Lovibond® Water Testing

Tintometer® Group

Handbook of Methods

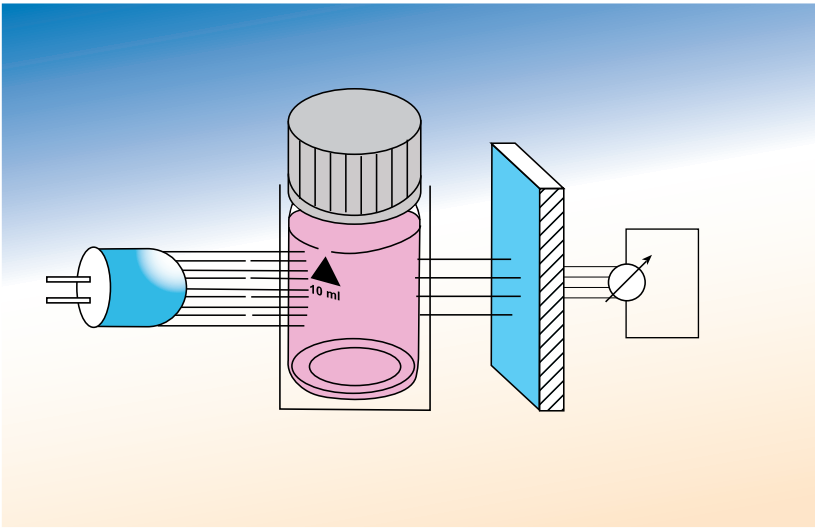
Analytical procedures for analysis of water and waste water

Photometry

Principles of Measuring

Concentration determination using photometry is based on the property of coloured solutions to absorb light of a certain colour.

A decrease in light intensity in the transmission of a sample depends on the strength of the colouration. If this strength of colouration depends of the concentration of analytes, it can therefore be concluded that a decline in light intensity affects concentration of the analyte.



Transmission is the ratio of the intensity of light before (I0) and after (I) radiating freely through the sample. To represent this absorption of light over a large area, a negative common logarithm of the transmission is usually chosen, which is also known as extinction or absorbency.

Extinction is linked via the Lambert-Beersche Law with sample concentration:

$$\mathbf{E_\lambda = -lg(Trans.) = -lg(I/I_0) = \varepsilon\lambda \cdot c \cdot d}$$

E_λ = Extinction at the wavelength λ ; ε_λ = molar absorption coefficient
c = Concentration of the sample ; d = path length of the cuvette

with knowledge of the layer thickness of the vial and of the molar extinction coefficient of the analyte, the concentration of the analyte can thus be determined by measuring the extinction.

Photometric testing methods

Test procedures were developed to determine analytes using photometry. With this, a specific chemical reaction produces a characteristic colour, which is then measured using a photometer.

In standardised test procedures, the procedure to be followed is specified by the standard precisely to the last detail. Only if this is implemented in all respects, can one appreciate the real advantage of a standardised method of analysis: the analytical performance data from the procedure are well known and generally accepted.

However, standardised analysis procedures for implementation often require laboratory technical expertise and they are both time- and equipment-intensive, so simplified procedures are preferred for routine analysis. These have been derived mostly from a standardised procedure, but in terms of time, effort and necessary skills, they are significantly optimised without compromising the analytical performance.

For more than 150 such analytical methods we offer reagents sets. They are known for their simple and safe handling for faster analysis. The calibrations necessary for these reagent kits, the response times and sequences are pre-programmed on our photo meters in the form of so-called methods. This helps the avoidance of errors in the analysis. In addition, non-chemists can reliably perform determinations and tests.

You can receive regular updates of the methods in the form of firmware updates through our website.

Influence factors on photometric analysis

- **Turbidity and Particles**

  Turbidity may already exist in the sample, or might occur only during the chemical reaction linked to the method of analysis. If the method of analysis is not based on measuring this turbidity, (such as in determining sulphate), the turbidity present in the measuring solution interferes with the photometric measurement and usually leads to higher results.
  Turbidity of the sample can be removed by filtration prior to analysis. It is important to ensure that the filter is sufficiently pre-rinsed with sample in order not to falsify the analyte concentration of the sample when carrying out filtration.
  If a turbid or particle-containing sample is digested before or during the actual analysis (for example, in the determination of total phosphorus or COD) and the particles contain analyte, this sample should not be filtered before analysis. The turbidity disappears as a result of digestion.
  A thorough homogenisation of the sample is important in such samples so that the small sample volume used for analysis is representative of the whole sample.

- **pH value**

  Reagent kits can never cover all conceivable compositions of samples. pH values strongly deviating from the norm of the sample must be adjusted before the analysis to the pH range specified for the relevant method of analysis. The sample volume modified by this pH adjustment must then be taken into account as a dilution in the calculation of the final result.

- **Time**

  The colouring reactions each require a certain amount of time until they are completed. Because with some procedures the formed colour complex is only stable for a limited time, exceeding the given times should be avoided. It is therefore important to comply exactly with the times specified in the analysis regulations.

- **Temperature**

  The speed of a chemical reaction depends on the temperature. Most reactions occur more slowly at low temperatures. If not otherwise instructed, the specified analysis methods assume room temperature. A very cold sample or very cold reagents can lead to a slowing down of the respective reaction, so that the specified times are no longer correct. Therefore, sample and reagents for the analysis should also have room temperature.

- **Interference**

  A high selectivity is sought in the development of methods of analysis. However, cross-sensitivities to other analytes can never be completely eliminated. Note the interferences specified for the respective methods in the selection of procedure. In some cases, interference must be reduced by a special sample preparation. The choice of a more sensitive method together with a pre-dilution of the sample can also be an appropriate countermeasure.
  The extent to which the sample composition interferes with the selected measurement system can be determined using the standard addition procedure.

Hints on Photometry

- During the measurement, avoid fluctuations in temperature and humidity. This can cause the optical components (e.g. photo-detector, vial) to fog up.
- Only clean vials are to be used for the analysis.
- Turbidity and the formation of bubbles in the coloured sample solution or on the surface of the vial lead to deviations in the measured value.
- The areas allowing light into the vials should not be touched with fingers
- The outer walls of the vial must be dry.
- Only use reagents or indicators that were originally designed for the photometer and calibrated. Different measurement results are likely to be experienced with the use of foreign chemicals.
- The sample and reagent volumes stated in the analytical procedure are to be complied with exactly.
- That specified time periods in the analysis procedures between the addition of the reagent and measurement are to be maintained exactly.

Reagents

Reagents may contain hazardous substances. Please therefore always note the dangers and handling instructions on the safety data sheets of the reagents.

Reagent solutions

During the dosing of liquid reagents using a dropper bottle, keep it held vertically.
By pressing slowly, equal-sized drops are added to the sample.
Bottles must be closed immediately after their use with the corresponding screw cap.
To ensure a long shelf life of reagents, they should be stored according to the storage instructions.

Reagent tablets

Among the key advantages of this formulation, is that each tablet contains a precisely defined amount of required preparation for dosing. Moreover, the shelf life of reagents in tablet form is superior to other forms of reagents.
When handling reagent tablets, be certain that they pass straight from the blister foil to the water sample, without touching them with your fingers. When pressing them out, make sure that the adjacent pockets of tablets are not touched, so as to not endanger their durability.

Reagent powder

Dosed powder packets are the most common form of preparation. The reagent is welded between 2 aluminium foils. Thus, the reagent solution has a superior shelf life, although not they do not quite reach the durability level of reagent tablets. In terms of dosing accuracy, reagent powder is superior to the other reagent solutions. However, reagent tablet are also generally better with this. The main advantage of reagent powder is that it dissolves the quickest.
Powder reagents are optimised to fully trickle out from an open packet of the powder. Any minimal remains of reagents remaining in the packet are not required for the exact implementation of the method. It is therefore not necessary to rinse out powder packets, e.g. to wash out any residual powder.

Sample

Sampling

The first step of the analysis is the extraction of the sample to be analysed. The accuracy of the subsequent analysis results depends predominantly on proper sampling. The primary objective of sampling is that the part taken represents the state of the whole as best as possible.

Also, the requirements for sampling and sample preparation depend on the analytes to be tested.
So, enough water must have gone through the pipe, in the example of determining chlorine from a pipe network, before the actual sample is removed. Strong swirling of the sample is to be avoided, since otherwise there could be chlorine outgassing during the sampling. In the case of a total phosphorus determination in waste water, however, the actual analyte content is not negatively affected by turbulence during the sampling. It is, on the contrary, even desirable because waste water commonly contains solids, so that removing some to a quiet zone of a channel can lead to a reduced amount of solids being removed, so that the sample no longer represents the general state in the channel.

Also, it can make sense to refer to several partial samples and then to combine them to increase the representativeness of the sample.

To carry out the analysis of comparison measurement to another (e.g. stationary) measuring system, make sure that in both cases the actual same sample is measured, so with both measurements there is no temporal or local difference in the sampling (e.g. for comparative measurements, through a direct sampling of the installed measuring system and not the channel from which the sample is taken – a permanently installed measuring system).

Sample preparation

Before a sample is analysed, preparatory steps are usually necessary, which can have a significant influence on the result.

- **Stabilisation**

  For parameters measured directly on the site, the sample should be stabilised before transport and storage so that the analyte remains unchanged.

Parameter	***Handling***	***Storage***
Cl_2, Br_2, ClO_2	none, analyse immediately	not possible
Heavy metal	not handled	short-term analysis
Heavy metal	to pH 1 with HNO_3	max. 4 weeks
COD	cool to 2° - 5°C	max. 24 h
NH_4, NO_3, NO_2	none, analyse immediately	only in exceptional cases
		at 2° - 5°C for max. 3hnot
handled	short-term analysis	
PO_4, P	to pH 1 with HNO_3	max. 4 weeks

- **Neutralisation**

  Most analytical methods only work properly in a defined pH range. If the sample material prevents to be of a significantly different pH or has a very strong buffering capacity so that the reagent can amend this target pH range, the user must amend the pH value of the sample material accordingly.

- **Dilution**

  A dilution of the sample may be necessary if the analyte exceeds the measuring range of the method, or if you want to minimise the impact of errors by means of dilution.

  So that the dilution is as exact as possible, it should be carried out as follows:

  The desired amount of pipette sample is placed into a 100 ml volumetric flask using an appropriate pipette or smaller volume with a piston-type pipette. Fill these up to the mark with deionised water and mix well.

  Take the sample volume from this diluted sample, as described in the analysis instructions, remove and conduct the analysis. The displayed result is then converted from the output volume:

  Example for 100 ml volumetric flask:

Pipette sample volume / [ml]	Result to be multiplied by
1	100
2	50
5	20
10	10
25	4
50	2

- **Filtration**

  Turbidity of the sample can be removed by filtration prior to analysis if the analyte is itself easily soluble in water and does not adsorb particles or is bound to them. It is important to ensure that the filter is sufficiently pre-rinsed with sample in order not to falsify the analyte concentration of the sample when carrying out filtration.

  If a turbid or particle-containing sample is closed up before or during the actual analysis (for example, in the determination of total phosphorus or COD) this sample should not be filtered before analysis since the particles could contain analytes and therefore influence the result. The same turbidity most disappears as a result of digestion.

  Weak turbidity can be compensated in appropriate photometers to the extent that the turbidity base is measured and included on a second wavelength in addition to the colour to be measured.

- **Homogenisation**

  With samples holding particles or with turbid samples, which are to be digested, pay attention in order that sufficient homogenisation of the sample is achieved before and during the removal of a subset. To do this, the maximum speed of agitation (more than 5000 revolutions per minute) is commonly used, as it both smashes particles at the same time as providing a sufficiently uniform distribution.

Digestion

The analyte may exist in forms that are not accessible to the chemical reaction for the method. Metal ions can, for example, be bound to strong complexing agents, or be in the wrong oxidation state. Phosphorus or nitrogen might not be available as molecular building blocks for the respective detection response. Analyte bound in solids must be transferred in solution before a wet-chemical analysis is carried out. In all these cases, a so-called digestion precedes the actual analysis.

In each method description, carefully noted are things such as digestions, insofar as the digestion reagents are part of the reagent sets. However, if, for example, undissolved parts in a sample are to be analysed by a method that is intended to analyse clear solutions, they must be analysed independently before the analysis.

Dilution of the original sample taking place as a result of a digestion procedure is taken into account in the calculation of the final result.

If it is unknown is whether digestion is necessary (e.g. in the context of heavy metal analysis), we recommend that you compare a digested sample analysis result with one that is not. If the values are similar, no digestion is necessary. If the digested test shows higher values, a digestion should be performed in the future. The knowledge gained from this should be monitored occasionally.

Glossary of analytical chemistry

Analytics

The substance is referred to as analyte, which should be demonstrated or determined in their concentration within the framework of an analytical procedure.

Absorption

The partial aspect of absorbency (extinction) is known as absorption, wherein the light interacts with matter that penetrates it in such a way that it decreases in intensity.

Extinction (Absorbency)

Extinction Is derived from the Latin word "extinctio" meaning "Extinction". It generally refers to the attenuation of light in optics. It is essentially based on scattering, diffraction and absorption.

Accuracy

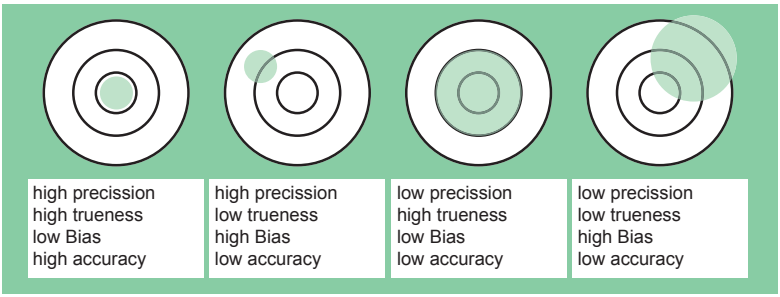
Accuracy is probably one of the most commonly used terms in analytical chemistry. And yet for most people, they have a vague understanding of the underlying concept. This is primarily because the term includes two specifically identifiable dimensions (precision and accuracy) and thus does not represent a self-determinable size. According to the VIM (Vocabulaire International de Métrologie) accuracy is indeed synonymous with a lower error rate. Because these errors are composed, however, of unpredictable deviations in the measurement result in terms of the true value and an equal dispersion of results, the accuracy of the number is not specifically measured.

Precision

Precision is a measure of the unsystematic scattering of results of the measurement of a sample, which is produced by repeated measurements under the same conditions. In the calculation of precision, the assumption of statistically equally distributed errors is used. If an unequal distribution of the error is found in relation to the true value, this is attributed to a systematic cause and thus a lack of accuracy.

Trueness, or sometimes conversely know as bias; incorrectly known often as 'accuracy'

A measurement result can be described as true if it is indistinguishable from the real value of the sample. Normally, this true value of a real sample is unknown. Yet to determine a value for the trueness of a method of analysis, a man-made sample with a known concentration of the analyte (so-called standard) is measured. Also in the event of true measurements, repeated measurements are dispersed around the true value, because total precision cannot be achieved. However, these measurements in terms of the mean value do not differ from the true value.
Thus, trueness refers to the distance between the mean value of the results and the true value. Thereby there is a small distance with high accuracy, and vice versa.



Detection limit

The smallest concentration that can be significantly distinguished from zero is the detection limit. Often a significance of 99.7% is created here as the criteria (out of 1000 measurements, only three statements would be wrong). In the event that a sufficient number of measurements are available and the errors are distributed normally in the statistical sense, the detection limit with this required significance is three times the standard deviation of the background signal.
From a signal of this strength, you can therefore say with 99.7% certainty that the signal no longer comes from the background (zero), but from a higher analyte concentration.
A concentration determination is still not possible at the level of the detection limit. This is because the possible levels that can trigger such a signal (more specifically 99.7%), span an interval from zero up to twice the limit of detection.

Limit of determination

To provide a concentration with sufficient precision, a signal with an amount of 9 to 10 times the standard deviation of the substrate is usually required. The concentration that dissolves this signal is called the limit of determination.

Sensitivity

A change in the measuring signal relative to the change in the concentration of the analyte is called sensitivity. A photometric method is all the more sensitive the more the absorption changes by a specific change in concentration of the analyte.

Measuring range

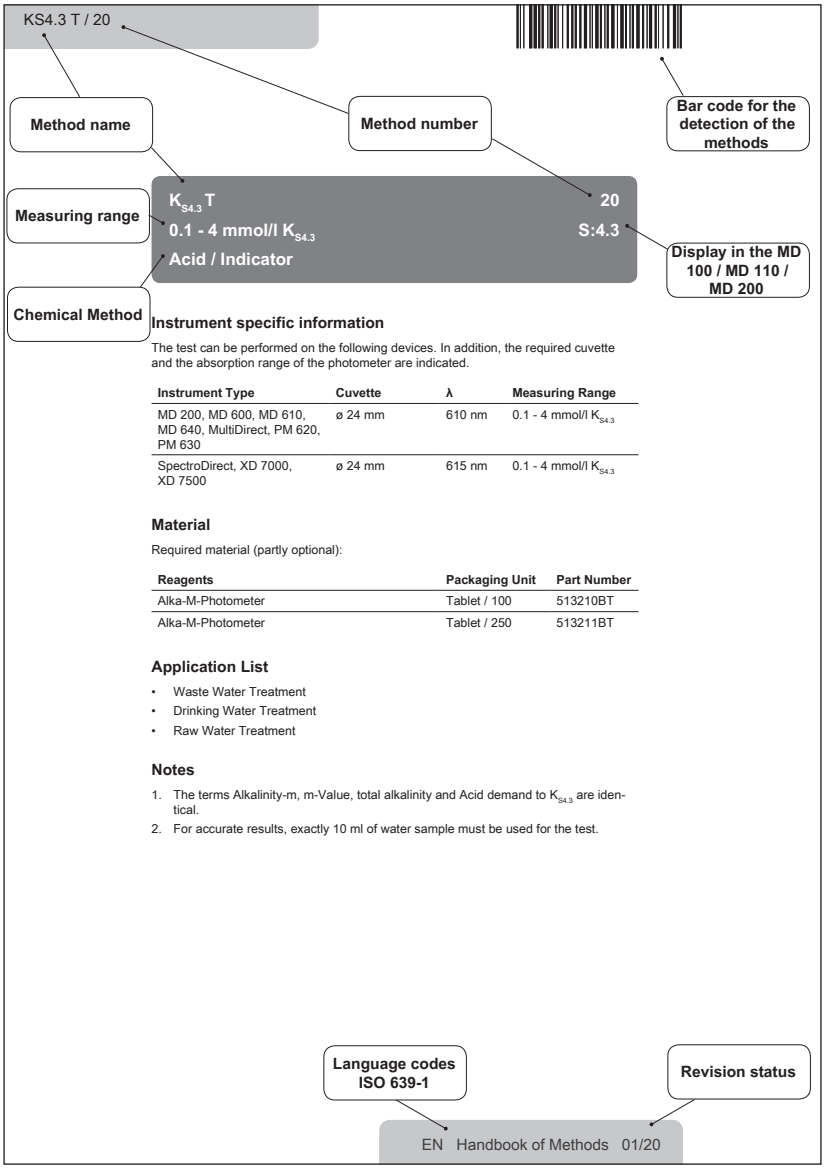
The concentration range is defined as the measuring range, in which an analytical method with a given precision (to be defined) can work. Therefore, the limit of detection of the method can be regarded as the lowest possible limit, and as the maximum upper limit, is the maximum evaluable concentration.
The actual measuring range always depends on the precision requirements of the specific application. It can therefore be smaller than this maximum possible range.

Matrix

All the components of the sample out of the analytes are referred to as matrix. They often have an influence on the accuracy of the method. Components of the sample, for example, can react in a similar way to the analyte, which could cause turbidity; pH values could be influenced or even reactions could be influenced
To detect possible interference by the matrix, the standard addition procedure can be used in the context of analytical quality assurance.

Standard addition procedure

In this process, both the sample and the sample to which a known amount of analyte has been added, are analysed. The analytical results obtained should ideally be exactly the same as the amount of analyte added. If the difference is smaller, the sample matrix leads to lower results when using this analysis method. If the difference is greater, the sample matrix leads to higher results.
The initial concentration of the increased sample should be corrected in line with the extra amount of additional solution:
Example:
10 ml sample results in a measured value of 5 mg/l analyte
9 ml sample + 1 ml increased solution with 20 mg/l analyte =
5 mg/l /10*9 + 20 mg/l /10*1 = 6.5 mg/l to the expected measured value



Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 200, MD 600, MD 610, MD 640, MultiDirect, PM 620, PM 630	ø 24 mm	610 nm	0.1 - 4 mmol/l $K_{S4.3}$
SpectroDirect, XD 7000, XD 7500	ø 24 mm	615 nm	0.1 - 4 mmol/l $K_{S4.3}$

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Alka-M-Photometer	Tablet / 100	513210BT
Alka-M-Photometer	Tablet / 250	513211BT

Application List

- Waste Water Treatment
- Drinking Water Treatment
- Raw Water Treatment

Notes

1. The terms Alkalinity-m, m-Value, total alkalinity and Acid demand to $K_{S4.3}$ are identical.
2. For accurate results, exactly 10 ml of water sample must be used for the test.

KS4.3 T / 20

Performing test procedure

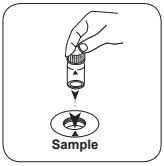
Implementation of the provision Acid capacity $K_{S4.3}$ with Tablet

Select the method on the device

For this method, no ZERO measurements are to be carried out with the following devices: XD 7000, XD 7500

Fill 24 mm vial with **10 ml sample**.

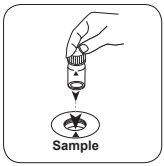
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

• • •

Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

Press the **TEST** (XD: **START**) button.

The result in Acid Capacity $K_{S4.3}$ appears on the display.

EN Handbook of Methods 01/20

Note:

For the XD 7000 and, XD 7500, the procedure for starting a measurement is different than described above. (XD: "START") Inserting a cuvette test with a barcode will trigger the measurement directly. Insert the cuvette test down to the bottom into the round sample chamber. The photometer uses the barcode to select the method and starts the measurement automatically.
For 24 mm round cuvettes or rectangular cuvettes, the method must be selected manually or via an external barcode reader first. The insertion of the 24 mm round cuvette then also triggers the measurement directly. When using rectangular cuvettes, first close the inner turn up lid and then start the measurement by pressing the START button.

Procedure with time limits:

If a reaction time is specified in the method after the addition of a reagent, you have to wait until it’s finished before a measurement is triggered.

No.	Analyses	Measuring Range	Measuring Range Unit	Display MD 100/110/200
M31	Alkalinity-m HR T	5 - 500	mg/L $CaCO_3$	
M30	Alkalinity-m T	5 - 200	mg/L $CaCO_3$	tA
M35	Alkalinity-p T	5 - 500	mg/L $CaCO_3$	
M50	Aluminium PP	0.01 - 0.25	mg/L Al	AL
M40	Aluminium T	0.01 - 0.3	mg/L Al	AL
M66	Ammonia HR TT	1.0 - 50	mg/L N	
M65	Ammonia LR TT	0.02 - 2.5	mg/L N	
M62	Ammonia PP	0.01 - 0.8	mg/L N	A
M60	Ammonia T	0.02 - 1	mg/L N	A
M68	Arsenic	0.02 - 0.6	mg/L As	
M85	Boron T	0.1 - 2	mg/L B	
M78	Bromine 10 T	0.1 - 3	mg/L Br_2	
M79	Bromine 50 T	0.05 - 1	mg/L Br_2	
M81	Bromine PP	0.05 - 4.5	mg/L Br_2	
M80	Bromine T	0.05 - 13	mg/L Br_2	Br
M87	Cadmium M. TT	0.025 - 0.75	mg/L Cd	
M63	Chloramine (M) PP	0.02 - 4.5	mg/L NH_2Cl as Cl_2	
M92	Chloride L (A)	0.5 - 20	mg/L Cl^-	CL-
M91	Chloride L (B)	5.00 - 60	mg/L Cl^-	
M90	Chloride T	0.5 - 25	mg/L Cl^-	CL-1
M93	Chloride T	5 - 250	mg/L Cl^-	CL-2
M98	Chlorine 10 T	0.1 - 6	mg/L Cl_2	
M99	Chlorine 50 T	0.02 - 0.5	mg/L Cl_2	
M64	Chlorine (free) and Mono-chloramine	0.02 - 4.50	mg/L Cl_2	CL2
M119	Chlorine dioxide 50 T	0.05 - 1	mg/l ClO_2	
M122	Chlorine dioxide PP	0.04 - 3.8	mg/l ClO_2	CLO2
M120	Chlorine dioxide T	0.02 - 11	mg/l ClO_2	CLO2
M104	Chlorine HR 10 T	0.1 - 10	mg/L Cl_2	
M105	Chlorine HR (KI) T (105)	5 - 200	mg/L Cl_2	CLHr
M111	Chlorine HR PP	0.1 - 8	mg/L Cl_2	CL8

, Test Kit	MD 100	MD 110	MD 200	MD 600, MD 610	MD 640	MultiDirect	PM 600	PM 620	PM 630	SpectroDirect	XD 7000	XD 7500	Page
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No.	Analyses	Measuring Range	Measuring Range Unit	Display MD 100/110/200
M103	Chlorine HR T	0.1 - 10	mg/L Cl_2	CL10
M101	Chlorine L	0.02 - 4.0	mg/L Cl_2	CL6
M113	Chlorine MR PP	0.02 - 3.5	mg/L Cl_2	CL2
M110	Chlorine PP	0.02 - 2	mg/L Cl_2	CL2
M100	Chlorine T	0.01 - 6.0	mg/L Cl_2	CL6
M124	Chromium 50 PP	0.005 - 0.5	mg/L Cr	
M125	Chromium PP	0.02 - 2	mg/L Cr	
M132	COD HR TT	200 - 15000	mg/L COD	Hr
M133	COD LMR TT	15 - 300	mg/L COD	LMr
M130	COD LR TT	3 - 150	mg/L COD	Lr
M131	COD MR TT	20 - 1500	mg/L COD	Mr
M149	Copper 50 T	0.05 - 1	mg/L Cu	
M151	Copper L	0.05 - 4	mg/L Cu	
M153	Copper PP	0.05 - 5	mg/L Cu	Cu
M150	Copper T	0.05 - 5	mg/L Cu	Cu
M161	CyA HR T	10 - 200	mg/L CyA	CyAH
M156	Cyanide 50 L	0.005 - 0.2	mg/L CN^-	
M157	Cyanide L	0.01 - 0.5	mg/L CN^-	
M160	CyA T	10 - 160	mg/L CyA	CyA
M167	DEHA PP	0.02 - 0.5	mg/L DEHA	DEHA
M165	DEHA T (L)	0.02 - 0.5	mg/L DEHA	
M510	Fluorescein	10 - 400	ppb	
M511	Fluorescein	10 - 300	ppb	
M170	Fluoride L	0.05 - 2	mg/L F^-	F
M175	Formaldehyde 10 M. L	1.00 - 5.00	mg/L HCHO	
M176	Formaldehyde 50 M. L	0.02 - 1.00	mg/L HCHO	
M177	Formaldehyde M. TT	0.1 - 5	mg/L HCHO	
M209	H2O2 50 T	0.01 - 0.5	mg/L H_2O_2	
M214	H2O2 HR L	40 - 500	mg/L H_2O_2	HP2
M213	H2O2 LR L	1 - 50	mg/L H_2O_2	HP1
M210	H2O2 T	0.03 - 3	mg/L H_2O_2	

, Test Kit	MD 100	MD 110	MD 200	MD 600, MD 610	MD 640	MultiDirect	PM 600	PM 620	PM 630	SpectroDirect	XD 7000	XD 7500	Page
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			•	•	•	•		•	•		•	•	490
			•	•	•	•					•	•	484
				•	•	•							474

No.	Analyses	Measuring Range	Measuring Range Unit	Display MD 100/110/200
M190	Hardness Calcium (B) T	50 - 900	mg/L $CaCO_3$	
M191	Hardness Calcium (B) T	20 - 500	mg/L $CaCO_3$	CAH
M201	Hardness total HR T	20 - 500	mg/L $CaCO_3$	tH2
M200	Hardness total T	2 - 50	mg/L $CaCO_3$	tH1
M204	Hazen 24	10 - 500	mg/L Pt	PtCo
M203	Hazen 50	10 - 500	mg/L Pt	
M207	Hydrazine C	0.01 - 0.7	mg/L N_2H_4	
M206	Hydrazine L	0.01 - 0.6	mg/L N_2H_4	
M205	Hydrazine P	0.05 - 0.5	mg/L N_2H_4	Hydr
M212	Hypochlorite T	0.2 - 16	% NaOCl	
M218	Iron 10 T	0.05 - 1	mg/L Fe	
M221	Iron 50 PP	0.01 - 1.5	mg/L Fe	
M219	Iron 50 T	0.01 - 0.5	mg/L Fe	
M223	Iron (TPTZ) PP	0.02 - 1.8	mg/L Fe	FE2
M227	Iron HR L	0.1 - 10	mg/L Fe	
M224	Iron in Mo PP (224)	0.01 - 1.8	mg/L Fe	FEM
M225	Iron LR L (A)	0.03 - 2	mg/L Fe	FE
M226	Iron LR L (B)	0.03 - 2	mg/L Fe	
M222	Iron PP	0.02 - 3	mg/L Fe	FE1
M220	Iron T	0.02 - 1	mg/L Fe	FE
M20	KS4.3 T	0.1 - 4	mmol/L $K_{S4.3}$	S:4.3
M232	Lead 10	0.1 - 5	mg/L Pb	
M234	Lead (A) TT	0.1 - 5	mg/L Pb	
M235	Lead (B) TT	0.1 - 5	mg/L Pb	
M215	Iodine T	0.05 - 3.6	mg/L I	
M243	Manganese HR PP	0.1 - 18	mg/L Mn	Mn2
M245	Manganese L	0.05 - 5	mg/L Mn	
M242	Manganese LR PP	0.01 - 0.7	mg/L Mn	Mn1
M240	Manganese T	0.2 - 4	mg/L Mn	Mn
M254	Molybdate HR L	1 - 100	mg/L MoO_4	Mo2
M252	Molybdate HR PP	0.3 - 40	mg/L Mo	MO2

, Test Kit	MD 100	MD 110	MD 200	MD 600, MD 610	MD 640	MultiDirect	PM 600	PM 620	PM 630	SpectroDirect	XD 7000	XD 7500	Page
				•	•	•					•	•	414
	•	•	•	•	•	•	•	•	•				420
	•	•		•	•	•		•	•				432
	•			•	•	•		•	•				426
	•			•	•	•							444
										•	•	•	438
				•	•	•							462
				•	•	•							456
	•	•		•	•	•							450
				•	•	•	•	•	•				480
										•	•	•	498
											•	•	516
										•	•	•	504
	•			•	•	•							528
				•	•						•	•	562
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	•			•	•	•							522
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										•	•	•	572
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	•			•	•	•							602
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	•			•	•	•							592
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				•	•	•							622

No.	Analyses	Measuring Range	Measuring Range Unit	Display MD 100/110/200
M251	Molybdate LR PP	0.03 - 3	mg/L Mo	Mo1
M250	Molybdate T	1 - 50	mg/L MoO_4	Mo3
M255	Nickel 50 L	0.02 - 1	mg/L Ni	
M256	Nickel L	0.2 - 7	mg/L Ni	
M268	Nitrate HR	1.2 - 35	mg/L N	
M266	Nitrate LR2 TT	0.2 - 15	mg/L N	
M267	Nitrate LR TT	0.5 - 14	mg/L N	
M260	Nitrate T	0.08 - 1	mg/L N	
M265	Nitrate TT	1 - 30	mg/L N	
M276	Nitrite HR TT	0.3 - 3	mg/L N	
M275	Nitrite LR TT	0.03 - 0.6	mg/L N	
M272	Nitrite PP	0.01 - 0.3	mg/L N	
M270	Nitrite T	0.01 - 0.5	mg/L N	
M271	Nitrite VHR L	25 - 2500	mg/L NO_2^-	
M290	Oxygen active T	0.1 - 10	mg/L O_2	
M292	Oxygen dissolved C	10 - 800	µg/L O_2	O2
M299	Ozone 50 T	0.02 - 0.5	mg/L O_3	
M301	Ozone PP	0.015 - 2	mg/L O_3	
M300	Ozone T	0.02 - 2	mg/L O_3	O3
M315	Phenol T	0.1 - 5	mg/L C_6H_5OH	
M70	PHMB T	2 - 60	mg/lLPHMB	
M325	Phosphate h. TT	0.02 - 1.6	mg/L P	
M327	Phosphate HR C	1.6 - 13	mg/L P	
M335	Phosphate HR L	5 - 80	mg/L PO_4	PO4
M321	Phosphate HR T	0.33 - 26	mg/L P	
M322	Phosphate HR TT	1 - 20	mg/L P	
M328	Phosphate LR C	0.02 - 1.6	mg/L P	
M334	Phosphate LR L	0.1 - 10	mg/L PO_4	
M320	Phosphate LR T	0.02 - 1.3	mg/L P	PO4
M319	Phosphate LR T	0.05 - 4	mg/L P	P

, Test Kit	MD 100	MD 110	MD 200	MD 600, MD 610	MD 640	MultiDirect	PM 600	PM 620	PM 630	SpectroDirect	XD 7000	XD 7500	Page
				•	•	•				•	•	•	616
				•	•	•							612
										•	•	•	632
										•	•	•	636
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										•	•	•	650
										•	•	•	656
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				•	•	•							646
										•	•	•	686
										•	•	•	680
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				•	•								672
				•	•	•		•	•				720
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				•	•								864
	•	•		•	•	•							790
							•	•	•				784

No.	Analyses	Measuring Range	Measuring Range Unit	Display MD 100/110/200
M323	Phosphate PP	0.02 - 0.8	mg/L P	PO4
M326	Phosphate t. TT	0.02 - 1.1	mg/L P	
M318	Phosphate total HR TT	1.5 - 20	mg/L P	
M317	Phosphate total LR TT	0.07 - 3	mg/L P	
M324	Phosphate TT	0.06 - 5	mg/L P	
M316	Phosphonate PP	0.2 - 125	mg/L PO_4	
M332	pH-value HR T	8.0 - 9.6	pH	
M331	pH value L	6.5 - 8.4	pH	PH
M329	pH-value LR T	5.2 - 6.8	pH	
M330	pH-value T	6.5 - 8.4	pH	PH
M338	Polyacrylate L	1 - 30	mg/L Poly-acryl	POLY
M340	Potassium T	0.7 - 16	mg/L K	
M500	PTSA	10 - 1000	ppb	
M501	PTSA	10 - 400	ppb	
M344	SAC 254 nm (344)	0.5 - 50	m^{-1}	
M345	SAC 436 nm	0.5 - 50	m^{-1}	
M346	SAC 525 nm	0.5 - 50	m^{-1}	
M347	SAC 620 nm	0.5 - 50	m^{-1}	
M363	Selenium	0.05 - 1.6	mg/L Se	
M350	Silcate T	0.05 - 4	mg/L SiO_2	Si
M352	Silicate HR PP	1 - 90	mg/L SiO_2	SiHr
M353	Silicate L	0.1 - 8	mg/L SiO_2	
M351	Silicate LR PP	0.1 - 1.6	mg/L SiO_2	SiLr
M349	Silica VLR PP	0.005 - 0.5	mg/L SiO_2	
M361	Sulphate HR PP	50 - 1000		
M360	Sulphate PP	5 - 100	mg/L SO_4^{2-}	SO4
M355	Sulphate T	5 - 100	mg/L SO_4^{2-}	
M365	Sulphide T	0.04 - 0.5	mg/L S^{2-}	
M368	Sulphite 10 T	0.1 - 10	mg/L SO_3	
M370	Sulphite T	0.1 - 5	mg/L SO_3	

, Test Kit	MD 100	MD 110	MD 200	MD 600, MD 610	MD 640	MultiDirect	PM 600	PM 620	PM 630	SpectroDirect	XD 7000	XD 7500	Page
	•			•	•	•							808
				•	•	•							828
										•	•	•	776
										•	•	•	768
				•	•	•							814
				•	•	•							760
	•	•		•	•	•		•	•		•	•	860
	•	•	•	•	•	•		•	•				854
				•	•	•		•	•		•	•	846
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										•			950
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										•	•	•	910
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				•	•	•							954
										•	•	•	958
				•	•	•							962

No.	Analyses	Measuring Range	Measuring Range Unit	Display MD 100/110/200
M376	Surfactants M. (anion.) TT	0.05 - 2	mg/L SDSA	
M378	Surfactants M. (cation.) TT	0.05 - 1.5	mg/L CTAB	
M377	Surfactants M. (not ionic) TT	0.1 - 7.5	mg/L Triton X-100	
M384	Suspended solids 24	10 - 750	mg/L TSS	SuS
M383	Suspended solids 50	10 - 750	mg/L TSS	
M389	Tannin L	0.5 - 20	mg/L Tannin	
M284	TN HR 2 TT	5 - 140	mg/L N	
M281	TN HR TT	5 - 150	mg/L N	
M283	TN LR 2 TT	0.5 - 14	mg/L N	
M280	TN LR TT	0.5 - 25	mg/L N	
M381	TOC HR M. TT	50 - 800	mg/L TOC	
M380	TOC LR M. TT	5 - 80	mg/L TOC	
M388	Triazole PP	1 - 16	mg/L Benzotri-azole or Tolyltriazole	tri
M386	Turbidity 24	10 - 1000	FAU	
M385	Turbidity 50	5 - 500	FAU	
M390	Urea T	0.1 - 2.5	mg/L Urea	Ur1
M391	Urea T	0.2 - 5	mg/L Urea	Ur2
M405	Zinc L	0.1 - 2.5	mg/L Zn	Zn
M400	Zinc T	0.02 - 1	mg/L Zn	

, Test Kit	MD 100	MD 110	MD 200	MD 600, MD 610	MD 640	MultiDirect	PM 600	PM 620	PM 630	SpectroDirect	XD 7000	XD 7500	Page
				•	•	•				•	•	•	966
				•	•	•				•	•	•	976
				•	•	•				•	•	•	972
	•			•	•	•							998
										•	•	•	994
				•	•								1016
										•	•	•	714
				•	•	•							700
										•	•	•	708
				•	•	•							692
				•	•	•					•	•	988
				•	•						•	•	982
	•	•		•	•						•	•	1010
				•	•	•							1006
										•	•	•	1002
	•		•	•	•	•		•	•				1020
	•												1026
	•	•		•	•						•	•	1038
				•	•	•							1032

$K_{S4.3}$ T M20

0.1 - 4 mmol/L $K_{S4.3}$ S:4.3

Acid / Indicator

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 200, MD 600, MD 610, MD 640, MultiDirect, PM 620, PM 630	ø 24 mm	610 nm	0.1 - 4 mmol/L $K_{S4.3}$
SpectroDirect, XD 7000, XD 7500	ø 24 mm	615 nm	0.1 - 4 mmol/L $K_{S4.3}$

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Alka-M-Photometer	Tablet / 100	513210BT
Alka-M-Photometer	Tablet / 250	513211BT

Application List

- Waste Water Treatment
- Drinking Water Treatment
- Raw Water Treatment

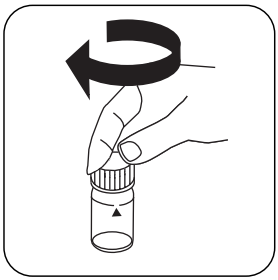
Notes

1. The terms Alkalinity-m, m-Value, total alkalinity and Acid demand to $K_{S4.3}$ are identical.
2. For accurate results, exactly 10 ml of water sample must be used for the test.

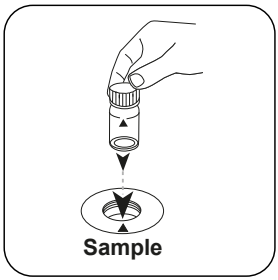
Implementation of the provision Acid capacity $K_{S4.3}$ with Tablet

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

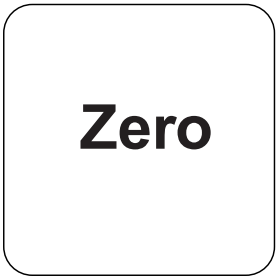
Fill 24 mm vial with **10 ml sample**.



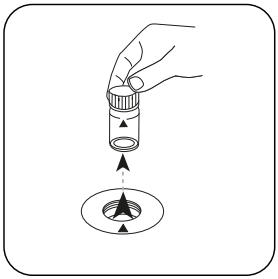
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

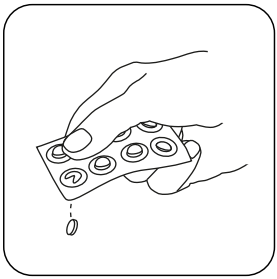


Press the **ZERO** button.

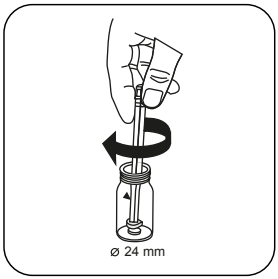


Remove the vial from the sample chamber.

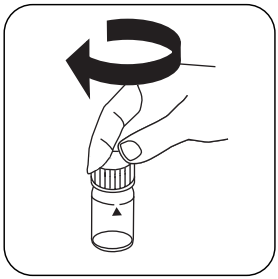
For devices that require **no ZERO measurement** , **start here**.



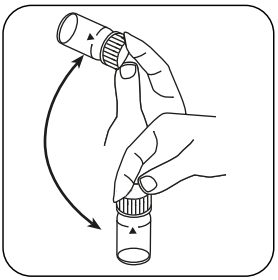
Add **ALKA-M-PHOTOMETER tablet**.



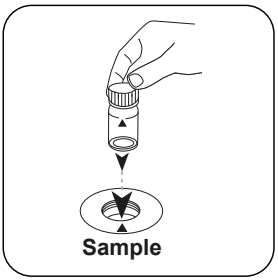
Crush tablet(s) by rotating slightly.



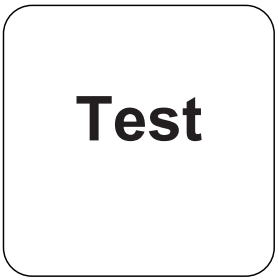
Close vial(s).



Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in Acid Capacity $K_{S4.3}$ appears on the display.

Chemical Method

Acid / Indicator

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	$-6.4527 \cdot 10^{-1}$	$-6.4527 \cdot 10^{-1}$
b	$6.15265 \cdot 10^{+0}$	$1.32282 \cdot 10^{+1}$
c	$-4.02416 \cdot 10^{+0}$	$-1.86017 \cdot 10^{+1}$
d	$1.42949 \cdot 10^{+0}$	$1.42068 \cdot 10^{+1}$
e		
f		

Derived from

DIN 38409 - H 7-2

Alkalinity-m T M30

5 - 200 mg/L $CaCO_3$ tA

Acid / Indicator

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 110, MD 200, MD 600, MD 610, MD 640, MultiDirect, PM 600, PM 620, PM 630	ø 24 mm	610 nm	5 - 200 mg/L $CaCO_3$
SpectroDirect, XD 7000, XD 7500	ø 24 mm	615 nm	5 - 200 mg/L $CaCO_3$
Scuba II	ø 24 mm		0 - 300 mg/L $CaCO_3$

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Alka-M-Photometer	Tablet / 100	513210BT
Alka-M-Photometer	Tablet / 250	513211BT

Application List

- Drinking Water Treatment
- Waste Water Treatment
- Raw Water Treatment
- Pool Water Treatment
- Pool Water Control

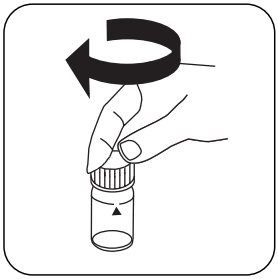
Notes

1. The terms Alkalinity-m, m-Value, total alkalinity and Acid demand to $K_{S4.3}$ are identical.
2. For accurate results, exactly 10 ml of water sample must be used for the test.

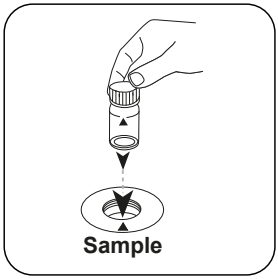
Implementation of the provision Alkalinity, total = Alkalinity-m = m-Value with Tablet

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

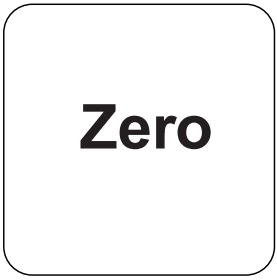
Fill 24 mm vial with **10 ml sample**.



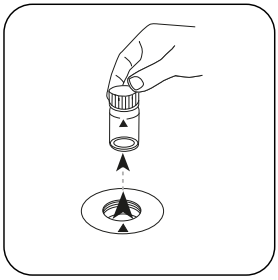
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

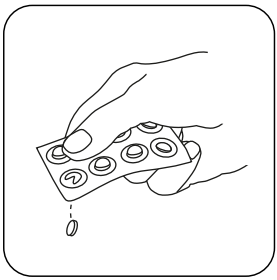


Press the **ZERO** button.

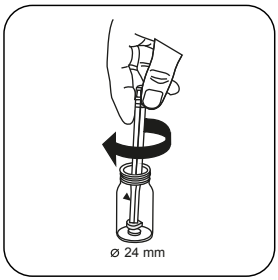


Remove the vial from the sample chamber.

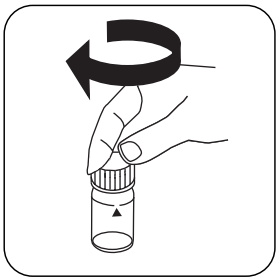
For devices that require **no ZERO measurement** , **start here**.



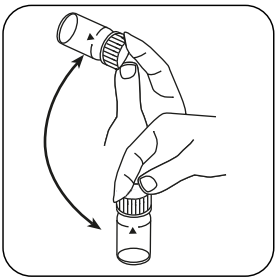
Add **ALKA-M-PHOTOMETER tablet**.



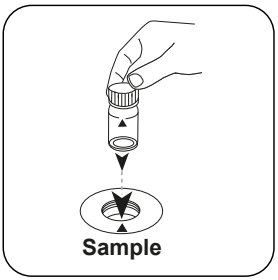
Crush tablet(s) by rotating slightly.



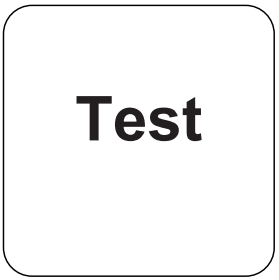
Close vial(s).



Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in Alkalinity-m appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	$CaCO_3$	1
	°dH	0.056
	°eH	0.07
	°fH	0.1
	°aH	0.058
	$K_{S4.3}$	0.02

Chemical Method

Acid / Indicator

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ 10 mm
a	$-2.46587 \cdot 10^{+1}$	$-2.46587 \cdot 10^{+1}$
b	$2.67915 \cdot 10^{+2}$	$5.76017 \cdot 10^{+2}$
c	$-1.48158 \cdot 10^{+2}$	$-6.84858 \cdot 10^{+2}$
d	$5.11097 \cdot 10^{+1}$	$5.07947 \cdot 10^{+2}$
e		
f		

Derived from

EN ISO 9963-1

Alkalinity-m HR T M31

5 - 500 mg/L $CaCO_3$

Acid / Indicator

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect, PM 600, PM 620, PM 630	ø 24 mm	610 nm	5 - 500 mg/L $CaCO_3$
SpectroDirect, XD 7000, XD 7500	ø 24 mm	615 nm	5 - 500 mg/L $CaCO_3$

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Alka-M-HR Photometer	Tablet / 100	513240BT
Alka-M-HR Photometer	Tablet / 250	513241BT

Application List

- Drinking Water Treatment
- Waste Water Treatment
- Raw Water Treatment
- Pool Water Treatment
- Pool Water Control

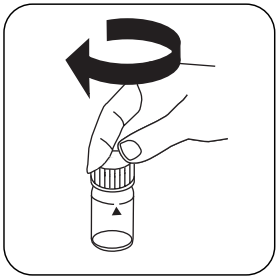
Notes

1. For verification of the result, check whether a thin yellow layer has formed on the bottom of the vial. If this is the case, mix the contents of the vial. This ensures that reaction is complete. Carry out the measurement again and reread the result.

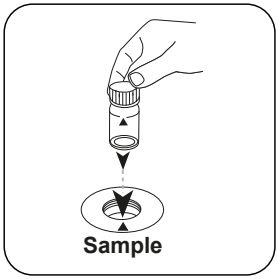
Implementation of the provision Alkalinity HR, total = Alkalinity-m HR = m-Value HR with Tablet

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

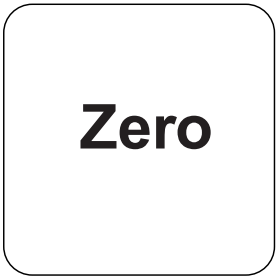
Fill 24 mm vial with **10 ml sample**.



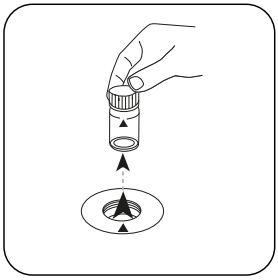
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

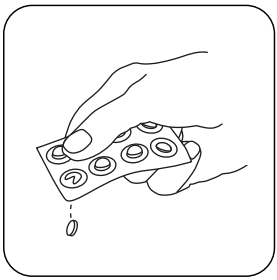


Press the **ZERO** button.

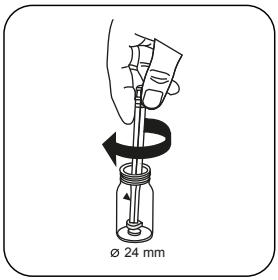


Remove the vial from the sample chamber.

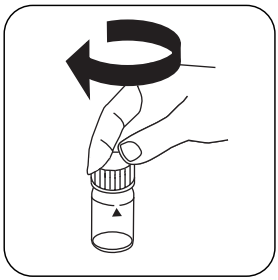
For devices that require **no ZERO measurement** , **start here**.



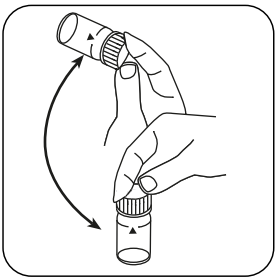
Add **ALKA-M-HR Photometer tablet**.



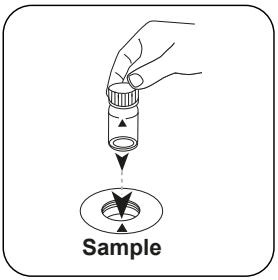
Crush tablet(s) by rotating slightly.



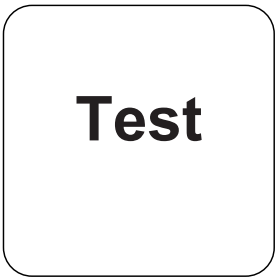
Close vial(s).



Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in Alkalinity-m appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	$CaCO_3$	1
	°dH	0.056
	°eH	0.07
	°fH	0.1
	°aH	0.058
	$K_{S4.3}$	0.02

Chemical Method

Acid / Indicator

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ 10 mm
a	$-2.56422 \cdot 10^{+1}$	$-2.56422 \cdot 10^{+1}$
b	$6.02918 \cdot 10^{+2}$	$1.29627 \cdot 10^{+3}$
c	$-3.78514 \cdot 10^{+2}$	$-1.74968 \cdot 10^{+3}$
d	$1.37851 \cdot 10^{+2}$	$1.37002 \cdot 10^{+3}$
e		
f		

Derived from

EN ISO 9963-1

Alkalinity-p T M35

5 - 500 mg/L $CaCO_3$

Acid / Indicator

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect	ø 24 mm	560 nm	5 - 500 mg/L $CaCO_3$
SpectroDirect, XD 7000, XD 7500	ø 24 mm	552 nm	5 - 500 mg/L $CaCO_3$

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Alka-P-Photometer	Tablet / 100	513230BT
Alka-P-Photometer	Tablet / 250	513231BT

Application List

- Drinking Water Treatment
- Raw Water Treatment

Notes

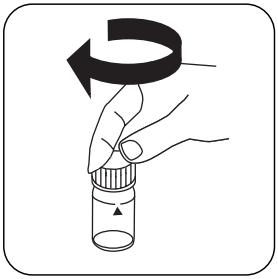
1. The terms Alkalinity-p, p-Value, and Acid demand to $K_{S8.2}$ are identical.
2. For accurate results, exactly 10 ml of water sample must be used for the test.
3. This method was developed from a volumetric procedure. Due to undefined boundary conditions, deviations from the standardised method may be greater.
4. By determining Alkalinity-p and Alkalinity-m, it is possible to classify the alkalinity as Hydroxide, Carbonate and Hydrogencarbonate.
5. The following differentiation is only valid if:
6. a) no other alkalis are present and
7. b) Hydroxide and Hydrogen are not present in the sample. If condition b) is not fulfilled, please see additional information from ”Deutsche Einheitsverfahren zur Wasser-, Abwasser- and Schlammuntersuchung, D8”.

- If p-Alkalinity = 0:
  Hydrogen carbonate = m
  Carbonate = 0
  Hydroxide = 0
- If p-Alkalinity > 0 and m-Alkalinity > 2p:
  Hydrogencarbonate = m - 2p
  Carbonate = 2p
  Hydroxide = 0
- If p-Alkalinity > 0 and m-Alkalinity < 2p:
  Hydrogen carbonate = 0
  Carbonate = 2m - 2p
  Hydroxide = 2p - m

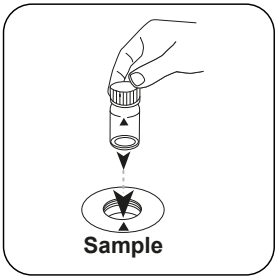
Implementation of the provision Alkalinity-p = p-Value with Tablet

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

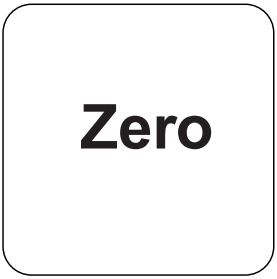
Fill 24 mm vial with **10 ml sample**.



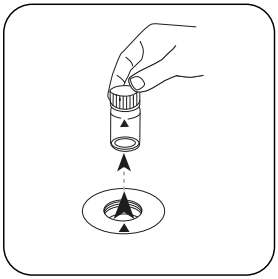
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

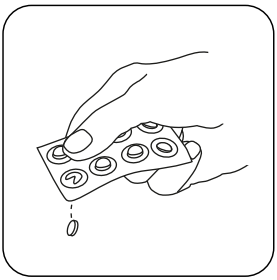


Press the **ZERO** button.

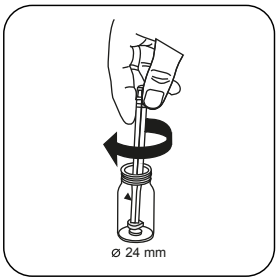


Remove the vial from the sample chamber.

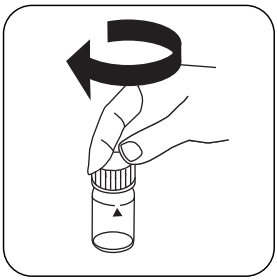
For devices that require **no ZERO measurement** , **start here**.



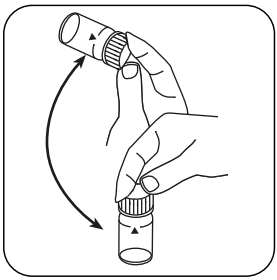
Add **ALKA-P-PHOTOMETER tablet**.



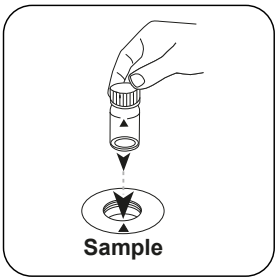
Crush tablet(s) by rotating slightly.



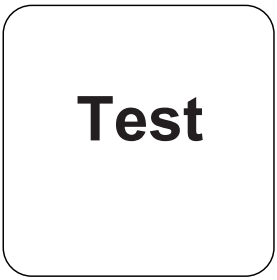
Close vial(s).



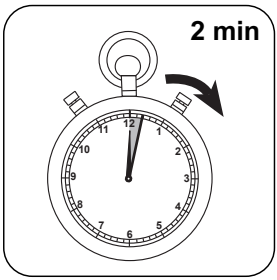
Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **2 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically. The result in Alkalinity-p appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	$CaCO_3$	1
	°dH	0.056
	°eH	0.07
	°fH	0.1
	°aH	0.058
	$K_{S4.3}$	0.02

Chemical Method

Acid / Indicator

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ 10 mm
a	$-5{,}64325 \cdot 10^{0}$	$-4{,}64325 \cdot 10^{0}$
b	$2{,}19451 \cdot 10^{+2}$	$4{,}7182 \cdot 10^{+2}$
c	$-7{,}83499 \cdot 10^{+1}$	$-3{,}62172 \cdot 10^{+2}$
d	$2{,}24118 \cdot 10^{+1}$	$2{,}24737 \cdot 10^{+2}$
e		
f		

Method Validation

Limit of Detection	3.34 mg/L
Limit of Quantification	10.03 mg/L
End of Measuring Range	500 mg/L
Sensitivity	167.10 mg/L / Abs
Confidence Intervall	23.21 mg/L
Standard Deviation	10.67 mg/L
Variation Coefficient	4.22 %

Derived from

DIN 38409 - H-4-2
EN ISO 9963-1

Aluminium T M40

0.01 - 0.3 mg/L Al AL

Eriochrom Cyanine R

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 110, MD 600, MD 610, MD 640, MultiDirect, PM 620, PM 630	ø 24 mm	530 nm	0.01 - 0.3 mg/L Al
SpectroDirect, XD 7000, XD 7500	ø 24 mm	535 nm	0.01 - 0.3 mg/L Al

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Aluminium No. 1	Tablet / 100	515460BT
Aluminium No. 1	Tablet / 250	515461BT
Aluminium No. 2	Tablet / 100	515470BT
Aluminium No. 2	Tablet / 250	515471BT
Set Aluminium No. 1/No. 2 100 Pc.#	100 each	517601BT
Set Aluminium No. 1/No. 2 250 Pc.#	250 each	517602BT

Application List

- Drinking Water Treatment
- Waste Water Treatment
- Raw Water Treatment
- Boiler Water
- Cooling Water
- Pool Water Treatment

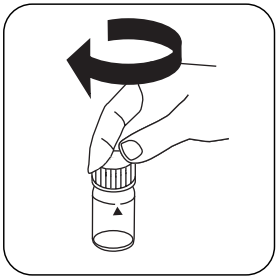
Preparation

1. To get accurate results the sample temperature must be between 20 °C and 25 °C.
2. To avoid errors caused by contamination, rinse the vial and the accessories with Hydrochloric acid (approx. 20%) before the analysis. Then rinse them with deionised water.

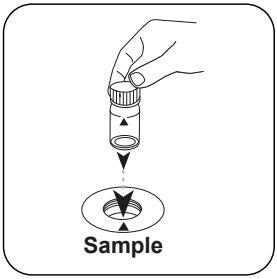
Implementation of the provision Aluminium with Tablet

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

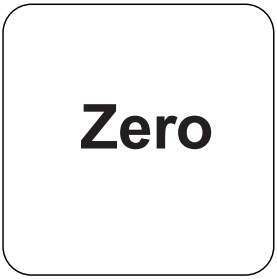
Fill 24 mm vial with **10 ml sample**.



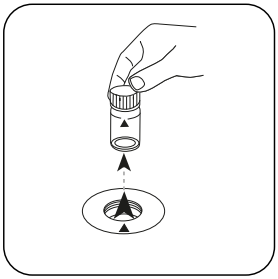
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

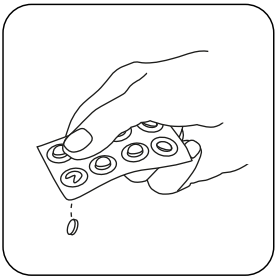


Press the **ZERO** button.

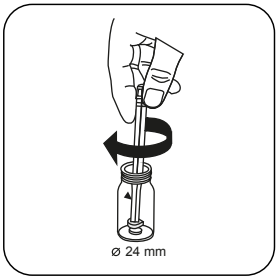


Remove the vial from the sample chamber.

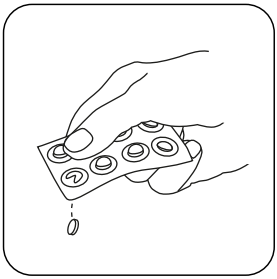
For devices that require **no ZERO measurement** , **start here**.



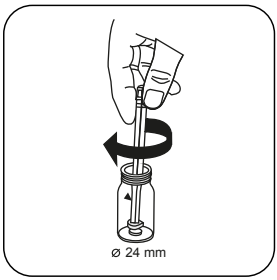
Add **ALUMINIUM No. 1 tablet** .



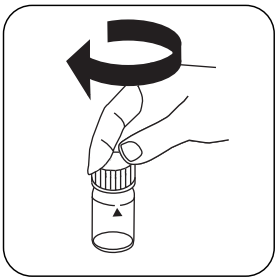
Crush tablet(s) by rotating slightly and dissolve.



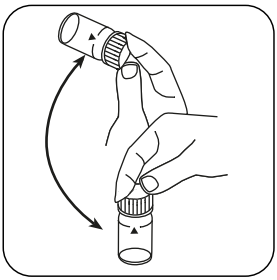
Add **ALUMINIUM No. 2 tablet** .



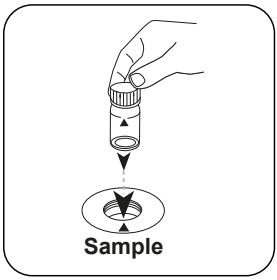
Crush tablet(s) by rotating slightly.



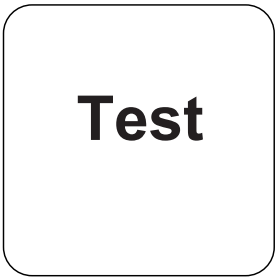
Close vial(s).



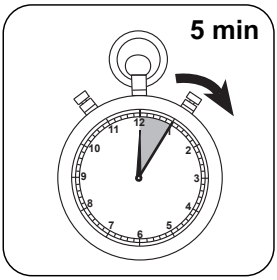
Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **5 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Aluminium appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	Al	1
mg/l	Al_2O_3	1.8894

Chemical Method

Eriochrom Cyanine R

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ 10 mm
a	$-3.21414 \cdot 10^{-2}$	$-3.21414 \cdot 10^{-2}$
b	$1.60965 \cdot 10^{-1}$	$3.46075 \cdot 10^{-1}$
c	$7.15538 \cdot 10^{-2}$	$3.30757 \cdot 10^{-1}$
d		
e		
f		

Interferences

Removeable Interferences

- A low test result may be given in the presence of Fluorides and Polyphosphates. The effect of this is generally insignificant unless the water has fluoride added artificially. In this case, the following table should be used to determine the actual concentration of aluminium.
- A special tablet ingredient prevents the measurement being affected as a result of iron and manganese.

Fluo-ride	Displayed value: Aluminium [mg/L]					
[mg/L F]	0.05	0.10	0.15	0.20	0.25	0.30
0.2	0.05	0.11	0.16	0.21	0.27	0.32
0.4	0.06	0.11	0.17	0.23	0.28	0.34
0.6	0.06	0.12	0.18	0.24	0.30	0.37
0.8	0.06	0.13	0.20	0.26	0.32	0.40
1.0	0.07	0.13	0.21	0.28	0.36	0.45
1.5	0.09	0.20	0.29	0.37	0.48	---

Method Validation

Limit of Detection	0.02 mg/L
Limit of Quantification	0.044 mg/L
End of Measuring Range	0.3 mg/L
Sensitivity	0.17 mg/L / Abs
Confidence Intervall	0.014 mg/L
Standard Deviation	0.006 mg/L
Variation Coefficient	3.71 %

Bibliography

Richter, F. Fresenius, Zeitschrift f. anal. Chemie (1943) 126: 426

According to

APHA Method 3500-Al B

[#] including stirring rod, 10 cm

Aluminium PP M50

0.01 - 0.25 mg/L Al AL

Eriochrom Cyanine R

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 110, MD 600, MD 610, MD 640, MultiDirect, PM 620, PM 630	ø 24 mm	530 nm	0.01 - 0.25 mg/L Al
SpectroDirect, XD 7000, XD 7500	ø 24 mm	535 nm	0.01 - 0.25 mg/L Al

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
VARIO Aluminium Reagent, Set F20	1 pc.	535000

Application List

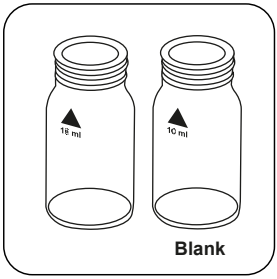
- Drinking Water Treatment
- Waste Water Treatment
- Raw Water Treatment
- Boiler Water
- Cooling Water
- Pool Water Treatment

Preparation

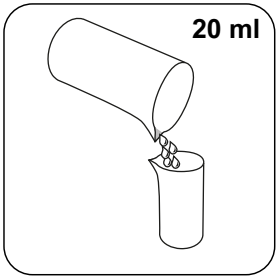
1. To get accurate results the sample temperature must be between 20 °C and 25 °C.
2. To avoid errors caused by contamination, rinse the vial and the accessories with Hydrochloric acid (approx. 20%) before the analysis. Then rinse them with deionised water.

Implementation of the provision Aluminium with Vario Powder Pack

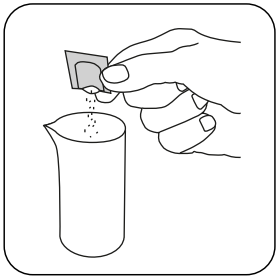
Select the method on the device



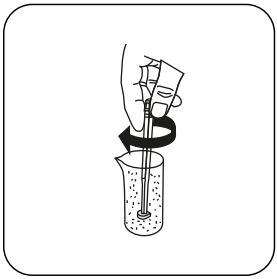
Prepare two clean 24 mm vials. Mark one as a blank.



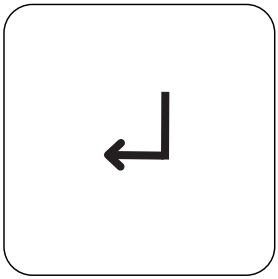
Put **20 ml sample** in 100 ml measuring beaker



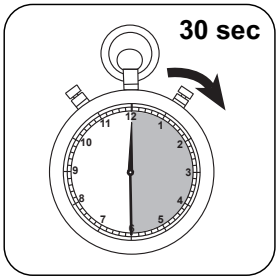
Add **Vario ALUMINIUM ECR F20 powder pack**.



Dissolve the powder by mixing.

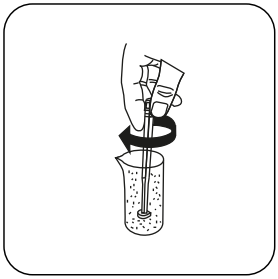


Press the **ENTER** button.

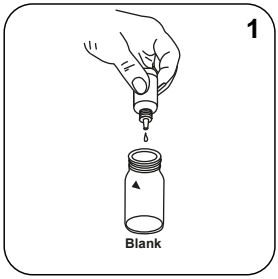


Wait for **30 second(s) reaction time**.

Add **Vario HEXAMINE F20 powder pack**.

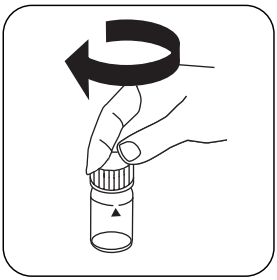


Dissolve the powder by mixing.

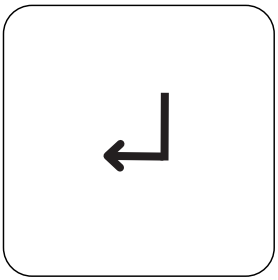


Place **1 drops Vario ALUMINIUM ECR Masking Reagent** in the blank.

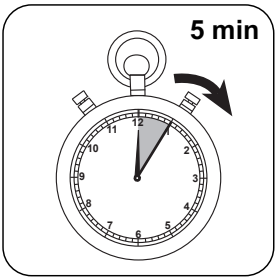
Place **10 ml pre-treated sample** in each vial.



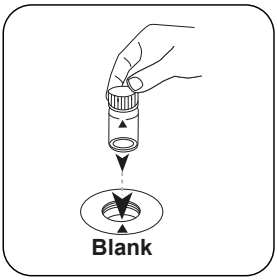
Close vial(s).



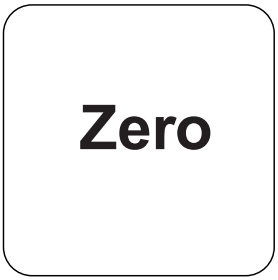
Press the **ENTER** button.



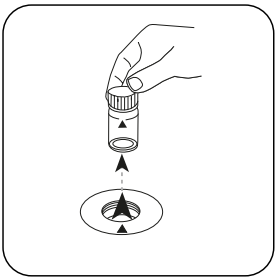
Wait for **5 minute(s) reaction time**.



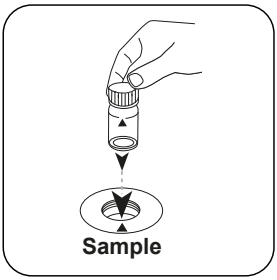
Place **blank** in the sample chamber. • Pay attention to the positioning.



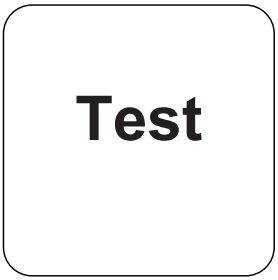
Press the **ZERO** button.



Remove the vial from the sample chamber.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in mg/l Aluminium appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	Al	1
mg/l	Al_2O_3	1.8894

Chemical Method

Eriochrom Cyanine R

Appendix

Calibration function for 3rd-party photometers

Conc. = $a + b \cdot Abs + c \cdot Abs^2 + d \cdot Abs^3 + e \cdot Abs^4 + f \cdot Abs^5$

	ø 24 mm	**□ 10 mm**
a	$5.35254 \cdot 10^{-3}$	$5.35254 \cdot 10^{-3}$
b	$1.95468 \cdot 10^{-1}$	$4.20256 \cdot 10^{-1}$
c		
d		
e		
f		

Interferences

Removeable Interferences

- A low test result may be given in the presence of Fluorides and Polyphosphates. The effect of this is generally insignificant unless the water has fluoride added artificially. In this case, the following table should be used to determine the actual concentration of aluminium.

Fluo-ride	Displayed value: Aluminium [mg/L]					
[mg/L F]	0.05	0.10	0.15	0.20	0.25	0.30
0.2	0.05	0.11	0.16	0.21	0.27	0.32
0.4	0.06	0.11	0.17	0.23	0.28	0.34
0.6	0.06	0.12	0.18	0.24	0.30	0.37
0.8	0.06	0.13	0.20	0.26	0.32	0.40
1.0	0.07	0.13	0.21	0.28	0.36	0.45
1.5	0.09	0.20	0.29	0.37	0.48	---

Bibliography

Richter, F. Fresenius, Zeitschrift f. anal. Chemie (1943) 126: 426

According to

APHA Method 3500-Al B

Ammonia T M60

0.02 - 1 mg/L N A

Indophenole Blue

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
, MD 100, MD 110, MD 600, MD 610, MD 640, MultiDirect, PM 620, PM 630, Test Kit	ø 24 mm	610 nm	0.02 - 1 mg/L N
SpectroDirect, XD 7000, XD 7500	ø 24 mm	676 nm	0.02 - 1 mg/L N

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Ammonia No. 1	Tablet / 100	512580BT
Ammonia No. 1	Tablet / 250	512581BT
Ammonia No. 2	Tablet / 100	512590BT
Ammonia No. 2	Tablet / 250	512591BT
Set Ammonia No. 1/No. 2 100 Pc.#	100 each	517611BT
Set Ammonia No. 1/No. 2 250 Pc.#	250 each	517612BT
Ammonia Conditioning Powder	Powder / 15 g	460170

Application List

- Waste Water Treatment
- Drinking Water Treatment
- Raw Water Treatment

Preparation

1. Sea water samples:
   Ammonia conditioning reagent is required when testing sea water or brackish water samples to prevent precipitation (settlement) of salts.
   Fill the test tube with the sample to the 10 ml mark and add one level spoonful of Aluminium Conditioning Powder. Close the vials with the caps and swirl until the powder has dissolved. Then proceed as described.

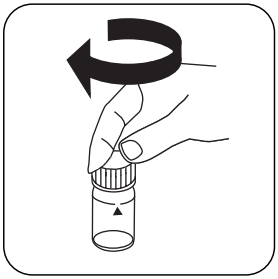
Notes

1. The AMMONIA No. 1 tablet will only dissolve completely after the AMMONIA No. 2 Tablet has been added.
2. The temperature of the sample is important for full colour development. At temperatures of below 20 °C the reaction period is 15 minutes.

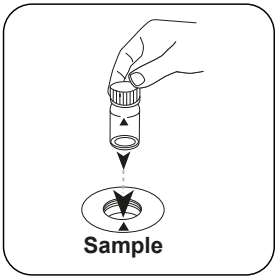
Implementation of the provision Ammonium with Tablet

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

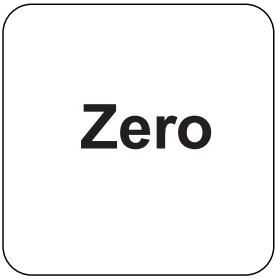
Fill 24 mm vial with **10 ml sample**.



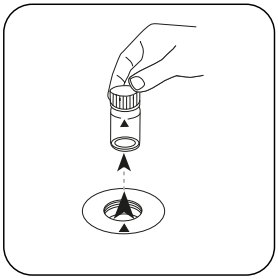
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

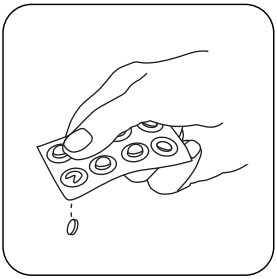


Press the **ZERO** button.

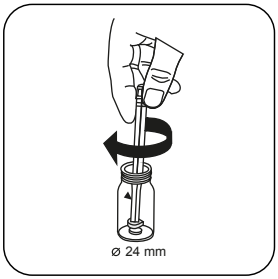


Remove the vial from the sample chamber.

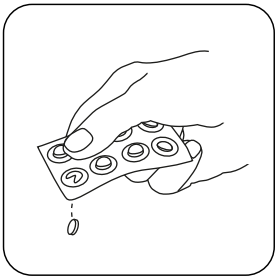
For devices that require **no ZERO measurement** , **start here**.



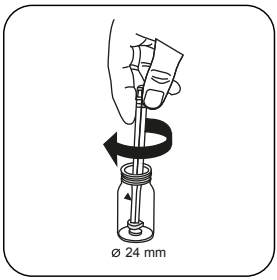
Add **AMMONIA No. 1 tablet** .



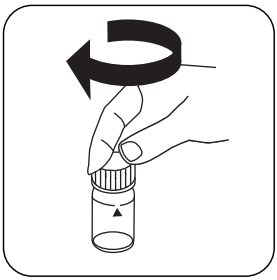
Crush tablet(s) by rotating slightly.



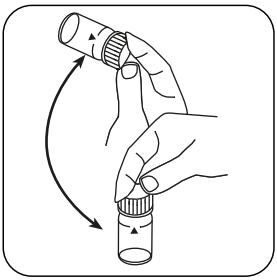
Add **AMMONIA No. 2 tablet** .



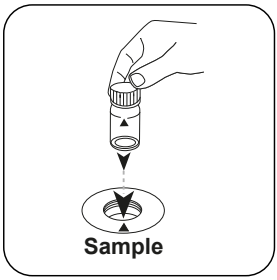
Crush tablet(s) by rotating slightly.



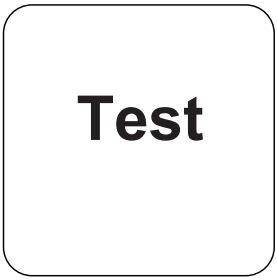
Close vial(s).



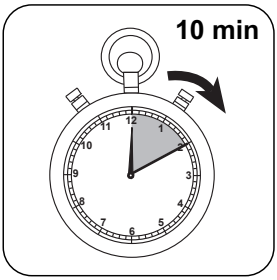
Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **10 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically. The result in mg/l Ammonium appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	N	1
mg/l	NH_4	1.2878
mg/l	NH_3	1.2158

Chemical Method

Indophenole Blue

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ 10 mm
a	$-3.54512 \cdot 10^{-2}$	$-3.54512 \cdot 10^{-2}$
b	$6.22226 \cdot 10^{-1}$	$1.33779 \cdot 10^{+0}$
c		
d		
e		
f		

Interferences

Persistant Interferences

- Sulphides, cyanides, rhodanide, aliphatic amine and aniline interfere in higher concentrations.

Bibliography

Photometrische Analyseverfahren, Schwendt, Wissenschaftliche Verlagsgesellschaft mbH, Stuttgart 1989

According to

APHA Method 4500-NH3 F

including stirring rod, 10 cm

Ammonia PP M62

0.01 - 0.8 mg/L N A

Salicylate

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 600, MD 610, MD 640, MultiDirect	ø 24 mm	660 nm	0.01 - 0.8 mg/L N
SpectroDirect, XD 7000, XD 7500	ø 24 mm	655 nm	0.01 - 0.8 mg/L N

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
VARIO Ammonia Nitrogen, Set F10	1 Set	535500

Application List

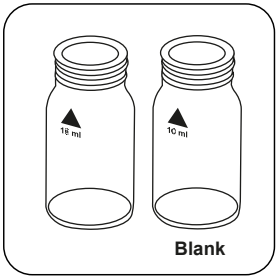
- Waste Water Treatment
- Raw Water Treatment

Preparation

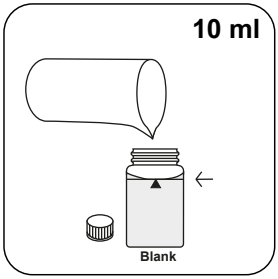
1. Extremely alkaline or acidic water samples should be adjusted with 0.5 mol/l (1N) Sulphuric acid or 1 mol/l (1 N) Sodium hydroxide to pH 7.

Implementation of the provision Ammonium with Vario Powder Pack

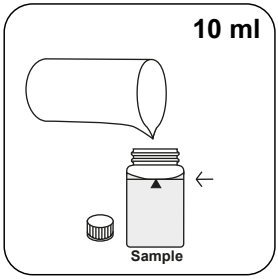
Select the method on the device



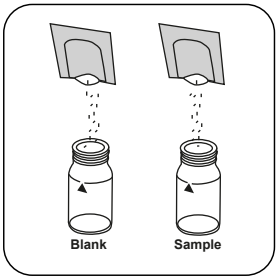
Prepare two clean 24 mm vials. Mark one as a blank.



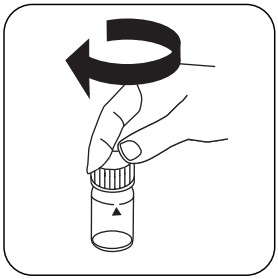
Put **10 ml deionised water** in the blank.



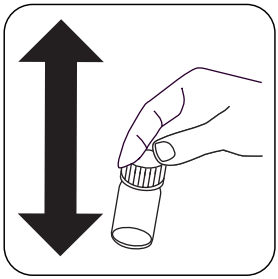
Put **10 ml sample** in the sample vial.



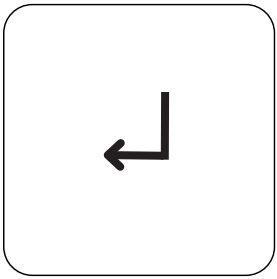
Add **a Ammonium Salicylate F10 powder pack** in each vial.



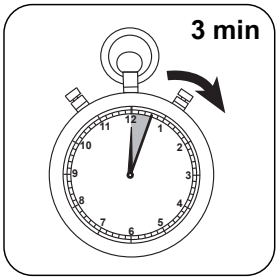
Close vial(s).



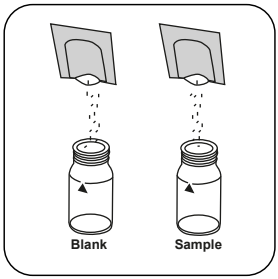
Dissolve the contents by shaking.



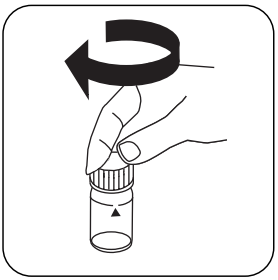
Press the **ENTER** button.



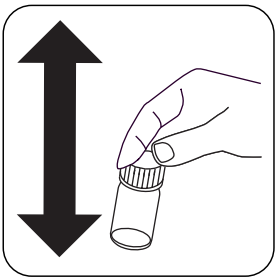
Wait for **3 minute(s) reaction time**.



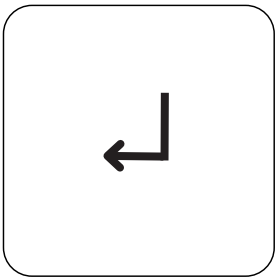
Add **a Vario Ammonium Cyanurate F10 powder pack** in each vial.



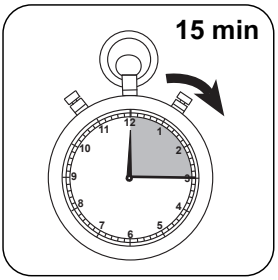
Close vial(s).



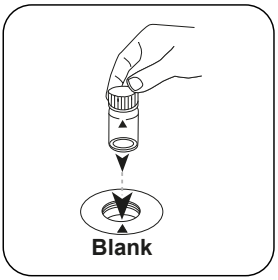
Dissolve the contents by shaking.



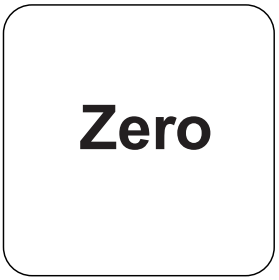
Press the **ENTER** button.



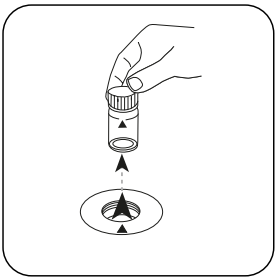
Wait for **15 minute(s) reaction time**.



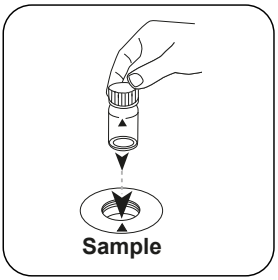
Place **blank** in the sample chamber. • Pay attention to the positioning.



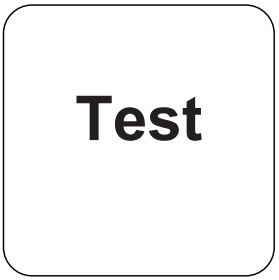
Press the **ZERO** button.



Remove the vial from the sample chamber.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in mg/l Ammonium appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	N	1
mg/l	NH_4	1.288
mg/l	NH_3	1.22

Chemical Method

Salicylate

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ 10 mm
a	$-5.42114 \cdot 10^{-2}$	$-5.42114 \cdot 10^{-2}$
b	$4.15543 \cdot 10^{-1}$	$8.93417 \cdot 10^{-1}$
c		
d		
e		
f		

Interferences

Persistant Interferences

- Sulphide intensifies the colouration.

Removeable Interferences

- Iron interferes with the test at all concentrations. Iron interference is eliminated as follows.
  a) Determine the concentration of iron present in the sample by performing a total Iron test.
  b) in the blank, use the same iron concentration as that determined instead of the deionised water.
- Less common interferences such as Hydrazine and Glycine will cause intensified colours in the prepared sample. Turbidity and colour will give erroneous high values. For samples where there are severe interferences, distillation will be necessary.

Interference	from / [mg/L]
Ca^{2+}	1000 ($CaCO_3$)
Mg^{2+}	6000 ($CaCO_3$)
NO_3^-	100
NO_2^-	12
PO_4^{3-}	100
SO_4^{2-}	300

Method Validation

Limit of Detection	0.02 mg/L
Limit of Quantification	0.07 mg/L
End of Measuring Range	0.08 mg/L
Sensitivity	0.42 mg/L / Abs
Confidence Intervall	0.014 mg/L
Standard Deviation	0.006 mg/L
Variation Coefficient	1.45 %

Derived from

DIN 38406-E5-1
ISO 7150-1

Chloramine (M) PP M63

0.02 - 4.5 mg/L NH_2Cl as Cl_2

Indophenole method

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640	ø 24 mm	660 nm	0.02 - 4.5 mg/L NH_2Cl as Cl_2

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
VARIO Monochloramine Set	1 Set	535800
VARIO Monochlor F Rgt - 100	Powder / 100 pc.	531810
VARIO Free Ammonia Reagent Solution - 5 ml	5 mL	531800
Vario Rochelle Salt Solution, 30 ml [h)]	30 mL	530640

Application List

- Disinfection Control
- Drinking Water Treatment
- Pool Water Control
- Food and Beverage
- Others

Notes

1. Full colour development – temperature
   The reaction periods indicated in the manual refer to a sample temperature between 12 °C and 14 °C. Due to the fact that the reaction period is strongly influenced by sample temperature, you have to adjust both reaction periods according to the following table:

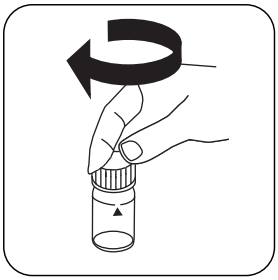
Sample temperature		Reaction period in **X** min
°C	°F	
5	41	10
7	45	9
9	47	8
10	50	8
12	54	7
14	57	7
16	61	6
18	64	5
20	68	5
23	73	2.5
25	77	2
> 25	> 77	2

2. Press [Enter] key to to cancel a reaction period.
3. Hold the bottle vertically and squeeze slowly.
4. To determine the ammonia concentration the difference between mono chloramine (T1) and the sum of mono chloramine and ammonia (T2) is calculated. If T2 exceeds the range limit the following message is displayed:
   $N[NH_2Cl] + N[NH_3] > 0.9$ mg/L
   In this case the sample has to be diluted and the measurement repeated.

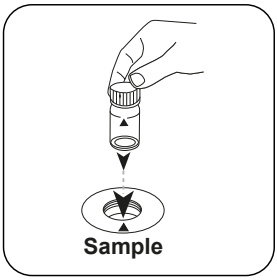
Implementation of the provision Monochloramine, without Free Ammonia

Select the method on the device
In addition, choose the test: without Ammonia
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

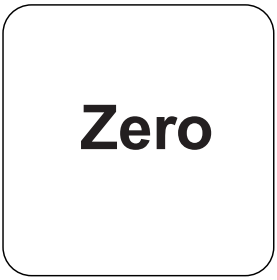
Fill 24 mm vial with **10 ml sample**.



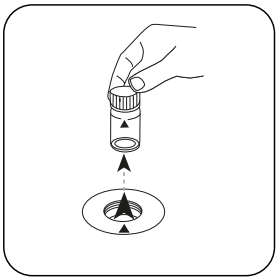
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

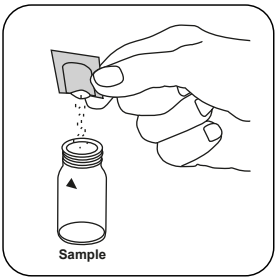


Press the **ZERO** button.

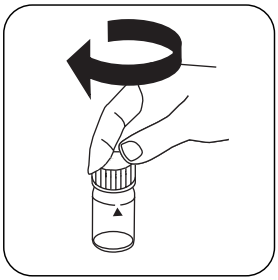


Remove the vial from the sample chamber.

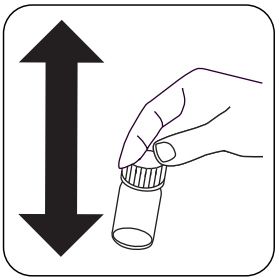
For devices that require **no ZERO measurement** , **start here**.



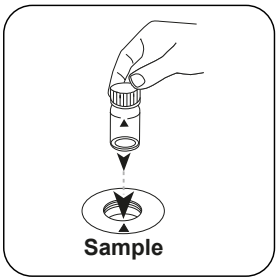
Add **Monochlor FRGT powder pack**.



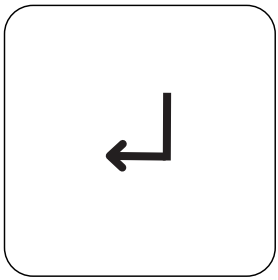
Close vial(s).



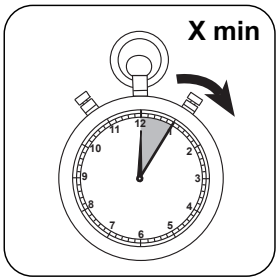
Dissolve the contents by shaking. (20 sec.)



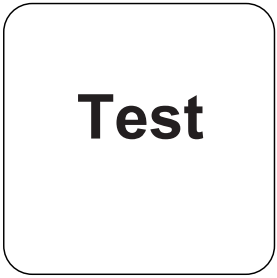
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **ENTER** button for countdown.
(XD: start timer)



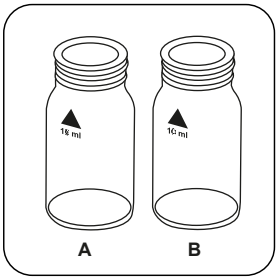
Reaction time **X minute(s)** according to table. **Wait for reaction time**.



Press the **TEST** (XD: **START**)button.
The result in mg/l Monochloramine - Chlorine Cl [NH_2Cl] appears on the display.

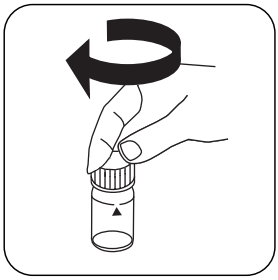
Implementation of the provision Monochloramine, in presence of free ammonia with powder pack

Select the method on the device
In addition, choose the test: with Free Ammonia
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

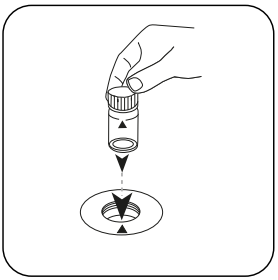


Prepare two clean 24 mm vials. Mark one as Ammonia and the other as Chloramine vial.

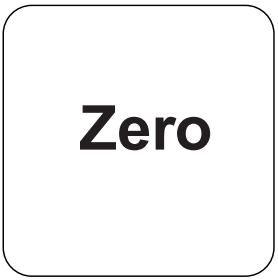
Place **10 ml sample** in each vial.



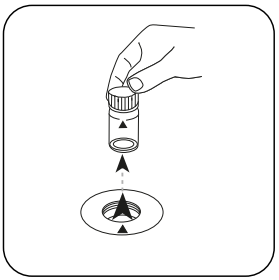
Close vial(s).



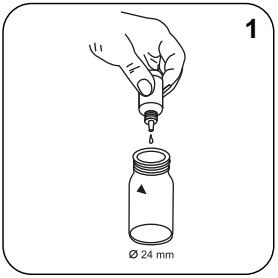
Place Ammonia **vial** in the sample chamber. • Pay attention to the positioning.



Press the **ZERO** button.

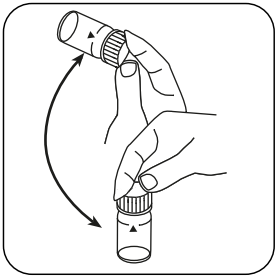


Remove the vial from the sample chamber.

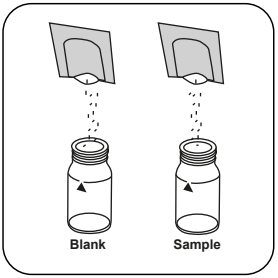


Add **1 drops Free Ammonia Reagent Solution** to the **vial**.

Close vial(s).

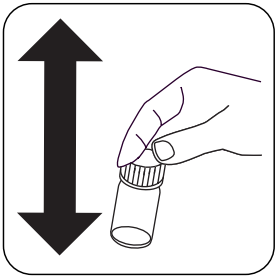


Invert several times to mix the contents (approx. 15 sec).

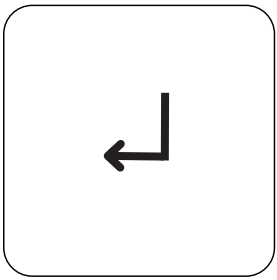


Add **a Monochlor FRGT powder pack** simultaneously in each vial.

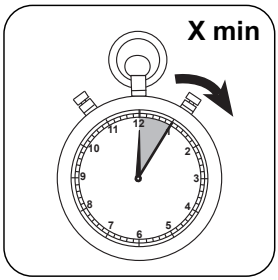
Close vial(s).



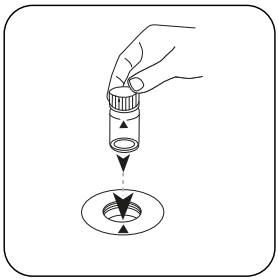
Dissolve the contents by shaking. (20 sec.)



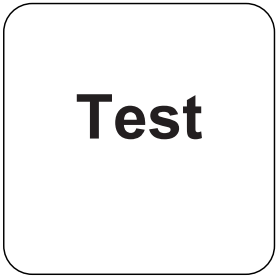
Press the **ENTER** button for countdown.
(XD: start timer)



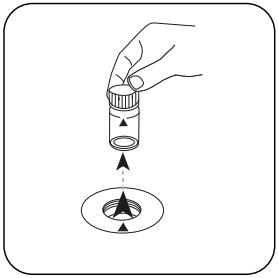
Reaction time **X minute(s)** according to table. **Wait for reaction time**.



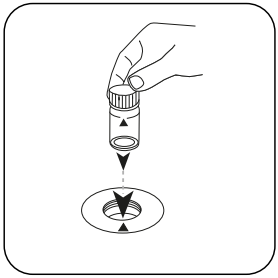
Place Chloramine **vial** in the sample chamber. • Pay attention to the positioning.



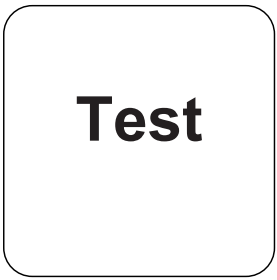
Press the **TEST** (XD: **START**)button.



Remove the vial from the sample chamber.



Place Ammonia **vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.
The result in mg/l Monochloramine - Chlorine Cl [NH_2Cl] and mg/l free Ammonia - Nitrogen N [NH_3] appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	Cl_2	1
mg/l	NH_2Cl	0.72598
mg/l	$N[NH_2Cl]$	0.19754
mg/l	NH_3	0.24019

Chemical Method

Indophenole method

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ 10 mm
a	$-5{,}8124 \cdot 10^{-2}$	$-5{,}8124 \cdot 10^{-2}$
b	$1.80357 \cdot 10^{0}$	$3.87768 \cdot 10^{0}$
c	-	-
d	-	-
e	-	-
f	-	-

Interferences

Removeable Interferences

Disturbances caused by precipitation caused by magnesium hardness of more than 400 mg / l $CaCO_3$ can be eliminated by adding 5 drops of Rochelle salt solution.

Interference	from / [mg/L]
Alanine (N)	1
Aluminium (Al)	10
Bromide (Br^-)	100
Bromine (Br_2)	15
Calcium ($CaCO_3$)	1000
Chloride (Cl^-)	18.000
Chlorine Dioxide (ClO_2)	5

Interference	from / [mg/L]
Copper (Cu)	10
Dichloramine (Cl_2)	10
Fluoride (F^-)	5
Free Chloride (Cl_2)	10
Glycine (N)	1
Iron (II) (Fe^{2+})	10
Iro (III) (Fe^{3+})	10
Lead (Pb)	10
Permanganate	3
Nitrate (N)	100
Nitrite (N)	50
Sulfide	0.5
Phosphate (PO_4)	100
Silica (SiO_2)	100
Sulfate (SO_4^{2+})	2600
Sulfite (SO_3^{2-})	50
Ozone	1
Tyrosine (N)	1
Urea (N)	10
Zinc (Zn)	5

Method Validation

Limit of Detection	0.010 mg/L
Limit of Quantification	0.03 mg/L
End of Measuring Range	4.5 mg/L
Sensitivity	1.78 mg/L / Abs
Confidence Intervall	0.044 mg/L
Standard Deviation	0.018 mg/L
Variation Coefficient	0.78 %

Chlorine (free) and Monochloramine M64

0.02 - 4.50 mg/L Cl_2 CL2

Indophenole method

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, PM 620	ø 24 mm	660 nm	0.02 - 4.50 mg/L Cl_2

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
VARIO Monochloramine Set	1 Set	535800
VARIO Free Chlorine Reagent Solution - 30 ml	30 mL	531820
VARIO Monochlor F Rgt - 100	Powder / 100 pc.	531810
Vario Rochelle Salt Solution, 30 ml [h)]	30 mL	530640

Application List

- Disinfection Control
- Drinking Water Treatment
- Pool Water Control
- Food and Beverage
- Others

Notes

1. Full colour development – temperature
   The reaction periods indicated in the manual refer to a sample temperature between 12 °C and 14 °C. Due to the fact that the reaction period is strongly influenced by sample temperature, you have to adjust both reaction periods according to the following table:

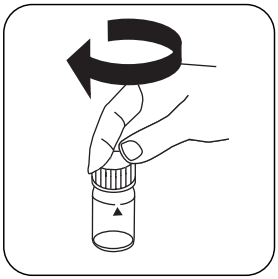
Sample temperature		Reaction period in **X** min
°C	°F	
5	41	10
7	45	9
9	47	8
10	50	8
12	54	7
14	57	7
16	61	6
18	64	5
20	68	5
23	73	2.5
25	77	2
> 25	> 77	2

2. Press [Enter] key to to cancel a reaction period.
3. Hold the bottle vertically and squeeze slowly.
4. To determine the chlorine concentration the difference between the monochloramine and the sum of monochloramine and chlorine is calculated. If one measured value exceeds the range limit the following message is displayed:
   $Cl_2[NH_2Cl] + Cl_2 > 4.5$ mg/L
   In this case the sample has to be diluted and the measurement repeated.

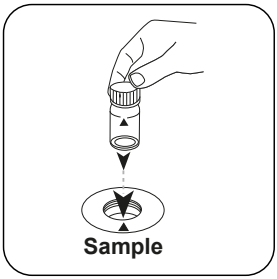
Implementation of the provision Free Chlorine in absence of Monochloramine

Select the method on the device
In addition, choose the test: free Chlorine in absence of Monochloramine

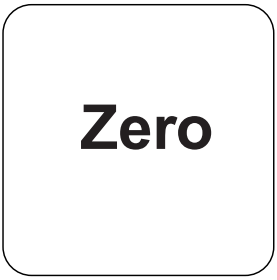
Fill 24 mm vial with **10 ml sample**.



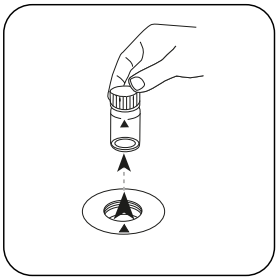
Close vial(s).



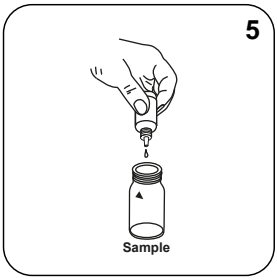
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



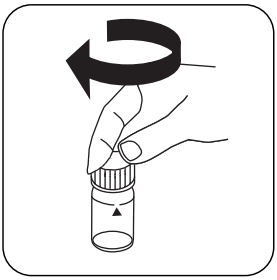
Press the **ZERO** button.



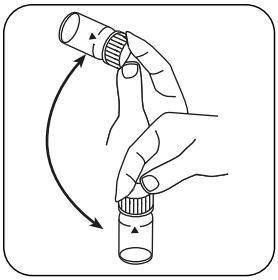
Remove the vial from the sample chamber.



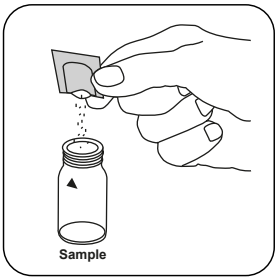
Add **5 drops Free Chlorine Reagent Solution** to the **sample vial**.



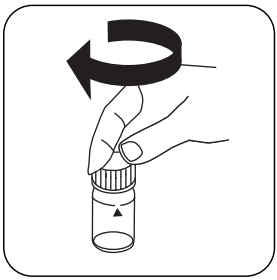
Close vial(s).



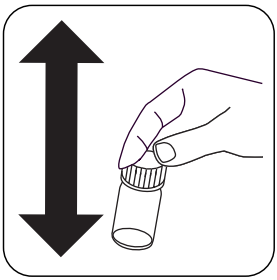
Invert several times to mix the contents (15 sec.).



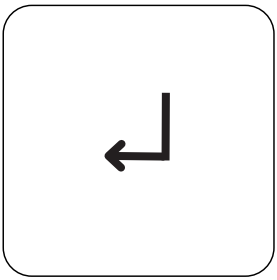
Add **Monochlor FRGT powder pack**.



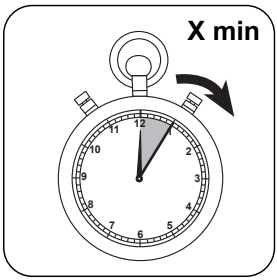
Close vial(s).



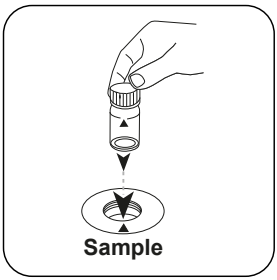
Dissolve the contents by shaking. (20 sec.)



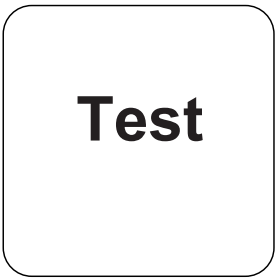
Press the **ENTER** button for countdown.
(XD: start timer)



Reaction time **X minute(s)** according to table. **Wait for reaction time**.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

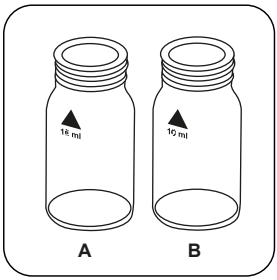


Press the **TEST** (XD: **START**)button.

The result in mg/l free Chlorine appears on the display.

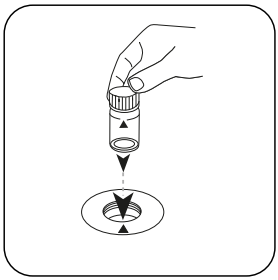
Implementation of the provision free Chlorine and Monochloramine

Select the method on the device
In addition, choose the test: Free Chlorine
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

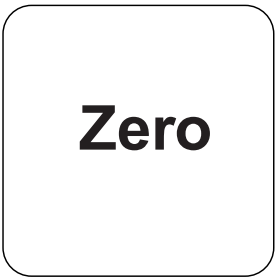


Prepare two clean 24 mm vials. Mark one as Chloramine and the other as Chlorine vial.

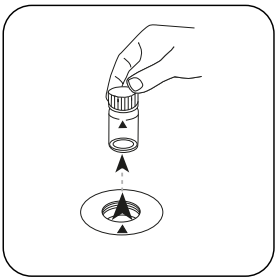
Place **10 ml sample** in each vial.



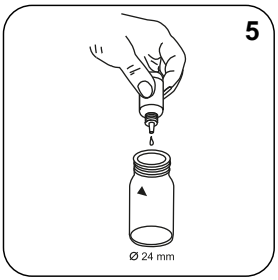
Place Chlorine **vial** in the sample chamber. • Pay attention to the positioning.



Press the **ZERO** button.

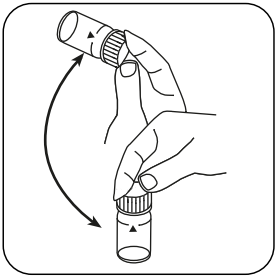


Remove the vial from the sample chamber.

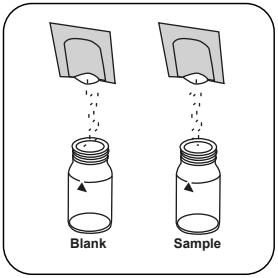


Add **5 drops Free Chlorine Reagent Solution** to the **vial**.

Close vial(s).

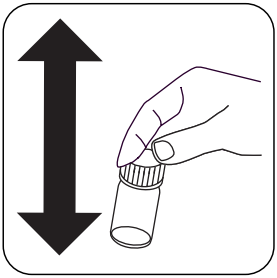


Invert several times to mix the contents (approx. 15 sec).

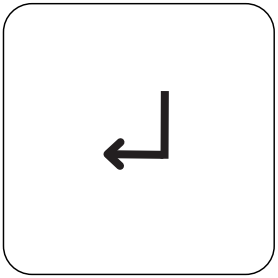


Add **a Monochlor FRGT powder pack** simultaneously in each vial.

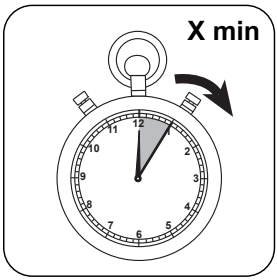
Close vial(s).



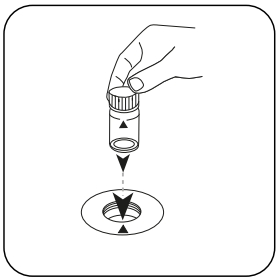
Dissolve the contents by shaking. (20 sec.)



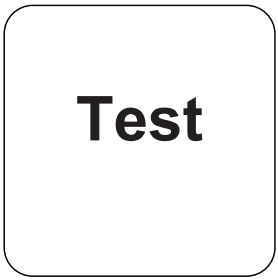
Press the **ENTER** button for countdown.
(XD: start timer)



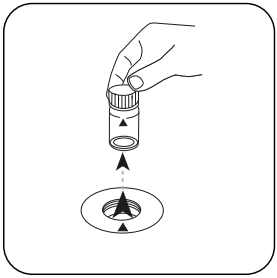
Reaction time **X minute(s)** according to table. **Wait for reaction time**.



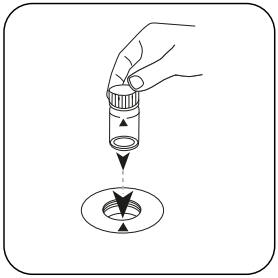
Place Chloramine **vial** in the sample chamber. • Pay attention to the positioning.



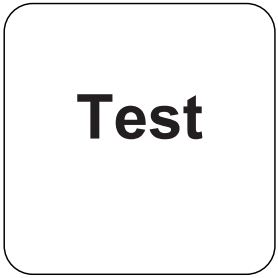
Press the **TEST** (XD: **START**)button.



Remove the vial from the sample chamber.



Place Chlorine **vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in mg/l Chlorine and mg/l Monochloramine - Chlorine Cl [NH_2Cl] appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	Cl_2	1
mg/l	NH_2Cl	0.72598
mg/l	$N[NH_2Cl]$	0.19754
mg/l	NH_3	0.24019

Chemical Method

Indophenole method

Calibration function for 3rd-party photometers

Conc. = $a + b \cdot Abs + c \cdot Abs^2 + d \cdot Abs^3 + e \cdot Abs^4 + f \cdot Abs^5$

	ø 24 mm	□ 10 mm
a	$-5{,}8124 \cdot 10^{-2}$	$-5{,}8124 \cdot 10^{-2}$
b	$1.80357 \cdot 10^{0}$	$3.87768 \cdot 10^{0}$
c	-	-
d	-	-
e	-	-
f	-	-

Interferences

Removeable Interferences

Disturbances caused by precipitation caused by magnesium hardness of more than 400 mg / l $CaCO_3$ can be eliminated by adding 5 drops of Rochelle salt solution.

Interference	from / [mg/L]
Alanine (N)	1
Aluminium (Al)	10
Bromide (Br^-)	100
Bromine (Br_2)	15
Calcium ($CaCO_3$)	1000
Chloride (Cl^-)	18.000
Chlorine Dioxide (ClO_2)	5

Interference	from / [mg/L]
Copper (Cu)	10
Dichloramine (Cl_2)	10
Fluoride (F^-)	5
Glycine (N)	1
Iron (II) (Fe^{2+})	10
Iron (III) (Fe^{3+})	10
Lead (Pb)	10
Permanganate	3
Nitrate (N)	100
Nitrite (N)	50
Sulfide	0.5
Phosphate (PO_4)	100
Silica (SiO_2)	100
Sulfate (SO_4^{2+})	2600
Sulfite (SO_3^{2-})	50
Ozone	1
Tyrosine (N)	1
Urea (N)	10
Zinc (Zn)	5

Method Validation

Limit of Detection	0.010 mg/L
Limit of Quantification	0.03 mg/L
End of Measuring Range	4.5 mg/L
Sensitivity	1.78 mg/L / Abs
Confidence Intervall	0.044 mg/L
Standard Deviation	0.018 mg/L
Variation Coefficient	0.78 %

Ammonia LR TT M65

0.02 - 2.5 mg/L N

Salicylate

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect	ø 16 mm	660 nm	0.02 - 2.5 mg/L N
SpectroDirect, XD 7000, XD 7500	ø 16 mm	655 nm	0.02 - 2.5 mg/L N

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
VARIO Am Vial Test Reagent, Set Low Rage F5	1 Set	535600

Application List

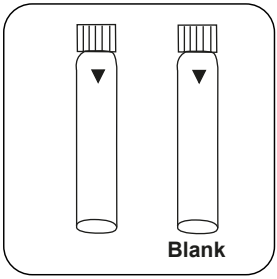
- Waste Water Treatment
- Drinking Water Treatment
- Raw Water Treatment

Preparation

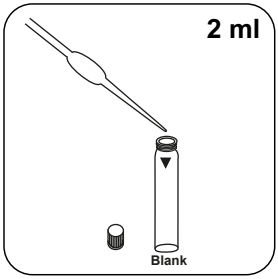
1. Strong alkaline or acidic water samples must be adjusted to approx. pH 7 before analysis (use 1 mol/l Hydrochloric acid or 1 mol/l Sodium hydroxide).

Implementation of the provision Ammonium LR with Vario Vial Test

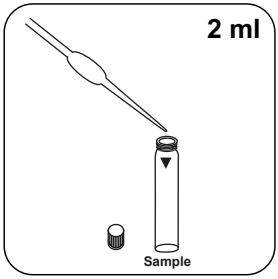
Select the method on the device



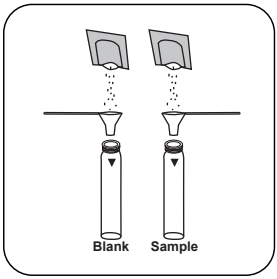
Prepare two **reaction vials**. Mark one as a blank.



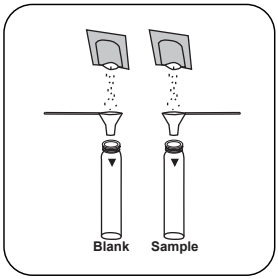
Put **2 ml deionised water** in the blank.



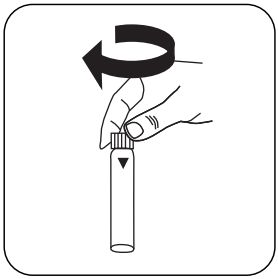
Put **2 ml sample** in the sample vial.



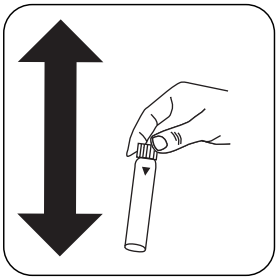
Add **a Vario AMMONIA Salicylate F5 powder pack** in each vial.



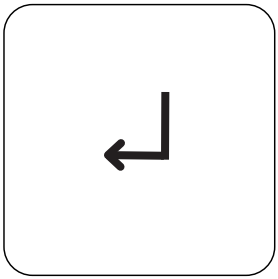
Add **a Vario AMMONIA Cyanurate F5 powder pack** in each vial.



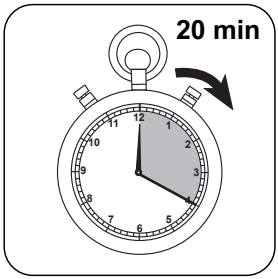
Close vial(s).



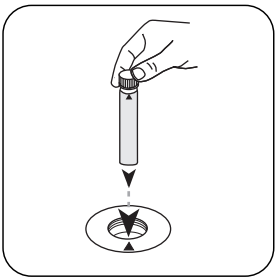
Dissolve the contents by shaking.



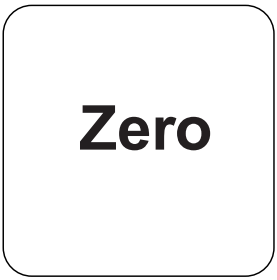
Press the **ENTER** button.



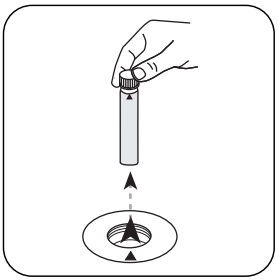
Wait for **20 minute(s) reaction time**.



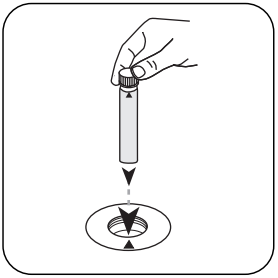
Place **blank** in the sample chamber. • Pay attention to the positioning.



Press the **ZERO** button.



Remove **vial** from the sample chamber.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

Press the **TEST** (XD: **START**)button.

The result in mg/l Ammonium appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	N	1
mg/l	NH_4	1.29
mg/l	NH_3	1.22

Chemical Method

Salicylate

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 16 mm
a	$-1.54654 \cdot 10^{-1}$
b	$1.45561 \cdot 10^{+0}$
c	
d	
e	
f	

Interferences

Removeable Interferences

- Iron interferes with the test and can be eliminated as follows: Determine the amount of total iron present. To produce the blank, add an iron standard solution with the same concentration instead of deionised water.

Method Validation

Limit of Detection	0.01 mg/L
Limit of Quantification	0.04 mg/L
End of Measuring Range	2.5 mg/L
Sensitivity	1.49 mg/L / Abs
Confidence Intervall	0.061 mg/L
Standard Deviation	0.025 mg/L
Variation Coefficient	2.02 %

Derived from

DIN 38406-E5-1
ISO 7150-1

Ammonia HR TT M66

1.0 - 50 mg/L N

Salicylate

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect	ø 16 mm	660 nm	1.0 - 50 mg/L N
SpectroDirect, XD 7000, XD 7500	ø 16 mm	655 nm	1.0 - 50 mg/L N

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
VARIO am Vial Test Reagent Set High Range F5	1 Set	535650

Application List

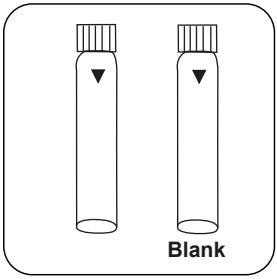
- Waste Water Treatment
- Raw Water Treatment

Preparation

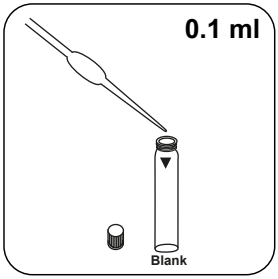
1. Strong alkaline or acidic water samples must be adjusted to approx. pH 7 before analysis (use 1 mol/l Hydrochloric acid or 1 mol/l Sodium hydroxide).

Implementation of the provision Ammonium HR with Vario Tube Test

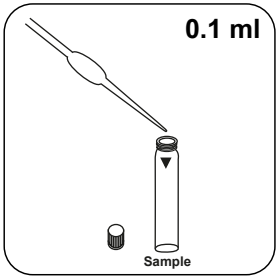
Select the method on the device



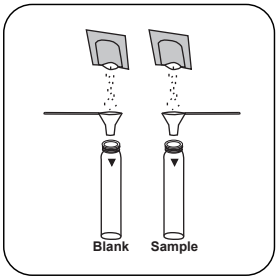
Prepare two **reaction vials**. Mark one as a blank.



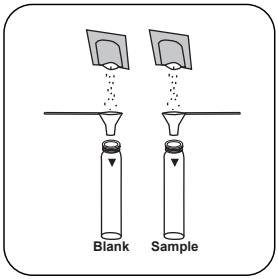
Put **0.1 ml deionised water** in the blank.



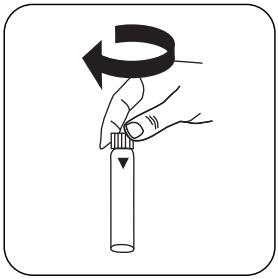
Put **0.1 ml sample** in the sample vial.



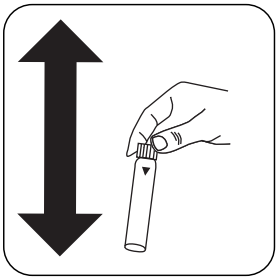
Add **a Vario AMMONIA Salicylate F5 powder pack** in each vial.



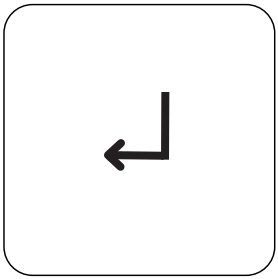
Add **a Vario AMMONIA Cyanurate F5 powder pack** in each vial.



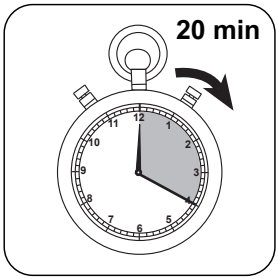
Close vial(s).



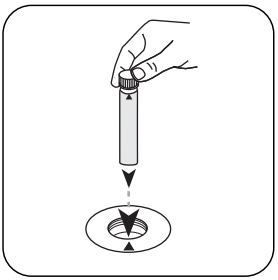
Dissolve the contents by shaking.



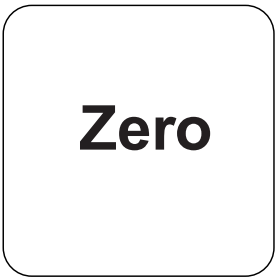
Press the **ENTER** button.



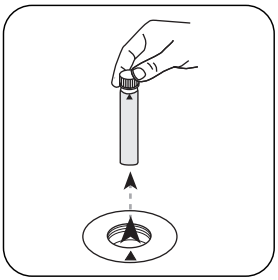
Wait for **20 minute(s) reaction time**.



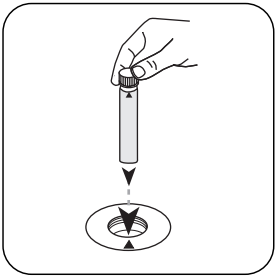
Place **blank** in the sample chamber. • Pay attention to the positioning.



Press the **ZERO** button.



Remove **vial** from the sample chamber.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

Press the **TEST** (XD: **START**)button.

The result in mg/l Ammonium appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	N	1
mg/l	NH_4	1.29
mg/l	NH_3	1.22

Chemical Method

Salicylate

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 16 mm
a	$-3.25421 \cdot 10^{+0}$
b	$3.62204 \cdot 10^{+1}$
c	
d	
e	
f	

Interferences

Removeable Interferences

- Iron interferes with the test and can be eliminated as follows: Determine the amount of total iron present. To produce the blank, add an iron standard solution with the same concentration instead of deionised water.
- If chlorine is known to be present, the sample must be treated with sodium thiosulphate. Add one drop of 0.1 mol/l Sodium thiosulphate for each 0.3 mg/L Cl_2 in a one litre water sample.

Method Validation

Limit of Detection	0.59 mg/L
Limit of Quantification	1.78 mg/L
End of Measuring Range	50 mg/L
Sensitivity	36.82 mg/L / Abs
Confidence Intervall	3.66 mg/L
Standard Deviation	1.51 mg/L
Variation Coefficient	5.93 %

Derived from

DIN 38406-E5-1 ISO 7150-1

Arsenic M68

0.02 - 0.6 mg/L As

Silver Diethyldithiocarbamate

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	□ 20 mm	507 nm	0.02 - 0.6 mg/L As

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
for chemicals see manual, reagents at specialized chemistry dealer		

Application List

- Drinking Water Treatment
- Raw Water Treatment

Preparation

The following reagents need to be purchased:

1. 40 % Sulfuric Acid p.a. (H_2SO_4, CAS-Number: 7664-93-6)
2. 8.33 g Potassium Iodide (KI, CAS-Number: 7681-11-0) in 50 ml of deionised water
   Note: stored in a dark bottle it can be used for 1 week
3. 4.0 g Tin(II)-chloride-Dihydrate ($SnCl_2 \cdot 2H_2O$, CAS-Number: 10025-69-1) in 10 ml Hydrochloric Acid 25 % (HCl, CAS-Number: 7647-01-0)
4. 2.0 g Zinc (Zn, CAS-Number: 7440-66-6, particle size about: 0.3-1.5 mm)
5. Absorption solution:
   Disolve 0.25 g Silver diethyldithiocarbamate ($C_5H_{10}AgNS_2$, CAS-Number: 1470-61-7) and 0.02 g Brucine ($C_{23}H_{26}N_2O_4$, CAS-Number: 357-57-3)
   in 100 ml 1-Methyl-2-pyrrolidone p.a. (As ‹ 10 ppb, Sb ‹ 10 ppb, C_5H_9NO CAS-Number: 872-50-4)
   and store in a dark bottle.
   If it is not possible to dissolve completely, stir for min. 1 hour and filtrate to get a clear solution.

Notes

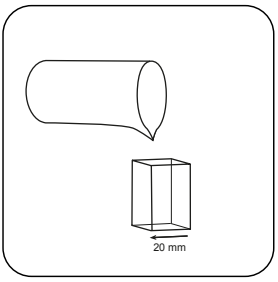
1. Appropriate safety precautions and good laboratory technique must be used during the whole procedure.
2. Reagents are to be obtained from chemical retailers. Notes on the disposal and handling of reagents can be found on the respective safety data sheets.
3. Only use completely dry glass vessels.
4. Use of a rectangular cell, 20 mm layer depth (Order No.: 60 10 50). Positioning: Insert the cell to the left in the cell holder.
5. Store Silver diethyldithiocarbamate at 4 °C.
6. Stored in the dark at max. 20 °C, the absorption solution can be kept for about 1 week.

Implementation of the provision Arsenic (III, IV)

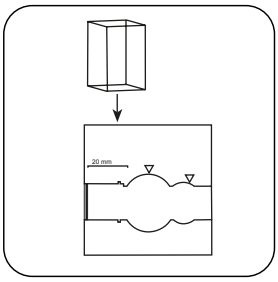
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

Sample preparation: Adhere to reaction times exactly!

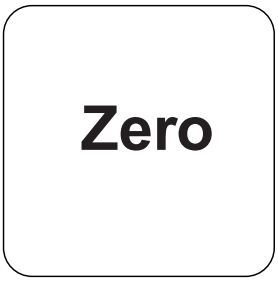
1. Build up the **dry** reaction equipment in the outlet (toxic steam!).
2. Use a pipette to put **50 ml sample** into a 100 ml conical flask (NS 29/32).
3. Add **30 ml of sulphuric acid, 2.0 ml of potassium iodide solution and 0.3 ml of Zinc (II) chloride solution** to the sample.
4. Close the flask with the plug seal, invert and leave to stand for **15 minutes** .
5. Weigh **2.0 g Zinc** and prepare.
6. Fill the absorption tube with exactly **5.0 ml absorption solution**. (Use a volumetric pipette).
7. After 15 minutes reaction time, place the prepared amount of zinc in the Erlenmeyer flask and **immediately close** it with the prepared absorption tube.
8. Arsenic hydrogen development **(strong!)** starts. **60 minutes** Wait for reaction time.



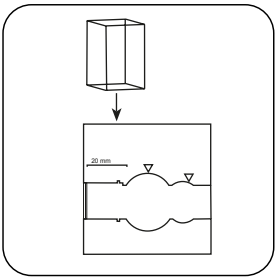
Fill **20 mm vial** with **deionised water** .



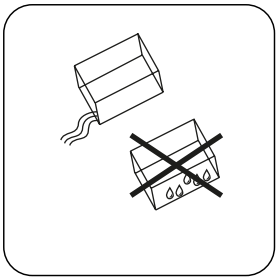
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



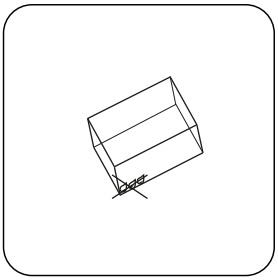
Press the **ZERO** button.



Remove **vial** from the sample chamber.

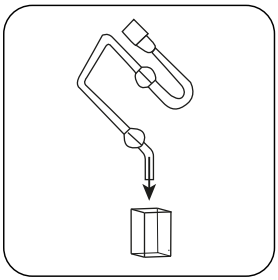


Empty vial.

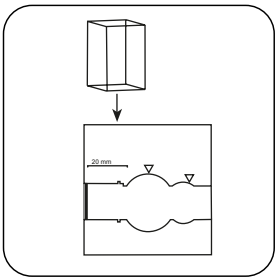


Dry the vial thoroughly.

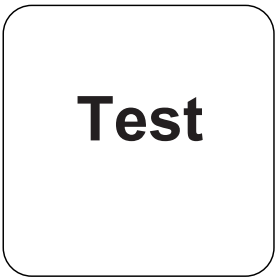
For devices that require **no ZERO measurement** , **start here**.



Fill 20 mm vial with the coloured absorption solution.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in mg/l Arsenic appears on the display.

Chemical Method

Silver Diethyldithiocarbamate

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	□ **20 mm**
a	-6.96705 • 10^{+0}
b	4.41627 • 10^{+2}
c	
d	
e	
f	

Interferences

Persistant Interferences

1. Antimony, selenium, and tellurium react in the same way as arsenic.
2. Thiosulfate interferes with the test.

Bibliography

G. Ackermann, J. Köthe: Fresenius Z. Anal. Chem. 323 (1986), 135

Derived from

DIN EN 26595
ISO 6595

PHMB T M70

2 - 60 mg/lPHMB

Buffer / Indicator

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect, PM 620, PM 630, XD 7000, XD 7500	ø 24 mm	560 nm	2 - 60 mg/lPHMB

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
PHMB Photometer	Tablet / 100	516100BT
PHMB Photometer	Tablet / 250	516101BT

Application List

- Pool Water Control

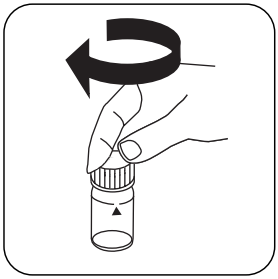
Notes

1. After the end of the test, the vials must be immediately rinsed and cleaned with a brush.
2. During extended use, vials and stirring rods can become discoloured blue. This discolouration can be easily removed if the vials and stirring rod are cleaned with a lab cleaner. Rinse thoroughly with tap water and then with deionised water.
3. With this test, the result will influence the analysis of the hardness and acid capacity of the water sample. This method is adjusted using water with the following composition:
   Calcium hardness: 2 mmol/l
   Acid capacity: 2.4 mmol/l.

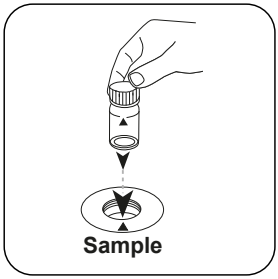
Implementation of the provision PHMB (Biguanide) with Tablet

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

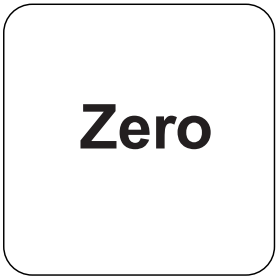
Fill 24 mm vial with **10 ml sample**.



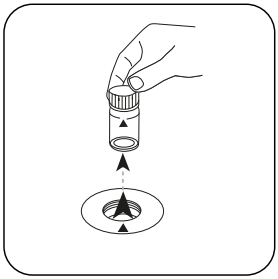
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

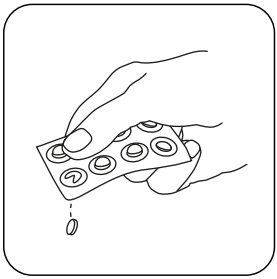


Press the **ZERO** button.

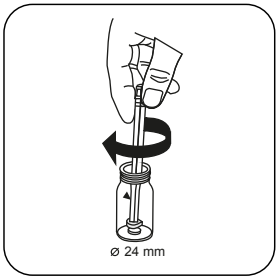


Remove the vial from the sample chamber.

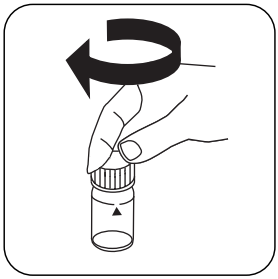
For devices that require **no ZERO measurement** , **start here**.



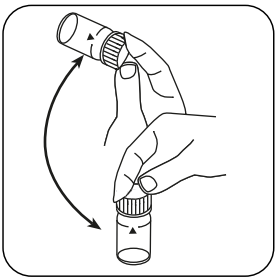
Add **PHMB PHOTOMETER tablet**.



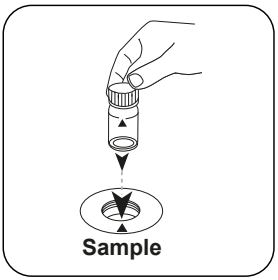
Crush tablet(s) by rotating slightly.



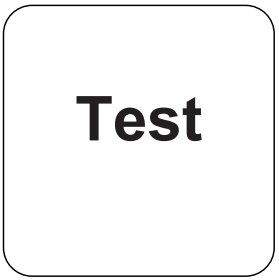
Close vial(s).



Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in mg/l PHMB appears on the display.

Chemical Method

Buffer / Indicator

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ **10 mm**
a	-2.00454 • 10^{+1}	-2.00454 • 10^{+1}
b	1.29751 • 10^{+2}	2.78966 • 10^{+2}
c	-4.47145 • 10^{+1}	-2.06693 • 10^{+2}
d	-1.07518 • 10^{+2}	-1.06855 • 10^{+3}
e	1.42602 • 10^{+2}	3.04706 • 10^{+3}
f		

Bromine 10 T M78

0.1 - 3 mg/L Br_2

DPD

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	□ 10 mm	510 nm	0.1 - 3 mg/L Br_2

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
DPD No. 1	Tablet / 100	511050BT
DPD No. 1	Tablet / 250	511051BT
DPD No. 1	Tablet / 500	511052BT
DPD No. 1 High Calcium [e)]	Tablet / 100	515740BT
DPD No. 1 High Calcium [e)]	Tablet / 250	515741BT
DPD No. 1 High Calcium [e)]	Tablet / 500	515742BT

Application List

- Disinfection Control
- Raw Water Treatment
- Pool Water Control
- Pool Water Treatment

Preparation

1. Cleaning of vials:
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, the subsequent determination of oxidising agents (e.g. ozone and chlorine) may show lower results. To avoid measurement errors, the glassware used should be free of chlorine consumption. To achieve this, all glassware should be placed in a sodium hypochlorite solution (0.1 g/L) for one hour and then rinsed thoroughly with deionised water.
2. When preparing the sample, Bromine outgassing, e.g. through the pipette or shaking, must be avoided. The analysis must take place immediately after taking the sample.
3. Strong alkaline or acidic water samples must be adjusted between pH 6 and pH 7 before the analysis (use 0.5 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).

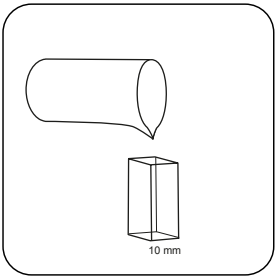
Notes

Variations in the length of the vial can extend the measuring range:

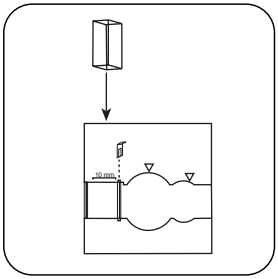
- 10 mm vial: 0.1 mg/L - 3 mg/L, solution: 0.01
- 20 mm vial: 0.05 mg/L - 1.5 mg/L, solution: 0.01
- 50 mm vial: 0.02 mg/L - 0.6 mg/L, solution: 0.001

Implementation of the provision Bromine with Tablet

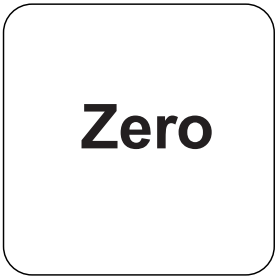
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



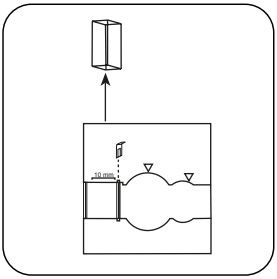
Fill 10 mm vial with **sample**.



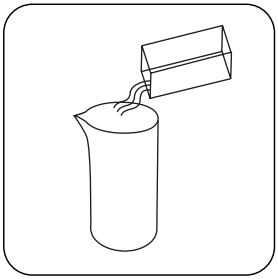
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



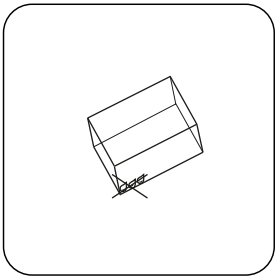
Press the **ZERO** button.



Remove **vial** from the sample chamber.

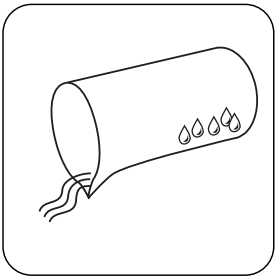


Empty vial.

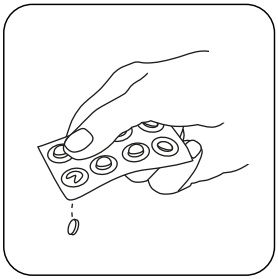


Dry the vial thoroughly.

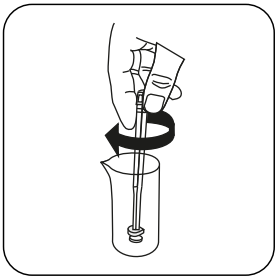
For devices that require **no ZERO measurement** , **start here**.



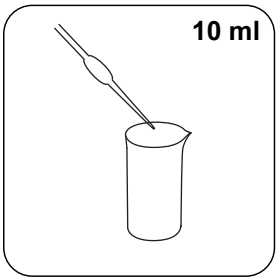
Rinse a beaker **with the sample and empty it, leaving a few drops remaining** in the beaker.



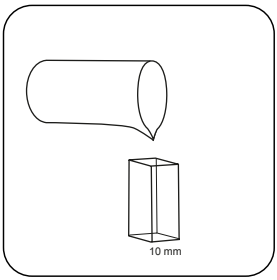
Add **DPD No. 1 tablet** .



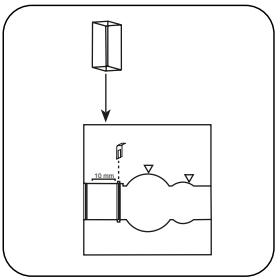
Crush tablet(s) by rotating slightly and dissolve.



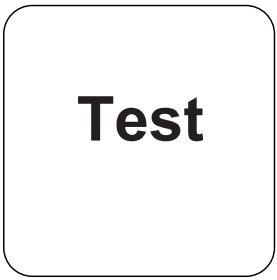
Add **10 ml sample**.



Fill 10 mm vial with **sample**.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.
The result in mg/l Bromine appears on the display.

Chemical Method

DPD

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	□ **10 mm**
a	-3.47814 • 10^{-2}
b	8.22863 • 10^{+0}
c	7.07422 • 10^{+0}
d	
e	
f	

Interferences

Persistant Interferences

1. All oxidising agents in the samples react like bromine, which leads to higher results.

2. Concentrations above 22 mg/L Bromine can lead to results within the measuring range of up to 0 mg/L. In this case, the water sample must be diluted. 10 ml of the diluted sample should be mixed with the reagent and the measurement taken again (plausibility test).

Derived from

US EPA 330.5 (1983)
APHA Method 4500 Cl-G

[e] alternative reagent, used instead of DPD No.1/No.3 in case of turbidity in the water sample caused by high concentration of calcium and/or high conductivity

Bromine 50 T M79

0.05 - 1 mg/L Br_2

DPD

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	□ 50 mm	510 nm	0.05 - 1 mg/L Br_2

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
DPD No. 1	Tablet / 100	511050BT
DPD No. 1	Tablet / 250	511051BT
DPD No. 1	Tablet / 500	511052BT
DPD No. 1 High Calcium [e)]	Tablet / 100	515740BT
DPD No. 1 High Calcium [e)]	Tablet / 250	515741BT
DPD No. 1 High Calcium [e)]	Tablet / 500	515742BT

Application List

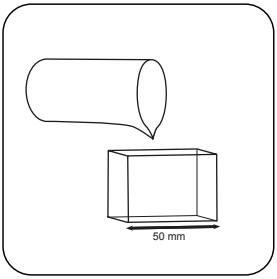
- Disinfection Control
- Raw Water Treatment
- Pool Water Control
- Pool Water Treatment

Preparation

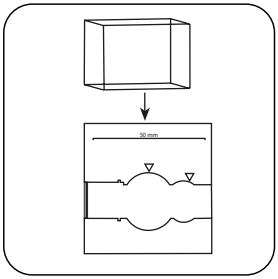
1. Cleaning of vials:
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, the subsequent determination of oxidising agents (e.g. ozone and chlorine) may show lower results. To avoid measurement errors, the glassware used should be free of chlorine consumption. To achieve this, all glassware should be placed in a sodium hypochlorite solution (0.1 g/L) for one hour and then rinsed thoroughly with deionised water.
2. When preparing the sample, Bromine outgassing, e.g. through the pipette or shaking, must be avoided. The analysis must take place immediately after taking the sample.
3. Strong alkaline or acidic water samples must be adjusted between pH 6 and pH 7 before the analysis (use 0.5 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).

Implementation of the provision Bromine with Tablet

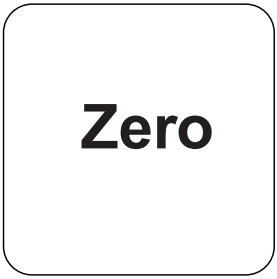
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



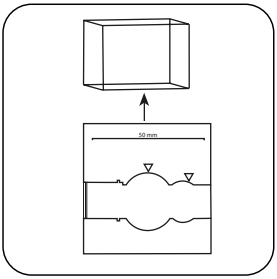
Fill 50 mm vial with **sample**.



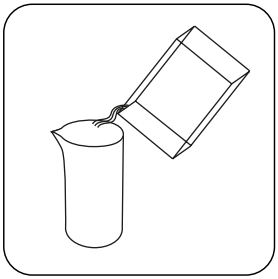
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



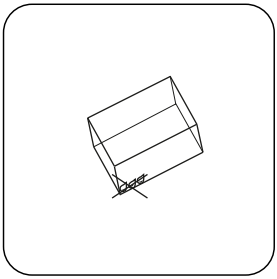
Press the **ZERO** button.



Remove **vial** from the sample chamber.

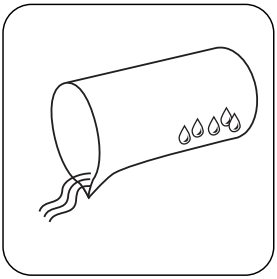


Empty vial.

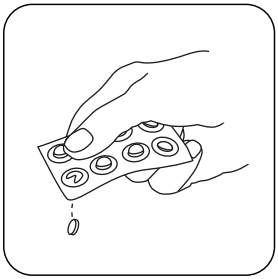


Dry the vial thoroughly.

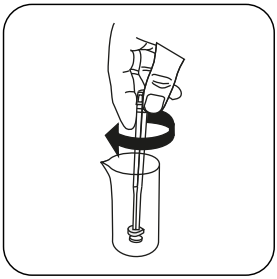
For devices that require **no ZERO measurement** , **start here**.



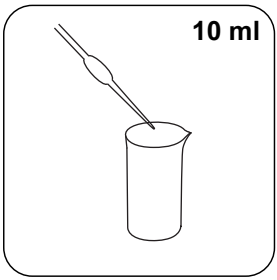
Rinse a beaker **with the sample and empty it, leaving a few drops remaining** in the beaker.



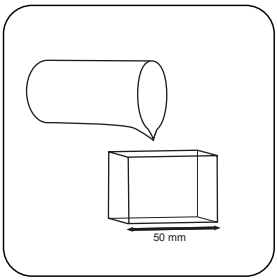
Add **DPD No. 1 tablet** .



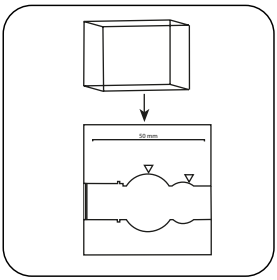
Crush tablet(s) by rotating slightly and dissolve.



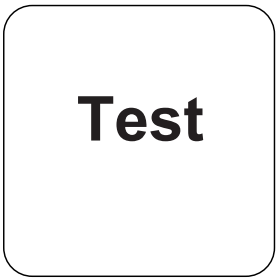
Add **10 ml sample**.



Fill 50 mm vial with **sample**.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.
The result in mg/l Bromine appears on the display.

Chemical Method

DPD

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	□ **50 mm**
a	-2.45723 • 10^{-2}
b	3.75449 • 10^{+0}
c	
d	
e	
f	

Interferences

Persistant Interferences

1. All oxidising agents in the samples react like bromine, which leads to higher results.
2. Concentrations above 22 mg/L Bromine can lead to results within the measuring range of up to 0 mg/L. In this case, the water sample must be diluted. 10 ml of the diluted sample should be mixed with the reagent and the measurement taken again (plausibility test).

Derived from

US EPA 330.5 (1983)
APHA Method 4500 Cl-G

e) alternative reagent, used instead of DPD No.1/No.3 in case of turbidity in the water sample caused by high concentration of calcium and/or high conductivity

Bromine T M80

0.05 - 13 mg/L Br_2 Br

DPD

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 110, MD 200, MD 600, MD 610, MD 640, MultiDirect, PM 600, PM 620, PM 630	ø 24 mm	530 nm	0.05 - 13 mg/L Br_2
SpectroDirect, XD 7000, XD 7500	ø 24 mm	510 nm	0.05 - 13 mg/L Br_2
Scuba II	ø 24 mm	530 nm	0.2 - 13 mg/L Br_2

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
DPD No. 1	Tablet / 100	511050BT
DPD No. 1	Tablet / 250	511051BT
DPD No. 1	Tablet / 500	511052BT
DPD No. 1 High Calcium [e)]	Tablet / 100	515740BT
DPD No. 1 High Calcium [e)]	Tablet / 250	515741BT
DPD No. 1 High Calcium [e)]	Tablet / 500	515742BT

Application List

- Disinfection Control
- Raw Water Treatment
- Pool Water Control
- Pool Water Treatment

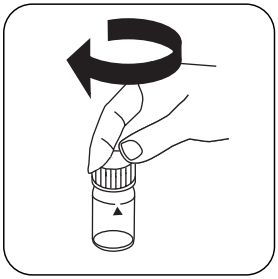
Preparation

1. Cleaning of vials:
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, the subsequent determination of oxidising agents (e.g. ozone and chlorine) may show lower results. To avoid measurement errors, the glassware used should be free of chlorine consumption. To achieve this, all glassware should be placed in a sodium hypochlorite solution (0.1 g/L) for one hour and then rinsed thoroughly with deionised water.
2. When preparing the sample, Bromine outgassing, e.g. through the pipette or shaking, must be avoided. The analysis must take place immediately after taking the sample.
3. Strong alkaline or acidic water samples must be adjusted between pH 6 and pH 7 before the analysis (use 0.5 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).

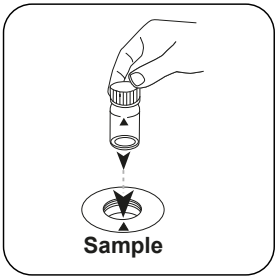
Implementation of the provision Bromine with Tablet

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

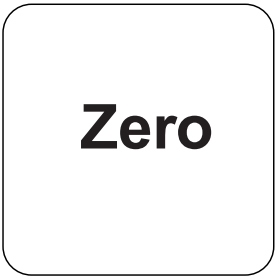
Fill 24 mm vial with **10 ml sample**.



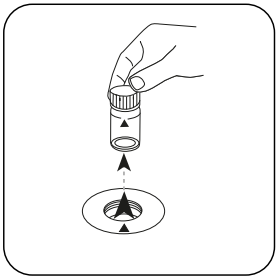
Close vial(s).



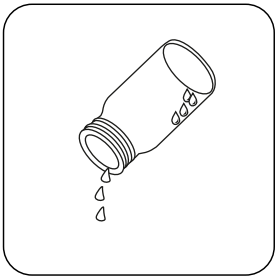
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **ZERO** button.

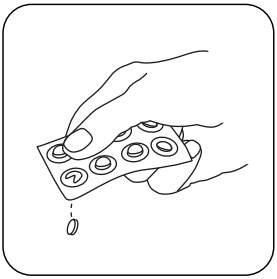


Remove the vial from the sample chamber.

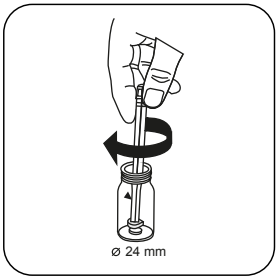


Empty vial except for a few drops.

For devices that require **no ZERO measurement** , **start here**.

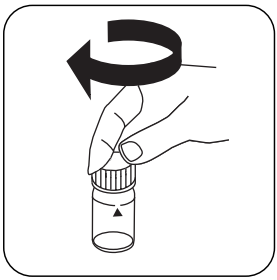


Add **DPD No. 1 tablet** .

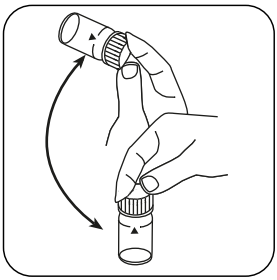


Crush tablet(s) by rotating slightly.

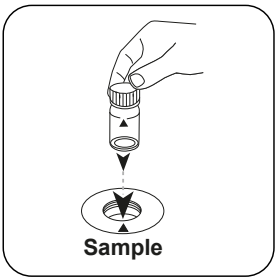
Fill up vial with **sample** to the **10 ml mark**.



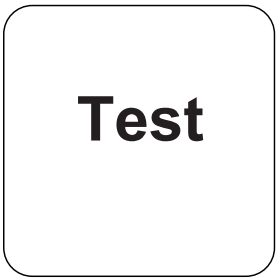
Close vial(s).



Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.
The result in mg/l Bromine appears on the display.

Chemical Method

DPD

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	$4.51215 \cdot 10^{-2}$	$4.51215 \cdot 10^{-2}$
b	$3.39914 \cdot 10^{+0}$	$7.30815 \cdot 10^{+0}$
c	$3.68532 \cdot 10^{-1}$	$1.70354 \cdot 10^{+0}$
d	$1.00204 \cdot 10^{-1}$	$9.95865 \cdot 10^{-1}$
e		
f		

Interferences

Persistant Interferences

1. All oxidising agents in the samples react like bromine, which leads to higher results.
2. Concentrations above 22 mg/L Bromine can lead to results within the measuring range of up to 0 mg/L. In this case, the water sample must be diluted. 10 ml of the diluted sample should be mixed with the reagent and the measurement taken again (plausibility test).

Derived from

US EPA 330.5 (1983)
APHA Method 4500 Cl-G

[e)] alternative reagent, used instead of DPD No.1/No.3 in case of turbidity in the water sample caused by high concentration of calcium and/or high conductivity

Bromine PP M81

0.05 - 4.5 mg/L Br_2

DPD

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect	ø 24 mm	530 nm	0.05 - 4.5 mg/L Br_2
XD 7000, XD 7500	ø 24 mm	510 nm	0.05 - 4.5 mg/L Br_2

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Chlorine Total DPD F10	Powder / 100 pc.	530120

Application List

- Disinfection Control
- Raw Water Treatment
- Pool Water Control
- Pool Water Treatment

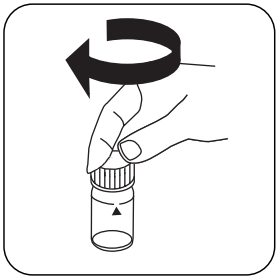
Preparation

1. Cleaning of vials:
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, the subsequent determination of oxidising agents (e.g. ozone and chlorine) may show lower results. To avoid measurement errors, the glassware used should be free of chlorine consumption. To achieve this, all glassware should be placed in a sodium hypochlorite solution (0.1 g/L) for one hour and then rinsed thoroughly with deionised water.
2. When preparing the sample, Bromine outgassing, e.g. through the pipette or shaking, must be avoided. The analysis must take place immediately after taking the sample.
3. Strong alkaline or acidic water samples must be adjusted between pH 6 and pH 7 before the analysis (use 0.5 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).

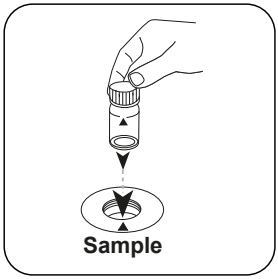
Implementation of the provision Bromine with Powder Pack

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

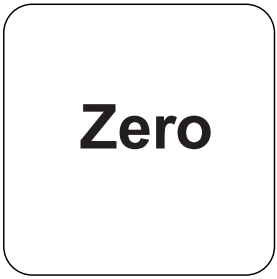
Fill 24 mm vial with **10 ml sample**.



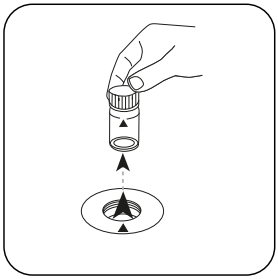
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

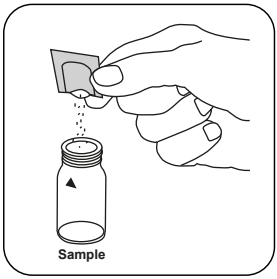


Press the **ZERO** button.

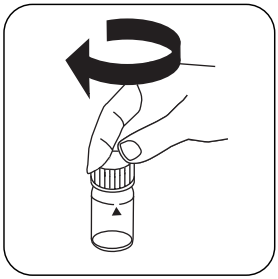


Remove the vial from the sample chamber.

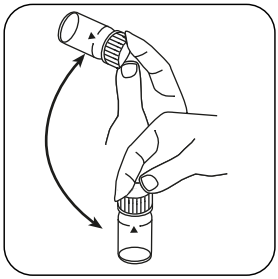
For devices that require **no ZERO measurement** , **start here**.



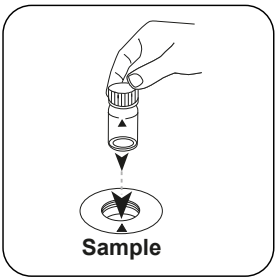
Add **Chlorine TOTAL DPD/ F10 powder pack**.



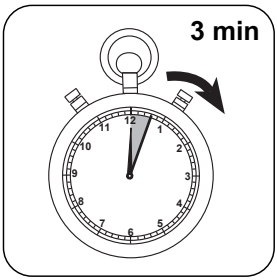
Close vial(s).



Invert several times to mix the contents (20 sec.).



Test



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

Press the **TEST** (XD: **START**)button.

Wait for **3 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Bromine appears on the display.

Chemical Method

DPD

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	$-4.54564 \cdot 10^{-2}$	$-4.54564 \cdot 10^{-2}$
b	$3.79613 \cdot 10^{+0}$	$8.16168 \cdot 10^{+0}$
c	$4.48111 \cdot 10^{-1}$	$2.07139 \cdot 10^{+0}$
d	$-1.33013 \cdot 10^{-1}$	$-1.32193 \cdot 10^{+0}$
e		
f		

Interferences

Persistant Interferences

1. All oxidising agents in the samples react like bromine, which leads to higher results.
2. Concentrations above 22 mg/L Bromine can lead to results within the measuring range of up to 0 mg/L. In this case, the water sample must be diluted. 10 ml of the diluted sample should be mixed with the reagent and the measurement taken again (plausibility test).

Derived from

US EPA 330.5 (1983)
APHA Method 4500 Cl-G

Boron T M85

0.1 - 2 mg/L B

Azomethine

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect	ø 24 mm	430 nm	0.1 - 2 mg/L B
SpectroDirect, XD 7000, XD 7500	ø 24 mm	450 nm	0.1 - 2 mg/L B

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Boron No. 1	Tablet / 100	515790BT
Boron No. 2	Tablet / 100	515800BT
Boron No. 2	Tablet / 250	515801BT
Set Boron No. 1/No. 2 100 Pc.#	100 each	517681BT
Set Boron No. 1/No. 2 200 Pc.#	200 each	517682BT

Application List

- Raw Water Treatment
- Waste Water Treatment
- Drinking Water Treatment

Preparation

1. The aqueous sample solution should have a pH value between 6 and 7.
2. Colour development depends on the temperature. The sample temperature must be 20 °C ± 1 °C.

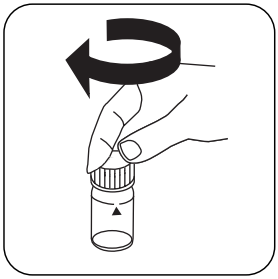
Notes

1. The tablets must be added in the correct sequence.

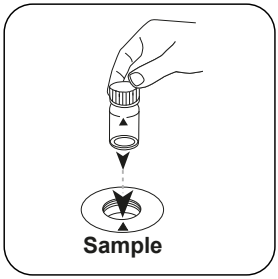
Implementation of the provision Boron with Tablet

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

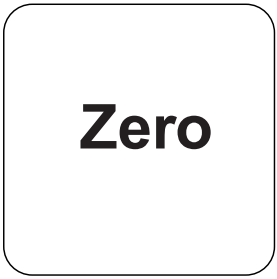
Fill 24 mm vial with **10 ml sample**.



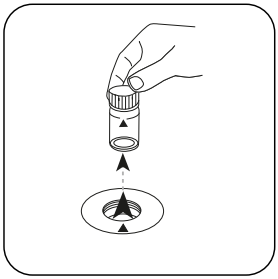
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

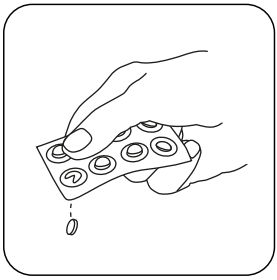


Press the **ZERO** button.

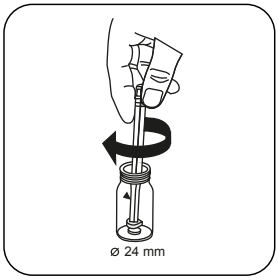


Remove the vial from the sample chamber.

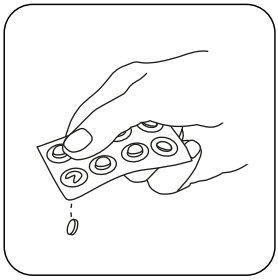
For devices that require **no ZERO measurement** , **start here**.



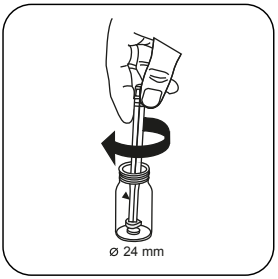
Add **BORON No. 1 tablet** .



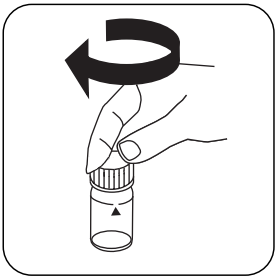
Crush tablet(s) by rotating slightly and dissolve.



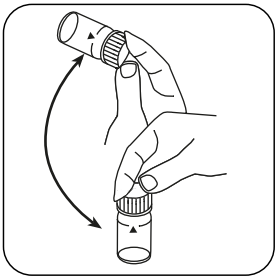
Add **BORON No 2. tablet**.



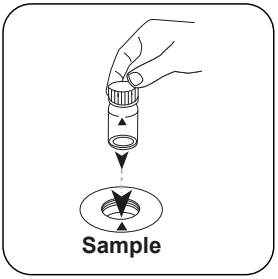
Crush tablet(s) by rotating slightly.



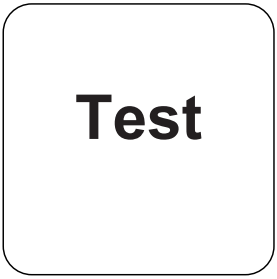
Close vial(s).



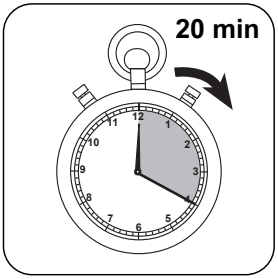
Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **20 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically. The result in mg/l Boron appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	B	1
mg/l	H_3BO_3	5.72

Chemical Method

Azomethine

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	-1.20451 • 10^{+0}	-1.20451 • 10^{+0}
b	7.17234 • 10^{+0}	1.54205 • 10^{+1}
c	-1.04549 • 10^{+1}	-4.83279 • 10^{+1}
d	8.83702 • 10^{+0}	8.78256 • 10^{+1}
e	-2.59333 • 10^{+0}	-5.5413 • 10^{+1}
f		

Interferences

Removeable Interferences

1. Interferences are eliminated by the contents of the tablets (EDTA).

Bibliography

Hofer, A., Brosche, E. & Heidinger, R. Z. Anal. Chem. (1971) 253: 117

Derived from

ISO 9390

including stirring rod, 10 cm

Cadmium M. TT M87

0.025 - 0.75 mg/L Cd

Cadion

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	ø 16 mm	525 nm	0.025 - 0.75 mg/L Cd

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Cadmium Spectroquant 1.14834.0001 tube test [d)]	25 pc.	420750

Application List

- Waste Water Treatment
- Drinking Water Treatment
- Raw Water Treatment
- Galvanization

Preparation

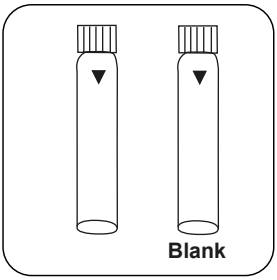
1. Before performing the test, you must read through the original instructions and safety advice that is delivered with the test kit (MSDS are available on the homepage of www.merckmillipore.com).
2. With the test process described, only Cd^{2+} ions are determined. To determine colloidal, undissolved and complex-bound cadmium, digestion is first required.
3. The pH value of the sample must be between 3 and 11.

Notes

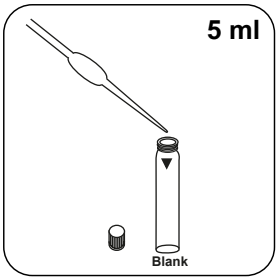
1. This method is adapted from MERCK.
2. Spectroquant® is a registered trademark of the company MERCK KGaA.
3. Appropriate safety precautions and good laboratory technique should be used during the whole procedure.
4. Sample and reagent volumes must be metered using a suitable volumetric pipette (class A).
5. Because the reaction depends on temperature, the sample temperature must be between 10 and 40 °C.
6. The reagents are to be stored in closed containers at a temperature of +15 °C – +25 °C.

Implementation of the provision Cadmium with MERCK Spectroquant® Cell Test, No. 1.14834.0001

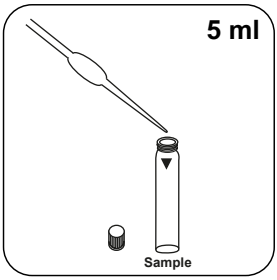
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7500, XD 7500
Skip steps with Blank.



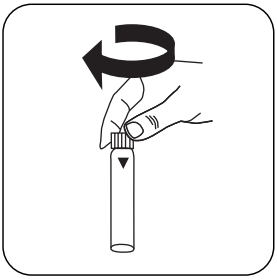
Prepare two **reaction vials**. Mark one as a blank.



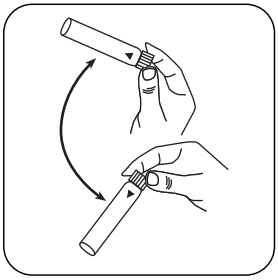
Put **5 ml deionised water** in the blank.



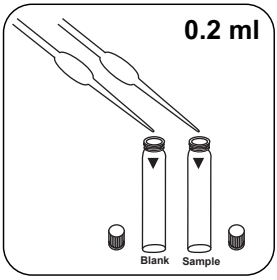
Put **5 ml sample** in the sample vial.



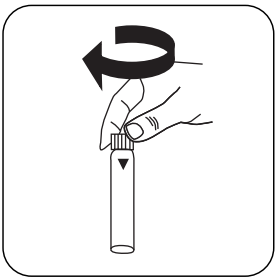
Close vial(s).



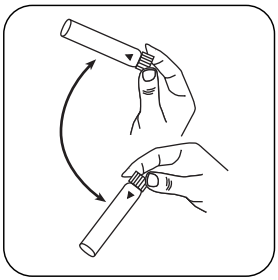
Invert several times to mix the contents.



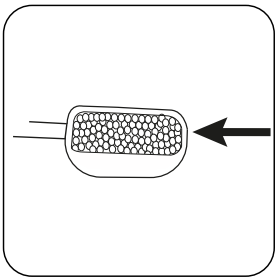
Add **0.2 ml Reagenz Cd-1K solution** to each vial.



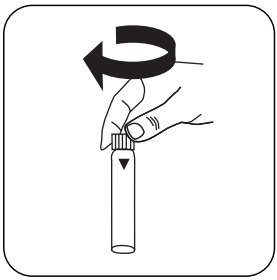
Close vial(s).



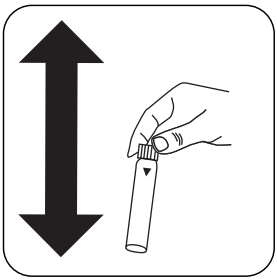
Invert several times to mix the contents.



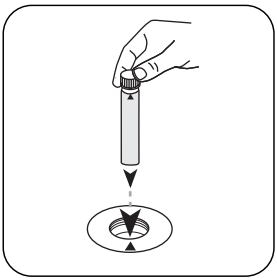
Add exactly **one level microspoon Reagent Cd-2K**.



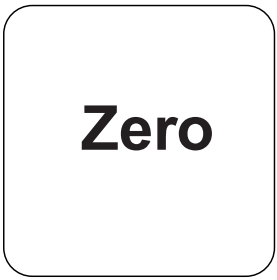
Close vial(s).



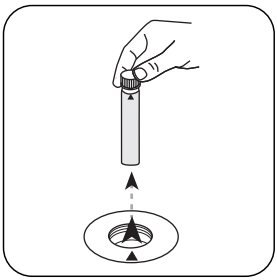
Dissolve the contents by shaking.



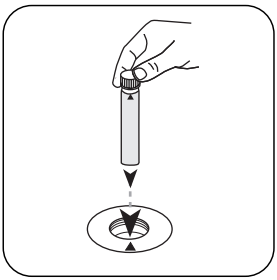
Place **blank** in the sample chamber. • Pay attention to the positioning.



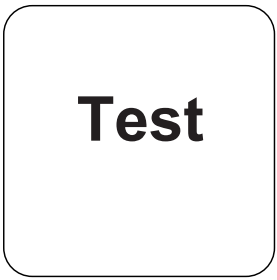
Press the **ZERO** button.



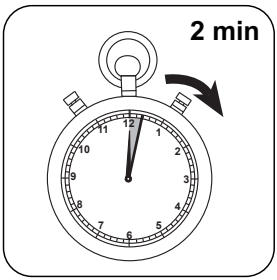
Remove **vial** from the sample chamber.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **2 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically. The result in mg/l Cadmium appears on the display.

Chemical Method

Cadion

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 16 mm
a	$1.03645 \cdot 10^{+1}$
b	$4.81917 \cdot 10^{+2}$
c	
d	
e	
f	

Interferences

Interference	**from / [mg/L]**
Al	25
Ca^{2+}	1000
$Cr_2O_7^{2-}$	100
Cu^{2+}	10
Fe^{3+}	1
Mg^{2+}	1000
Mn^{2+}	10
NH_4^+	100
Ni^{2+}	0,5
Pb^{2+}	100
PO_4^{3-}	100
Zn^{2+}	0,5
NaCl	0,005
$NaNO_3$	0,05
Na_2SO_4	0,005

Bibliography

H. Watanabe, H. Ohmori (1979), Dual-wavelength spectrophotometric determination of cadmium with cadion, Talanta, 26 (10), 959-961

[d] Spectroquant® is a Merck KGaA Trademark

Chloride T M90

0.5 - 25 mg/L Cl^- CL-1

Silver Nitrate / Turbidity

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 600, MD 610, MD 640, MultiDirect	ø 24 mm	530 nm	0.5 - 25 mg/L Cl^-
SpectroDirect, XD 7000, XD 7500	ø 24 mm	450 nm	0.5 - 25 mg/L Cl^-

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Chloride T1	Tablet / 100	515910BT
Chloride T1	Tablet / 250	515911BT
Chloride T2	Tablet / 100	515920BT
Chloride T2	Tablet / 250	515921BT
Set Chloride T1/T 2 100 Pc.#	100 each	517741BT
Set Chloride T1/T 2 250 Pc.#	250 each	517742BT

Application List

- Waste Water Treatment
- Cooling Water
- Drinking Water Treatment
- Raw Water Treatment
- Galvanization

Preparation

1. Highly alkaline water should – if necessary – be neutralised before any analysis with Nitric acid.

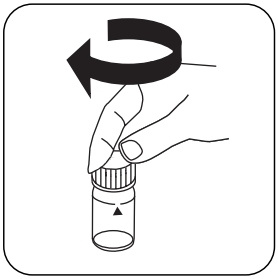
Notes

1. High concentrations of electrolytes and organic compounds have different effects on the precipitation reaction.

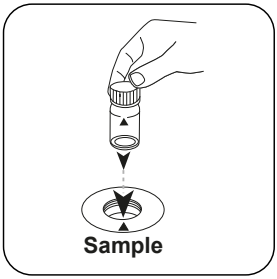
Implementation of the provision Chloride with Tablet

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

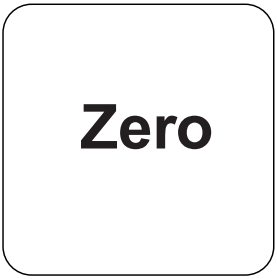
Fill 24 mm vial with **10 ml sample**.



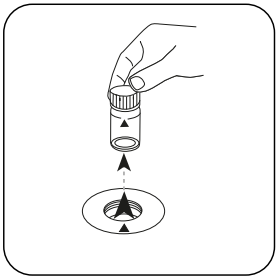
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

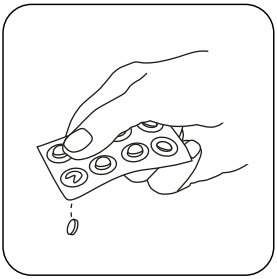


Press the **ZERO** button.

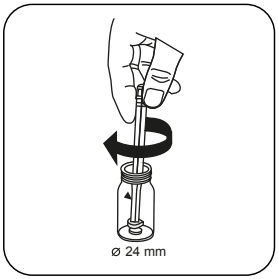


Remove the vial from the sample chamber.

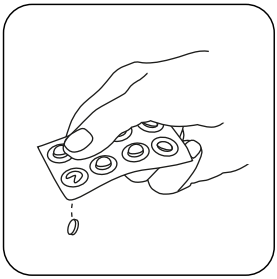
For devices that require **no ZERO measurement** , **start here**.



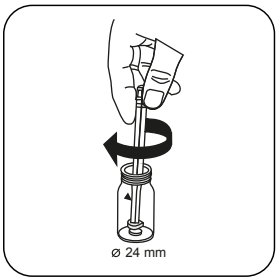
Add **CHOLORIDE T1 tablet** .



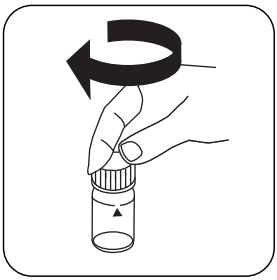
Crush tablet(s) by rotating slightly and dissolve.



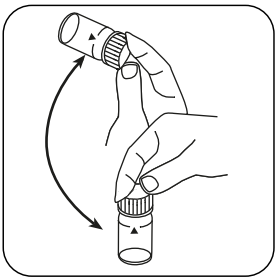
Add **CHLORIDE T2 tablet** .



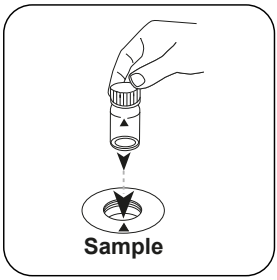
Crush tablet(s) by rotating slightly.



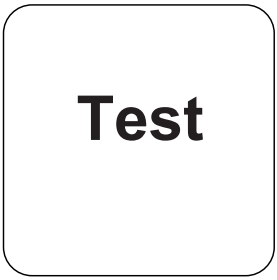
Close vial(s).



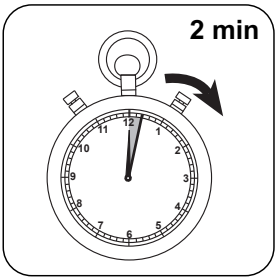
Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **2 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Chloride appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	Cl^-	1
mg/l	NaCl	1.65

Chemical Method

Silver Nitrate / Turbidity

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ 10 mm
a	$-1.74125 \cdot 10^{+0}$	$-1.74125 \cdot 10^{+0}$
b	$1.28236 \cdot 10^{+1}$	$2.75707 \cdot 10^{+1}$
c		
d		
e		
f		

Interferences

Persistant Interferences

1. Ions that also form deposits with Silver nitrate in acidic media, such as Bromides, Iodides and Thiocyanates, cause interference.
2. Individual particles are not attributable to the presence of chloride. Chloride causes a finely distributed turbidity with a milky appearance. **Disturbance through heavy shaking or stirring leads to bigger sized particles, which can cause lower readings.**
3. Cyanide, Iodine and Bromine also are determined as chloride. Chromate and dichromate interfere and should be reduced to the chromic state or removed.

Derived from

DIN 38405

including stirring rod, 10 cm

Chloride L (B) M91

5.00 - 60 mg/L Cl^-

Iron(III)-thiocyanate

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	ø 24 mm	455 nm	5.00 - 60 mg/L Cl^-

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Chloride Reagent Test	1 pc.	2419031

Application List

- Waste Water Treatment
- Cooling Water
- Drinking Water Treatment
- Raw Water Treatment
- Galvanization

Preparation

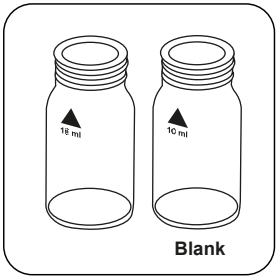
1. The test sample and the reagents should be at room temperature when undertaking the test.
2. The pH value of the sample must be between 3 and 9.

Notes

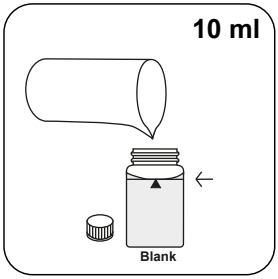
1. The reagents are to be stored in closed containers (in a fridge) at +4 °C – +8 °C.

Implementation of the provision Chloride Reagent test

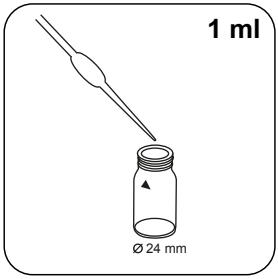
Select the method on the device



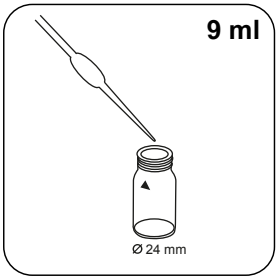
Prepare two clean 24 mm vials. Mark one as a blank.



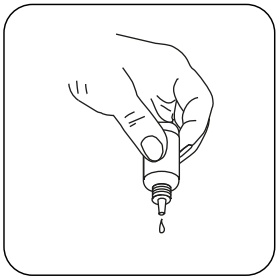
Put **10 ml deionised water** in the blank.



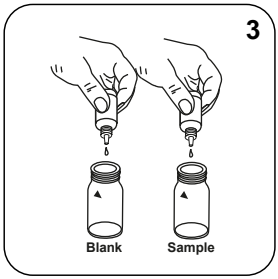
Put **1 ml sample** in the vial.



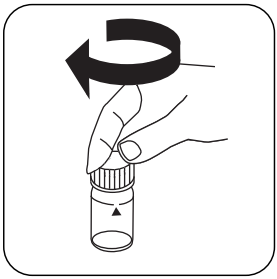
Fill 24 mm vial with **9 ml deionised water** .



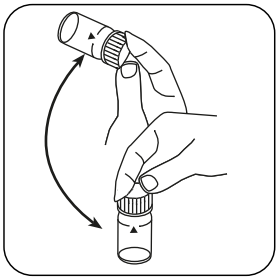
Hold cuvettes vertically and add equal drops by pressing slowly.



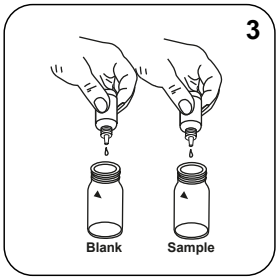
Add **3 drops Chloride-51 solution** to each vial.



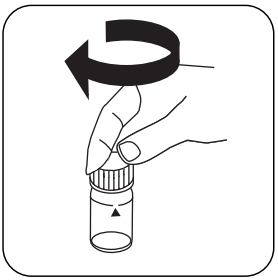
Close vial(s).



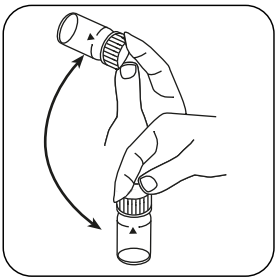
Invert several times to mix the contents.



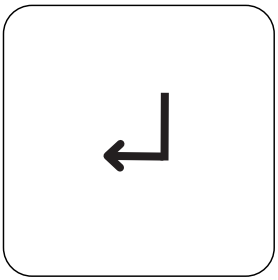
Add **3 drops Chloride-52 solution** to each vial.



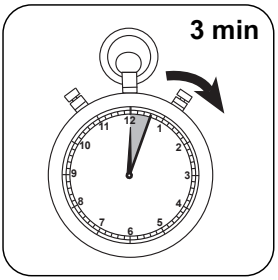
Close vial(s).



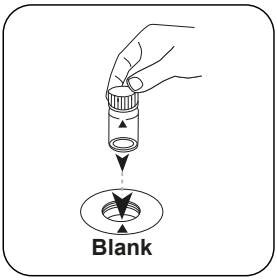
Invert several times to mix the contents.



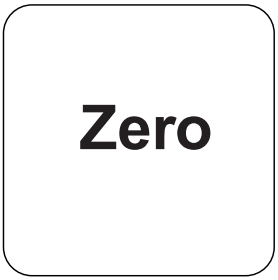
Press the **ENTER** button.



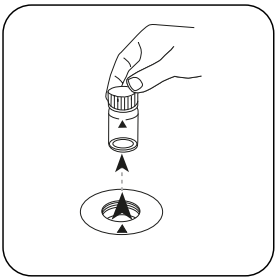
Wait for **3 minute(s) reaction time**.



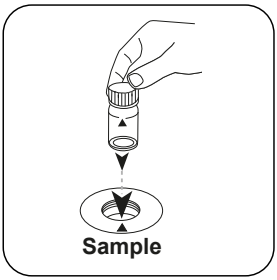
Place **blank** in the sample chamber. • Pay attention to the positioning.



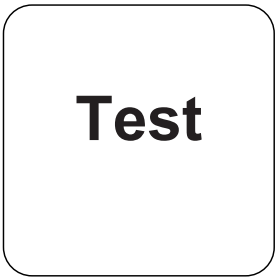
Press the **ZERO** button.



Remove the vial from the sample chamber.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in mg/l Chloride appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	Cl^-	1
mg/l	NaCl	1.65

Chemical Method

Iron(III)-thiocyanate

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ 10 mm
a	$-4.54503 \cdot 10^{+0}$	$-4.54503 \cdot 10^{+0}$
b	$4.04636 \cdot 10^{+1}$	$8.69967 \cdot 10^{+1}$
c	$8.94686 \cdot 10^{+1}$	$4.13569 \cdot 10^{+2}$
d		
e		
f		

Interferences

Persistant Interferences

1. Reducing substances such as sulfite and thiosulfate, that can reduce iron (III) to iron (II) or mercury (II) to mercury (I) may interfere. Cyanide, Iodine and Bromide give a positive intereference.

Derived from

APHA Method 4500 Cl-E

Chloride L (A) M92

0.5 - 20 mg/L Cl^- CL-

Mercury Thiocyanate / Iron Nitrate

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 110, MD 600, MD 610, MD 640, XD 7000, XD 7500	ø 24 mm	430 nm	0.5 - 20 mg/L Cl^-

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Chlorid Reagent Set	1 pc.	56R018490

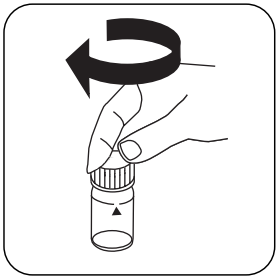
Application List

- Waste Water Treatment
- Cooling Water
- Drinking Water Treatment
- Raw Water Treatment
- Galvanization

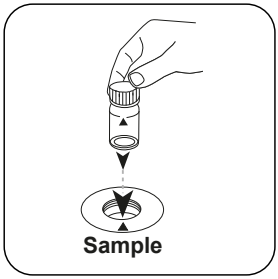
Implementation of the provision Chloride with liquid reagent

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

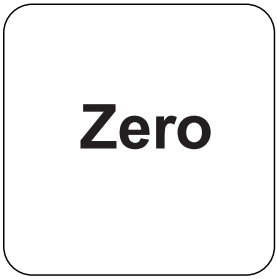
Fill 24 mm vial with **10 ml sample**.



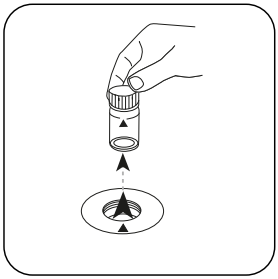
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

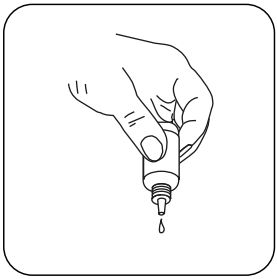


Press the **ZERO** button.

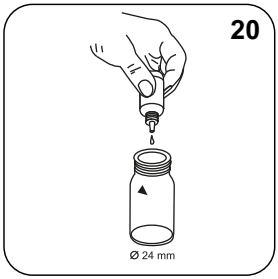


Remove the vial from the sample chamber.

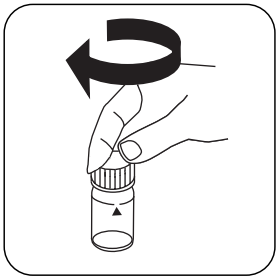
For devices that require **no ZERO measurement** , **start here**.



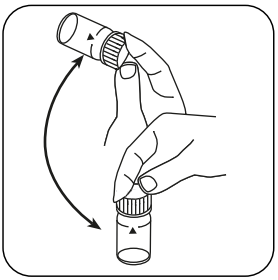
Hold cuvettes vertically and add equal drops by pressing slowly.



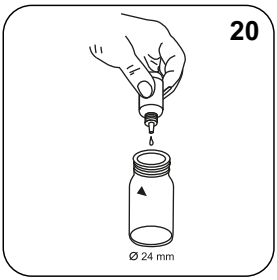
Add **20 drops KS251 (Chloride Reagenz A)**.



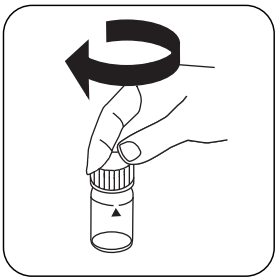
Close vial(s).



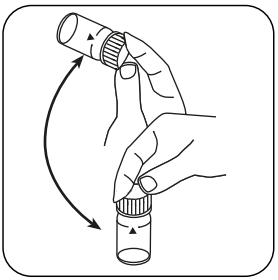
Invert several times to mix the contents.



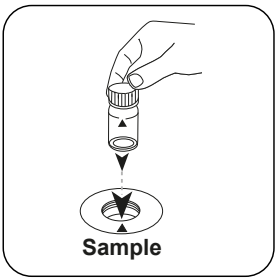
Add **20 drops KS253 (Chloride Reagenz B)**.



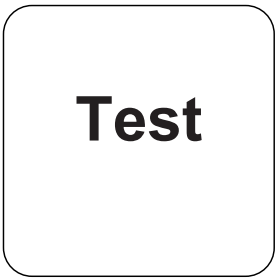
Close vial(s).



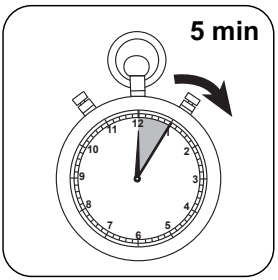
Invert several times to mix the contents.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **5 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically. The result in mg/l Chloride appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	Cl^-	1
mg/l	NaCl	1.65

Chemical Method

Mercury Thiocyanate / Iron Nitrate

Appendix

Calibration function for 3rd-party photometers

Conc. = $a + b \cdot Abs + c \cdot Abs^2 + d \cdot Abs^3 + e \cdot Abs^4 + f \cdot Abs^5$

	ø 24 mm	**□ 10 mm**
a	$1.53241 \cdot 10^{+0}$	$1.53241 \cdot 10^{+0}$
b	$-1.29813 \cdot 10^{+1}$	$-2.79098 \cdot 10^{+1}$
c	$4.02483 \cdot 10^{+1}$	$1.86048 \cdot 10^{+2}$
d	$-3.11237 \cdot 10^{+1}$	$-3.09319 \cdot 10^{+2}$
e	$9.1645 \cdot 10^{+0}$	$1.95823 \cdot 10^{+2}$
f		

Interferences

Persistant Interferences

1. Reducing substances such as sulfite and thiosulfate, that can reduce iron (III) to iron (II) or mercury (II) to mercury (I) may interfere. Cyanide, Iodine and Bromide give a positive intereference.

Derived from

DIN 15682-D31
DIN ISO 15923-1 D49

Chloride T M93

5 - 250 mg/L Cl^- [i] CL-2

Silver Nitrate / Turbidity

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100	ø 24 mm	530 nm	5 - 250 mg/L Cl^- [i]

Material

Required material (partly optional):

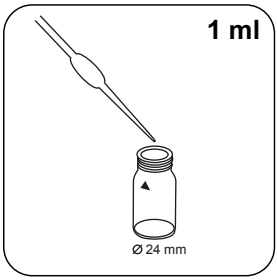
Reagents	Packaging Unit	Part Number
Chloride T1	Tablet / 100	515910BT
Chloride T1	Tablet / 250	515911BT
Chloride T2	Tablet / 100	515920BT
Chloride T2	Tablet / 250	515921BT
Set Chloride T1/T 2 100 Pc.#	100 each	517741BT
Set Chloride T1/T 2 250 Pc.#	250 each	517742BT

Application List

- Waste Water Treatment
- Cooling Water
- Drinking Water Treatment
- Raw Water Treatment
- Galvanization

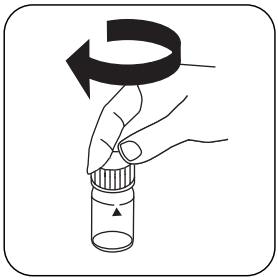
Implementation of the provision Chloride with Tablet

Select the method on the device

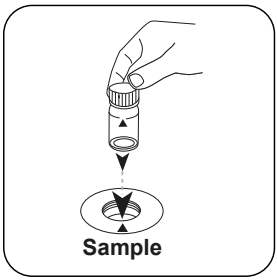


Put **1 ml sample** in the vial.

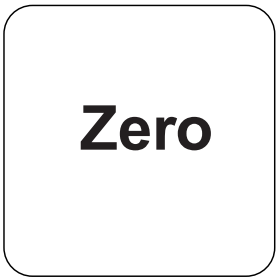
Fill up vial with **deionised water** to the **10 ml mark** .



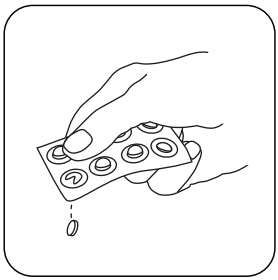
Close vial(s).



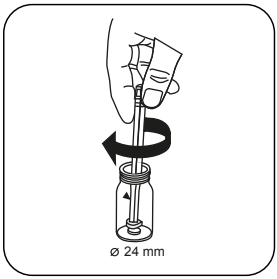
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



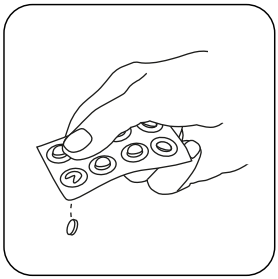
Press the **ZERO** button.



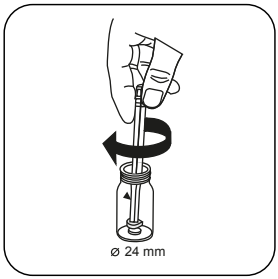
Add **CHLORIDE T1 tablet** .



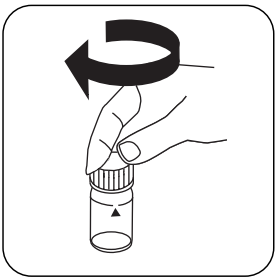
Crush tablet(s) by rotating slightly and dissolve.



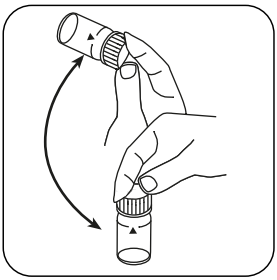
Add **CHLORIDE T2 tablet** .



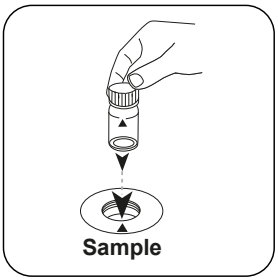
Crush tablet(s) by rotating slightly.



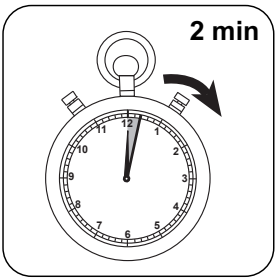
Close vial(s).



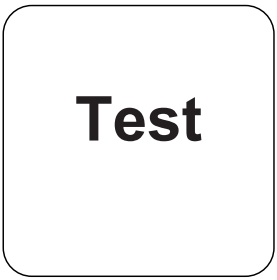
Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Wait for **2 minute(s) reaction time**.



Press the **TEST** (XD: **START**)button.

The result in mg/l Chloride appears on the display.

Chemical Method

Silver Nitrate / Turbidity

[3] high range by dilution | # including stirring rod, 10 cm

Chlorine 10 T M98

0.1 - 6 mg/L Cl_2

DPD

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	□ 10 mm	510 nm	0.1 - 6 mg/L Cl_2

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
DPD No. 1	Tablet / 100	511050BT
DPD No. 1	Tablet / 250	511051BT
DPD No. 1	Tablet / 500	511052BT
DPD No. 3	Tablet / 100	511080BT
DPD No. 3	Tablet / 250	511081BT
DPD No. 3	Tablet / 500	511082BT
DPD No. 1 High Calcium [e)]	Tablet / 100	515740BT
DPD No. 1 High Calcium [e)]	Tablet / 250	515741BT
DPD No. 1 High Calcium [e)]	Tablet / 500	515742BT
DPD No. 3 High Calcium [e)]	Tablet / 100	515730BT
DPD No. 3 High Calcium [e)]	Tablet / 250	515731BT
DPD No. 3 High Calcium [e)]	Tablet / 500	515732BT
DPD No. 4	Tablet / 100	511220BT
DPD No. 4	Tablet / 250	511221BT
DPD No. 4	Tablet / 500	511222BT

Available Standards

Title	Packaging Unit	Part Number
ValidCheck Chlorine 1,5 mg/l	1 pc.	48105510

Application List

- Waste Water Treatment
- Disinfection Control
- Boiler Water
- Cooling Water
- Raw Water Treatment
- Pool Water Control
- Pool Water Treatment
- Drinking Water Treatment

Sampling

1. When preparing the sample, Chlorine outgassing, e.g. through the pipette or shaking, must be avoided.
2. The analysis must take place immediately after taking the sample.

Preparation

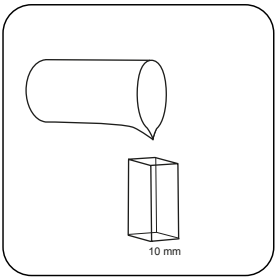
1. Cleaning of vials:
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, this can lead to lower results with the determination of Chlorine. To avoid measurement errors, the glassware used should be free of chlorine consumption. To achieve this, all glassware should be placed in a sodium hypochlorite solution (0.1 g/L) for one hour and then rinsed thoroughly with deionised water.
2. For individual testing of free and total Chlorine, the use of different sets of glassware is recommended (EN ISO 7393-2, 5.3)
3. The DPD colour development is carried out at a pH value of 6.2 to 6.5. The reagents therefore contain a buffer for the pH adjustment. Strong alkaline or acidic water samples must therefore be adjusted between pH 6 and pH 7 before the analysis (use 0.5 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).

Notes

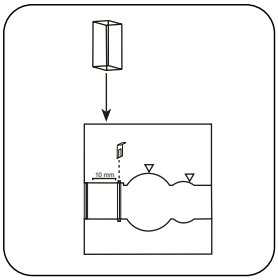
Variations in the length of the vial can extend the measuring range:
- 10 mm vial: 0.1 mg/L - 6 mg/L, solution: 0.01
- 20 mm vial: 0.05 mg/L - 3 mg/L, solution: 0.01
- 50 mm vial: 0.02 mg/L - 1.2 mg/L, solution: 0.001

Implementation of the provision Chlorine free with tablet

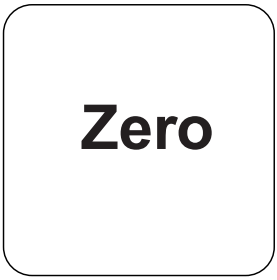
Select the method on the device
In addition, choose the test: free
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



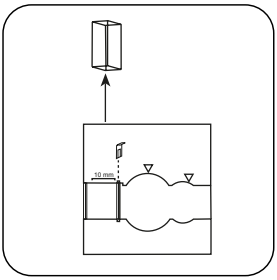
Fill 10 mm vial with **sample**.



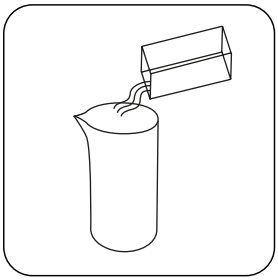
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



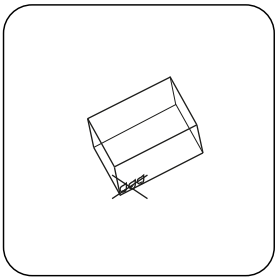
Press the **ZERO** button.



Remove **vial** from the sample chamber.

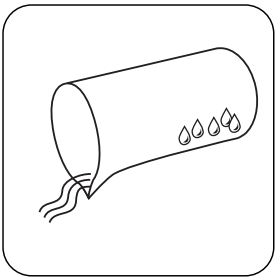


Empty vial.

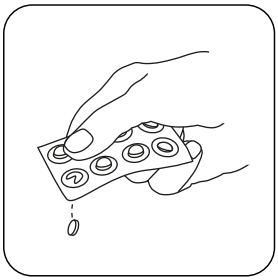


Dry the vial thoroughly.

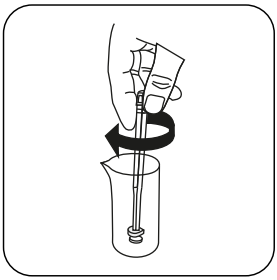
For devices that require **no ZERO measurement** , **start here**.



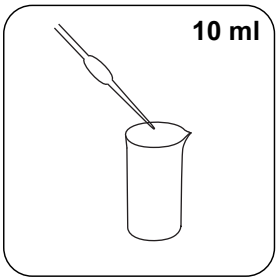
Rinse a beaker **with the sample and empty it, leaving a few drops remaining** in the beaker.



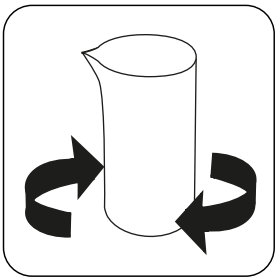
Add **DPD No. 1 tablet** .



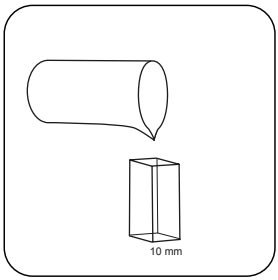
Crush tablet(s) by rotating slightly.



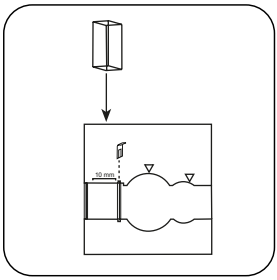
Add **10 ml sample**.



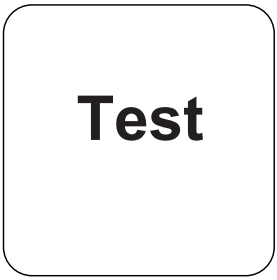
Dissolve tablet(s) by inverting.



Fill 10 mm vial with **sample**.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

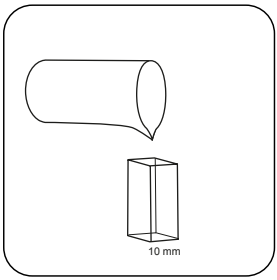


Press the **TEST** (XD: **START**)button.

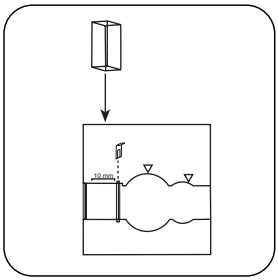
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l free chlorine appears on the display.

Implementation of the provision Chlorine total with tablet

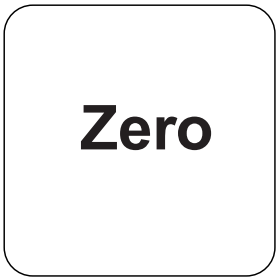
Select the method on the device
In addition, choose the test: total
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



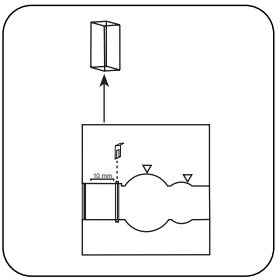
Fill 10 mm vial with **sample**.



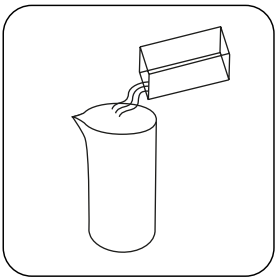
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



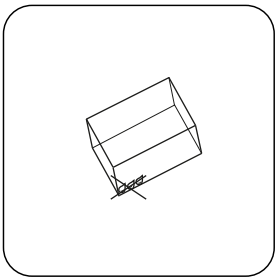
Press the **ZERO** button.



Remove **vial** from the sample chamber.

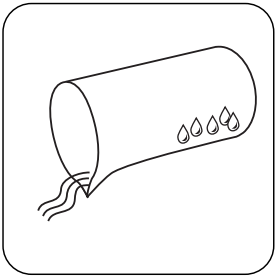


Empty vial.

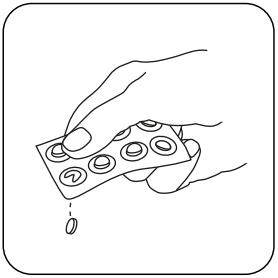


Dry the vial thoroughly.

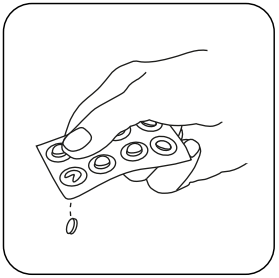
For devices that require **no ZERO measurement** , **start here**.



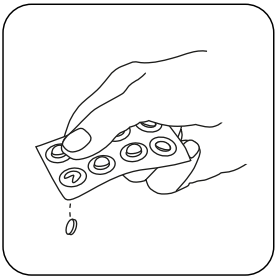
Rinse a beaker **with the sample and empty it, leaving a few drops remaining** in the beaker.



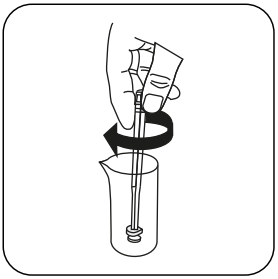
Add **DPD No. 1 tablet** .



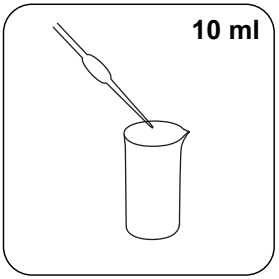
Add **DPD No. 3 tablet** .



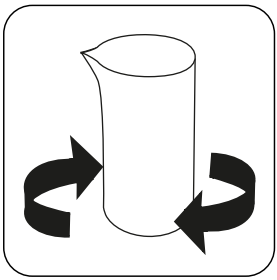
As an alternative to DPD No. 1 and No. 3 tablets, a DPD No. 4 tablet can be added.



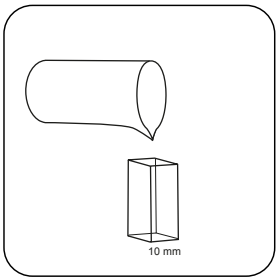
Crush tablet(s) by rotating slightly.



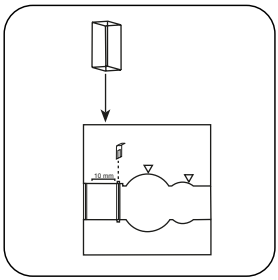
Add **10 ml sample**.



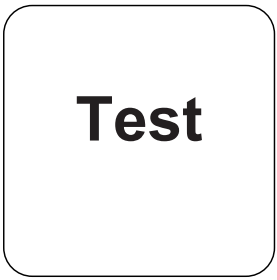
Dissolve tablet(s) by inverting.



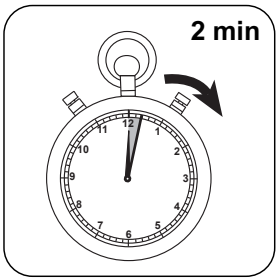
Fill 10 mm vial with **sample**.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

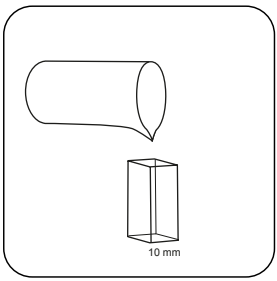


Wait for **2 minute(s) reaction time**.

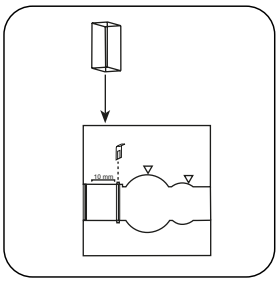
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l total Chlorine appears on the display.

Implementation of the provision Chlorine differentiated with tablet

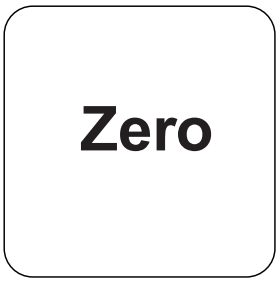
Select the method on the device
In addition, choose the test: differentiated
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



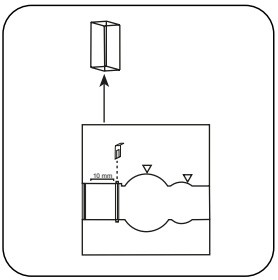
Fill 10 mm vial with **sample**.



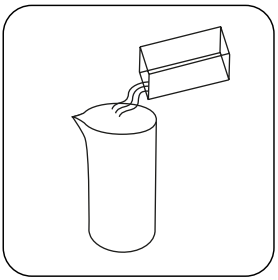
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



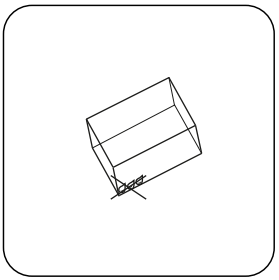
Press the **ZERO** button.



Remove **vial** from the sample chamber.

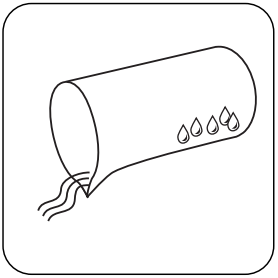


Empty vial.

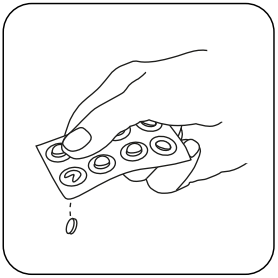


Dry the vial thoroughly.

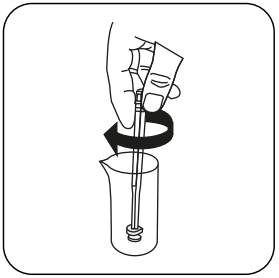
For devices that require **no ZERO measurement** , **start here**.



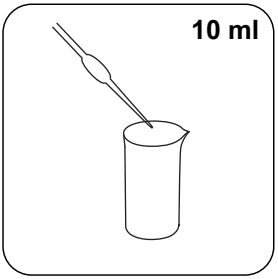
Rinse a beaker **with the sample and empty it, leaving a few drops remaining** in the beaker.



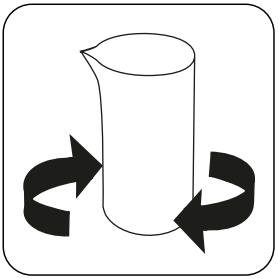
Add **DPD No. 1 tablet** .



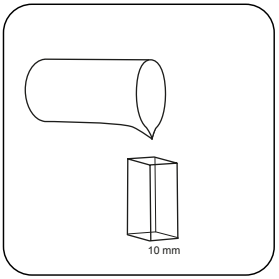
Crush tablet(s) by rotating slightly.



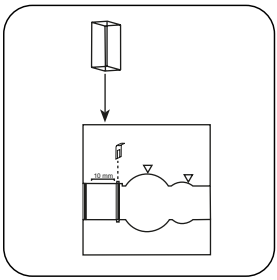
Add **10 ml sample**.



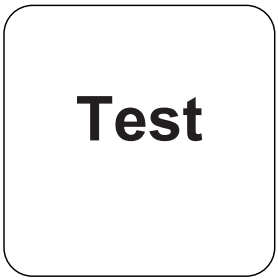
Dissolve tablet(s) by inverting.



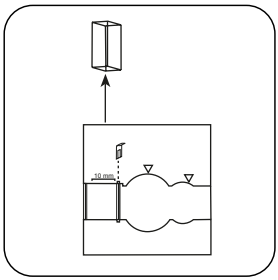
Fill 10 mm vial with **sample**.



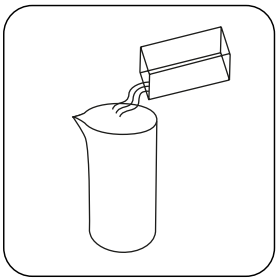
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



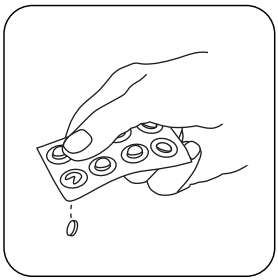
Press the **TEST** (XD: **START**)button.



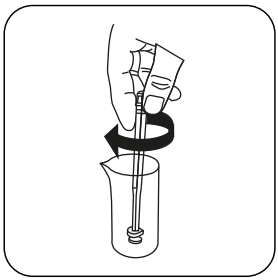
Remove **vial** from the sample chamber.



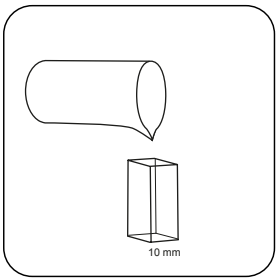
Return the sample solution completely to the sample vessel.



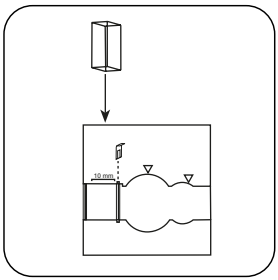
Add **DPD No. 3 tablet** .



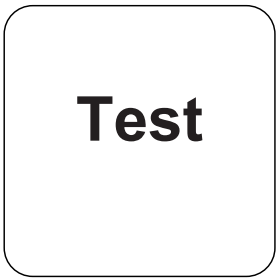
Crush tablet(s) by rotating slightly and dissolve.



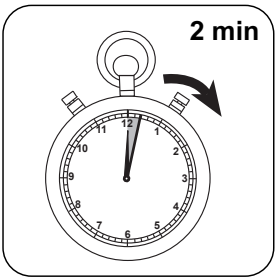
Fill 10 mm vial with **sample**.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **2 minute(s) reaction time**.
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l free chlorine; mg/l combined Chlor; mg/l total chlorine appears on the display.

Chemical Method

DPD

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	□ **10 mm**
a	$-7.25624 \cdot 10^{-2}$
b	$4.18101 \cdot 10^{+0}$
c	$-1.3065 \cdot 10^{+0}$
d	$1.84562 \cdot 10^{+0}$
e	
f	

Interferences

Persistant Interferences

- All oxidising agents in the samples react like chlorine, which leads to higher results.

Removeable Interferences

- Interference from Copper and Iron (III) are eliminated by the addition of EDTA.
- The use of reagent tablets in samples with high Calcium content* and/or high conductivity* can lead to turbidity of the sample and therefore incorrect measurements. In this case, the alternative reagent tablet DPD No. 1 High Calcium and reagent tablet DPD No. 3 High Calcium should be used.
  *it is not possible to give exact values, because the development of turbidity depends on the composition and nature of the sample.
- Concentrations above 10 mg/L Chlorine, in the event of using fluid reagents, can lead to results within the measuring range of up to 0 mg/L. In this case, the sample must be diluted with chlorine-free water. 10 ml of the diluted sample should be mixed with the reagent and the measurement taken again (plausibility test).

Bibliography

Photometrische Analyseverfahren, Schwedt, Wissenschaftliche Verlagsgesellschaft mbH, Stuttgart, 1989

According to

EN ISO 7393-2

[e] alternative reagent, used instead of DPD No.1/No.3 in case of turbidity in the water sample caused by high concentration of calcium and/or high conductivity

Chlorine 50 T M99

0.02 - 0.5 mg/L Cl_2 [a)]

DPD

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	□ 50 mm	510 nm	0.02 - 0.5 mg/L Cl_2 [a)]

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
DPD No. 1	Tablet / 100	511050BT
DPD No. 1	Tablet / 250	511051BT
DPD No. 1	Tablet / 500	511052BT
DPD No. 3	Tablet / 100	511080BT
DPD No. 3	Tablet / 250	511081BT
DPD No. 3	Tablet / 500	511082BT
DPD No. 1 High Calcium [e)]	Tablet / 100	515740BT
DPD No. 1 High Calcium [e)]	Tablet / 250	515741BT
DPD No. 1 High Calcium [e)]	Tablet / 500	515742BT
DPD No. 3 High Calcium [e)]	Tablet / 100	515730BT
DPD No. 3 High Calcium [e)]	Tablet / 250	515731BT
DPD No. 3 High Calcium [e)]	Tablet / 500	515732BT
DPD No. 4	Tablet / 100	511220BT
DPD No. 4	Tablet / 250	511221BT
DPD No. 4	Tablet / 500	511222BT

Available Standards

Title	Packaging Unit	Part Number
ValidCheck Chlorine 1,5 mg/l	1 pc.	48105510

Application List

- Waste Water Treatment
- Disinfection Control
- Boiler Water
- Cooling Water
- Raw Water Treatment
- Pool Water Control
- Pool Water Treatment
- Drinking Water Treatment

Sampling

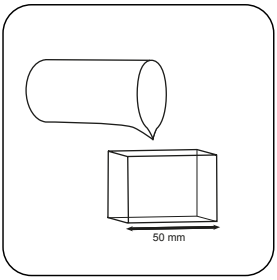
1. When preparing the sample, Chlorine outgassing, e.g. through the pipette or shaking, must be avoided.
2. The analysis must take place immediately after taking the sample.

Preparation

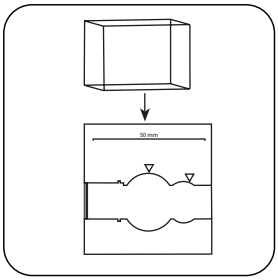
1. Cleaning of vials:
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, this can lead to lower results with the determination of Chlorine. To avoid measurement errors, the glassware used should be free of chlorine consumption. To achieve this, all glassware should be placed in a sodium hypochlorite solution (0.1 g/L) for one hour and then rinsed thoroughly with deionised water.
2. For individual testing of free and total Chlorine, the use of different sets of glassware is recommended (EN ISO 7393-2, 5.3)
3. The DPD colour development is carried out at a pH value of 6.2 to 6.5. The reagents therefore contain a buffer for the pH adjustment. Strong alkaline or acidic water samples must therefore be adjusted between pH 6 and pH 7 before the analysis (use 0.5 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).

Implementation of the provision Chlorine free with tablet

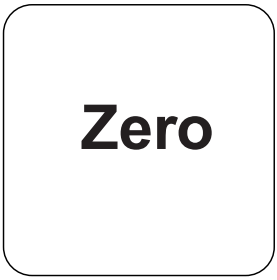
Select the method on the device
In addition, choose the test: free
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



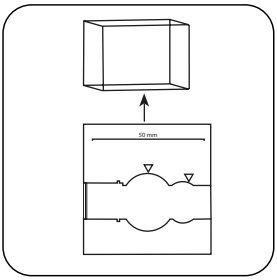
Fill 50 mm vial with **sample**.



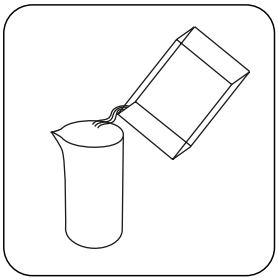
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



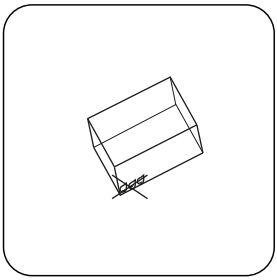
Press the **ZERO** button.



Remove **vial** from the sample chamber.

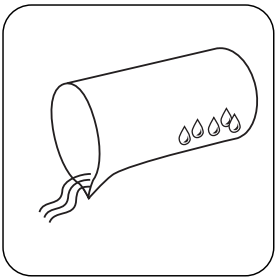


Empty vial.

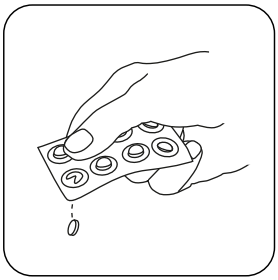


Dry the vial thoroughly.

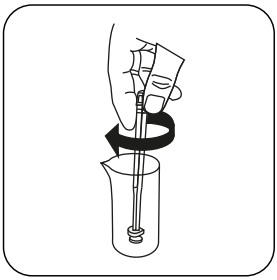
For devices that require **no ZERO measurement** , **start here**.



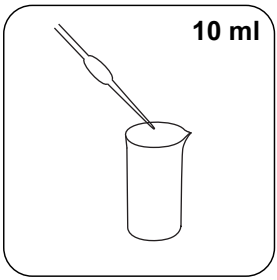
Rinse a beaker **with the sample and empty it, leaving a few drops remaining** in the beaker.



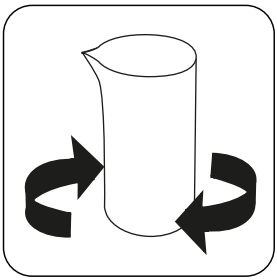
Add **DPD No. 1 tablet** .



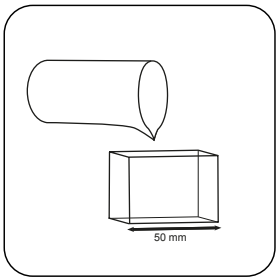
Crush tablet(s) by rotating slightly.



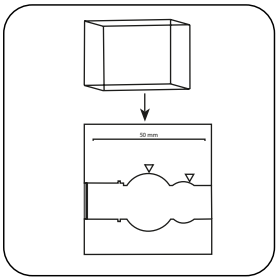
Add **10 ml sample**.



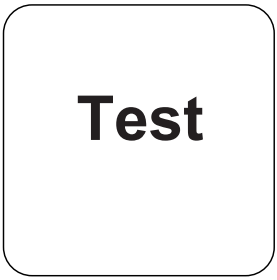
Dissolve tablet(s) by inverting.



Fill 50 mm vial with **sample**.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

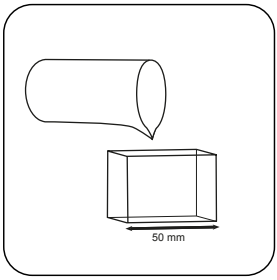


Press the **TEST** (XD: **START**)button.

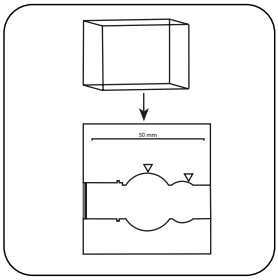
The result in mg/l free chlorine appears on the display.

Implementation of the provision Chlorine total with tablet

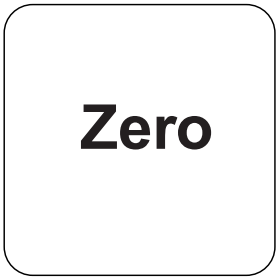
Select the method on the device
In addition, choose the test: total
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



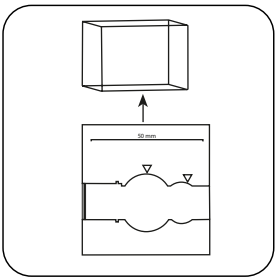
Fill 50 mm vial with **sample**.



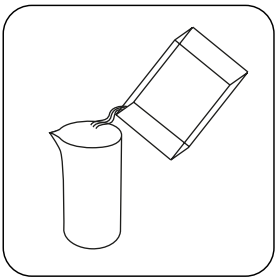
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



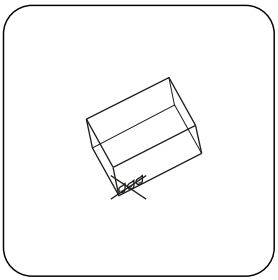
Press the **ZERO** button.



Remove **vial** from the sample chamber.

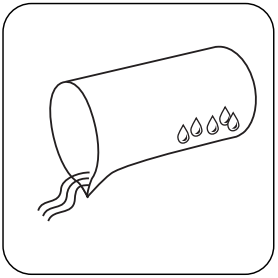


Empty vial.

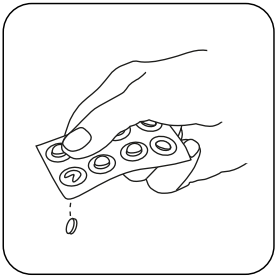


Dry the vial thoroughly.

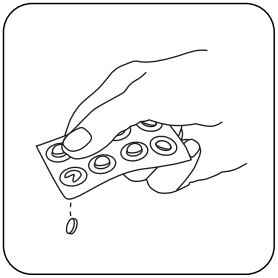
For devices that require **no ZERO measurement** , **start here**.



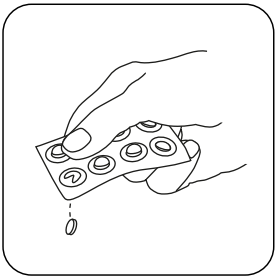
Rinse a beaker **with the sample and empty it, leaving a few drops remaining** in the beaker.



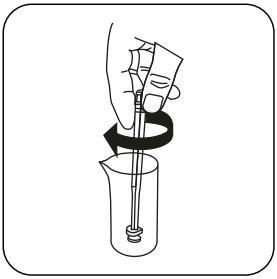
Add **DPD No. 1 tablet** .



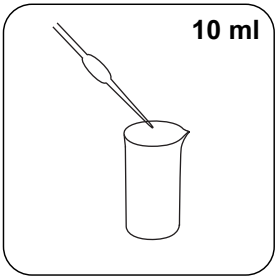
Add **DPD No. 3 tablet** .



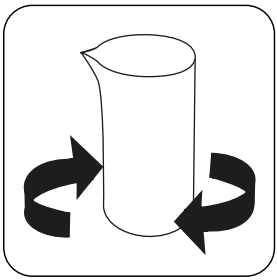
As an alternative to DPD No. 1 and No. 3 tablets, a DPD No. 4 tablet can be added.



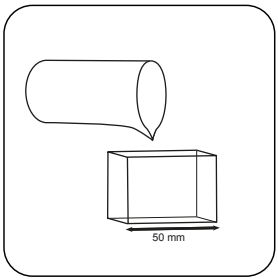
Crush tablet(s) by rotating slightly.



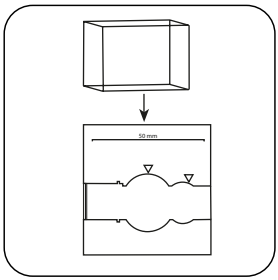
Add **10 ml sample**.



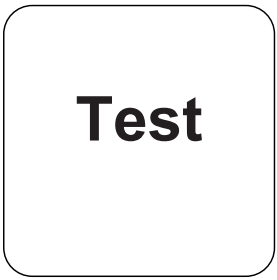
Dissolve tablet(s) by inverting.



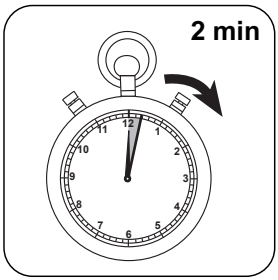
Fill 50 mm vial with **sample**.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

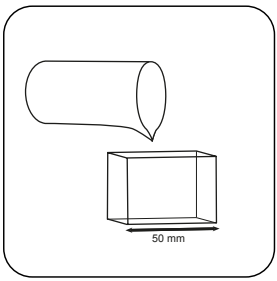


Wait for **2 minute(s) reaction time**.

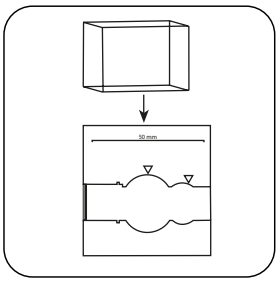
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l total Chlorine appears on the display.

Implementation of the provision Chlorine differentiated with tablet

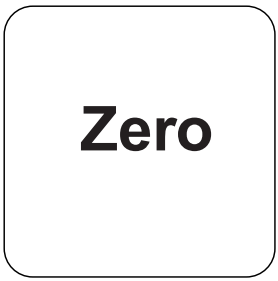
Select the method on the device
In addition, choose the test: differentiated
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



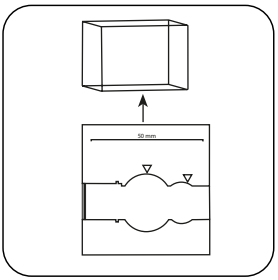
Fill 50 mm vial with **sample**.



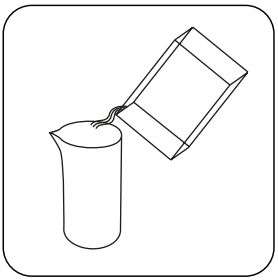
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



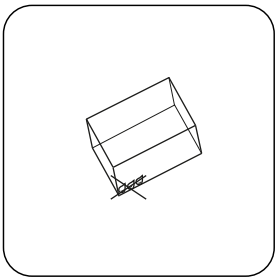
Press the **ZERO** button.



Remove **vial** from the sample chamber.

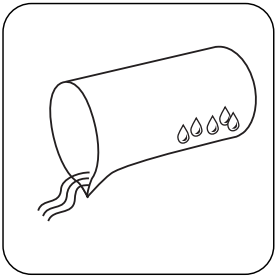


Empty vial.

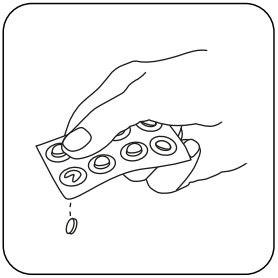


Dry the vial thoroughly.

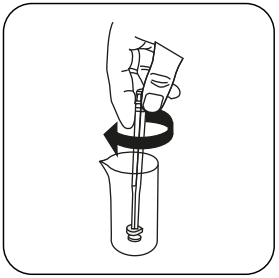
For devices that require **no ZERO measurement** , **start here**.



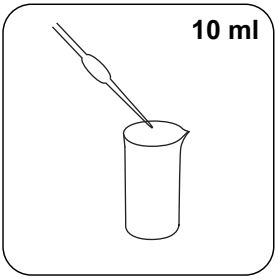
Rinse a beaker **with the sample and empty it, leaving a few drops remaining** in the beaker.



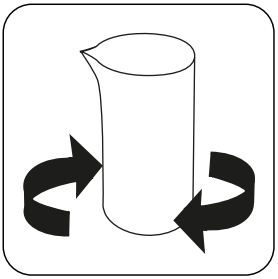
Add **DPD No. 1 tablet** .



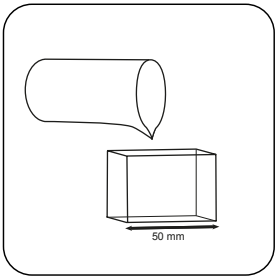
Crush tablet(s) by rotating slightly.



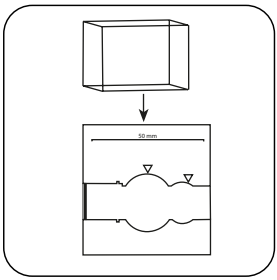
Add **10 ml sample**.



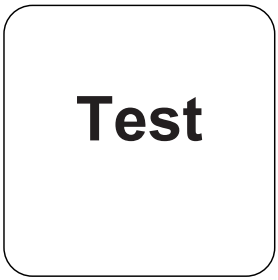
Dissolve tablet(s) by inverting.



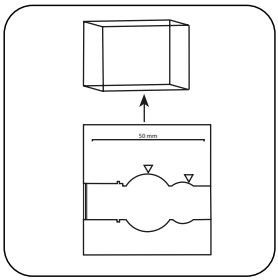
Fill 50 mm vial with **sample**.



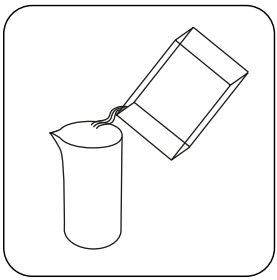
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



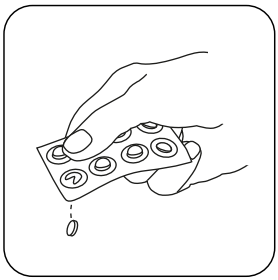
Press the **TEST** (XD: **START**)button.



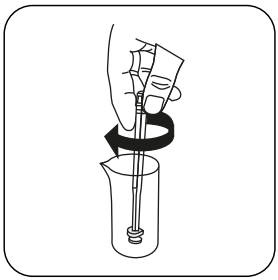
Remove **vial** from the sample chamber.



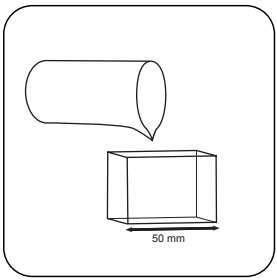
Return the sample solution completely to the sample vessel.



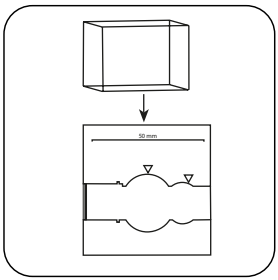
Add **DPD No. 3 tablet** .



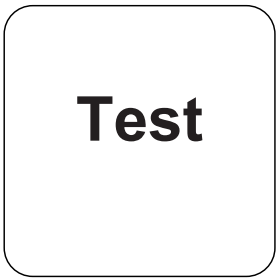
Crush tablet(s) by rotating slightly and dissolve.



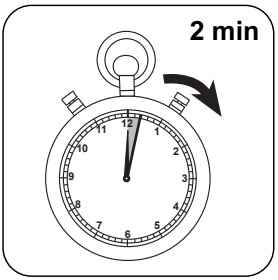
Fill 50 mm vial with **sample**.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **2 minute(s) reaction time**.
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l free chlorine, mg/l combined chlorine, mg/l total chlorine appears on the display.

Chemical Method

DPD

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	□ **50 mm**
a	$-2.01515 \cdot 10^{-2}$
b	$7.71349 \cdot 10^{-1}$
c	$-1.14318 \cdot 10^{-1}$
d	
e	
f	

Interferences

Persistant Interferences

- All oxidising agents in the samples react like chlorine, which leads to higher results.

Removeable Interferences

- Interference from Copper and Iron (III) are eliminated by the addition of EDTA.
- The use of reagent tablets in samples with high Calcium content* and/or high conductivity* can lead to turbidity of the sample and therefore incorrect measurements. In this case, the alternative reagent tablet DPD No. 1 High Calcium and reagent tablet DPD No. 3 High Calcium should be used.
  *it is not possible to give exact values, because the development of turbidity depends on the composition and nature of the sample.
- Concentrations above 10 mg/L Chlorine, in the event of using fluid reagents, can lead to results within the measuring range of up to 0 mg/L. In this case, the sample must be diluted with chlorine-free water. 10 ml of the diluted sample should be mixed with the reagent and the measurement taken again (plausibility test).

Interference	**from / [mg/L]**
CrO_4^{2-}	0,01
MnO_2	0,01

Bibliography

Photometrische Analyseverfahren, Schwedt, Wissenschaftliche Verlagsgesellschaft mbH, Stuttgart, 1989

According to

EN ISO 7393-2

[a)] determination of free, combined and total | [e)] alternative reagent, used instead of DPD No.1/No.3 in case of turbidity in the water sample caused by high concentration of calcium and/or high conductivity

Chlorine T M100

0.01 - 6.0 mg/L Cl_2 [a] CL6

DPD

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 110, MD 200, MD 600, MD 610, MD 640, MultiDirect, PM 600, PM 620, PM 630	ø 24 mm	530 nm	0.01 - 6.0 mg/L Cl_2 [a]
SpectroDirect	ø 24 mm	510 nm	0.02 - 6.0 mg/L Cl_2 [a]
Scuba II	ø 24 mm	530 nm	0.1 - 6.0 mg/L Cl_2 [a]
XD 7000, XD 7500	ø 24 mm	510 nm	0.01 - 6.0 mg/L Cl_2 [a]

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
DPD No. 1	Tablet / 100	511050BT
DPD No. 1	Tablet / 250	511051BT
DPD No. 1	Tablet / 500	511052BT
DPD No. 3	Tablet / 100	511080BT
DPD No. 3	Tablet / 250	511081BT
DPD No. 3	Tablet / 500	511082BT
DPD No. 1 High Calcium [e]	Tablet / 100	515740BT
DPD No. 1 High Calcium [e]	Tablet / 250	515741BT
DPD No. 1 High Calcium [e]	Tablet / 500	515742BT
DPD No. 3 High Calcium [e]	Tablet / 100	515730BT
DPD No. 3 High Calcium [e]	Tablet / 250	515731BT
DPD No. 3 High Calcium [e]	Tablet / 500	515732BT
DPD No. 4	Tablet / 100	511220BT
DPD No. 4	Tablet / 250	511221BT
DPD No. 4	Tablet / 500	511222BT
Refill Pack Scuba II	1 pc.	525600

Available Standards

Title	Packaging Unit	Part Number
ValidCheck Chlorine 1,5 mg/l	1 pc.	48105510

Application List

- Waste Water Treatment
- Disinfection Control
- Boiler Water
- Cooling Water
- Raw Water Treatment
- Pool Water Control
- Pool Water Treatment
- Drinking Water Treatment

Sampling

1. When preparing the sample, Chlorine outgassing, e.g. through the pipette or shaking, must be avoided.
2. The analysis must take place immediately after taking the sample.

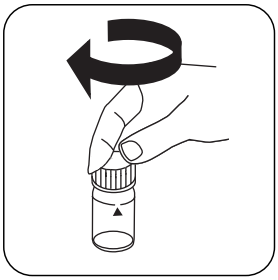
Preparation

1. Cleaning of vials:
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, this can lead to lower results with the determination of Chlorine. To avoid measurement errors, the glassware used should be free of chlorine consumption. To achieve this, all glassware should be placed in a sodium hypochlorite solution (0.1 g/L) for one hour and then rinsed thoroughly with deionised water.
2. For individual testing of free and total Chlorine, the use of different sets of glassware is recommended (EN ISO 7393-2, 5.3)
3. The DPD colour development is carried out at a pH value of 6.2 to 6.5. The reagents therefore contain a buffer for the pH adjustment. Strong alkaline or acidic water samples must therefore be adjusted between pH 6 and pH 7 before the analysis (use 0.5 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).

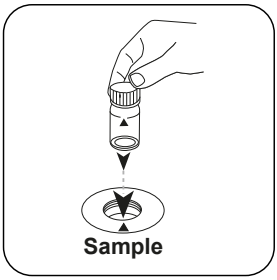
Implementation of the provision free chlorine with tablet

Select the method on the device
In addition, choose the test: free
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

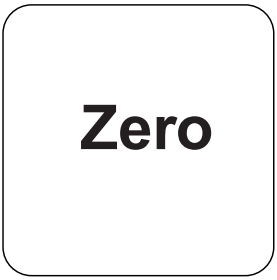
Fill 24 mm vial with **10 ml sample**.



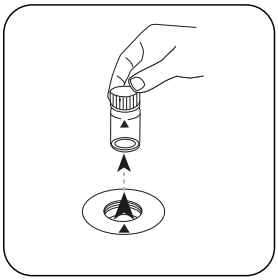
Close vial(s).



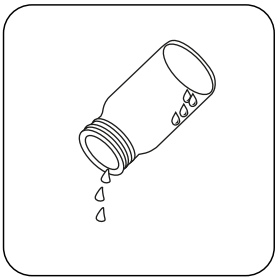
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **ZERO** button.

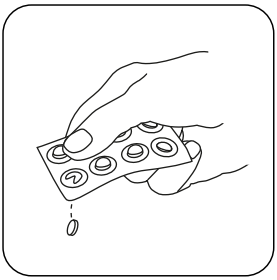


Remove the vial from the sample chamber.

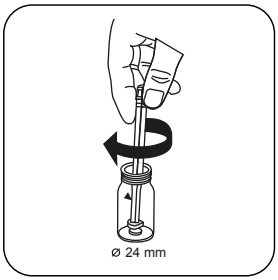


Empty vial except for a few drops.

For devices that require **no ZERO measurement** , **start here**.

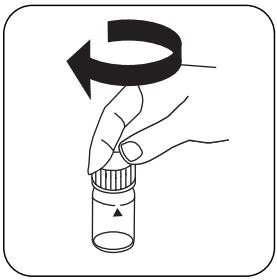


Add **DPD No. 1 tablet** .

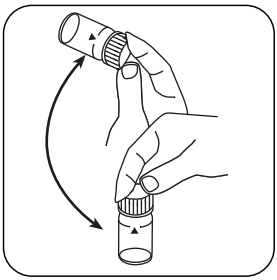


Crush tablet(s) by rotating slightly.

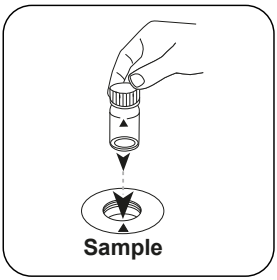
Fill up vial with **sample** to the **10 ml mark**.



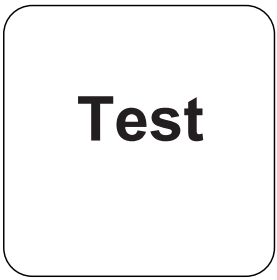
Close vial(s).



Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

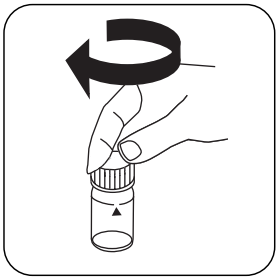


Press the **TEST** (XD: **START**)button.
The result in mg/l free chlorine appears on the display.

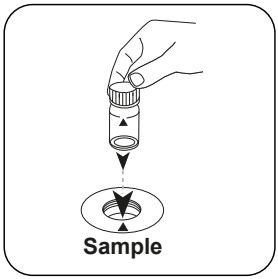
Implementation of the provision total Chlorine with tablet

Select the method on the device
In addition, choose the test: total
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

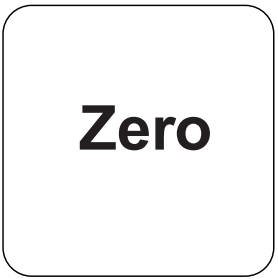
Fill 24 mm vial with **10 ml sample**.



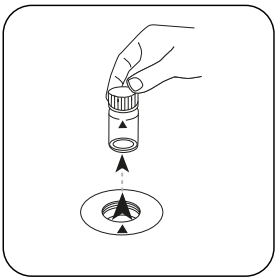
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



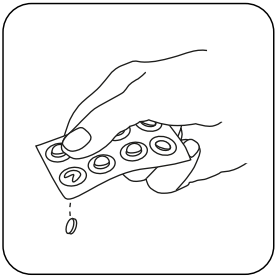
Press the **ZERO** button.



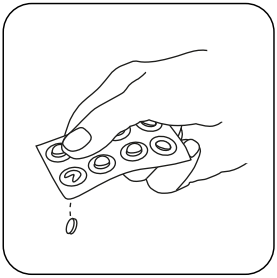
Remove the vial from the sample chamber.

Empty vial except for a few drops.

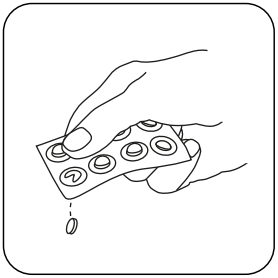
For devices that require **no ZERO measurement** , **start here**.



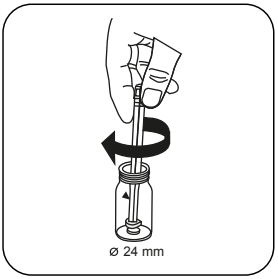
Add **DPD No. 1 tablet** .



Add **DPD No. 3 tablet** .

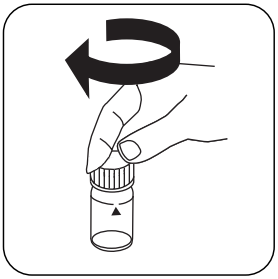


As an alternative to DPD No. 1 and No. 3 tablets, a DPD No. 4 tablet can be added.

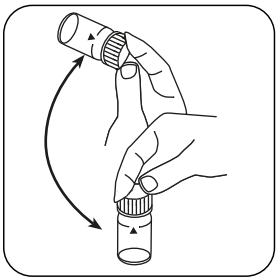


Crush tablet(s) by rotating slightly.

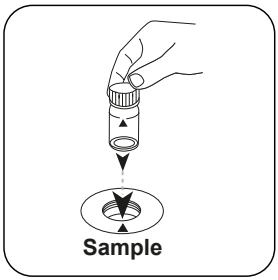
Fill up vial with **sample** to the **10 ml mark**.



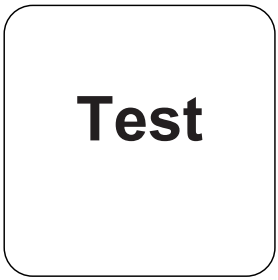
Close vial(s).



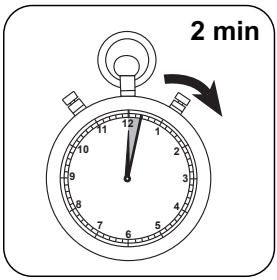
Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



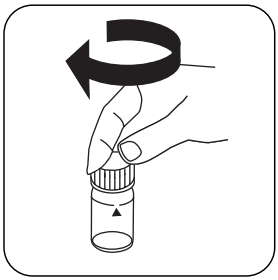
Wait for **2 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l total Chlorine appears on the display.

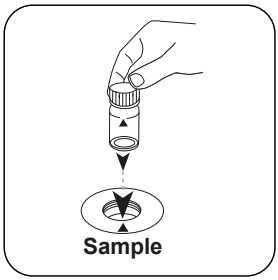
Implementation of the provision Chlorine differentiated with tablet

Select the method on the device
In addition, choose the test: differentiated
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

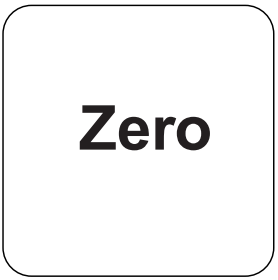
Fill 24 mm vial with **10 ml sample**.



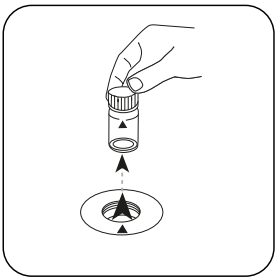
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



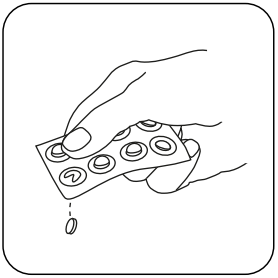
Press the **ZERO** button.



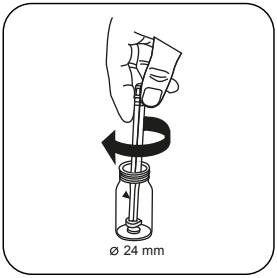
Remove the vial from the sample chamber.

Empty vial except for a few drops.

For devices that require **no ZERO measurement** , **start here**.



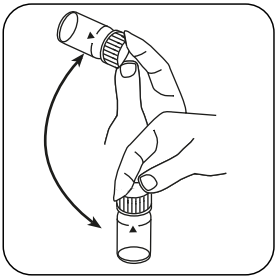
Add **DPD No. 1 tablet** .



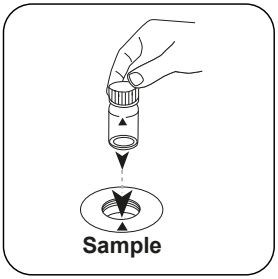
Crush tablet(s) by rotating slightly.

Fill up vial with **sample** to the **10 ml mark**.

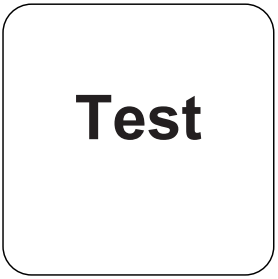
Close vial(s).



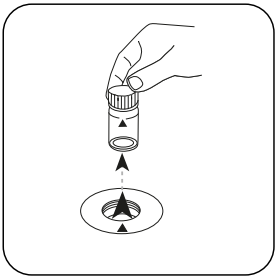
Dissolve tablet(s) by inverting.



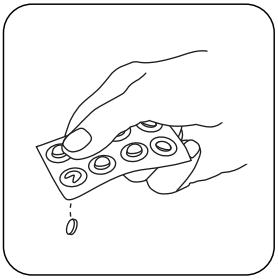
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



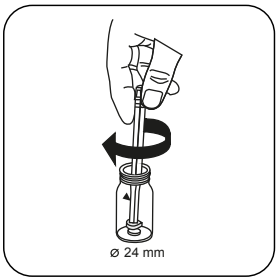
Press the **TEST** (XD: **START**)button.



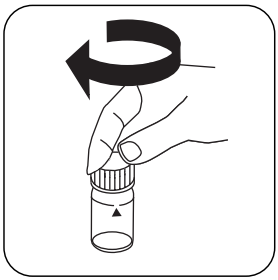
Remove the vial from the sample chamber.



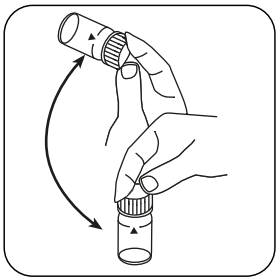
Add **DPD No. 3 tablet** .



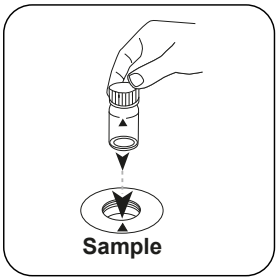
Crush tablet(s) by rotating slightly.



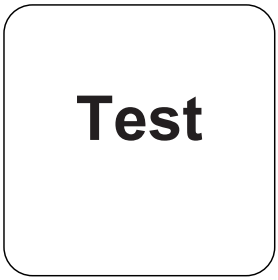
Close vial(s).



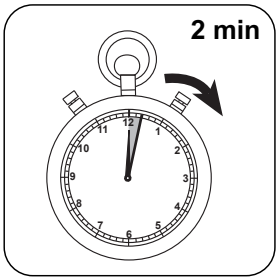
Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **2 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l free chlorine, mg/l combined chlorine, mg/l total chlorine appears on the display.

Chemical Method

DPD

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	$-5.41232 \cdot 10^{-2}$	$-5.41232 \cdot 10^{-2}$
b	$1.78498 \cdot 10^{+0}$	$3.83771 \cdot 10^{+0}$
c	$-8.7417 \cdot 10^{-2}$	$-4.04085 \cdot 10^{-1}$
d	$1.08323 \cdot 10^{-1}$	$1.07655 \cdot 10^{+0}$
e		
f		

Interferences

Persistant Interferences

- All oxidising agents in the samples react like chlorine, which leads to higher results.

Removeable Interferences

- Interference from Copper and Iron (III) are eliminated by the addition of EDTA.
- The use of reagent tablets in samples with high Calcium content* and/or high conductivity* can lead to turbidity of the sample and therefore incorrect measurements. In this case, the alternative reagent tablet DPD No. 1 High Calcium and reagent tablet DPD No. 3 High Calcium should be used.
  *it is not possible to give exact values, because the development of turbidity depends on the composition and nature of the sample.
- Concentrations above 10 mg/L Chlorine, in the event of using fluid reagents, can lead to results within the measuring range of up to 0 mg/L. In the event of a high concentration of Chlorine, the sample must be diluted with chlorine-free water. 10 ml of the diluted sample should be mixed with the reagent and the measurement taken again (plausibility test).

Interference	**from / [mg/L]**
CrO_4^{2-}	0.01
MnO_2	0.01

Method Validation

Limit of Detection	0.02 mg/L
Limit of Quantification	0.06 mg/L
End of Measuring Range	6 mg/L
Sensitivity	2.05 mg/L / Abs
Confidence Intervall	0.04 mg/L
Standard Deviation	0.019 mg/L
Variation Coefficient	0.87 %

Conformity

EN ISO 7393-2

[a)] determination of free, combined and total | [e)] alternative reagent, used instead of DPD No.1/No.3 in case of turbidity in the water sample caused by high concentration of calcium and/or high conductivity

Chlorine L M101

0.02 - 4.0 mg/L Cl_2 [a] CL6

DPD

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 110, MD 200, MD 600, MD 610, MD 640, MultiDirect, PM 620, PM 630	ø 24 mm	530 nm	0.02 - 4.0 mg/L Cl_2 [a]
SpectroDirect	ø 24 mm	510 nm	0.02 - 3 mg/L Cl_2 [a]
XD 7000, XD 7500	ø 24 mm	510 nm	0.02 - 4.0 mg/L Cl_2 [a]
, Test Kit	ø 24 mm		0.02 - 4.0 mg/L Cl_2 [a]

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
DPD 1 Buffer Solution, Blue Bottle	15 mL	471010
DPD 1 Buffer Solution	100 mL	471011
DPD 1 Buffer Solution	1 pc.	471016
DPD 1 Reagent Solution, Green Bottle	15 mL	471020
DPD 1 Reagent Solution	100 mL	471021
DPD 1 Reagent Solution	1 pc.	471026
DPD 3 Solution, Red Bottle	15 mL	471030
DPD 3 Solution	100 mL	471031
DPD 3 Solution	1 pc.	471036
DPD Reagent Set	1 pc.	471056

Available Standards

Title	Packaging Unit	Part Number
ValidCheck Chlorine 1,5 mg/l	1 pc.	48105510

Application List

- Waste Water Treatment
- Disinfection Control
- Boiler Water
- Cooling Water
- Raw Water Treatment
- Pool Water Control
- Pool Water Treatment
- Drinking Water Treatment

Sampling

1. When preparing the sample, Chlorine outgassing, e.g. through the pipette or shaking, must be avoided.
2. The analysis must take place immediately after taking the sample.

Preparation

1. Cleaning of vials:
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, this can lead to lower results with the determination of Chlorine. To avoid measurement errors, the glassware used should be free of chlorine consumption. To achieve this, all glassware should be placed in a sodium hypochlorite solution (0.1 g/L) for one hour and then rinsed thoroughly with deionised water.
2. For individual testing of free and total Chlorine, the use of different sets of glassware is recommended (EN ISO 7393-2, 5.3)
3. The DPD colour development is carried out at a pH value of 6.2 to 6.5. The reagents therefore contain a buffer for the pH adjustment. Strong alkaline or acidic water samples must therefore be adjusted between pH 6 and pH 7 before the analysis (use 0.5 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).

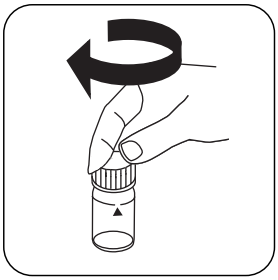
Notes

1. After use, ensure the cuvettes are once again closed with the respective same-coloured screw caps.
2. Reagent sets are to be stored in the cool at +6 °C to +10 °C.

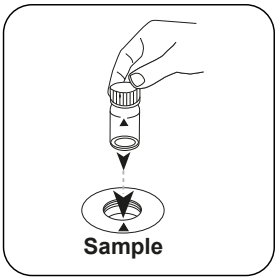
Implementation of the provision free chlorine with liquid reagent

Select the method on the device
In addition, choose the test: free
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

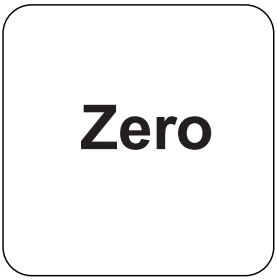
Fill 24 mm vial with **10 ml sample**.



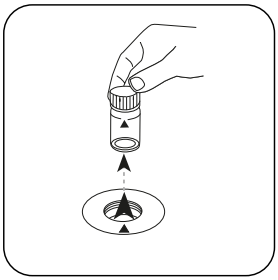
Close vial(s).



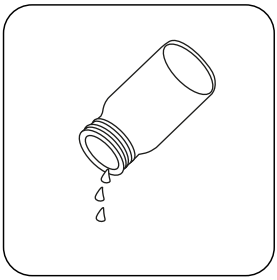
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **ZERO** button.

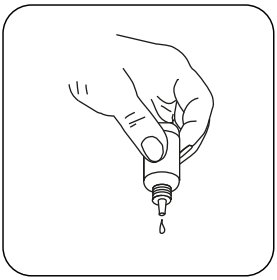


Remove the vial from the sample chamber.

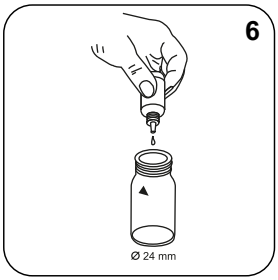


Empty vial.

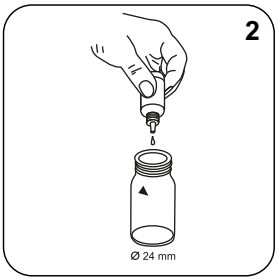
For devices that require **no ZERO measurement** , **start here**.



Hold cuvettes vertically and add equal drops by pressing slowly.

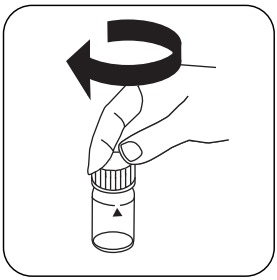


Add **6 drops DPD 1 Buffer Solution**.

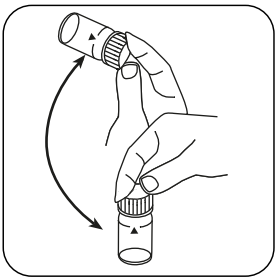


Add **2 drops DPD 1 Reagent Solution**.

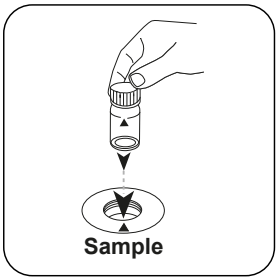
Fill up vial with **sample** to the **10 ml mark**.



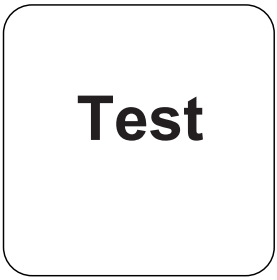
Close vial(s).



Invert several times to mix the contents.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



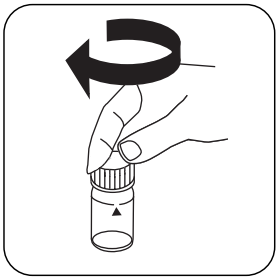
Press the **TEST** (XD: **START**)button.

The result in mg/l free chlorine appears on the display.

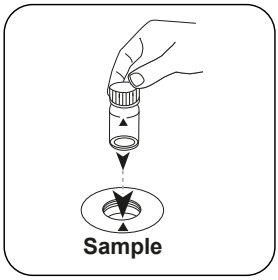
Implementation of the provision totale Chlorine with liquid reagent

Select the method on the device
In addition, choose the test: total
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

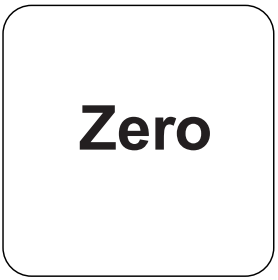
Fill 24 mm vial with **10 ml sample**.



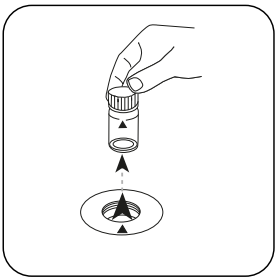
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



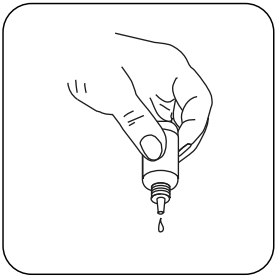
Press the **ZERO** button.



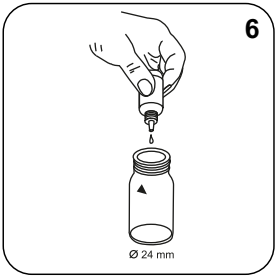
Remove the vial from the sample chamber.

Empty vial.

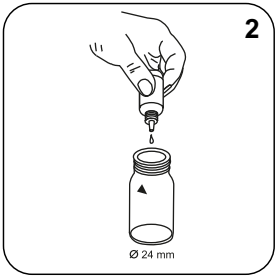
For devices that require **no ZERO measurement** , **start here**.



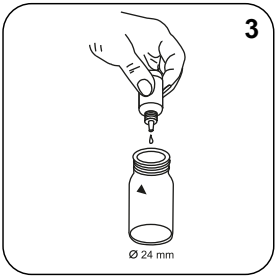
Hold cuvettes vertically and add equal drops by pressing slowly.



Add **6 drops DPD 1 Buffer Solution**.



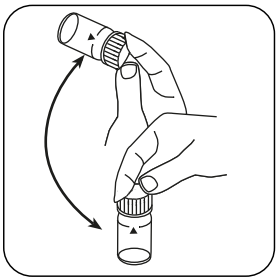
Add **2 drops DPD 1 Reagent Solution**.



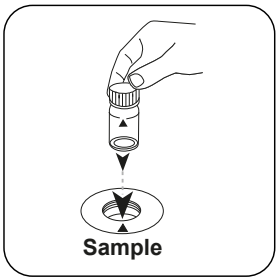
Add **3 drops DPD 3 Solution** .

Fill up vial with **sample** to the **10 ml mark**.

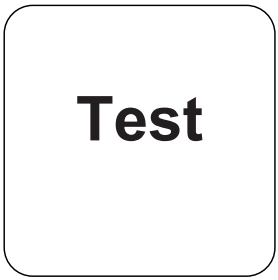
Close vial(s).



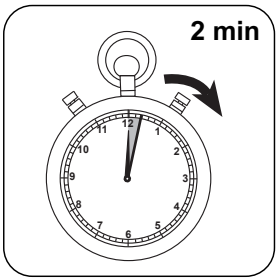
Invert several times to mix the contents.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



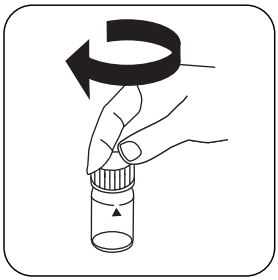
Wait for **2 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l total Chlorine appears on the display.

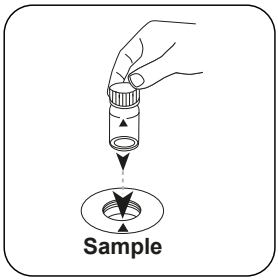
Implementation of the provision Chlorine differentiated with liquid reagent

Select the method on the device
In addition, choose the test: differentiated
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

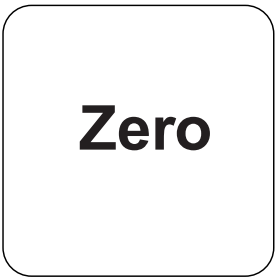
Fill 24 mm vial with **10 ml sample**.



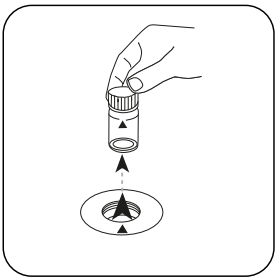
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



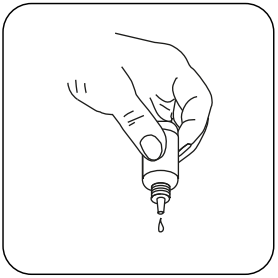
Press the **ZERO** button.



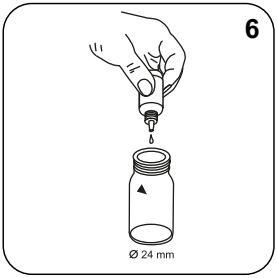
Remove the vial from the sample chamber.

Empty vial.

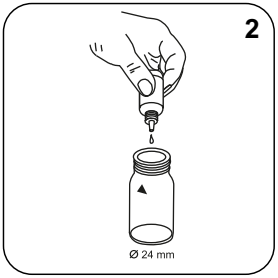
For devices that require **no ZERO measurement** , **start here**.



Hold cuvettes vertically and add equal drops by pressing slowly.



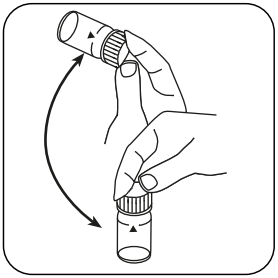
Add **6 drops DPD 1 Buffer Solution**.



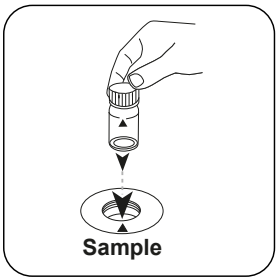
Add **2 drops DPD 1 Reagent Solution**.

Fill up vial with **sample** to the **10 ml mark**.

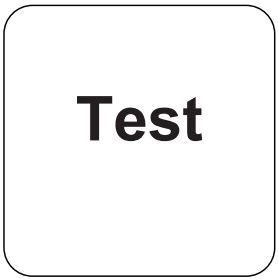
Close vial(s).



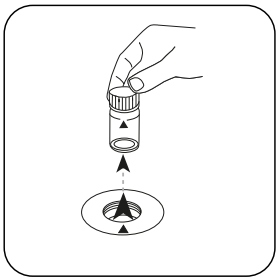
Invert several times to mix the contents.



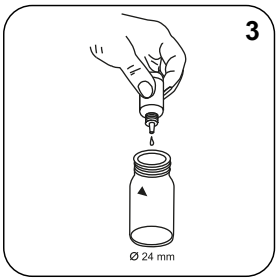
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



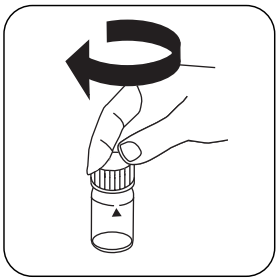
Press the **TEST** (XD: **START**)button.



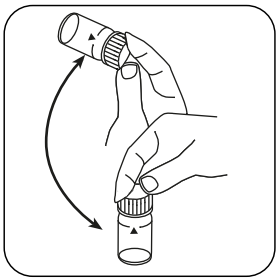
Remove the vial from the sample chamber.



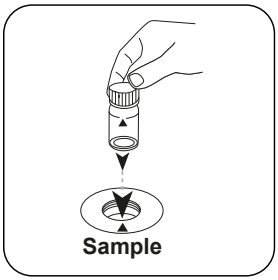
Add **3 drops DPD 3 Solution** .



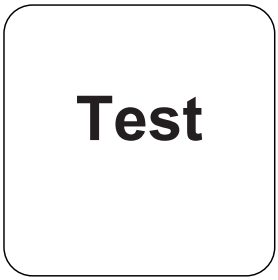
Close vial(s).



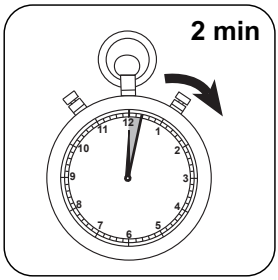
Invert several times to mix the contents.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **2 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l free chlorine, mg/l gebundenes Chor, mg/l total chlorine appears on the display.

Chemical Method

DPD

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	-4.53212 • 10^{-2}	-4.53212 • 10^{-2}
b	1.78637 • 10^{+0}	3.8407 • 10^{+0}
c	-1.14952 • 10^{-1}	-5.31366 • 10^{-1}
d	1.21371 • 10^{-1}	1.20623 • 10^{+0}
e		
f		

Interferences

Persistant Interferences

- All oxidising agents in the samples react like chlorine, which leads to higher results.

Removeable Interferences

- Interference from Copper and Iron (III) are eliminated by the addition of EDTA.
- Concentrations above 4 mg/L Chlorine, in the event of using fluid reagents, can lead to results within the measuring range of up to 0 mg/L. In this case, the sample must be diluted with chlorine-free water. 10 ml of the diluted sample should be mixed with the reagent and the measurement taken again (plausibility test).

Interference	**from / [mg/L]**
CrO_4^{2-}	0,01
MnO_2	0,01

Conformity

EN ISO 7393-2

[a] determination of free, combined and total

Chlorine HR T — M103

0.1 - 10 mg/L Cl_2 [a] — CL10

DPD

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 110, MD 200, MD 600, MD 610, MD 640, MultiDirect, PM 600, PM 620, PM 630	ø 24 mm	530 nm	0.1 - 10 mg/L Cl_2 [a]

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
DPD No. 1 HR	Tablet / 100	511500BT
DPD No. 1 HR	Tablet / 250	511501BT
DPD No. 1 HR	Tablet / 500	511502BT
DPD No. 3 HR	Tablet / 100	511590BT
DPD No. 3 HR	Tablet / 250	511591BT
DPD No. 3 HR	Tablet / 500	511592BT
Set DPD No. 1 HR/No. 3 HR 100 Pc. #	100 each	517791BT
Set DPD No. 1 HR/No. 3 HR 250 Pc. #	250 each	517792BT
DPD No. 1 High Calcium [e]	Tablet / 100	515740BT
DPD No. 1 High Calcium [e]	Tablet / 250	515741BT
DPD No. 1 High Calcium [e]	Tablet / 500	515742BT
DPD No. 3 High Calcium [e]	Tablet / 100	515730BT
DPD No. 3 High Calcium [e]	Tablet / 250	515731BT
DPD No. 3 High Calcium [e]	Tablet / 500	515732BT

Application List

- Waste Water Treatment
- Disinfection Control
- Boiler Water
- Cooling Water
- Raw Water Treatment
- Pool Water Control
- Pool Water Treatment

Sampling

1. When preparing the sample, Chlorine outgassing, e.g. through the pipette or shaking, must be avoided.
2. The analysis must take place immediately after taking the sample.

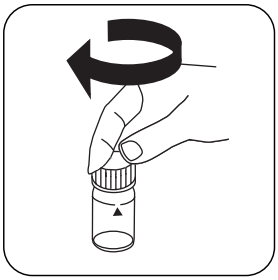
Preparation

1. Cleaning of vials:
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, this can lead to lower results with the determination of Chlorine. To avoid measurement errors, the glassware used should be free of chlorine consumption. To achieve this, all glassware should be placed in a sodium hypochlorite solution (0.1 g/L) for one hour and then rinsed thoroughly with deionised water.
2. For individual testing of free and total Chlorine, the use of different sets of glassware is recommended (EN ISO 7393-2, 5.3)
3. The DPD colour development is carried out at a pH value of 6.2 to 6.5. The reagents therefore contain a buffer for the pH adjustment. Strong alkaline or acidic water samples must therefore be adjusted between pH 6 and pH 7 before the analysis (use 0.5 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).

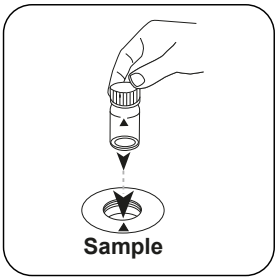
Implementation of the provision free chlorine HR with tablet

Select the method on the device
In addition, choose the test: free
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

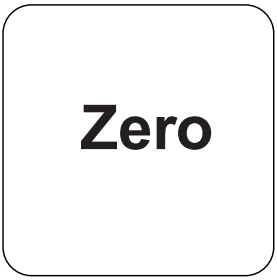
Fill 24 mm vial with **10 ml sample**.



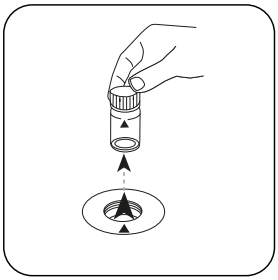
Close vial(s).



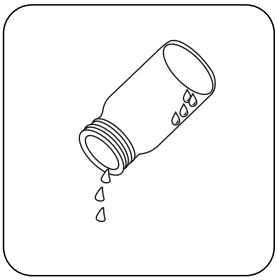
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **ZERO** button.

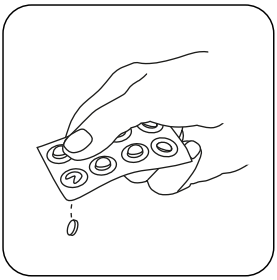


Remove the vial from the sample chamber.

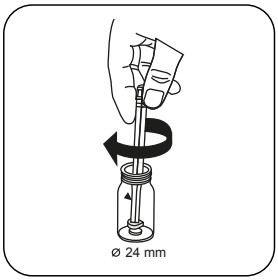


Empty vial except for a few drops.

For devices that require **no ZERO measurement** , **start here**.

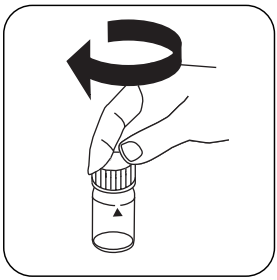


Add **DPD No. 1 HR tablet**.

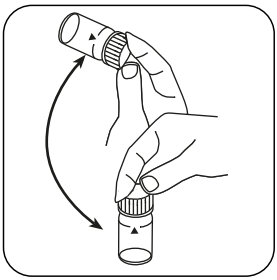


Crush tablet(s) by rotating slightly.

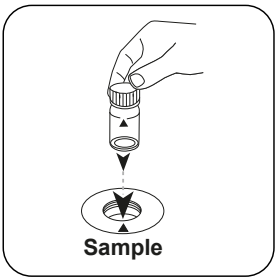
Fill up vial with **sample** to the **10 ml mark**.



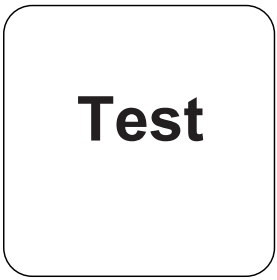
Close vial(s).



Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

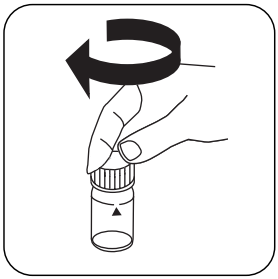


Press the **TEST** (XD: **START**)button.
The result in mg/l free chlorine appears on the display.

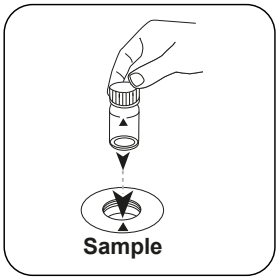
Implementation of the provision totale Chlorine HR with tablet

Select the method on the device
In addition, choose the test: total
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

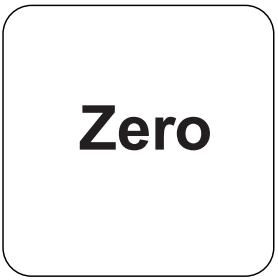
Fill 24 mm vial with **10 ml sample**.



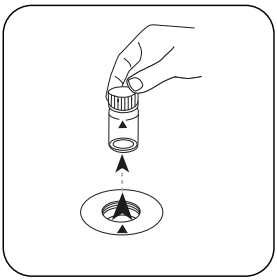
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



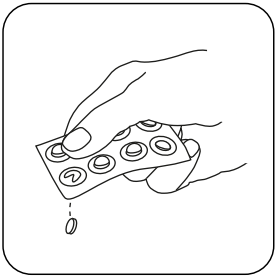
Press the **ZERO** button.



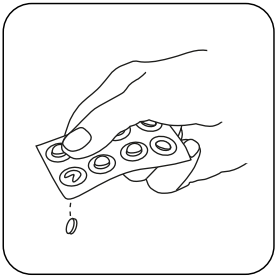
Remove the vial from the sample chamber.

Empty vial except for a few drops.

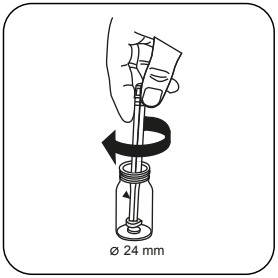
For devices that require **no ZERO measurement** , **start here**.



Add **DPD No. 1 HR tablet**.

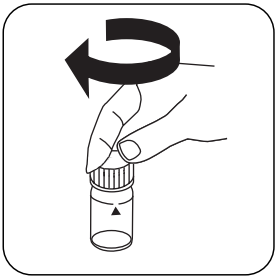


Add **DPD No. 3 HR tablet**.

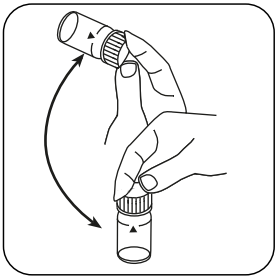


Crush tablet(s) by rotating slightly.

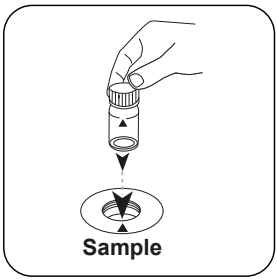
Fill up vial with **sample** to the **10 ml mark**.



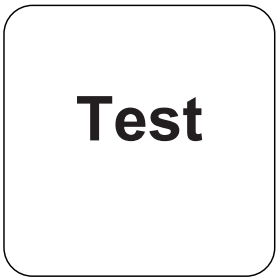
Close vial(s).



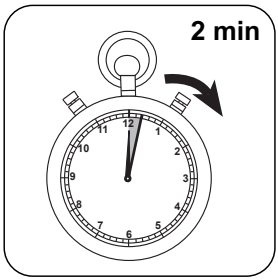
Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



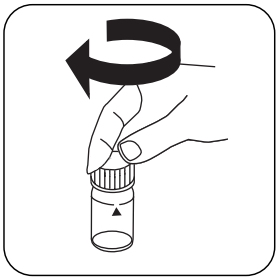
Wait for **2 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l total Chlorine appears on the display.

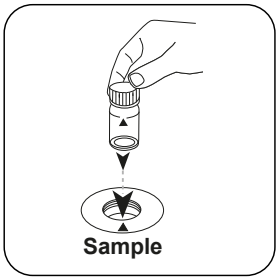
Implementation of the provision Chlorine HR differentiated with tablet

Select the method on the device
In addition, choose the test: differentiated
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

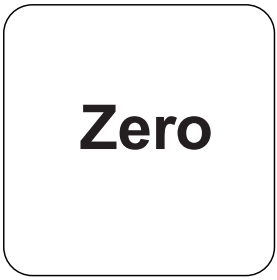
Fill 24 mm vial with **10 ml sample**.



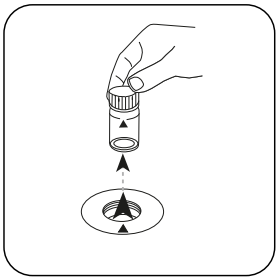
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



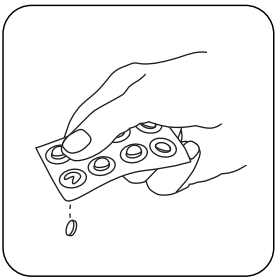
Press the **ZERO** button.



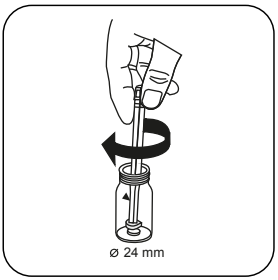
Remove the vial from the sample chamber.

Empty vial except for a few drops.

For devices that require **no ZERO measurement** , **start here**.

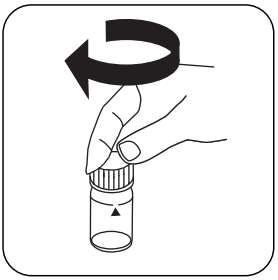


Add **DPD No. 1 HR tablet**.

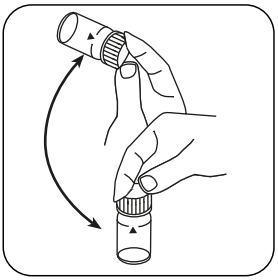


Crush tablet(s) by rotating slightly.

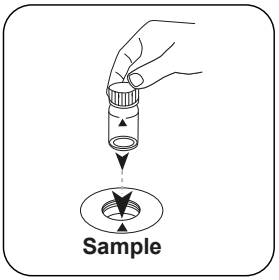
Fill up vial with **sample** to the **10 ml mark**.



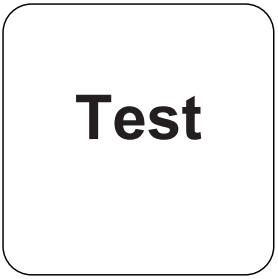
Close vial(s).



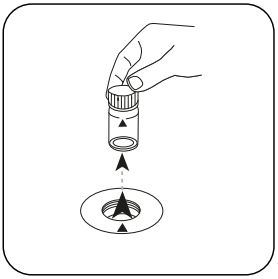
Dissolve tablet(s) by inverting.



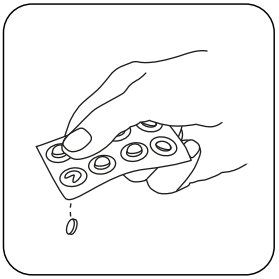
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



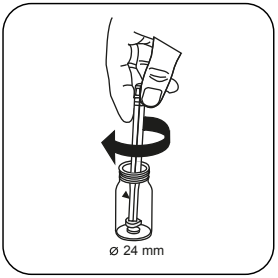
Press the **TEST** (XD: **START**)button.



Remove the vial from the sample chamber.

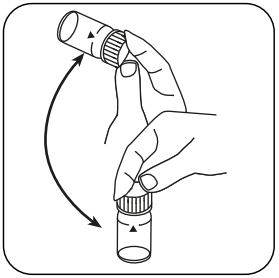


Add **DPD No. 3 HR tablet**.

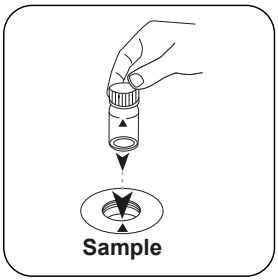


Crush tablet(s) by rotating slightly.

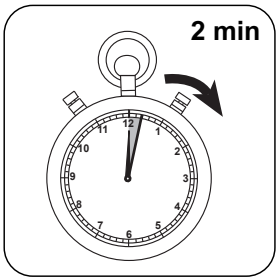
Close vial(s).



Dissolve tablet(s) by inverting.



Test



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

Press the **TEST** (XD: **START**)button.

Wait for **2 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l free chlorine, mg/l combined chlorine, mg/l total chlorine appears on the display.

Chemical Method

DPD

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	$4.46524 \cdot 10^{-2}$	$4.46524 \cdot 10^{-2}$
b	$1.50355 \cdot 10^{+0}$	$3.23263 \cdot 10^{+0}$
c	$9.34178 \cdot 10^{-2}$	$4.31824 \cdot 10^{-1}$
d		
e		
f		

Interferences

Persistant Interferences

- All oxidising agents in the samples react like chlorine, which leads to higher results.

Removeable Interferences

- Interference from Copper and Iron (III) are eliminated by the addition of EDTA.
- The use of reagent tablets in samples with high Calcium content* and/or high conductivity* can lead to turbidity of the sample and therefore incorrect measurements. In this case, the alternative reagent tablet DPD No. 1 High Calcium and reagent tablet DPD No. 3 High Calcium should be used.
  *it is not possible to give exact values, because the development of turbidity depends on the composition and nature of the sample.

Conformity

EN ISO 7393-2

[a)] determination of free, combined and total | [e)] alternative reagent, used instead of DPD No.1/No.3 in case of turbidity in the water sample caused by high concentration of calcium and/or high conductivity | # including stirring rod, 10 cm

Chlorine HR 10 T M104

0.1 - 10 mg/L Cl_2 a)

DPD

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	□ 10 mm	510 nm	0.1 - 10 mg/L Cl_2 a)

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
DPD No. 1 HR	Tablet / 100	511500BT
DPD No. 1 HR	Tablet / 250	511501BT
DPD No. 1 HR	Tablet / 500	511502BT
DPD No. 3 HR	Tablet / 100	511590BT
DPD No. 3 HR	Tablet / 250	511591BT
DPD No. 3 HR	Tablet / 500	511592BT
Set DPD No. 1 HR/No. 3 HR 100 Pc. #	100 each	517791BT
Set DPD No. 1 HR/No. 3 HR 250 Pc. #	250 each	517792BT
DPD No. 1 High Calcium e)	Tablet / 100	515740BT
DPD No. 1 High Calcium e)	Tablet / 250	515741BT
DPD No. 1 High Calcium e)	Tablet / 500	515742BT
DPD No. 3 High Calcium e)	Tablet / 100	515730BT
DPD No. 3 High Calcium e)	Tablet / 250	515731BT
DPD No. 3 High Calcium e)	Tablet / 500	515732BT

Application List

- Waste Water Treatment
- Disinfection Control
- Boiler Water
- Cooling Water
- Raw Water Treatment
- Pool Water Control
- Pool Water Treatment

Sampling

1. When preparing the sample, Chlorine outgassing, e.g. through the pipette or shaking, must be avoided.
2. The analysis must take place immediately after taking the sample.

Preparation

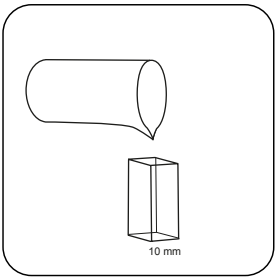
1. Cleaning of vials:
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, this can lead to lower results with the determination of Chlorine. To avoid measurement errors, the glassware used should be free of chlorine consumption. To achieve this, all glassware should be placed in a sodium hypochlorite solution (0.1 g/L) for one hour and then rinsed thoroughly with deionised water.
2. For individual testing of free and total Chlorine, the use of different sets of glassware is recommended (EN ISO 7393-2, 5.3)
3. The DPD colour development is carried out at a pH value of 6.2 to 6.5. The reagents therefore contain a buffer for the pH adjustment. Strong alkaline or acidic water samples must therefore be adjusted between pH 6 and pH 7 before the analysis (use 0.5 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).

Notes

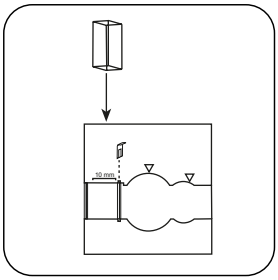
Variations in the length of the vial can extend the measuring range:
- 10 mm vial: 0.1 mg/L - 10 mg/L, solution: 0.01
- 20 mm vial: 0.05 mg/L - 5 mg/L, solution: 0.01
- 50 mm vial: 0.02 mg/L - 2 mg/L, solution: 0.001

Implementation of the provision Chlorine HR, free with tablet

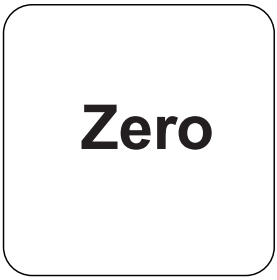
Select the method on the device
In addition, choose the test: free
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



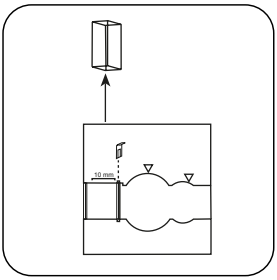
Fill 10 mm vial with **sample**.



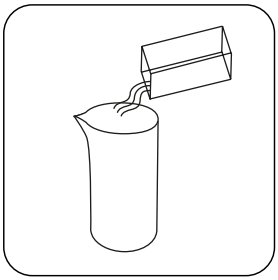
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



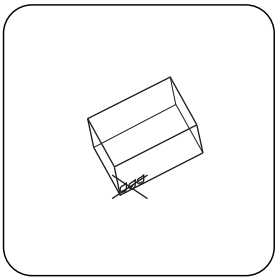
Press the **ZERO** button.



Remove **vial** from the sample chamber.

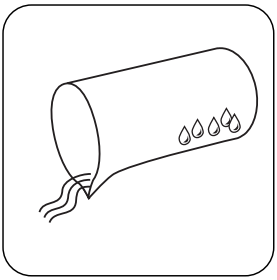


Empty vial.

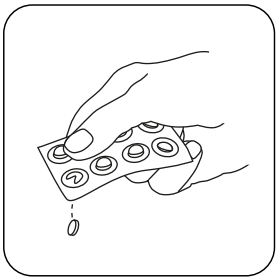


Dry the vial thoroughly.

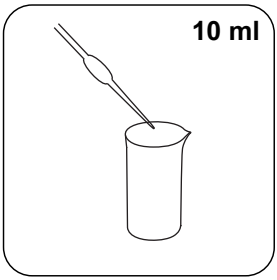
For devices that require **no ZERO measurement** , **start here**.



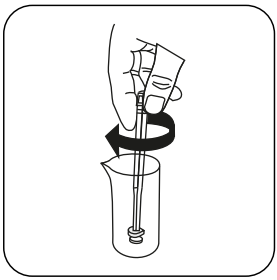
Rinse a beaker **with the sample and empty it, leaving a few drops remaining** in the beaker.



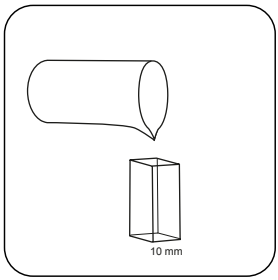
Add **DPD No.1 HR tablet**.



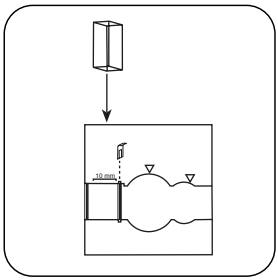
Add **10 ml sample**.



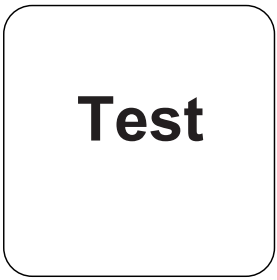
Crush tablet(s) by rotating slightly and dissolve.



Fill 10 mm vial with **sample**.



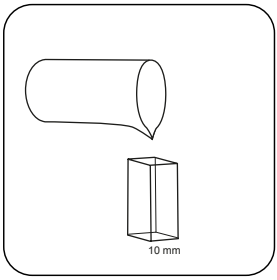
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



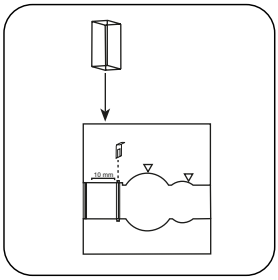
Press the **TEST** (XD: **START**)button.
The result in mg/l free chlorine appears on the display.

Implementation of the provision Chlorine HR, total with tablet

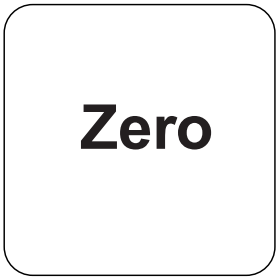
Select the method on the device
In addition, choose the test: total
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



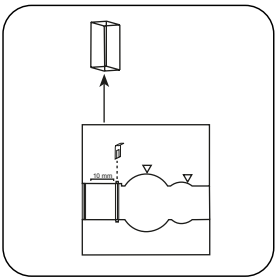
Fill 10 mm vial with **sample**.



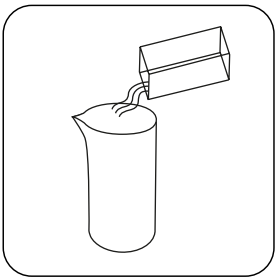
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



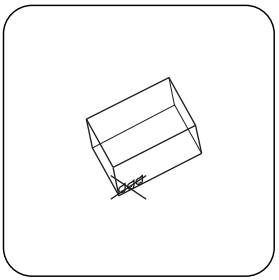
Press the **ZERO** button.



Remove **vial** from the sample chamber.

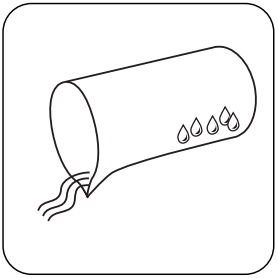


Empty vial.

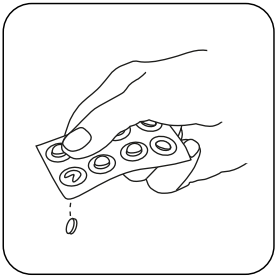


Dry the vial thoroughly.

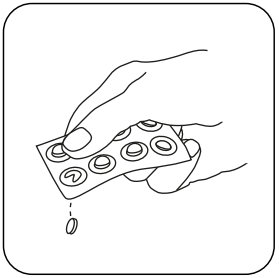
For devices that require **no ZERO measurement** , **start here**.



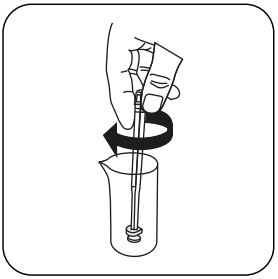
Rinse a beaker **with the sample and empty it, leaving a few drops remaining** in the beaker.



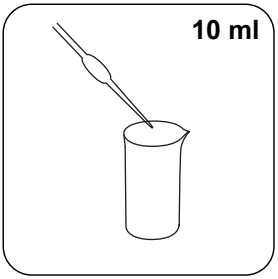
Add **DPD No.1 HR tablet**.



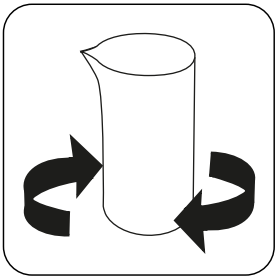
Add **DPD No.3 HR tablet**.



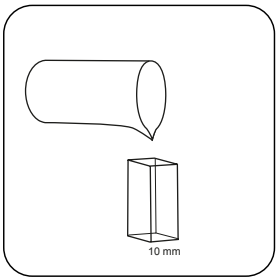
Crush tablet(s) by rotating slightly.



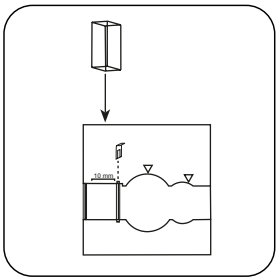
Add **10 ml sample**.



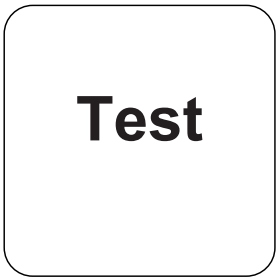
Dissolve tablet(s) by inverting.



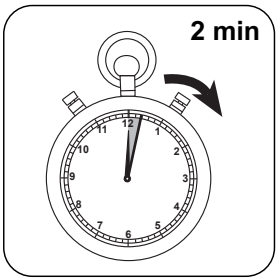
Fill 10 mm vial with **sample**.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

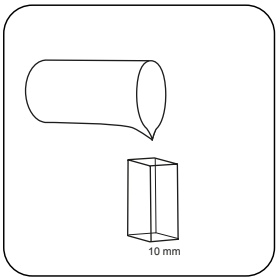


Wait for **2 minute(s) reaction time**.

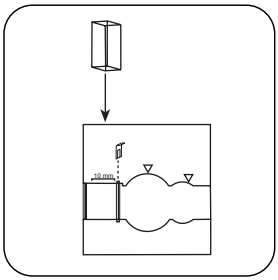
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l total Chlorine appears on the display.

Implementation of the provision Chlorine HR, differentiated with tablet

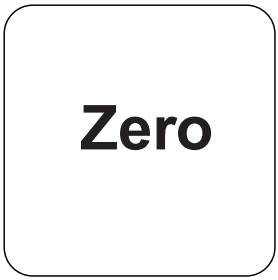
Select the method on the device
In addition, choose the test: differentiated
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



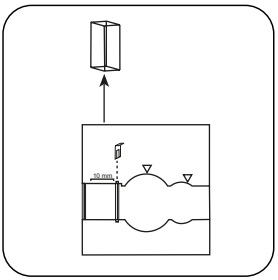
Fill 10 mm vial with **sample**.



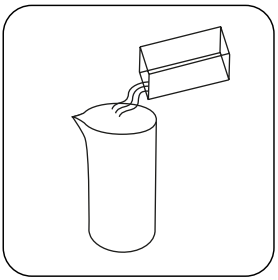
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



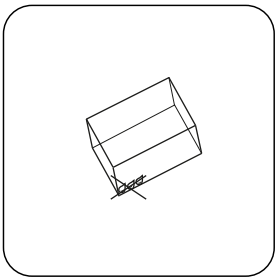
Press the **ZERO** button.



Remove **vial** from the sample chamber.

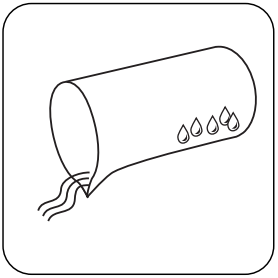


Empty vial.

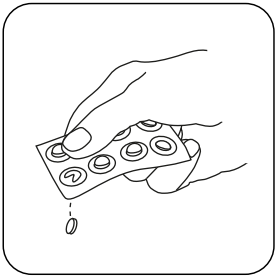


Dry the vial thoroughly.

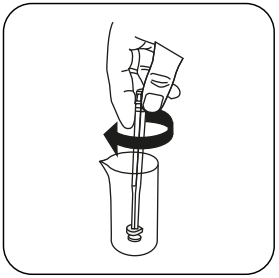
For devices that require **no ZERO measurement** , **start here**.



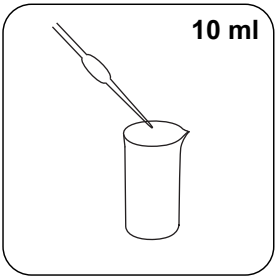
Rinse a beaker **with the sample and empty it, leaving a few drops remaining** in the beaker.



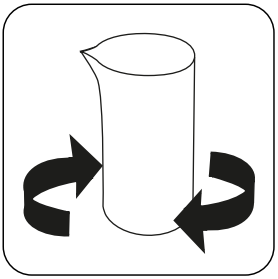
Add **DPD No.1 HR tablet**.



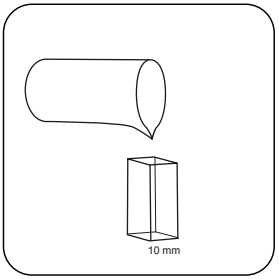
Crush tablet(s) by rotating slightly.



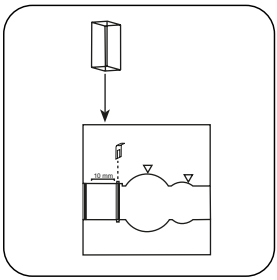
Add **10 ml sample**.



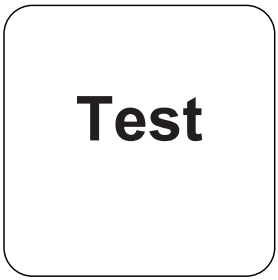
Dissolve tablet(s) by inverting.



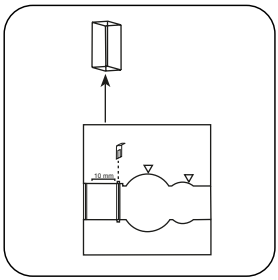
Fill 10 mm vial with **sample**.



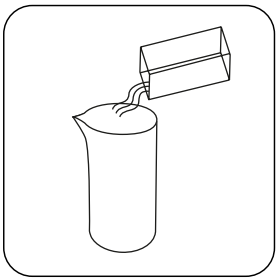
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



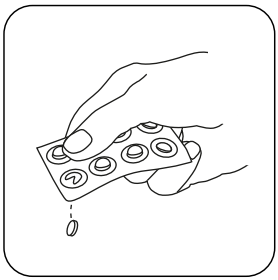
Press the **TEST** (XD: **START**)button.



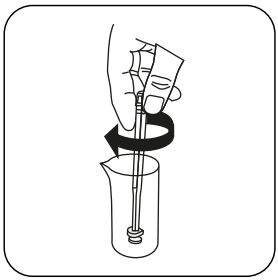
Remove **vial** from the sample chamber.



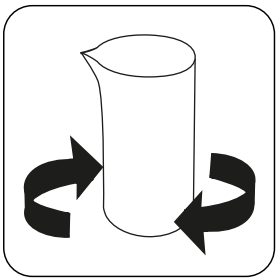
Return the sample solution completely to the sample vessel.



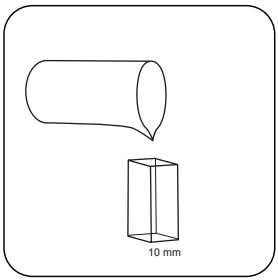
Add **DPD No.3 HR tablet**.



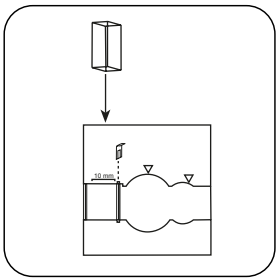
Crush tablet(s) by rotating slightly.



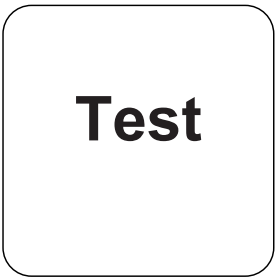
Dissolve tablet(s) by inverting.

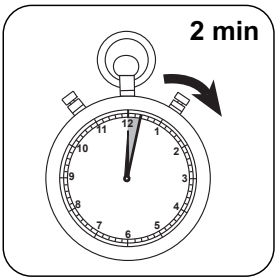


Fill 10 mm vial with **sample**.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.





Press the **TEST** (XD: **START**)button.

Wait for **2 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l free chlorine; mg/l combined chlorine; mg/l total chlorine appears on the display.

Chemical Method

DPD

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	□ **10 mm**
a	$1.42151 \cdot 10^{-1}$
b	$3.06749 \cdot 10^{+0}$
c	$4.92199 \cdot 10^{-1}$
d	
e	
f	

Interferences

Persistant Interferences

- All oxidising agents in the samples react like chlorine, which leads to higher results.

Removeable Interferences

- Interference from Copper and Iron (III) are eliminated by the addition of EDTA.
- The use of reagent tablets in samples with high Calcium content* and/or high conductivity* can lead to turbidity of the sample and therefore incorrect measurements. In this case, the alternative reagent tablet DPD No. 1 High Calcium and reagent tablet DPD No. 3 High Calcium should be used.
  *it is not possible to give exact values, because the development of turbidity depends on the composition and nature of the sample.

Interference	**from / [mg/L]**
CrO_4^{2-}	0,01
MnO_2	0,01

Conformity

EN ISO 7393-2

[a] determination of free, combined and total | [e] alternative reagent, used instead of DPD No.1/No.3 in case of turbidity in the water sample caused by high concentration of calcium and/or high conductivity | # including stirring rod, 10 cm

Chlorine HR (KI) T (105) M105

5 - 200 mg/L Cl_2 CLHr

KI / Acid

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 110, MD 600, MD 610, MD 640, MultiDirect	ø 16 mm	530 nm	5 - 200 mg/L Cl_2
SpectroDirect, XD 7000, XD 7500	ø 16 mm	470 nm	5 - 200 mg/L Cl_2

Material

Required material (partly optional):

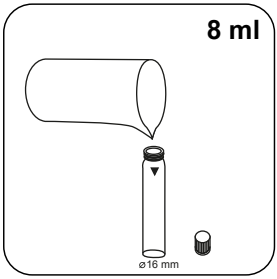
Reagents	Packaging Unit	Part Number
Chlorine HR (KI)	Tablet / 100	513000BT
Chlorine HR (KI)	Tablet / 250	513001BT
Acidifying GP	Tablet / 100	515480BT
Acidifying GP	Tablet / 250	515481BT
Set Chlorine HR (KI)/Acidifying GP 100 Pc. #	100 each	517721BT
Set Chlorine HR (KI)/Acidifying GP 250 Pc. #	250 each	517722BT
Chlorine HR (KI)	Tablet / 100	501210
Chlorine HR (KI)	Tablet / 250	501211

Application List

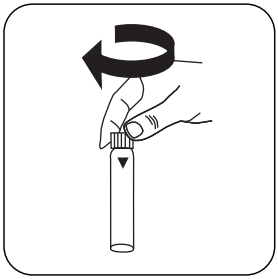
- Waste Water Treatment
- Disinfection Control
- Boiler Water
- Cooling Water
- Raw Water Treatment
- Pool Water Treatment

Implementation of the provision Chlorine HR (KI) with Tablet

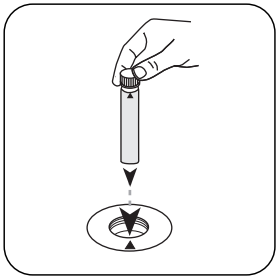
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



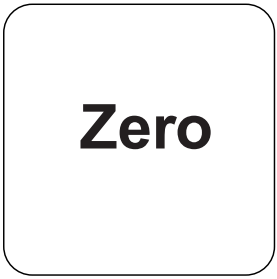
Fill 16 mm vial with **8 ml sample**.



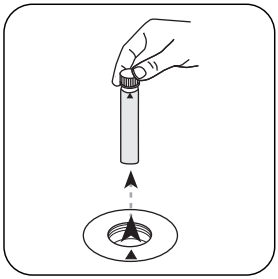
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

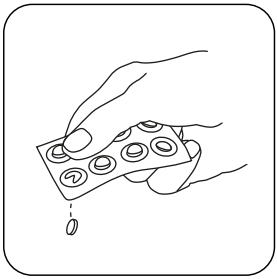


Press the **ZERO** button.

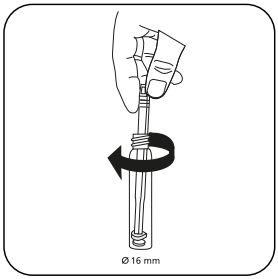


Remove **vial** from the sample chamber.

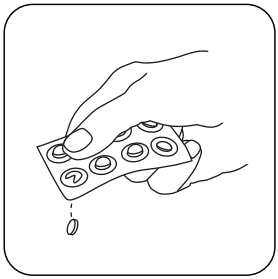
For devices that require **no ZERO measurement** , **start here**.



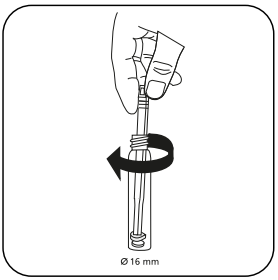
Add **Chlorine HR (KI) tablet**.



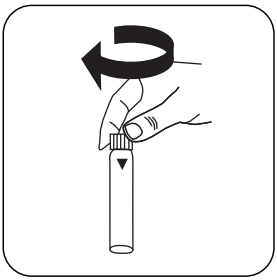
Crush tablet(s) by rotating slightly.



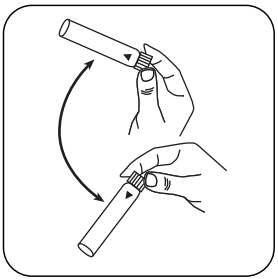
Add **ACIDIFYING GP tablet**.



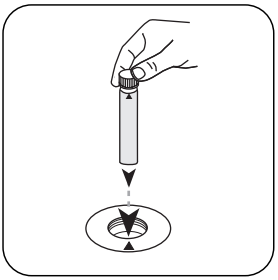
Crush tablet(s) by rotating slightly.



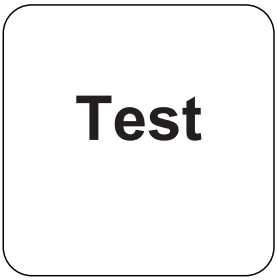
Close vial(s).



Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in mg/l Chlorine appears on the display.

Chemical Method

KI / Acid

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 16 mm
a	-3.51241 • 10^{-1}
b	8.04513 • 10^{+1}
c	1.53448 • 10^{+0}
d	
e	
f	

Interferences

Persistant Interferences

- All oxidising agents in the samples react like chlorine, which leads to higher results.

Method Validation

Limit of Detection	1.29 mg/L
Limit of Quantification	3.86 mg/L
End of Measuring Range	200 mg/L
Sensitivity	83.96 mg/L / Abs
Confidence Intervall	1.14 mg/L
Standard Deviation	0.45 mg/L
Variation Coefficient	0.45 %

Derived from

EN ISO 9963-1

including stirring rod, 10 cm

Chlorine PP M110

0.02 - 2 mg/L Cl_2 [a] CL2

DPD

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 600, MD 610, MD 640, MultiDirect, PM 620, PM 630	ø 24 mm	530 nm	0.02 - 2 mg/L Cl_2 [a]
SpectroDirect, XD 7000, XD 7500	ø 24 mm	510 nm	0.02 - 2 mg/L Cl_2 [a]

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Chlorine Free DPD F10	Powder / 100 pc.	530100
Chlorine Free DPD F10	Powder / 1000 pc.	530103
Chlorine Total DPD F10	Powder / 100 pc.	530120
Chlorine Total DPD F10	Powder / 1000 pc.	530123

Available Standards

Title	Packaging Unit	Part Number
ValidCheck Chlorine 1,5 mg/l	1 pc.	48105510

Application List

- Waste Water Treatment
- Disinfection Control
- Boiler Water
- Cooling Water
- Raw Water Treatment
- Pool Water Control
- Pool Water Treatment
- Drinking Water Treatment

Sampling

1. When preparing the sample, Chlorine outgassing, e.g. through the pipette or shaking, must be avoided.
2. The analysis must take place immediately after taking the sample.

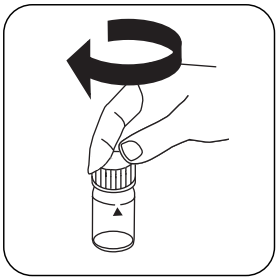
Preparation

1. Cleaning of vials:
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, this can lead to lower results with the determination of Chlorine. To avoid measurement errors, the glassware used should be free of chlorine consumption. To achieve this, all glassware should be placed in a sodium hypochlorite solution (0.1 g/L) for one hour and then rinsed thoroughly with deionised water.
2. For individual testing of free and total Chlorine, the use of different sets of glassware is recommended (EN ISO 7393-2, 5.3)
3. The DPD colour development is carried out at a pH value of 6.2 to 6.5. The reagents therefore contain a buffer for the pH adjustment. Strong alkaline or acidic water samples must therefore be adjusted between pH 6 and pH 7 before the analysis (use 0.5 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).

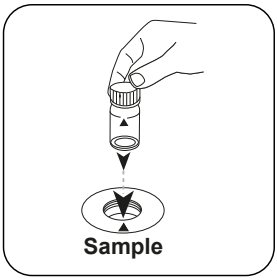
Implementation of the provision free chlorine with powder packs

Select the method on the device
In addition, choose the test: free
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

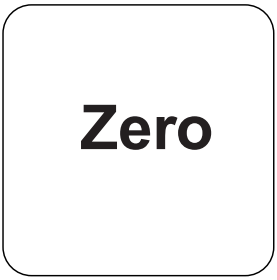
Fill 24 mm vial with **10 ml sample**.



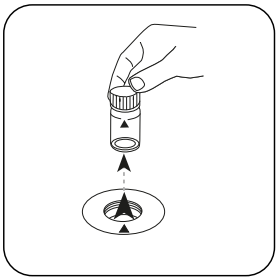
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

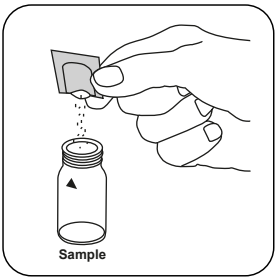


Press the **ZERO** button.

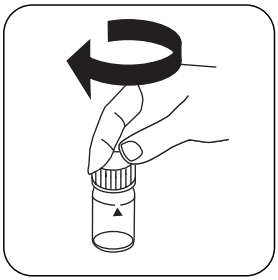


Remove the vial from the sample chamber.

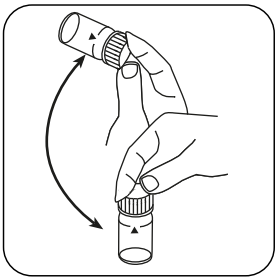
For devices that require **no ZERO measurement** , **start here**.



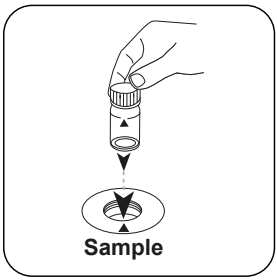
Add **Chlorine FREE-DPD/ F10 powder pack**.

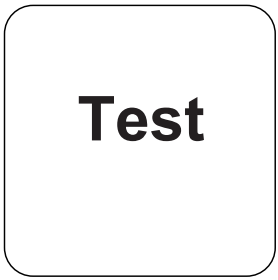


Close vial(s).



Invert several times to mix the contents (20 sec.).





Place **sample vial** in the sample chamber. • Pay attention to the positioning.

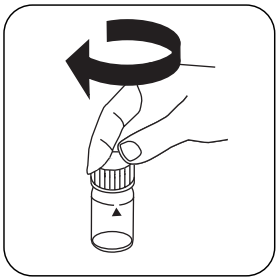
Press the **TEST** (XD: **START**)button.

The result in mg/l free chlorine appears on the display.

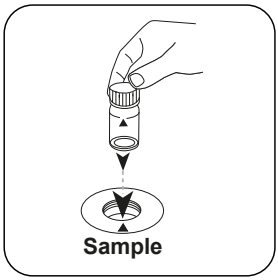
Implementation of the provision totale Chlorine with powder packs

Select the method on the device
In addition, choose the test: total
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

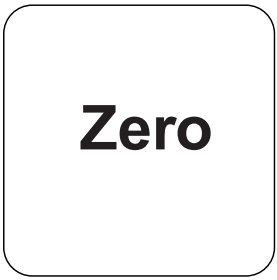
Fill 24 mm vial with **10 ml sample**.



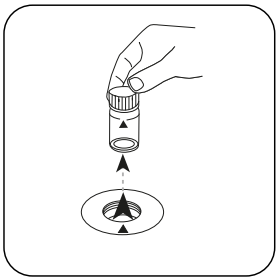
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

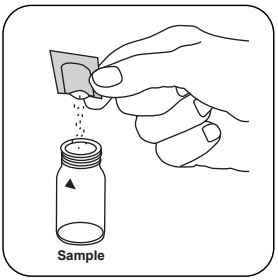


Press the **ZERO** button.

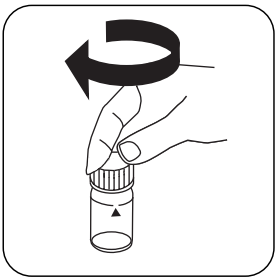


Remove the vial from the sample chamber.

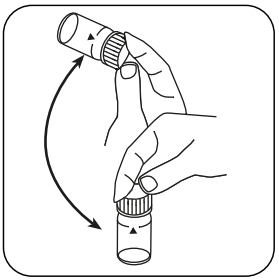
For devices that require **no ZERO measurement** , **start here**.



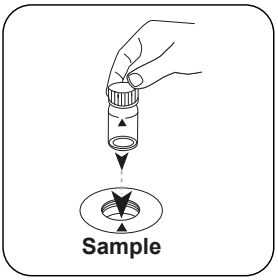
Add **Chlorine TOTAL-DPD/ F10 powder pack**.



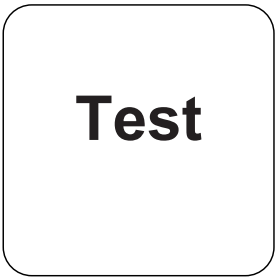
Close vial(s).



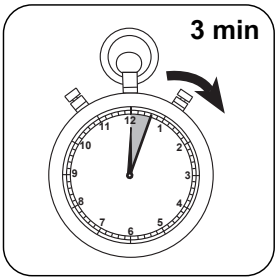
Invert several times to mix the contents (20 sec.).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



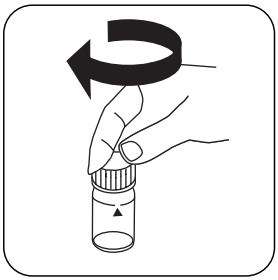
Wait for **3 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l total Chlorine appears on the display.

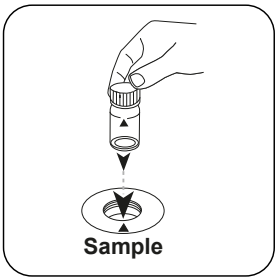
Implementation of the provision Chlorine differentiated with powder packs

Select the method on the device
In addition, choose the test: differentiated
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

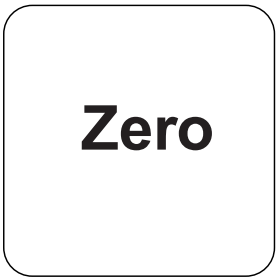
Fill 24 mm vial with **10 ml sample**.



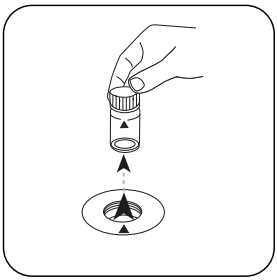
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

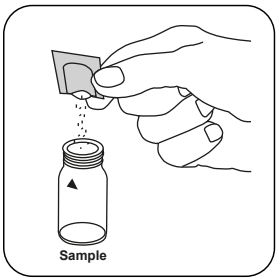


Press the **ZERO** button.

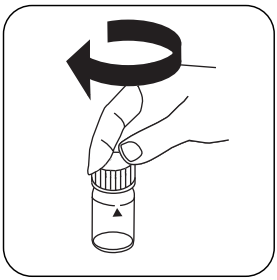


Remove the vial from the sample chamber.

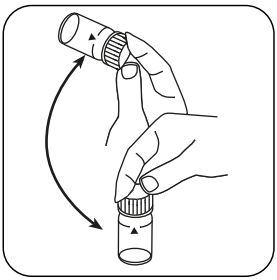
For devices that require **no ZERO measurement** , **start here**.



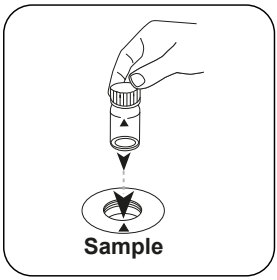
Add **Chlorine FREE-DPD/ F10 powder pack**.



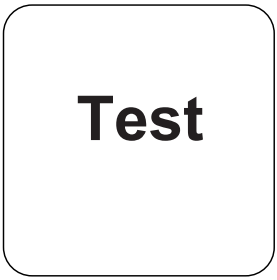
Close vial(s).



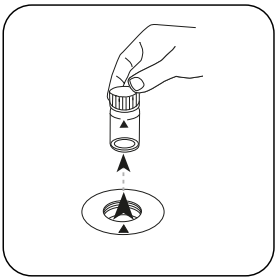
Invert several times to mix the contents (20 sec.).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



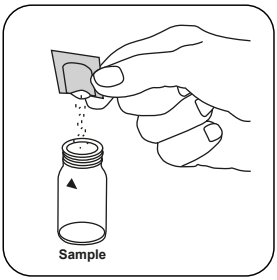
Press the **TEST** (XD: **START**)button.



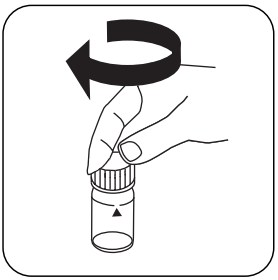
Remove the vial from the sample chamber.

Thoroughly clean the vial and vial cap.

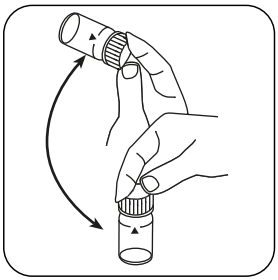
Fill 24 mm vial with **10 ml sample**.



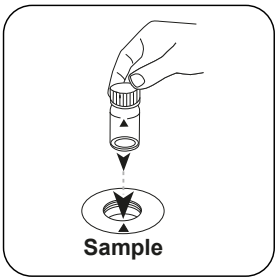
Add **TOTAL-DPD/ F10 powder pack**.



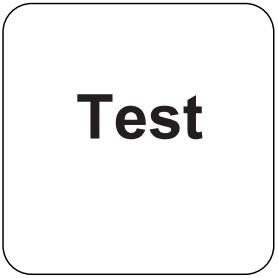
Close vial(s).



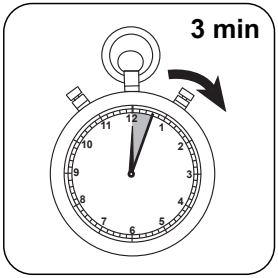
Invert several times to mix the contents (20 sec.).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **3 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically. The result in mg/l free chlorine, mg/l combined chlorine, mg/l total chlorine appears on the display.

Chemical Method

DPD

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	-3.94263•10^{-2}	-3.94263•10^{-2}
b	1.70509•10^{+0}	3.66594•10^{+0}
c		
d		
e		
f		

Interferences

Persistant Interferences

- All oxidising agents in the samples react like chlorine, which leads to higher results.

Removeable Interferences

- Interference from Copper and Iron (III) are eliminated by the addition of EDTA.
- Concentrations above 2 mg/L Chlorine, in the event of using Powder Packs, can lead to results within the measuring range of up to 0 mg/L. In this case, the sample must be diluted with chlorine-free water. 10 ml of the diluted sample should be mixed with the reagent and the measurement taken again (plausibility test).

Interference	**from / [mg/L]**
CrO_4^{2-}	0,01
MnO_2	0,01

Method Validation

Limit of Detection	0.01 mg/L
Limit of Quantification	0.03 mg/L
End of Measuring Range	2 mg/L
Sensitivity	1.68 mg/L / Abs
Confidence Intervall	0.033 mg/L
Standard Deviation	0.014 mg/L
Variation Coefficient	1.34 %

Conformity

EN ISO 7393-2

[a)] determination of free, combined and total

Chlorine HR PP M111

0.1 - 8 mg/L Cl_2 [a] CL8

DPD

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, PM 620, PM 630	Multy cuvette, type 3	530 nm	0.1 - 8 mg/L Cl_2 [a]
MD 100	Multy cuvette, type 2	530 nm	0.1 - 8 mg/L Cl_2 [a]

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Chlorine Free DPD F10	Powder / 100 pc.	530100
Chlorine Free DPD F10	Powder / 1000 pc.	530103
Chlorine Total DPD F10	Powder / 100 pc.	530120
Chlorine Total DPD F10	Powder / 1000 pc.	530123

Application List

- Waste Water Treatment
- Disinfection Control
- Boiler Water
- Cooling Water
- Raw Water Treatment
- Pool Water Control
- Pool Water Treatment

Sampling

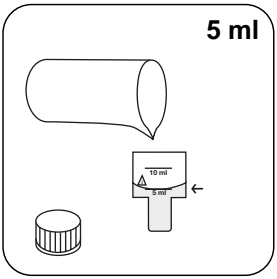
1. When preparing the sample, Chlorine outgassing, e.g. through the pipette or shaking, must be avoided.
2. The analysis must take place immediately after taking the sample.

Preparation

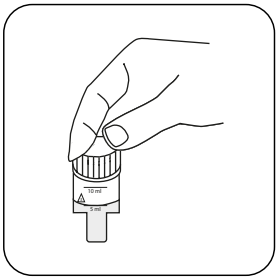
1. Cleaning of vials:
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, this can lead to lower results with the determination of Chlorine. To avoid measurement errors, the glassware used should be free of chlorine consumption. To achieve this, all glassware should be placed in a sodium hypochlorite solution (0.1 g/L) for one hour and then rinsed thoroughly with deionised water.
2. For individual testing of free and total Chlorine, the use of different sets of glassware is recommended (EN ISO 7393-2, 5.3)
3. The DPD colour development is carried out at a pH value of 6.2 to 6.5. The reagents therefore contain a buffer for the pH adjustment. Strong alkaline or acidic water samples must therefore be adjusted between pH 6 and pH 7 before the analysis (use 0.5 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).

Implementation of the provision free chlorine HR with powder packs

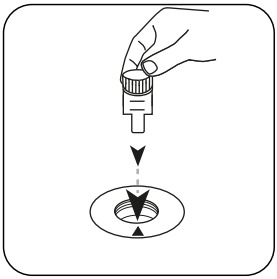
In addition, choose the test: free
Select the method on the device



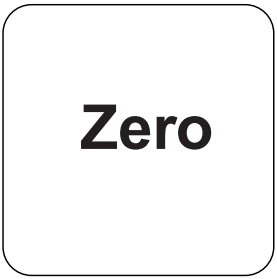
Fill 10 mm vial with **5 ml sample**.



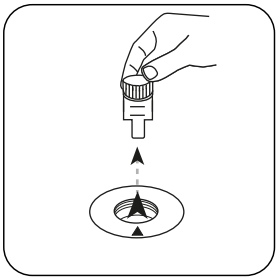
Close vial(s).



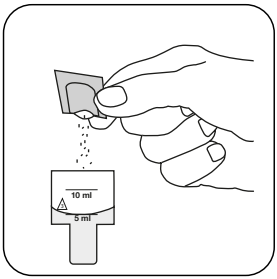
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



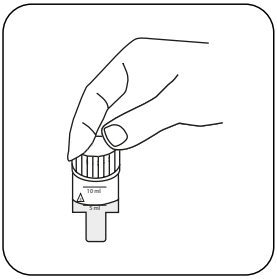
Press the **ZERO** button.



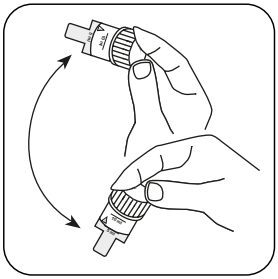
Remove **vial** from the sample chamber.



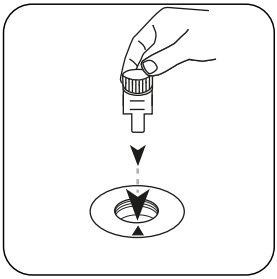
Add **two Chlorine FREE-DPD / F10 powder packs** .



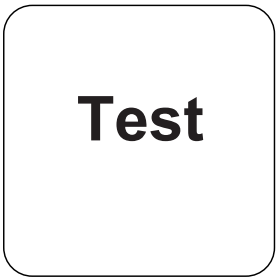
Close vial(s).



Invert several times to mix the contents (20 sec.).



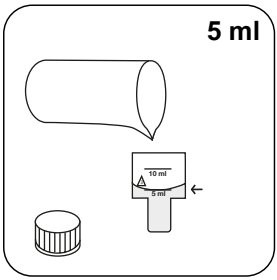
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



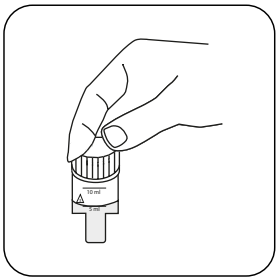
Press the **TEST** (XD: **START**)button.
The result in mg/l free chlorine appears on the display.

Implementation of the provision totale Chlorine HR with powder packs

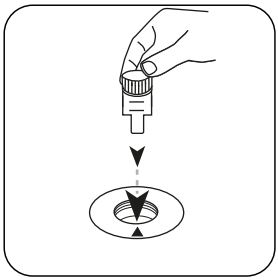
In addition, choose the test: total
Select the method on the device



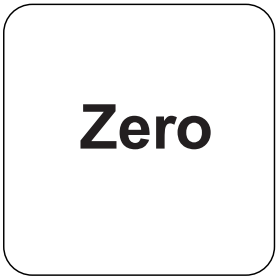
Fill 10 mm vial with **5 ml sample**.



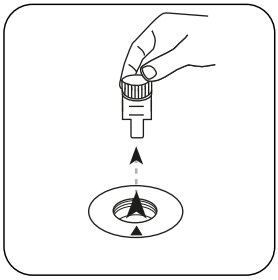
Close vial(s).



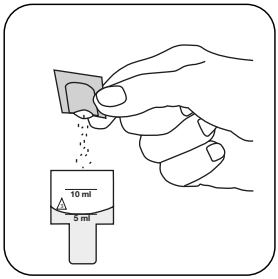
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



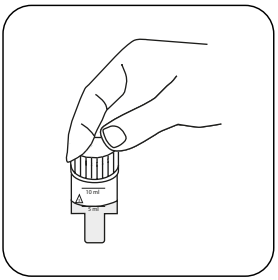
Press the **ZERO** button.



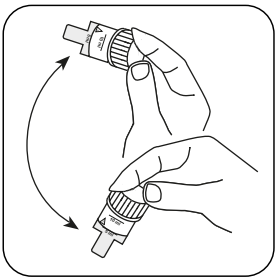
Remove **vial** from the sample chamber.



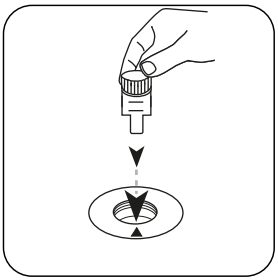
Add **two Chlorine TOTAL-DPD / F10 powder packs** .



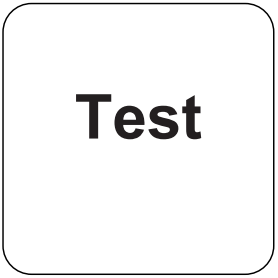
Close vial(s).



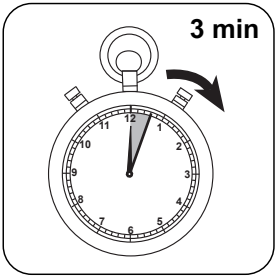
Invert several times to mix the contents (20 sec.).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

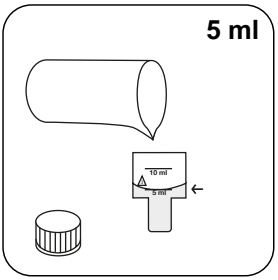


Wait for **3 minute(s) reaction time**.

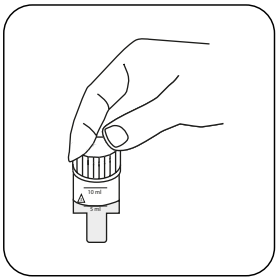
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l total Chlorine appears on the display.

Implementation of the provision Chlorine HR differentiated with powder packs

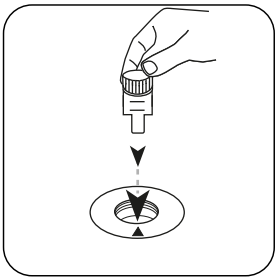
Select the method on the device
In addition, choose the test: differentiated



Fill 10 mm vial with **5 ml sample**.



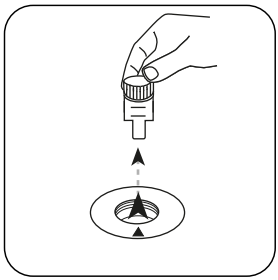
Close vial(s).



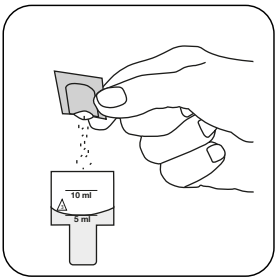
Place **sample vial** in the sample chamber. • Pay attention to the positioning.

Zero

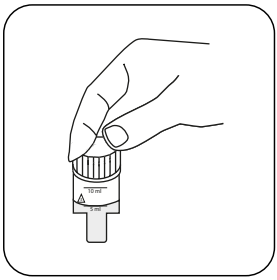
Press the **ZERO** button.



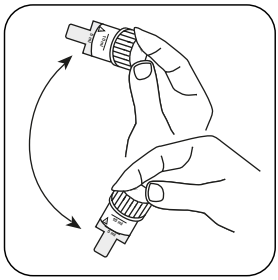
Remove **vial** from the sample chamber.



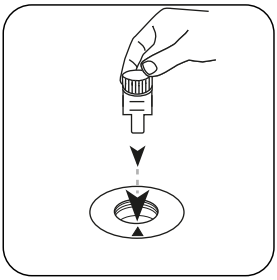
Add **two Chlorine FREE-DPD / F10 powder packs** .



Close vial(s).



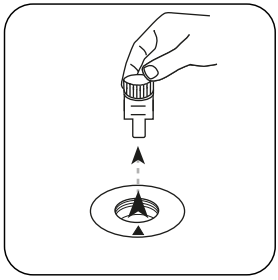
Invert several times to mix the contents (20 sec.).



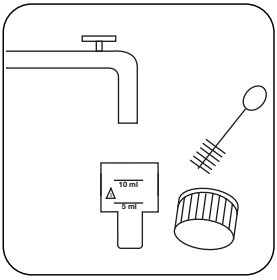
Place **sample vial** in the sample chamber. • Pay attention to the positioning.

Test

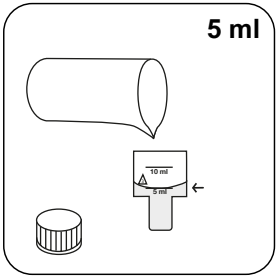
Press the **TEST** (XD: **START**)button.



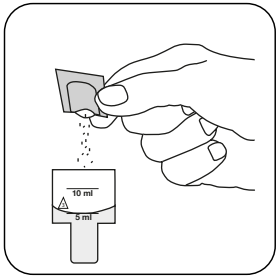
Remove **vial** from the sample chamber.



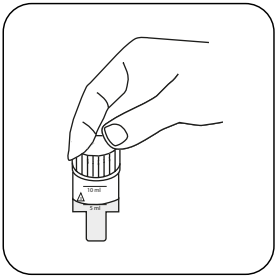
Thoroughly clean the vial and vial cap.



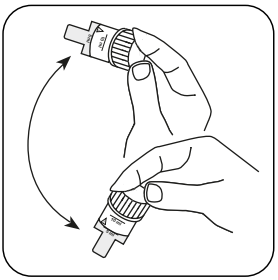
Fill 10 mm vial with **5 ml sample**.



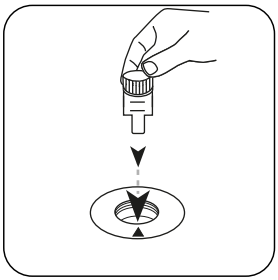
Add **two Chlorine TOTAL-DPD / F10 powder packs** .



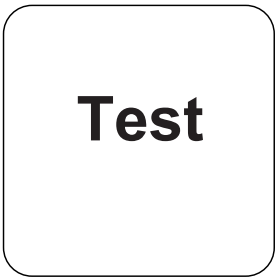
Close vial(s).



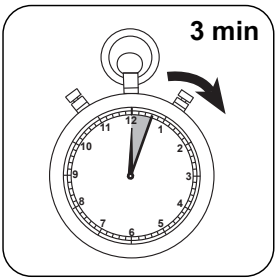
Invert several times to mix the contents (20 sec.).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **3 minute(s) reaction time**.
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l free chlorine, mg/l combined chlorine, mg/l total chlorine appears on the display.

Chemical Method

DPD

Appendix

Interferences

Persistant Interferences

- All oxidising agents in the samples react like chlorine, which leads to higher results.

Removeable Interferences

- Interference from Copper and Iron (III) are eliminated by the addition of EDTA.
- Concentrations above 8 mg/L Chlorine, in the event of using Powder Packs, can lead to results within the measuring range of up to 0 mg/L. In this case, the sample must be diluted with chlorine-free water. 10 ml of the diluted sample should be mixed with the reagent and the measurement taken again (plausibility test).

Conformity

EN ISO 7393-2

[a)] determination of free, combined and total

Chlorine MR PP M113

0.02 - 3.5 mg/L Cl_2 [a] CL2

DPD

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 600, MD 610, MD 640, MultiDirect, PM 620, PM 630	ø 24 mm	530 nm	0.02 - 3.5 mg/L Cl_2 [a]
SpectroDirect, XD 7000, XD 7500	ø 24 mm	510 nm	0.02 - 3.5 mg/L Cl_2 [a]

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
VARIO Chlorine Free DPD F10	Powder / 100 pc.	530180
VARIO Chlorine Free DPD F10	Powder / 1000 pc.	530183
VARIO Chlorine Total DPD F10	Powder / 100 pc.	530190
VARIO Chlorine Total DPD F10	Powder / 1000 pc.	530193

Available Standards

Title	Packaging Unit	Part Number
ValidCheck Chlorine 1,5 mg/l	1 pc.	48105510

Application List

- Waste Water Treatment
- Disinfection Control
- Boiler Water
- Cooling Water
- Raw Water Treatment
- Pool Water Control
- Pool Water Treatment
- Drinking Water Treatment

Sampling

1. When preparing the sample, Chlorine outgassing, e.g. through the pipette or shaking, must be avoided.
2. The analysis must take place immediately after taking the sample.

Preparation

1. Cleaning of vials:
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, this can lead to lower results with the determination of Chlorine. To avoid measurement errors, the glassware used should be free of chlorine consumption. To achieve this, all glassware should be placed in a sodium hypochlorite solution (0.1 g/L) for one hour and then rinsed thoroughly with deionised water.
2. For individual testing of free and total Chlorine, the use of different sets of glassware is recommended (EN ISO 7393-2, 5.3)
3. The DPD colour development is carried out at a pH value of 6.2 to 6.5. The reagents therefore contain a buffer for the pH adjustment. Strong alkaline or acidic water samples must therefore be adjusted between pH 6 and pH 7 before the analysis (use 0.5 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).

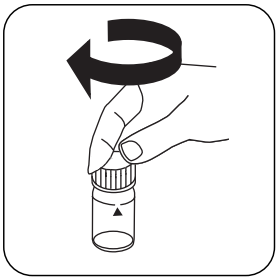
Notes

1. The powder reagents used are marked in blue for easy identification The powder for the determination of free chlorine carries a closed and a dotted line. The powder for the determination of total chlorine has two closed lines.

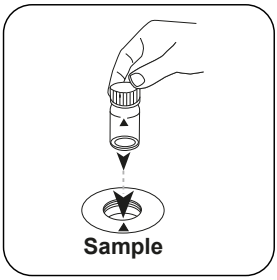
Implementation of the provision free chlorine MR, with powder pack

Select the method on the device
In addition, choose the test: free
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

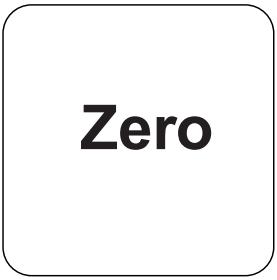
Fill 24 mm vial with **10 ml sample**.



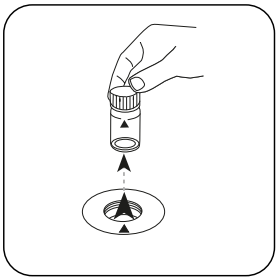
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

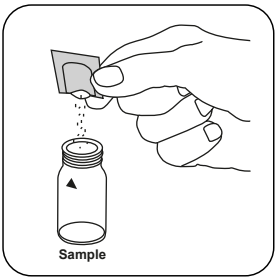


Press the **ZERO** button.

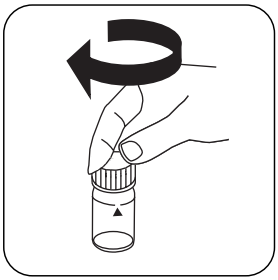


Remove the vial from the sample chamber.

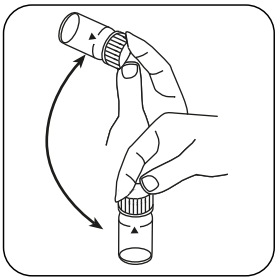
For devices that require **no ZERO measurement** , **start here**.



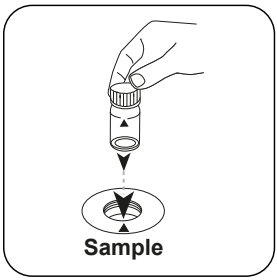
Add **VARIO Chlorine FREE-DPD/ F10 powder pack**.



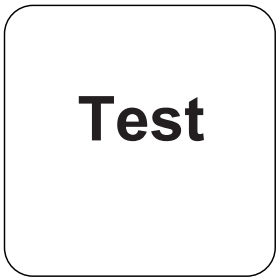
Close vial(s).



Invert several times to mix the contents (20 sec.).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



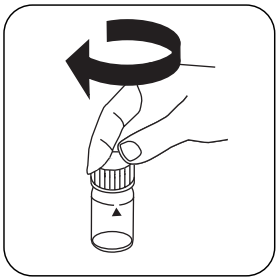
Press the **TEST** (XD: **START**)button.

The result in mg/l free chlorine appears on the display.

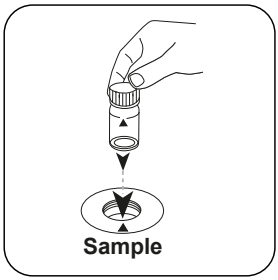
Implementation of the provision Chlorine differentiated MR with powder packs

Select the method on the device
In addition, choose the test: differentiated
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

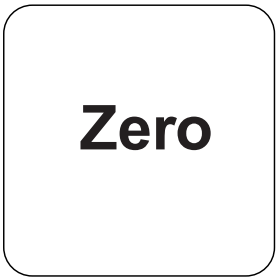
Fill 24 mm vial with **10 ml sample**.



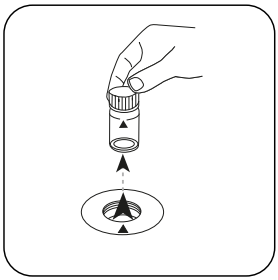
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

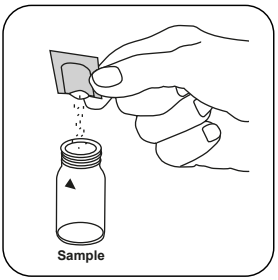


Press the **ZERO** button.

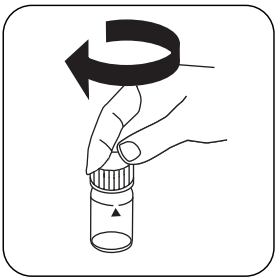


Remove the vial from the sample chamber.

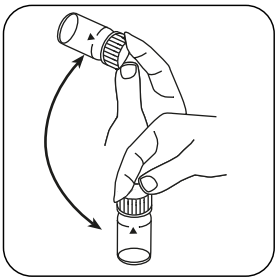
For devices that require **no ZERO measurement** , **start here**.



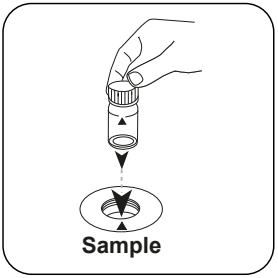
Add **VARIO Chlorine FREE-DPD/ F10 powder pack**.



Close vial(s).

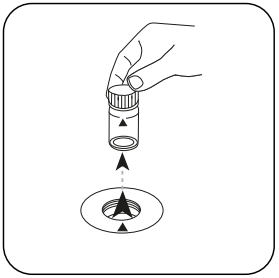


Invert several times to mix the contents (20 sec.).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

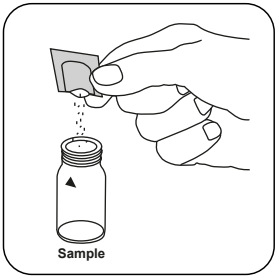
Press the **TEST** (XD: **START**)button.



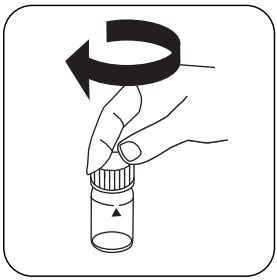
Remove the vial from the sample chamber.

Thoroughly clean the vial and vial cap.

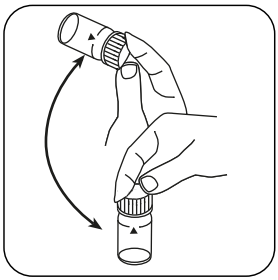
Fill 24 mm vial with **10 ml sample**.



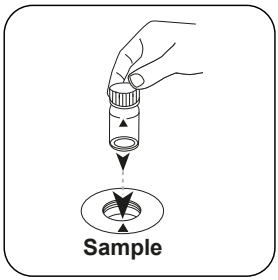
Add **Chlorine TOTAL-DPD/ F10 powder pack**.



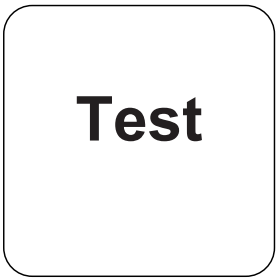
Close vial(s).



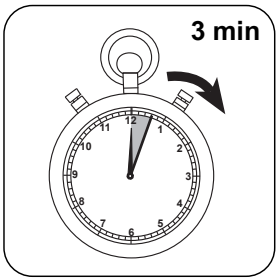
Invert several times to mix the contents (20 sec.).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



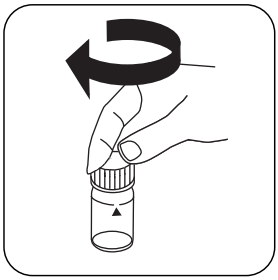
Wait for **3 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically. The result in mg/l free chlorine, combined chlorine, total chlorine appears on the display.

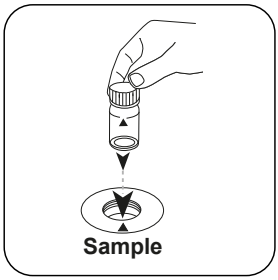
Implementation of the provision totale Chlorine MR with powder packs

Select the method on the device
In addition, choose the test: total
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

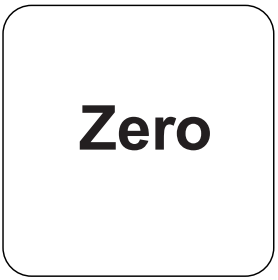
Fill 24 mm vial with **10 ml sample**.



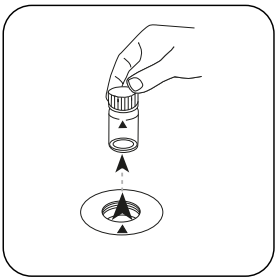
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

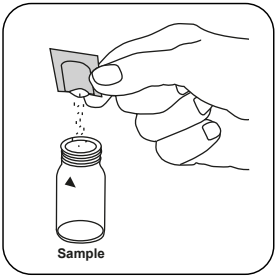


Press the **ZERO** button.



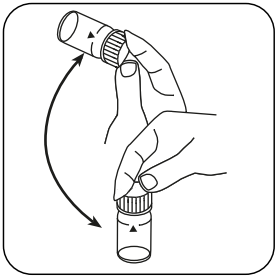
Remove the vial from the sample chamber.

For devices that require **no ZERO measurement** , **start here**.

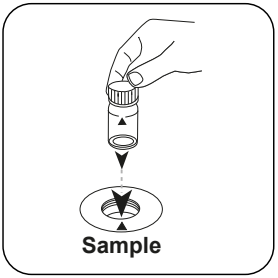


Add **VARIO Chlorine TOTAL-DPD/ F10 powder pack**.

Close vial(s).

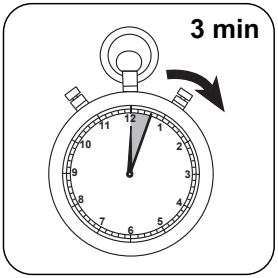


Invert several times to mix the contents (20 sec.).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

Press the **TEST** (XD: **START**)button.



Wait for **3 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l total Chlorine appears on the display.

Chemical Method

DPD

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	$-9.48367 \cdot 10^{-3}$	$-9.48367 \cdot 10^{-3}$
b	$1.5024 \cdot 10^{+0}$	$3.23016 \cdot 10^{+0}$
c	$9.28696 \cdot 10^{-2}$	$4.2929 \cdot 10^{-1}$
d		
e		
f		

Interferences

Persistant Interferences

- All oxidising agents in the samples react like chlorine, which leads to higher results.

Removeable Interferences

- Interference from Copper and Iron (III) are eliminated by the addition of EDTA.
- Concentrations above 4 mg/L Chlorine, in the event of using Powder Packs, can lead to results within the measuring range of up to 0 mg/L. In this case, the sample must be diluted with chlorine-free water. 10 ml of the diluted sample should be mixed with the reagent and the measurement taken again (plausibility test).

Interference	**from / [mg/L]**
CrO_4^{2-}	0,01
MnO_2	0,01

Method Validation

Limit of Detection	0.01 mg/L
Limit of Quantification	0.03 mg/L
End of Measuring Range	3.5 mg/L
Sensitivity	1.7 mg/L / Abs
Confidence Intervall	0.014 mg/L
Standard Deviation	0.006 mg/L
Variation Coefficient	0.34 %

[a] determination of free, combined and total

Chlorine dioxide 50 T M119

0.05 - 1 mg/l ClO_2

DPD / Glycine

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	□ 50 mm	510 nm	0.05 - 1 mg/l ClO_2

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
DPD No. 1	Tablet / 100	511050BT
DPD No. 1	Tablet / 250	511051BT
DPD No. 1	Tablet / 500	511052BT
DPD No. 3	Tablet / 100	511080BT
DPD No. 3	Tablet / 250	511081BT
DPD No. 3	Tablet / 500	511082BT
DPD No. 1 High Calcium [e)]	Tablet / 100	515740BT
DPD No. 1 High Calcium [e)]	Tablet / 250	515741BT
DPD No. 1 High Calcium [e)]	Tablet / 500	515742BT
DPD No. 3 High Calcium [e)]	Tablet / 100	515730BT
DPD No. 3 High Calcium [e)]	Tablet / 250	515731BT
DPD No. 3 High Calcium [e)]	Tablet / 500	515732BT
Set DPD No. 1/No. 3 100 Pc.[#]	100 each	517711BT
Set DPD No. 1/No. 3 250 Pc.[#]	250 each	517712BT
Set DPD No. 1/Glycine 100 Stck. [#]	100 each	517731BT
Set DPD No. 1/Glycine 250 Stck. [#]	250 each	517732BT
Set DPD No. 1/No. 3 High Calcium 100 Pc. [#]	100 each	517781BT
Set DPD No. 1/No. 3 High Calcium 250 Pc. [#]	250 each	517782BT
Glycine [f)]	Tablet / 100	512170BT
Glycine [f)]	Tablet / 250	512171BT

Application List

- Waste Water Treatment
- Disinfection Control
- Boiler Water
- Cooling Water
- Raw Water Treatment
- Pool Water Control
- Pool Water Treatment
- Drinking Water Treatment

Sampling

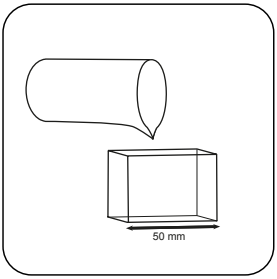
1. When preparing the sample, outgassing, e.g. through the pipette or shaking, must be avoided.
2. The analysis must take place immediately after taking the sample.

Preparation

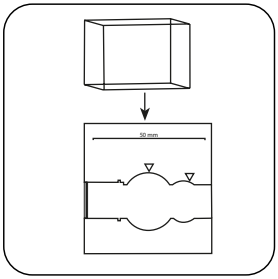
1. Cleaning of vials:
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, this can lead to lower results with the determination of Chlorine dioxide. To avoid measurement errors, the glassware used should be free of chlorine consumption. To achieve this, all glassware should be placed in a sodium hypochlorite solution (0.1 g/L) for one hour and then rinsed thoroughly with deionised water.
2. Strong alkaline or acidic water samples must be adjusted between pH 6 and pH 7 before the analysis (use 0.5 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).

Implementation of the provision Chlorine Dioxide, in absence of chlorine with tablet

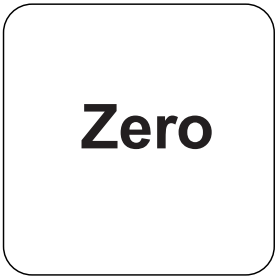
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



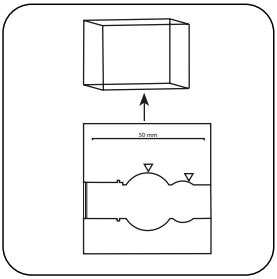
Fill 50 mm vial with **sample**.



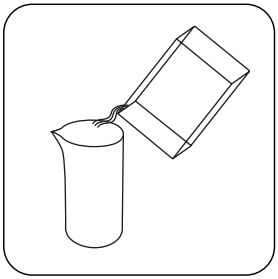
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



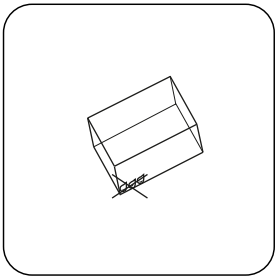
Press the **ZERO** button.



Remove **vial** from the sample chamber.

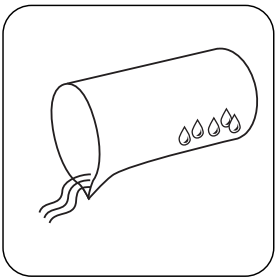


Empty vial.

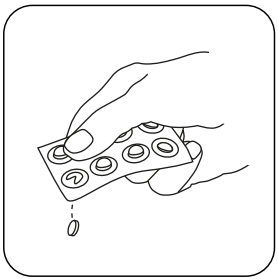


Dry the vial thoroughly.

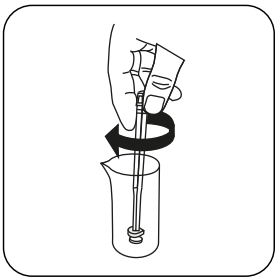
For devices that require **no ZERO measurement** , **start here**.



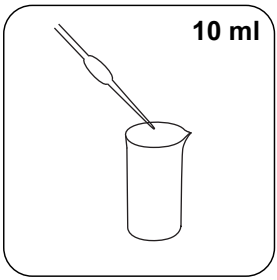
Rinse a beaker **with the sample and empty it, leaving a few drops remaining** in the beaker.



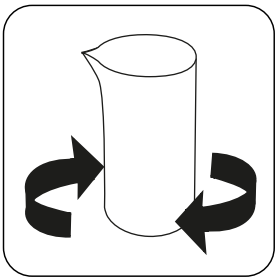
Add **DPD No. 1 tablet** .



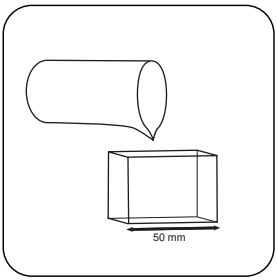
Crush tablet(s) by rotating slightly.



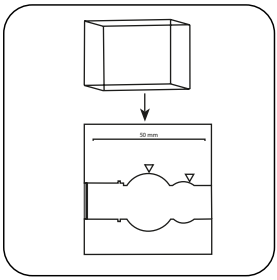
Add **10 ml sample**.



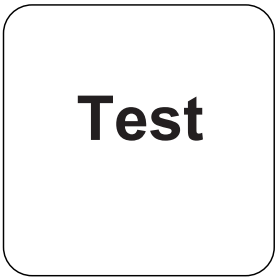
Dissolve tablet(s) by inverting.



Fill 50 mm vial with **sample**.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in mg/l Chlorine Dioxide appears on the display.

Chemical Method

DPD / Glycine

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	□ **50 mm**
a	$1.25575 \cdot 10^{-2}$
b	$3.13095 \cdot 10^{+0}$
c	
d	
e	
f	

Interferences

Persistant Interferences

1. All oxidising agents in the samples lead to higher results.

Removeable Interferences

1. Concentrations above 19 mg/L chlorine dioxide can lead to results within the measuring range of up to 0 mg/L. In this case, the water sample must be diluted with water that is free from chlorine dioxide. 10 ml of the diluted sample should be mixed with the reagent and the measurement taken again (plausibility test).
2. Turbidity: In samples with high Calcium content* (and/or high humidity*, the use of DPD No. 1 Tablet can lead to turbidity of the sample and therefore incorrect measurements. In this case, the alternative reagent tablet DPD No. 1 High Calcium should be used.
   *it is not possible to give exact values, because the development of turbidity depends on the composition and nature of the sample.

Derived from

DIN 38408, Section 5

[e] alternative reagent, used instead of DPD No.1/No.3 in case of turbidity in the water sample caused by high concentration of calcium and/or high conductivity | [f] additionally required for determination of bromine, chlorine dioxide and ozone in the presence of chlorine | [#] including stirring rod, 10 cm

Chlorine dioxide T M120

0.02 - 11 mg/l ClO_2 CLO2

DPD / Glycine

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 110, MD 200, MD 600, MD 610, MD 640, MultiDirect, PM 620, PM 630	ø 24 mm	530 nm	0.02 - 11 mg/l ClO_2
SpectroDirect	ø 24 mm	510 nm	0.05 - 2.5 mg/l ClO_2
XD 7000, XD 7500	ø 24 mm	510 nm	0.02 - 11 mg/l ClO_2

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
DPD No. 1	Tablet / 100	511050BT
DPD No. 1	Tablet / 250	511051BT
DPD No. 1	Tablet / 500	511052BT
DPD No. 3	Tablet / 100	511080BT
DPD No. 3	Tablet / 250	511081BT
DPD No. 3	Tablet / 500	511082BT
Glycine [f)]	Tablet / 100	512170BT
Glycine [f)]	Tablet / 250	512171BT
DPD No. 3 High Calcium [e)]	Tablet / 100	515730BT
DPD No. 3 High Calcium [e)]	Tablet / 250	515731BT
DPD No. 3 High Calcium [e)]	Tablet / 500	515732BT
DPD No. 1 High Calcium [e)]	Tablet / 100	515740BT
DPD No. 1 High Calcium [e)]	Tablet / 250	515741BT
DPD No. 1 High Calcium [e)]	Tablet / 500	515742BT
Set DPD No. 1/No. 3 100 Pc.[#]	100 each	517711BT
Set DPD No. 1/No. 3 250 Pc.[#]	250 each	517712BT
Set DPD No. 1/Glycine 100 Stck. [#]	100 each	517731BT
Set DPD No. 1/Glycine 250 Stck. [#]	250 each	517732BT
Set DPD No. 1/No. 3 High Calcium 100 Pc. [#]	100 each	517781BT
Set DPD No. 1/No. 3 High Calcium 250 Pc. [#]	250 each	517782BT

Application List

- Waste Water Treatment
- Disinfection Control
- Boiler Water
- Cooling Water
- Raw Water Treatment
- Pool Water Control
- Pool Water Treatment
- Drinking Water Treatment

Sampling

1. When preparing the sample, outgassing, e.g. through the pipette or shaking, must be avoided.
2. The analysis must take place immediately after taking the sample.

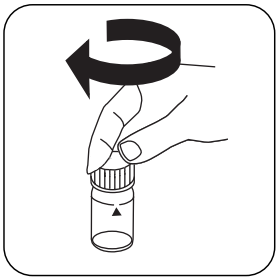
Preparation

1. Cleaning of vials:
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, this can lead to lower results with the determination of Chlorine dioxide. To avoid measurement errors, the glassware used should be free of chlorine consumption. To achieve this, all glassware should be placed in a sodium hypochlorite solution (0.1 g/L) for one hour and then rinsed thoroughly with deionised water.
2. Strong alkaline or acidic water samples must be adjusted between pH 6 and pH 7 before the analysis (use 0.5 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).

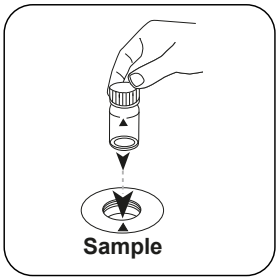
Implementation of the provision Chlorine Dioxide, in absence of chlorine with tablet

Select the method on the device
In addition, choose the test: without Chlorine
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

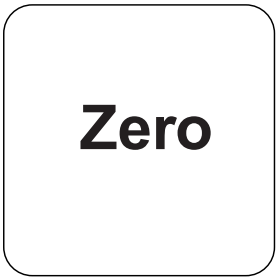
Fill 24 mm vial with **10 ml sample**.



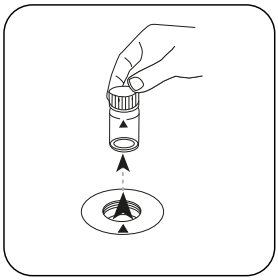
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



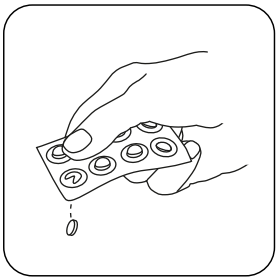
Press the **ZERO** button.



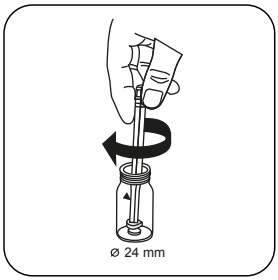
Remove the vial from the sample chamber.

Empty vial except for a few drops.

For devices that require **no ZERO measurement** , **start here**.

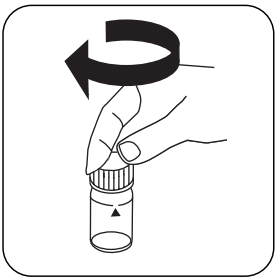


Add **DPD No.1 tablet** .

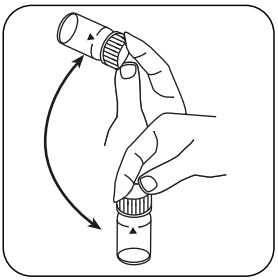


Crush tablet(s) by rotating slightly.

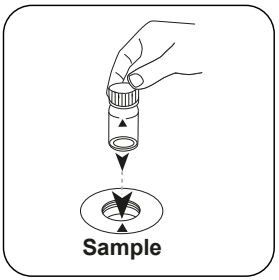
Fill up vial with **sample** to the **10 ml mark**.



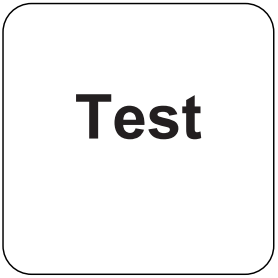
Close vial(s).



Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

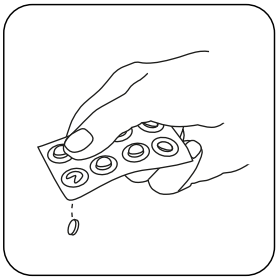


Press the **TEST** (XD: **START**)button.
The result in mg/l Chlorine Dioxide appears on the display.

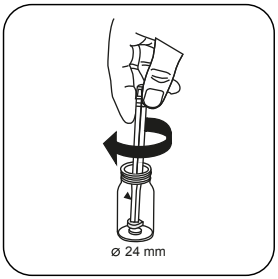
Implementation of the provision Chlorine Dioxide, in presence of chlorine with tablet

Select the method on the device
In addition, choose the test: in presence of Chlorine
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

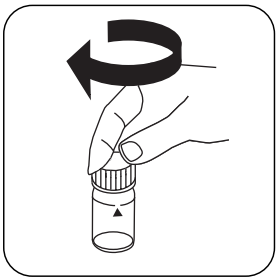
Fill 24 mm vial with **10 ml sample**.



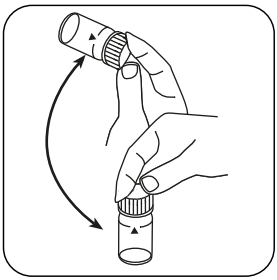
Add **GLYCINE tablet**.



Crush tablet(s) by rotating slightly.

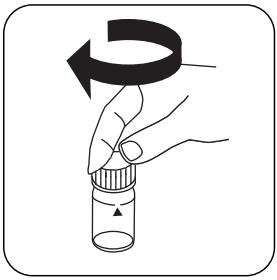


Close vial(s).

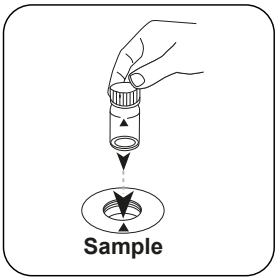


Dissolve tablet(s) by inverting.

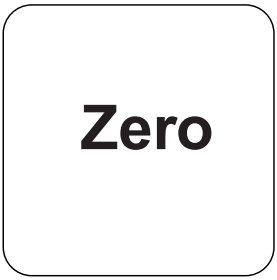
Fill a **second vial** with **10 ml sample** .



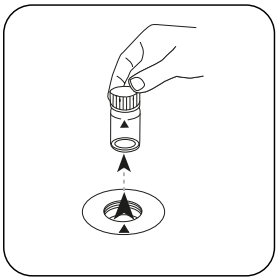
Close vial(s).



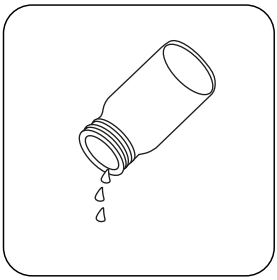
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **ZERO** button.

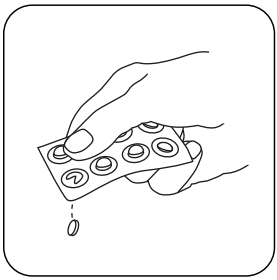


Remove the vial from the sample chamber.

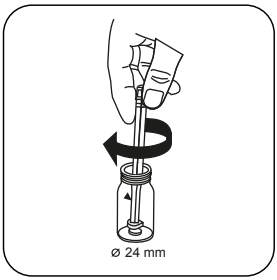


Empty vial.

For devices that require **no ZERO measurement** , **start here**.

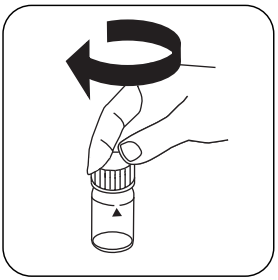


Add **DPD No. 1 tablet** .

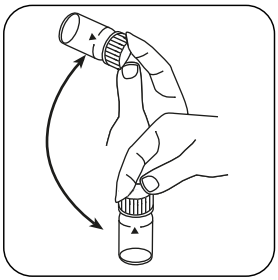


Crush tablet(s) by rotating slightly.

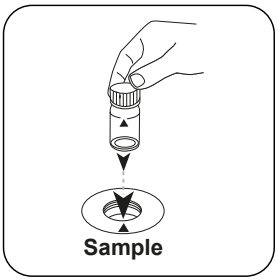
Fill prepared vial with prepared **glycine solution**.



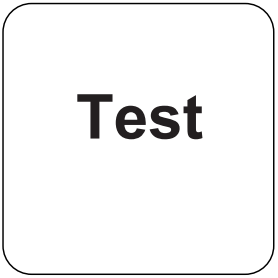
Close vial(s).



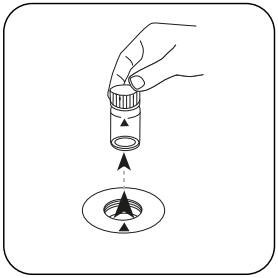
Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

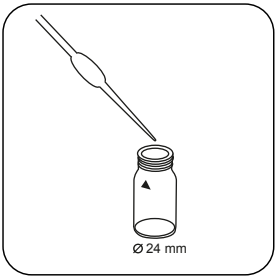


Press the **TEST** (XD: **START**)button.

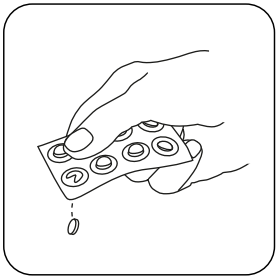


Remove the vial from the sample chamber.

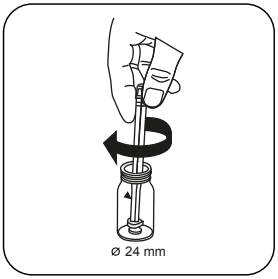
Thoroughly clean the vial and vial cap.



Fill vial with **some drops of** sample.

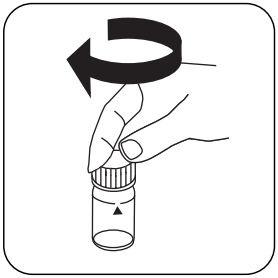


Add **DPD No. 1 tablet** .

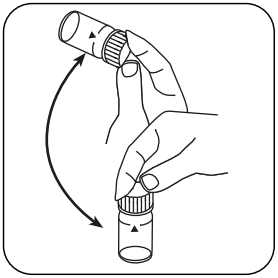


Crush tablet(s) by rotating slightly.

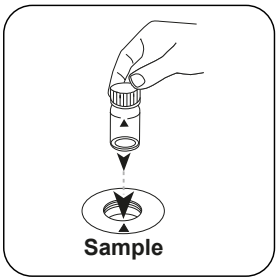
Fill up vial with **sample** to the **10 ml mark**.



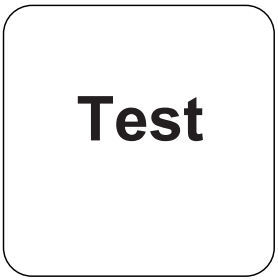
Close vial(s).



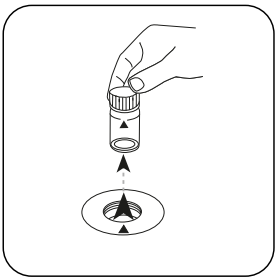
Dissolve tablet(s) by inverting.



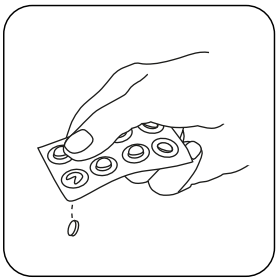
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



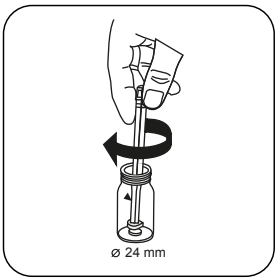
Press the **TEST** (XD: **START**)button.



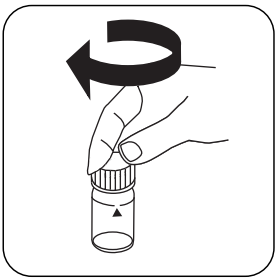
Remove the vial from the sample chamber.



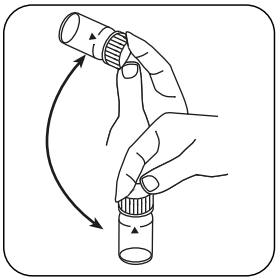
Add **DPD No.3 tablet** .



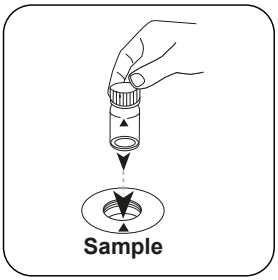
Crush tablet(s) by rotating slightly.



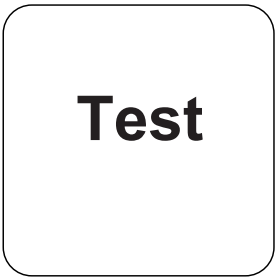
Close vial(s).



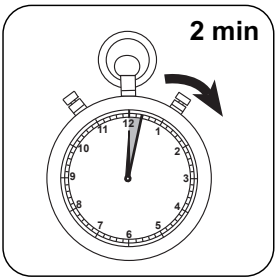
Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **2 minute(s) reaction time**.
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Chlorine Dioxide appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	ClO_2	1
mg/l	Cl_2 frei	0.525
mg/l	Cl_2 geb.	0.525
mg/l	ges. Cl_2	0.525

Chemical Method

DPD / Glycine

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ 10 mm
a	$-8.24762 \cdot 10^{-2}$	$-8.24762 \cdot 10^{-2}$
b	$3.33567 \cdot 10^{+0}$	$7.17169 \cdot 10^{+0}$
c	$-1.16192 \cdot 10^{-1}$	$-5.37098 \cdot 10^{-1}$
d	$1.95263 \cdot 10^{-1}$	$1.9406 \cdot 10^{+0}$
e		
f		

Interferences

Persistant Interferences

1. All oxidising agents in the samples lead to higher results.

Removeable Interferences

1. Concentrations above 19 mg/L chlorine dioxide can lead to results within the measuring range of up to 0 mg/L. In this case, the water sample must be diluted with water that is free from chlorine dioxide. 10 ml of the diluted sample should be mixed with the reagent and the measurement taken again.

Derived from

DIN 38408, Section 5

[e] alternative reagent, used instead of DPD No.1/No.3 in case of turbidity in the water sample caused by high concentration of calcium and/or high conductivity | [f] additionally required for determination of bromine, chlorine dioxide and ozone in the presence of chlorine | * including stirring rod, 10 cm

Chlorine dioxide PP M122

0.04 - 3.8 mg/l ClO_2 CLO2

DPD

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 600, MD 610, MD 640, MultiDirect	ø 24 mm	530 nm	0.04 - 3.8 mg/l ClO_2
XD 7000, XD 7500	ø 24 mm	510 nm	0.04 - 3.8 mg/l ClO_2

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Chlorine Free DPD F10	Powder / 100 pc.	530100
Chlorine Free DPD F10	Powder / 1000 pc.	530103
Glycine [f)]	Tablet / 100	512170BT
Glycine [f)]	Tablet / 250	512171BT
VARIO Glycine Reagent 10 %, 29 ml	29 mL	532210

Application List

- Waste Water Treatment
- Disinfection Control
- Boiler Water
- Cooling Water
- Raw Water Treatment
- Pool Water Control
- Pool Water Treatment
- Drinking Water Treatment

Sampling

1. When preparing the sample, outgassing, e.g. through the pipette or shaking, must be avoided.
2. The analysis must take place immediately after taking the sample.

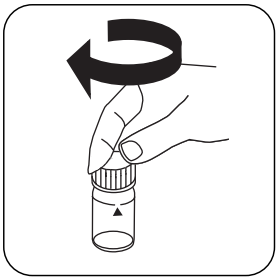
Preparation

1. Cleaning of vials:
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, this can lead to lower results with the determination of Chlorine dioxide. To avoid measurement errors, the glassware used should be free of chlorine consumption. To achieve this, all glassware should be placed in a sodium hypochlorite solution (0.1 g/L) for one hour and then rinsed thoroughly with deionised water.
2. Strong alkaline or acidic water samples must be adjusted between pH 6 and pH 7 before the analysis (use 0.5 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).

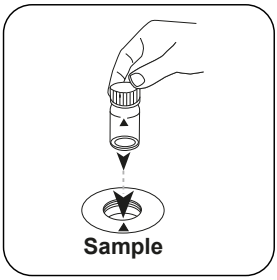
Implementation of the provision Chlorine Dioxide, in absence of chlorine with powder packs

Select the method on the device
In addition, choose the test: without Chlorine
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

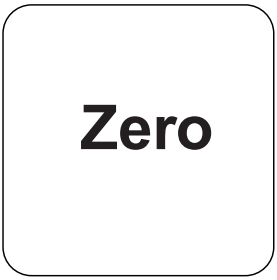
Fill 24 mm vial with **10 ml sample**.



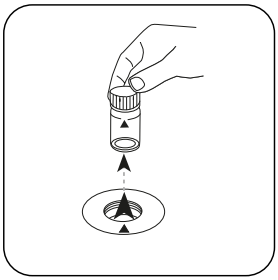
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

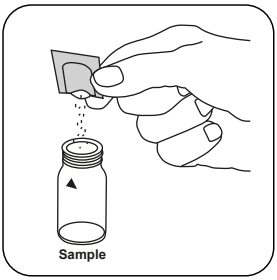


Press the **ZERO** button.

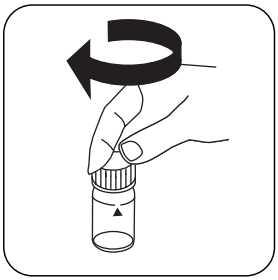


Remove the vial from the sample chamber.

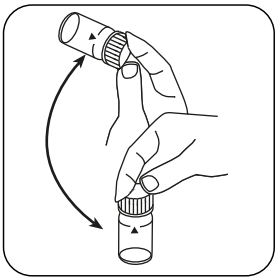
For devices that require **no ZERO measurement** , **start here**.



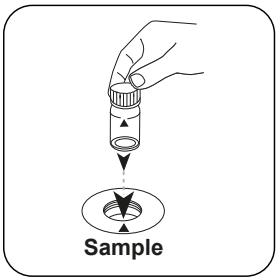
Add **Chlorine FREE-DPD / F10 powder pack**.

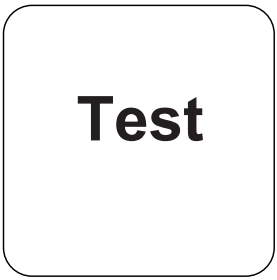


Close vial(s).



Invert several times to mix the contents (20 sec.).





Place **sample vial** in the sample chamber. • Pay attention to the positioning.

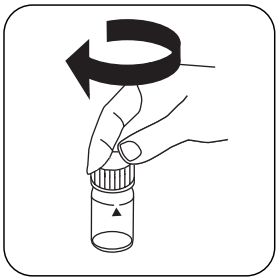
Press the **TEST** (XD: **START**)button.

The result in mg/l Chlorine Dioxide appears on the display.

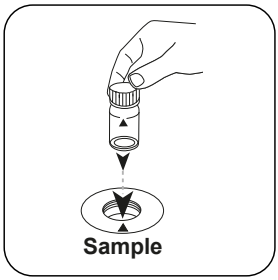
Implementation of the provision Chlorine Dioxide, in presence of chlorine with powder packs

Select the method on the device
In addition, choose the test: in presence of Chlorine
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

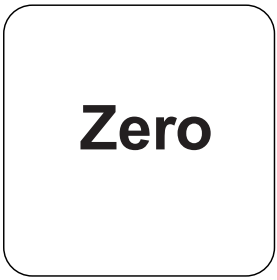
Fill 24 mm vial with **10 ml sample**.



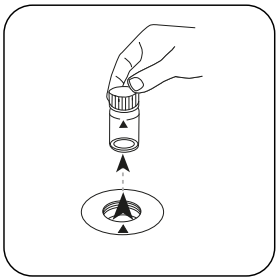
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

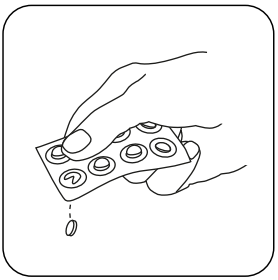


Press the **ZERO** button.

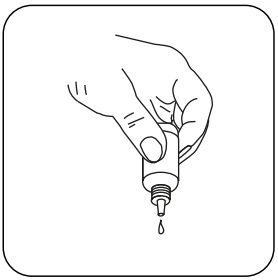


Remove the vial from the sample chamber.

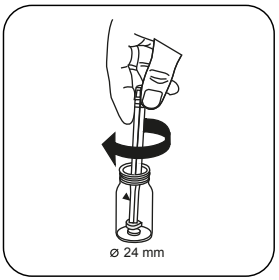
For devices that require **no ZERO measurement** , **start here**.



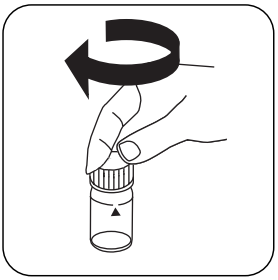
Add **GLYCINE tablet**.



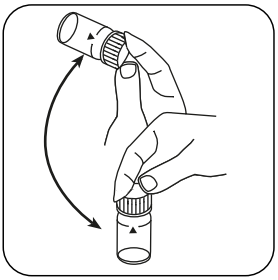
or add 4 drops GLYCINE Reagent.



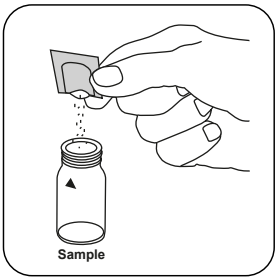
Crush tablet(s) by rotating slightly.



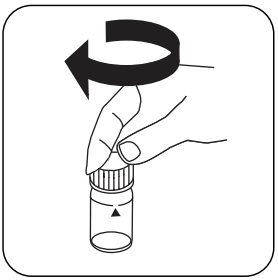
Close vial(s).



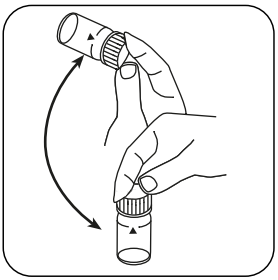
Dissolve tablet(s) by inverting.



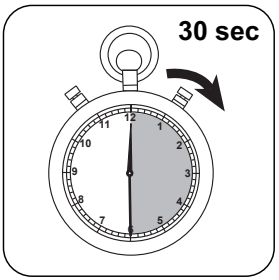
Add **Chlorine-Free-DPD/ F10 powder pack**.



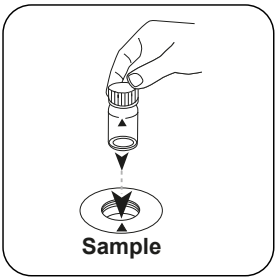
Close vial(s).



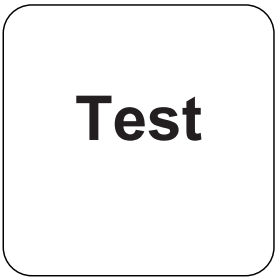
Invert several times to mix the contents (20 sec.).



Wait for **30 second(s) reaction time**.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in mg/l Chlorine Dioxide appears on the display.

Chemical Method

DPD

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^{2} + d•Abs^{3} + e•Abs^{4} + f•Abs^{5}

	ø 24 mm	**□ 10 mm**
a	-5.31232 • 10^{-2}	-5.31232 • 10^{-2}
b	3.27999 • 10^{+0}	7.05198 • 10^{+0}
c	2.13647 • 10^{-1}	9.87583 • 10^{-1}
d		
e		
f		

Interferences

Persistant Interferences

1. All oxidising agents in the samples lead to higher results.

Removeable Interferences

1. Concentrations above 3.8 mg/L chlorine dioxide can lead to results within the measuring range of up to 0 mg/L. In this case, the water sample must be diluted with water that is free from chlorine dioxide. 10 ml of the diluted sample should be mixed with the reagent and the measurement taken again (plausibility test).

Derived from

DIN 38408, Section 5

[f] additionally required for determination of bromine, chlorine dioxide and ozone in the presence of chlorine

Chromium 50 PP M124

0.005 - 0.5 mg/L Cr[b)]

Diphenylcarbazide

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	□ 50 mm	542 nm	0.005 - 0.5 mg/L Cr[b)]

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Persulfat Reagent für CR	Powder / 100 pc.	537300
Chromium Hexavalent	Powder / 100 pc.	537310

The following accessories are required.

Accessories	Packaging Unit	Part Number
Thermoreactor RD 125	1 pc.	2418940

Application List

- Waste Water Treatment
- Raw Water Treatment
- Galvanization
- Drinking Water Treatment

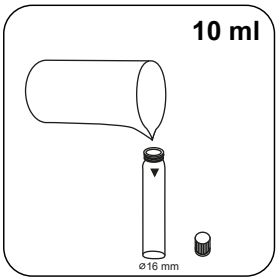
Preparation

1. The pH value of the sample should be between 3 and 9.

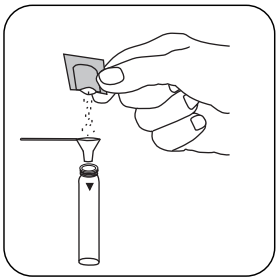
Notes

1. Implementation of the first part determines concentration of total chromium. In the second part, the concentration of Chromium (VI) is measured. The concentration of Chromium (III) is the result of the difference.

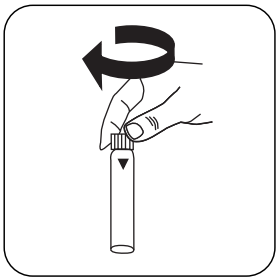
Digestion Chromium with powder packs



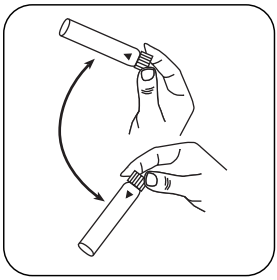
Fill 16 mm vial with **10 ml sample**.



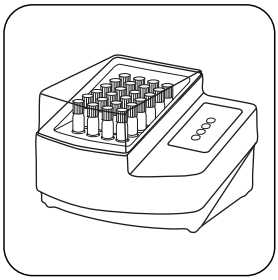
Add **PERSULFT.RGT FOR CR powder pack**.



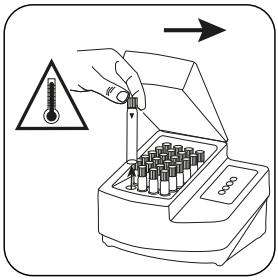
Close vial(s).



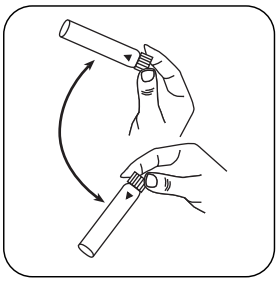
Invert several times to mix the contents.



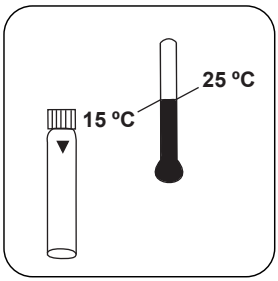
Seal the vials in the pre-heated thermoreactor for **120 minutes at 100 °C** .



Remove the vial from the thermoreactor. **(Note: vial will be hot!)**



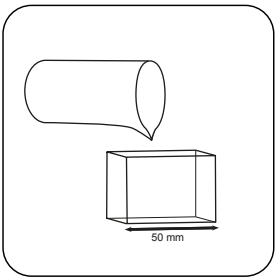
Invert several times to mix the contents.



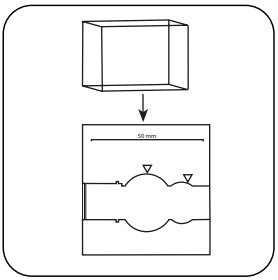
Allow the vial(s) to cool to room temperature.

Implementation of the provision Chromium(VI) with powder packs

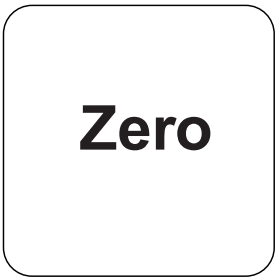
Select the method on the device
In addition, choose the test: Cr(VI)
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



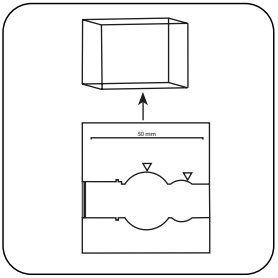
Fill 50 mm vial with **sample**.



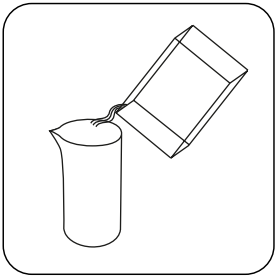
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



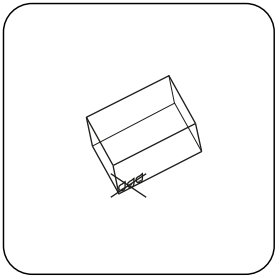
Press the **ZERO** button.



Remove **vial** from the sample chamber.

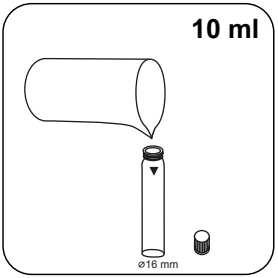


Empty vial.

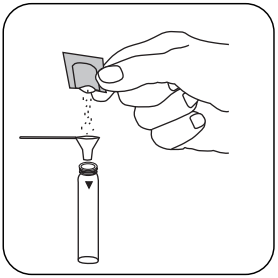


Dry the vial thoroughly.

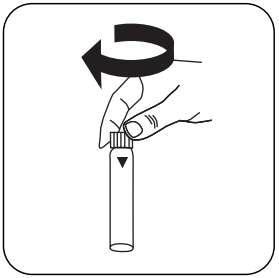
For devices that require **no ZERO measurement** , **start here**.



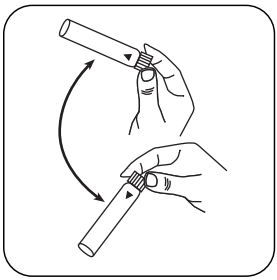
Fill 16 mm vial with **10 ml sample**.



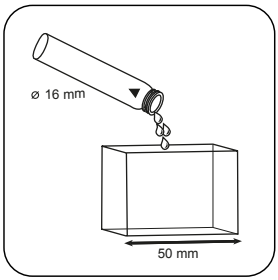
Add **CHROMIUM HEXA-VALENT powder pack**.



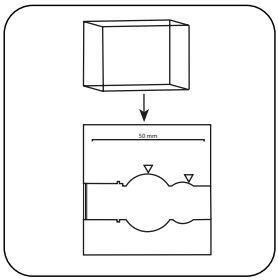
Close vial(s).



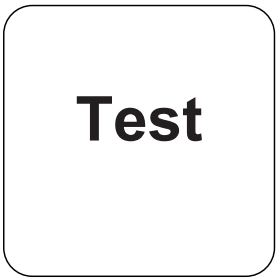
Invert several times to mix the contents.



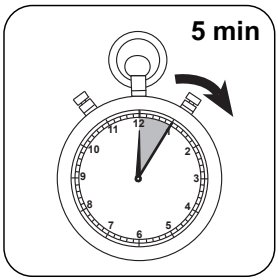
Fill 50 mm vial with prepared sample.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

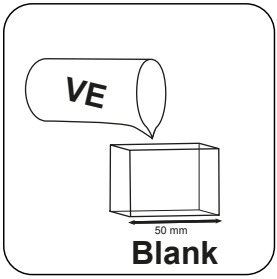


Wait for **5 minute(s) reaction time**.

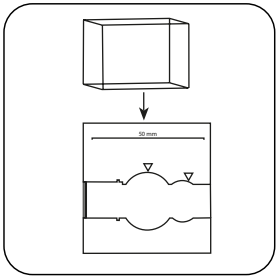
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Cr(VI) appears on the display.

Implementation of the provision Chromium, total (Cr(III) + Cr(VI)) with powder packs

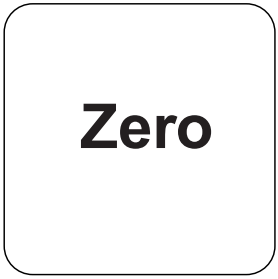
Select the method on the device
In addition, choose the test: Cr(III + VI)
For testing of **Chromium, total (Cr(III) + Cr(VI),** carry out the described **digestion**.
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



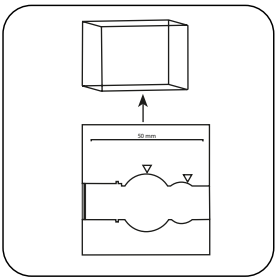
Fill **50 mm vial** with **deionised water** .



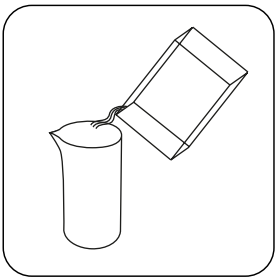
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



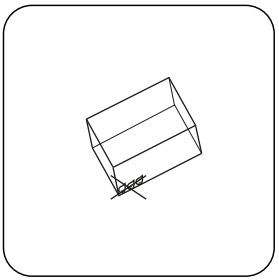
Press the **ZERO** button.



Remove **vial** from the sample chamber.

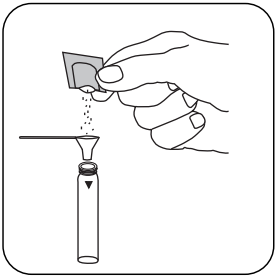


Empty vial.

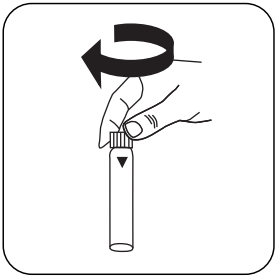


Dry the vial thoroughly.

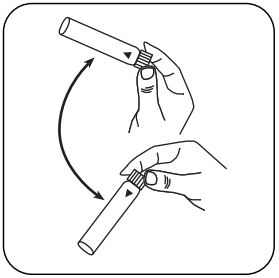
For devices that require **no ZERO measurement** , **start here**.



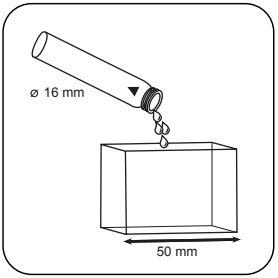
Place **Chromium HEXA-VALENT powder packs** in the digestion vial.



Close vial(s).

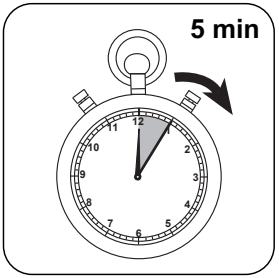


Invert several times to mix the contents.



Fill 50 mm vial with prepared sample.

Press the **TEST** (XD: **START**)button.

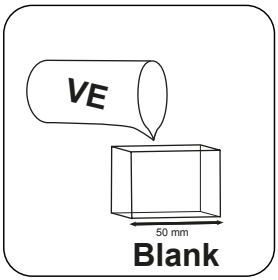


Wait for **5 minute(s) reaction time**.

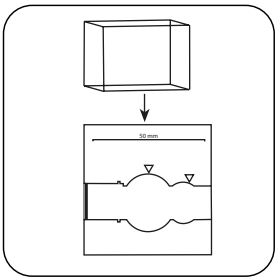
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l total Chromium appears on the display.

Implementation of the provision Chromium, differentiated, with powder packs

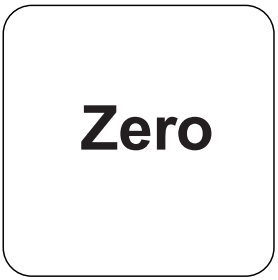
Select the method on the device
In addition, choose the test: differentiated
For testing of **Chromium, differentiated,** carry out the described **digestion**.
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



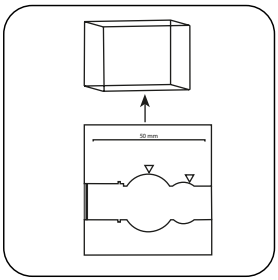
Fill **50 mm vial** with **deionised water** .



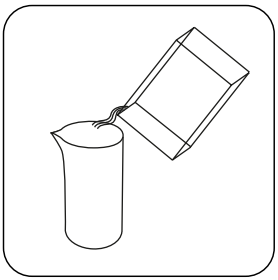
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



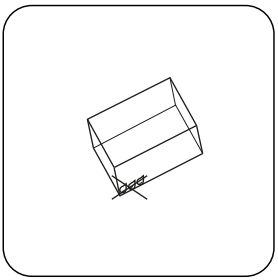
Press the **ZERO** button.



Remove **vial** from the sample chamber.

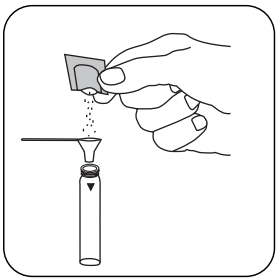


Empty vial.

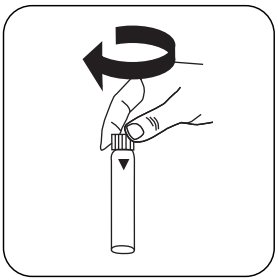


Dry the vial thoroughly.

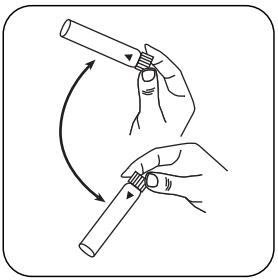
For devices that require **no ZERO measurement** , **start here**.



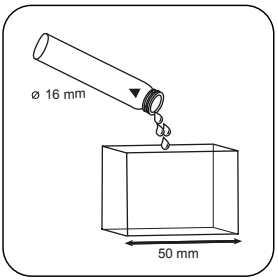
Place **Chromium HEXA-VALENT powder packs** in the digestion vial.



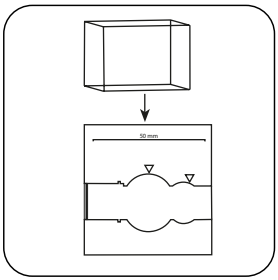
Close vial(s).



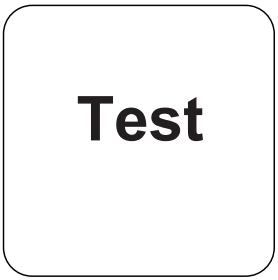
Invert several times to mix the contents.



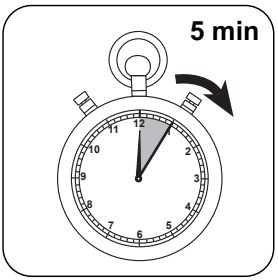
Fill 50 mm vial with prepared sample.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

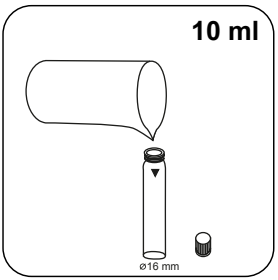


Press the **TEST** (XD: **START**)button.

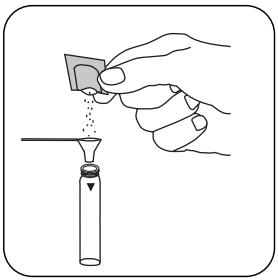


Wait for **5 minute(s) reaction time**.

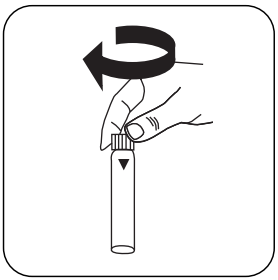
Once the reaction period is finished, the measurement takes place automatically.



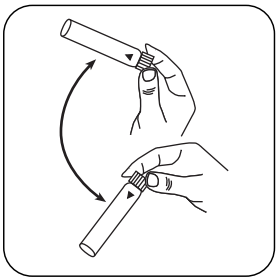
Fill a **second vial** with **10 ml sample** .



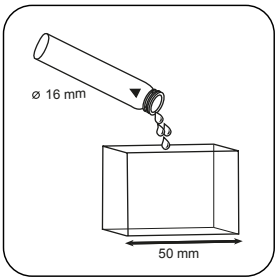
Add **CHROMIUM HEXAVALENT powder pack**.



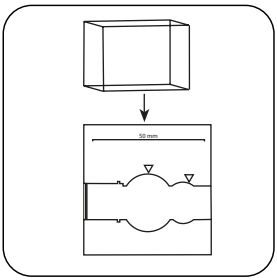
Close vial(s).



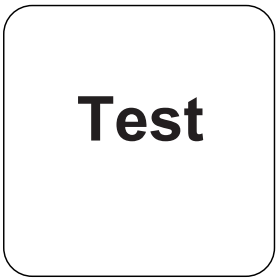
Invert several times to mix the contents.



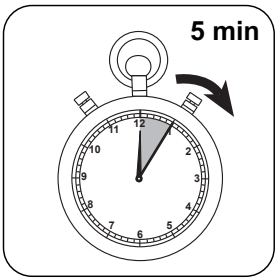
Fill 50 mm vial with prepared sample.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **5 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Cr(VI); mg/l Cr(III); mg/l Cr Total Chromium appears on the display.

Chemical Method

Diphenylcarbazide

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	□ **50 mm**
a	-6.54461 • 10^{+0}
b	2.44266 • 10^{+2}
c	6.29996 • 10^{+0}
d	
e	
f	

Interferences

Persistant Interferences

1. For information about interferences through metals and reductive or oxidizing agents, especially in strongly polluted water, see DIN 38 405 – D 24 and Standard Methods of Water and Wastewater, 20th Edition; 1998.

Derived from

DIN 18412
US EPA 218.6

[b] Reactor is necessary for COD (150 °C), TOC (120 °C) and total -chromium, - phosphate, -nitrogen, (100 °C)

Chromium PP M125

0.02 - 2 mg/L Cr[b)]

Diphenylcarbazide

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect	ø 16 mm	530 nm	0.02 - 2 mg/L Cr[b)]
SpectroDirect, XD 7000, XD 7500	ø 16 mm	542 nm	0.02 - 2 mg/L Cr[b)]

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Persulfat Reagent für CR	Powder / 100 pc.	537300
Chromium Hexavalent	Powder / 100 pc.	537310

The following accessories are required.

Accessories	Packaging Unit	Part Number
Thermoreactor RD 125	1 pc.	2418940

Application List

- Waste Water Treatment
- Raw Water Treatment
- Galvanization
- Drinking Water Treatment

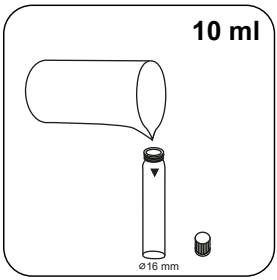
Preparation

1. The pH value of the sample should be between 3 and 9.

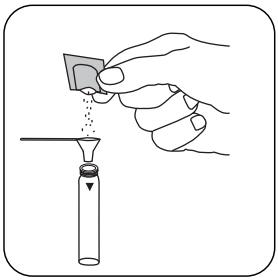
Notes

1. Implementation of the first part determines concentration of total chromium. In the second part, the concentration of Chromium (VI) is measured. The concentration of Chromium (III) is the result of the difference.

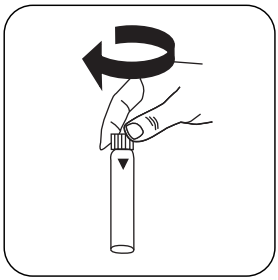
Digestion Chromium with powder packs



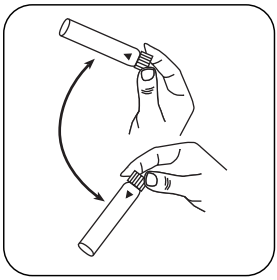
Fill 16 mm vial with **10 ml sample**.



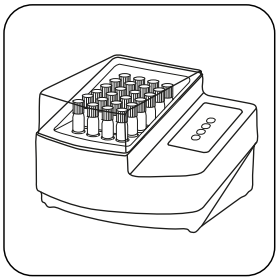
Add **PERSULFT.RGT FOR CR powder pack**.



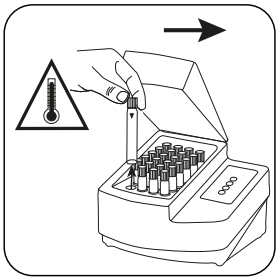
Close vial(s).



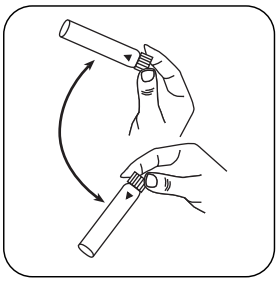
Invert several times to mix the contents.



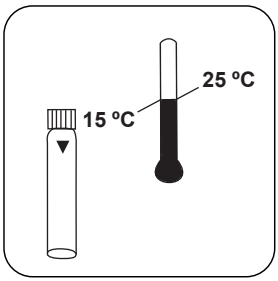
Seal the vials in the pre-heated thermoreactor for **120 minutes at 100 °C** .



Remove the vial from the thermoreactor. **(Note: vial will be hot!)**



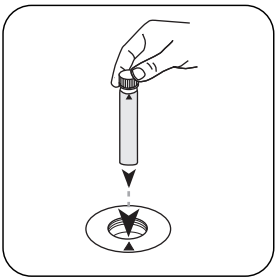
Invert several times to mix the contents.



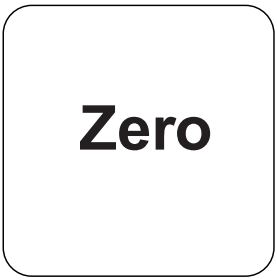
Allow the vial(s) to cool to room temperature.

Implementation of the provision Chromium differentiated, with powder packs

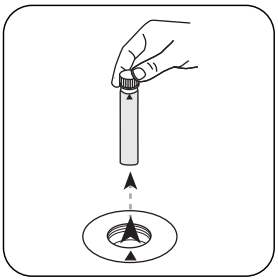
Select the method on the device
In addition, choose the test: differentiated
For testing of **Chromium, differentiated,** carry out the described **digestion**.
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



Place pre-treated vial in the sample chamber. • Pay attention to the positioning.

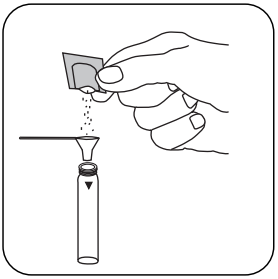


Press the **ZERO** button.

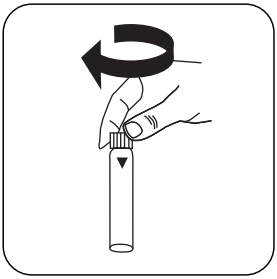


Remove **vial** from the sample chamber.

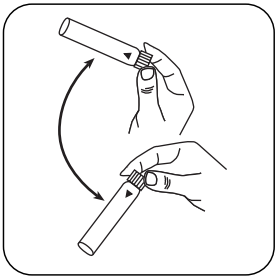
For devices that require **no ZERO measurement** , **start here**.



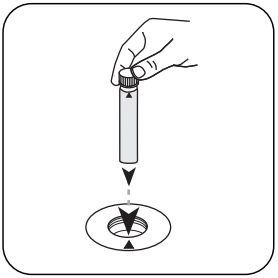
Add **CHROMIUM HEXA-VALENT powder pack**.



Close vial(s).

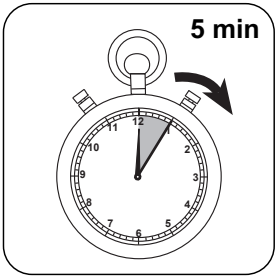


Invert several times to mix the contents.



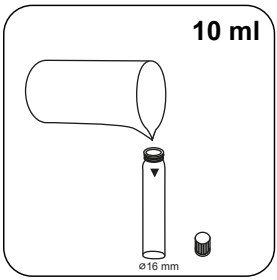
Place **sample vial** in the sample chamber. • Pay attention to the positioning.

Press the **TEST** (XD: **START**)button.

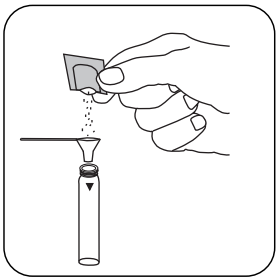


Wait for **5 minute(s) reaction time**.

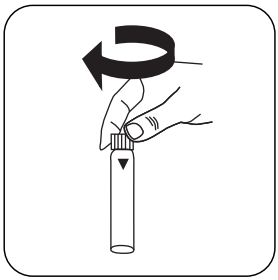
Once the reaction period is finished, the measurement takes place automatically.



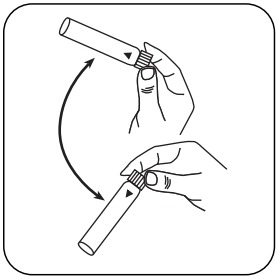
Fill a **second vial** with **10 ml sample** .



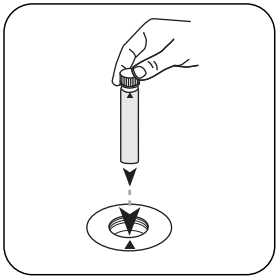
Add **CHROMIUM HEXA-VALENT powder pack**.



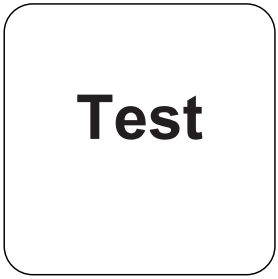
Close vial(s).



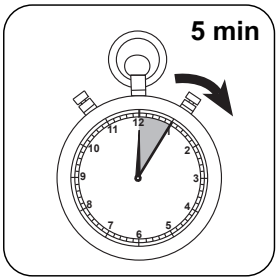
Invert several times to mix the contents.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

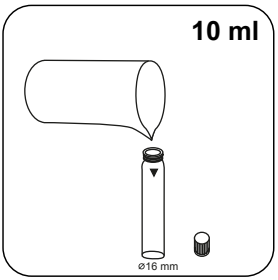


Wait for **5 minute(s) reaction time**.

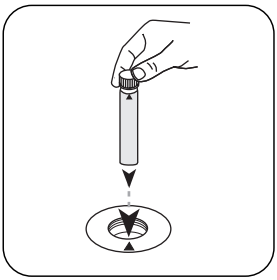
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Cr(VI); Cr(III); Cr Total Chromium appears on the display.

Implementation of the provision Chromium(VI), with powder packs

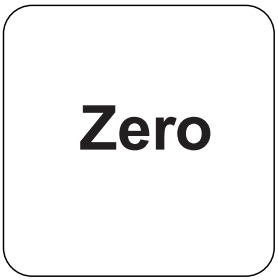
Select the method on the device
In addition, choose the test: Cr(VI)
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



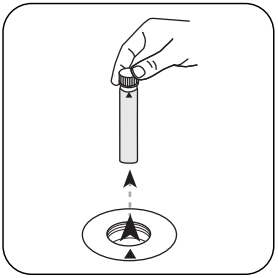
Fill 16 mm vial with **10 ml sample**.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

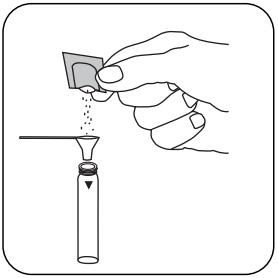


Press the **ZERO** button.

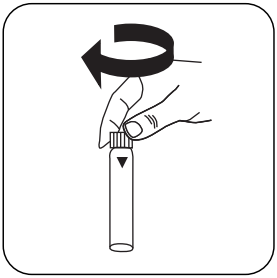


Remove **vial** from the sample chamber.

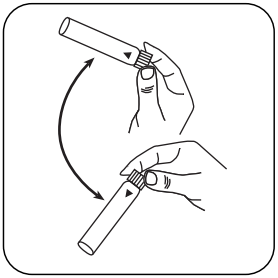
For devices that require **no ZERO measurement** , **start here**.



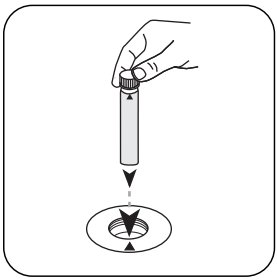
Add **CHROMIUM HEXA-VALENT powder pack**.



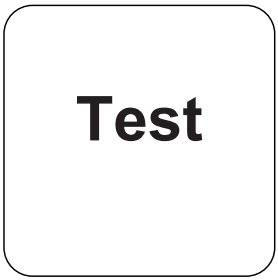
Close vial(s).



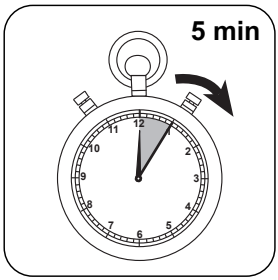
Invert several times to mix the contents.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

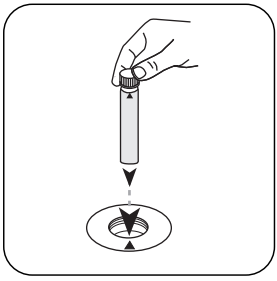


Wait for **5 minute(s) reaction time**.

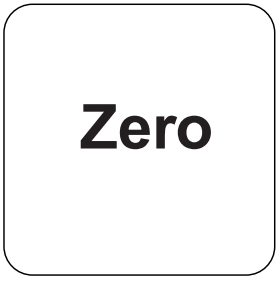
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Cr(VI) appears on the display.

Implementation of the provision Chromium total (Cr(III) + Cr(VI)), with powder packs

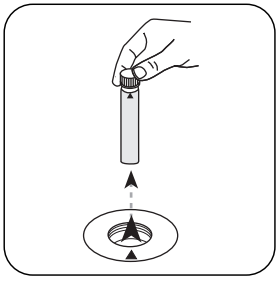
Select the method on the device
In addition, choose the test: Cr(III + VI)
For testing of **Chromium, total (Cr(III)+ Cr(VI)),** carry out the described **digestion**.
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



Place pre-treated vial in the sample chamber. • Pay attention to the positioning.

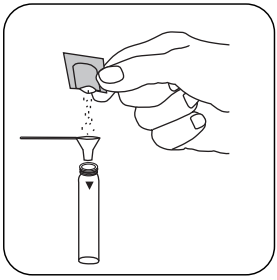


Press the **ZERO** button.

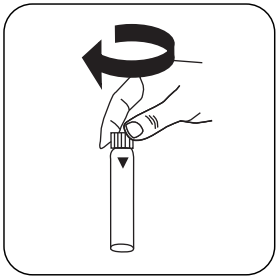


Remove **vial** from the sample chamber.

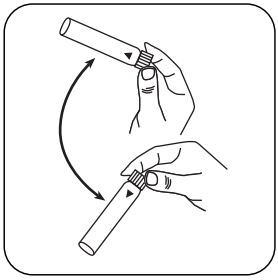
For devices that require **no ZERO measurement** , **start here**.



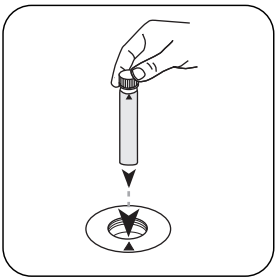
Add **CHROMIUM HEXAVALENT powder pack**.



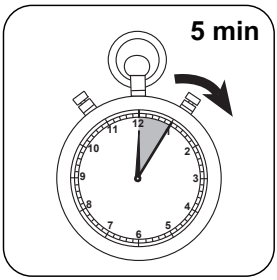
Close vial(s).



Invert several times to mix the contents.



Test



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

Press the **TEST** (XD: **START**)button.

Wait for **5 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l total Chromium appears on the display.

Chemical Method

Diphenylcarbazide

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 16 mm
a	-2.66512 • 10^{-2}
b	8.73906 • 10^{-1}
c	9.34973 • 10^{-2}
d	
e	
f	

Interferences

Persistant Interferences

1. For information about interferences through metals and reductive or oxidizing agents, especially in strongly polluted water, see DIN 38 405 – D 24 and Standard Methods of Water and Wastewater, 20th Edition; 1998.

According to

DIN 3805 - D24

Derived from

DIN 18412
US EPA 218.6

[b] Reactor is necessary for COD (150 °C), TOC (120 °C) and total -chromium, - phosphate, -nitrogen, (100 °C)

COD LR TT M130

3 - 150 mg/L COD[b)] Lr

Dichromate / H_2SO_4

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 110, MD 200, MD 600, MD 610, MD 640, MultiDirect	ø 16 mm	430 nm	3 - 150 mg/L COD[b)]
SpectroDirect, XD 7000, XD 7500	ø 16 mm	443 nm	3 - 150 mg/L COD[b)]

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
COD LR/25	25 pc.	2420720
COD LR/25, mercury free	25 pc.	2420710
COD LR/150	150 pc.	2420725

The following accessories are required.

Accessories	Packaging Unit	Part Number
Thermoreactor RD 125	1 pc.	2418940

Application List

- Raw Water Treatment
- Waste Water Treatment

Notes

1. The blank is stable when stored in the dark.
2. Blanks and test vials must be from the same batch.
3. Do not place hot vials in the sample chamber. The most stable measured values can be determined if the vials are left standing overnight.

Removal of high Chloride concentration in COD samples

Chloride content may interfere during COD determination, if the tolerance level of the used test will be exceeded. To overcome that problem the following sample pretreatment can be used:

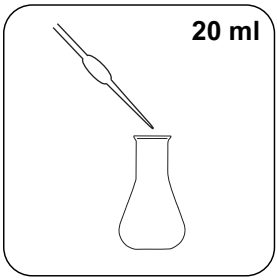
Equipment:

- 2 Erlenmeyer flasks 300 ml with NS 29/32 connection
- 2 HCl absorber according to DIN 38409
- 2 glass stoppers NS 29/32
- Pipettes for volumes of 20 and 25ml
- Magnetic stirrer and magnetic stirring rods
- Thermometer to measure 0 - 100 °C
- Ice bath

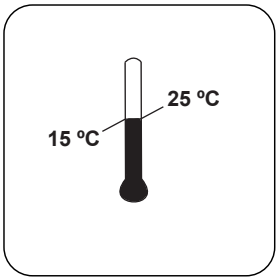
Reagents:

- 12 to 14 g of sodalime
- 50 ml H_2SO_4 (95 - 97%, 1.84 g/ml, CSB free)
- Hydrochloric acid 10 % to clean absorber from residual lime

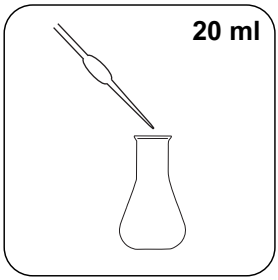
The work must be carried out under a fume hood!



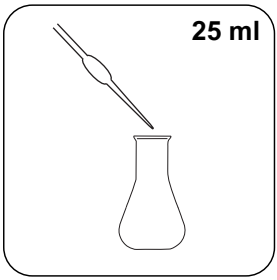
Put **20 ml homogenised sample** in the erlenmeyer flask.



Add the magnetic stirring rod, and cool in the ice bath.

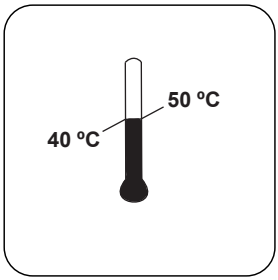


Put **20 ml deionized water** in the second erlenmeyer flask.

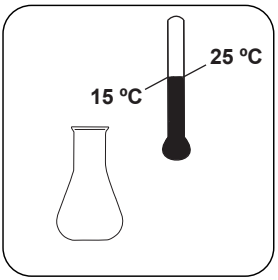


Add slowly **25 ml concentrated Sulfuric acid** each under cooling and stirring.

Sample will be hot!

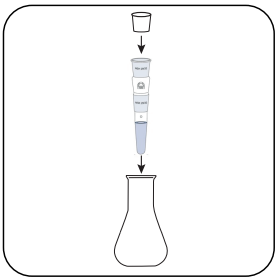


Temperature should not exceed 40 to 50 °C.

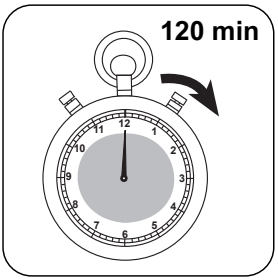


After the complete addition of the sulfuric acid, cool to room temperature in the ice bath.

Add **6 - 7 g soda lime powder** into the absorption tubes.



Close the absorption tubes with a plug and fit onto the Erlenmeyer flasks.



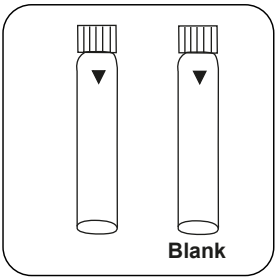
Stir at about 250 rpm for **120 minutes** at room temperature (a turbidity may be formed).

This sample is used for the analysis of COD. Due to this pretreatment procedure the original sample has been diluted by a factor of 2.05.

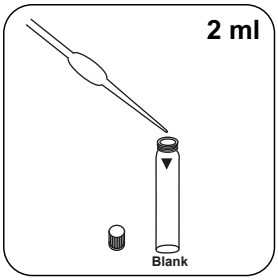
$CSB_{sample} = CSB_{display} \times 2.05$

Implementation of the provision COD LR with Vario Vial Test

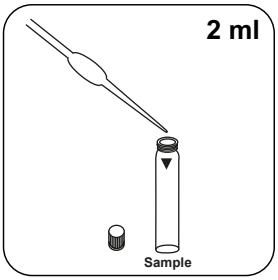
Select the method on the device



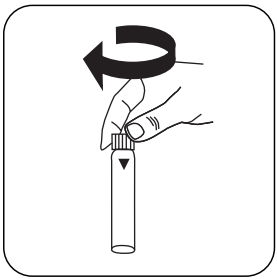
Prepare two **reaction vials**. Mark one as a blank.



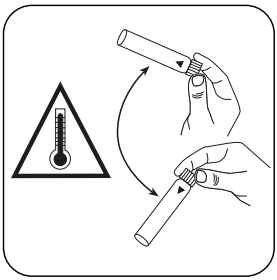
Put **2 ml deionised water** in the blank.



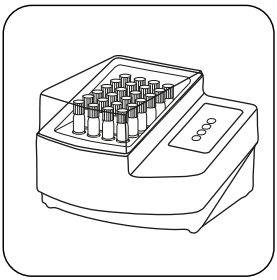
Put **2 ml sample** in the sample vial.



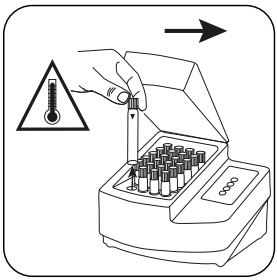
Close vial(s).



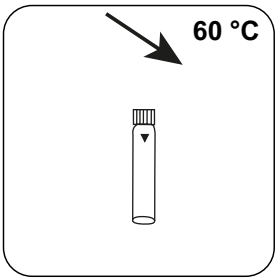
Carefully invert several times to mix the contents. **Note: Will get hot!**



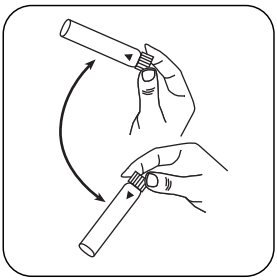
Seal the vials in the pre-heated thermoreactor for **120 minutes at 150 °C** .



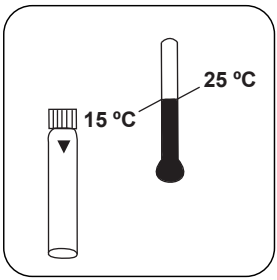
Remove the vial from the thermoreactor. **(Note: vial will be hot!)**



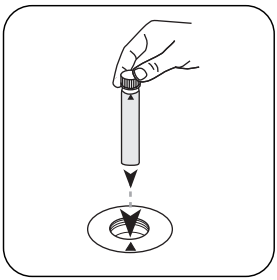
Allow vial(s) to cool to 60 °C.



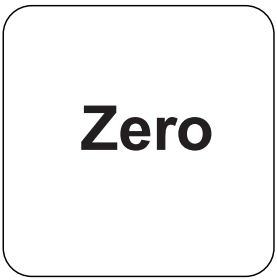
Invert several times to mix the contents.



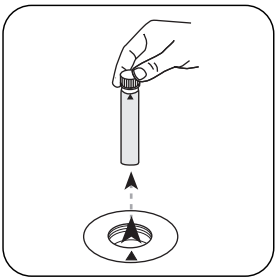
Allow the vial to cool to room temperature and then measure.



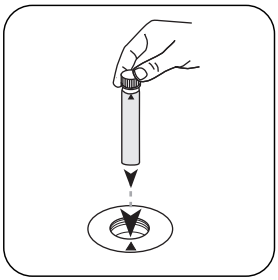
Place **blank** in the sample chamber. • Pay attention to the positioning.



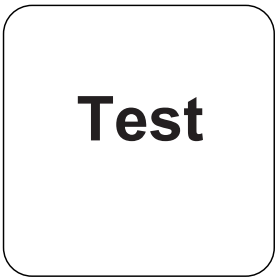
Press the **ZERO** button.



Remove **vial** from the sample chamber.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in mg/l COD appears on the display.

Chemical Method

Dichromate / H_2SO_4

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 16 mm
a	2.16352 • 10^{+2}
b	-2.71531 • 10^{+2}
c	
d	
e	
f	

Interferences

Persistant Interferences

- In exceptional cases, contents, for which the oxidation capacity of the reagent is not sufficient, can lead to lower results.

Removeable Interferences

- Suspended solids in the vial can lead to incorrect measurements and so to avoid this, it is important to place the vials carefully in the sample chamber as the method necessitates a build-up of precipitate at the bottom of the vial.
- The outer walls of the vial must be clean and dry before the analysis is carried out. Fingerprints or water droplets on the vial lead to incorrect measurements.
- In the standard version, chloride interferes from a concentration of 1000 mg/L. In the mercury-free version, the disturbance depends on the chloride concentration and the COD. Concentrations from 100 mg/L chloride can lead to significant disturbances here.

Method Validation

Limit of Detection	3.2 mg/L
Limit of Quantification	9.7 mg/L
End of Measuring Range	150 mg/L
Sensitivity	-272 mg/L / Abs
Confidence Intervall	3.74 mg/L
Standard Deviation	1.55 mg/L
Variation Coefficient	2.02 %

Conformity

ISO 15705:2002

According to

ISO 15705:2002
DIN 38409 part 41

[b] Reactor is necessary for COD (150 °C), TOC (120 °C) and total -chromium, - phosphate, -nitrogen, (100 °C)

COD MR TT M131

20 - 1500 mg/L COD[b] Mr

Dichromate / H_2SO_4

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 110, MD 200, MD 600, MD 610, MD 640, MultiDirect	ø 16 mm	610 nm	20 - 1500 mg/L COD[b]
SpectroDirect, XD 7000, XD 7500	ø 16 mm	596 nm	20 - 1500 mg/L COD[b]

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
COD MR/25	25 pc.	2420721
COD MR/25, mercury free	25 pc.	2420711
COD MR/150	150 pc.	2420726
COD MR/150, mercury free	150 pc.	2420716

The following accessories are required.

Accessories	Packaging Unit	Part Number
Thermoreactor RD 125	1 pc.	2418940

Application List

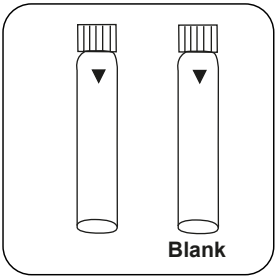
- Raw Water Treatment
- Waste Water Treatment

Notes

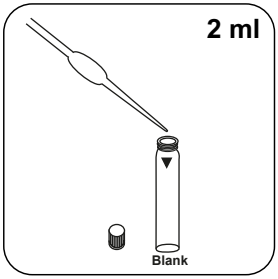
1. The blank is stable when stored in the dark. Blanks and test vials must be from the same batch.
2. Do not place hot vials in the sample chamber. The most stable measured values can be determined if the vials are left standing overnight.
3. For samples under 100 mg/L COD it is recommended to to use the tube test COD LR if a higher degree of accuracy is required.

Implementation of the provision COD MR with Vario Vial Test

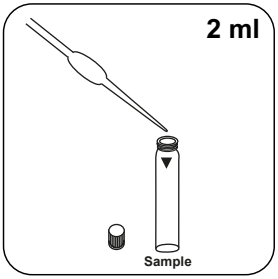
Select the method on the device



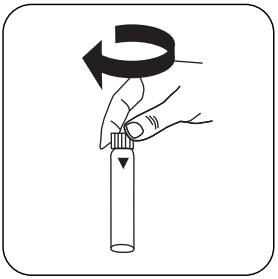
Prepare two **reaction vials**. Mark one as a blank.



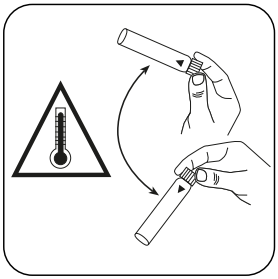
Put **2 ml deionised water** in the blank.



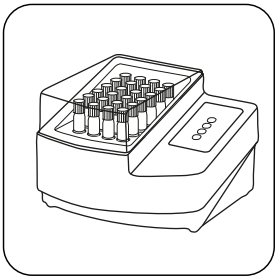
Put **2 ml sample** in the sample vial.



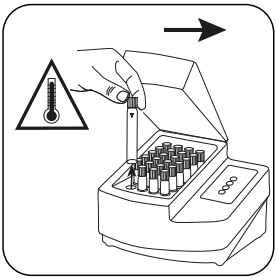
Close vial(s).



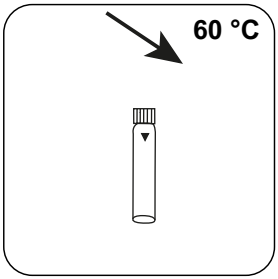
Carefully invert several times to mix the contents. **Note: Will get hot!**



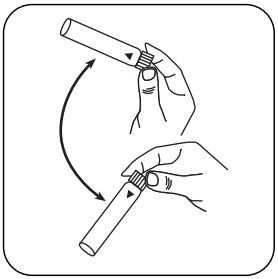
Seal the vials in the pre-heated thermoreactor for **120 minutes at 150 °C** .



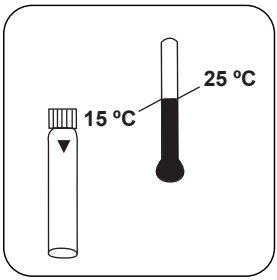
Remove the vial from the thermoreactor. **(Note: vial will be hot!)**



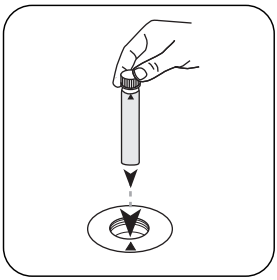
Allow vial(s) to cool to 60 °C.



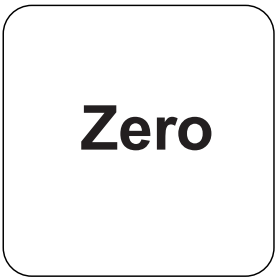
Invert several times to mix the contents.



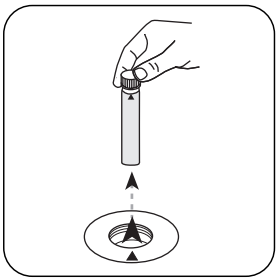
Allow the vial to cool to room temperature and then measure.



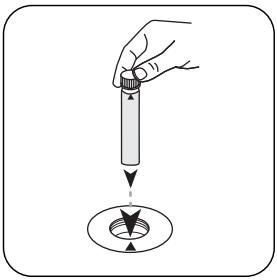
Place **blank** in the sample chamber. • Pay attention to the positioning.



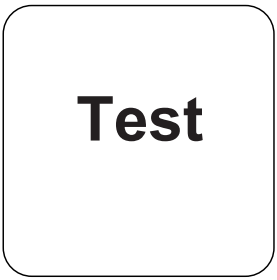
Press the **ZERO** button.



Remove **vial** from the sample chamber.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in mg/l COD appears on the display.

Chemical Method

Dichromate / H_2SO_4

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 16 mm
a	-1.04251 • 10^{+1}
b	2.09975 • 10^{+3}
c	
d	
e	
f	

Interferences

Persistant Interferences

- In exceptional cases, contents, for which the oxidation capacity of the reagent is not sufficient, can lead to lower results.

Removeable Interferences

- Suspended solids in the vial can lead to incorrect measurements and so to avoid this, it is important to place the vials carefully in the sample chamber as the method necessitates a build-up of precipitate at the bottom of the vial.
- The outer walls of the vial must be clean and dry before the analysis is carried out. Fingerprints or water droplets on the vial lead to incorrect measurements.
- In the standard version, chloride interferes from a concentration of 1000 mg/L. In the mercury-free version, the disturbance depends on the chloride concentration and the COD. Concentrations from 100 mg/L chloride can lead to significant disturbances here. To remove high chloride concentrations in COD samples, see method M130 COD LR TT.

Method Validation

Limit of Detection	8.66 mg/L
Limit of Quantification	25.98 mg/L
End of Measuring Range	1500 mg/L
Sensitivity	2,141 mg/L / Abs
Confidence Intervall	18.82 mg/L
Standard Deviation	7.78 mg/L
Variation Coefficient	1.04 %

Conformity

ISO 15705:2002

According to

ISO 15705:2002
DIN 38409 part 43

[b] Reactor is necessary for COD (150 °C), TOC (120 °C) and total -chromium, - phosphate, -nitrogen, (100 °C)

COD HR TT M132

200 - 15000 mg/L COD[b)] Hr

Dichromate / H_2SO_4

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 110, MD 200, MD 600, MD 610, MD 640, MultiDirect, SpectroDirect	ø 16 mm	610 nm	200 - 15000 mg/L COD[b)]
SpectroDirect, XD 7000, XD 7500	ø 16 mm	602 nm	200 - 15000 mg/L COD[b)]

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
COD HR/25	25 pc.	2420722
COD HR/25, mercury free	25 pc.	2420712
COD HR/150	150 pc.	2420727

The following accessories are required.

Accessories	Packaging Unit	Part Number
Thermoreactor RD 125	1 pc.	2418940

Application List

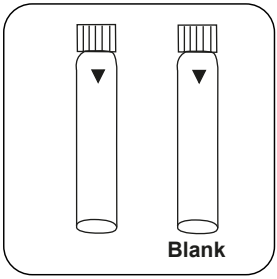
- Raw Water Treatment
- Waste Water Treatment

Notes

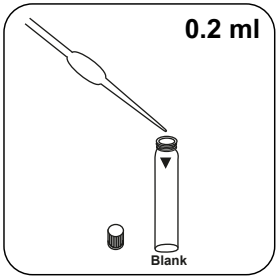
1. The blank is stable when stored in the dark. Blanks and test vials must be from the same batch.
2. Do not place hot vials in the sample chamber. The most stable measured values can be determined if the vials are left standing overnight.
3. For samples under 1 g/L COD it is recommended to repeat the test with the test kit for COD MR or for samples under 0.1 g/L COD to use the tube test COD LR if a higher degree of accuracy is required.

Implementation of the provision CSB HR with Vario Vial Test

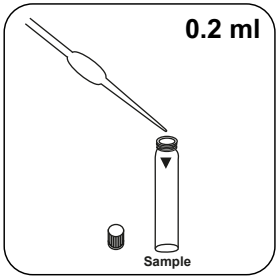
Select the method on the device



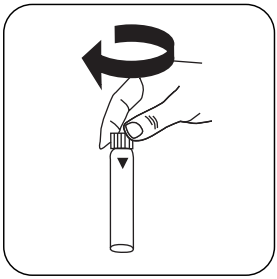
Prepare two **reaction vials**. Mark one as a blank.



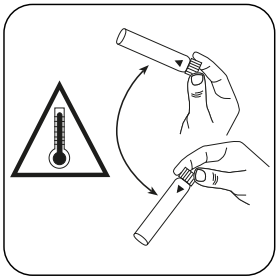
Put **0.2 ml deionised water** in the blank.



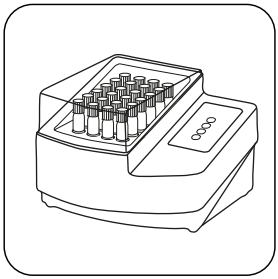
Put **0.2 ml sample** in the sample vial.



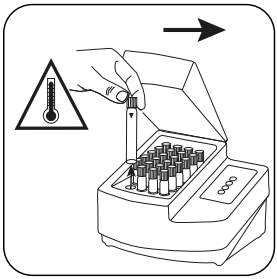
Close vial(s).



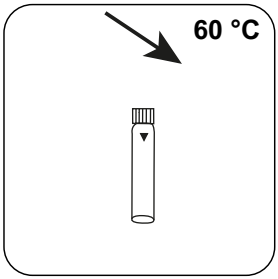
Carefully invert several times to mix the contents. **Note: Will get hot!**



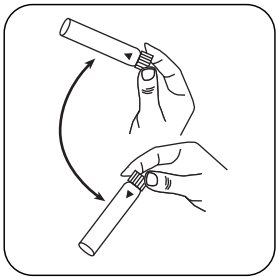
Seal the vials in the pre-heated thermoreactor for **120 minutes at 150 °C** .



