

## Bruksanvisning dH test:

Fyll vatten i provröret till 1:a röda strecket markerat "5 ml"

Tillsätt 3 droppar från flaska märkt "H-1"

Skaka eller "rotera" provet tills färgämnet löst sig.

Provet blir rött OM det innehåller kalk, grönt eller mörkt om det INTE innehåller kalk.

Blir provet rött, tillsätt 1 droppe ur flaska "H-2" , rotera provet.

Tillsätt ytterligare droppe från flaska "H-2", rotera provet.

Fortsätt på samma sätt tills provet ändrar färg till grönt eller svart/mörkt.

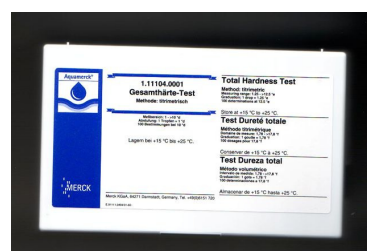
Den röda färgen försvinner vid aktuell hårdhet.

**Antal droppar från flaska "H-2"=hårdhet i tyska grader °dH**

*Då exaktare mätning erfordras mät upp vattenmängden med*

*mätinstrumentet, fyll 10 ml i provröret samt använd 6 droppar ur flaska "H-1"*

*Varje droppe ur flaska "H-2" motsvarar nu 0.5 dH*





## 1. Definition

The hardness (total hardness) of a given water is due to its content of salts of the alkaline earth metals calcium, magnesium, strontium, and barium ("hardening constituents"). Since strontium and barium are generally present in waters only in traces, the hardness is defined as the content in a water of calcium ions,  $\text{Ca}^{2+}$ , and magnesium ions,  $\text{Mg}^{2+}$  ("hardness ions"). The conventional procedure is to relate the statement of the water hardness only to calcium, in other words to express also the content of magnesium ions as calcium content. Practical measurement units for the hardness that are frequently employed are the English degree and the German degree. These are defined as follows:

$$1 \text{ } ^\circ\text{e} = 14.29 \text{ mg/l CaCO}_3$$

$$1 \text{ } ^\circ\text{d} = 10 \text{ mg/l CaO} (= 1.25 \text{ } ^\circ\text{e})$$

## 2. Method

### Titrimetric determination with dropping bottle

Calcium and magnesium ions react with an indicator to form a red complex compound. The indicator is released from this compound by titration with a solution of ethylenedinitrilotetraacetic acid disodium salt dihydrate (Titriplex® III). At the titration end-point the colour changes to green. The total hardness is determined from the consumption of titration solution.

## 3. Measuring range and number of determinations

Graduation	Number of determinations <sup>1)</sup>
1 drop $\hat{=}$ 1.25 °e 7.1 mg/l Ca	100 at 12.5 °e at 71.5 mg/l Ca

<sup>1)</sup> In the case of total hardness values exceeding 12.5 °e, the maximum number of determinations possible is fewer than 100 (see section 11).

## 4. Applications

### Sample material:

Groundwater and surface water  
Drinking water  
Mineral water and curative water  
Boiler water

## 5. Influence of foreign substances

Cadmium, cobalt, iron, copper, nickel, mercury, and zinc interfere with the determination.

## 6. Reagents and auxiliaries

The reagents in the test are stable up to the date stated on the pack when stored closed at +15 to +25 °C.

### Package contents:

1 bottle of reagent H-1 (indicator solution)  
2 bottles of reagent H-2 (titration solution)  
1 graduated 5-ml plastic syringe  
1 test vessel

### Other reagents:

Universal indicator strips pH 0 - 14, Cat. No. 1.09535.0001  
Sodium hydroxide solution 1 mol/l, Cat. No. 1.09137.  
Hydrochloric acid 1 mol/l, Cat. No. 1.09057.  
Calcium chloride dihydrate GR for analysis, Cat. No. 1.02382.

## 7. Preparation

The pH must be within the range 6 - 8.

Adjust, if necessary, with sodium hydroxide solution or hydrochloric acid.

## 8. Procedure

Rinse the test vessel several times with the pretreated sample.

Pretreated sample	5 ml	Inject into the test vessel with the syringe.
Reagent H-1	3 drops	Add and swirl. The sample turns red in colour in the presence of hardening constituents.

Holding the reagent bottle upright, slowly and with swirling add reagent H-2 to the sample dropwise until its colour changes from red via grey-violet (shortly before the complete colour change) to green. Shortly before the colour changes, wait a few seconds after adding each drop.

Result in °e = number of drops x 1.25

## Evaluation:

Hardness range	°e	mmol/l (Ca + Mg)	mg/l Ca	Designation of the water
	I	<9	<1.3	
II	9 - 17.5	1.3 - 2.5	50 - 100	moderately hard
III	17.5 - 26	2.5 - 3.8	100 - 150	hard
IV	>26	>3.8	>150	very hard

## 9. Conversions

required given	mmol/l (Ca + Mg)	mg/l (ppm) Ca	German degree °d	English degree °e	French degree °f	mg/l (ppm) CaCO <sub>3</sub>
1 mmol/l (Ca + Mg)	1	40.08	5.61	7.00	10.01	100.1
1 mg/l (ppm) Ca	0.025	1	0.140	0.175	0.250	2.50
1 German degree °d	0.178	7.15	1	1.25	1.78	17.85
1 English degree °e	0.143	5.72	0.800	1	1.43	14.29
1 French degree °f	0.100	4.00	0.560	0.700	1	10.00
1 mg/l (ppm) CaCO <sub>3</sub>	0.010	0.400	0.056	0.070	0.100	1

## 10. Method control

To check test reagents and handling:

Dissolve 3.668 g of calcium chloride dihydrate in distilled water, make up to 1000 ml with distilled water, and mix. Ca content: 1000 mg/l (175 °e). Dilute this standard solution to 50 mg/l Ca (= 8.75 °e) and analyze as described in section 8.

## 11. Notes

- Reclose the reagent bottles immediately after use.
- Rinse the test vessel and the syringe with distilled water only.
- In titrimetric determinations the consumption of titration solution is dependent on the concentration of the substance to be determined (here: the hardness ions). The quantities of indicator and titration solution contained in the reagent bottles have been calculated to suffice for 100 determinations each of 12.5 °e. The following applies for softer or harder waters:

Hardness °e	Number of determinations	Indicator solution	Titration solution
1.25 - <12.5	100	is used up completely	A remainder is left over.
>12.5	<100	A remainder is left over.	is not sufficient for 100 determinations



**Gesamthärte**  
**Total hardness**  
**Dureté totale**  
**Durezza total**

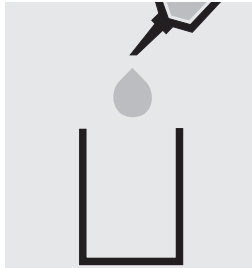
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**Aquamerck**

**Messbereich / Measuring range / Domaine de mesure / Intervalo de medida :**

1 Tropfen / 1 drop / 1 goutte / 1 gota

= 1 °d = 1.25 °e = 1.8 °f = 18 mg/l (de) CaCO<sub>3</sub>

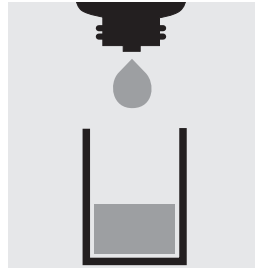


5 ml Wasserprobe in das Testglas pipettieren.

Pipet 5 ml of the water to be tested into the test vessel.

Pipetter 5 ml d'eau à analyser dans le tube à essai.

Pipetear 5 ml de la muestra de agua en el recipiente de ensayo.

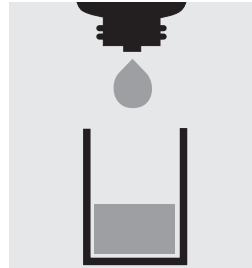


3 Tropfen **H-1** zugeben und mischen; die Lösung färbt sich rot.

Add 3 drops of **H-1** and mix; the solution becomes red.

Ajouter 3 gouttes de **H-1** et mélanger; l'échantillon se colore en rouge.

Añadir 3 gotas de **H-1** y mezclar; la solución se colorea de rojo.



Unter Umschwenken **H-2** zutropfen bis die Farbe von Rot nach Grün umschlägt.

While swirling add **H-2** until the red colour turns to green.

Ajouter goutte à goutte la solution **H-2** tout en agitant le tube jusqu'à virage au vert de la couleur rouge.

Bajo agitación por balanceo, añadir gota a gota **H-2** hasta que el color rojo vire a verde.



Tropfen zählen.

Count the drops.

Compter les gouttes.

Contar las gotas.