



Boiler Feed and Scale Test Kit

BSC-1 (2350300)

DOC326.97.00095

Test preparation

CAUTION: Review the Safety Data Sheets (MSDS/SDS) for the chemicals that are used. Use the recommended personal protective equipment.

- Hold the dropper vertically above the sample. Do not let the dropper touch the bottle during the titration.
- Rinse the measuring tube, bottle or flask with sample before each test. Rinse with deionized water after each test.
- To verify the test accuracy, use a standard solution as the sample.

Alkalinity:

- Alkalinity is the capacity of water to neutralize acids. Carbonates, bicarbonates and hydroxides are the primary sources of alkalinity in water. In a boiler system, alkalinity is controlled to prevent corrosion from low pH and also to prevent scaling from calcium precipitates.
- To record the test result as gpg (grains per gallon), multiply the LR test result by 0.3 and the HR test result by 1.2

Chloride:

- Keep the silver nitrate titrant solution in the closed test kit case when not in use. The titrant solution slowly decomposes in light.
- To record the test result as mg/L sodium chloride (NaCl), multiply the chloride result by 1.65.
- In boiler water, the chloride concentration is used to determine when the dissolved solids have increased to a level that requires removal by blowdown.

Hardness:

- If the sample color is blue after the indicator is added, the water is soft.
- Hardness in boiler or cooling water can cause scale in the system and decrease the efficiency of the boiler or cooling tower.

Sample collection

- Collect samples in clean glass or plastic bottles.
- Analyze the samples at room temperature as soon as possible for best results.

Test procedure—Hardness (0–20 mg/L CaCO₃)



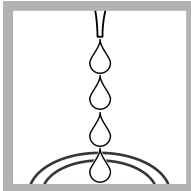
1. Fill the flask to the 100-mL mark with sample.



2. Add two full droppers of the Hardness 1 Buffer Solution.



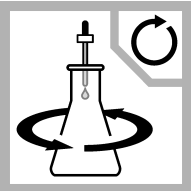
3. Swirl to mix.



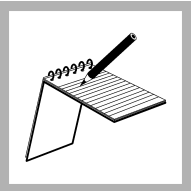
4. Add four drops of the Hardness 2 Indicator Solution. A pink color develops.



5. Swirl to mix.



6. Add the Hardness 3 Titrant Solution by drops. Swirl to mix after each drop. Count the drops until the color changes from pink to blue.



7. Record the number of drops. The number of drops of the titrant solution is the result in mg/L.

Replacement items

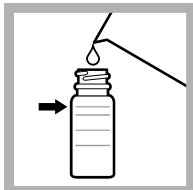
NOTE: Product and Article numbers may vary for some selling regions. Contact the appropriate distributor or refer to the company website for contact information.

Description	Unit	Item no.
Bromcresol Green-Methyl Red Indicator Powder Pillows	100/pkg	94399
Phenolphthalein Indicator Powder Pillows	100/pkg	94299
Sulfuric acid standard solution, 0.035 N	100 mL MDB	2349732
Chloride 2 Indicator Powder Pillows	100/pkg	104399
Chloride Titrant, Silver Nitrate, 0.0493 N	100 mL MDB	2349832
Flask, Erlenmeyer, 125 mL	each	50543
Hardness 1 Buffer Solution	100 mL MDB	42432
Hardness 2 Indicator Solution	100 mL MDB	42532
Hardness 3 Titrant Solution	100 mL MDB	42632
Bottle, square, 29 mL, with 10, 15, 20 and 23-mL marks	6/pkg	232706
Measuring tube, plastic, 5.83 mL	each	43800

Optional items

Description	Unit	Item no.
Alkalinity standard solution, 500 mg/L as CaCO ₃	1 L	2826253
Chloride standard solution, 100 mg/L Cl ⁻	1000 mL	2370853
Dropper, glass, 0.5- and 1.0-mL marks	5/pkg	1419705
Filter paper, 2–3 micron, pleated, 12.5 cm	100/pkg	189457
Flask, Erlenmeyer, 125 mL	each	50543
Funnel, poly, 65 mm	each	108367
Hardness standard solution, 5 mg/L as CaCO ₃	1 L	2696353
Hydrogen Peroxide Solution, 30%, ACS	473 mL	14411
Sulfide Inhibitor Reagent Powder Pillows	100/pkg	241899
Water, deionized	500 mL	27249

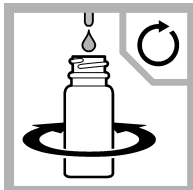
Test procedure—Alkalinity (0–100 mg/L CaCO₃)



1. Fill the bottle to the 23-mL mark with sample.



2. Add one Phenolphthalein Indicator Powder Pillow. Swirl to mix. If the solution is colorless, the Phenolphthalein (P) alkalinity is zero. Go to step 5.



3. Add the 0.035 N Sulfuric Acid Standard Solution by drops. Mix after each drop. Count the drops until the color changes from pink to colorless.



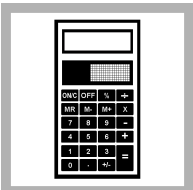
4. Multiply the number of drops by 5 to get the phenolphthalein alkalinity result as CaCO₃.



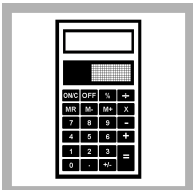
5. Add one Bromocresol Green-Methyl Red Powder Pillow. Swirl to mix.



6. Add the 0.035 N Sulfuric Acid Standard Solution by drops. Mix after each drop. Count the drops until the color changes from green to pink.

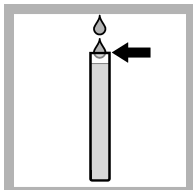


7. Add the number of drops from step 3 and step 6.



8. Multiply the total number of drops by 5 to get the total (methyl orange) alkalinity result as CaCO₃.

Test procedure—Alkalinity (0–400 mg/L CaCO₃)



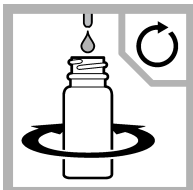
1. Fill the measuring tube with sample.



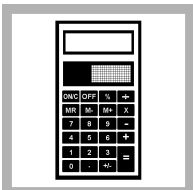
2. Pour the sample into the mixing bottle.



3. Add one Phenolphthalein Indicator Powder Pillow. Swirl to mix. If the solution is colorless, the Phenolphthalein (P) alkalinity is zero. Go to step 6.



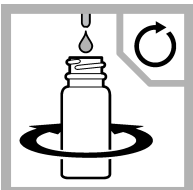
4. Add the 0.035 N Sulfuric Acid Standard Solution by drops. Mix after each drop. Count the drops until the color changes from pink to colorless.



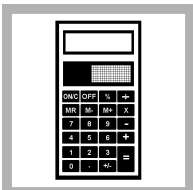
5. Multiply the number of drops by 20 to get the phenolphthalein alkalinity result as CaCO₃.



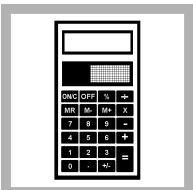
6. Add one Bromocresol Green-Methyl Red Powder Pillow. Swirl to mix.



7. Add the 0.035 N Sulfuric Acid Standard Solution by drops. Mix after each drop. Count the drops until the color changes from green to pink.



8. Add the number of drops from step 4 and step 7.



9. Multiply the total number of drops by 20 to get the total (methyl orange) alkalinity result as CaCO₃.

Determine the alkalinity relationships

The primary forms of alkalinity in water are hydroxide, carbonate and bicarbonate ions. The concentration of these ions in a sample can be determined from the phenolphthalein alkalinity and total alkalinity values. Refer to [Table 1](#) and the steps that follow to determine the hydroxide, carbonate and bicarbonate alkalinities.

- If the phenolphthalein (P) alkalinity is 0 mg/L, use Row 1.
- If the phenolphthalein (P) alkalinity is equal to the total alkalinity, use Row 2.
- Divide the total alkalinity by 2 to calculate one-half of the total alkalinity.
 - Compare the phenolphthalein (P) alkalinity to one-half of the total alkalinity. Then, use Row 3, 4 or 5.
 - Do the calculations in the row (if applicable).
- Make sure that the sum of the three alkalinity types is equal to the total alkalinity.

Example:

A sample has 170 mg/L as CaCO₃ phenolphthalein alkalinity and 250 mg/L as CaCO₃ total alkalinity.

The phenolphthalein alkalinity of 170 mg/L is more than one-half of the total alkalinity, so use Row 5.

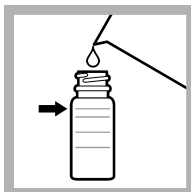
- Hydroxide alkalinity: $2 \times 170 = 340$; $340 - 250 = 90$ mg/L hydroxide alkalinity
- Carbonate alkalinity: $250 - 170 = 80$; $80 \times 2 = 160$ mg/L carbonate alkalinity
- Bicarbonate alkalinity: 0 mg/L

Sum of the alkalinity types: 90 mg/L hydroxide alkalinity + 160 mg/L carbonate alkalinity + 0 mg/L bicarbonate alkalinity = 250 mg/L total alkalinity.

Table 1 Alkalinity relationships

Row	Titration result	Hydroxide alkalinity	Carbonate alkalinity	Bicarbonate alkalinity
1	P alkalinity = 0	0	0	= Total alkalinity
2	P alkalinity = Total alkalinity	= Total alkalinity	0	0
3	P alkalinity is less than ½ of Total alkalinity	0	= P alkalinity × 2	= Total alkalinity – (P alkalinity × 2)
4	P alkalinity = ½ Total alkalinity	0	= Total alkalinity	0
5	P alkalinity is more than ½ Total alkalinity	= (P alkalinity × 2) – Total alkalinity	= (Total alkalinity – P alkalinity) × 2	0

Test procedure—Chloride (0–100 mg/L Cl⁻)



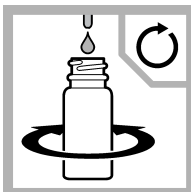
- Fill the bottle to the 23-mL mark with sample.



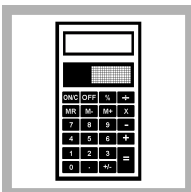
- Add one Chloride 2 Indicator Powder Pillow.



- Turn the bottle left and right to mix.

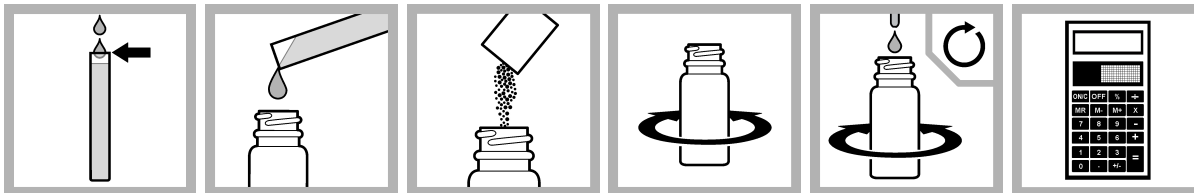


- Add the Silver Nitrate Titrant Solution by drops. Mix after each drop. Count the drops until the color changes to red-brown.



- Multiply the total number of drops by 5 to get the result in mg/L.

Test procedure—Chloride (0–400 mg/L Cl⁻)



1. Fill the measuring tube with sample.
2. Pour the sample into the mixing bottle.
3. Add one Chloride 2 Indicator Powder Pillow.
4. Turn the bottle left and right to mix.
5. Add the Silver Nitrate Titrant Solution by drops. Mix after each drop. Count the drops until the color changes to red-brown.
6. Multiply the total number of drops by 20 to get the result in mg/L.

Interferences—chloride test

Interfering substance	Interference level
Bromide	Interferes directly and is included in the test result.
Cyanide	Interferes directly and is included in the test result.
Iodide	Interferes directly and is included in the test result.
Iron	Concentrations that are more than 20 mg/L prevent the color change at the endpoint.
Orthophosphate	Concentrations that are more than 25 mg/L cause a precipitate to form.
Highly buffered samples or extreme sample pH	Can prevent the correct pH adjustment (of the sample) by the reagents. Sample pretreatment may be necessary.
Sulfide	Remove sulfide interference as follows: <ol style="list-style-type: none"> 1. Add the contents of one Sulfide Inhibitor Reagent Powder Pillow to approximately 125 mL of sample. 2. Mix for 1 minute. 3. Pour the solution through folded filter paper in a funnel. 4. Use the filtered sample in the chloride test procedure.
Sulfite	Concentrations that are more than 10 mg/L interfere with this method. To remove sulfite interference, add 3 drops of 30% Hydrogen Peroxide to the sample, then start the test.

