Kamco

The force behind clean heating systems

Systemsure water analysis test kit

for central heating and cooling systems

The Systemsure water analysis test kit enables engineers to make an immediate determination of the quality of water in a heating system, enabling them to understand the causes of problems, and to select the appropriate treatment to prevent future system failures and call backs.

It will indicate whether a system has been properly pre-commission cleaned, if corrosion is either taking place, or is likely to occur, whether the system should be power flushed, and whether it has been treated with the correct level of corrosion inhibitor. If power flushing is required, analysis can confirm that all deposits and residues have been purged from a system.

Wet central heating systems must be properly cleansed, and treated with corrosion inhibitor, in order to protect them from the otherwise inevitable decay as system metals trend back to their natural state.

Parameters that can be tested with the Systemsure water test kit.

pH (acidity/alkalinity)

The pH of water is an indication of how acid or alkaline it is. The scale runs from 0 to 14, with a pH of 7 being neutral. The nearer to 0 the pH value is, the more acidic, and conversely, the nearer the value is to 14, the more alkaline the water.

The corrosion rate of ferrous metals and copper becomes increasingly rapid as the pH falls below 6, and it is therefore important to ensure all residues of acidic flushing chemicals are removed after power flushing.

Aluminium heat exchangers and radiators are prone to corrosion when the pH is less than 6, or above 8.5.

Copper is adversely affected when the pH is above 9.5, as may happen when alkaline flushing chemicals or inhibitors are used, or when softened water is used to fill the system.

Dissolved iron

Iron oxides, produced by corrosion in heating systems, have only limited solubility in water.

Even heavily corroded systems will rarely contain more than 5 mg/l, at which level visible red or black iron oxide particles indicate that corrosion has already occurred, and that the system should be power flushed.

Mains water often contains iron, although at levels of less than 1 mg/l. A test reading of more than 1 mg/l above the mains water indicates that corrosion is taking place (even though water drawn from the top of a radiator may be clear), and the system should be power flushed.

After power flushing, a dissolved iron level check can ensure that all flushing chemical has been removed from the system. If flushing chemical is still present, then the dissolved iron level will be higher than that for mains water.

Dissolved copper

The presence of dissolved copper in system water, at a level of 1 mg/l or more, is indicative of corrosion problems, and is associated with excessive use of flux when installing or repairing a system, and inadequate pre-commission cleaning.

Only low levels are usually recorded, as the copper in solution tends to plate out onto steel and aluminium surfaces, causing localised corrosion and wasting (at ca. 0.5 to 1.0 mg/l), and pinholing at higher readings of >1.0 mg/l.

Total hardness

More than 60% of Britain, by area, has water classsified as hard, expressed as more than 200 mg/l calcium carbonate.

The harder the water, the more prone heat exchangers and calorifiers are to scaling up with limescale deposits.

Whilst soft water, expressed as less than 100 mg/l calcium carbonate, does not cause scaling problems, it tends to be more corrosive to metals used in heating systems.

If, when checking the hardness of system water, the hardness is much less than that of the mains water, then it is probable that scaling up of the boiler or heat exchanger has already occurred.

Even when the hardness of mains and system water are apparently similar, scaling may also have occurred if the system has been frequently drained and refilled, or if a water leak has lead to a continuous ingress of fresh water into the system.

Soft water produced by a water softener usually has a hardness value less than 2mg/l, but should not be used in central heating systems, as it is more aggressive than natural soft water, particularly to aluminium heat exchangers and radiators.

Chloride level

Most mains water supplies contain some dissolved chlorides, varying from ca. 20 mg/l upwards to 100 mg/l.

Chloride levels significantly above the mains level (more than 25 mg/l, or more than 50% higher) can cause pitting and corrosion of mild steel, particularly in areas of high stress, such as bends and welds, and will reduce the performance of corrosion inhibitors.

High chloride levels are indicative of flux contamination of the heating system, which should be power flushed and the chloride level re-checked.

It is important to check chloride level before and after pre-commission cleaning of a system, to ensure that the process has been fully effective.

Inhibitor concentration

It is important to check the correct level of corrosion inhibitor in a system in order to ensure long term protection from internal corrosion, sludge formation, scale deposition, and boiler noises.

The Systemsafe-DM inhibitor level test is used to check the correct level of Kamco inhibitor.

The test measures the molybdate content within a heating system. 330 mg/l (ppm) molybdate is the optimum treatment level of 1% Systemsafe-DM by volume, and **100 ppm for 0.5% Systemsafe DM Concentrate.**

A higher value is not detrimental, but if the test indicates under dosing, then the level should be brought up to the optimum by further addition of Systemsafe-DM or Concentrate.

Contents:

5m reel pH paper.
Tablet test for dissolved iron content evaluation.
Tablet test for dissolved copper content evaluation.
Tablet test for chloride level evaluation.
Drop test for total hardness evaluation.
Tablet test for corrosion inhibitor concentration.
Optional: Electronic pH and TDS meters.

Telephone help line:
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Systemsure water analysis test kit

Contents: The Systemsure water analysis test kit includes glassware and reagents to test water for pH value, dissolved iron, dissolved copper, chloride, total hardness and inhibitor concentration, together with an illustrated instruction manual.
General instruction notes: For accurate results, rinse sample tubes with a sample of the water to be tested before carrying out tests, and rinse again with fresh tap water after use.

Use of pH paper:
Remove 5-8 cm of pH paper from the dispenser roll, and immerse in water for 30 seconds. Compare the colour with the circular chart on the side of the dispenser, and note the pH number printed next to that colour.

Supplied in 5m dispenser pack.

Use of soluble iron tablet test:
Fill small test tube to the top line with sample water.

Add 1 x Iron LR tablet. Use the crushing rod to break the tablet into a fine powder, and mix.

Wait for one minute. Hold the tube 2 - 3 cm from the colour scale, and compare.
The number next to the best colour match is the dissolved iron level in mg/l (ppm).

Reagent for ca. 50 tests supplied. Range: 0 - 5 ppm.

Use of soluble copper tablet test:
Fill small test tube to the top line with sample water.
Add 1 x Copper/Zinc LR tablet, crush, and mix.
Wait for one minute.
Hold the tube 2-3 cm from the colour scale, and compare.

The number next to the best colour match is the dissolved copper level in mg/l (ppm).

Reagent for ca. 50 tests supplied. Range: 0 - 5 ppm.

Use of chloride tablet test:
Fill the large test tube with sample water to the 50 ml mark.

Add 1 x Chloride tablet and shake to dissolve.

Sample will be YELLOW.

Continue adding Chloride tablets one at a time until colour changes to BROWN.

Note number of tablets used, and multiply by 20 to give the chloride level in mg/l (ppm).
Reagent for ca. 50 tests supplied.
Range: 0 - 300 ppm.

Use of total hardness drop test:
Using the large test tube, take a sample according to expected range (see manual).

Add 1 drop of HR reagent. The sample should be RED (if BLUE, see note).

Add drops of HR reagent one at a time until colour changes from red to pure blue.
Note number of drops used, and multiply by the appropriate factor for the size of water sample used.

Note: If the colour changes to blue after the addition of only one drop, then the range has been exceeded. Take a fresh water sample and use a smaller sample size.

Reagent for ca. 50 tests supplied. Range:
0 - 750 ppm as $CaCO_3$.

Use of inhibitor / molybdate tablet test for use with either System-Safe-DM or SystemSafe-DM Concentrate (read appropriate instructions)
Fill small test tube with sample water to the lower line (5ml mark if you have a graduated tube), and then add mains water up to top line (10ml mark).

Add 1 x Molybdate No.1 tablet, crush, and mix.
Add 1 x Molybdate No.2 tablet, crush, and mix.

Wait for one minute for colour to develop.
Hold the tube 2-3 cm from the colour scale, and compare.

The result is shown as mg/l (ppm) of molybdate.

Systemsafe DM
330 ppm molybdate is the optimum treatment level for Systemsafe-DM (1% by volume of system water).

Systemsafe DM Concentrate
100 ppm molybdate is the optimum treatment level for **Systemsafe-DM Concentrate** (0.5% by volume of system water).

Reagent for ca. 50 tests supplied. Range: 0 - 300 ppm.

pHScan 1 pH meter
An electronic pH meter is available, at extra cost, enabling the pH value of water to be determined with an accuracy of one decimal point.
A separate data sheet on the pH meter is available.

TDScan LOW (total dissolved solids) meter
An electronic total dissolved solids meter is available, at extra cost. This measures the conductivity of water and hence the level of total dissolved solids in solution.

A comparison of TDS levels between mains water and system water can be used to confirm the efficiency of a power flush - after flushing, both values should be almost identical.

A TDS meter can also be used to ensure correct dosing of inhibitor or flushing chemical into a system of unknown volume. For details, see the separate TDS meter data sheet.

Interpretation and significance of water analysis test results

Analysis / test	*Result of test*	*Interpretation / cause*	*Action to be taken by engineer*
pH	pH less than 6.	Acidic cleanser left in system.	Power flush system, check pH, and add Systemsafe-DM inhibitor.
	pH greater than 8.5.	Alkaline cleanser left in system or system may contain softened water.	Power flush system, refill with mains water, and add Systemsafe-DM inhibitor.
Dissolved iron	More than 1 mg/l above mains water.	1. If no inhibitor present, system is corroding.	Check for aeration (pumping over?). Repair any leaks, power flush and add Systemsafe-DM inhibitor.
		2. If inhibitor is present, corrosion may have stabilised.	Check again after four weeks. If iron content has increased, power flush and add Systemsafe-DM inhibitor.
Dissolved copper	More than 0.5 mg/l.	Flux residues left in system.	Power flush system, and add Systemsafe-DM inhibitor.
Chloride level	More than 25 mg/l, or 50% higher, than the reading for mains water.	Flux residues left in system.	Power flush system, and add Systemsafe-DM inhibitor.
Hardness	Mains water much harder than system water.	Limescale deposits in heat exchanger or boiler.	Descale boiler with Scalebreaker FX, Scalebreaker SR, or Power Flush FX2.
	Less than 2 mg/l hardness in system water.	Heating system contains softened water.	If aluminium heat exchanger or boiler, check pH level. If above 8.5, drain and refill system with mains water, and add Systemsafe-DM inhibitor.
SystemSafe-DM Inhibitor concentration	Less than 330 mg/l molybdate.	Insufficient inhibitor added, or system has leaked.	Check for leaks, and add further inhibitor to give 330 mg/l molybdate.
	More than 330 mg/l molybdate.	System over dosed with inhibitor.	If all other tests passed, no action needed.
SystemSafe-DM Concentrate Inhibitor concentration	Less than 100 mg/l molybdate.	Insufficient inhibitor added, or system has leaked.	Check for leaks, and add further inhibitor to give 100 mg/l molybdate.
	More than 100 mg/l molybdate.	System over dosed with inhibitor.	If all other tests passed, no action needed.
T.D.S. (Total dissolved solids)	Reading after power flushing higher than mains water.	Residue of cleanser or corrosion debris in system.	Continue flushing until T.D.S. value is similar to mains water.

Stockist: