

Residual Hardness

Principle

Calcium and magnesium ions react with the reagent to give a violet dye.

Range of Application

Raw and drinking water, precipitation water, boiler water, process control

Storage Information

The test reagents are stable at +15 to +25°C up to the expiry date given on the package.

Interferences

There are no known interferences when the tests are used with drinking water and boiler water.

The measurement results must be subjected to plausibility checks (dilute and/or spike the water sample).

Special note

Measurement units of hardness (°dH):

Definition:

1 degree hardness, german (°d) = 10 mg CaO/L
 1 degree hardness, french (°f) = 10 mg CaCO₃/L
 1 degree hardness, english (°e) = 14.3 mg CaCO₃/L

Conversion table

	mmol/L CaCO ₃	°d	°f	°e
1 mmol/L CaCO ₃	1.00	5.60	10.00	7.02
1 °d	0.18	1.00	1.78	1.25
1 °f	0.10	0.560	1.00	0.702
1 °e	0.14	0.798	1.43	1.00

pH/Temperature

The pH of the water sample must be between pH 4 and pH 9.
 The temperature of the water sample and reagents must be between 15 and 25°C.

Safety Advice

On grounds of quality and reliability, the analysis should be carried out only with original HACH LANGE accessories.

CADAS 100 (LPG 185)

If this test is not already stored in your instrument please ask your HACH LANGE Agency for programming instructions.

Applies to all types of photometer

Residual Hardness

Edition 06/1997

Pipette into the cuvette test	
Buffer solution A (LCK 427 A)	2.0 mL
Water sample	5.0 mL
Close cuvette and invert a few times. After 2 min thoroughly clean the outside of the cuvette and evaluate.	

Data table

LCK 427

LP2W	06/1997
°dH/Ca/Mg • F ₁ = 3.9 • F ₂ = 4.251 • F ₃ = 5.8 • K = 0	
CADAS 30/30S/50/50S	06/1997
°dH/Ca/Mg • λ: 572 nm • Pro.: 5 • F ₁ = 2.62 • F ₂ = 4.4 • F ₃ = 7.06 • K = 0	
ISIS 6000/9000	06/1997
°dH/Ca/Mg • λ: 588 nm • Pro.: 5 • F ₁ = 3.741 • F ₂ = 6.740 • F ₃ = 5.041 • K ₁ = 0.048 • K ₂ = -0.052	
CADAS 100 / LPG 185	06/1997
°dH/Ca/Mg • λ: 572 nm • F ₁ = 0.2 • F ₂ = 2.5 • F ₃ = -2.625 • F ₄ = -0.079 • F ₅ = 4.3 • F ₆ = -6.88 • F ₇ = 0.129 • F ₈ = 0.14 • F ₉ = 0.23	
CADAS 100 / ≥ LPG 210	06/1997
°dH/Ca/Mg • λ: 572 nm • F ₁ = 0.2 • F ₂ = 2.5 • F ₃ = 2.625 • F ₄ = 0.079 • F ₅ = 4.3 • F ₆ = 6.88 • F ₇ = 0.129 • F ₈ = 0.14 • F ₉ = 0.23	

Residual Hardness

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Evaluation

1. Select »Barcode Programs«.
2. Select test number (see below).
3. Control number must be **9**.
4. Insert zero-solution cuvette and press »Zero«.
5. Insert sample cuvette and press »Read 1«.
6. Remove sample cuvette.

Pipette into the same cuvette	
Masking solution B (LCK 427 B)	0.2 mL
Close cuvette and invert a few times. Clean the outside of the cuvette.	

7. After **30 sec** insert sample cuvette again and press »Read 2«.

The result is displayed in residual hardness, Ca, and Mg.

If more than one sample is to be measured start the next evaluation at point 5.

Parameter	Test-No.	Meas. range
Residual Hardness (°dH)	427	0.02 – 0.6 °dH
Calcium (Ca)		0.1 – 2.0 mg/L
Magnesium (Mg)		0.15 – 2.0 mg/L

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Evaluation

1. Press "Mode" key and check program control number: **__ : 18**
2. Insert program filter **560 nm**.
3. Select test with "Mode" key.
4. Insert zero-solution cuvette.
5. Insert sample cuvette.
6. Remove sample cuvette.

Pipette into the same cuvette	
Masking solution B (LCK 427 B)	0.2 mL
Close cuvette and invert a few times. Clean the outside of the cuvette.	

7. Insert sample cuvette again.
After **30 sec** an acoustic signal is heard and the result is displayed in °dH, followed by the result for calcium then the result for magnesium. Each result is displayed for 20 sec, and the latter two are expressed in mg/L.

