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Water Testing

Industrial Water Monitoring

Dedicated Analytical Accuracy

Monitoring of water quality in industrial process is essential, and it has been proven that testing industrial waters on a regular basis can mitigate risks and system issues before they become problematic. This includes early detection of corrosion, scale and biofouling.

This early detection allows water treatment professionals to make assessments of system efficacy and integrity in a timely manner, enabling decisions on treatment programs to achieve optimal system performance.

Lovibond® has the solutions you need to meet these requirements. Our new range of industrial water products includes application-based test kits, reagents and accessories that have been specifically designed to meet the needs of our customers.

- On-site accuracy
- Complete solution, one manufacturer
- Technical know-how & support
- Combining liquid, tablet and powder chemistries to ensure best results for the application
- Streamlined portfolio
- Application based product selection

Problems in Water Treatment

Biofilm

Microbes like other life forms have favourable conditions in which they thrive. Unfortunately for people looking after cooling systems those, favourable conditions are just what we find in evaporative cooling water systems, where microbes are particularly abundant due to the concentration of nutrients through the system 'cycling'. Due to the constantly wet surfaces in cooling water systems the abundant growth of microbes leads to the formation of biofilms. These biofilms, if left untreated, can lead to biofouling, resulting in reduced plant efficacy and potentially reducing plant life.

The microorganisms that inhabit cooling systems are typically common soil, aquatic and airborne microbes that enter the system either via make up water, process leaks or are scrubbed from the air and vary depending on the water source.
Their control depends on whether they are in a planktonic (free floating) or sessile (attached) form. The sessile form is responsible for biofilm formation. As noted, biofilms form on wetted surfaces, such as heat exchanger tubes, and the microorganisms that form them secrete polysaccharides when submerged, allowing them to form a gel-like network which prevents them from being removed by the normal flow of water and consequently, hinders the action of the action of a biocide, whether oxidising or non-oxidizing. This is the reason the control of biofilms can require biocidal dosages many times higher than the control of planktonic species.

Once fouling has occurred in a system, even mechanical cleaning cannot remove all traces of the biofilm. Surfaces that have previously been fouled are more susceptible to colonisation than new surfaces, as residual biofilm materials promote growth and reduce lag time between fouling reappearing.

Some of the effects of biofilm formation:

- Biofilms act as insulation, where the performance of the heat exchanger deteriorates in correlation to the thickness of the biofilm.
- Biofilms can promote corrosion known as Microbial Influenced Corrosion (MIC), whereby the microbes act as catalysts for conventional forms of corrosion.
- The very presence of the microbes prevents corrosion inhibitors from reaching and passivating the metal surfaces.
- Corrosion reactions are accelerated by microbiological interactions.
- Microbial by-products can be directly damaging to the metal.

The most common form of bacteria involved in MIC are Sulphate Reducing Bacteria (SRB's). Having a large microbiological population in a cooling water systems is less than desirable, and it is therefore imperative that these numbers are monitored regularly so their impact on the operating system can be minimised. As microbe numbers can proliferate at an exponential rate the more regular their numbers can be monitored the better.

Corrosion

Water systems in industrial processes are generally made from metals, and virtually all metals (with the exception of noble metals) are at risk of corrosion in aqueous environments. This can be generalised corrosion and/or localised such as pitting or stress corrosion cracking.

The corrosion can cause primary damage, such as the direct damage causing leakages or valve failures, or can cause secondary damage resulting in blockages or problems elsewhere in the system.

Table 1 – Different alloys and non-metallic materials and their corrosion resistance taken from BG50*

Material	Where used	Corrosion 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 or aluminium hydroxide sludge.
Copper & Copper Alloys	Copper tube, brass valves and fittings	Good overall corrosion resistance of neutral or moderatly alkaline pH. In aerated water, copper is subject to attack from 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 contaminaton.
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 dissolved oxygen result in pitting attack under tubercles.	Formation of insoluble iron oxides as suspended solids increase 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 suspendid solids.
Stainless Steel (SS)	Plate heat exchangers, pump castings, 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	Resistance 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	Resistant 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.

**(BG50/2021 "Water Treatment for Closed Heating and Cooling Systems" – 2nd edition, Dr. P. Simpson)*

Scale

Typically, hardness scale is a precipitation of calcium and magnesium compounds (e.g., calcium carbonate, magnesium silicate)

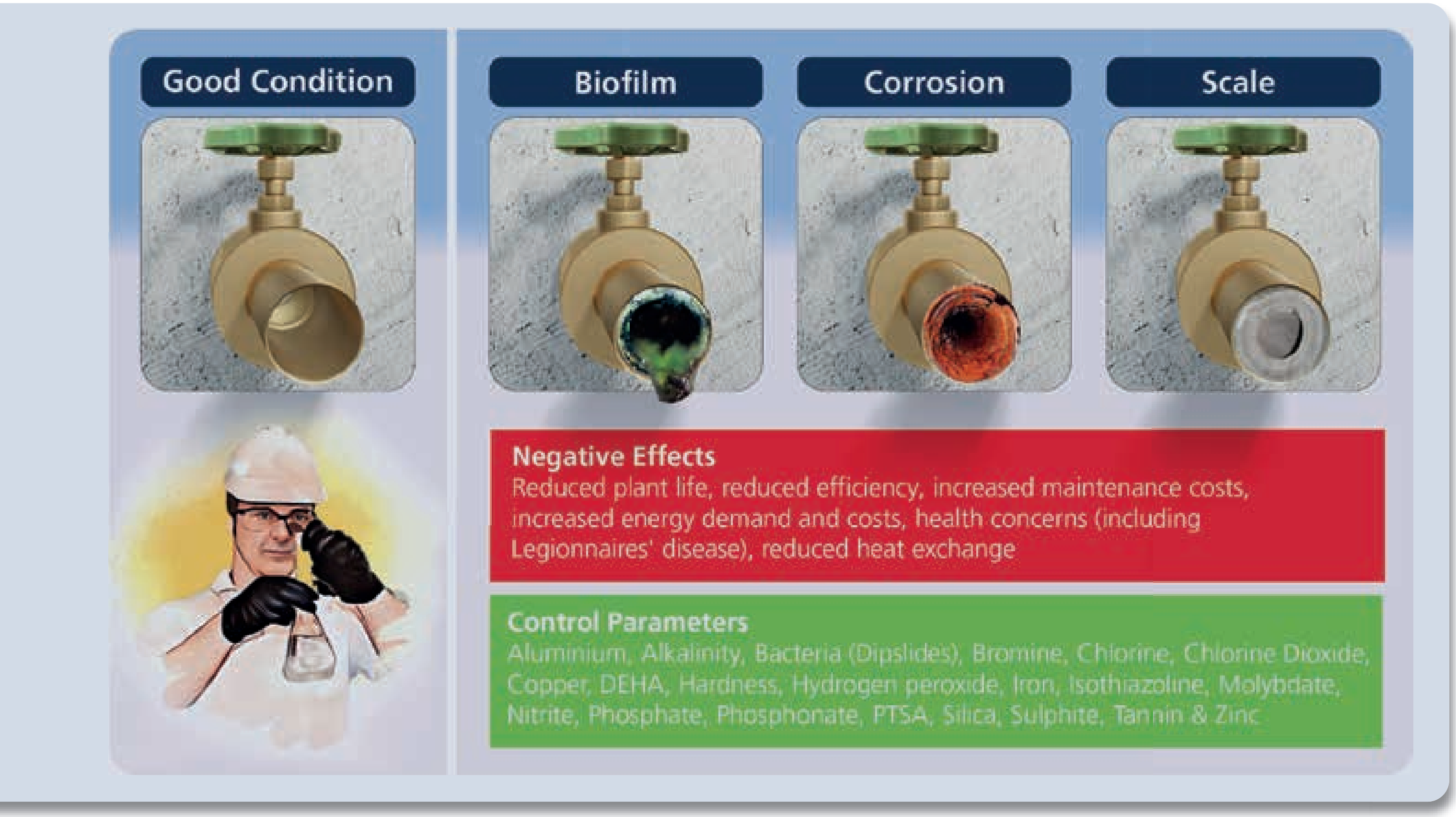
It can reduce system life, increase energy consumption, maintenance, and operational costs by forming a tough deposit in HVAC cooling systems and process water systems. As water temperature increases, calcium carbonate becomes less soluble, therefore in cooling water systems, scale typically deposits on hottest surfaces, such as heat transfer sites. As a result of this highly insulating deposit, the system has a reduced capacity to transfer heat. Additionally, as scale takes up space in the pipework, it can also lead to reduced flowrates.

It not only takes more effort to move energy through this scale, but the corrosion inhibitors can no longer adsorb to the system metallurgy, potentially leading to under-deposit corrosion.

The quantity and likelihood of scale deposition is affected by a number of parameters including high calcium, magnesium, alkalinity and pH and therefore it is essential to monitor those parameters.

In most instances, a measure of the water systems Langelier Saturation Index (LSI) will be performed on the Make Up water and theoretical 'cycles' of this water to see how many cycles of concentration you can safely run to, based on the expected performance of the scale/corrosion inhibitor in use.

Industrial water testing to prevent



Key Application & Industries

The term industrial water treatment is a blanket term used to describe the treatment of Industrial Water within certain processes in order to prevent, and/or, minimise the risk of, the problems and concerns covered in the previous section.

The next section is not a definitive list, but instead gives some detail on, the key application and process areas where monitoring the water has an impact in an industrial plant. In our definition of Industrial Water we do not cover industrial waste water but instead the water used prior to discharge.

Pre-Treatment & Raw Water

Raw/Make-Up Water (MU)

Raw/Make-Up Water (MU) should be tested to at least a minimum level every time you visit a site for a service visit (SV). This is especially true with recent climate issues resulting in areas of drought and/or flooding which can affect the MU water quality of the systems being served (closed system/cooling tower/boiler).

Sample Type	Minimum Recommended Tests
Raw/make-up (MU) Water	pH Conductivity/TDS Total Hardness Chloride (periodically)

- **Conductivity** – measures the dissolved solids level and can be used to quickly indicate if your site is experiencing a change in MU water quality when compared to previous readings.
- **pH** – confirms MU water quality and can indicate contamination, but the likelihood of mains water contamination is not very common
- **Hardness** – confirms MU water quality and can be used to diagnose/set-up any pre-treatment plant that exists downstream. If the hardness level has increased, an on-site water softener's regeneration frequency will likely need resetting. Failure to address can result in softener overruns and scale control issues.
- **Chloride** – needs to be checked periodically and whenever a change in 'normal' MU water quality is suspected.

Softened Water

Since you have tested your MU water to the minimum level as described above, you only need to check the performance of the water softening process. Conductivity/TDS has been included as it is a simple test which can quickly indicate issues with water softener regenerations. A water softener requires regenerating with salt (sodium chloride) after it has been 'exhausted' by removing hardness from the inlet MU water.

