



No chemicals.
Simply chemistry.



Introduction to eleXion

eleXion water treatment have a strong belief that effective hydronic corrosion protection should not cost earth, not just in terms of finances but also when considering our greatest asset.... [the environment](#).

With the drive towards carbon reduction and our impact on the environment, we are not only helping clients protect their assets, ensuring efficiencies remain high while keeping operating and maintenance costs low, we are also doing this in a sustainable way by minimising our impact on the environment.

Chemical additives have long been at the forefront of UK guidance and the HVAC industry in an ongoing struggle to prevent corrosion within our heating/cooling systems.

Our guidelines look at how metals react when they come into contact with water, salts/minerals and oxygen. We don't look to "inhibit" or suppress the issues, instead we deal with the root cause of the corrosion, doing so strictly without the use of chemical additives.

Our experience along with our German partners, [Daniel Schneider from elector](#) and [Helmut Kausch from FTK Filter Technik Kausch](#), allow us to offer our clients proven methods and products from two of Germany's leading experts in the field of chemical free water treatment.

A combined experience exceeding **50 years** in the prevention of corrosion, [eleXion](#) alongside our partners are now setting the standard in the UK for closed loop water treatment.

Not only are we [sustainable and environmentally friendly](#), we are also able to offer superior protection over traditional methods strictly without the use of chemicals thanks to constant corrosion control and passivation of metals.

Proven, tried & tested chemical free water treatment.

As leading experts in the field of chemical free water treatment, eleXion were recently invited to contribute on a technical basis towards the revised [BSRIA BG50](#) documentation. With our contribution, electrochemistry has now been included and recognised by BSRIA alongside the use of demineralised water as an accepted alternative to a more traditional less environmentally friendly chemical-based regime.

This guide covers troubled older systems as well as new systems and is in accordance with Europe's most stringent guides and our experience in closed loop water treatment.

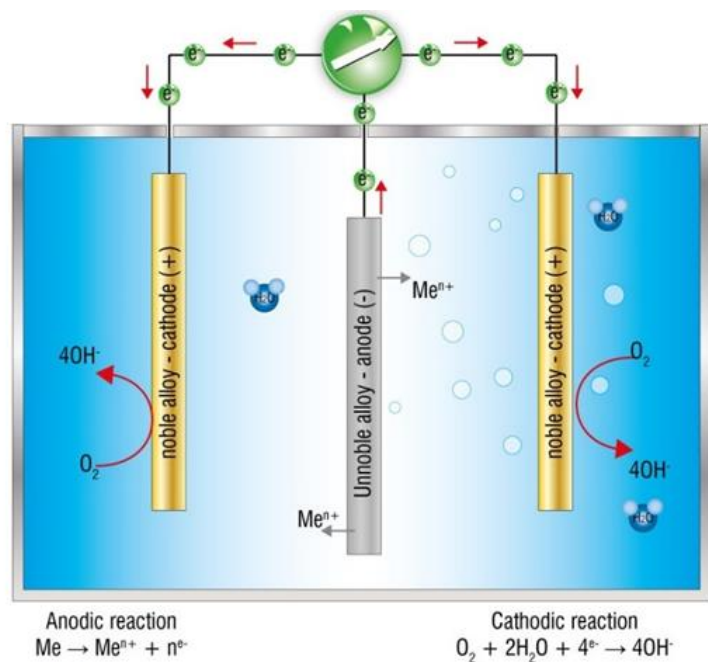
Referenced Guidelines:

[German VDI 2035.](#)

[Swiss SWKI BT 102-01.](#)

[Austrian ÖNORM H5195-1.](#)

[BSRIA BG50.](#)

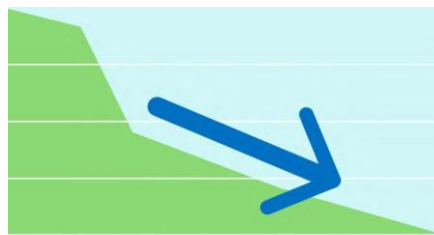


NO chemical cocktails and NO complicated formulas, eleXion simply use 100 % natural trusted chemistry to provide ongoing corrosion protection.

Sustainable & environmentally friendly system solutions, which offer constant and reliable protection, which doesn't cost the earth!

AS EASY AS...

1



Dissolved oxygen O_2 mg/l

2



pH value

3



Electrical conductivity $\mu S/cm$

Easy as 123 or ABC

Three simple key elements which help to protect system components and maintain high levels of efficiency.

Sustainable, simple and effective corrosion protection that doesn't cost the earth.

Chemical free guidance

Water from the mains supply often contains undesirable minerals, salts, bacteria and low pH which are not suitable for filling modern heating/cooling systems.

Hard water areas can severely impact the performance and life expectancy of a modern system with 1mm of scale decreasing efficiency by up to 10%.

VDI 2035 (table below and right) **Swiss SWKI BT 102-01** and **Austrian Ö NORM H5195-1**, all state that the sum of total hardness does not exceed certain levels with a view to preventing the effects caused by limescale within the system.

Total Heating output in kW	Total hardness in °dH		
	Specific system volume in l/kW (Based on smallest individual heating output)		
	≤ 20	>20 – 40 ≤	40 <
≤50 kW specific water content generator ≥ 0.3 l/kW	None	≤ 16.8	≤ 0.3
≤50 kW specific water content generator > 0.3 l/kW and systems with electrical heating elements	≤16.8	≤ 8.4	
>50 – 200 ≤ kW	≤ 11.2	≤ 5.6	
>200 – 600 ≤ kW	≤ 8.4	≤ 0.3	
>600kW	≤ 0.3		

Minerals and salts in the fill water give the water its electrical conductivity. Each mineral carries a small charge, either negative or positive and this is what gives water what is known as “electrical conductivity”. It has long been accepted that water with a high electrical conductivity provides an accelerated path for corrosion to take place as well as the potential for scale to form which will impact the efficiency and reliability of the system and its components.

Using a method known as the demineralisation via ion exchange, we can combat the effects of water high in conductivity, minerals and salts providing a better class of conditioned water for our systems which removes the possibility of scale and corrosion from taking place.

Xi+ is our in-house special mix ion exchange resin designed to condition the fill water and existing circulating water to the parameters set in this guideline and in accordance with VDI 2035.

Our resin not only removes salts and minerals from the fill/circulating water, the special blend of anion and cation resin provides a significantly better exchange capacity towards acids and aggressive salts over standard resins available. As these acids are removed along with carbon dioxide, the pH of the fill water already starts to increase which provides the ideal environment for passive layers to form on the metals surface.

Xi+ achieves the basic requirements of VDI 2035 at point of fill.

VDI 2035 LOW SALINE	System water	Unit
Total hardness	Dependant on system size	mg/l
Conductivity	≥10 - ≤ 100	µS/cm
pH	8.2 – 10	pH

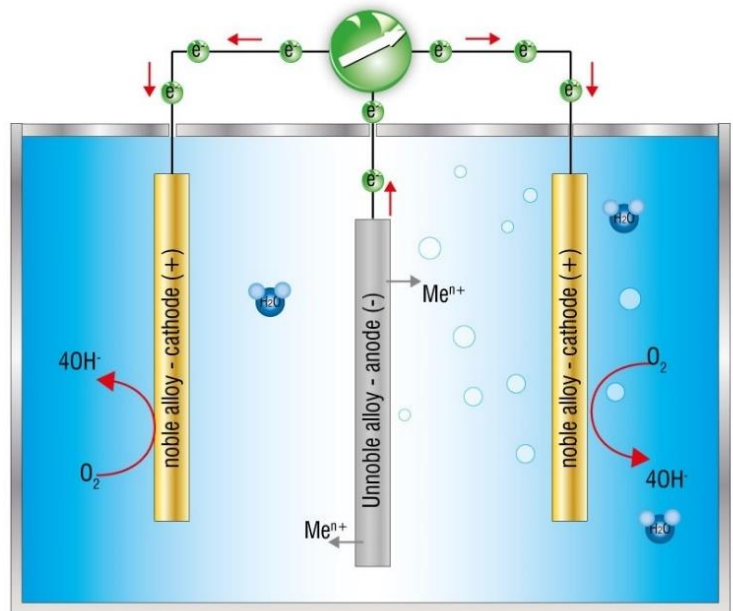
Along with the electrical conductivity of the circulating water VDI 2035 stipulates that dissolved oxygen should be removed from the system as well as controlling the pH to certain levels to aid in natural passivation of the system metals.

pH control can be achieved at the same time as removing dissolved oxygen from the system when utilising electrochemistry.

Electrochemistry can also be referred to as constant corrosion control as it constantly removes dissolved oxygen from the circulation water. It is well known and accepted that oxygen is the driving force for corrosion and it enters the system during initial filling, top ups and also enters through system materials such as gaskets, hoses, crimp fittings etc.

Regulation of the pH value, consumption of oxygen/carbon dioxide, separation of circulating particles and air bubbles can all be achieved when utilising electrochemistry.

Electrochemistry is recognised by **VDI 2035** and **BSRIA BG50** as suitable corrosion protection without the need for chemical additives, it is also actively recommended by Swiss **SWKI BT 102-01**.



Anodic reaction
 $Me \rightarrow Me^{n+} + n e^-$

Cathodic reaction
 $O_2 + 2H_2O + 4e^- \rightarrow 4OH^-$



Electrochemistry provides a 100% natural & sustainable method of system protection strictly without the use of chemicals



Furthermore, no electrical power supplies are required, no complexed system components or servicing routines are required when implementing electrochemistry.





Existing systems looking to convert on a gradual bases over to a chemical free standard, which are not suffering from constant or severe issues due to corrosion or bacteria.

Installation

Install elector and Refill devices to the system.

Elector tank will aid in helping to assist the clean-up of the system by collecting floating debris in the base of the tank, the mild alkaline environment created in the reaction tank can pick up oils, small particles, films and also kill bacteria as it passes into the chamber.

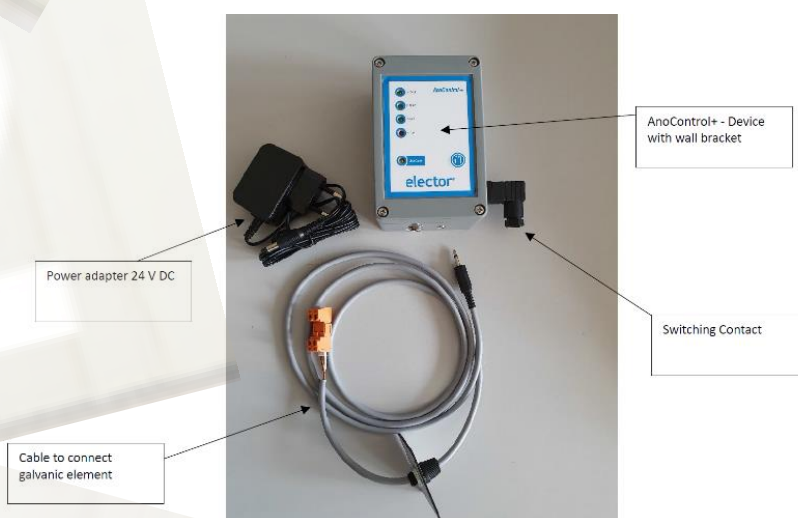
The elector tank will condition the overall system water by removing dissolved oxygen and regulating the pH to ideal ranges.

Refill devices will be installed to the outlet of the pressurisation unit and/or manual quick fill point on the system. When top up water is required it will pass through Xi+ ion exchange resin before entering the system, putting the water in a non-corrosive state and increasing the pH by removing minerals, salts and carbon dioxide.

Clean

As part of the gradual rejuvenation phase the elector tank will require regular maintenance, potentially up to the first year of operation. The client may also need to clean system strainers as part of their planned works, this is purely driven by the condition of the system water before works commence.

The elector tank will need to be drained to remove debris and allow the system to then be topped up with demineralised water. This process not only removes the debris but also works towards removing inactive chemical additives from the system and reducing the electrical conductivity of the system water. On a monthly basis the condition of the system water should show considerable improvements with water samples backing up visible improvements.



The anode can be cleaned manually by simply removing from the device and cleaning with a wire brush or alternatively AnodoControl+ can be installed which will automatically clean the anode on a weekly basis.

Protect

Once the system water conditions have improved, the levels of corrosion reduced and the reliability of the system back to an acceptable standard, the system can then be put back into a normal service routine. The anodes should be removed once/twice a year and the reaction chamber drained when doing so.

The anodes and resin should be replaced when required to maintain VDI 2035 limits and ensure the system water remains in the ideal non-corrosive conditions.

Existing systems looking for rapid results as a result of suffering from constant or severe issues due to corrosion or bacteria.

Installation

Install elector and Refill devices to the system.

Elector tank will aid in helping to assist the clean-up of the system by collecting floating debris in the base of the tank, the mild alkaline environment created in the reaction tank can pick up oils, small particles, films and also kill bacteria as it passes into the chamber.

The elector tank will condition the overall system water by removing dissolved oxygen and regulating the pH to ideal ranges.

Refill devices will be installed to the outlet of the pressurisation unit and/or manual quick fill point on the system. When top up water is required it will pass through $Xi+$ ion exchange resin before entering the system, putting the water in a non-corrosive state and increasing the pH by removing minerals, salts and carbon dioxide.

Clean

Dependant on system design, materials used, chemicals used and condition of the system water it may be preferable to dilute the system water with fresh mains water. Lowering the chemical concentration will reduce resin required to condition the circulation water, the impact of chemical additives can pollute the resin meaning the life expectancy is reduced and that the volume required to reach the required limits would be increased. Dilution can be undertaken by a simple dynamic flush to reduce the concentration.

The system water is now ready to be conditioned by inline treatment where the existing system water passes through our Envirofill mobile filling station on a side stream basis where it connects to the flushing bypass supplied with the electro tank.

The Envirofill filling station can be connected in series with mobile FTK filters or on larger systems multiple FTK filters can be temporarily installed on other parts of the system to help aid the initial clean-up of floating debris and films.

Once the system water has been conditioned to $<100 \mu S/cm$ the Envirofill unit can be removed.

FTK filters should remain on the system until circulation particles have been removed and that a water sample shows the correct required levels.

Protect

Once the system water conditions have improved, the levels of corrosion reduced and the reliability of the system back to an acceptable standard, the system can then be put back into a normal service routine. The anodes should be removed once/twice a year and the reaction chamber drained when doing so.

The anodes and resin should be replaced when required to maintain VDI 2035 limits and ensure the system water remains in the ideal non-corrosive conditions.



New systems which have been filled for the first time and ready for pre-commissioning cleaning in line with CPC processes stated in BSRIA BG29 and adapted to comply with chemical free guidance.

Installation

Install elector and Refill devices to the system.

Elector tank will aid in helping to assist the clean-up of the system by collecting floating debris in the base of the tank, the mild alkaline environment created in the reaction tank can pick up oils, small particles, films and also kill bacteria as it passes into the chamber.

The elector tank will condition the overall system water by removing dissolved oxygen and regulating the pH to ideal ranges.

Refill devices will be installed to the outlet of the pressurisation unit and/or manual quick fill point on the system. When top up water is required it will pass through Xi+ ion exchange resin before entering the system, putting the water in a non-corrosive state and increasing the pH by removing minerals, salts and carbon dioxide.

Clean

On completion of the installation of a new HVAC system the system should be filled with pre-treated conditioned water from a mobile Envirofill filling station. System components such as fan coil units should be put into bypass. The system water will enter the system with the minerals and salts extracted to the desired levels stated in VDI 2035 low saline operation. The water will also be conditioned to ensure it is free from bacteria.

FTK mobile filters should then be attached to temporary parts of the system on a side stream basis. Multiple filters can be added either in parallel or separate parts of the system to aid in filtering the debris/films.

Once the system has been filled, vented and pressure tested the system should then operate under velocities stated in BSRIA BG29, this can be achieved by using existing system pumps or temporary pumps provided to ensure velocities are met.

FTK filter will then operate to remove installation debris, initial corrosion particle and films. The internal differential switch will deactivate the pump and raise an alarm when the filters become blocked. Filter cartridges should start at 30µm, filtering down to 0.5µm.

Once the system reaches the desired levels components such as FCUs can be brought online ready for flushing.

Protect

During the initial CPC procedure, the elector tank should be allowed to operate which will help to remove circulating debris as well as remove dissolved oxygen and regulate the pH to the desired levels. The elector tank and Refill devices now fall under the routine maintenance of the plantroom equipment. The anodes should be removed once/twice a year and the reaction chamber drained when doing so.

The anodes and resin should be replaced when required to maintain VDI 2035 limits and ensure the system water remains in the ideal non-corrosive conditions.

eleXion recommended target parameter.

Based on our experience, we would recommend the below targets for the system parameters.

eleXion target requirements	System water	Unit
Total hardness	Dependant on system size	mg/l
Conductivity	>10 - <200*	µS/cm
O ₂	<0.1	mg/l
pH	8.2 – 10	pH
Chloride	<30	mg/l
Sulphates	<50	mg/l
Nitrates	<50	mg/l
Total iron	<1	mg/l
Dissolved iron	<0.5	mg/l
Total copper	<0.5	mg/l
Total Aluminium	<1	mg/l
SRB	0	cfu/ml
NRB	0	cfu/ml
Pseudomonads	0	cfu/ml
TVC	< 10,000 cru/ml at 30 °C and no increasing trend	cfu/ml

* VDI 2035 low saline operation recommends electrical conductivity of less than 100 µS/cm.

When using an elector reaction chamber, it is acceptable to be less than 200 µS/cm and still be protected.

UK sites now benefiting from chemical free water treatment

Elexion have worked on a variety of projects which include universities, schools, hotels, offices, Biomass farms & communal heating systems providing corrosion protection for both heating & chilled systems



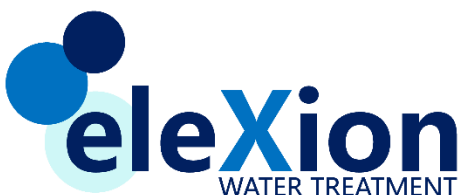


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Protecting our world, your asset and their future.