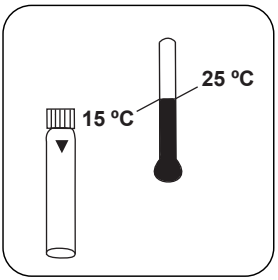
Remove the vial from the thermoreactor. **(Note: vial will be hot!)**



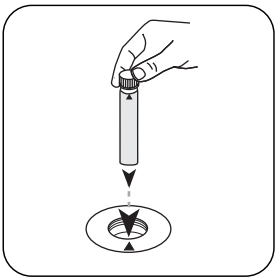
Allow vial(s) to cool to 60 °C.



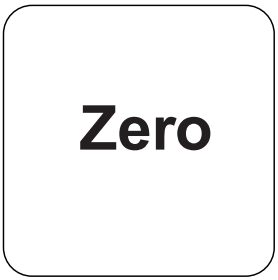
Invert several times to mix the contents.



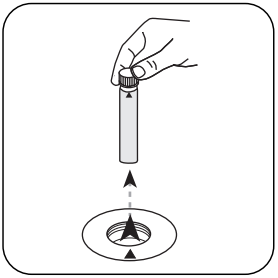
Allow the vial to cool to room temperature and then measure.



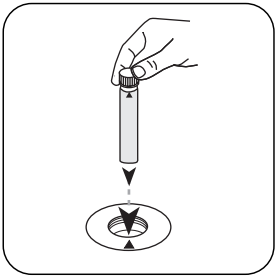
Place **blank** in the sample chamber. • Pay attention to the positioning.



Press the **ZERO** button.



Remove **vial** from the sample chamber.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

Press the **TEST** (XD: **START**)button.

The result in mg/l COD appears on the display.

Chemical Method

Dichromate / H_2SO_4

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 16 mm
a	-3.10235 • 10^{+2}
b	2.1173 • 10^{+4}
c	1.64139 • 10^{+2}
d	
e	
f	

Interferences

Persistant Interferences

- In exceptional cases, contents, for which the oxidation capacity of the reagent is not sufficient, can lead to lower results.

Removeable Interferences

- Suspended solids in the vial can lead to incorrect measurements and so to avoid this, it is important to place the vials carefully in the sample chamber as the method necessitates a build-up of precipitate at the bottom of the vial.
- The outer walls of the vial must be clean and dry before the analysis is carried out. Fingerprints or water droplets on the vial lead to incorrect measurements.
- In the standard version, chloride interferes from a concentration of 10000 mg/L. In the mercury-free version, the disturbance depends on the chloride concentration and the COD. Concentrations from 100 mg/L chloride can lead to significant disturbances here. To remove high chloride concentrations in COD samples, see method M130 COD LR TT.

Method Validation

Limit of Detection	112.81 mg/L
Limit of Quantification	338.43 mg/L
End of Measuring Range	15 g/L
Sensitivity	21,164 mg/L / Abs
Confidence Intervall	70.48 mg/L
Standard Deviation	27.84 mg/L
Variation Coefficient	0.37 %

Conformity

ISO 15705:2002

According to

ISO 15705:2002

[b] Reactor is necessary for COD (150 °C), TOC (120 °C) and total -chromium, - phosphate, -nitrogen, (100 °C)

COD LMR TT M133

15 - 300 mg/L COD[b] LMr

Dichromate / H_2SO_4

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 110, MD 200, MD 600, MD 610, MD 640, MultiDirect	ø 16 mm	430 nm	15 - 300 mg/L COD[b]
SpectroDirect, XD 7000, XD 7500	ø 16 mm	445 nm	15 - 300 mg/L COD[b]

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
COD LMR	25 pc.	2423120

The following accessories are required.

Accessories	Packaging Unit	Part Number
Thermoreactor RD 125	1 pc.	2418940

Application List

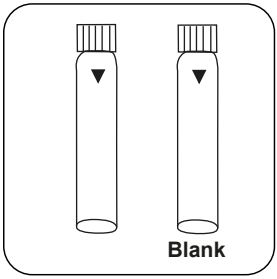
- Raw Water Treatment
- Waste Water Treatment

Notes

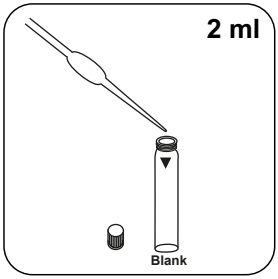
1. The blank is stable when stored in the dark. Blanks and test vials must be from the same batch.
2. Do not place hot vials in the sample chamber. The most stable measured values can be determined if the vials are left standing overnight.

Implementation of the provision COD LMR with Vial Test

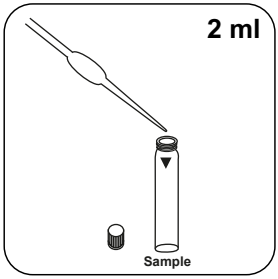
Select the method on the device



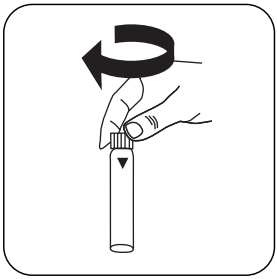
Prepare two **reaction vials**. Mark one as a blank.



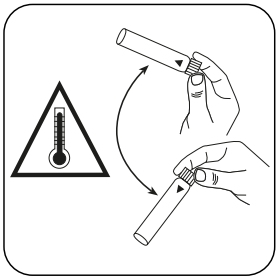
Put **2 ml deionised water** in the blank.



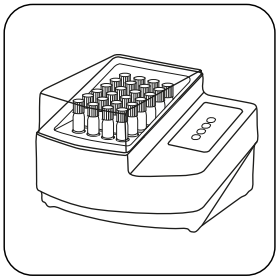
Put **2 ml sample** in the sample vial.



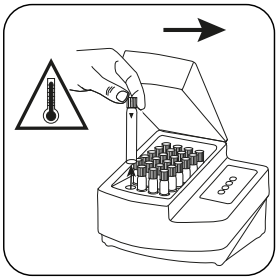
Close vial(s).



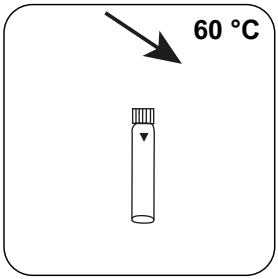
Carefully invert several times to mix the contents. **Note: Will get hot!**



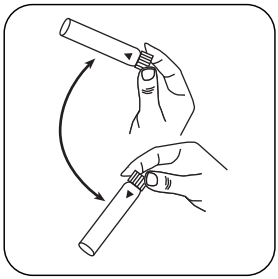
Seal the vials in the pre-heated thermoreactor for **120 minutes at 150 °C** .



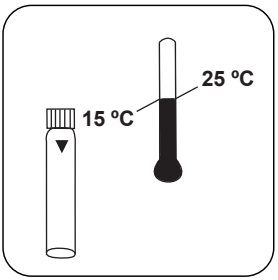
Remove the vial from the thermoreactor. **(Note: vial will be hot!)**



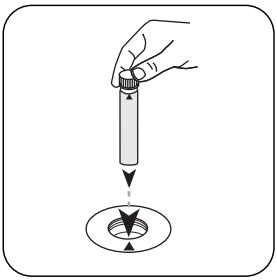
Allow vial(s) to cool to 60 °C.



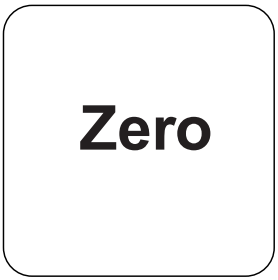
Invert several times to mix the contents.



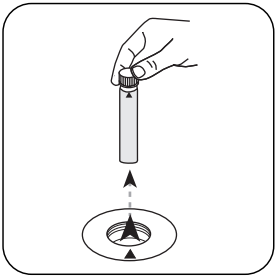
Allow the vial to cool to room temperature and then measure.



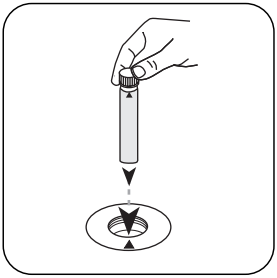
Place **blank** in the sample chamber. • Pay attention to the positioning.



Press the **ZERO** button.



Remove **vial** from the sample chamber.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

Press the **TEST** (XD: **START**)button.

The result in mg/l COD appears on the display.

Chemical Method

Dichromate / H_2SO_4

Appendix

Interferences

Persistant Interferences

- In exceptional cases, contents, for which the oxidation capacity of the reagent is not sufficient, can lead to lower results.

Removeable Interferences

- Suspended solids in the vial can lead to incorrect measurements and so to avoid this, it is important to place the vials carefully in the sample chamber as the method necessitates a build-up of precipitate at the bottom of the vial.
- The outer walls of the vial must be clean and dry before the analysis is carried out. Fingerprints or water droplets on the vial lead to incorrect measurements.
- In the standard version, chloride interferes from a concentration of 1000 mg/L. In the mercury-free version, the disturbance depends on the chloride concentration and the COD. Concentrations from 100 mg/L chloride can lead to significant disturbances here. To remove high chloride concentrations in COD samples, see method M130 COD LR TT.

Conformity

ISO 15705:2002

According to

ISO 15705:2002
DIN 38409 part 41

[b] Reactor is necessary for COD (150 °C), TOC (120 °C) and total -chromium, - phosphate, -nitrogen, (100 °C)

Copper 50 T M149

0.05 - 1 mg/L Cu[a)]

Biquinoline

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	□ 50 mm	559 nm	0.05 - 1 mg/L Cu[a)]

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Copper No. 1	Tablet / 100	513550BT
Copper No. 1	Tablet / 250	513551BT
Copper No. 2	Tablet / 100	513560BT
Copper No. 2	Tablet / 250	513561BT
Set Copper No. 1/No. 2 100 Pc.[#]	100 each	517691BT
Set Copper No. 1/No. 2 250 Pc.[#]	250 each	517692BT

Application List

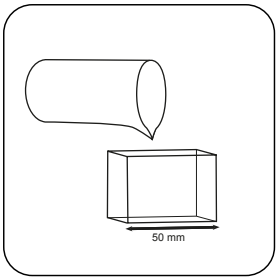
- Cooling Water
- Boiler Water
- Waste Water Treatment
- Pool Water Control
- Pool Water Treatment
- Drinking Water Treatment
- Galvanization

Preparation

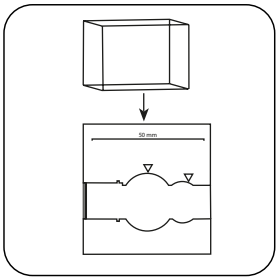
1. Strong alkaline or acidic water samples must be adjusted to pH 4 to 6 before analysis.

Implementation of the provision Copper, free with tablet

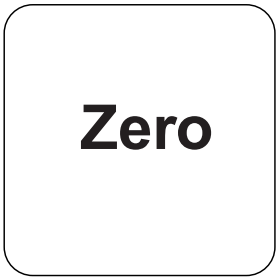
Select the method on the device
In addition, choose the test: free
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



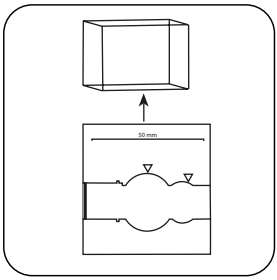
Fill 50 mm vial with **sample**.



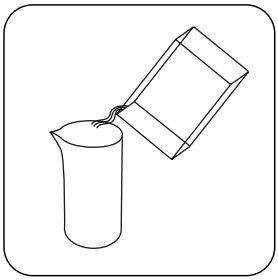
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



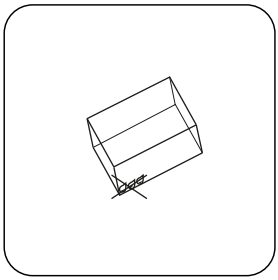
Press the **ZERO** button.



Remove **vial** from the sample chamber.

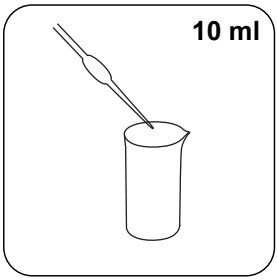


Empty vial.

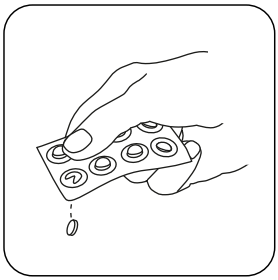


Dry the vial thoroughly.

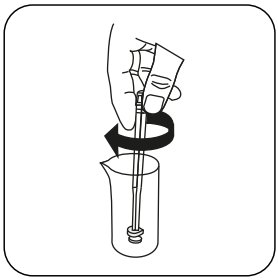
For devices that require **no ZERO measurement** , **start here**.



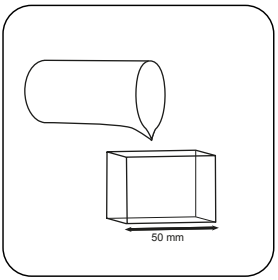
Fill a suitable sample vessel with **10 ml sample** .



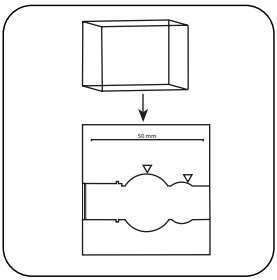
Add **COPPER No. 1 tablet** .



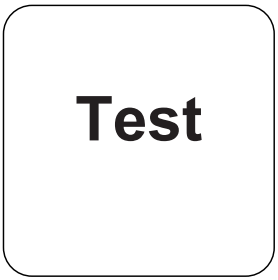
Crush tablet(s) by rotating slightly and dissolve.



Fill 50 mm vial with **sample**.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

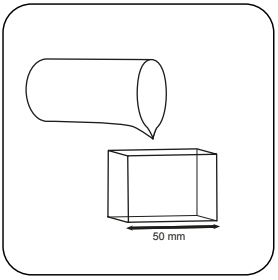


Press the **TEST** (XD: **START**)button.

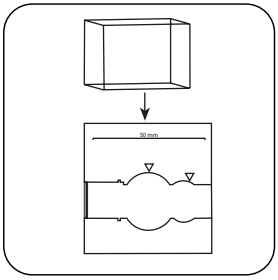
The result in mg/l free Copper appears on the display.

Implementation of the provision Copper, total with tablet

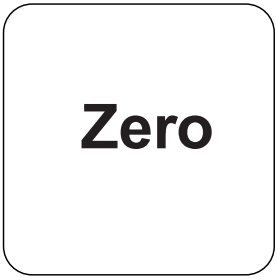
Select the method on the device
In addition, choose the test: total
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



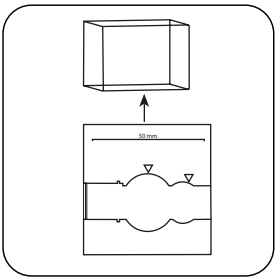
Fill 50 mm vial with **sample**.



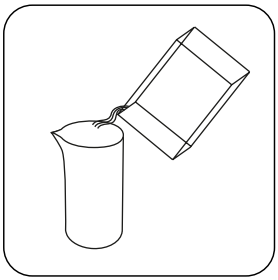
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



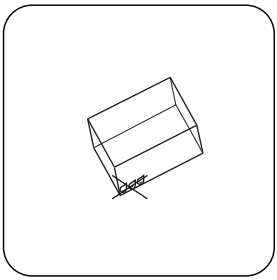
Press the **ZERO** button.



Remove **vial** from the sample chamber.

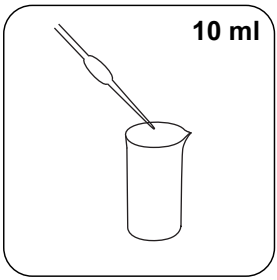


Empty vial.

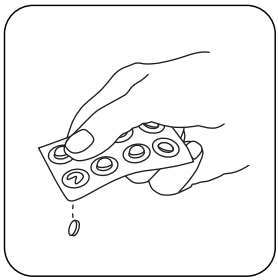


Dry the vial thoroughly.

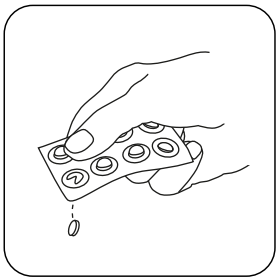
For devices that require **no ZERO measurement** , **start here**.



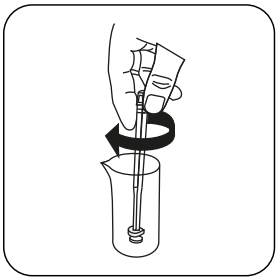
Fill a suitable sample vessel with **10 ml sample** .



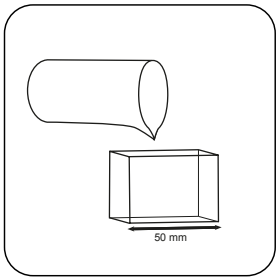
Add **COPPER No. 1 tablet** .



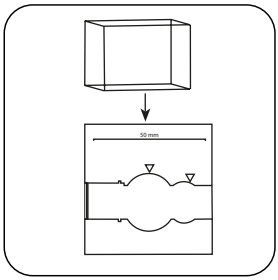
Add **COPPER No. 2 tablet** .



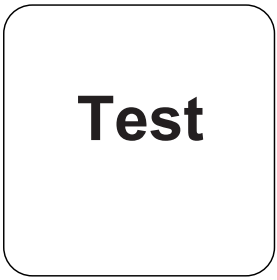
Crush tablet(s) by rotating slightly and dissolve.



Fill 50 mm vial with **sample**.



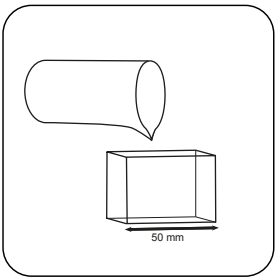
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



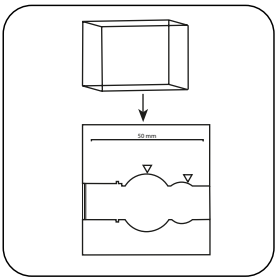
Press the **TEST** (XD: **START**)button.
The result in mg/l total Copper appears on the display.

Implementation of the provision Copper, differentiated with tablet

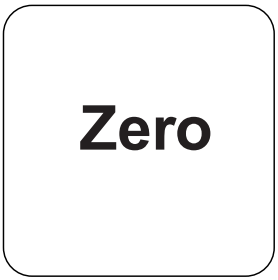
Select the method on the device
In addition, choose the test: differentiated
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



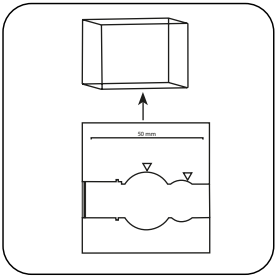
Fill 50 mm vial with **sample**.



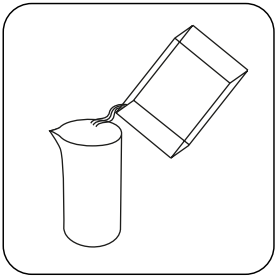
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



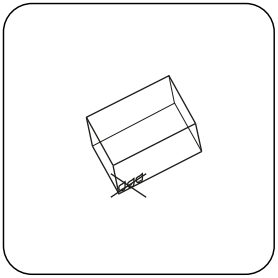
Press the **ZERO** button.



Remove **vial** from the sample chamber.

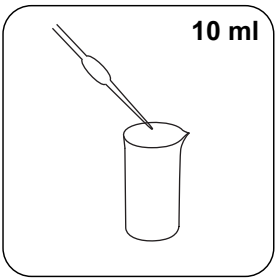


Empty vial.

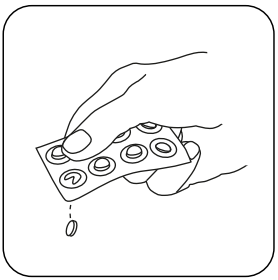


Dry the vial thoroughly.

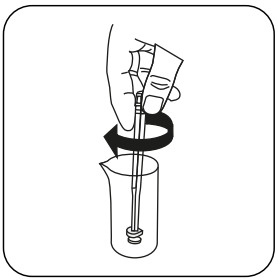
For devices that require **no ZERO measurement** , **start here**.



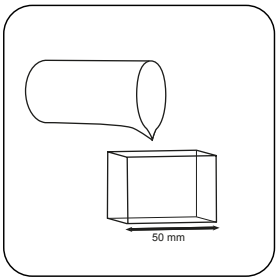
Fill a suitable sample vessel with **10 ml sample** .



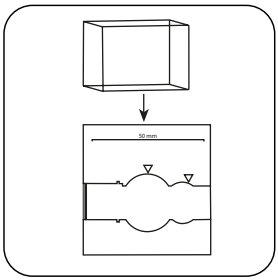
Add **COPPER No. 1 tablet** .



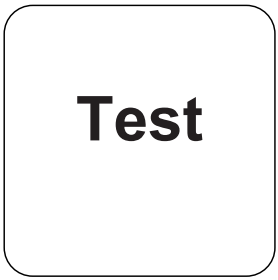
Crush tablet(s) by rotating slightly and dissolve.



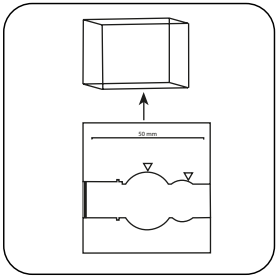
Fill 50 mm vial with **sample**.



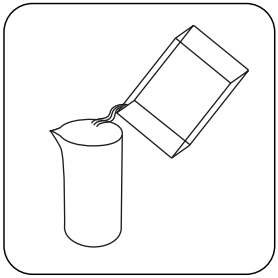
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



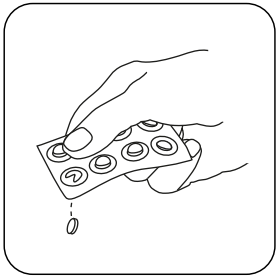
Press the **TEST** (XD: **START**)button.



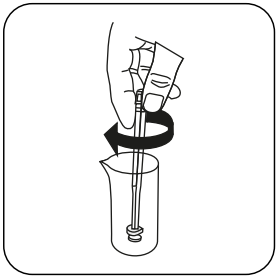
Remove **vial** from the sample chamber.



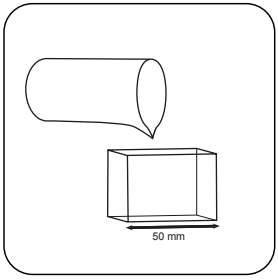
Return the sample solution completely to the sample vessel.



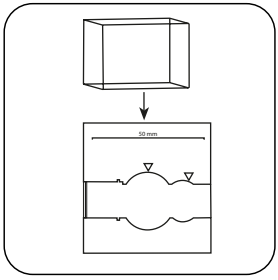
Add **COPPER No. 2 tablet** .



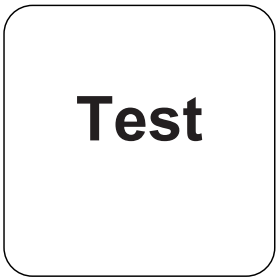
Crush tablet(s) by rotating slightly and dissolve.



Fill 50 mm vial with **sample**.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.
The result in mg/l free Copper; combined Copper; total Copper appears on the display.

Chemical Method

Biquinoline

Appendix

Interferences

Persistant Interferences

1. Cyanide and Silver interfere with the test result.

Method Validation

Limit of Detection	0.009 mg/L
Limit of Quantification	0.028 mg/L
End of Measuring Range	1 mg/L
Sensitivity	1.62 mg/L / Abs
Confidence Intervall	0.009 mg/L
Standard Deviation	0.004 mg/L
Variation Coefficient	0.71 %

Bibliography

Photometrische Analyse, Lange/Vedjelek, Verlag Chemie 1980

[a)] determination of free, combined and total | [#] including stirring rod, 10 cm

Copper T M150

0.05 - 5 mg/L Cu[a)] Cu

Biquinoline

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 110, MD 200, MD 600, MD 610, MD 640, MultiDirect, PM 600, PM 620, PM 630	ø 24 mm	560 nm	0.05 - 5 mg/L Cu[a)]
SpectroDirect, XD 7000, XD 7500	ø 24 mm	559 nm	0.05 - 5 mg/L Cu[a)]

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Copper No. 1	Tablet / 100	513550BT
Copper No. 1	Tablet / 250	513551BT
Copper No. 2	Tablet / 100	513560BT
Copper No. 2	Tablet / 250	513561BT
Set Copper No. 1/No. 2 100 Pc.[#]	100 each	517691BT
Set Copper No. 1/No. 2 250 Pc.[#]	250 each	517692BT

Application List

- Cooling Water
- Boiler Water
- Waste Water Treatment
- Pool Water Control
- Pool Water Treatment
- Drinking Water Treatment
- Galvanization

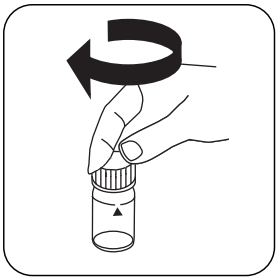
Preparation

1. Strong alkaline or acidic water samples must be adjusted to pH 4 to 6 before analysis.

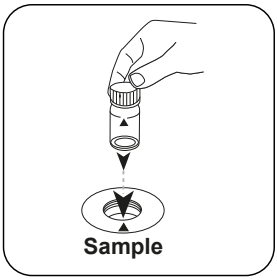
Implementation of the provision Copper, free with tablet

Select the method on the device
In addition, choose the test: free
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

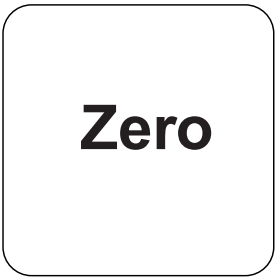
Fill 24 mm vial with **10 ml sample**.



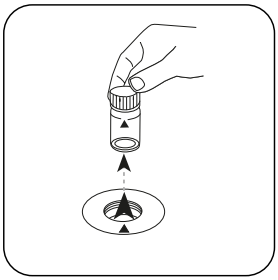
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

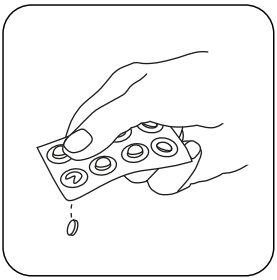


Press the **ZERO** button.

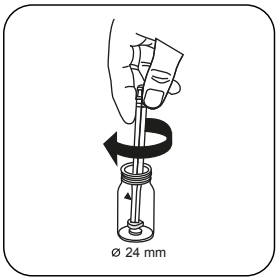


Remove the vial from the sample chamber.

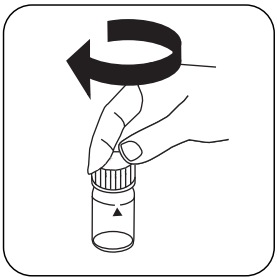
For devices that require **no ZERO measurement** , **start here**.



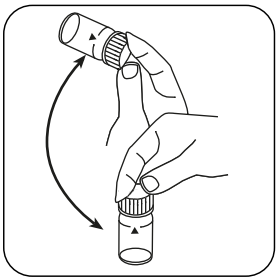
Add **COPPER No. 1 tablet** .



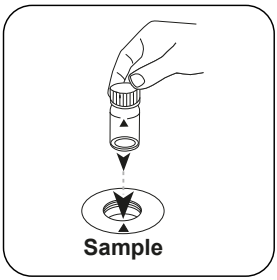
Crush tablet(s) by rotating slightly.



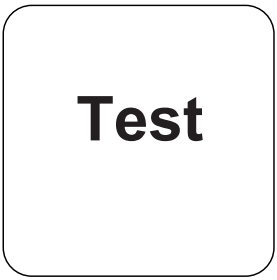
Close vial(s).



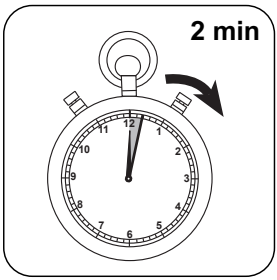
Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



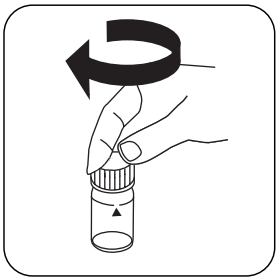
Wait for **2 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l free Copper appears on the display.

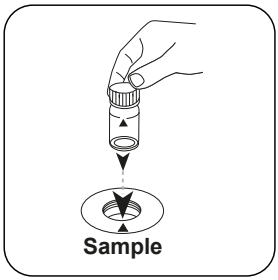
Implementation of the provision Copper, total with tablet

Select the method on the device
In addition, choose the test: total
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

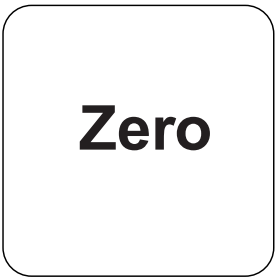
Fill 24 mm vial with **10 ml sample**.



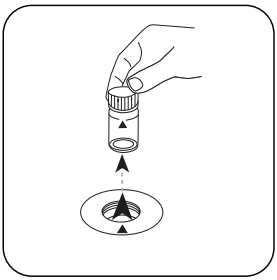
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

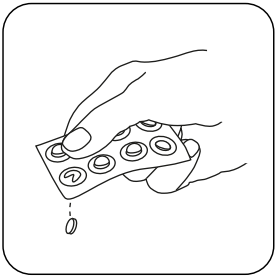


Press the **ZERO** button.

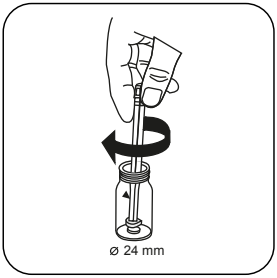


Remove the vial from the sample chamber.

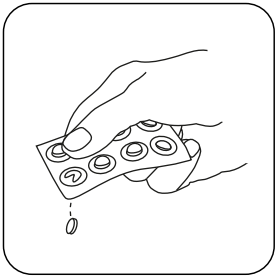
For devices that require **no ZERO measurement** , **start here**.



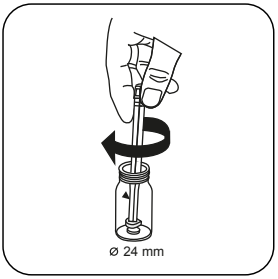
Add **COPPER No. 1 tablet** .



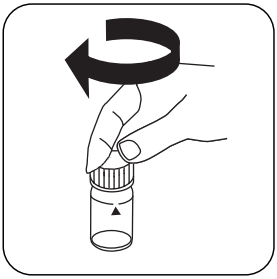
Crush tablet(s) by rotating slightly and dissolve.



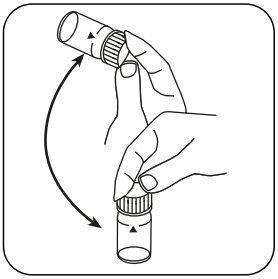
Add **COPPER No. 2 tablet** .



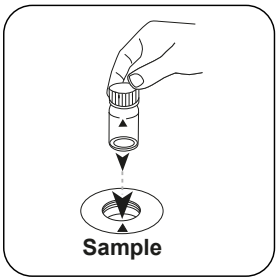
Crush tablet(s) by rotating slightly.



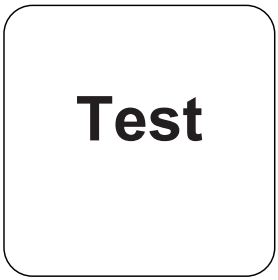
Close vial(s).



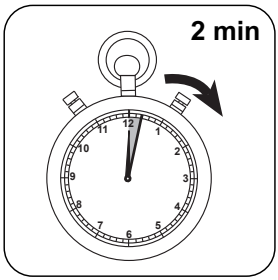
Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



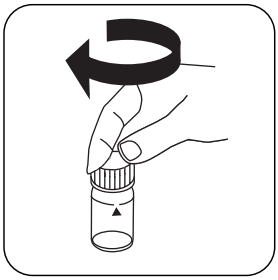
Wait for **2 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l total Copper appears on the display.

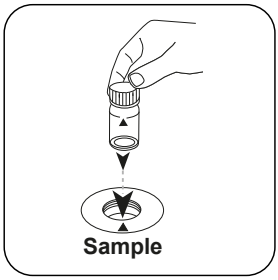
Implementation of the provision Copper, differentiated determination with Tablet

Select the method on the device
In addition, choose the test: differentiated
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

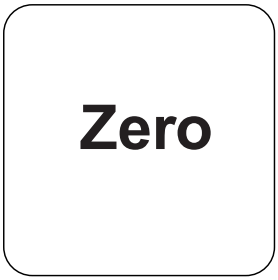
Fill 24 mm vial with **10 ml sample**.



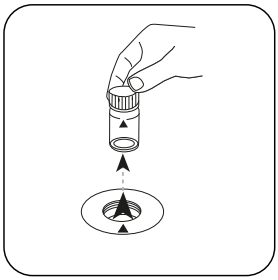
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

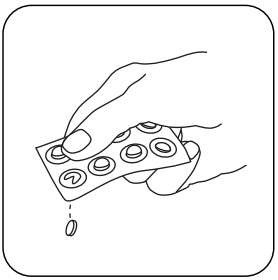


Press the **ZERO** button.

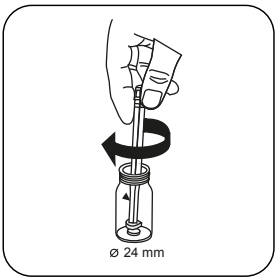


Remove the vial from the sample chamber.

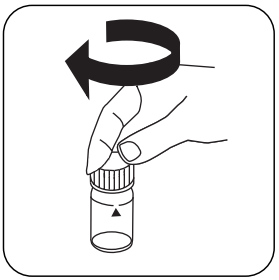
For devices that require **no ZERO measurement** , **start here**.



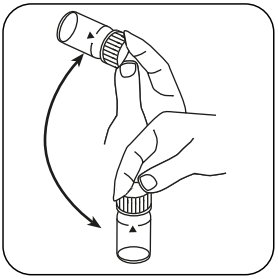
Add **COPPER No. 1 tablet** .



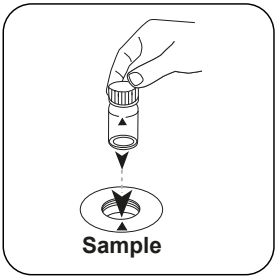
Crush tablet(s) by rotating slightly.



Close vial(s).

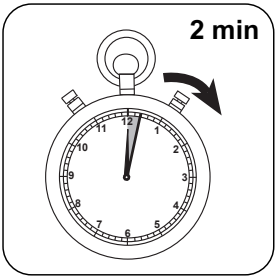


Dissolve tablet(s) by inverting.

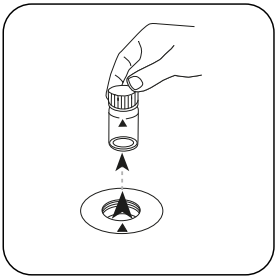


Place **sample vial** in the sample chamber. • Pay attention to the positioning.

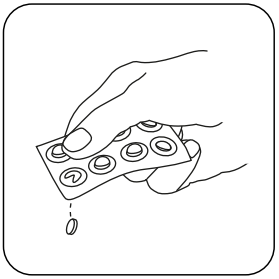
Press the **TEST** (XD: **START**)button.



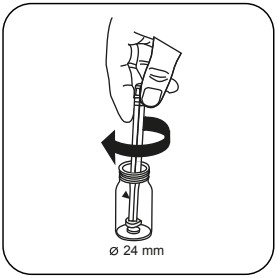
Wait for **2 minute(s) reaction time**.



Remove the vial from the sample chamber.

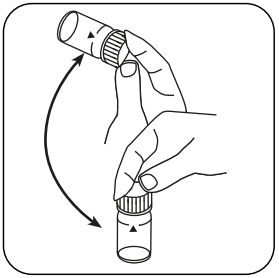


Add **COPPER No. 2 tablet** .

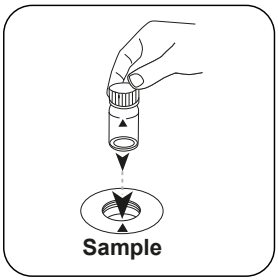


Crush tablet(s) by rotating slightly.

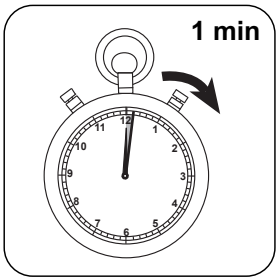
Close vial(s).



Dissolve tablet(s) by inverting.



Test



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

Press the **TEST** (XD: **START**)button.

Wait for **1 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically. The result in mg/l free Copper; combined Copper; total Copper appears on the display.

Chemical Method

Biquinoline

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	-4.78562 • 10^{-2}	-5.12445 • 10^{-2}
b	3.79263 • 10^{+0}	8.20998 • 10^{+0}
c		
d		
e		
f		

Interferences

Persistant Interferences

1. Cyanide CN^- and Silver Ag^+ interfere with the test result.

Method Validation

Limit of Detection	0.05 mg/L
Limit of Quantification	0.15 mg/L
End of Measuring Range	5 mg/L
Sensitivity	3.8 mg/L / Abs
Confidence Intervall	0.026 mg/L
Standard Deviation	0.011 mg/L
Variation Coefficient	0.42 %

Bibliography

Photometrische Analyse, Lange/Vedjelek, Verlag Chemie 1980

[a)] determination of free, combined and total | [#] including stirring rod, 10 cm

Copper L M151

0.05 - 4 mg/L Cu[a)]

Bicinchoninate

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, XD 7000, XD 7500	ø 24 mm	560 nm	0.05 - 4 mg/L Cu[a)]

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Copper Reagent Set	1 pc.	56R023355

The following accessories are required.

Accessories	Packaging Unit	Part Number
Stirring rod and spoon	1 pc.	56A006601

Application List

- Cooling Water
- Boiler Water
- Waste Water Treatment
- Pool Water Control
- Pool Water Treatment
- Drinking Water Treatment
- Galvanization

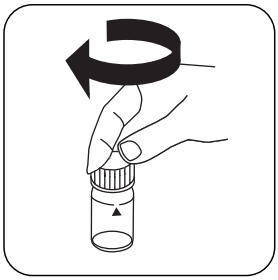
Preparation

1. Strong alkaline or acidic water samples must be adjusted to pH 4 to 6 before analysis.
2. The measuring spoon supplied with the reagents must be used for the correct dosage.

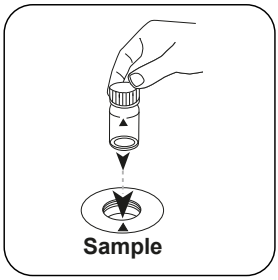
Implementation of the provision Copper, free with liquid reagent

Select the method on the device
In addition, choose the test: free
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

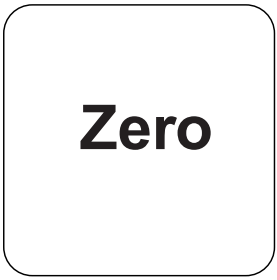
Fill 24 mm vial with **10 ml sample**.



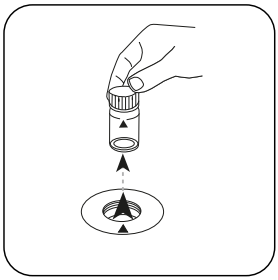
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

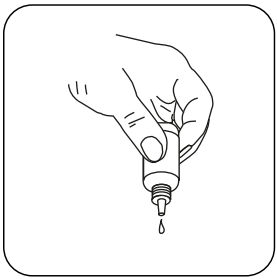


Press the **ZERO** button.

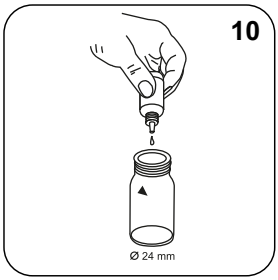


Remove the vial from the sample chamber.

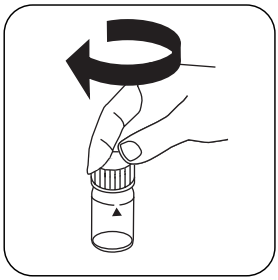
For devices that require **no ZERO measurement** , **start here**.



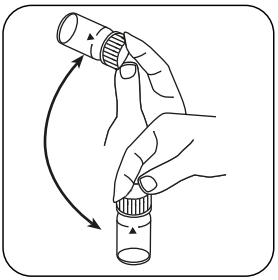
Hold cuvettes vertically and add equal drops by pressing slowly.



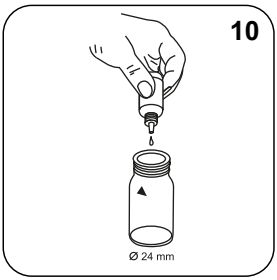
Add **10 drops KS240 (Coppercol Reagent 1)**.



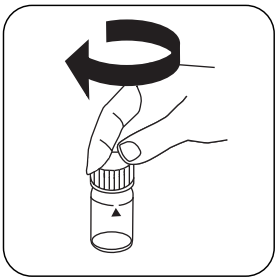
Close vial(s).



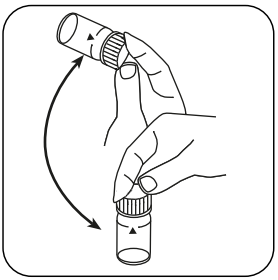
Invert several times to mix the contents.



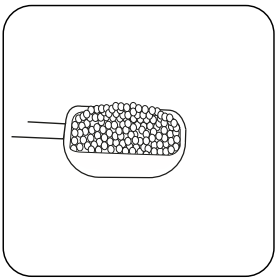
Add **10 drops KS241 (Coppercol Reagent 2)**.



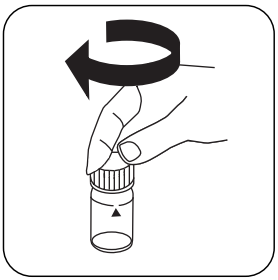
Close vial(s).



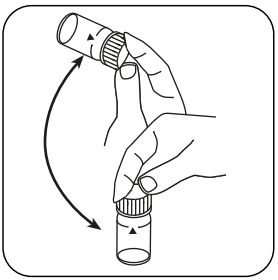
Invert several times to mix the contents.



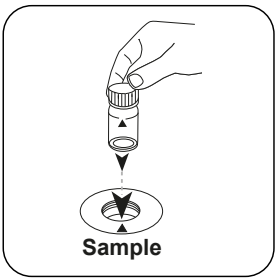
Add **a measuring scoop KP242 (Coppercol Reagent 3)** .



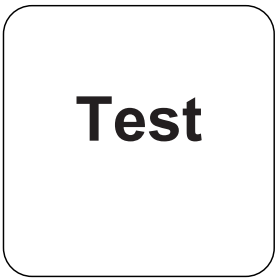
Close vial(s).



Swirl around to dissolve the powder.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



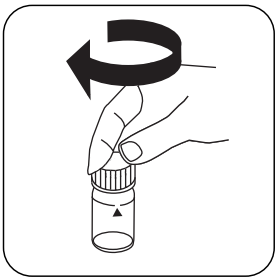
Press the **TEST** (XD: **START**)button.

The result in mg/l free Copper appears on the display.

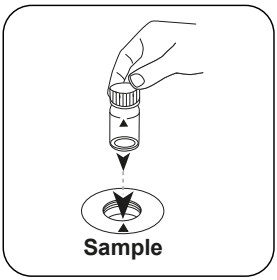
Implementation of the provision Copper, total with liquid reagent

Select the method on the device
In addition, choose the test: total
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

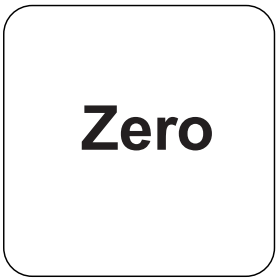
Fill 24 mm vial with **10 ml sample**.



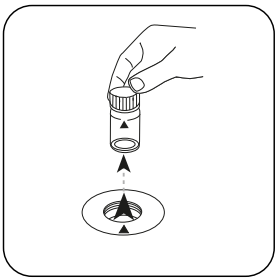
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

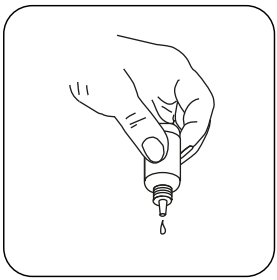


Press the **ZERO** button.

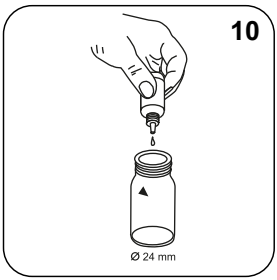


Remove the vial from the sample chamber.

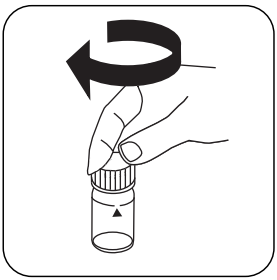
For devices that require **no ZERO measurement** , **start here**.



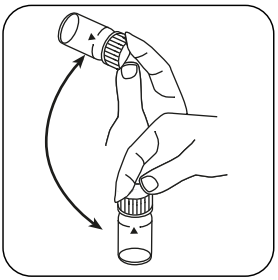
Hold cuvettes vertically and add equal drops by pressing slowly.



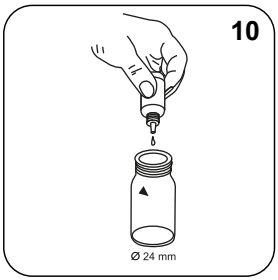
Add **10 drops KS240 (Coppercol Reagent 1)**.



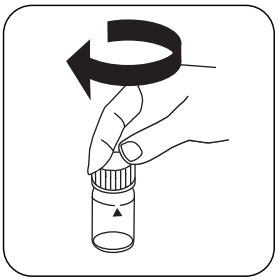
Close vial(s).



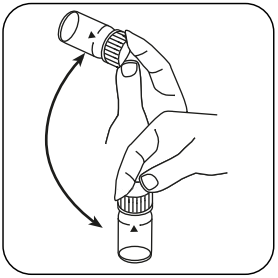
Invert several times to mix the contents.



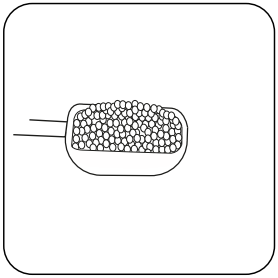
Add **10 drops KS241 (Coppercol Reagent 2)**.



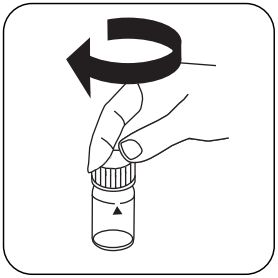
Close vial(s).



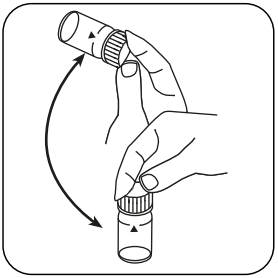
Invert several times to mix the contents.



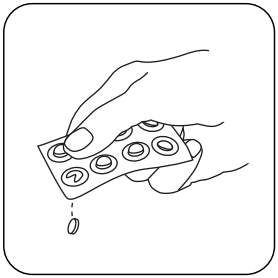
Add **a measuring scoop KP242 (Coppercol Reagent 3)** .



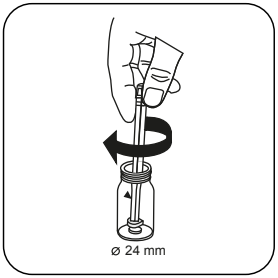
Close vial(s).



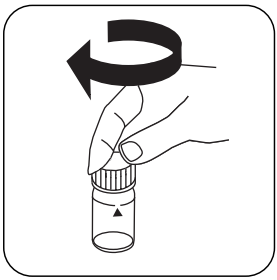
Swirl around to dissolve the powder.



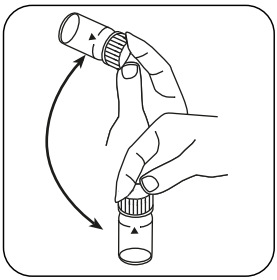
Add **COPPER No.2 tablet** .



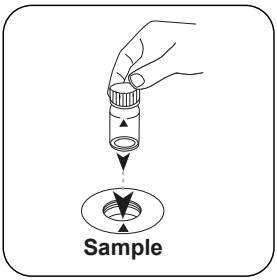
Crush tablet(s) by rotating slightly.



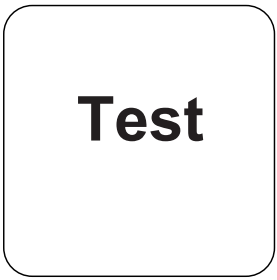
Close vial(s).



Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

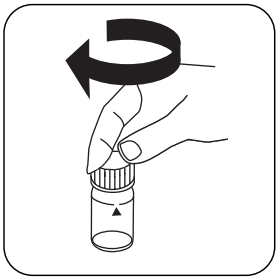


Press the **TEST** (XD: **START**)button.
The result in mg/l totale Copper appears on the display.

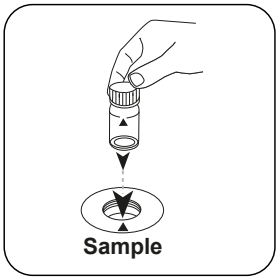
Implementation of the provision Copper, differentiated with liquid reagent

Select the method on the device
In addition, choose the test: differentiated
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

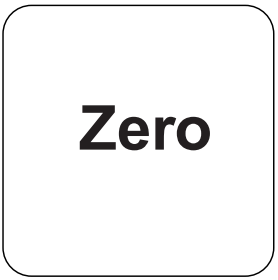
Fill 24 mm vial with **10 ml sample**.



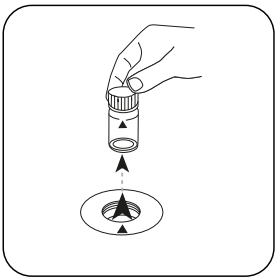
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

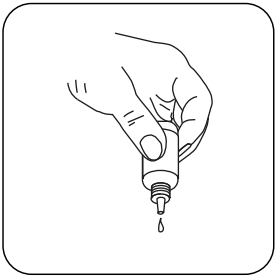


Press the **ZERO** button.

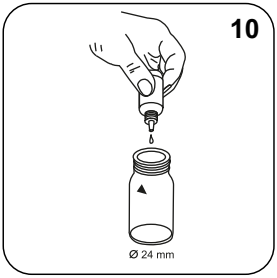


Remove the vial from the sample chamber.

For devices that require **no ZERO measurement** , **start here**.

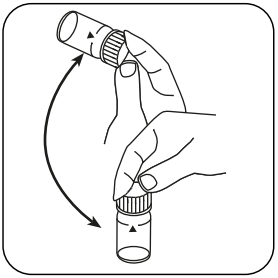


Hold cuvettes vertically and add equal drops by pressing slowly.

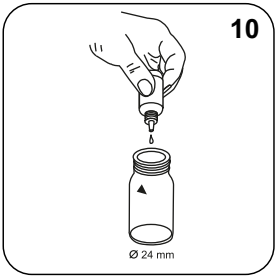


Add **10 drops KS240 (Coppercol Reagent 1)**.

Close vial(s).

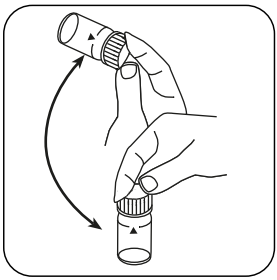


Invert several times to mix the contents.

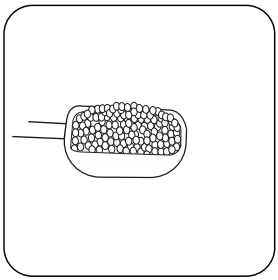


Add **10 drops KS241 (Coppercol Reagent 2)**.

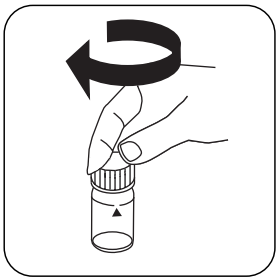
Close vial(s).



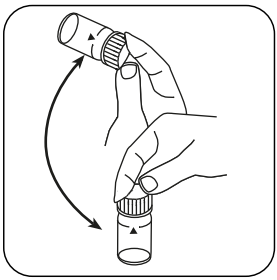
Invert several times to mix the contents.



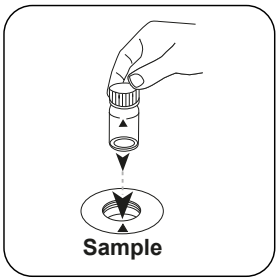
Add **a measuring scoop KP242 (Coppercol Reagent 3)** .



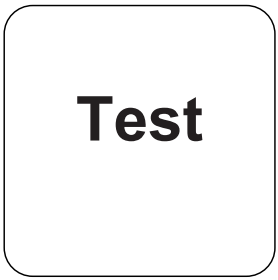
Close vial(s).



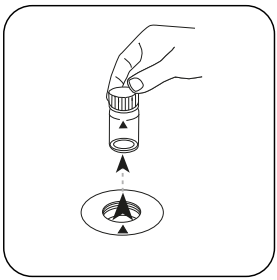
Swirl around to dissolve the powder.



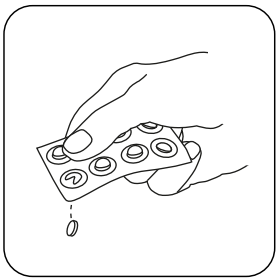
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



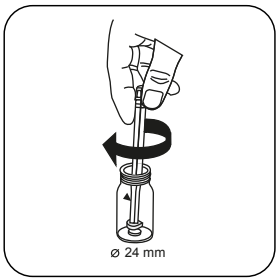
Press the **TEST** (XD: **START**)button.



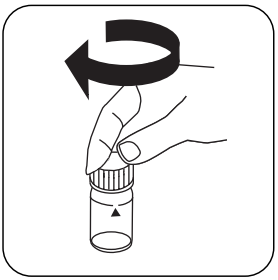
Remove the vial from the sample chamber.



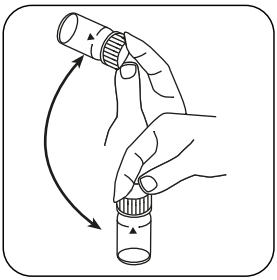
Add **COPPER No. 2 tablet** .



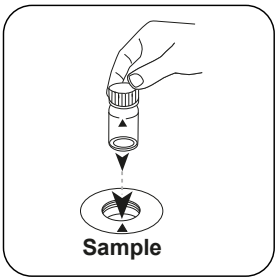
Crush tablet(s) by rotating slightly.



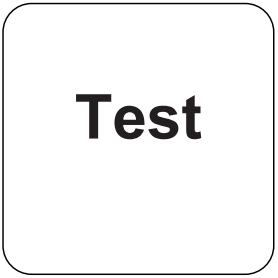
Close vial(s).



Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.
The result in mg/l free Copper; combined Copper; total Copper appears on the display.

Chemical Method

Bicinchoninate

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	$-2.55142 \cdot 10^{-3}$	$-2.55142 \cdot 10^{-3}$
b	$4.00888 \cdot 10^{+0}$	$8.61909 \cdot 10^{+0}$
c		
d		
e		
f		

Interferences

Persistant Interferences

1. Cyanide CN^- and Silver Ag^+ interfere with the test result.

Bibliography

S. Nakano, Y. Zasshi, 82 486 - 491 (1962) [Chemical Abstracts, 58 3390e (1963)]

Derived from

APHA Method 3500Cu

[a] determination of free, combined and total

Copper PP M153

0.05 - 5 mg/L Cu Cu

Bicinchoninate

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 600, MD 610, MD 640, MultiDirect, PM 620, PM 630, SpectroDirect, XD 7000, XD 7500	ø 24 mm	560 nm	0.05 - 5 mg/L Cu

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
VARIO CU1 F10	Powder / 100 pc.	530300
VARIO CU1 F10	Powder / 1000 pc.	530303

Application List

- Cooling Water
- Boiler Water
- Waste Water Treatment
- Pool Water Control
- Pool Water Treatment
- Drinking Water Treatment
- Galvanization

Preparation

1. Digestion is required for the determination of total copper.
2. Extremely acid water samples (pH 2 or less) must be adjusted between pH 4 and pH 6 before the reagent is added (with 8 mol/l Potassium hydroxide solution KOH). Note: pH values above 6 can lead to Copper precipitation.

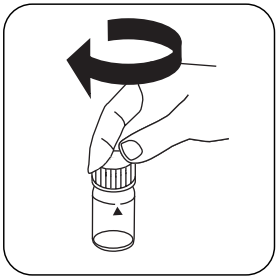
Notes

1. Accuracy is not affected by undissolved powder.

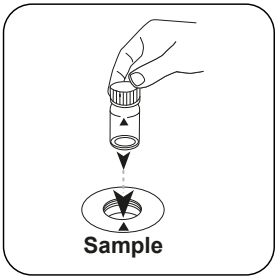
Implementation of the provision Copper, free with Vario Powder Pack

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

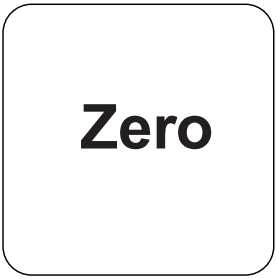
Fill 24 mm vial with **10 ml sample**.



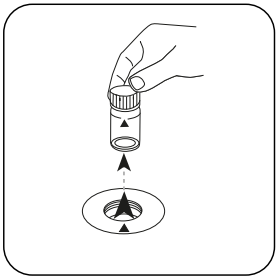
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

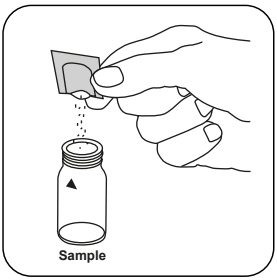


Press the **ZERO** button.

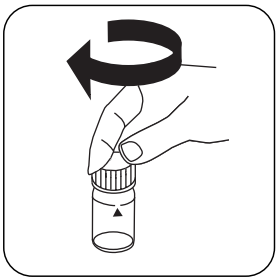


Remove the vial from the sample chamber.

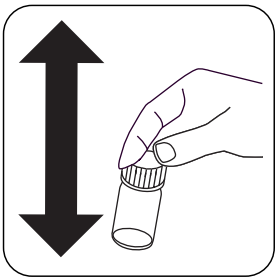
For devices that require **no ZERO measurement** , **start here**.



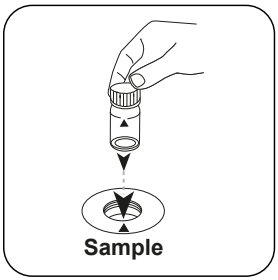
Add **Vario Cu 1 F10 powder pack**.



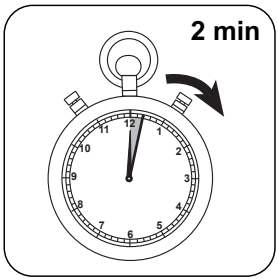
Close vial(s).



Mix the contents by shaking.



Test



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

Press the **TEST** (XD: **START**)button.

Wait for **2 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Copper appears on the display.

Chemical Method

Bicinchoninate

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	-6.44214 • 10^{-2}	-7.44232 • 10^{-2}
b	3.7903 • 10^{+0}	8.16011 • 10^{+0}
c		
d		
e		
f		

Interferences

Persistant Interferences

Hardness, Al and Fe produce lower test results.

Removeable Interferences

1. Cyanide, CN^-: Cyanide prevents full colour development.
   Cyanide interference is eliminated as follows: Add 0.2 ml Formaldehyde to 10 ml water sample and wait for a
   reaction time of 4 minutes. (Cyanide is masked). After this perform the test as described. Multiply the result by 1.02 to correct the sample dilution by Formaldehyde.
2. Silver, Ag^+: If a turbidity remains and turns black, silver interference is likely. Add 10 drops of saturated Potassium chloride solution to 75 ml of
   water sample and filter it through a fine filter. Use 10 ml of the filtered water sample to perform test.

Method Validation

Limit of Detection	0.05 mg/L
Limit of Quantification	0.15 mg/L
End of Measuring Range	5 mg/L
Sensitivity	3.77 mg/L / Abs
Confidence Intervall	0.064 mg/L
Standard Deviation	0.027 mg/L
Variation Coefficient	1.07 %

Bibliography

S. Nakano, Y. Zasshi, 82 486 - 491 (1962) [Chemical Abstracts, 58 3390e (1963)]

Derived from

APHA Method 3500Cu

Cyanide 50 L M156

0.005 - 0.2 mg/L CN^-

Pyridine-barbituric Acid

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	□ 50 mm	585 nm	0.005 - 0.2 mg/L CN^-

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Cyanide Reagent Test 585 nm	1 pc.	2418875

Application List

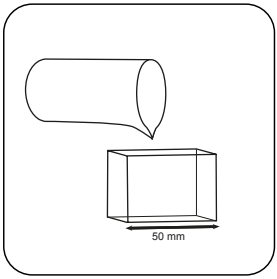
- Waste Water Treatment
- