CLOSED SYSTEM OVERVIEW

EXECUTIVE SUMMARY

- Many factors can influence the efficacy of a closed system such as water quality, corrosion, scale and microbial content.
- Failures in design, installation, commissioning and maintenance can all result in system problems but adherence to good practice, in particular BSRIA guides BG29 and BG50 and BS7074
- Primary Water Solutions has a range of chemical products suitable for different system components. Our chemical inhibitors, combined if necessary with filtration provide excellent protection to closed systems.
- Regular monitoring with both field test and/or laboratory tests can help eliminate problems before they become a major problem and impact production and help reduce costly repair bills.

Closed systems are typically low pressure hot water (LPHW or LTHW) and chilled or condenser water systems.

The problems associated with closed systems are Scale, Corrosion and Microbiological fouling. Primary Water Solutions has specialist knowledge in these areas and can provide complete treatment programmes so that closed systems can operate trouble free.

There are many factors which can influence whether corrosion of a particular material will take place and the rate of corrosion if it does occur. These are:

- Aeration – dissolved O2 in water
- Water composition – hardness, chlorides, sulphates, pH, conductivity
- Temperature
- Flow
- Deposits/flux residues
- Bimetallic couples – esp. Cu/Al
- Water treatment – corrosion inhibitors
- Component design / manufacture leading to creation of crevices

These problems can lead to flow issues, corrosion, leaks, component malfunction, process contamination which can lead to expensive repairs or loss of production.

TREATMENT & ANALYSIS

The treatment of closed heating and cooling systems is often a combination of chemical and physical means. Primary Water Solutions has a range of chemical products suitable for different system components. Our chemical inhibitors combined if necessary with filtration provide excellent protection to closed systems.

Analysis

We can undertake on site analysis for instant results or more in depth System Audits provided by our UKAS accredited laboratory.

Remedial Works

Issues can often occur through inappropriate treatment or incorrect pre-commission cleaning Primary Water Solutions can provide a resolution to problems related to Closed Systems

Chemical Cleaning and Flushing

The type of cleaning depends on the severity of the problem and other constraints such as an occupied building or the need to keep a system operational. Often chemical cleaning agents and flushing is used in conjunction with temporary filtration to achieve the bet results.

Pseudomonas Removal

Analysis and eradication of pseudomonas in closed systems is an area where Primary Water Solutions can assist and help bring a closed system back into ideal working parameters.

Filtration

We offer a range of cyclone and media filters or a combination of magnetic filtration and in line filters to control and remove suspended solids from closed systems.

Descaling

Scale can cause significant problems for equipment such as condensers, plate heat exchangers and calorifiers. Primary Water Solutions can provide a descaling service to restore plant to a safe condition and maximise operational efficiency.

Summary

The main influencing factor for corrosion in these systems is dissolved oxygen but water composition, temperature, flow, the presence of deposits and bi-metallic couples also play a role. Microbial Influenced corrosion is a particular problem under deposits or at moderate temperatures. Failures in design, installation, commissioning and maintenance can all result in system problems but adherence to good practice, in particular BSRIA guides BG29 and BG50 and BS7074, should significantly reduce the likelihood of failures. Continual monitoring of corrosion and key system components if used would mean that quick intervention to correct any faults in the system could be made before any corrosion damage occurs.

TABLE 1
DIFFERENT ALLOYS AND NON-METALLIC MATERIALS & THEIR CORROSION RESISTANCE

Material	Where used	Corrosive Resistance	Other Issues
Aluminium	**Some boiler heat exchangers and radiators**	**Good overall corrosion resistance in oxygenated waters of neutral or slightly alkaline pH. Should not be exposed to pH > 8.5**	**Exposure to high pH causes rapid loss of metal and formation of aluminium hydroxide sludge.**
Copper & Copper Alloys	Copper tube, brass valves and fittings	Good overall corrosion resistance of neutral or moderately alkaline pH. In aerated water copper is subject to erosion corrosion, flux residues and under deposit corrosion.	Copper ions entering the water can result in pitting corrosion of steel. Brass can be subject to stress corrosion cracking due to external contamination.
Mild Steel & Cast Iron	**Steel pipe, boiler heat exchangers, circulating pumps**	**Low levels of dissolved oxygen result in uniform corrosion and the production of magnetite sludge.** **High levels of DO result in pitting attack under tubercles**	**Formation of insoluble iron oxides as suspended solids increases wear in pumps and the risk of under-deposit corrosion in low flow areas where sedimentation occurs.**
Galvanised Steel	Some piping systems	Internally galvanised pipes and fittings should not be used in heating systems	Formation of zinc hydroxide as suspended solids
Stainless Steel (SS)	**Plate heat exchangers, pump casings, minor parts. Occasionally pipework**	**Very good resistance to general corrosion but may be susceptible to pitting, crevice corrosion and stress corrosion cracking at high chloride concentrations.**	**None**
Plastic	Plastic pipe including underfloor heating, Minor parts	Resistant to corrosion but may be subject to physical degradation e.g. by sunlight	Oxygen permeation through plastic pipe. Pressure resistance decreases with temperature
Rubber	**Flexible hose liners (EPDM), O-rings and seals.**	**Resistance to corrosion but may be subject to gradual chemical and physical degradation leading to loss of flexibility and cracking.**	**Amenable to the formation of biofilm.**