

# Save energy, save money with efficient water treatment...



## Electromag

### Scale Prevention for Industry & Commerce

**WRAS**  
APPROVED  
PRODUCT



- Scale inhibitors
- Water softening
- Water filtration
- Water chillers
- UV disinfection
- Reverse osmosis
- Chemicals
- Powerflushing



## VALUE ENGINEERING FOR CONSULTANTS, SPECIFIERS AND CONTRACTORS



**Value Engineering** is a conscious and explicit set of disciplined procedures designed to seek out optimum value for both initial and long-term investment. First utilized in the manufacturing industry during World War II, it has been widely used in the construction industry for many years.

Value Engineering (VE) is not a design/peer review or a cost-cutting exercise.

VE is a creative, organized effort, which analyses the requirements of a project for the purpose of achieving the essential functions at the lowest cost (capital, staffing, energy, maintenance) over the life of the project. Through a group investigation, using experienced, multi-disciplinary team value and economy are improved through the study of alternate design concepts, materials and methods without compromising the functional value objectives of the client.

The Society (SAVE) was formed in 1959 as a professional society dedicated to the advancement of VE through a better understanding of the primary methods, and concepts involved. Now known as SAVE International, SAVE has grown to over 1,500 members and Calmag believe that joining the SAVE Organisation gives us a competitive edge and also offering our customers the confidence that we look at all aspects of the project.

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VE can be applied at any point in a project, even in construction. However, typically the earlier it is applied the higher the return on the time and money invested.

The value methodology (VM), a systematic and structured approach, improves projects, products, and processes. VM is used to analyse manufacturing products and processes, design and construction project, and business and administrative processes. VM helps achieve balance between required functions, performance, quality, safety, and scope with the cost and other resources necessary to accomplish those requirements. The proper balance results in the maximum value for the project.

## Value = Function/Cost

**Value** is the reliable performance of functions to meet customer needs at the lowest overall cost.

**Function** is the natural or characteristic action performed by a product or service.

**Cost** is the expenditure necessary to produce a project, service, process, or structure.

The systematic and structural approach comes from the VM job plan. SAVE International®'s standard job plan consists of six phases:

1. Information Phase: Gather information to better understand the project
2. Function Analysis Phase: Analyse the project to understand and clarify the required functions.
3. Creative Phase: Generate ideas on all the possible ways to accomplish the required functions.
4. Evaluation Phase: Synthesize ideas and concepts to select feasible ideas for development into specific value improvement.
5. Development Phase: Select and prepare the "best" alternative (s) for improving value.
6. Presentation Phase: Present the value recommendation to project stakeholders.

At the Planning stage of development, there are additional benefits to be derived from a Value Engineering Workshop. At Calmag we follow the procedures below:

**Review** the program

**Perform** a functional analysis of the facility

**Obtain** the owner/users definition of value

**Define** the key criteria and objects for the project

**Verify**/validate the proposed program

**Review** master plan utility (e.g. Central Product Plant versus individual systems)

**Offer** alternative solutions (square footage needs per function, adjacency solutions, etc.)

**Verify** if the budget is adequate for the developed program

The **benefits** are tremendous

Any changes to the program at this stage have very little if any impact on the schedule or redesign costs.

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The VM process produces the best results when applied by a multi-disciplined team with experience and expertise relative to the type of project studied.

### Enhancing Value in Your Company

VM is embraced by a global spectrum of businesses and industries: building designers and contractors; automobile manufacturers; chemical processors; pharmaceutical companies; etc. Benefits realised by those companies using VM far exceeds the investment. Savings in time, cost, and quality contribute to improving an organization's competitive position.

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## Conclusion

In the final analysis, Value Engineering is not only beneficial, but essential because:

- The functionality of the project is often improved as well as producing tremendous savings, both initial and Life-Cycle cost.
- A "second look" at the design produced by the architect and engineers gives the assurance that all reasonable alternatives have been explored.
- Cost estimates and scope statements are checked thoroughly assuring that nothing has been omitted or underestimated.
- Assures that the best value will be obtained over the life of the building.



# Hard Water Problems

## Problems caused by Hard Water

Calcite, the main cause of scale, is the most common form of calcium carbonate and occurs naturally as a natural ingredient of chalk, limestone and marble. Water passing over and permeating through such rocks dissolves calcite when this water subsequently flows through a water system the calcite precipitates out to form a very hard scale on surfaces.

When hard water is heated, or evaporation takes place, the problems are exacerbated. Calcite forms ever growing layers of rock-like deposits until eventually pipes, jets, and equipment become totally blocked.

The problem increases as the water gets hotter. Water containing 145ppm of calcite, flowing at 3.5 litres per minute, produces in one year 4.8 kilograms of scale at 60°C. At 80°C this rises dramatically to a massive 29.9 kilograms!

Scale wastes both energy and financial resources just one eighth of an inch of limescale reduces heating efficiency by 25%. It is also very expensive to remove, descaling pipes and boilers alone costs British industry over £800m each year.

It has been shown that a heat exchanger surface with 1mm limescale deposit requires approximately 8% more energy to achieve the same output. Consequently, the energy saving benefits of a scale-free boiler are such that it makes sense to err on the side of caution.

For a modest outlay, businesses will see long term benefits in terms of reduced energy bills and fewer boiler breakdowns. Research indicates

that modern high efficiency boilers work at higher temperatures than standard boilers, efficiency boilers, temperatures fluctuate more, waterways tend to be narrower and heat exchangers



Limescale build-up in pipework

thinner so that limescale build up has a more serious effect on performance sooner than would otherwise be the case.



Cut open cylinder with limescale



Heat exchanger failure due to limescale. (inset) shows layers of the heat exchanger

## The current problem

In most cases, the quality of the water supplied to industry is determined by local conditions. There is no practical method of external treatment at the waterworks, which reduce the potential for corrosion and scale within the home. To minimise the likelihood of corrosion, scale, sludge, acidic waste and microbiological contamination, and to help us maintain the energy efficiency of the heating system, the water must be treated with the use of various products.

## Hard water in England & Wales

Information from the British Drinking Water Inspectorate ([www.dwi.gov.uk](http://www.dwi.gov.uk)) shows that drinking water in England is generally considered to be 'very hard', with most areas of England, particularly east of a line between the Severn and Tees estuaries, exhibiting above 200 ppm for the calcium carbonate equivalent. Wales, Devon, Cornwall and parts of North-West England are softer water areas, and range from 0 to 200 ppm. In the brewing industry in England and Wales, water is often deliberately hardened with gypsum in the process of Burtonisation.

Generally water is mostly hard in urban areas of England where soft water sources are unavailable. A number of cities built water supply sources in the 18th century as the industrial revolution and urban population burgeoned. Manchester was a notable such city in North West England and its wealthy corporation built a number of reservoirs at Thirlmere and Haweswater in the Lake District to the north. There is no exposure to limestone or chalk in their headwaters and consequently the water quality in Manchester is rated as 'very soft'. Similarly, tap water in Birmingham is also soft as it is sourced from the Elan Valley Reservoirs in Wales.

## Examples of water hardness levels in UK cities

| Area          | Primary source(s)   | Level  |
|---------------|---|--------|
| Manchester    | Lake District (Haweswater and Thirlmere)<br>Pennines (Longendale Chain) | 25ppm  |
| Birmingham    | Elan Valley Reservoirs  | 42ppm  |
| Bristol       | Mendip Hills (Bristol Reservoirs)                                       | 228ppm |
| Southampton   | Bowl Water  | 268ppm |
| London (EC1A) | Lee Valley Reservoir Chain  | 275ppm |

## Water hardness classification

| Classification  | Hardness in ppm |
|-----------------|-----------------|
| Soft            | 0-60            |
| Moderately hard | 61-120          |
| Hard            | 121-180         |
| Very Hard       | ≥ 181           |

## Indices of water hardness

Several indices are used to describe the behaviour of calcium carbonate in water, oil, or gas mixtures.

## Indices of water hardness

The Langelier Saturation Index (sometimes Langelier Stability Index) is a calculated number used to predict the calcium carbonate stability of water. It indicates whether the water will precipitate, dissolve, or be in equilibrium with calcium carbonate. In 1936, Wilfred Langelier developed a method for predicting the pH at which water is saturated in calcium carbonate (called pHs). The LSI is expressed as the difference between the actual system pH and the saturation pH:

$$LSI = pH \text{ (measured)} - pH_s$$

- For LSI > 0, water is super saturated and tends to precipitate a scale layer of CaCO<sub>3</sub>.
- For LSI = 0, water is saturated (in equilibrium) with CaCO<sub>3</sub>. A scale layer of CaCO<sub>3</sub> is neither precipitated nor dissolved.
- For LSI < 0, water is under saturated and tends to dissolve solid CaCO<sub>3</sub>.

If the actual pH of the water is below the calculated saturation pH, the LSI is negative and the water has a very limited scaling potential. If the actual pH exceeds pHs, the LSI is positive, and being supersaturated with CaCO<sub>3</sub>, the water has a tendency to form scale. At increasing positive index values, the scaling potential increases.

In practice, water with an LSI between -0.5 and +0.5 will not display enhanced mineral dissolving or scale forming properties. Water with an LSI below -0.5 tends to exhibit noticeably increased dissolving abilities while water with an LSI above +0.5 tends to exhibit noticeably increased scale forming properties.

It is also worth noting that the LSI is temperature sensitive. The LSI becomes more positive as the water temperature increases. This has particular implications in situations where well water is used. The temperature of the water when it first exits the well is often significantly lower than the temperature inside the building served by the well or at the laboratory where the LSI measurement is made. This increase in temperature can cause scaling, especially in cases such as hot water heaters. Conversely, systems that reduce water temperature will have less scaling.

## Ryznar Stability Index (RSI)

The Ryznar stability index (RSI) uses a database of scale thickness measurements in municipal water systems to predict the effect of water chemistry. Ryznar saturation index (RSI) was developed from empirical observations of corrosion rates and film formation in steel mains. It is defined as:

$$RSI = 2 \text{ pHs} - \text{pH (measured)}$$

- For  $6,5 < RSI < 7$  water is considered to be approximately at saturation equilibrium with calcium carbonate
- For  $RSI > 8$  water is under saturated and, therefore, would tend to dissolve any existing solid  $\text{CaCO}_3$
- For  $RSI < 6,5$  water tends to be scale forming

## Puckorius Scaling Index (PSI)

The Puckorius Scaling Index (PSI) uses slightly different parameters to quantify the relationship between the saturation state of the water and the amount of limescale deposited.

## Other indices

Other indices include the Larson-Skold Index, the Stiff-Davis Index, and the Oddo-Tomson Index.

## Langelier Saturation Index Calculator - Example

Table 1: Input Table

|                     |     |          |
|---------------------|-----|----------|
| pH                  | 8.6 |          |
| Conductivity in TDS | 273 | mg/L     |
| [Ca <sup>2+</sup> ] | 49  | mg/L     |
| [HCO <sub>3</sub> ] | 121 | mg/L     |
| Water Temperature   | 20  | degree C |

Table 2: Results Langelier Saturation Index

|  |  |
|--|--|
| pH <sub>s</sub>                                  | 7.9  |
| LSI  | 0.68   |
| Indication based on Langelier (1936)             | Water is supersaturated with respect to calcium carbonate (CaCO <sub>3</sub> ) and scale forming may occur |
| Indication based on improved by Langelier (1965) | Scale forming but non corrosive  |

The indications for the LSI are based on the following values:

| LSI     | Indication   |
|---------|--|
| LSI < 0 | Water is unsaturated with respect to calcium carbonate. Undersaturated water has a tendency to remove existing calcium carbonate protective coatings in pipelines and equipment. |
| LSI + 0 | Water is considered to be neutral. Neither scale-forming nor scale removing  |
| LSI > 0 | Water is supersaturated with respect to calcium carbonate (CaCO <sub>3</sub> ) and scale forming may occur   |

| LSI (Carrier) | Indication                              |
|---------------|---|
| -2,0 < -0,5   | Serious corrosion                       |
| -0,5 < 0      | Slight corrosion but non-scale forming  |
| LSI = 0,0     | Balanced but pitting corrosion possible |
| 0,0 < 0,5     | Slight scale forming and corrosive      |
| 0,5 < 2       | Scale forming but non corrosive         |

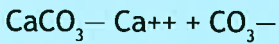
# The Science

## Efficient

The purpose of the Electromag is to prevent scale ( $\text{CaCO}_3$ ) adhering to heating elements and pipe work within a water system without changing the chemical composition of the water.

The Physics related to the Electromag shows how this relates to helping with the above problem.

There are various elements contained within water, including focus on the scale forming varieties, Calcium Carbonate ( $\text{CaCO}_3$ )

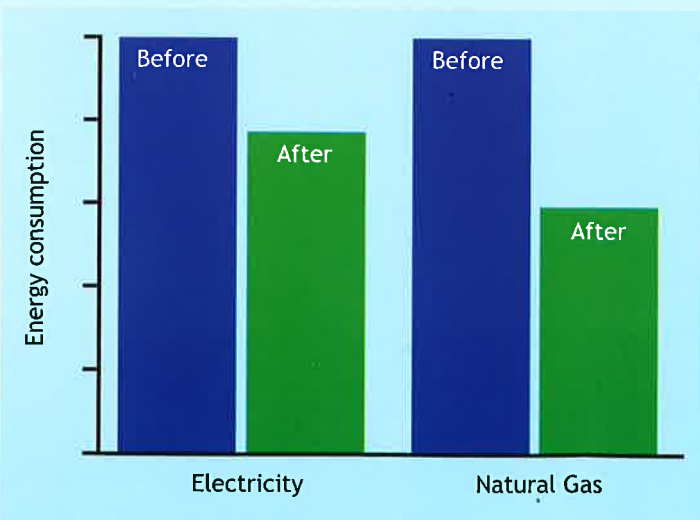


As per Coulombs Law Ca &  $\text{CO}_3$  are attracted to each other.

When water flows through the activation chamber of the Electromag a positive polarity is created over the entire body of water, which has many beneficial effects.

The  $\text{CaCO}_3$  ions will now repel each other due to their positive charge, preventing them from adhering to pipe work and heating elements.

Due to the electrostatic action, existing scale build up will be removed as it adheres to the positively charged ions passing through the water system, eventually leaving a system free of scale and working at peak efficiency.



## Energy savings after water treatment\*

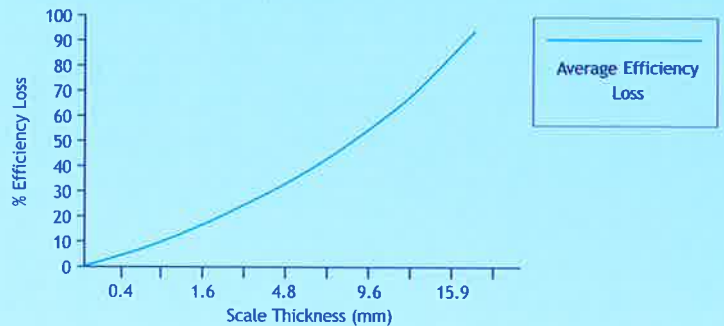
\* All data has been taken from various published figures

## The Scale of Economy

Every year Industry in Britain loses over £1 billion due to hard water.\*

Fig 3. Shows the efficiency lost, relative to scale accumulation.\*

### Average Efficiency Loss



With energy costs on the increase and predictions showing this trend will continue year on year, the Electromag offers an answer to costly efficiency loss due to hard water. Fig 4. Shows the energy lost, relative to scale accumulation.\*

|  | Scale Thickness (mm) |       |       |       |       |       |     |      |
|--|----------------------|-------|-------|-------|-------|-------|-----|------|
|  | 0.5                  | 1     | 2     | 4     | 6     | 8     | 10  | 12.7 |
| Decrease in Condensing Capacity          | 5%                   | 9%    | 17%   | 23%   | 29%   | 34%   | 50% | 56%  |
| Average Increase in Condensing Temp (°C) | 0.4                  | 0.8   | 1.6   | 3.2   | 4.8   | 6.4   | 8   | 10   |
| Increase in Energy Required              | 5.8%                 | 10.6% | 20.2% | 29.4% | 35.6% | 46.8% | 66% | 76%  |

## Applications

Electromag has been installed in a wide range of leisure, education, commerce and industry.

The list of users includes:

- MoD
- NHS
- Universities
- Gyms
- Dairies
- Care homes
- Manufacturing Plants
- Leisure Centres
- Shopping Centres
- Sports Stadia



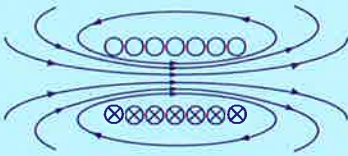
# The Science cont..

## Physics

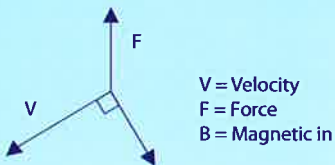
Physics related to Electromag:

Coulomb's Law, developed by physicist Charles Augustin de Coulomb in the 1780's may be stated in scalar form as follows:

*The magnitude of the electrostatic force between two point electric charges is directly proportional to the product of the magnitudes of each charge and inversely proportional to the square of the distance between charges. (Fig1).*



Right hand rule. In physics the right-hand rule is a common mnemonic for understanding notation conventions for vectors in 3 dimensions. It was invented by British physicist John Ambrose Fleming in the late 1800's for use in electromagnetism.



The magnetic field B (Fig.2) can be defined by: Lorentz Law,

$$\vec{F} = q\vec{v} \times \vec{B}$$

The implications of this expression include:

1. The force is perpendicular to both the velocity  $v$  of the charge  $q$  and the magnetic field  $B$ .
2. The magnitude of the force is  $F = qvB \sin\theta$  where  $\theta$  is the angle  $< 180$  degrees between the velocity and the magnetic field. This implies that the magnetic force on a stationary charge or a charge moving parallel to the magnetic field is zero. Right hand rule.
3. The direction of the force is given by the right hand rule. The force relationship above is in the form of a vector product.

## How Electromag Works

Hard water, which is 60-70% of the UK, has a drastic effect on the efficiency and lifespan of appliances. Limescale is a poor conductor of heat and any heat transfer surface, covered in scale will experience a reduction in efficiency.

The Electromag is an electromagnetic water conditioner, providing industry with a low cost solution to the build up of limescale. The unit is an innovative product which not only protects appliances from future limescale build-up, but will also remove existing limescale to further enhance heat transfer efficiency.

The Electromag is suitable for use in a variety of industrial and commercial applications where softened water is not viable.

Using the latest technology, the unit represents a breakthrough in electromagnetic water conditioning technology. The Electromag has a central shaft which is specifically designed to produce the maximum turbulence when water passes through the unit which in turn generates the maximum conditioning effect. Electromagnetic waves are formed by vibrations of electric and magnetic fields which are perpendicular to one another in the direction the wave is travelling - 90 degrees - this is how all electromagnetic waves work and is not specific to how our unit is manufactured, or any other unit that is manufactured - this is based on the actual science of electromagnetism.

A little further explanation is that the Electromag's ampere turns range from 2200AT to 25000AT by maintaining the current and increasing the number of turns of the coil, which determines the magnetic field across the unit and increases due to the relationship between the turns of the coil, amps and the specially designed central shaft, as each turn of the coil sets up its own magnetic field.

The magnetic field then unites with the fields of the other turns to produce a field around the entire coil making the total magnetic field stronger. This can only be achieved by this process and determines the overall size of the unit. The number of turns is calculated to ensure maximum performance in relation to each unit and it must also be noted that the strength of the magnetic field is not linearly



related to the ampere turns and therefore adding an infinite number of turns will have little effect at some point as the magnetic flux would become "saturated". The Electromag units have all been designed and calculated at the maximum level prior to any "saturation" effect.

We believe that through our experience a higher Gauss strength leads to a better performing product and is produced by using larger diameter copper wire and therefore the power consumption relates to the diameter of the wire and the number of windings. As part of our test procedure each unit is checked against the magnetic field strength to ensure the output generated is within our expectations prior to shipment and also each unit on its control panel shows the number of hours, amps, and voltage figures confirming performance.

The pressure drops have been calculated and these range from 0 bar on the E22 to a maximum of 0.04mbar on the E400 unit. These figures have been calculated at the designated flow rates, water at 20°C, a Reynolds number of 7050 and an absolute roughness of 0.0015mm on the inside of the pipe giving a pipe friction number of 0.03 and a resistance coefficient of 0.1.

Calmag have always found the time aspect as very ambiguous in relation to how long the effect actually lasts, due to the other variants that could be applied in each application. As our units work on a similar principle of magnetic flux and related to the Gauss strength of the magnetic field we have no issue in guaranteeing the effect of each Electromag.

The reason we do not publish any figures is that through our experience we have found it impossible to put an exact figure on how long the water will be conditioned for. What we have found over the years is that the conditioning effect can last up to 5 days due to the variations in applications, temperatures, flow rates, water quality, pressures, etc. We would always recommend that if a unit is to be installed then the most beneficial position is on the incoming mains feeding the appliances that they are designed to protect, or alternatively if they are installed on the feed to a storage tank then we would recommend a pump loop configuration to ensure that the water in the tank is constantly conditioned - in these circumstances providing that the water is

circulated through the unit then the water will be constantly conditioned.

Calmag also believe that there is no requirement for the unit to have a reverse polarity mechanism in regards to maintenance as whatever gathers at one end of the unit would end up gathering at the other end of the other unit when the polarity was reversed. The whole concept of the product is that the minerals (limescale) are held in suspension in the water when conditioned so they do not come out of solution and therefore cannot build up inside the unit. Limescale will not build up inside the unit as all units are installed on cold water lines and limescale is not produced until the water is heated.

The Electromag does not need maintenance as it is produced with a permanent fixed central shaft and does not have any moving parts which would result in wear and tear. The mechanical parts of the product carries a 10 year warranty.

## Benefits of the Electromag

- Removes existing build up.
- No maintenance.
- Low running costs.
- Easy installation.
- Protects heat exchangers, calorifiers and pipe work from scale build up.
- 10 year guarantee on mechanical parts.
- Suitable for all types of pipe work.
- No chemicals.
- Wide range of sizes available from 3/4" to 4".
- Reduces carbon emissions.
- BMS interface supplied as standard.

*\* All Electrical components are guaranteed for 12 months. Guarantees only applicable to units that have been commissioned by Calmag.*



# The Science cont..

## Specifying Electromag

### Water Conditioning

To inhibit limescale formation an electromagnetic water conditioner shall be installed and size should be recommended by the original manufacturer only.

The unit should be WRAS approved.

The unit shall have a 240v DC electrical coil for generating the electromagnetic field with a central dual purpose shaft allowing the magnetic field to interface with the water as it passes through the conditioning chamber.

The ampere turns should range from 2200AT to 25000AT.

The power supply or control box should either be connected directly into a 3-pin plug socket (E22-E42 inclusive), or alternatively should be connected to a 240v, single phase, 50Hz supply through a double pole fused switched spur with corresponding fuse size (E150-E400 inclusive).

The unit is to be a Calmag Electromag as detailed in the corresponding technical data.

## Warranty

The Electromag is covered by a 10 year warranty on mechanical parts and 12 months on any electrical parts\*. All warranties are only eligible on mainland UK.

In the unlikely event of a scale situation arises following installation of the unit, Calmag will undertake an investigation to recommend or carry out rectification work promptly.

All work to be carried out only on mainland UK.

Do not apply power to the unit for prolonged periods unless there is water in the system as this may damage the coil.

Warranties do not cover damage resulting by misuse, or incorrect installation.

\* Please note, the guarantees are only valid if Calmag have carried out the commissioning and service of the units.

## Benefits



- Prolongs the life of plant equipment - avoids premature equipment failure due to scale.
- Reduces maintenance costs and associated downtime - no regular replacement of parts affected by scale.
- Environmentally friendly - no chemicals used and helps eliminate areas of potential bacterial growth.
- Cost effective - return on investment usually achieved within 12-18 months.
- Energy efficient - power used is minimal and improves efficiency of the whole system.
- Avoids unscheduled maintenance - minimises inconvenient repair work and production time.
- Easy to install.
- Maintenance-free - no moving parts and contains a built-in system to stop unit from blocking with scale.
- Range offers units of varying capacities, with the largest handling 30 litres per second. Where greater capacities are required, additional units can be installed with no significant drop in pressure plus the units remain on-line continuously.
- 100% of the water receives conditioning at 90 degrees.



# WRAS

Water Regulations Advisory Scheme

This certifies that

CALMAG YORKSHIRE LTD.

has had the undermentioned product examined, tested and found, when correctly installed, to comply with the requirements of the United Kingdom Water Supply (Water Fittings) Regulations/Scottish Water Byelaws.

E22, E28, E35, E42, E150, E200, E250, E300 & E400 ELECTROMAG WATER CONDITIONERS

*This certificate by itself is not evidence of a valid WRAS Approval. Confirmation of the current status of an approval must be obtained from the WRAS Directory ([www.wras.co.uk/directory](http://www.wras.co.uk/directory)).*

The product so mentioned will be listed in the Water Fittings and Materials Directory for a period until:

31 JUNE 2017

1206056

Certificate No.

Chairman, Test and Assessment Group

Secretary

**WRAS**  
APPROVED  
PRODUCT

## WRc-NSF

### TEST CERTIFICATE

The

**Calmag Yorkshire Ltd**

**Electromag Range of Water Conditioners**

HAS SUCCESSFULLY COMPLETED MECHANICAL TESTING AGAINST THE REGULATORS' SPECIFICATION FOR WATER FITTINGS AND THEREFORE MEETS THE MECHANICAL REQUIREMENTS OF THE WATER SUPPLY (WATER FITTINGS) REGULATIONS 1999 IN ENGLAND AND WALES, THE WATER BYELAWS 2004 IN SCOTLAND AND THE WATER SUPPLY (WATER FITTINGS) REGULATIONS (NORTHERN IRELAND) 2009.

The following models are covered by this test certificate  
E22, E28, E35, E42, E150, E200, E250, E300 & E400

S G Warburton (Laboratory Director)

Date: 24<sup>th</sup> April 2012

Certificate number: 119334

WRc-NSF Ltd, 30 Fern Close, Pen-y-San Industrial Estate, Oswestry, Shropshire, CH21 3EH, UK  
Telephone: +44 (0) 1495 236 260 Website: [www.wrcnsf.com](http://www.wrcnsf.com)

This test certificate relates to the successful completion of testing of the range of products detailed above against the requirements of the Regulators' Specification for water fittings and does not constitute approval or endorsement of the above items by WRc-NSF or any of its associated organisations.



© WRc-NSF Ltd 2012

# Installation

## Installation Guidelines

The Electromag is suitable for installation on copper or steel pipework - please refer to the relevant pipe material specification sheets.

Ensure that the unit is adequately supported with suitable bracketing if required.

Installation should be undertaken by a competent professional.

To ensure periodic inspection under the Health and Safety guidelines we recommend that isolating valves be installed prior and after the unit and also a bypass valve and system to be in place to ensure that water can be accessed at all times. The installation of these valves is purely down to the discretion of the installer.

The range of Electromags do not introduce any sodium into the water which means that the water remains potable as the carbon steel shaft is coated and is safe to drink, neither does it require a separate drain. The unit is compact and can be installed in confined spaces.

When installing the unit on pipework which is situated close to a wall it may be necessary to install elbows and/or additional pipework to accommodate the diameter of the outer casing of the unit.

In situations where the water flow is minimal for extended periods, or when water is static within the unit the temperature of the water may increase.

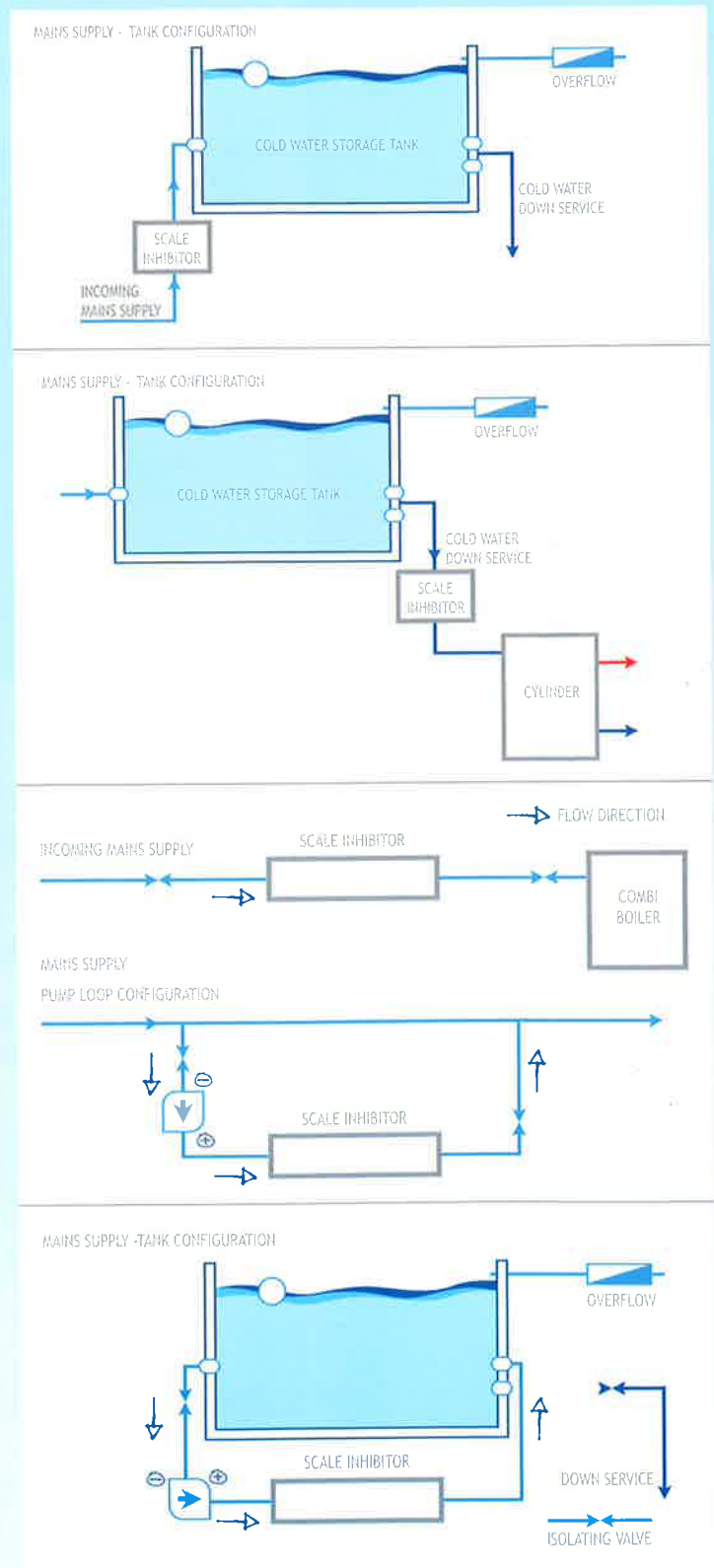
Please note that the Electromag internal pipework and shaft are coated with Copon Hycote EA5 WB which is a WRAS approved product and suitable for cold water use. BMS interface is supplied as standard for the E150 - E400 units.

### Quality:

All products are 100% tested prior to delivery. All units are robustly manufactured from quality materials to ensure maximum performance. All units are manufactured in the UK.

Please call for assistance and advice on 01535 210320.

## Typical installations:



# Case Studies

## SCALE CONTROL FOR NEW HEATING SYSTEM

### Customer

Capitol Group  
Sydenham Court Sheltered Housing  
Portsmouth, Hampshire

### Installation

2 x E300 Electromag Water Conditioners



### Application

95 bed sheltered housing complex

### Problem

Reduce scale build up with heating system and newly installed hot water chlorination units.

### Resolution

A competitor's 4" unit was included in the M&E design brief to be installed on 3" pipe work.

Capitol were instructed to offer a Value Engineering Package and after assessing the products available Calmag's 3" Electromag was chosen due to it suiting the design and it saved the client in excess of £10,000.



## LIMESCALE BUILD UP PREVENTION

### Customer

Eurolec Services  
Unite Student Accommodation Blocks  
North Lodge, London

### Installation

2 x E400 Electromag Water Conditioners



### Application

New build student accommodation blocks.

### Problem

Prevent limescale build up within the 800 plus student apartment units.

### Resolution

Via the BSS Industrial (London) Projects Team the plant room equipment was specified which included 2 x E400 Electromag's to provide the water conditioning.

The installation of E400 Electromag Water Conditioners produced project savings of £22,000.



# Case Studies

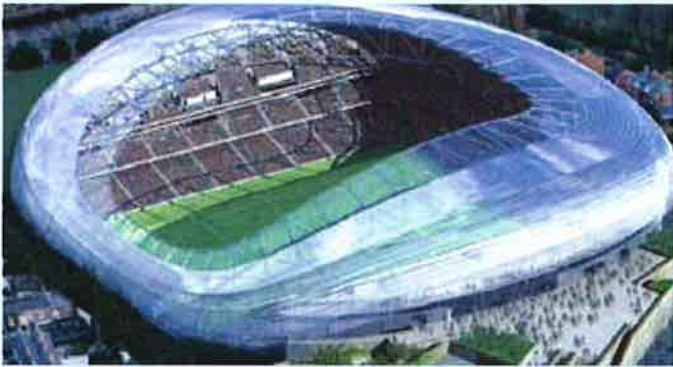
## LIMESCALE CONTROL IN NEW STADIUM

### Customer

Mercury Engineering & AH Cullen  
Aviva Stadium, Dublin,  
Ireland

### Installation

2 x E400 Electromag Water Conditioners



### Application

51,700 all seat sporting arena.

### Problem

AH Cullen was tasked with providing a full water treatment works for the stadium including the prevention of limescale build up within the stadium's mains water supply.

### Resolution

Calmag's Electromag was chosen to provide lime scale protection in order to fulfill the consultant's design brief.

Calmag's Electromag was chosen due to it suiting the design, whilst saving the client in excess of £18,000.



## ELECTROMAG AT POLICE STATION

### Customer

Balfour Beatty Building Services BBESL  
Harrogate Police Station  
Harrogate, North Yorkshire

### Installation

E200 Electromag Water Conditioners



### Application

D&B BREEM standard, state of the art 16 cell Police Station.

### Problem

To ensure BREEM rating within the heating systems a scale reduction unit was installed despite hard water not being an issue within the area.

### Resolution

Balfour Beatty specified a Calmag Electromag to ensure that lime scale build up doesn't form throughout the £11.7M development.

The installation of E200 Electromag Water Conditioners produced project savings of £2,500.



# Case Studies

## SCALE CONTROL IN RESIDENTIAL AREA

### Customer

DC Mechanical  
Private Residence  
Sydenham Hill, Dulwich, London

### Installation

E200 Electromag Water Conditioners



### Application

Conversion of 7 flats into one residential unit.

### Problem

Provide sustainable cost effective lime scale protection to the properties brand new heating and hot water system.

### Resolution

Calmag provided cost comparisons to show the effectiveness of scale inhibitors against chemical and softener solutions in a costing exercise which showed the Electromag as the most efficient solution.

Calmag's Electromag was chosen due to it suiting the design and without incurring maintenance and any future costs.



## FULL CALMAG COVER AT COLLEGE CAMPUS

### Customer

BSS Industrial Project Team, Southampton  
Marlborough College, Marlborough, Wiltshire

### Installation

E200 Electromag and CalUltra 270 Ultra Violet  
Disinfection Unit



### Application

Converted Hotel into new College Campus Block.

### Problem

Preventing lime scale and Legionella risk.

### Resolution

BSS Industrial specified Calmag's range of ElectroMag and CalUltra to provide water treatment within the re-vamped water and heating systems.

The installation of E200 Electromag Water Conditioners produced project savings of £2,500.



# Specification for copper pipe installations...

| Model                      | E22   | E28              | E35              | E42              |
|----------------------------|---|------------------|------------------|------------------|
| Maximum flow rate:         | 38 l/min                                    | 64l/min          | 100l/min         | 148l/min         |
| Connections:               | 22mm compression                            | 28mm compression | 35mm compression | 42mm compression |
| Maximum water temperature: | 90°C  | 90°C             | 90°C             | 90°C             |
| <b>Unit Dimensions</b>     |   |                  |                  |                  |
| Total length:              | 430mm                                       | 440mm            | 500mm            | 520mm            |
| Diameter of housing:       | 114mm                                       | 114mm            | 141mm            | 141mm            |
| Length of housing:         | 330mm                                       | 330mm            | 365mm            | 365mm            |
| Central shaft:             | Low carbon shaft with WRAS approved coating |                  |                  |                  |
| Frictional loss:           | ----- Minimal across the range -----        |                  |                  |                  |
| Maximum pressure:          | 20 Bar                                      | 20 Bar           | 20 Bar           | 20 Bar           |
| Power supply:              | 230v 50Hz                                   | 230v 50Hz        | 230v 50Hz        | 230v 50H z       |
| Power consumption:         | 50 Watts                                    | 50 Watts         | 50 Watts         | 50 Watts         |

Note: All units between E22 and E42 are manufactured to suit compression fittings

## Guideline Installation instructions - copper

MODEL - E22, E28, E35, E42

### INSTALLATION

- Units are best installed on the cold feed to a specified appliance. If the pipework contains a booster pump, the Electromag must be fitted downstream of this pump.
- Ensure that the correct sized unit corresponds to the pipework.
- The peak flow rates and nominal frictional losses are measured at 5 bar supply pressure.

- Maximum working pressure on all models is 20 bar.
- Temperature of 23°C (standard). Maximum temperature 90°C.
- All fittings, tubes and power supplies are to British Standard.

### OTHER INFORMATION

- All products are 100% tested.
- All units are robustly manufactured from quality materials to ensure maximum performance.
- A 230v 50Hz electrical supply is required.



# Specification for steel pipe installations...

| Model                            | E150  | E200                | E250                  | E300                 | E400                  |
|----------------------------------|---|---------------------|-----------------------|----------------------|-----------------------|
| Maximum flow rate:               | 2.47 l/sec (148 l/min)                      | 5 l/sec (300 l/min) | 6.7 l/sec (400 l/min) | 10 l/sec (600 l/min) | 30 l/sec (1800l /min) |
| Inlet/Outlet:                    | 1.5" BSP                                    | 2" BSP              | 2.5" BSP              | 3" BSP               | 4" BSP                |
| Maximum water temperature:       | 90°C  | 90°C                | 90°C                  | 90°C                 | 90°C                  |
| <b>Unit Dimensions</b>           |   |                     |                       |                      |                       |
| Total length:                    | 520mm                                       | 560mm               | 560mm                 | 630mm                | 640m m                |
| Diameter of housing:             | 165mm                                       | 270mm               | 270mm                 | 270mm                | 270mm                 |
| Length of housing:               | 365mm                                       | 440mm               | 440mm                 | 480mm                | 480m m                |
| Central shaft:                   | Low carbon shaft with WRAS approved coating |                     |                       |                      |                       |
| Frictional loss:                 | ----- Minimal across the range -----        |                     |                       |                      |                       |
| Maximum pressure:                | 20 Bar                                      | 20 Bar              | 20 Bar                | 20 Bar               | 20 Bar                |
| Power supply:                    | 230v 50Hz                                   | 230v 50Hz           | 230v 50Hz             | 230v 50Hz            | 230v 50H z            |
| Power consumption:               | 50 Watts                                    | 500 Watts           | 550 Watts             | 600 Watts            | 700 Wa tts            |
| Fuse rating:                     | 3 Amp                                       | 3 Amp               | 3 Amp                 | 10 Amp               | 10 Am p               |
| <b>Control box dimensions</b>    |   |                     |                       |                      |                       |
| Height:                          | 250mm                                       | 400mm               | 400mm                 | 400mm                | 400m m                |
| Width:                           | 200mm                                       | 300mm               | 300mm                 | 300mm                | 300mm                 |
| Depth:                           | 150mm                                       | 160mm               | 160mm                 | 160mm                | 160m m                |
| <b>Mounting frame dimensions</b> |   |                     |                       |                      |                       |
| Height:                          |   | 400mm               | 400mm                 | 400mm                | 400m m                |
| Width:                           | N/A   | 530mm               | 530mm                 | 570mm                | 570m m                |
| Depth:                           |   | 400mm               | 400mm                 | 400mm                | 400m m                |

Mounting frame is a steel based painted tube and to be used for permanent fixing to a solid floor or wall.

Note: Flanged units available on request. Please call for details and lead times.

Steel units are able to be adapted for copper pipe installations with additional fittings. Please call for details.

All units between E150 and E400 are manufactured to suit BSP fittings.

All units between E150 and E400 are supplied with a BMS interface as standard.

# Guideline installation instructions...

## Installation instructions - steel

MODEL - E150, E200, E250, E300, E400

### INSTALLATION

- Units are best installed on the cold feed to a specified appliance. If the pipework contains a booster pump, the Electromag must be fitted downstream of this pump.
- Ensure that the correct sized unit corresponds to the pipework. This will ensure that the electromagnetism field is contained within the unit for maximum efficiency.
- The peak flow rates and nominal frictional losses are measured at 5 bar supply pressure.
- Maximum working pressure on all models is 20 bar.
- Temperature of 23°C (standard).  
Maximum temperature of 90°C.
- All fittings, tubes and power supplies are to British Standard.

### ELECTRICAL

- We recommend that the Electromag is connected to the following sized spur:-  
E150 - 1 x double pole fused switched spur 5 amp.  
E200, E250, E300 and E400 - 1 x double pole fused switched spur 10 amp.
- The Electromag control panel needs to be connected to a 5 amp or 10 amp fused, 230v 50Hz supply. 5 amp for the E150. 10 amp for the E200, E250, E300 and E400. The spur must incorporate a switch to enable maintenance or repair of the equipment.
- The cable must be connected to a supply having a means of disconnection which must incorporate a gap of at least 3mm.
- A means of isolating the Electromag (double pole fused switch) must be accessible to the user.
- The Electromag must be connected to the mains supply via the control panel.
- The lead from the control panel to the Electromag body must not be coiled. Due to the current running through the coil this may lead to failure due to the heat transfer that may occur.
- The E150 to E400 units are supplied with a BMS interface as standard.

### MAIN UNIT

The main unit should be mounted to the wall or floor depending on the installation. If fixed to the floor use the correct sized coach bolts (not provided).

**DO NOT MOUNT ON A FALSE WALL DUE TO THE OVERALL WEIGHT.**

**DO NOT CONNECT THE ELECTROMAG BODY DIRECTLY TO THE MAINS.**

### CONTROL PANEL

Mount to a wall using 10mm or similar sized bolts (not provided).

### OTHER INFORMATION

- All products have been tested for performance prior to despatch and is the reason when on start up you will find that the "Hours Run" setting on the control panel is not at zero.

The ends of the Electromag may also have hemp within the threads which is again due to our testing procedures.

- All products are 100% tested.
- All units are robustly manufactured from quality materials to ensure maximum performance.
- A 230v 50Hz electrical supply is required to the unit - see above for fuse ratings.
- A control circuit and transformer provide the DC current for the coil.

Electromag is available in different sizes for steel ranging from 1.5" to 4" depending upon the size of pipework and the type of appliance being protected.

Flanged units available as special orders on request.

Units are designed to be installed with corresponding BSP sockets.

Flanges are not normally required as the product does not need to be removed for maintenance purposes.

# CalScale



At Calmag we advise best possible practice and when an Electromag is installed on the incoming mains supply we would also recommend a CalScale to be fitted on the return feed if applicable. This gives absolute protection for the whole system.

## How CalScale Works

Plugged in to the main electrical supply, CalScale draws power to the main control unit where it generates, via the signal cable wound around the water pipe, a modulated pulsed current that forms an electrical field through which the hard water has to pass. Due to the variations in water flow, temperature and the amount of calcium dissolved, the electronics thus produces a complex oscillating field that will cover all the necessary descaling conditions.

CalScale will not only prevent further limescale build up, but will also reduce, and finally clear all existing hard water limescale build up already present in the system or in plumbed-in appliances.

The unit is supplied as an IP65 rated plastic unit with a clear hinged door. The quality electronic components have been selected to withstand the harsh conditions experienced close to damp, cold water pipes.

## Specification

Height: 165mm    Rating: 6 VA  
Width: 190mm    Voltage: 220V/240V 50Hz  
Depth: 140mm    Max flow rate: 420 litres per minute  
Case Sealing: IP65 rating  
Pipe size: up to 100mm Ø

## CalScale Installation guidelines

### Operation.

Once the unit has been sited, connect the signal cable to the unit if necessary. Remove the bottom panel via the two screws and connect each end of the coil to the connecting block. Please note, polarity is not important.

Re-secure the panel.

Mains power is supplied to the unit via the 3 pin lead whilst the mains cable is already fitted with the correct plug and is protected with the correct mains fuse. The supply voltage will be between 220v and 240v.

Once power is applied the following will confirm correct operation:-

- The relevant mains voltage lamp will illuminate GREEN.
- The Signal light will illuminate RED and remain illuminated and constant whilst the unit is operating correctly.



# CalScale Cont...

Please note that the CalScale should be used on free flowing water and do not switch off. The CalScale unit does not remove calcium from the water.

## Power adjustment control.

Adjustment of the CalScale power output may be achieved by means of rotating the switch located on the front of the unit. There are 3 settings available - Low, Medium, and High.

Where it is desirable that descaling of a system should be carried out in a measured controlled manner then the unit should be set to High initially, and following the achieved results a lower power setting can be used for continuous protection.

## Mains power indicator light.

A GREEN light is illuminated on the front of the CalScale unit whilst 220/240v AC power is connected.

## Signal cable.

All CalScale units are supplied with heat resistant, single core multi-stranded cable with a diameter of 6mm and suitable at temperatures upto 180°C.

## Signal cable installation.

For best results please follow instructions:-  
Installing the cable clear of possible sources of electromagnetic influence. Winding 10-12 turns of the signal cable around the pipe to be treated.  
Keep the coil windings tight with close turns held securely with the supplied self-locking cable ties.  
Keep coil windings away from any obstructions.  
Install the CalScale unit close to the coil - between 15cm and 2m.

Cut the cable to length removing excessive cable. Install the coil on a pump discharge as opposed to a pump inlet.

## Testing alarm system.

The alarm consists of both audible and visual indicators and will operate under the following conditions:-

Signal lead broken.  
Signal lead disconnected.  
Signal generation failure due to internal power supply failure as an example.

To test, disconnect one of the signal leads and the audible alarm will sound together with the red light flashing on the front of the unit.

## Other scale control units available from Calmag include...

### ELECTRONIC RANGE



Light commercial and domestic applications. Electronic non-intrusive device for pipework of 15mm to 42mm. Can be used on any pipe material.



As above but for larger pipe sizes up to 180mm in diameter and a flow rate of 420l/min. Can be used on any pipe material.

### MAGNETIC RANGE



Magnetic in-line devices to prolong the life of heating appliances. Lifetime guarantee on the product manufacture. Pipe sizes range from 15mm to 54mm for copper installations.

### ELECTROLYTIC RANGE



Electrolytic in-line devices to prolong the life of heating appliances. 5 year guarantee on the product manufacture. Pipe sizes range from 15mm to 28mm for copper installations.

### POLYPHOSPHATE RANGE



Polyphosphate dosing to prevent scale and corrosion build-up. Maintenance required on a regular basis. Pipe sizes range from 15mm upwards and also include stainless steel housings.

**Please call Calmag for further details on 01535 210320**

# Other Commercial Products Include...

## Water Softeners

Water softeners work by a process of ion exchange. The incoming water passes through a high quality resin vessel. The resin traps the calcium ions, or limescale, from the solution and exchanges them for ions of sodium. When the resin becomes exhausted, it is put through a regeneration cycle that draws in a brine solution. During this cycle calcium ions are released from the resin and exchanged with sodium ions. Unwanted ions are flushed to drain. Regeneration takes between 60 and 180 minutes depending on the softener size.

### Typical users

- Hospitals
- Hotels
- Restaurants
- Nursing Homes
- Car Washes
- Commercial Kitchens
- Laundrettes
- Food Processing Plants

### Areas Used

- Dish & glass washers
- Combination Ovens
- Baking ovens with steam injectors
- Washing machines
  - Autoclaves
  - Sluices
- Steam boilers
- Humidifiers
- Cooling towers



# Other Commercial Products Include...

## Reverse Osmosis & Water Filters

There are a number of water problems that are common within industry that can be dealt with effectively using filtration. In some cases the purest form of water is needed, for example in a laboratory. In these areas the most refined form of filtration is needed, this is Reverse Osmosis.

Calmag supplies a range of filters and Reverse Osmosis plants to meet the needs of the industry, including specialist industry sectors.

### Typical Users

- Hotels, Bars and Pubs
- Restaurant, Canteens
- Laboratories
- Hospitals
- Offices
- Food Processors
- Pharmaceutical Industry
- Commercial Bottling Plants

### Area Used

- Private water supplies
- Prior to UV disinfection
- Incoming mains - whole building application
- Film Processing
- Industrial Processing
- Laboratories
- Brewing Industry
- Soft drinks industry
- Drinking fountains
- Vending Machines
- Water reclamation
- Pure water requirements
- Dietary conditions



# Other Commercial Products Include...

## Ultra Violet Disinfection

### Benefits

- Kills micro organisms
- Economical with low power consumption
- Low maintenance
- No taste or odour emitted
- Robust stainless steel construction
- Highly efficient low pressure UV lamps
- Easily fitted and maintained
- Environmentally friendly

### Typical Users

- Legionella control on cold feed to low temperature, hot water systems, feeding showers etc.
- Laboratories
- Pharmaceuticals
- Food processing
- Irrigation
- Hydroponics
- Market Gardening
- Fish ponds and farming
- Water bottling
- Drinks Manufacturing

### Area Used

Private water supplies, springs, wells, rivers and lakes serving:

- Dairies and farms
- Guest houses
- Camp and caravan sites
- Hotels and golf clubs
- Youth hostels
- Country houses
- Rainwater collection systems.



# Domestic and Commercial Products

Calmag (Yorkshire) Ltd offers a range of other commercial products ranging from water coolers, ph correction units, nitrate removal units and a whole range of domestic products. We can supply bespoke solutions for almost any commercial applications: Please do not hesitate to call us for your specific product requirements.



**Calmag (Yorkshire) Ltd**

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Calmag has a policy of continuous product development and reserves the right to alter any specifications without prior notice.

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