### **APPLYING THE SIGNAL**

Only care about pipe passing through the unit Don't care about

- Alignment
- Position
- Insulation



#### **PROPAGATION OF SIGNAL**

The signal is "trying" to return to the other side of the unit

The signal travels in both directions along pipe

Signal will travel through whole piping system

Splits (roughly) 50-50 at each junction



# ALTERNATIVE TREATMENTS

#### CHEMICAL

#### Softeners

- Change Composition of the water
- Beneficial minerals in drinking water reduced
- Need regular replacement

#### Electrolytic

- Finite lifespan
- Can actually scale up!





#### MAGNETIC

Permanent or electro-magnets
Magnetic fields (not Electric Fields)
Local (point protection only)
Only works when water is moving (and at right angles)
Very weak (E = c B)



#### **COMPARISON VS HYDROFLOW**

Electric field induced along length of pipe Stronger effect than magnetic field Present all through plumbing system Independent of flow



# LIMESCALE

#### LIMESCALE

- Calcium dissolved in water
- Forms a hard mass on surfaces
- Pipes and heat exchanger surfaces (e.g. boilers)
- Reduces heater efficiency and water flow
- Causes blockages, leaks and damage



#### **COSTS OF LIMESCALE**

#### The Costs of Scale in Boiler Systems

Scale thickness (mm)	0.4	0.8	1.6	3.2	4.8	6.4	9.6	12.7	15.9	19.1
Gallons of Oil Wasted per 1000	40	70	110	180	270	380	480	600	740	900
Pounds of Coal Wasted per Ton	80	140	220	360	540	760	960	1200	1480	1800
Gas Wasted per 1000 Cubic Feet	40	70	110	180	270	380	480	600	740	900
Average Efficiency Loss	4%	7%	11%	18%	27%	38%	48%	60%	74%	90%

#### The Costs of Scale in Cooling Systems

Scale thickness (mm)	0.5	1	2	4	6	8	10	12.7
Decrease in Condensing Capacity	40	70	110	180	270	380	480	600
Increase in Condensing Temp (°C)	80	140	220	360	540	760	960	1200
Increase in Energy Required	40	70	110	180	270	380	480	600



#### WHEN DOES SCALE FORM?

- Calcium and bicarbonate dissolved in water
- Water becomes super-saturated when
- Temperature increases or pressure decreases
- Ions precipitate as calcium carbonate: limescale



#### **CHANGING WHERE SCALE FORMS**

- Do not fight nature!
- Hydroflow induces an electric field so scale does not form on the pipe
- Instead, scale forms in the water and is washed away



#### **CLUSTER FORMATION**

The Hydroflow signal encourages the ions to form clusters

These clusters then become seed crystals

Further crystalisation occurs on these seeds





#### **PREVENTION OF SCALE**

#### Without Hydroflow

• Water is heated

-

- Surface provides nucleation site
- Scale forms on surface

# orms on surface

#### **PREVENTION OF SCALE**

#### With Hydroflow

-

- Hydroflow forms clusters
- Water is heated
- Cluster provides nucleation site
- Scale forms in suspension

# 

# HOLIDAY HOMES, FRANCE

A single unit was used to protect 4 boilers supplying water to holiday homes Previously had 200kg/ year scale in cylinders, with 5cm thick layer on heaters With Hydroflow, <10kg/ year of light scale in cylinder, very little on heaters Energy savings estimated at >50%, maintenance savings 50% plus replacement savings

Hydroflow

#### **REMOVAL OF EXISTING SCALE**

Crystals form Creates Carbon Dioxide Dissolves existing scale





## LINNEO DE PAULA MACHADO, BRAZIL

Cooling towers treated for a year Existing scale removed, new scale prevented Corrosion reduced

*Hydro***flow**<sup>®</sup>







Chemical factory heat exchanger - ready to be scrapped
Heat transfer goes up as Hydroflow cleans exchanger
Outlet levels of Calcium initially increase as HEX is cleaned
Once cleaned, the outlet Ca levels return to match inlet Ca levels

*Hydro*flow<sup>®</sup>

#### LIMESCALE SUMMARY

Hydroflow prevents scale

- Without chemicals
- Without changing composition of water
- Water is just as drinkable!

Hydroflow dissolves existing scale



#### **OSMOSIS AND BACTERIA**

#### Osmosis

- Semi-permeable membrane: passes water, but not salt.
- Consider a situation where a semi-permeable membrane separates salty and fresh water
- Water flows from dilute to concentrated region

#### Bacteria

- Bacteria cell: semi-permeable membrane
- In distilled water, water flows into bacteria
- Bacteria becomes "too dilute", dies, bursts
- (kills even "freshwater" bacteria)



#### HYDROPATH AND BACTERIA

- Consider bacteria in salt water
- Hydropath charges bacteria, creating a wetting layer
- Layer of very pure water around bacteria
- Osmosis forces water into bacteria
- Bacteria dies



#### **BIOFILMS AND BIOFOULING**

- Bacteria cling to surface of pipe
- Form a layer know as biofilm
- Larger "macrofoulers" attach in biofilm
- This includes larvae
- Biofilm protects larvae
- Larvae grow into limpets, barnacles, etc



#### **BIOFILMS AND BIOFOULING**

- Hydropath signal charges bacteria, creating wetting layer
- Osmosis causes bacteria to swell and die
- No bacteria means no biofilm
- Larvae and macrofoulers cannot attach
- Washed away by flow
- Pipe remains unfouled



#### **REMOVAL OF EXISTING BIOFILM**

Bacteria form a thick layer on heat exchange surface Reduces heat transfer efficiency and blocks flow Signal disrupts biofilm layer Layer falls off in pieces

#### **BACTERIA APPLICATIONS**

- Unit is not a steriliser
- Will not get perfect results on a once-through pass
- Works best in commercial/ industrial context

## KARKHOV MEAT PLANT



Biofouling present in steam boilers for 7 yearsFrequent shutdown requiredUnits installed January 2016 for 105 daysBiofilm removed – results visibly clear

*Hydro***flow**<sup>®</sup>

# CAR FACTORY COOLING TOWER, JAPAN



Unit used to treat oil cooler and cooling tower Algae on cooling tower fins removed after 108 days Oil cooler remained clear

Hydroflow

# FLOCCULATION

#### FILTRATION

Physical material with holes (sand or cartridge)Blocks dirt particles (of a particular size)Filter eventually blocks (pressure increases)Need to "backwash" to clean filterWastes water (and heat, chemicals etc)



#### ENHANCEMENT OF FILTRATION

- Flocculation
- Clump to form larger "flock"
- Filter removes smaller particles
- Particles sit on surface of filter: easier to remove
- Can reduce the frequency and duration of filter backwashing (by a factor of four or more)
- Save on make-up water and effluent charges
   no chemicals



#### **ENHANCEMENT OF FILTRATION**

Particles charged by unit

**Turbulence mixes them – positively and negatively charged meet** 

Clump to form larger "flock"



### HA'MAPIL POOL

500 cubic meters (132,000 gallon) swimming pool (recently built)
A 6" circulation pipe connecting to two 10 cubic meters filters, circulating 120 cubic meters per hour
Chlorine reduction by 47%, Acid reduction by 70%
Backwash reduced by 66% - Saving 48 cubic meters of water per month

*Hydro*flow<sup>®</sup>

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