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# Test kits for water analysis

**VISOCOLOR® test kits and reagent cases**  
**photometer PF-12 • VISOCOLOR® photino**

## Compact and flexible

- Complete mini-laboratories with reagents and accessories for water analysis
- Chemical analysis without additional accessories and without any prior experience in chemistry
- Suitable for analysis in the lab, in schools or on-site
- 3 product lines with different accuracies, precisions and sensitivities for universal use depending on the analytical request
- Various measuring methods and detection principles for all parameters from acidity to zinc
- VISOCOLOR® reagent cases as portable laboratories with individual combinations of different test kits

## Simple and precise

- Comfortable test procedures since test kits are based on simple chemical-analytical methods like colorimetry and titration
- Instructions in different languages and with pictograms for a safe and simple performance of the tests
- Colour-coded reagent bottles for clear identification of reagents
- Fast-dissolving reagents save time and facilitate the daily work – no crushing of tablets and no stirring of reaction solutions are necessary

## Reliable and safe

- Reliable and comparable results – the reaction principles of VISOCOLOR® tests are based on internationally acknowledged regulations like DIN-, EN-, ISO- and EPA standards
- Maximum safety for the user and easy disposal of used reagents by avoiding of dangerous and environmentally hazardous substances
- Low susceptibility towards interferences, high selectivity regarding to the substance to be analyzed as well as compensation of turbidities and colours guarantee reliable results
- Additional increase of accuracy and reproducibility by photometric determination of VISOCOLOR® ECO tests with the photometers PF-12 and VISOCOLOR® photino



VISOCOLOR® alpha uses colorimetric, as well as titrimetric procedures. Use of multicomponent reagents results in a very convenient, rapid and safe handling, because often only one reagent is needed for each test.

The reagent bottles are packed in practical blister packs. The slidable cardboard back is used for opening and closing the

package, and also provides all information required for the test: instructions for use in 6 languages with pictographs, as well as a colour comparison chart for colorimetric evaluations. The blister packs of the VISOCOLOR® alpha test kits have a punched hole for convenient storage or display in showrooms or at sales counters.

### Colorimetric Tests

#### Principle:

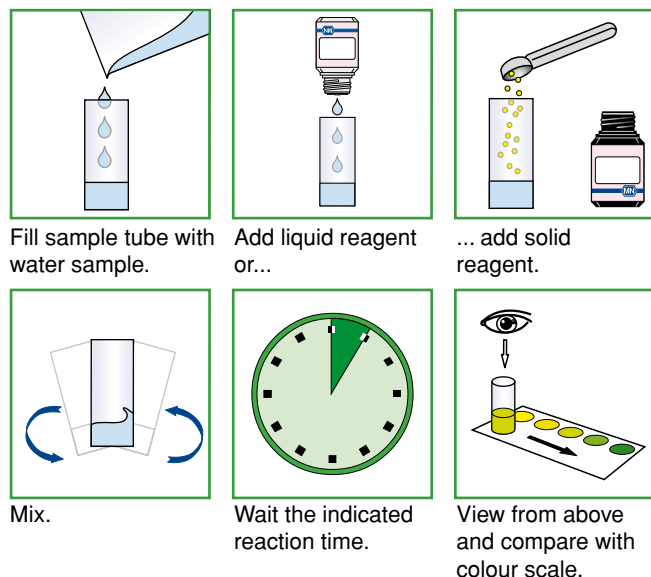
##### Colorimetry with colour comparison card

- visual evaluation
- environment-friendly, without hazardous reactants
- low-priced
- convenient handling, as easy as dip sticks
- accurate results
- handy packages
- with pictographic instructions
- reagent bottles with clear dosing instructions



#### Test kit consists of plastic pack with:

- sample tube with 5 ml ring mark
- colour coded bottles with liquid or powder reagents
- measuring spoon for accurate dosage of solid reagents
- colour scale with at least 5 gradations



### Titration Test Kits

#### Principle:

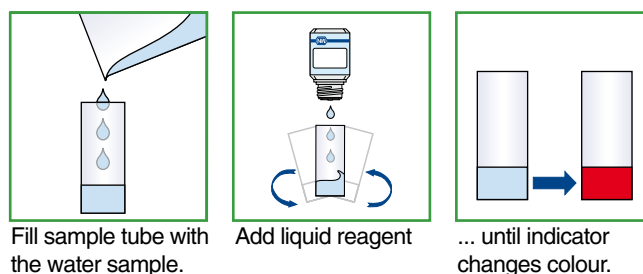
##### Titration with drop counting

- visual evaluation
- environment-friendly, without hazardous reactants
- low-priced
- convenient handling, as easy as dip sticks
- accurate results
- indicator and titration solution in one dropping bottle
- handy packages
- with pictographic instructions
- reagent bottles with clear dosing instructions



#### Test kit consists of plastic pack with:

- sample tube with 5 ml ring mark
- one dropping bottle with mixture of indicator and titration solution



Count drops: 1 ∆ = 1 measuring unit, e.g. °d

# Test kits for water analysis

## VISOCOLOR® ECO

VISOCOLOR® ECO presents a product group of colorimetric and titrimetric test kits which avoids hazardous substances wherever possible. With VISOCOLOR® ECO even water constituents with low limiting values can be determined with sufficient accuracy. All VISOCOLOR® ECO test kits are packed in an environment-friendly box and contain easy to understand instructions in 6 languages.

### Colorimetric Test Kits

#### Principle:

##### Colorimetry with colour comparison card

- visual and photometric evaluation (PF-12 / VISOCOLOR® photino)
- environment-friendly
- economically priced
- convenient handling
- higher accuracy and sensitivity
- with pictographic instructions
- reagent bottles with clear dosing instructions
- compensation of turbidities and colours
- refill packs available



### Titration Test Kits

#### Principle:

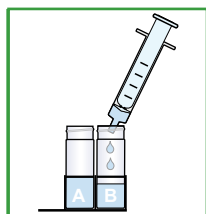
##### Titration with drop counting

- visual evaluation
- environment-friendly, without toxic reagents
- economically priced
- convenient handling
- higher accuracy and sensitivity
- sharper colour change due to separated dropping reagents
- reagent bottles with clear dosing instructions

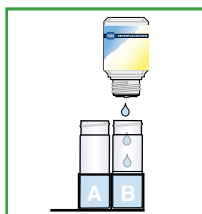


#### Test kit consists of cardboard box with:

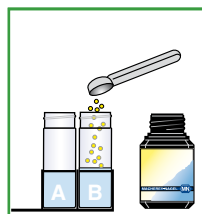
- 2 measuring tubes 20 mm diameter with screw caps
- holder for the measuring tubes
- colour coded bottles with liquid or powder reagents
- graduated plastic syringe 5 ml for convenient sample dosage
- measuring spoon for accurate dosage of solid reagents
- colour comparison card with at least 8 gradations



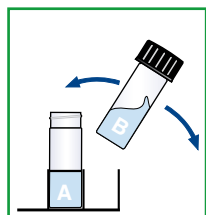
Fill both tubes with the water sample.



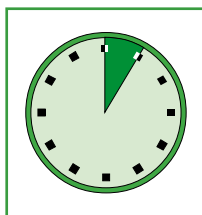
Add liquid reagent (tube B).



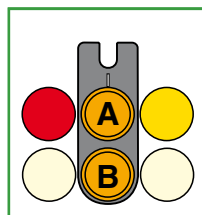
Add solid reagent (tube B).



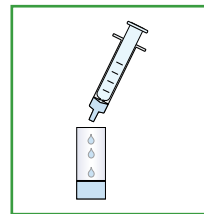
Close and mix.



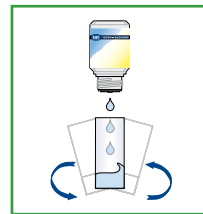
Wait the indicated reaction time.



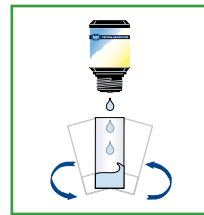
Place on colour scale and shift until colours match.



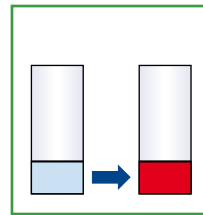
Fill sample tube with water sample.



Add indicator and mix



Add titration solution drop by drop ...



... until indicator changes colour.

Count drops:  
1 drop = 1 measuring unit, e. g. °d

VISOCOLOR® HE test kits are highly sensitive colorimetric test kits. In comparison with conventional VISOCOLOR® kits, their sensitivity is enhanced by increasing the length of the test tube and the use of highly sensitive reagents. This technique allows a 10-fold to 100-fold increase in sensitivity. Each VISOCOLOR® HE test kit is packed in a robust plastic box

### Colorimetric Test Kits

#### Principle:

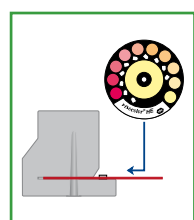
**High sensitivity colorimetry with comparator block and colour comparison disc**

- visual evaluation
- environment-friendly
- economically priced
- convenient handling
- highest accuracy due to extremely narrow gradation
- highest sensitivity down to 0.002 mg/l due to longer measuring tubes
- reagent bottles with clear dosing instructions
- compensation of turbidities and colours
- refill packs available

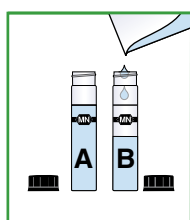


#### Test kit consists of plastic box with:

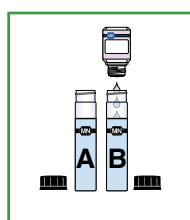
- 2 measuring tubes 20 mm diameter with screw caps
- comparator block with colour comparison disk
- colour coded bottles with liquid or powder reagents
- measuring spoon for accurate dosage of solid reagents
- beaker for convenient sample dosage



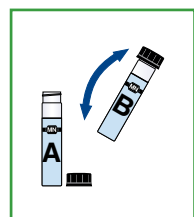
Insert colour comparison disk.



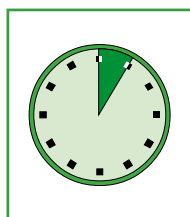
Fill both tubes with water sample



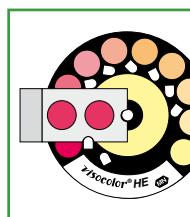
Add liquid and / or solid reagents (tube B).



Close and mix.



Wait the indicated reaction time



Turn the disk until colours match.

which contains the comparator block with colour comparison disk and all required reagents. The VISOCOLOR® titration test kits are based on principles of volumetric analysis. On the graduated syringe the results can be read off in mg/l or in alternative dimensions.

### Titration Test Kits

#### Principle:

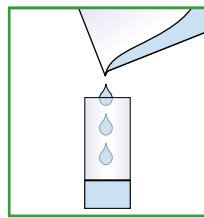
**High sensitive volumetric analysis with graduated syringe**

- visual evaluation
- economically priced
- convenient handling
- highest accuracy due to narrow graduated syringe
- reagent bottles with clear dosing instructions
- sharper colour change due to separated dropping reagents
- refill packs available

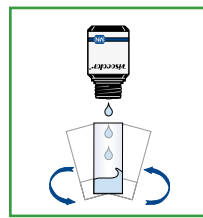


#### Test kit consists of cardboard box with:

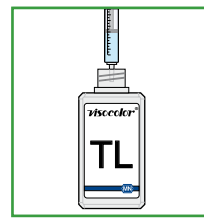
- sample tube with 5 ml ring mark
- graduated syringe for precise reagent dosage
- bottle(s) with indicator solution
- bottle(s) with titration solution



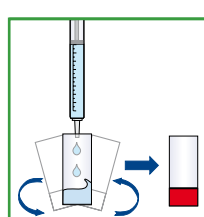
Fill sample tube with the water sample.



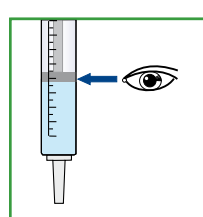
Add the indicator and mix.



Fill the titration syringe.



Add titration solution until the indicator changes colour



Read result.



# Test kits for water analysis

## VISOCOLOR® programme

VISOCOLOR® single tests kits are complete plastic boxes with all reagents and accessories for a test.

Refill packs are for the replacement of used reagents in a test kit or reagent case. They cannot be used as individual test kits.