Sample Type	Minimum Recommended Tests
Softened Water	Conductivity/TDS Total Hardness Chloride

- **Hardness** – A properly functioning water softener should be capable of providing < 2 ppm hardness.
- **Chloride** (Conductivity/TDS) – This is to check if your water softener has regenerated properly and rinsed all the excess salt off the softener before going into service. To accurately assess this, you should test the softener immediately after it finishes the regeneration process, before it goes into service, which is not always easy to catch naturally. Chloride levels should be no greater than the MU water level. If safe to do so, performing a regeneration while you are on-site can allow this check to be made.

Other forms of pre-treatment

There are many other forms of pretreatment available such as de-alkalisation, reverse osmosis, de-mineralisation, ultra-filtration etc. Overall recommendation is to assess what the pre-treatment is designed to do and then test if it was sucessful.

A quick example, a de-mineralisation plant can produce near distilled water quality with almost zero dissolved solids.
So, a simple conductivity check would be a good measurement to assess performance. Remember, these are the minimum recommended tests.

Control of industrial water systems

Closed Water Systems

Pre-Treatment & Raw Water

Closed water systems, as the name implies, are closed to the greater environment and use very little Make Up (MU) water in their normal operation. A properly 'tight' system will have no more than 5 % MU water annually, annually, as such closed water systems do not concentrate up the amount of dissolved solid present in the MU water. This fact usually means 'calcium' based scale formation is not as significant a risk as corrosion is for these systems.

Sample Type	Minimum Recommended Tests
Closed Water Systems	Conductivity/TDS pH Iron (dissolved & total) Inhibitor (test as applicable) Other metals (test as applicable) Microbiological check(s) Turbidity/Suspended Solids

Minimum recommended tests for a closed water system would include the following:

- Conductivity – the conductivity of a closed system can vary based on the initial MU water conductivity and the type of chemical treatments that are in use. Measuring the conductivity on start-up and on each service visit allows you to monitor in-spec trends and identify any large changes in readings. A significantly lower conductivity reading may suggest a system leak has occurred. A significantly higher reading may suggest that there has been an addition of a chemical(s) since the last visit, or some form of contamination has occurred.
- pH – routine monitoring (trending) of the pH, likewise conductivity, will give a reasonable confirmation that the system is running well. High pH could mean excess chemical addition or some form of contamination. Low pH would usually mean some form of contamination has occurred or a high level of sulphate reducing bacteria (SRB's) may have taken hold in the system giving off low pH hydrogen sulphide as a byproduct. Systems with measurably high SRB's will likely have a heavy biofilm formation as well.
- Hardness – not normally required. As closed systems do not 'cycle-up' from evaporation, hardness levels should stay around MU water levels or just below as some hardness may have dropped out of solution.
- Iron – unlike hardness, corrosion is a common problem and is typically the main cause of failures with closed water systems. Corrosion problems can sometimes link right back to the installation of the system, and all too often are the result of an insufficient pre-commissioning program.
- Inhibitor Levels – One of the more important tests that should be performed during each SV is a check on the inhibitor level. In general, most closed water systems tend to be treated with molybdate-based or nitrite-based corrosion inhibitors as the primary chemical component. Whichever inhibitor is in use, there should be clear guidance on the control levels needed and it should be tested for its active ingredient every SV. The test results are then used to assess whether any chemical additions need to be made to the operating system.

Note – other tests that can be done on closed systems include alkalinities (P & M), chloride, hardness etc. but the above water tests should be sufficient to allow an operator enough information to keep control of any closed water system.

- Microbiological testing – There are several microbiological tests that can be done during a SV on a closed water system. These include dipslides for general bacteria levels (TVC's), more specific dipslides for pseudomonas (aeruginosa or species) as well as tests for Nitrite Reducing Bacteria (NRB's) and Sulphate Reducing Bacteria (SRB's). For systems that contain glycol for freeze point depression, checks for yeast and moulds is a good recommendation. Any of these microbiological controls will require incubating your sample for prescribed times at set temperatures but will usually provide activity levels well ahead of samples sent to a laboratory.
- Turbidity/Suspended Solids – a visual check of the water clarity is the easiest of tests, yet always a good indicator of the condition of the operating system. Turbidity/suspended solids is usually left as the visual check and an 'appearance' result is entered. If a multi-parameter photometer is used for site testing it's likely that one or both tests can be performed by the electronic meter.

Sample Type	Minimum Recommended Tests
Cooling Tower Systems	**All Closed System Tests:** Conductivity/TDS pH Iron (dissolved & total) Inhibitor (test as applicable) Other metals (test as applicable) Microbiological check(s) Turbidity/Suspended Solid **And in addition:** Alkalinities (M&P) Hardness (total & calcium) Biocide levels (test as applicable)

Cooling Tower Systems

Cooling towers are used to expel heat from some process needing to be cooled (i.e., machine cooling/air conditioning/ refrigeration) via a water re-circulation system that eventually flows over a cooling tower. When operating, a cooling tower by design is open to the environment and will incur evaporation losses to varying degrees. It is this evaporation loss that results in the concentrating up of the MU water dissolved solids level in the system. Commonly known as 'cycling-up', this aspect of cooling towers tends to change the emphasis from corrosion to scale formation when looking at the major concerns with using water as a heat rejection medium, unless some form of water softening is involved. In very general terms 'all' of the tests that have been discussed with closed water systems are applicable when routinely testing cooling towers. However, there is significant interest in the alkalinities (M & P) and the hardness levels (particularly calcium hardness) as they relate to the likelihood of scale formation.

- Alkalinities (M, P & OH) – There are generally 3 types of alkalinities that need to be discussed when talking about general water chemistry. These are bicarbonate (HCO_3^-) alkalinity, carbonate (CO_3^{2-}) alkalinity and hydroxide (OH^-) alkalinity. If we look in very general terms at the characteristics of these alkalinity types, we can see that they have varying levels of alkaline nature
  - HCO_3^- Alkalinity exists to a maximum pH of approx. 8.0
  - CO_3^{2-} Alkalinity exists to a maximum pH of approx. 10.5
  - OH^- Alkalinity exists to a maximum pH of approx. 14.0

All raw waters around the world have varying levels of HCO_3^- alkalinity. As this form of alkalinity can only produce a pH of around 8.0 and most importantly has a high solubility level in the presence of water hardness, it would seem to be 'safe' to use water with HCO_3^- alkalinity for most cooling water applications. However, it's well-documented that when water with HCO_3^- alkalinity is heated, it will convert through chemical process to form CO_3^{2-} alkalinity which has a higher characteristic pH of around 10.5.

The more you use water for heat rejection which will naturally increase the water's temperature, the more CO_3^{2-} alkalinity we will generate with a corresponding increase in pH.

- Hardness (Total & Calcium) – Testing the hardness levels during each SV is key to monitoring the system for potential scaling issues. Monitoring the calcium hardness levels in the MU water and comparing it to the level of calcium hardness in the cycled-up cooling tower is referred to as performing a 'calcium balance'. If MU water calcium hardness is 200 ppm, and you were controlling your cooling tower at 3.0 cycles of concentration (CoC) then you would like to see a calcium hardness level of 600 ppm in the cooling tower. Anything less than a factor of 3 would suggest that calcium is dropping out as scale formation.We want to use water as a heat rejection medium: the more we heat the water the more CO_3^{2-} alkalinity will form, and the more heat we pick up, the more $CaCO_3$ wants to drop out of solution.
- Conductivity/TDS – Measuring conductivity/TDS has been mentioned under closed water systems but it is important to note that it is usually used as a controlling parameter for cooling tower systems. An automatic bleed control system based on an in-line conductivity probe will control a bleed valve to maintain the required CoC.
- Biocides – Control of the microbiological content in a cooling tower system is critical for several reasons including the need to control Legionella bacteria to reduce the risk of someone contracting Legionnaires' Disease as well as the need to control other pathogenic microbes. Control usually involves a combination of physical control of the cooling tower to reduce the risk of exposure to an aerosol during operation (i.e., drift eliminators), with the use of chemical and/or non-chemical biocides. It should be noted that microbiological control will also help to minimize the formation of biofilms which will reduce the possibility of blockages, low flow areas, poor heat exchange and lessen the possibility of under-deposit corrosion. Oxidising biocides such as bromine, chlorine and chlorine dioxide are typically used on a continuous low level dosing program with evaporative cooling systems. These oxidising biocides are routinely backed up with the use of a non-oxidising 'shock dosed' biocide. It is important to not overdose the oxidizing biocide as it can promote higher corrosion levels.

Steam Boilers

In very general terms we expect the following sequence of water qualities will need water testing to maintain satisfactory operating conditions.

- Raw MU water
- Softened MU water (requires ZERO hardness levels)
- Condensate returns
- Feedwater (combination of above waters in varying quantities)
- Boiler water

- Alkalinity – Due to the temperatures and pressures involved within an 'operating' steam boiler OH hydroxide alkalinity is formed in the boiler. Some might think this would be a problem due to the high expected pH but mild steel 'prefers' pH to be in the region of pH = 11.0–12.5 which minimises the corrosion potential for the steel construction. Each boiler type (manufacturer) will have recommended levels for M & P alkalinity control which will provide suitable levels of OH alkalinity.
- It is this OH alkalinity, when combined with the proper levels of your sludge conditioner additive (typically phosphate), that will allow any calcium or magnesium hardness to be properly 'conditioned' as a fluid sludge that can be removed via bottom blowdowns.
- It is also important to note that allowing alkalinity levels to run too high in a boiler increases the surface tension of the water making it difficult for steam bubbles to break free at the water/steam interface and join the steam space in the boiler. This is referred to as 'wet' steam and results in carryover of boiler water into the steam which can cause problems related to steam use and steam trap operation.
- Temperature – Levels of dissolved gases (particularly O_2 & CO_2) in water are directly proportional to the temperature of the water. As we do not want either dissolved gas to enter the boiler, both can cause corrosion problems, we try to maintain as high a feedwater temperature as possible. Condensate returns, live steam injection system and/or deaerators can be beneficial in raising the feedwater temperature.
- Oxygen Scavengers – As per above discussion on temperature, we do not want any oxygen in our boiler feedwater. As such it's common to dose an oxygen scavenger into the feedwater tank (or hot well) or directly into the feedwater line ahead of the feedwater pump.
  It is important that the chemical addition is made with sufficient reaction time to scavenge all the oxygen before it reaches the boiler. Most sulphite-based oxygen scavengers are catalysed so the pick-up of oxygen is 10 to 100 faster than un-catalysed, sulphite. When cobalt is used as the catalyst it will become inactive at a pH of 9.3 or greater, as such it is important to use a separate mix/dosing tank just for the catalysed, sulphite solutions.
  The cobalt catalyst precipitates as a brown floc. If you see this material collecting in the dosing tank, your catalyst has dropped out. When testing your sampled boiler water it is important to test the sulphite level first as the level can change as your sample picks up atmospheric oxygen when cooling down.

Other forms of oxygen scavenger include the below chemicals. Tannin is listed here but acts as both a filming agent (tannate film), as well as an oxygen scavenger.

- Sodium Sulphite
- Erythorbate
- Diethylhydroxylamine (DEHA)
- Hydroquinone
- Hydrazine
- Carbohydrazide
- Methyl Ethyl Ketoxime (MEKO)
- Tannin

It is important to note that guidance for the control levels of each of these different types of oxygen scavengers is available from the boiler manufacturers or the chemical suppliers.

- Sludge Conditioners – As with oxygen scavengers, there are many different formats for sludge conditioner with likely hundreds of proprietary blends. Some will attempt to keep solids in solution, in solution so they can be removed with surface blowdown, e.g. chelant based conditioners. Others like phosphate-based conditioners will seek to form 'fluid' sludges for bottom blowdown removal.
- Unlike oxygen scavenger dosing, there is no real need to increase the reserve level when the boiler is not in operation as without actual feedwater entering the boiler and therefore there is no increase in demand for the sludge conditioner. It is important to note that the boiler sample needs to be filtered prior to testing for a phosphate reserve in order to remove calcium/phosphate complexes that could be tested as reserve phosphate.
- pH (condensate) – During the breakdown of HCO_3^- to CO_3^{2-} and finally to OH^- alkalinity conversion reactions, CO_2 is released, which as a gas flows off with the steam. When the steam has cooled down enough to condense so that CO_2 is dissolved again in the form of HCO_3^-, a pH around 8.0 would be satisfactory. However, when the CO_2 dissolves back into the condensate, it forms carbonic acid H_2CO_3, which can lower the pH of the condensate to 4.0–5.0. This low pH condensate can corrode the condensate return pipework especially at the bottom of the pipe exposed to the acidic liquid.

Sample Type	Minimum Recommended Tests
Boiler Systems **(includes Raw MU, Softener – or other Pre-Treatment–, Condensate, Feedwater & Boiler Water)**	**All MU and Softener/ Pre-Treatment Tests:** pH Conductivity/TDS Total Hardness Chloride **And in addition:** Alkalinities (M, P & OH) re-visited Temperature (feedwater) Oxygen scavenger (test as applicable) Sludge conditioner (test as applicable) pH (Condensate)

Understanding Interferences

When running analytical methods users need to remain diligent about the tests being carried out and pay particular attention to details such as pH of the sample, cleanliness of the sample container and the colour produced by the chemical reagents.
In complex water systems such as those found in water treatment plants, there are many species of chemicals which may possess cross reactivity to the chemistry involved in measurement. These cross reactivities may lead to the production of a different colour than expected.
Water treatment professionals should be aware of the make-up of their system but also, in addition, the chemistry behind the analysis techniques they are using.
With knowledge of the chemistry, potential problems from interferences can be avoided or compensated for. If those interferences are unaccounted for, wrong decisions can be taken in the care of the water system treatment leading to problems including increased corrosion or biofilm build up.
Below is a common list of interferences users should be aware of when using any analytical methods. Our instruments and reagents are designed to mitigate some of these interferences as much as possible but the user must also take responsibility for eliminating these common issues.

Turbidity Interferences

As simple as turbidity appears on first sight, it is important to understand possible influences and interferences to receive most reliable results.
Turbidity readings are not always stable and may fluctuate. In most cases, the cause for that is not a defective instrument. Most suspended particles are not ideally spherical. Different orientations of an asymmetric particle can cause minor fluctuating readings as the incident light may hit particles at different positions.
Signal averaging and repetitive measurements are helpful to obtain reliable readings.
Strong turbidity fluctuations may result from interferences based on physical effects or material contamination and damage.

Interference	What is it / Why it happens	Impact on Readings	How to eliminate
Dirty sample containers	Not cleaned after last use	Wrong results	Clean sample containers before and after every use. Sample containers should be at minimum, rinsed with sample being tested prior to being filled.
Dirty test jars/cells	Fingerprints on cells and jars Not cleaned after last use	Wrong results	Light passing through the sample does not differentiate between dirt and the substance to be determined.
Turbidity and particles	Turbidity in sample or can occur as part of the chemical reaction.	Additional turbidity or particles in the sample will interfere with the results and usually lead to higher results.	Depending on the cause, filtration prior to testing can be used or a sample blank to eliminate the impact of the reading.
Temperature	Temperature of sample or environment in which the test is being completed can change.	In general higher temperatures may lead to quicker reactions, and lower temperatures to slower reactions.	Unless stated otherwise – in the method it is assumed that reactions will take place at room temperature. Therefore, warm samples should be cooled prior to analysis and cold samples should be warmed prior to analysis. Effectively, it should be noted that reagents should be at room temperature unless otherwise stated.
Cross reactivity of chemical species	Different Make Up waters, contaminants, different chemical additives, plant materials and complex reactions within water systems all contribute	Production of a different colour and/or results than expected.	Water treatment professionals should be aware of the make-up of their system, chemicals added to the system and, the chemistry behind the analysis techniques they are using. With knowledge of the chemistry, potential problems from interferences can be avoided or compensated for.

Drop Test Kits

Single Parameter Test Kits

Our high quality Drop Test Kits and reagents are available in a wide range of parameter specific options to suit many analytical requirements.

The following list of reagents are for use in various water testing applications including Potable, Process, Industrial Boilers & Cooling Systems, Swimming Pool and Waste Water treatment.

Test Kit	Range	Quantity*	Code
Acidity Drop Test Kit	50–40000 mg/L as H_2SO_4	100 Tests	56K700100
Acidity Products Drop Test Kit	0–7.5 % w/v as H_2SO_4	100 Tests	56K700110
Alkalinity M (total) Drop Test Kit	50–2400 mg/L $CaCO_3$	100 Tests	56K700120
Alkalinity P, M & OH Drop Test Kit	50–2400 mg/L $CaCO_3$	100 Tests	56K700130
Alkalinity Products Test Kit	0.025–6 % as NaOH	100 Tests	56K700140
Anionic Drop Test Kit	as product	100 Tests	56K700150
Bromine Total Drop Test Kit	0.25–20 mg/L Br_2	100 Tests	56K700160
Carbon Dioxide Drop Test Kit	10–150 mg/L $CaCO_3$	100 Tests	56K700170
Chelant Free Drop Test Kit	10–240 mg/L EDTA	100 Tests	56K700180
Chloride Drop Test Kit	20–12000 mg/L Cl	100 Tests	56K700190
Chlorine Free Drop Test Kit	1–300 mg/L Cl_2	100 Tests	56K700200
Chlorine Dioxide LR Drop Test Kit	0.16–12 mg/L ClO_2	100 Tests	56K700220
Chlorine Dioxide Drop Test Kit	0.16–600 mg/L ClO_2	100 Tests	56K700230
Glutaraldehyde Drop Test Kit	12.5–1600 mg/L as Aldehyde	100 Tests	56K700240
Hardness Calcium & Total Drop Test Kit	5–600 mg/L $CaCO_3$	100 Tests	56K700270
Hardness Total Drop Test Kit	5–600 mg/L $CaCO_3$	100 Tests	56K700280
Hydrogen Peroxide Drop Test Kit	15–500 mg/L H_2O_2	100 Tests	56K700290
Nitrite Drop Test Kit	10–2000 mg/L $NaNO_2$	100 Tests	56K700300
Peracetic Acid Drop Test Kit	10–6000 mg/L H_2O_2	100 Tests	56K700310
Phosphonate Drop Test Kit	4–20 mg/L as HEDP	100 Tests	56K700320
Polyacrylate Drop Test Kit	0–20 mg/L as Polyacrylate	100 Tests	56K700330
Polyamine Drop Test Kit	0–20 mg/L as CTAB	100 Tests	56K700340
QAC/Cationics Drop Test Kit	60–2000 mg/L QAC as CTAB	100 Tests	56K700350
Sulphite Drop Test Kit	5–150 mg/L Na_2SO_3	100 Tests	56K700360
Tannin Drop Test Kit	50–300 mg/L Tannin	100 Tests	56K700370
Zinc Drop Test Kit	0.1–5 mg/L Zinc	100 Tests	56K700380

* Number of tests calculated based on the quantity of titration reagent

Application Specific Test Kits

No matter what type of industrial water, we have the solutions you need to save operating costs and protect the life of your plant.

Minimise the effects of corrosion, scale and biofilm in your industrial water process by monitoring key parameters with Lovibond Application Specific Test Kits.

Test Kit	Parameter	Range	Test Instrument	Code
Boiler Water Test Kit 	pH	0–14 pH	Pocket Testers	56K701170
	Conductivity	0–20 mS/cm	CHECKIT® Comparator	
	Alkalinity (M, P, OH)	50–2400 mg/L $CaCO_3$	Drop Tests	
	Chloride	20–12000 mg/L Cl		
	Hardness Yes/No	8–20 mg/L $CaCO_3$		
	Hardness Total	5–600 mg/L $CaCO_3$		
	Phosphate	0–80 mg/L PO_4		
	Sulphite	25–150 mg/L Na_2SO_3		
	Tannin	50–300 mg/L		
Cooling Water Weekly Test Kit 	pH	0–14 pH	Pocket Testers	56K701100
	Conductivity	0–20 mS/cm	CHECKIT® Comparator	
	Bromine	0–5 mg/L Br	Drop Tests	
	Hardness Calcium	5–600 mg/L $CaCO_3$		
	Hardness Total	5–600 mg/L $CaCO_3$		
Cooling Water Legionella Compliance Test Kit 	pH	0–14 pH	Pocket Testers	56K701110
	Conductivity	0–20 mS/cm	CHECKIT® Comparator	
	Bromine	0–5 mg/L Br	Drop Tests	
	Hardness Calcium	5–600 mg/L $CaCO_3$		
	Hardness Total	5–600 mg/L $CaCO_3$		
	Iron	0–1 mg/L Fe		
	Alkalinity Total	50–2400 mg/L $CaCO_3$		
Closed System Weekly Test Kit 	pH	0–14 pH	Pocket Testers	56K701120
	Conductivity	0–20 mS/cm	CHECKIT® Comparator	
	Iron	0–1 mg/L Fe	Drop Tests	
	Molybdate	5–500 mg/L MoO_4		
	Nitrite	10–2000 mg/L $NaNO_2$		
Closed System Engineer Test Kit 	pH	0–14 pH	Pocket Testers	56K701600
	Conductivity	0–20 mS/cm	CHECKIT® Comparator	
	Alkalinity Total	50–2400 mg/L $CaCO_3$	Drop Tests	
	Aluminium	0–0.3 mg/L Al	Refractometer	
	Chloride	20–12000 mg/L Cl		
	Copper	0–5 mg/L Cu		
	Glycol	% PEG/MEG		
	Hardness Total	5–600 mg/L $CaCO_3$		
	Iron	0–1 mg/L Fe		
	Molybdate	5–500 mg/L MoO_4		
	Nitrite	10–2000 mg/L $NaNO_2$		
Water Treatment Engineers Test Kit Visual 	pH	0–14 pH	Pocket Testers	56K701300
	Conductivity	0–20 mS/cm	Refractometer	
	Glycol	% PEG/MEG	CHECKIT® Comparator	
	Aluminium	0–0.3 mg/L Al	Drop Test	
	Bromine	0–5 mg/L Br		
	Chlorine	0–2 mg/L Cl_2		
	Copper	0–5 mg/L Cu		
	Iron	0–1 mg/L Fe		
	Molybdate	50–500 mg/L MoO_4		
	Phosphate	0–80 mg/L PO_4		
	Alkalinity (M, P, OH)	50–2400 mg/L $CaCO_3$		
	Hardness Calcium	5–600 mg/L $CaCO_3$		
	Hardness Total	5–600 mg/L $CaCO_3$		
	Hardness Yes/No	8–20 mg/L $CaCO_3$		
	Chloride	20–12000 mg/L Cl		
	Hydrogen Peroxide	15–500 mg/L H_2O_2		
	Nitrite	10–2000 mg/L $NaNO_2$		
	Phosphonate	0–20 mg/L HEDP		
	Sulphite	25–150 mg/L Na_2SO_3		
	Tannin	50–300 mg/L		

Test Kit	Parameter	Range	Test Instrument	Code
Water Treatment Engineers Test Kit Photometric	pH	0–14 pH	Pocket Testers	**56K701400**
	Conductivity	0–20 mS/cm	Refractometer	
	Glycol	% PEG/MEG	Photometer (MD600)	
	Aluminium	0–0.3 mg/L Al	Drop Test	
	Bromine	0–13 mg/L Br		
	Chlorine	0–6 mg/L Cl_2		
	Copper	0–5 mg/L Cu		
	Iron	0–10 mg/L Fe		
	Molybdate	1–50 mg/L MoO_4		
	Phosphate	0–26 mg/L P		
	Alkalinity (M, P, OH)	50–2400 mg/L $CaCO_3$		
	Hardness Calcium	5–600 mg/L $CaCO_3$		
	Hardness Total	5–600 mg/L $CaCO_3$		
	Hardness Yes/No	8–20 mg/L $CaCO_3$		
	Chloride	20–12000 mg/L Cl		
	Hydrogen Peroxide	15–500 mg/L H_2O_2		
	Nitrite	10–2000 mg/L $NaNO_2$		
	Phosphonate	0–20 mg/L HEDP		
	Sulphite	25–150 mg/L Na_2SO_3		
	Tannin	50–300 mg/L		
Water Treatment Engineers Test Kit Advanced	pH	-2–16 pH	Hand Held Meters	**56K701500**
	Conductivity	0–200 mS/cm	Refractometer	
	Glycol	% PEG/MEG	Photometer (MD640)	
	Aluminium	0–0.3 mg/L Al	Drop Test	
	Bromine	0–13 mg/L Br		
	Chlorine	0–6 mg/L Cl_2		
	Copper	0–5 mg/L Cu		
	Iron	0–10 mg/L Fe		
	Molybdate	1–50 mg/L MoO_4		
	Phosphate	0–80 mg/L PO_4		
	Alkalinity (M, P, OH)	50–2400 mg/L $CaCO_3$		
	Hardness Calcium	5–600 mg/L $CaCO_3$		
	Hardness Total	5–600 mg/L $CaCO_3$		
	Hardness Yes/No	8–20 mg/L $CaCO_3$		
	Chloride	20–12000 mg/L Cl^-		
	Hydrogen Peroxide	15–500 mg/L H_2O_2		
	Nitrite	10–2000 mg/L $NaNO_2$		
	Phosphonate	0–20 mg/L HEDP		
	PTSA	10–400 ppb		
	Sulphite	25–150 mg/L Na_2SO_3		
	Tannin	50–300 mg/L		

Non Oxidising Biocide Test Kits

DBNPA / Glutaraldehyde/Isothiazolinone/THPS Test Kits

- Ideal for mobile treatment engineers
- Compact & portable design
- Easy to follow waterproof instructions
- Clear product labelling

Biocide Test Kits

Non oxidising biocides are often used as a "shock" treatment in cooling waters. These test kits can be used to determine the level of biocides in Open & Closed water systems and can be used when dosing biocides to systems recently pre-commissioned cleaned. Measuring non oxidising biocides is crucial in ensuring that the biocide in use is not over or under dosed and these kits are ideal for this application.

Test Kit	Range	Quantity	Test Instrument	Code
DBNPA Test Kit	0–6.8 mg/L	100 Tests	CHECKIT® Comparator	**56K701190**
Glutaraldehyde Test Kit	12.5–1600 mg/L	100 Tests	Drop Test	**56K700240**
Isothiazolinone Test Kit	0–7.5 mg/L	100 Tests	Colour Card	**56K701200**
THPS Test Kit	0–20 mg/L	100 Tests	Drop Test	**56K701210**

Each of our non-oxidising biocide test kits is supplied ready to use. Each kit contains all the necessary reagents to carry out between 50 and 100 tests and uses either a colour card, comparator or drop count to determine the reserve.

Dipslides

Dipslides indicate the presence of microorganisms and work with a semiquantitative measuring method. Microbiological risks can thus be correctly categorised and evaluated in most applications.

Some of the benefits of Lovibond® dipslides include:

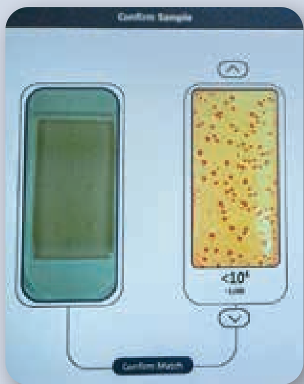
- Broad variety of dipslides to fit best for a given situation
- Large surface area of 11.5 cm^2 for high sensitivity
- Effective contact area of 10 cm^2 for easy calculation in surface testing
- Media produced to meet ISO 11133

Our dipslides provide valuable assistance in monitoring microbial growth wherever the potential can exceed 100 (10^2) organisms in one millilitre of sample liquid. These include, in particular, the applications industrial water, industrial fluids, food manufacturing, dental practices, breweries, environmental hygiene, leather industry, fuels, dairy industry, pools & spas and cosmetics.

Flexible paddles & raised agar profile allow user to test both surfaces and liquids.

Get our App!

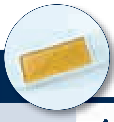
The app is available to support evaluation & documentation



App Store

Google Play

Single Agar Dipslides



for Total Count

TTC/TTC
Code: 56B010110

Agar
Nutrient agar with TTC additive

Application/Industry

Standard
HSG274 Part 1
VDI 2047

Why use this slide?
TTC additive for colony staining (red) that makes counting easier.

---

for Total Count

R2A/R2A
Code: 56B011110

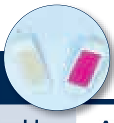
Agar
R2A Agar with TTC additive

Application/Industry

Standard
HTM 01-05
HTM 01-06
Marine Conventions MLC, 2006 & ILO178

Why use this slide?
Has a lower detection limit than the other slides. Count from 10^2.

Dual Agar Dipslides



for Total Count/Yeast & Moulds

TTC/Malt
Code: 56B010210

Agar
Nutrient agar with TTC additive
Malt Agar

Application/Industry

Standard
HSG274 Part 1
VDI 2047
Health & Safety at Work Act

Why use this slide?
Tests total bacteria and yeast and moulds according to standards.

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for Total Count/Yeast & Moulds

TTC/Rose
Code: 56B010310

Agar
Nutrient agar with TTC additive
Rose Bengal Agar with Chloramphenicol

Application/Industry

Standard
-

Why use this slide?
Pink medium ideal for the enumeration of moulds and yeasts in foods.

---

for Total Count/ Enterobacteriaceae

TTC/Mac
Code: 56B010410

Agar
Nutrient agar with TTC additive
MacConkey No.3 Agar

Application/Industry

Standard
APHA

Why use this slide?
Tests Total Bacteria and enterobacteriaceae simultaneously.

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for Total Count/*E. coli*

TTC/*E. coli*
Code: 56B010510

Agar
Nutrient agar with TTC additive
Chromogenic *E. coli* Agar

Application/Industry

Standard
HSG282

Why use this slide?
For *E. coli* and Coliforms. Identifies each bacterial species in different colours making them easy to count.

---

for Pseudomonas/ Enterobacteriaceae

PDM/Mac
Code: 56B010610

Agar
Pseudomonas Base Medium Agar with C.F.C supplement
MacConkey No.3 agar

Application/Industry

Standard
APHA

Why use this slide?
Tests Pseudomonas and Enterobacteriaceae simultaneously.

---

for Total Count/Pseudomonas

TTC/PDM
Code: 56B010710

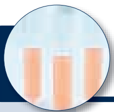
Agar
Nutrient agar with TTC additive
Pseudomonas Base Medium Agar

Application/Industry

Standard
HSG282
HTM 01-06

Why use this slide?
Tests total bacteria and Pseudomonas simultaneously.

Tube Tests for anaerobic Measurement



for Sulphate Reducing Bacteria

SRB Tube Test
Code: 56B010810

Agar
Semisolid medium for the analysis of anaerobic microorganisms capable of reducing sulphates to sulphides

Application/Industry

Standard
-

Why use this slide?
Measures anaerobic bacteria and indicates microbial induced corrosion.

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for Nitrite Reducing Bacteria

NRB Tube Test
Code: 56B010910

Agar
Semisolid medium for the analysis of anaerobic microorganisms capable of nitrite ammonification

Application/Industry

Standard
-

Why use this slide?
Measures anaerobic bacteria and indicates microbial induced corrosion.

Industrial Water
Industrial Fluids
Brewing
Dairy
Laundry
Clinical
Potable
Food
Fuel
General Purpose
Sewage
Biofouling
Cosmetic
Cooling Water
Marine
Dental
Pool & Spas
Faecal Contamination

Shelf Life Dipslides have a typical use by date of 6-9 months dependent on manufacture cycle, they can be used after this date as long as no contamination or visible shrinkage shows on the the agar surface. Excess water in the bottom of the slide would indicate the storage temperature was too high.

Please Contact Us

Lovibond® website

Discover the product portfolio of Lovibond® and much more with one click.

Industrial Water Test Kits

Scan & get more information about all kits or ask for the different leaflets

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