Parameter	Display	Meas. range
Residual Hardness (°dH)	R-Har LCK 427	0.02 – 0.6 °dH
Calcium (Ca)		0.1 – 2.0 mg/L
Magnesium (Mg)		0.15 – 2.0 mg/L

Residual Hardness

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Evaluation

1. Press any key.
2. Check program control number: (≥) **__ : 39 b**
3. Select test with ↑ or ↓ key.
4. Insert zero-solution cuvette.
5. Insert sample cuvette.
6. Remove sample cuvette.

Pipette into the same cuvette	
Masking solution B (LCK 427 B)	0.2 mL
Close cuvette and invert a few times. Clean the outside of the cuvette.	

7. Insert sample cuvette again.
After **30 sec** an acoustic signal is heard and the result is displayed in °dH.

Parameter	Display	Meas. range
Residual Hardness (°dH)	R-H LCK 427	0.02 – 0.6 °dH

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Evaluation

1. Insert filter **588 nm**.
2. Select »Dr. Lange« mode.
3. Select test number (see below).
4. Control number must be **9**.
5. Insert zero-solution cuvette and press blue key.
6. Insert sample cuvette and press green key.
7. Remove sample cuvette.

Pipette into the same cuvette	
Masking solution B (LCK 427 B)	0.2 mL
Close cuvette and invert a few times. Clean the outside of the cuvette.	

8. After **30 sec** insert sample cuvette again and press green key.

The result is displayed in residual hardness, Ca, and Mg.

If more than one sample is to be measured start the next evaluation at point 6.

Parameter	Test-No.	Meas. range
Residual Hardness (°dH)	427	0.02 – 0.6 °dH
Calcium (Ca)		0.1 – 2.0 mg/L
Magnesium (Mg)		0.15 – 2.0 mg/L

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Evaluation

1. Insert program filter **550 nm**.
2. Press "Tests" key until display (see below) appears.
3. Control number must be **1**.
4. Insert zero-solution cuvette and press "Null" (zero) key.
5. Insert sample cuvette and press "Ergebnis" (result) key.
6. Remove sample cuvette.

Pipette into the same cuvette	
Masking solution B (LCK 427 B)	0.2 mL
Close cuvette and invert a few times. Clean the outside of the cuvette.	

7. After **30 sec** insert sample cuvette again and press "Ergebnis" (result) key.

The result is displayed in °dH. The results for Ca/Mg/residual hardness can be called up one after another by pressing the key ↑.

If more than one sample is to be measured start the next evaluation at point 5.

Parameter	Display	Meas. range
Residual Hardness (°dH)	Hardn. LCK 427	0.02 – 0.6 °dH
Calcium (Ca)		0.1 – 2.0 mg/L
Magnesium (Mg)		0.15 – 2.0 mg/L

Residual Hardness

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Evaluation

1. Insert filter **550 nm**.
2. Insert zero-solution cuvette and press "Null" (zero) key.
3. Insert sample cuvette and press "Extinktion" (extinction) key.
Make a note of the display – **Ext. 1**
4. Remove sample cuvette.

Pipette into the same cuvette	
Masking solution B (LCK 427 B)	0.2 mL
Close cuvette and invert a few times. Clean the outside of the cuvette.	

5. After **30 sec** insert sample cuvette again and press "Extinktion" (extinction) key.
Make a note of the display – **Ext. 2**

Calculation:

$$A = \text{Ext. 1} - (\text{Ext. 2} \times 1.09)$$

$$\text{Residual hardness } ^\circ\text{dH} = (A \times 0.545) + (\text{Ext. 2} \times 1.34)$$

$$\text{mg/L calcium} = A \times 3.9$$

$$\text{mg/L magnesium} = \text{Ext. 2} \times 5.8$$

Parameter	Meas. range
Residual Hardness (°dH)	0.02 – 0.6 °dH
Calcium (Ca)	0.1 – 2.0 mg/L
Magnesium (Mg)	0.15 – 2.0 mg/L



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Evaluation

1. Insert zero-solution cuvette.
2. Insert sample cuvette.
3. Remove sample cuvette.

Pipette into the same cuvette	
Masking solution B (LCK 427 B)	0.2 mL
Close cuvette and invert a few times. Clean the outside of the cuvette.	

4. After **30 sec** insert sample cuvette again.

CADAS 30/50, ISIS 9000:

The result is displayed in °dH. The results for Ca/Mg/residual hardness can be called up one after another by pressing the key under the symbol " → ".

CADAS 30S/50S/200, LASA 50/100, XION 500, DR 2800/3800/3900/5000/6000:

The result is displayed in residual hardness, Ca, and Mg.

If more than one sample is to be measured start the next evaluation at point 2.

Parameter	Meas. range
Residual Hardness (°dH)	0.02 – 0.6 °dH
Calcium (Ca)	0.1 – 2.0 mg/L
Magnesium (Mg)	0.15 – 2.0 mg/L

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Evaluation

1. Check program control number: __ : **38**
2. Select test number (see below).
3. Control number must be **9**.
4. Insert zero-solution cuvette and press blue key.
5. Insert sample cuvette and press green key.
6. Remove sample cuvette.

Pipette into the same cuvette	
Masking solution B (LCK 427 B)	0.2 mL
Close cuvette and invert a few times. Clean the outside of the cuvette.	

7. After **30 sec** insert sample cuvette again and press green key.

The result is displayed in residual hardness, Ca, and Mg.

If more than one sample is to be measured start the next evaluation at point 5.

Parameter	Test-No.	Meas. range
Residual Hardness (°dH)	427	0.02 – 0.6 °dH
Calcium (Ca)		0.1 – 2.0 mg/L
Magnesium (Mg)		0.15 – 2.0 mg/L

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Evaluation

1. Check program control number: __ : **32**
2. Select »CUVETTE TEST« mode.
3. Select test number (see below).
4. Control number must be **9**.
5. Insert zero-solution cuvette and press blue key.
6. Insert sample cuvette and press green key.
7. Remove sample cuvette.

Pipette into the same cuvette	
Masking solution B (LCK 427 B)	0.2 mL
Close cuvette and invert a few times. Clean the outside of the cuvette.	

8. After **30 sec** insert sample cuvette again and press green key.

The result is displayed in °dH. The results for Ca/Mg/residual hardness can be called up one after another by pressing the key under the symbol " → " .

If more than one sample is to be measured press the key under the symbol " ↑ " and start the next evaluation at point 6.

Parameter	Test-No.	Meas. range
Residual Hardness (°dH)	427	0.02 – 0.6 °dH
Calcium (Ca)		0.1 – 2.0 mg/L
Magnesium (Mg)		0.15 – 2.0 mg/L

Residual Hardness

Edition 06/1997

Evaluation

1. Select »TEST« mode.
2. Select symbol (see below). / 3. Select symbol » > «.
4. Check factors and measuring wavelength in memory »Mem«.
5. Close cuvette compartment – without cuvette – and press "NULL" (zero) key.
6. Insert zero-solution cuvette. Press "MESS" (measure) key.
7. Remove zero-solution cuvette; close cuvette compartment – without cuvette – and press "NULL" (zero) key.
8. Insert sample cuvette and press "MESS" (measure) key.
9. Remove sample cuvette; close cuvette compartment – without cuvette – and press "NULL" (zero) key.

Pipette into the same cuvette	
Masking solution B (LCK 427 B)	0.2 mL
Close cuvette and invert a few times. Clean the outside of the cuvette.	

10. After **30 sec** insert sample cuvette again and press "MESS" (measure) key.

The result is printed out in residual hardness, Ca, and Mg.

If more than one sample is to be measured start the next evaluation at point 5.

Parameter	Symbol	Meas. range
Residual Hardness (°dH)	\$ 427	0.02 – 0.6 °dH
Calcium (Ca)		0.1 – 2.0 mg/L
Magnesium (Mg)		0.15 – 2.0 mg/L

Residual Hardness

Edition 06/1997

Evaluation

1. Select »TEST« mode.
2. Select symbol (see below).
3. Control number must be **9**.
4. Close cuvette compartment – without cuvette – and press "NULL" (zero) key.
5. Insert zero-solution cuvette. Press "MESS" (measure) key.
6. Insert sample cuvette and press "MESS" (measure) key.
7. Remove sample cuvette.

Pipette into the same cuvette	
Masking solution B (LCK 427 B)	0.2 mL
Close cuvette and invert a few times. Clean the outside of the cuvette.	

8. After **30 sec** insert sample cuvette again and press "MESS" (measure) key.

The result is printed out in residual hardness, Ca, and Mg.

If more than one sample is to be measured start the next evaluation at point 5.

Parameter	Symbol	Meas. range
Residual Hardness (°dH)	427	0.02 – 0.6 °dH
Calcium (Ca)		0.1 – 2.0 mg/L
Magnesium (Mg)		0.15 – 2.0 mg/L