### VISOCOLOR® test kits · Ordering information

Test	Range	Type	No of tests	REF	
				single test kit	refill pack
Acidity AC 7 (base capacity)	0.2 – 7.0 mmol/l H <sup>+</sup> <sup>1)</sup>	HE	200	915 006	915 206
Alkalinity AL 7 (total)	0.2 – 7.0 mmol/l OH <sup>-</sup> <sup>1)</sup>	HE	200	915 007	915 207
Alkalinity (p/m-Wert)	see Carbonate hardness C 20				
Aluminium	0.10 – 0.50 mg/l Al <sup>3+</sup>	ECO	50	931 006	931 206
Ammonium 15	0.5 – 15 mg/l NH <sub>4</sub> <sup>+</sup>	ECO	50	931 010	931 210
Ammonium	0.2 – 3 mg/l NH <sub>4</sub> <sup>+</sup>	alpha	50	935 012	–
Ammonium 3	0.2 – 3 mg/l NH <sub>4</sub> <sup>+</sup>	ECO	50	931 008	931 208
Ammonium	0.02 – 0.50 mg/l NH <sub>4</sub> <sup>+</sup>	HE	110	920 006	920 106
Calcium CA 20	0.5 – 20.0 °d / 0.1 – 3.6 mmol/l Ca <sup>2+</sup> <sup>1)</sup>	HE	200	915 010	915 210
Calcium	1 drop $\triangleq$ 5 mg/l Ca <sup>2+</sup>	ECO	100	931 012	–
Carbonate hardness	1 drop $\triangleq$ 1 °d	alpha	100	935 016	–
Carbonate hardness	1 drop $\triangleq$ 1 °d	ECO	100	931 014	–
Carbonate hardness C 20 (p-/m-Wert)	0.5 – 20.0 °d / 0.2 – 7.2 mmol/l H <sup>+</sup> <sup>1)</sup>	HE	200	915 003	915 203
Chloride	1 – 60 mg/l Cl <sup>-</sup>	ECO	90	931 018	931 218
Chloride CL 500	5 – 500 mg/l Cl <sup>-</sup> <sup>1)</sup>	HE	300	915 004	915 204
Chlorine	0.25 – 2.0 mg/l Cl <sub>2</sub>	alpha	150	935 019	–
Chlorine 2	0.1 – 2.0 mg/l Cl <sub>2</sub>	ECO	150	931 015	931 215
free Chlorine 2	0.1 – 2.0 mg/l Cl <sub>2</sub>	ECO	150	931 016	931 216
Chlorine 6 <sup>2)</sup>	0.05 – 6.00 mg/l Cl <sub>2</sub>	ECO	200	–	931 217
free Chlorine 6 <sup>2)</sup>	0.05 – 6.00 mg/l Cl <sub>2</sub>	ECO	400	–	931 219
Chlorine	0.02 – 0.60 mg/l Cl <sub>2</sub>	HE	160	920 015	920 115
Chlorine + pH	see Swimming pool				
Chromium(VI)	0.02 – 0.50 mg/l Cr(VI)	ECO	140	931 020	931 220
Copper	0.1 – 1.5 mg/l Cu <sup>2+</sup>	ECO	100	931 037	931 237
Copper	0.04 – 0.50 mg/l Cu <sup>2+</sup>	HE	150	920 050	920 150
Cyanide	0.01 – 0.20 mg/l CN <sup>-</sup>	ECO	100	931 022	931 222
Cyanide	0.002 – 0.04 mg/l CN <sup>-</sup>	HE	55	920 028	920 128
Cyanuric acid	10 – 100 mg/l Cya	ECO	100	931 023	931 223
DEHA (diethylhydroxylamine)	0.01 – 0.30 mg/l DEHA	ECO	125	931 024	931 224
Fluoride <sup>3)</sup>	0.1 – 2.0 mg/l F <sup>-</sup>	ECO	150	–	931 227
Hardness (total)	1 drop $\triangleq$ 1 °d	alpha	100	935 042	–
Hardness (total)	1 drop $\triangleq$ 1 °d	ECO	110	931 029	–
Hardness H 20 F (total)	0.5 – 20.0 °d / 0.1 – 3.6 mmol/l Ca <sup>2+</sup> <sup>1)</sup>	HE	200	915 005	915 205
Hardness H 2 (total)	0.05 – 2.00 °d / 0.01 – 0.36 mmol/l Ca <sup>2+</sup> <sup>1)</sup>	HE	200	915 002	915 202
Hardness (residual)	0.04 – 0.30 °d	alpha	200	935 080	–
Hydrazin	0.05 – 0.40 mg/l N <sub>2</sub> H <sub>4</sub>	ECO	130	931 030	931 230
Iron	0.04 – 1.0 mg/l Fe	ECO	100	931 026	931 226
Iron	0.01 – 0.20 mg/l Fe	HE	300	920 040	920 140

<sup>1)</sup> For titration test kits the range can be increased with additional syringes of reagent.

<sup>2)</sup> only for the photometric determination with PF-11, PF-12 and VISOCOLOR® photino

<sup>3)</sup> only for the photometric determination with PF-11 and PF-12

<sup>4)</sup> based on the chemical procedures of the German Standard Methods (DEV)

# Test kits for water analysis

## VISOCOLOR® programme

Test	Range	Type	No of tests	REF	
				single test kit	refill pack
Manganese	0.1 – 1.5 mg/l Mn	ECO	70	931 038	931 238
Manganese	0.03 – 0.50 mg/l Mn	HE	100	920 055	920 155
Nickel	0.1 – 1.5 mg/l Ni <sup>2+</sup>	ECO	150	931 040	931 240
Nitrate	2 – 50 mg/l NO <sub>3</sub> <sup>-</sup>	alpha	100	935 065	–
Nitrate	1 – 120 mg/l NO <sub>3</sub> <sup>-</sup>	ECO	110	931 041	931 241
Nitrite	0.05 – 1.0 mg/l NO <sub>2</sub> <sup>-</sup>	alpha	200	935 066	–
Nitrite	0.02 – 0.5 mg/l NO <sub>2</sub> <sup>-</sup>	ECO	120	931 044	931 244
Nitrite	0.005 – 0.10 mg/l NO <sub>2</sub> <sup>-</sup>	HE	150	920 063	920 163
pH 5 – 9	pH 5.0 – 9.0	alpha	200	935 075	–
pH 4.0 – 9.0	pH 4.0 – 9.0	ECO	450	931 066	931 266
pH 4.0 – 10.0	pH 4.0 – 10.0	HE	500	920 074	920 174
pH 6.0 – 8.2 <sup>2)</sup>	pH 6.0 – 8.2	ECO	150	–	931 270
Phosphate	2 – 20 mg/l PO <sub>4</sub> <sup>3-</sup>	alpha	70	935 079	–
Phosphate	0.2 – 5 mg/l P	ECO	80	931 084	931 284
Phosphate	0.05 – 1.0 mg/l P	HE	300	920 082	920 182
Phosphate (DEV) <sup>4)</sup>	0.01 – 0.25 mg/l P	HE	100	920 080	920 180
Potassium	2 – 15 mg/l K <sup>+</sup>	ECO	60	931 032	931 232
Residual hardness	see Hardness (residual)				
Oxygen	1 – 10 mg/l O <sub>2</sub>	ECO	50	931 088	931 288
Oxygen SA 10	0.2 – 10 mg/l O <sub>2</sub> <sup>1)</sup>	HE	100	915 009	915 209
Silica / silicon	0.2 – 3.0 mg/l SiO <sub>2</sub>	ECO	80	931 033	931 233
Silica / silicon	0.01 – 0.30 mg/l Si	HE	120	920 087	920 187
Sulphate	25 – 200 mg/l SO <sub>4</sub> <sup>2-</sup>	ECO	100	914 035	914 235
Sulphite	0.1 – 0.8 mg/l S <sup>2-</sup>	ECO	90	931 094	931 294
Sulphite	1 drop $\triangleq$ 1 mg/l SO <sub>3</sub> <sup>2-</sup>	ECO	60	931 095	–
Sulphite SU 100	2 – 100 mg/l SO <sub>3</sub> <sup>2-</sup> <sup>1)</sup>	HE	100	915 008	915 208
Swimming pool (Chlorine + pH)	0.1 – 2.0 mg/l Cl <sub>2</sub> pH 6.9 – 8.2	ECO	150 150	931 090	931 290
Zinc	0.5 – 3 mg/l Zn <sup>2+</sup>	ECO	120	931 098	931 298

<sup>1)</sup> For titration test kits the range can be increased with additional syringes of reagent.

<sup>2)</sup> only for the photometric determination with PF-11, PF-12 and VISOCOLOR® photino

<sup>3)</sup> only for the photometric determination with PF-11 and PF-12

<sup>4)</sup> based on the chemical procedures of the German Standard Methods (DEV)



# Test kits for water analysis

## Analytical principles

### Colorimetry

In colorimetric procedures advantage is taken of the fact that certain reagents form coloured compounds with the substances to be determined. The intensity of the colour is directly related to the concentration of the substance in question. For example in the case of the **VISOCOLOR®** Nitrite, the reagents form a blue-red dye with nitrite. The resulting colour intensity is proportional to the concentration of nitrite. In the case of pH measurements the use of specific indicator mixtures permits the formation of a characteristic colour for each pH value. The reaction colours obtained are compared with a range of standards in a sample vessel called comparator. As soon as the reaction colour has been matched to a comparison colour, the result can be read from the comparator or colour charts.

### Volumetric analysis (titration)

For certain substances it is difficult or even impossible to convert them to compounds which can be colorimetrically evaluated. In many of these cases titrimetric methods are used for

analysis. This measuring principle is briefly explained as follows: For volumetric analysis one adds drop by drop of a titration solution into a defined volume of the sample solution. The active substance in the titration solution reacts with the substance to be determined in the sample. After complete reaction further addition of titration solution would cause an excess of the active substance. The point of complete reaction (end point or equivalence point) is visualised by the colour change of an indicator added to the sample.

## Description of individual parameters and tests

### Acidity

H<sup>+</sup>

In natural unpolluted waters mainly carbonic acid is present, but also humic acids. With this test kit all acids, i. e. also those present in industrial waters, can be determined.

#### Reaction basis:

Titrimetric determination of acids with sodium hydroxide solution against the p indicator (Reaction basis according to DIN 38409-H7).

#### Note:

To differentiate between mineral acids and carbonic acid, the sample should be titrated against indicator m from the **VISOCOLOR®** test kit Carbonate hardness C 20.

#### **VISOCOLOR® HE Acidity AC 7**

REF 915 006

##### Refill pack

REF 915 206

Type:	titration test kit
Range:	0.2 – 7.0 mmol/l H <sup>+</sup> 1 gradation mark = 0.2 mmol/l H <sup>+</sup>
Sufficient for:	about 200 tests with an average acid content of 4 mmol/l H <sup>+</sup>
Shelf life:	at least 2 years
Sea water suitability:	yes

### Alkalinity (total)

OH<sup>-</sup>

All compounds which cause a pH increase above pH 7 are determined, e. g. hydroxide, carbonate, hydrogen carbonate etc.

#### Reaction basis:

Titrimetric determination of the alkalinity with hydrochloric acid against the m indicator (Reaction basis according to DIN 38409-H7).

Note: To differentiate between hydroxide, carbonate and hydrogen carbonate you should use the test kit **VISOCOLOR®** Carbonate hardness C 20 (see German Standard Methods DIN 38 409-H7).

#### **VISOCOLOR® HE Alkalinity AL 7**

REF 915 007

##### Refill pack

REF 915 207

Type:	titration test kit
Range:	0.2 – 7.0 mmol/l OH <sup>-</sup> 1 gradation mark = 0.2 mmol/l OH <sup>-</sup>
Sufficient for:	about 200 tests with an average acid content of 4 mmol/l OH <sup>-</sup>
Shelf life:	at least 2 years
Sea water suitability:	yes

### Aluminium

Al<sup>3+</sup>

Aluminium is the most common metal in our anthroposphere and after oxygen and silica even the most common element of the earth's crust. Because of its big affinity to oxygen, aluminium does not exist in elemental form in nature, but in different oxidized compounds.

For drinking water, the WHO recommends a guide value of 0.2 mg/l Al<sup>3+</sup>. In accordance to the EU council guideline 98/83/EEC, the threshold value for drinking water is 0.2 mg/l Al<sup>3+</sup>. In natural waters, the concentration of aluminium compounds is usually low, but in waste water aluminium can be contained in higher concentrations, e.g. at electroplating companies or paper mills. Different national regulations tolerate 2 – 3 mg/l Al<sup>3+</sup> in effluents from various industries (metal, electroplating and printing industries).

#### Reaction basis:

Colorimetric determination with chromazurol S.

#### **VISOCOLOR® ECO Aluminium**

REF 931 006

##### Refill pack

REF 931 206

Type:	colorimetric test kit
Range:	0 · 0.10 · 0.15 · 0.20 · 0.25 · 0.30 · 0.40 · 0.50 mg/l Al <sup>3+</sup>
Sufficient for:	50 tests
Shelf life:	at least 2 years
Sea water suitability:	yes, after dilution (1+9)

# Test kits for water analysis

## Description of individual parameters and tests

### Ammonium



Ammonium ions occur primarily in domestic waste waters, but frequently also in industrial waste waters. In surface and ground waters ammonium ions indicate decomposition of animal or vegetable substances. Control of the ammonium values is therefore important to the water supply.

#### Reaction basis:

DEV procedure: in alkaline medium ammonium ions react with chlorine to form chloroamine which in the presence of a catalyst forms a blue coloured indophenol with phenols (Reaction basis according to DIN 38406-E5).

Primary amines react like ammonium ions resulting in high results.

Chlorine-consuming substances can lower the result or even inhibit the reaction depending on their concentration.

#### VISOCOLOR® alpha Ammonium

REF 935 012

Type: colorimetric test kit  
Range: 0 · 0.2 · 0.5 · 1 · 2 · 3 mg/l  $\text{NH}_4^+$   
Sufficient for: 50 tests  
Shelf life: at least 1.5 years  
Sea water suitability: yes, after dilution (1+9)

#### VISOCOLOR® ECO Ammonium 15

REF 931 010

##### Refill pack

REF 931 210

Type: colorimetric test kit  
Range: 0 · 0.5 · 1 · 2 · 3 · 5 · 7 · 10 · 15 mg/l  $\text{NH}_4^+$   
Sufficient for: 50 tests  
Shelf life: at least 1.5 years  
Sea water suitability: yes, after dilution (1+9)



#### VISOCOLOR® ECO Ammonium 3

REF 931 008

##### Refill pack

REF 931 208

Type: colorimetric test kit  
Range: 0 · 0.2 · 0.3 · 0.5 · 0.7 · 1 · 2 · 3 mg/l  $\text{NH}_4^+$   
Sufficient for: 50 tests  
Shelf life: at least 1.5 years  
Sea water suitability: yes, after dilution (1+9)

#### VISOCOLOR® HE Ammonium

REF 920 006

##### Refill pack

REF 920 106

Type: highly sensitive test kit  
Range: 0.0 · 0.02 · 0.04 · 0.07 · 0.10 · 0.15 · 0.20 · 0.30 · 0.40 · 0.50 mg/l  $\text{NH}_4^+$   
Sufficient for: 110 tests  
Shelf life: at least 1 year  
Sea water suitability: no

### Bromine



Bromine and brominating reagents such as 1,3-dibromo-5,5-dimethylhydantoin (DBH) are used – like chlorine – for disinfecting swimming pool water. For determination of bromine you may use all VISOCOLOR® Chlorine tests (see page 55). A factor for conversion is given in the instructions.

### Calcium



Calcium is widely distributed in nature in rocks and in water. Water containing calcium and magnesium causes problems in industry as well as in households, since during boiling calcium carbonate is precipitated as detrimental boiler scale and since calcium ions inhibit the foaming of soaps.

#### Reaction basis:

Complexometric titration after precipitation of the magnesium salts. (Reaction basis according to DIN 38406-E3)

#### VISOCOLOR® ECO Calcium

REF 931 012

Type: titration test kit  
Range: 1 drop = 5 mg/l  $\text{Ca}^{2+}$   
Sufficient for: about 100 tests with an average calcium concentration of 50 mg/l  $\text{Ca}^{2+}$   
Shelf life: at least 1.5 years  
Sea water suitability: yes, after dilution (1+4)



#### VISOCOLOR® HE Calcium CA 20

REF 915 010

##### Refill pack

REF 915 210

Type: titration test kit  
Range: 0.5 – 20.0 °d or 0.1 – 3.6 mmol/l  $\text{Ca}^{2+}$   
Sufficient for: about 200 tests with an average calcium hardness of 10 °d or 1.8 mmol/l  $\text{Ca}^{2+}$   
Shelf life: at least 2 years  
Sea water suitability: yes, after dilution (1+4)

# Test kits for water analysis

## Description of individual parameters and tests

### Carbonate hardness



Carbonate hardness is that portion of calcium and magnesium ions which are present as carbonate or hydrogen carbonate.

#### Reaction basis:

The determination is performed as titration with hydrochloric acid against a mixed indicator, which changes colour at pH 4.5 (Reaction basis according to zu DIN EN ISO 9963-1 C24).

Normally the carbonate hardness is smaller than the total hardness. If the carbonate hardness is larger than the total hardness, you should trace the origin of this abnormal conditions, e. g. discharge of alkali hydrogen carbonates or high buffer capacity.

#### **VISOCOLOR® alpha Carbonate hardness** REF 935 016

Type: titration test kit  
Range: 1 drop = 1 °d  
Sufficient for: about 100 tests with an average hardness of 10 °d  
Shelf life: at least 1.5 years  
Sea water suitability: yes

#### **VISOCOLOR® ECO Carbonate hardness** REF 931 014

Type: titration test kit  
Range: 1 drop = 1 °d  
Sufficient for: about 100 tests with an average hardness of 10 °d  
Shelf life: at least 2 years  
Sea water suitability: yes



#### **VISOCOLOR® HE Carbonate hardness C 20**

REF 915 003  
REF 915 203

#### Refill pack

Type: titration test kit  
Range: 0.5 – 20.0 °d or 0.2 – 7.0 mmol/l H<sup>+</sup>  
Sufficient for: about 200 tests with an average hardness of 10 °d or 3.6 mmol/l H<sup>+</sup>  
Shelf life: at least 2 years  
Sea water suitability: yes

*With this test kit you can also determine the partial alkalinity (p-value) in addition to the carbonate hardness (m-value).*

### Carbonic acid



Carbonic acid is a natural component of the acidity of waters. Determination is performed with the test kit **VISOCOLOR® Acidity AC 7** and is described in detail under that heading (see page 52).

### Chloride



Chloride ions occur in all natural waters. Their concentration depends on the geological and local situation. In waste waters and polluted rivers the chloride concentration can reach high values.

#### Reaction bases:

(a) Mercurimetric titration

(b) Mercury(II) thiocyanate method



#### **VISOCOLOR® HE Chloride CL 500**

REF 915 004  
REF 915 204

#### Refill pack

Type: titration test kit  
Range: 5 – 500 mg/l Cl<sup>-</sup>  
1 gradation mark = 5 mg/l Cl<sup>-</sup>  
Reaction basis: (a) Mercurimetric titration  
Sufficient for: about 300 tests with an average chloride ion concentration of 200 mg/l Cl<sup>-</sup>  
Shelf life: at least 2 years  
Sea water suitability: yes, after dilution (1:50)

#### **VISOCOLOR® ECO Chloride**

REF 931 018  
REF 931 218

#### Refill pack

Type: colorimetric test kit  
Range: 1 · 2 · 4 · 7 · 12 · 20 · 40 · 60 mg/l Cl<sup>-</sup>  
Reaction basis: (b) Mercury(II) thiocyanate method  
Sufficient for: 90 tests  
Shelf life: at least 1 year  
Sea water suitability: no

# Test kits for water analysis

## Description of individual parameters and tests

### Chlorine

Cl<sub>2</sub>

The addition of chlorine to swimming pools, water reservoirs and water mains is an approved procedure to rid the water of germs. With the correct dose harmful microorganisms are destroyed, many impurities removed and the growth of algae is prevented. However it is imperative that the chlorine content is regularly checked, since excessive chlorine not only impairs the smell and taste of the water but can be hazardous. One distinguishes between free chlorine and bound chlorine (chloroamines); the sum of both is called total chlorine.

#### Reaction basis:

At a pH value of 5 – 6 free chlorine reacts with *N,N*-diethyl-1,4-phenylene diamine (DPD) to form a red-violet dye. In the presence of iodide ions the content of total chlorine can be determined, too. (Reaction basis according to DIN ISO 7393 G4-2).

The determination of free chlorine includes the concentrations of bromine, bromoamine, chloroamine, iodine and in part chlorine dioxide.

1.0 mg/l Cl<sub>2</sub>  $\triangleq$  2.3 mg/l Br<sub>2</sub>  $\triangleq$  3.6 mg/l I<sub>2</sub>

Higher-valency manganese compounds simulate free chlorine.

#### Note:

When measuring the chlorine content in swimming pools it is recommended to check the pH value as well. For this purpose we supply combination test kits *VISOCOLOR® ECO* Swimming pool (page 65).

#### *VISOCOLOR® alpha* Chlorine

REF 935 019

Type: colorimetric test kit  
Range: 0.25 · 0.5 · 1.0 · 1.5 · 2.0 mg/l Cl<sub>2</sub>  
Sufficient for: 150 tests  
Shelf life: at least 1.5 years  
Sea water suitability: yes

#### *VISOCOLOR® ECO* Chlorine 2

REF 931 015

##### Refill pack

REF 931 215

Type: colorimetric test kit  
Range: < 0.1 · 0.1 · 0.2 · 0.3 · 0.4 · 0.6 · 0.9 · 1.2 · 2.0 mg/l Cl<sub>2</sub>  
Sufficient for: 150 tests  
Shelf life: at least 1.5 years  
Sea water suitability: yes

#### *VISOCOLOR® ECO* free Chlorine 2

REF 931 016

##### Refill pack

REF 931 216

Type: colorimetric test kit  
Range: < 0.1 · 0.1 · 0.2 · 0.3 · 0.4 · 0.6 · 0.9 · 1.2 · 2.0 mg/l Cl<sub>2</sub>  
Sufficient for: 150 tests  
Shelf life: at least 1.5 years  
Sea water suitability: yes

#### *VISOCOLOR® ECO* Chlorine 6

REF 931 217

Type: reagent set for photometric determination  
Range: 0.05 – 6.00 mg/l Cl<sub>2</sub>  
Sufficient for: 200 tests  
Shelf life: at least 2 years  
Sea water suitability: yes

*A visual colorimetric determination is not possible.*

#### *VISOCOLOR® ECO* free Chlorine 6

REF 931 219

Type: reagent set for photometric determination  
Range: 0.05 – 6.00 mg/l Cl<sub>2</sub>  
Sufficient for: 400 tests  
Shelf life: at least 2 years  
Sea water suitability: yes

*A visual colorimetric determination is not possible.*

#### *VISOCOLOR® HE* Chlorine

REF 920 015

##### Refill pack

REF 920 115

Type: highly sensitive test kit  
Range: 0.0 · 0.02 · 0.04 · 0.06 · 0.10 · 0.15 · 0.20 · 0.30 · 0.40 · 0.60 mg/l Cl<sub>2</sub>  
Sufficient for: 160 tests  
Shelf life: at least 2 years  
Sea water suitability: yes





# Test kits for water analysis

## Description of individual parameters and tests

### Chromate



Chromium compounds can be present in industrial waste waters in trivalent form [chromium(III) ions] and in hexavalent form (chromate and dichromate ions). In order to determine the total chromium all other valencies must be oxidised to chromium(VI). Each test kit is equipped with a detailed description.

#### Reaction basis:

In sulphuric acid chromate ions react with diphenylcarbazide to form a red-violet dye. (Reaction basis according to DIN EN ISO 7393 G4-2).

#### VISOCOLOR® ECO Chromium(VI)

REF 931 020

##### Refill pack

REF 931 220

Type: colorimetric test kit  
Range: 0.02 · 0.05 · 0.10 · 0.15 · 0.20 · 0.30 · 0.40 · 0.50 mg/l Cr(VI)  
Sufficient for: 140 tests  
Shelf life: at least 1.5 years  
Sea water suitability: yes



### Copper



In water, copper(II) can be found in dissolved as well as in undissolved form. Copper(I) compounds and undissolved copper(II) compounds are not determined unless they are decomposed with concentrated nitric acid prior to the test.

#### Reaction basis:

In weakly alkaline medium copper(II) ions react with cupri-zone forming a blue colour complex.

#### VISOCOLOR® ECO Copper

REF 931 037

##### Refill pack

REF 931 237

Type: colorimetric test kit  
Range: 0 · 0.1 · 0.2 · 0.3 · 0.5 · 0.7 · 1.0 · 1.5 mg/l  $\text{Cu}^{2+}$   
Sufficient for: 100 tests  
Shelf life: at least 2 years  
Sea water suitability: yes

#### VISOCOLOR® HE Copper

REF 920 050

##### Refill pack

REF 920 150

Type: highly sensitive test kit  
Range: 0.0 · 0.04 · 0.07 · 0.10 · 0.15 · 0.20 · 0.25 · 0.30 · 0.40 · 0.50 mg/l  $\text{Cu}^{2+}$   
Sufficient for: 100 tests  
Shelf life: at least 2 years  
Sea water suitability: yes

### Cyanide



Cyanide ions are very toxic because they block the iron of the respiratory enzyme and thus inhibit the oxygen transport. For humans 1 mg cyanide per kg body weight is considered lethal.

#### Reaction basis:

Cyanide ions react with chlorine to form cyanogen chloride, which then opens a pyridine ring to form glutaconedialdehyde. By aldol condensation with barbituric acid a, violet polymethine dye is produced.

This test covers free cyanide and cyanide complexes which can be destroyed with chlorine. If interfering substances like heavy metal complexes, thiocyanate, sulphide, dyes or aromatic amines are present, a distillation according to DIN 38 405-D 13-2-2 must precede the cyanide test.

For the determination of easily released and total cyanide as well as for the determination of cyanide in stone fruit spirits please contact MACHEREY-NAGEL for special instructions.

#### VISOCOLOR® ECO Cyanide

REF 931 022

##### Refill pack

REF 931 222

Type: colorimetric test kit  
Range: 0 · 0.01 · 0.02 · 0.03 · 0.05 · 0.07 · 0.10 · 0.15 · 0.20 mg/l  $\text{CN}^-$   
Sufficient for: 100 tests  
Shelf life: at least 1 year  
Sea water suitability: yes, after dilution (1+3)

#### VISOCOLOR® HE Cyanide

REF 920 028

##### Refill pack

REF 920 128

Type: highly sensitive test kit  
Range: 0.0 · 0.002 · 0.004 · 0.007 · 0.010 · 0.015 · 0.020 · 0.025 · 0.030 · 0.040 mg/l  $\text{CN}^-$   
Sufficient for: 55 tests  
Shelf life: at least 1 year  
Sea water suitability: yes



# Test kits for water analysis

## Description of individual parameters and tests

### Cyanuric acid

Cya

Chlorine for disinfection in swimming pools, is degraded by intensive UV radiation. A common stabilizer for chlorine in swimming pools is cyanuric acid. Chloroisocyanic acid is also used directly as disinfecting agent. Forced by legal regulations, or because of their personal interest in a good state of their pools, many private and public owners use rapid tests for frequent monitoring of cyanuric acid.

#### Reaction basis:

Turbidity measurement

Cyanuric acid forms a fine precipitate with a triazine derivative.

The turbidity caused by this reaction can be measured visually or photometrically to determine the cyanuric acid concentration.

Turbidities interfere and must be filtered prior to the analysis.

#### VISOCOLOR® ECO Cyanuric acid

REF 931 023

##### Refill pack

REF 931 223

Type: colorimetric test kit  
Range: 10 · 15 · 20 · 30 · 40 · 60 · 80 · 100 mg/l Cya  
Sufficient for: 100 tests  
Shelf life: at least 1.5 years  
Sea water suitability: yes

### DEHA (Diethylhydroxylamine)

DEHA

In boiler houses the carcinogenic hydrazine is more and more replaced by diethylhydroxylamine (DEHA) to remove oxygen.

#### Reaction basis:

Measurement of the reduction properties of DEHA for iron(III) ions and determination of the iron(II) ions formed. Strictly observe the temperature and reaction time since they strongly influence the colour intensity.

Iron(II) ions interfere. This error can be taken into account by a modified test procedure.

#### VISOCOLOR® ECO DEHA

REF 931 024

##### Refill pack

REF 931 224

Type: colorimetric test kit  
Range: 0 · 0.01 · 0.03 · 0.05 · 0.10 · 0.15 · 0.20 · 0.25 · 0.30 mg/l DEHA  
Sufficient for: 125 tests  
Shelf life: at least 1 year  
Sea water suitability: yes



### Dithionite

$S_2O_4^{2-}$

Dithionite ( $S_2O_4^{2-}$ ), above all sodium dithionite (so-called hydrosulphite), are important aids in dyeing, textile and paper industries due to their reducing properties. They are especially used for vat dyeing, for bleaching of wood-based paper stuffs, sugars, sirup, gelatines, starches, molasses, saccharine juice, soaps, technical fats, as decolorant for textiles, for desilvering of used fixing baths etc. Dithionite can be determined by a special method with VISOCOLOR® Sulphite SU 100. Please contact MACHEREY-NAGEL for special instructions.

### Fluoride

$F^-$

Normally, the content of fluoride in surface and ground water is lower than 1 mg/l. Permanent consumption of water containing more than 2 mg/l fluoride can cause a drinking water fluorese (a stained discolouration of the tooth enamel). On the other hand a content of fluoride lower than 0.5 mg/l could lead to an increasing risk of caries. The optimal content of fluoride in drinking water is about 1 mg/l. To avoid problems with caries, in some countries the content of fluoride in drinking water is artificially increased. However, WHO and EC drinking water regulations recommend a threshold value of 1.5 mg/l  $F^-$ .

In some European countries, the threshold value for mineral water is also 1.5 mg/l  $F^-$ . For the suitability of water for the preparation of baby food a threshold value of 0.7 mg/l  $F^-$  is recommended. Natural mineral waters with a fluoride content of more than 5 mg/l must be labelled with a warning.

#### Reaction basis:

Photometric determination of fluoride with 1,8-dihydroxy-2-(4-sulfophenylazo)naphthalene-3,6-disulfonic acid (SPADNS) with the photometer PF-12.

#### VISOCOLOR® ECO Fluoride

REF 931 227

Type: reagent set for photometric determination  
Range: 0.1 – 2.0 mg/l  $F^-$   
Sufficient for: 150 tests  
Shelf life: at least 1.5 years  
Sea water suitability: yes, after distillation

*A visual colorimetric determination is not possible*



# Test kits for water analysis

## Description of individual parameters and tests

### Hardness (total and residual)

°d

The total hardness of water is based on its content of alkaline earth ions (calcium and magnesium ions). This content depends on the geological conditions the water encounters during its course and may vary widely. Knowledge of the total hardness is important for the use of water in industrial as well as municipal applications, e. g. in the household as wash water or as boiler feed water in industry.

#### Reaction bases:

##### (a) Complexometric titration

in accordance with DIN 38406 E3 and DIN 38409 H6.

##### (b) Colorimetry with a mixed indicator

Copper(II) ions can delay or (in higher concentrations) even block the colour change of the indicator. For this reason allow enough water to run through copper pipes prior to sampling.

#### VISOCOLOR® alpha Hardness (total)

REF 935 042

Type: titration test kit  
Range: 1 drop = 1 °d  
Reaction basis: (a) titration  
Sufficient for: 100 tests with an average hardness of 10 °d  
Shelf life: at least 1.5 years  
Sea water suitability: yes, after dilution (1:30)



#### VISOCOLOR® ECO Hardness (total)

REF 931 029

Type: titration test kit  
Range: 1 drop = 1 °d  
Reaction basis: (a) titration  
Sufficient for: 110 tests with an average hardness of 10 °d  
Shelf life: at least 1.5 years  
Sea water suitability: yes, after dilution (1:30)



#### VISOCOLOR® HE Hardness H 20 F (total)

REF 915 005

##### Refill pack

REF 915 205

Type: titration test kit  
Range: 0.5 – 20.0 °d or  
0.1 – 3.6 mmol/l Ca<sup>2+</sup>  
1 gradation mark = 0.5 °d =  
0.1 mmol/l Ca<sup>2+</sup>  
Reaction basis: (a) titration  
Sufficient for: about 200 tests with an average hardness of 10 °d or 1.8 mmol/l Ca<sup>2+</sup>  
Shelf life: at least 1.5 years  
Sea water suitability: yes, after dilution (1:30)

#### VISOCOLOR® alpha residual Hardness

REF 935 080

Type: colorimetric test kit  
Range: 0.00 · 0.04 · 0.08 · 0.15 · 0.30 °d  
Reaction basis: (b) colorimetry  
Sufficient for: 200 tests  
Shelf life: at least 1 year  
Sea water suitability: no

#### VISOCOLOR® HE Hardness H 2 (residual)

REF 915 002

##### Refill pack

REF 915 202

Type: titration test kit  
Range: 0.05 – 2.00 °d or  
0.01 – 0.36 mmol/l Ca<sup>2+</sup>  
1 gradation mark = 0.05 °d or  
0.01 mmol/l Ca<sup>2+</sup>  
Reaction basis: (a) titration  
Sufficient for: 200 tests with an average hardness of 1 °d or 0.18 mmol/l Ca<sup>2+</sup>  
Shelf life: at least 1.5 years  
Sea water suitability: no

#### VISOCOLOR® ECO Reagent

REF 931 929

to eliminate copper ions during determination of total hardness

### Hydrosulphite



see Dithionite, page 57

# Test kits for water analysis

## Description of individual parameters and tests

### Hydrazine **NEW!**



Hydrazine is used to destroy residual oxygen in boiler feed water and condensate water, for example in power plants, to avoid corrosion of the boiler casing. Reaction products are merely nitrogen gas and water, thus the salt load of the water is kept low.

Because of its highly reactive properties, hydrazine is also used as fuel in aviation and astronautics.

Hydrazine is toxic and has a highly toxic effect on water organisms. Hydrazine can be absorbed through the skin. Therefore, water and waste water with potential content of hydrazine must be determined.

#### Reaction basis:

DIN method: In acidic solution hydrazine reacts with 4-dimethylaminobenzaldehyde to form a yellow/orange coloured compound (Reaction basis according to DIN 38413-P1).

#### VISOCOLOR® ECO Hydrazine

REF 931 030

##### Refill pack:

REF 931 230

Type: titration test kit  
Range: 0 · 0.05 · 0.10 · 0.15 · 0.20 · 0.25 · 0.30 · 0.40 mg/l  $\text{N}_2\text{H}_4$   
Sufficient for: 130 tests  
Shelf life: at least 1 year  
Sea water suitability: yes

### Iron



Natural waters as well as waste waters often contain some iron. It can be present as Fe(II) or Fe(III) ions if the pH value of the water is below 3 or if the water is free of oxygen. At higher pH values Fe(III) forms an insoluble oxyhydrate. Frequently the sample is in a transition state with finely dispersed iron oxides. In waste water and natural water containing humic acids iron is often present in the form of a complex salt. The VISOCOLOR® test kits only determine iron which is present in dissolved form as  $\text{Fe}^{2+}$  or  $\text{Fe}^{3+}$  ions. Iron complexes are not covered unless they are decomposed by oxidation with nitric acid and sulphuric acid.

#### Reaction basis:

Triazin-Methode: iron(II) ions react with a triazine derivative to form a violet complex. Iron(III) ions are reduced and thus also determined.

#### VISOCOLOR® ECO Iron

REF 931 026

##### Refill pack

REF 931 226

Type: colorimetric test kit  
Range: 0 · 0.04 · 0.07 · 0.10 · 0.15 · 0.20 · 0.30 · 0.50 · 1.0 mg/l Fe  
Sufficient for: 100 tests  
Shelf life: at least 2 years  
Sea water suitability: yes

#### VISOCOLOR® HE Iron

REF 920 040

##### Refill pack

REF 920 140

Type: highly sensitive test kit  
Range: 0.0 · 0.01 · 0.02 · 0.03 · 0.04 · 0.05 · 0.07 · 0.10 · 0.15 · 0.20 mg/l Fe  
Sufficient for: 300 tests  
Shelf life: at least 2 years  
Sea water suitability: no



### Magnesium



In order to differentiate between the hardness constituents calcium and magnesium one can determine the total hardness (see VISOCOLOR® test kits Hardness (total)) and the calcium hardness (see VISOCOLOR® test kits Calcium). The difference of both is the magnesium content – an important parameter in food and building industries.

### Manganese



Natural waters contain manganese in the divalent, soluble form as well as in colloidal tri- and tetravalent states. Valencies are interchanged by oxidation-reduction reactions taking place in the water. The test procedure determines all oxidation states of manganese.

#### Reaction basis:

In alkaline solution manganese ions react with formaldoxime to form an orange-red complex. (Reaction basis according to DIN 38406-E2).

#### VISOCOLOR® ECO Manganese

REF 931 038

##### Refill pack

REF 931 238

Type: colorimetric test kit  
Range: 0 · 0.1 · 0.2 · 0.3 · 0.5 · 0.7 · 0.9 · 1.2 · 1.5 mg/l Mn  
Sufficient for: 70 tests  
Shelf life: at least 1.5 years  
Sea water suitability: yes

#### VISOCOLOR® HE Manganese

REF 920 055

##### Refill pack

REF 920 155

Type: highly sensitive test kit  
Range: 0.0 · 0.03 · 0.06 · 0.10 · 0.15 · 0.20 · 0.25 · 0.30 · 0.40 · 0.50 mg/l Mn  
Sufficient for: 100 tests  
Shelf life: at least 1.5 years  
Sea water suitability: no

# Test kits for water analysis

## Description of individual parameters and tests

### Nickel



Nickel can be present in industrial waste water. It occurs as the divalent ion or as a nickel complex.

#### Reaction basis:

In ammonia solution nickel ions react with diacetyldioxime after oxidation with bromine to form a reddish-brown dye. Insoluble nickel compounds (e. g. nickel cyanide, nickel carbonate) and the nickel cyano complexes are not determined.

#### VISOCOLOR® ECO Nickel

REF 931 040

##### Refill pack

REF 931 240

Type: colorimetric test kit  
Range: 0 · 0.1 · 0.2 · 0.3 · 0.5 · 0.7 · 0.9 · 1.2 · 1.5 mg/l  $\text{Ni}^{2+}$

Sufficient for: 150 tests

Shelf life: at least 1.5 years

Sea water suitability: yes, after dilution (1+9)



### Nitrate



Nitrates occur in most ground and surface waters in concentrations of up to 20 mg/l. In addition to mere geological influences nitrate concentrations can also increase from agricultural sources (fertilisers). The VISOCOLOR® test kits are intended for the determination of nitrate in surface and drinking water and in industrial waste waters which do not contain high concentrations of interfering ions.

#### Reaction basis:

Nitrate is reduced to nitrite with an inorganic reducing agent. Nitrite is then diazotised with an aromatic amine and simultaneously coupled to form an azo dye.

#### VISOCOLOR® alpha Nitrate

REF 935 065

Type: colorimetric test kit  
Range: 2 · 8 · 15 · 30 · 50 mg/l  $\text{NO}_3^-$   
Sufficient for: 100 tests  
Shelf life: at least 1.5 years  
Sea water suitability: yes

#### VISOCOLOR® ECO Nitrate

REF 931 041

##### Refill pack

REF 931 241

Type: colorimetric test kit  
Range: 0 · 1 · 3 · 5 · 10 · 20 · 30 · 50 · 70 · 90 · 120 mg/l  $\text{NO}_3^-$   
Sufficient for: 110 tests  
Shelf life: at least 1.5 years  
Sea water suitability: yes



# Test kits for water analysis

## Description of individual parameters and tests

### Nitrite



In surface waters nitrite ions are generally present in low concentrations. Their presence in ground water is less common. In waste waters nitrite frequently occurs, even in fairly high concentrations.

#### Reaction basis:

In surface waters nitrite ions are generally present in low concentrations. Their presence in ground water is less common. In waste waters nitrite frequently occurs, even in fairly high concentrations.

#### VISOCOLOR® alpha Nitrite

REF 935 066

Type: colorimetric test kit  
Range: 0.05 · 0.10 · 0.25 · 0.5 · 1.0 mg/l  $\text{NO}_2^-$   
Sufficient for: 200 tests  
Shelf life: at least 1.5 years  
Sea water suitability: yes

#### VISOCOLOR® ECO Nitrite

REF 931 044

##### Refill pack

REF 931 244

Type: colorimetric test kit  
Range: 0 · 0.02 · 0.03 · 0.05 · 0.07 · 0.1 · 0.2 · 0.3 · 0.5 mg/l  $\text{NO}_2^-$   
Sufficient for: 120 tests  
Shelf life: at least 1.5 years  
Sea water suitability: yes

#### VISOCOLOR® HE Nitrite

REF 920 063

##### Refill pack

REF 920 163

Type: highly sensitive test kit  
Range: 0.0 · 0.005 · 0.010 · 0.015 · 0.02 · 0.03 · 0.04 · 0.06 · 0.08 · 0.10 mg/l  $\text{NO}_2^-$   
Sufficient for: 150 tests  
Shelf life: at least 2 years  
Sea water suitability: yes

### Oxygen



The solubility of oxygen in water depends on the temperature, the pressure and the other components of the water. The oxygen content of a water at the time of sampling is often quoted as the percentage of the possible saturation.

#### Reaction basis:

Oxygen determination according to Winkler: in alkaline solution dissolved oxygen oxidises manganese(II) ions to higher-valent manganese hydroxides. In a strongly acidic medium these form manganese(III) ions which can be determined either titrimetrically or colorimetrically after addition of a colour reagent.

#### VISOCOLOR® ECO Oxygen

REF 931 088

##### Refill pack

REF 931 288

Type: colorimetric test kit  
Range: 0 · 1 · 2 · 3 · 4 · 6 · 8 · 10 mg/l  $\text{O}_2$   
Sufficient for: 50 tests  
Shelf life: at least 1 year  
Sea water suitability: yes

*When ordering this test kit for the first time, you also need an oxygen bottle, REF 915 498*

#### VISOCOLOR® HE Oxygen SA 10

REF 915 009

##### Refill pack

REF 915 209

Type: titration test kit, according to DIN EN 25 813  
Range: 0.2 – 10 mg/l  $\text{O}_2$   
1 gradation mark = 0.2 mg/l  
Sufficient for: about 100 tests with an average oxygen content of 9 mg/l  
Shelf life: at least 1.5 years  
Sea water suitability: yes



In combination with the BOD<sub>5</sub> accessories package (REF 916 918) and the BOD<sub>5</sub> nutrient mixture without N-allylthiourea (ATU) (REF 918 994) or the BOD<sub>5</sub> nutrient mixture Plus with ATU (REF 918 995) this test kit can also be used for determination of the BOD<sub>5</sub> (sufficient for 25 – 50 samples). Preparation of the samples is performed using the so-called dilution principle according to DIN ISO 1899-1-H51.



# Test kits for water analysis

## Description of individual parameters and tests

### pH value

pH

The pH value indicates whether a water reacts acidic, alkaline or neutral. It is determined by the concentration of hydrogen ions. All biological processes in water are tied to specific pH ranges. For municipal and industrial applications, too, the control of specific pH limits is important since e. g. the efficiency of sewage plants or the corrosive action of tap water on the pipes depend in the pH value. Contrary to pH indicator papers, **VISOCOLOR®** pH test kits can also be used to determine accurate pH values in unbuffered sample solutions.

#### Reaction basis:

A special mixture of indicator dyes shows a characteristic colour for every pH value within the range of the kit.

The favourable ratio between sample volume and amount of indicator minimises the indicator error (acid-base-error). This allows reliable pH measurements in weakly buffered solutions as well. High contents of neutral salts and colloids as well as organic solvent concentrations above 10 % can cause wrong results.

#### **VISOCOLOR® alpha pH 5 – 9** REF 935 075

Type: colorimetric test kit  
Range: pH 5.0 · 5.5 · 6.0 · 6.5 · 7.0 · 7.5 · 8.0 · 8.5 · 9.0

Sufficient for: 200 tests  
Shelf life: at least 3 years  
Sea water suitability: yes

#### **VISOCOLOR® ECO pH 4.0 – 9.0** REF 931 066

Refill pack REF 931 266  
Type: colorimetric test kit  
Range: pH 4.0 · 5.0 · 6.0 · 6.5 · 7.0 · 7.5 · 8.0 · 8.5 · 9.0

Sufficient for: 450 tests  
Shelf life: at least 3 years  
Sea water suitability: yes

#### **VISOCOLOR® ECO pH 6.0 – 8.2** REF 931 270

Type: reagent set for photometric determination

Range: pH 6.0 – 8.2  
Sufficient for: 150 tests  
Shelf life: at least 1.5 years  
Sea water suitability: yes

*A visual colorimetric determination is not possible.*

#### **VISOCOLOR® HE pH 4.0 – 10.0** REF 920 074

Refill pack REF 920 174

Type: highly sensitive test kit  
Range: pH 4.0 · 5.0 · 5.5 · 6.0 · 6.5 · 7.0 · 7.5 · 8.0 · 8.5 · 9.0 · 10.0

Sufficient for: 500 tests  
Shelf life: at least 2 years

Sea water suitability: yes  
For the determination of the pH value, see also Swimming pool 64

### Phosphate

PO<sub>4</sub><sup>3-</sup>

The phosphate content in a surface water has direct consequences for its ability to support the growth of certain organisms. Since increasing quantities of phosphates are being fed through domestic waste waters into rivers and lakes, these waters have a tendency towards eutrophication. Exact data about the phosphate content are important for boiler water and feed water. Precise dosing of phosphates in these waters can inhibit formation of boiler scale. Pyro-, meta- and polyphosphates are not determined with **VISOCOLOR®** test kits. The determination of total phosphate requires a decomposition prior to the test.

#### Reaction basis:

Ammonium molybdate reacts with phosphate ions to form phosphomolybdic acid which is reduced to molybdenum blue (Reaction basis according to DIN EN ISO 6878-D11).

#### **VISOCOLOR® alpha Phosphate** REF 935 079

Type: colorimetric test kit  
Range: 2 · 5 · 10 · 15 · 20 mg/l PO<sub>4</sub><sup>3-</sup>  
Sufficient for: 70 tests  
Shelf life: at least 2 years  
Sea water suitability: yes

#### **VISOCOLOR® ECO Phosphate** REF 931 084

Refill pack REF 931 284  
Type: colorimetric test kit  
Range: 0 · 0.2 · 0.3 · 0.5 · 0.7 · 1 · 2 · 3 · 5 mg/l PO<sub>4</sub>-P  
Sufficient for: 90 tests  
Shelf life: at least 3 years  
Sea water suitability: yes



# Test kits for water analysis

## Description of individual parameters and tests

### VISOCOLOR® HE Phosphate

REF 920 082

Refill pack

REF 920 182

Type: highly sensitive test kit  
 Range: 0.0 · 0.05 · 0.10 · 0.15 · 0.20 · 0.3 · 0.4 · 0.6 · 0.8 · 1.0 mg/l P  
 Sufficient for: 300 tests  
 Shelf life: at least 2 years  
 Sea water suitability: yes

### VISOCOLOR® HE Phosphate (DEV)

REF 920 080

Refill pack

REF 920 180

Type: highly sensitive test kit  
 Range: 0.0 · 0.01 · 0.02 · 0.03 · 0.05 · 0.07 · 0.10 · 0.15 · 0.20 · 0.25 mg/l P  
 Sufficient for: 100 tests  
 Shelf life: at least 2 years  
 Sea water suitability: yes



## Phosphonate

PO<sub>x</sub>

Phosphonates are used as complexing agents for softening process and cooling water. They can be determined with NANOCOLOR® NanOx Metal and VISOCOLOR® ECO Phosphate. Please ask for our special instructions.

## Potassium

K<sup>+</sup>

The natural potassium content in ground water is generally about 1 – 2 mg/l K. Higher values may indicate faecal contaminations, but can also originate from potassium fertilisers. For the growth of plants and animals potassium is an essential factor. Especially in agriculture the determination of potassium therefore gains increasing importance.

### Reaction basis:

Potassium reacts with sodium tetraphenylborate to form a precipitate. Under defined conditions this turbidity can be used for concentration measurements.

Turbidities interfere and have to be filtered prior to the test. Good reproducibility is obtained for drinking, surface and ground water. For polluted waste waters low potassium values may be measured.

### VISOCOLOR® ECO Potassium

REF 931 032

Refill pack

REF 931 232

Type: turbidity test kit  
 Range: 2 · 3 · 4 · 6 · 8 · 10 · 15 mg/l K<sup>+</sup>  
 Sufficient for: 60 tests  
 Shelf life: at least 3 years  
 Sea water suitability: yes, after dilution (1+1)



## Residual hardness

°d

see Hardness (total and residual), page 58



# Test kits for water analysis

## Description of individual parameters and tests

### Silica / silicon



Natural water contains silica in different amounts, depending on the geological conditions the water encounters during its course. The silica occurs partly as soluble silicate, partly colloidal as polysilicic acids. The silica content in water for medium and high pressure boilers may not exceed certain limits; in power plants therefore constant measurement of the silica content is required.

#### Reaction basis:

In acidic solution soluble silica or silicates react with ammonium molybdate to form yellow silicomolybdic acid, which is reduced to silico-molybdenum blue with a reducing agent. (Reaction basis according to DIN EN ISO 16264-H57).

#### VISOCOLOR® ECO Silica

REF 931 033

##### Refill pack

REF 931 233

Type: colorimetric test kit  
Range: 0 · 0.2 · 0.4 · 0.6 · 1.0 · 1.5 · 2.0 · 2.5 · 3.0 mg/l  $\text{SiO}_2$   
Sufficient for: 80 tests  
Shelf life: at least 3 years  
Sea water suitability: yes

#### VISOCOLOR® HE Silicon

REF 920 087

##### Refill pack

REF 920 187

Type: highly sensitive test kit  
Range: 0.0 · 0.01 · 0.02 · 0.03 · 0.05 · 0.07 · 0.10 · 0.15 · 0.20 · 0.30 mg/l  $\text{Si}^{4+}$   
Sufficient for: 120 tests  
Shelf life: at least 2 years  
Sea water suitability: yes



### Sodium



About 2.43 % of the uppermost crust of the earth, with a thickness of 16 km, consist of chemically bonded sodium; this is place 6 in the frequency list of elements. In rocks and minerals it is mostly present as silicate (e.g. soda feldspar or albite) and as sodium chloride (rocksalt), but also as carbonate, nitrate (especially chile salpeter) and cryolite as well as in many other minerals. Each ton of sea water contains an average of 27 kg common salt (10.6 kg sodium), this is 77 % of all salts present in sea water. Under the assumption, that in natural waters beside sodium mainly calcium and magnesium can occur as cations, it is easily possible to determine the sodium content using VISOCOLOR® titration test kits. Please ask for the respective special instructions.

### Sulphate



The determination of sulphate ions is of special importance to evaluate the aggressiveness of a water towards concrete. Sulphate, a component of natural water, is formed in many manufacturing processes and is found in waste waters even after neutralisation.

#### Reaction basis:

Sulphate reacts with barium ions forming a precipitate of barium sulphate. Under defined conditions this turbidity can be used for concentration measurements.

Turbidities of the sample interfere and have to be filtered. Good reproducibility is obtained for drinking, surface and ground water. For polluted waste waters low concentrations are measured.

#### VISOCOLOR® Sulphate

REF 914 035

##### Refill pack

REF 914 235

Type: turbidity test kit  
Range: 25 · 30 · 35 · 40 · 50 · 60 · 70 · 80 · 100 · 120 · 150 · 200 mg/l  $\text{SO}_4^{2-}$   
Sufficient for: 100 tests  
Shelf life: at least 3 years  
Sea water suitability: yes, after dilution (1:50)

### Sulphide



In water sulphides can be present as dissolved hydrogen sulphide or as hydrosulphide or sulphide ions.

#### Reaction basis:

N,N-Dimethyl-1,4-phenylene diamine reacts with hydrogen sulphide to form an unstable compound which rearranges to leucomethylene blue. Oxidation with iron(III) ions yields methylene blue.

#### VISOCOLOR® ECO Sulphide

REF 931 094

##### Refill pack

REF 931 294

Type: colorimetric test kit  
Range: 0.1 · 0.2 · 0.3 · 0.4 · 0.5 · 0.6 · 0.7 · 0.8 mg/l  $\text{S}^{2-}$   
Sufficient for: 90 tests  
Shelf life: at least 3 years  
Sea water suitability: yes

# Test kits for water analysis

## Description of individual parameters and tests

### Sulphite



Sulphite ions are not present in natural, unpolluted waters, however they often appear in large quantities in industrial waste waters (e. g. paper mills, dye works).

#### Reaction basis:

Titrimetric determination by addition of iodine solution and reverse titration of unused iodine with sodium thiosulphate.

Oxidizing and reducing substances interfere.

#### VISOCOLOR® ECO Sulphite

REF 931 095

Type: titration test kit  
Range: 1 drop = 1 mg/l  $\text{SO}_3^{2-}$   
Sufficient for: 60 tests with an average sulphite concentration of 10 mg/l  $\text{SO}_3^{2-}$   
Shelf life: at least 1 year  
Sea water suitability: yes

#### VISOCOLOR® HE Sulphite SU 100

REF 915 008  
REF 915 208

Refill pack  
Type: titration test kit  
Range: 2 – 100 mg/l  $\text{SO}_3^{2-}$   
1 gradation mark = 2 mg/l  
Sufficient for: 100 tests with an average sulphite content of 100 mg/l  $\text{SO}_3^{2-}$   
Shelf life: at least 3 years  
Sea water suitability: yes



### Swimming pool



pH

Chlorination of water in swimming pools with chlorine or chlorine compounds takes place within certain limits. One distinguishes between free chlorine and bound chlorine (chloroamines); the sum of both is called total chlorine. The content of free chlorine should be between 0.3 and 0.6 mg/l. Chlorination alters the pH value of the swimming pool water. The ideal pH value is pH 7.4. This prevents formation of malodorous pollutants and irritants to the mucous membrane, and prevents damage to the water treatment system.

#### Reaction basis:

Free chlorine reacts with *N,N*-diethyl-1,4-phenylene diamine (DPD) to form a red-violet dye. The pH value is determined with phenol red as indicator.

For test kits for the determination of chlorine alone see VISOCOLOR® Chlor (page 55)

#### VISOCOLOR® ECO Swimming pool

REF 931 090  
REF 931 290

Refill pack  
Type: colorimetric test kit  
Range: < 0.1 · 0.2 · 0.3 · 0.4 · 0.6 · 0.9 · 1.2 · 2.0 mg/l  $\text{Cl}_2$   
pH 6.9 · 7.2 · 7.4 · 7.6 · 7.8 · 8.2  
Sufficient for: 150 tests each  
Shelf life: at least 1.5 years  
Sea water suitability: yes

### Zinc



Zinc is one of the most often used metals for surface finishing. Its content in waste water from e. g. electroplating companies has to be monitored regularly.

#### Reaction basis:

At a pH of 8.5 – 9.5 zinc ions react with zincon to form a colour complex. Acidic, alkaline and buffered samples have to be adjusted to pH 9 for the test.

#### VISOCOLOR® ECO Zinc

REF 931 098  
REF 931 298

Refill pack  
Type: colorimetric test kit  
Range: 0 · 0.5 · 1 · 2 · 3 mg/l  $\text{Zn}^{2+}$   
Sufficient for: 120 tests  
Shelf life: at least 1 year  
Sea water suitability: yes, after dilution (1+9)



# Reagent cases

## Combinations of several *VISOCOLOR*® test kits

### Programme of *VISOCOLOR*® reagent cases

Type	for the determination of	REF
<b>Reagent case for soil analysis</b>		
<i>VISOCOLOR</i> ® reagent case for soil analysis	phosphate, potassium, nitrogen (ammonium, nitrite and nitrate), pH, soil structure, incl. all requisite equipment and accessories	914 601
<b>Reagent case for water analysis · without photometer</b>		
<i>VISOCOLOR</i> ® ECO reagent case	ammonium, carbonate hardness, total hardness, nitrate, nitrite, pH, phosphate	931 001
<i>VISOCOLOR</i> ® ECO reagent case (empty)	without test kits for individual combination of up to 7 test kits of type <i>VISOCOLOR</i> ® ECO	931 100
<i>VISOCOLOR</i> ® reagent case	alkalinity, ammonium, total hardness, nitrite, pH, phosphate, oxygen, temperature	931 302
<i>VISOCOLOR</i> ® reagent case (empty)	without test kits for individual combination of up to 9 test kits of type <i>VISOCOLOR</i> ® ECO and titration test kits	931 307
<b>Reagent case for water analysis · with photometer PF-12</b>		
Reagent case "Environmental analysis"	ammonium, carbonate hardness, iron, total hardness, nitrate, nitrite, pH, phosphate, incl. photometer PF-12	914 303
<i>VISOCOLOR</i> ® Reagent case with PF-12	without test kits for individual combination of test papers and <i>VISOCOLOR</i> ® kits	914 301
For the carrying case with the photometer <i>VISOCOLOR</i> ® photino, please see page 70		

### Soil analysis

For its many ecological functions a biologically active soil, which is extensively used for agriculture, has to be maintained and supported. The best, economically and ecologically most meaningful procedure is to analyse first the important parameters of the soil before planning measures such as fertilization, liming etc.

The *VISOCOLOR*® reagent case for soil analysis has been developed for the rapid, convenient and reliable determination of the soil condition, even in the field.

#### *VISOCOLOR*® reagent case for soil analysis

REF 914 601

The *VISOCOLOR*® reagent case for soil analysis contains all reagents, instruments and accessories required for the preparation of soil extracts and the subsequent determination of

- Phosphate (P)
- Potassium (K)
- Ammonium, Nitrite, Nitrate (N)
- soil structure
- pH

The soil extracts are either prepared with Calcium-Acetate-Lactate (CAL) solution (prior to the determination of P and K) or with CaCl<sub>2</sub> solution (prior to the determination of N and pH).

If required by national regulations for soil analysis or because of local geological conditions, the *VISOCOLOR*® reagent case for soil analysis can also be used together with extraction solutions other than CaCl<sub>2</sub> or CAL. Please consult instruction leaflets for possible interferences.

Reagents are sufficient for 110 CaCl<sub>2</sub> extractions, 7 CAL extractions and 60 – 100 tests

Shelf life of reagents: at least 1.5 years

As refills the following reagents can be used.

CaCl <sub>2</sub> stock solution, for 300 soil samples	REF 914 612
CAL stock solution, for 10 soil samples	REF 914 614
<i>VISOCOLOR</i> ® HE pH 4 – 10	REF 920 174
<i>VISOCOLOR</i> ® HE Phosphorus in soil	REF 920 183
Pyrophosphate solution	REF 914 611
<i>VISOCOLOR</i> ® ECO Potassium	REF 931 232
QUANTOFIX® Ammonium	REF 913 15
QUANTOFIX® Nitrate/Nitrite	REF 913 13
pH-Fix 2 – 9	REF 921 18
Folded filters MN 616 1/4, 18.5 cm ø	REF 532 018

In addition to the reagent case, various *VISOCOLOR*® reagents can also be used for soil analysis. Please request information about suitable extraction solutions.



# Reagent cases

## Combinations of several VISOCOLOR® test kits

### Reagent cases for water analysis

Reagent cases with VISOCOLOR® test kits give fish breeders, anglers and other interested parties the possibility to carry out fast and simple analyses of the most important parameters which are important for evaluation of the water quality. No previous knowledge of chemistry is required for proper performance of the tests.

The different VISOCOLOR® reagent cases contain a thermoformed lining which holds all requisite reagents, comparators, and accessories. Colour coding of reagent bottles prevents confusion of reagents. VISOCOLOR® ECO reagent bottles are identified by unambiguous symbols. Reagents are sufficient for at least 60 tests.

The high sensitivity VISOCOLOR® HE test kits cannot be placed in a VISOCOLOR® reagent case.

#### VISOCOLOR® ECO reagent case REF 931 001

This VISOCOLOR® ECO reagent case contains the following test kits:

• Ammonium	0.2 – 3 mg/l $\text{NH}_4^+$
• Carbonate Hardness	1 drop = 1 °d
• total Hardness	1 drop = 1 °d
• Nitrate	1 – 120 mg/l $\text{NO}_3^-$
• Nitrite	0.02 – 0.5 mg/l $\text{NO}_2^-$
• pH	pH 4.0 – 9.0
• Phosphate	0.2 – 5 mg/l P

Shelf life of reagents: at least 1.5 years



#### VISOCOLOR® ECO reagent case without test kits REF 931 100

This VISOCOLOR® ECO reagent case allows the individual combination of up to 7 test kits from the VISOCOLOR® ECO programme.

#### VISOCOLOR® reagent case REF 931 302

This VISOCOLOR® reagent case contains the following test kits:

• Alkalinity AL 7(SBV)	accuracy: 0.2 mmol/l or 0.5 °d
• Ammonium	0.2 – 3 mg/l $\text{NH}_4^+$
• Hardness H 20 F (total)	accuracy: 0.1 mmol/l or 0.5 °d
• Nitrite	0.02 – 0.50 mg/l $\text{NO}_2^-$
• Oxygen SA 10	accuracy: 0.2 mg/l $\text{O}_2$ (oxygen deficit)
• pH 4.0 – 9.0	pH 4.0 – 9.0
• Phosphate	0.2 – 5 mg/l P
• Temperature	–10 to +60 °C

Shelf life of reagents: at least 1.5 years

Additionally the case can hold one VISOCOLOR® ECO test kit (REF 931 0...).

As refill for this VISOCOLOR® reagent case you can use following refill packs:

• Alkalinity AL 7	REF 915 207
• Ammonium	REF 931 208
• Hardness H 20 F (total)	REF 915 205
• Nitrite	REF 931 244
• Oxygen SA 10	REF 915 209
• pH 4.0 – 9.0	REF 931 266
• Phosphate	REF 931 284



#### VISOCOLOR® reagent case without test kits REF 931 307

This VISOCOLOR® reagent case allows the individual combination of up to 9 test kits from the complete range of VISOCOLOR® ECO and titration test kits; e.g. for applications in

- boiler water conditioning
- water treatment
- beverage industries
- printing industries
- corrosion prevention
- construction industries
- and others
- cooling water conditioning
- irrigation
- education
- surface finishing
- aquaculture

To get your personal selection of specific test kits, please see on page 70 or contact us prior to ordering.



## Reagent cases

### Combinations of several **VISOCOLOR®** test kits

#### **VISOCOLOR®** reagent cases with the photometer PF-12

**VISOCOLOR®** reagent cases with photometer PF-12 (see page 72) contain a rugged foam plastic insert which holds the photometer PF-12 and all requisite reagents and accessories. Colour coding of the reagent bottles prevents confusion of reagents. The reagents are sufficient for 50 - 400 tests.

##### **VISOCOLOR®** reagent case "Environmental analysis"

REF 914 303

This **VISOCOLOR®** reagent case is intended for the ecological evaluation of very different types of water and contains the photometer PF-12 and the following **VISOCOLOR® ECO** tests:

• Ammonium 15	0.5 – 8.0 mg/l $\text{NH}_4^+$
• Carbonate hardness C 20	accuracy: 0.1 mmol/l or 0.5 °d
• Hardness H 20 F (total)	accuracy: 0.1 mmol/l or 0.5 °d
• Iron	0.04 – 2.00 mg/l Fe
• Nitrate	1 – 80 mg/l $\text{NO}_3^-$
• Nitrite	0.02 – 0.50 mg/l $\text{NO}_2^-$
• pH 4.0 – 9.0	pH 4.0 – 9.0
• Phosphate	0.2 – 5.0 mg/l P

Reagents are sufficient for 50 – 400 tests.

Shelf life of reagents: at least 18 months



Carbonate hardness (p/m alkalinity) and total hardness are determined titrimetrically, pH only by visual colorimetry, i. e. not with the photometer.

As refill packs for the **VISOCOLOR®** reagent case "Environmental analysis" you can use the following test kits:

• Ammonium 15	REF 931 210
• Carbonate hardness C 20	REF 915 203
• Hardness H 20 F (total)	REF 915 205
• Iron	REF 931 226
• Nitrate	REF 931 241
• Nitrite	REF 931 244
• pH 4.0 – 9.0	REF 931 266
• Phosphate	REF 931 284

Additionally, the photometer PF-12 can be used for the evaluation of all other **VISOCOLOR® ECO** tests with colour comparator scale and **NANOCOLOR®** tube tests.

##### **VISOCOLOR®** reagent case with PF-12, without test kits

REF 914 301

This **VISOCOLOR®** reagent case contains the photometer PF-12 and allows the individual combination of test kits from the **VISOCOLOR®** programme, e. g. for applications in:

- boiler water conditioning
- water treatment
- beverage industries
- printing industries
- corrosion prevention
- construction industries and others
- cooling water conditioning
- irrigation
- education
- surface finishing
- aquaculture

To get your personal selection of specific test kits, please contact us prior to ordering.



##### Individual mini-labs

In the new **VISOCOLOR®** reagent cases with photometer PF-12, photometric analysis of **VISOCOLOR® ECO** tests can be individually combined with **VISOCOLOR® alpha** tests, **VISOCOLOR® HE** tests, pH indicator papers, pH-Fix test strips, qualitative test papers and semi-quantitative **QUANTOFIX®** test strips.



# Reagent cases

## Combinations of several VISOCOLOR® test kits

### Individual VISOCOLOR® reagent cases for different applications

Choose from different empty VISOCOLOR® reagent cases to fill them with various VISOCOLOR® test kits and refill packs to customize your own portable environmental laboratory. The empty VISOCOLOR® reagent cases are available with or without the photometer PF-12.

To customize your individual reagent cases, please keep the following in mind:

- Which parameters do you want to check?
- Which measuring range are you looking for?
- How many samples do you have to analyse?
- Which kind of samples have to be analysed?
- Which method should be used (colorimetric, titrimetric, photometric)?

You only have to order your desired empty VISOCOLOR® reagent case and the suitable test kits or refill packs. On request we can check which arrangement is the most practical way and offer you an individual solution.

Some examples for customized VISOCOLOR® reagent cases are as follows:

### Reagent cases without photometer

#### Example of a reagent case for aquaculture and fish farming



**Ammonium 3**  
REF 931 008  
**Carbonate hardness**  
REF 931 014  
**Hardness**  
REF 931 029  
**Iron**  
REF 931 026  
**Nitrat**  
REF 931 041  
**Oxygen**  
REF 931 088  
**pH 4.0 – 9.0**  
REF 931 066  
**Phosphate**  
REF 931 084

This reagent case is equipped with VISOCOLOR® ECO test kits.

#### Example of a reagent case for construction industry



**Acidity AC 7**  
REF 931 014  
**Ammonium**  
REF 913 15  
**Chloride**  
REF 931 018  
**pH 4.5 - 10.0**  
REF 921 20  
**Hardness**  
REF 931 029  
**Magnesium**  
REF 931 029  
**Sulphate**  
REF 913 29  
**Sulphide**  
REF 931 094

This reagent case is equipped with test papers, test strips and VISOCOLOR® ECO test kits.

### Reagent cases with photometer

#### Example of a reagent case for electroplating industry



**Chlorine 2**  
REF 931 215  
**Chromium(VI)**  
REF 931 220  
**Copper**  
REF 931 237  
**Cyanide**  
REF 931 222  
**Nickel**  
REF 931 240  
**Sulphate**  
REF 914 235  
**Zinc**  
REF 931 298

This reagent case is equipped with VISOCOLOR® ECO refill packs in combination with photometer PF-12.

#### Example of a special reagent case



**Chromium(VI)**  
REF 931 220  
**Copper**  
REF 931 237  
**Cyanide**  
REF 931 222  
**Hardness**  
REF 931 029  
**Iron**  
REF 931 226  
**Nickel**  
REF 931 240  
**pH 6.0 – 8.2**  
REF 931 270  
**Phosphate**  
REF 931 284  
**Sulphate**  
REF 914 235

This reagent case is equipped with VISOCOLOR® ECO test kits and refill packs in combination with photometer PF-12.



# Photometer for water analysis

## VISOCOLOR® photino

### Portable photometer for drinking water and pool analysis

The VISOCOLOR® photino is an irreplaceable analytical tool for the determination of:

- Chlorine
- pH and
- Cyanuric acid

#### Modern optics · Accurate results

Highest accuracy is obtained by an optimal match of calibrations due to a state-of-the-art microprocessor and signal averaging over the complete measurement period. The results are directly displayed in mg/l. An off-scale warning occurs if results are out of the measuring range. The LED technology assures a long-term stability of the light source and low power consumption.

#### Auto zero function

The auto zero function speeds up analysis time and reduces preparation of blank values to a minimum.

#### Easy to use

The one button operation allows an extremely simple measurement procedure. All methods are factory programmed, no user calibrations are needed

#### Auto switch technology



The photometric measurement is released automatically after the cuvette has been inserted into the cuvette slot. No additional keystroke is necessary.

#### Economic power management

Up to 2000 measurements can be done with a set of 3 AA batteries. The power consumption is reduced to a minimum due to the modern LED technology and power saving auto-off function after 15 min of non-use. A low battery warning indicates when you need to replace the batteries.

#### Portable laboratory



The VISOCOLOR® photino with its lightweight but rugged carrying case is a complete portable laboratory with space for reagents and analytical accessories.



#### Reagents



The VISOCOLOR® photino case can be supplemented with VISOCOLOR® colorimetric reagents for determination of free and total chlorine (0.05 – 6.00 mg/l), pH 6.0-8.2 and cyanuric acid (10 – 100 mg/l) - up to 150 determinations each. The reagents do not contain any hazardous chemicals and the resulting preparations are easy to dispose of after use. The economically priced refill reagents remarkably reduce the price per test.

#### Easy handling · no more stirring, no more crushing

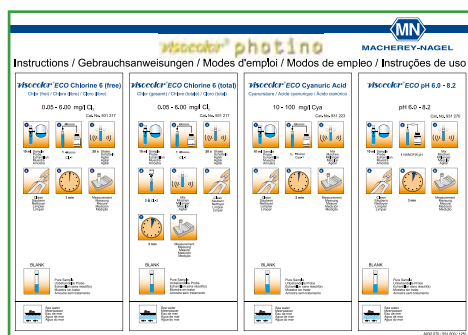


Whether liquid DPD reagents for chlorine, NANOFIX indicator capsules for pH or finest reagent powder for chlorine and cyanuric acid; all reagents are easy to dose and dissolve immediately.

# Photometer for water analysis


## VISOCOLOR® photino

### Clear dosage and test instructions



Coloured pictograms guide you through the tests step by step. All VISOCOLOR® reagent bottles are labelled with clear dosing instructions.

### Technical Data

Type:	handheld LED photometer, preprogrammed with 3 calibrations
Optics:	narrow band LED with 525 nm
Detector:	photovoltaic cell
Display:	alphanumeric LC display, 2 x 16 characters
Operation:	microswitch for automatic release of measurements, 2 foil-covered keys
User languages:	operator controlled selection of various languages (4 per instrument)
Autoblack:	optional operator controlled feature
Automatic shutt off:	after 15 min
Stability:	< 0.005 E/h
Power supply:	3 AA batteries (included)
Temperature range:	0 – 50 °C; 0 – 95% rel. humidity
Housing:	corrosion and water resistant ABS plastic, sealed and splash-proof keypad, IP 54
Dimensions:	146 x 91 x 50 mm
Weight:	340 g
Warranty:	2 years
Declaration of conformity:	
 This device complies with the following directive: - 2004/108/EC - EMC Directive	

### Reagent cases VISOCOLOR® photino · Ordering information

Description	REF
Carrying case with photometer VISOCOLOR® photino, 3 AA batteries, 4 test tubes, 1 syringe 10 ml, 1 funnel, 1 plastic beaker 25 ml, 1 instrument manual and test instructions; available with different combinations of reagents. User languages: German, English, Spanish and Portuguese (French version on request)	
<b>VISOCOLOR® photino carrying case for the determination of Chlorine with liquid DPD reagent (Range 0.10 – 2.50 mg/l)</b>	
Carrying case without reagents	931 300.1
Carrying case with reagents VISOCOLOR® ECO Chlorine 2	931 311.1
Carrying case with reagents VISOCOLOR® ECO Chlorine 2 and pH 6.0 – 8.2	931 322.1
Carrying case with reagents VISOCOLOR® ECO Chlorine 2, pH 6.0 – 8.2 and Cyanuric acid	931 333.1
<b>VISOCOLOR® photino carrying case for the determination of Chlorine with solid DPD reagent (Range 0.05 – 6.00 mg/l)</b>	
Carrying case without reagents	931 600.1
Carrying case with reagents VISOCOLOR® ECO Chlorine 6	931 611.1
Carrying case with reagents VISOCOLOR® ECO Chlorine 6 and pH 6.0 – 8.2	931 622.1
Carrying case with reagents VISOCOLOR® ECO Chlorine 6, pH 6.0 – 8.2 and Cyanuric acid	931 633.1
<b>Reagent refill packs</b>	
VISOCOLOR® ECO Chlorine 2 (0.10 – 2.50 mg/l)	931 215
VISOCOLOR® ECO free Chlorine 2 (0.10 – 2.50 mg/l)	931 216
VISOCOLOR® ECO Chlorine 6 (0.05 – 6.00 mg/l)	931 217
VISOCOLOR® ECO free Chlorine 6 (0.05 – 6.00 mg/l)	931 219
VISOCOLOR® ECO pH 6.0 – 8.2	931 270
VISOCOLOR® ECO Cyanuric acid (10 – 100 mg/l)	931 223

# Photometer for water analysis

## Compact photometer PF-12

### Maximum flexibility

- More than 100 preprogrammed methods
- Automatic wavelength adjustment
- Backlit graphic display with intuitive user guidance
- Data storage according to GLP
- USB interface for data transfer, update and power supply

### Experience flexibility

The compact photometer PF-12 is the logical result of a further development based on our very successful photometer PF-11. Adapted to our customers' requirements the PF-12 impresses with modern design and precise analytic. Preprogrammed tests, automatic wavelength adjustment and the intuitive user guidance allow fast and easy operation. Results are stored according to GLP and transferred safely to your PC with the included PC-software. The PF-12 features an unrivaled flexibility with variable power supply via mains supply, standard and rechargeable batteries, PC and 12 V car adapter. Additionally, the PF-12 offers photometric analysis of *VISOCOLOR*<sup>®</sup> ECO tests and *NANOCOLOR*<sup>®</sup> tube tests including all relevant parameters for water and waste water analysis and individual combination of tests in the new reagent cases.

### Save time

**Backlit graphic display with self-explanatory user guidance**



- All tests and menu items can be activated fast and easily
- Operation without complex and time-consuming training

### Results within seconds

The progressively designed optics is insensitive to external light and makes measuring straightforward

### Be prepared for the future

#### Fast photometer update – free of charge

- At any time, stay up-to-date with our easy online software update
- For current software updates please visit [www.mn-net.com](http://www.mn-net.com)



**NEW!**



### Assure results

#### Documentation of results according to GLP

- Individual entries of sample number, sample location and dilution

#### Clear memory management

- GLP-conform storage of results with all supplementary information such as date, time, sample number, sample location and dilution
- Fast and easy access to stored results and data sets

#### Convenient data export



- *NANOCOLOR*<sup>®</sup> Software DVD included in delivery
- Easy transfer of results to PC
- Data export directly to MS Excel
- Recording of calibration curves to programme user-defined methods

#### Internal quality control according to ISO 9001

- Fulfill supervisor and authority requirements
- Fast and easy self-monitoring of photometric accuracy with *NANOCONTROL* *NANOCHECK* (REF 925 701)



# Photometer for water analysis

## Compact photometer PF-12

### Be mobile

#### Works under any condition

- Variable power supply for mobile use:



Standard and rechargeable batteries for more than 2000 off the line measurements



USB adaptor (REF 919 220) for cigarette lighter in the car



USB adaptor for mains supply in the lab

- Power saving auto-off function after 5, 10, 15 or 20 min
- Waterproof housing (IP 67)

### Enjoy versatility

#### Complete water and waste water analysis

- Ammonium, Chlorine, *total*-N, *total*-P, Nitrate, Nitrite, all COD tests and many more
- More than 100 preprogrammed tests
  - *VISOCOLOR*<sup>®</sup> *ECO* tests
  - *NANOCOLOR*<sup>®</sup> tube tests
- Programmable for 10 user-defined methods
- Photometric basic functions: absorbance, transmission, factor and standard



### Endless opportunities

#### Individual mini-labs

- Portable reagent cases with photometer PF-12
- Photometric analysis of *VISOCOLOR*<sup>®</sup> *ECO* tests can be combined with:



Qualitative test papers, *VISOCOLOR*<sup>®</sup> reagent bottles,



QUANTOFIX<sup>®</sup> test strips, pH-Fix test strips, pH indicator papers and



Accessories



Please find further information and examples of reagent cases on page 68.

# Photometer for water analysis

## Compact photometer PF-12

### Technical data

Type:	Filter photometer with microprocessor control, self-test and auto-calibration Wavelength range 340 – 860 nm
Optics:	Automatic filter wheel with 7 interference filters Insensitive to external light – no light shield required
Wavelengths:	345 / 436 / 470 / 540 / 585 / 620 / 690 nm plus 1 compartment for an additional filter
Wavelength accuracy:	± 2 nm, bandwidth at half transmission 10 – 12 nm
Light source:	Tungsten lamp
Detector:	Silicon photodiode
Blank value:	Automatic
Measuring modes:	Over 100 preprogrammed tests ( <i>NANOCOLOR</i> ® tube tests and <i>VISOCOLOR</i> ® <i>ECO</i> tests) Absorbance, transmission, factor, standard 10 freely programmable methods
Photometric range:	± 3 E
Photometric accuracy:	± 1 %
Stability:	< 0.002 E/h
Cuvette holder:	Round tubes 16 mm OD
Data memory:	200 results, GLP conform
Display:	Backlit graphic display, 64 x 128 pixels All important data at a glance: Result in respective unit, date, time, sample number, sample location and dilution
Operation:	Display user guidance, plastic foil keyboard Test selection via test number or parameter lists 12 languages (de, en, fr, es, it, nl, hu, pl, pt, cz, id, si)
Quality Control:	With <i>NANOCONTROL</i> <i>NANOCHECK</i>
Interface:	USB 2.0
Update:	Via Internet / PC, free of charge
Operating range:	0 – 50 °C, up to 90 % relative humidity
Power supply:	Via USB power supply, standard or rechargeable batteries
Housing:	Waterproof, IP 67
Dimensions:	215 x 100 x 65 mm
Weight:	0.7 kg
Warranty:	2 years



This device complies with the following directives:  
 - 2006/95/EG - Low-Voltage Directive  
 - 2004/108/EG - EMC-Directive

### Ordering information

Description	REF
Compact photometer PF-12 Incl. software DVD, manual, 4 batteries, 4 empty test tubes, funnel, beaker, syringe, USB cable, calibration cuvette and certificate in rugged case	919 200
USB power supply	919 220
Charger	919 221



# Photometer for water analysis

## Compact photometer PF-12

**VISOCOLOR® ECO and NANOCOLOR® tests which can be evaluated with the photometer PF-12 · Ordering information**

Test	Ranges	Test no	Wavelength	No of tests	REF
<b>VISOCOLOR® ECO</b>					
Ammonium 3	0.1 – 2.5 mg/l $\text{NH}_4^+$	5-08	690	50	931 208
Ammonium 15	0.5 – 8.0 mg/l $\text{NH}_4^+$	5-10	585	50	931 210
Chloride	1 – 60 mg/l $\text{Cl}^-$	5-18	470	90	931 218
Chlorine 2, free + total	0.10 – 2.00 mg/l $\text{Cl}_2$	5-15	540	150	931 215
free Chlorine 2	0.10 – 2.00 mg/l $\text{Cl}_2$	5-16	540	150	931 216
Chlorine 6, free + total	0.05 – 6.00 mg/l $\text{Cl}_2$	5-17	540	200	931 217
free Chlorine 6	0.05 – 6.00 mg/l $\text{Cl}_2$	5-19	540	400	931 219
Chromium(VI)	0.04 – 1.00 $\text{CrO}_4^{2-}$	5-20	540	140	931 220
Copper	0.1 – 5.0 mg/l $\text{Cu}^{2+}$	5-37	585	100	931 237
Cyanide	0.01 – 0.20 mg/l $\text{CN}^-$	5-22	585	100	931 222
Cyanuric acid	10 – 100 mg/l Cya	5-23	540	100	931 223
Fluoride	0.1 – 2.0 mg/l $\text{F}^-$	5-27	585	150	931 227
Hydrazine	0.05 – 0.40 mg/l $\text{N}_2\text{H}_4$	5-30	436	130	931 230
Iron	0.04 – 2.00 mg/l Fe	5-26	540	100	931 226
Manganese	0.1 – 5.0 mg/l $\text{Mn}^{2+}$	5-38	436	70	931 238
Nickel	0.1 – 5.0 mg/l $\text{Ni}^{2+}$	5-40	470	150	931 240
Nitrate	1 – 80 mg/l $\text{NO}_3^-$	5-41	436	110	931 241
Nitrite	0.02 – 0.50 mg/l $\text{NO}_2^-$	5-44	540	120	931 244
Oxygen	1 – 8 mg/l $\text{O}_2$	5-88	540	50	931 288
pH 6.0 – 8.2	pH 6.0 – 8.2	5-70	436/540	150	931 270
Phosphate	0.2 – 5.0 mg/l $\text{PO}_4\text{-P}$ 0.6 – 15 mg/l $\text{PO}_4^{3-}$	5-84	690	80	931 284
Potassium	2 – 25 mg/l $\text{K}^+$	5-32	690	60	931 232
Silica	0.2 – 3.0 mg/l $\text{SiO}_2$	5-33	690	80	931 233
Sulphate	20 – 200 mg/l $\text{SO}_4^{2-}$	5-92	436	100	931 292
Sulphide	0.05 – 0.80 mg/l $\text{S}^{2-}$	5-94	620	90	931 294
Zinc	0.1 – 3.0 mg/l $\text{Zn}^{2+}$	5-98	620	120	931 298
<b>NANOCOLOR® tube tests</b>					
Aluminium 07	0.02 – 0.70 mg/l $\text{Al}^{3+}$	0-98	540	19	985 098
Ammonium 3	0.04 – 2.30 mg/l $\text{NH}_4\text{-N}$ 0.05 – 3.00 mg/l $\text{NH}_4^+$	0-03	690	20	985 003
Ammonium 10	0.2 – 8.0 mg/l $\text{NH}_4\text{-N}$ 0.2 – 10 mg/l $\text{NH}_4^+$	0-04	690	20	985 004
Ammonium 50	1 – 40 mg/l $\text{NH}_4\text{-N}$ 1 – 50 mg/l $\text{NH}_4^+$	0-05	690	20	985 005
Ammonium 100	4 – 80 mg/l $\text{NH}_4\text{-N}$ 5 – 100 mg/l $\text{NH}_4^+$	0-08	585	20	985 008
Ammonium 200	30 – 160 mg/l $\text{NH}_4\text{-N}$ 40 – 200 mg/l $\text{NH}_4^+$	0-06	585	20	985 006
AOX 3	0.1 – 3.0 mg/l AOX 0.01 – 0.30 mg/l AOX	0-07	470	20	985 007
BOD <sub>5</sub>	0.5 – 12.0 mg/l $\text{O}_2$	8-22	470	25-50	985 822
BOD <sub>5</sub> -TT	0.5 – 7.5 mg/l $\text{O}_2$	8-25	470	11-21	985 825
Cadmium 2	0.05 – 2.00 mg/l $\text{Cd}^{2+}$	0-14	540	10-19	985 014
Carbonate hardness 15	1.0 – 15.0 °d 0.4 – 5.4 mmol/l $\text{H}^+$	0-15	436/585	20	985 015
Chloride 50	0.5 – 50.0 mg/l $\text{Cl}^-$	0-21	470	20	985 021
Chloride 200	5 – 200 mg/l $\text{Cl}^-$	0-19	470	20	985 019
Chlorine/Ozone 2	0.05 – 2.50 mg/l $\text{Cl}_2$ 0.05 – 2.00 mg/l $\text{O}_3$	0-17	540	20	985 017
Chlorine dioxide 5	0.15 – 5.00 mg/l $\text{ClO}_2$	0-18	540	20	985 018
Chromate 5	0.05 – 2.00 mg/l $\text{Cr(VI)}$ 0.1 – 4.0 mg/l $\text{CrO}_4^{2-}$	0-24	540	20	985 024
COD 40	2 – 40 mg/l $\text{O}_2$	0-27	345	20	985 027



# Photometer for water analysis

## Compact photometer PF-12

Test	Ranges	Test no	Wavelength	No of tests	REF
COD 60	5 – 60 mg/l O <sub>2</sub>	0-22	345	20	985 022
COD 160	15 – 160 mg/l O <sub>2</sub>	0-26	436	20	985 026
COD 160 Hg-free	15 – 160 mg/l O <sub>2</sub>	0-26	436	20	963 026
COD 300	50 – 300 mg/l O <sub>2</sub>	0-33	436	20	985 033
COD 1500	100 – 1500 mg/l O <sub>2</sub>	0-29	620	20	985 029
COD 10000	1.00 – 10.00 g/l O <sub>2</sub>	0-23	620	20	985 023
COD 15000	1.0 – 15.0 g/l O <sub>2</sub>	0-28	620	20	985 028
COD 60000	5.0 – 60.0 g/l O <sub>2</sub>	0-12	620	20	985 012
org. Complexing agents 10 (Screeningtest)	0.5 – 10.0 mg/l IBiC	0-52	540	10 – 19	985 052
Copper 7	0.10 – 7.00 mg/l Cu <sup>2+</sup>	0-54	585	20	985 054
Cyanide 08	0.02 – 0.80 mg/l CN <sup>-</sup>	0-31	585	20	985 031
DEHA 1 (Diethylhydroxylamine)	0.05 – 1.00 mg/l DEHA	0-35	540	20	985 035
Ethanol 1000	0.10 – 1.00 g/l EtOH	8-38	620	23	985 838
Fluoride 2	0.1 – 2.0 mg/l F <sup>-</sup>	0-40	620	20	985 040
Formaldehyde 8	0.1 – 8.0 mg/l HCHO	0-41	585	20	985 041
Formaldehyde 10	0.20 – 10.00 mg/l HCHO	0-46	436	10 – 19	985 046
Hardness 20	1.0 – 20.0 °d 5 – 50 mg/l Mg <sup>2+</sup> 0.2 – 3.6 mmol/l 10 – 100 mg/l Ca <sup>2+</sup>	0-43	540	20	985 043
HC 300 (hydrocarbons)	0.5 – 5.6 mg/l HC 30 – 300 mg/kg HC	0-57	436	20	985 057
Iron 3	0.10 – 3.00 mg/l Fe	0-37	540	20	985 037
Lead 5	0.10 – 5.00 mg/l Pb <sup>2+</sup>	0-09	540	20	985 009
Manganese 10	0.1 – 10.0 mg/l Mn <sup>2+</sup>	0-58	470	20	985 058
Methanol 15	0.2 – 15.0 mg/l MeOH	8-59	620	23	985 859
Molybdenum 40	1.0 – 30.0 mg/l Mo (VI) 1.6 – 50.0 mg/l MoO <sub>4</sub>	0-56	345	20	985 056
Nickel 7	0.10 – 7.00 mg/l Ni <sup>2+</sup>	0-61	470	20	985 061
Nitrate 8	0.30 – 8.00 mg/l NO <sub>3</sub> -N 1.3 – 35.0 mg/l NO <sub>3</sub> <sup>-</sup>	0-65	345	20	985 065
Nitrate 50	0.3 – 22.0 mg/l NO <sub>3</sub> -N 2 – 100 mg/l NO <sub>3</sub> <sup>-</sup>	0-64	345	20	985 064
Nitrate 250	4 – 60 mg/l NO <sub>3</sub> -N 20 – 250 mg/l NO <sub>3</sub> <sup>-</sup>	0-66	345	20	985 066
Nitrite 2	0.003 – 0.460 mg/l NO <sub>2</sub> -N 0.02 – 1.50 mg/l NO <sub>2</sub> <sup>-</sup>	0-68	540	20	985 068
Nitrite 4	0.1 – 4.0 mg/l NO <sub>2</sub> -N 0.3 – 13.0 mg/l NO <sub>2</sub> <sup>-</sup>	0-69	540	20	985 069
total-Nitrogen TN <sub>b</sub> 22	0.5 – 22.0 mg/l N	0-83	345	20	985 083
total-Nitrogen TN <sub>b</sub> 220	5 – 220 mg/l N	0-88	345	20	985 088
Organic acids 3000	30 – 3000 mg/l CH <sub>3</sub> COOH 0.5 – 50.0 mmol/l CH <sub>3</sub> COOH	0-50	470	20	985 050
Oxygen 12	0.5 – 12.0 mg/l O <sub>2</sub>	0-82	436	22	985 082
Peroxide 2	0.03 – 2.00 mg/l H <sub>2</sub> O <sub>2</sub>	8-71	620	10 – 19	985 871
pH 6.5-8.2	pH 6.5 – 8.2	0-72	436/540	100	918 72
Phenolic index 5	0.2 – 5.0 mg/l Phenol	0-74	470	10 – 19	985 074
Potassium 50	2 – 50 mg/l K <sup>+</sup>	0-45	690	20	985 045
ortho- and total-Phosphate 1	0.05 – 1.50 mg/l P 0.2 – 5.0 mg/l PO <sub>4</sub> <sup>3-</sup>	0-76	690	19	985 076
ortho- and total-Phosphate 5	0.20 – 5.00 mg/l P 0.5 – 15.0 mg/l PO <sub>4</sub> <sup>3-</sup>	0-81	690	19	985 081
ortho- and total-Phosphate 15	0.30 – 15.00 mg/l P 1.0 – 45.0 mg/l PO <sub>4</sub> <sup>3-</sup>	0-80	690	19	985 080
ortho- and total-Phosphate 45	5.0 – 50.0 mg/l P 15 – 150 mg/l PO <sub>4</sub> <sup>3-</sup>	0-55	690	19	985 055

# Photometer for water analysis

## Compact photometer PF-12

Test	Ranges	Test no	Wavelength	No of tests	REF
<i>ortho</i> - and <i>total</i> -Phosphate 50	10.0 – 50.0 mg/l P 30 – 150 mg/l PO <sub>4</sub> <sup>3-</sup>	0-79	436	19	985 079
POC 200 (polyoxycarboxylic acids)	20 – 200 mg/l	0-70	436	20	985 070
Residual hardness 1	0.02 – 1.00 °d 0.004 – 0.180 mmol/l	0-84	540	20	985 084
Silver 3	0.20 – 3.00 mg/l Ag <sup>+</sup>	0-49	620	20	985 049
Starch 100	5 – 100 mg/l Stärke	0-85	540	19	985 085
Sulphate 200	10 – 200 mg/l SO <sub>4</sub> <sup>2-</sup>	0-86	436	20	985 086
Sulphate 1000	200 – 1000 mg/l SO <sub>4</sub> <sup>2-</sup>	0-87	436	20	985 087
Sulphide 3	0.05 – 3.00 mg/l S <sup>2-</sup>	0-73	620	20	985 073
Sulphite 10	0.2 – 10.0 mg/l SO <sub>3</sub> <sup>2-</sup>	0-89	436	20	985 089
Sulphite 100	5 – 100 mg/l SO <sub>3</sub> <sup>2-</sup>	0-90	470	19	985 090
Surfactants: Anionic surfactants 4	0.20 – 4.00 mg/l MBAS	0-32	620	20	985 032
Surfactants: Cationic surfactants 4	0.20 – 4.00 mg/l CTAB	0-34	620	20	985 034
Surfactants: Nonionic surfactants 15	0.3 – 15.0 mg/l Triton® X-100	0-47	620	20	985 047
Thiocyanate 50	0.5 – 50.0 mg/l SCN <sup>-</sup>	0-91	470	20	985 091
Tin 3	0.10 – 3.00 mg/l Sn	0-97	436	9 – 17	985 097
TOC 25	2.0 – 25.0 mg/l TOC	0-93	585	10	985 093
TOC 60	10 – 60 mg/l TOC	0-94	585	10	985 094
TOC 600	40 – 600 mg/l TOC	0-99	585	10	985 099
TTC/Sludge activity 150	5 – 150 µg TPF 0.050 – 2.300 E	8-90	470	20	985 890
Zinc 4	0.10 – 4.00 mg/l Zn <sup>2+</sup>	0-96	620	20	985 096