Hardness, Total, LR

DOC316.53.01514

Colorimetric Method **Method 10284**

3 to 100 mg/L as $CaCO_3$ **Chemkey® Reagents**

Scope and application: For boiler water and drinking water.

Test preparation

Before starting

Make sure that the sample is colorless and the turbidity value is less than 20 NTU.
Use a new Chemkey for each measurement.
Do not touch the Chemkey with hands.
Do not move the Chemkey after it is installed in the meter.
The display shows a progress bar with the time that remains until the measurement is completed. Different parameters have different reaction times.
The meter automatically identifies the type of Chemkey(s) that is installed.
Refer to the meter documentation for additional information.
The Chemkeys are articles and have no MSDS/SDS.
Dispose of reacted solutions according to local, state and federal regulations. Refer to the environmental, health and safety staff for your facility and/or local regulatory agencies for further disposal information.

Items to collect

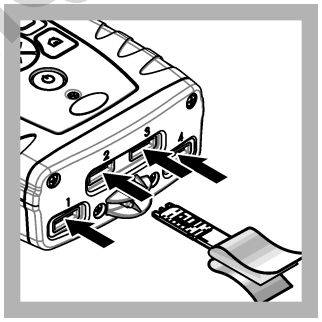
Description	Quantity
Total Hardness Low Range Chemkey Reagents	1

Refer to Consumables and replacement items on page 3 for order information.

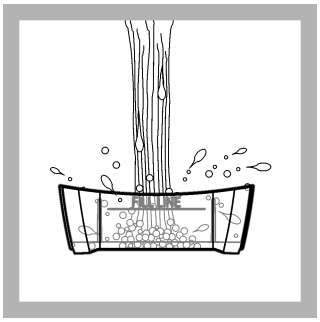
Test procedure



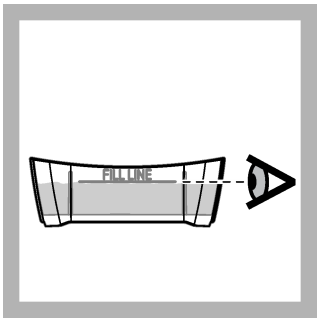
1. Peel back the packaging to show the end of the Chemkey. Do not touch the Chemkey with hands.



2. Put the Chemkey quickly in one movement into any slot. Carefully remove the packaging from the Chemkey.

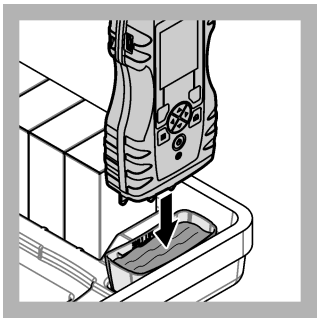


3. Rinse the sample cup with the sample.

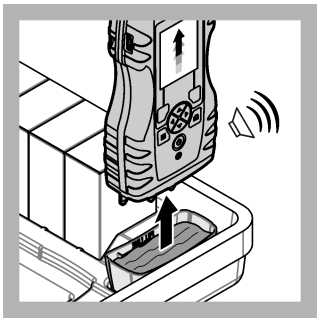


4. Fill the sample cup to the fill-line with sample.

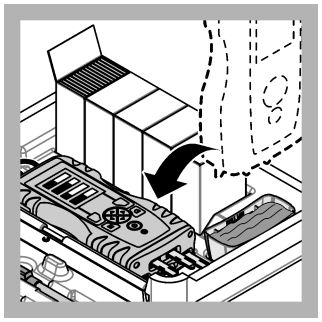
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5. Put the meter into the sample cup.



6. Wait for the sound alert and/or the meter removal animation (within 1 to 2 seconds), then immediately remove the meter from the sample cup.



7. Put the meter back into the case. Wait for the measurement to complete.

Interferences

The substances that are shown in Table 1 interfere in the total hardness determination at the given concentrations. The interference from some substances can be prevented by pretreatment of the sample as shown in the table. If the sample is pretreated, use the pretreated sample only for the applicable parameter. Do not use a pretreated sample to measure multiple parameters.

Table 2 shows the substances that were tested and do not interfere at or below the levels that are shown.

Table 1 Interfering substances

Interfering substance	Interference level
Copper	Levels above 0.10 mg/L result in a positive interference
Sodium and Potassium	High levels can result in a positive interference
Silica	Silica above 20 mg/L results in a negative interference
Iron	Iron above 0.20 mg/L results in a positive interference in the 3–20 mg/L hardness range. Iron above 1.0 mg/L results in a positive interference in the full hardness range of 3–100 mg/L.
Highly buffered samples or extreme sample pH	Sample pre-treatment may be necessary for highly buffered solutions. Sample pH above 12 or below 4 may need adjustment. If adjustment is necessary adjust approximately to pH 10.

Table 2 Non-interfering substances

Substance	Maximum level tested	Substance	Maximum level tested
Alkalinity (as $CaCO_3$)	700 mg/L	Nitrate (NO_3^-–N)	50 mg/L
Aluminum (as Al^{3+})	0.2 mg/L	Phosphate (PO_4^{3-})	50 mg/L
Chloride (Cl^-)	400 mg/L	Potassium (K^+)	100 mg/L
Copper (Cu^{2+})	0.1 mg/L	Silica (SiO_2)	20 mg/L
Fluoride (as F^-)	4.0 mg/L	Sodium (Na^+)	1000 mg/L
Manganese (Mn^{2+})	0.2 mg/L	Sulfate (SO_4^{2-})	500 mg/L
Monochloramine (as Cl_2)	3.0 mg/L	Zinc (Zn^{2+})	0.1 mg/L

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Accuracy check

Standard solution method

Use the standard solution method to validate the test procedure, the reagents and the instrument.

Items to collect:

- 10,000-mg/L as $CaCO_3$ Calcium Hardness Standard Solution (Voluette Ampule)
- 200-mL volumetric flask, Class A
- Pipet, adjustable volume, 0.2–1.0 mL and pipet tip
- Deionized water

1. Prepare a 10-mg/L calcium hardness standard solution as follows:
   a. Use a pipet to add 0.2 mL of the calcium hardness standard solution into the volumetric flask.
   b. Dilute to the mark with deionized water. Mix well. Prepare this solution daily.
2. Use the test procedure to measure the concentration of the prepared standard solution.
3. Compare the expected result to the actual result.

   Note: *The factory calibration can be adjusted slightly with the standard adjust option so that the instrument shows the expected value of the standard solution. The adjusted calibration is then used for all test results. This adjustment can increase the test accuracy when there are small variations in the reagents or instruments.*

Method Performance

The method performance data that follows was derived from laboratory tests during ideal test conditions. Users can get different results under different test conditions.

Standard	Precision (95% confidence interval)	Sensitivity Concentration change per 0.010 Abs change
10 ppm $CaCO_3$	8.6–11.4 mg/L $CaCO_3$	0.29 mg/L $CaCO_3$
50 ppm $CaCO_3$	45.2–54.8 mg/L $CaCO_3$	0.73 mg/L $CaCO_3$

Summary of method

At an optimal pH, an indicator molecule changes color when reacts with magnesium and calcium. This color change is monitored to determine the total hardness accurately.

Consumables and replacement items

Description	Quantity/Test	Unit	Item no.
Total Hardness Low Range Chemkey® Reagents	1	25/pkg	8636400
Sample cup	1	each	9418100

Recommended standards

Description	Unit	Item no.
Calcium Chloride Standard Solution, 1000-mg/L as $CaCO_3$	1 L	12153
Hardness Standard Solution, 10,000-mg/L as $CaCO_3$, 10-mL Voluette ampule	16/pkg	218710

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Optional reagents and apparatus

Description	Unit	Item no.
Ampule Breaker, 10-mL Voluette® Ampules	each	2196800
Flask, volumetric, Class A, 200 mL	each	1457445
Pipette, adjustable volume, 0.1–1.0 mL	each	BBP078
Pipette tips, for 0.1–1.0 mL pipette	100/pkg	BBP079
Water, deionized	4 L	27256

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HACH COMPANY
WORLD HEADQUARTERS
Telephone: (970) 669-3050
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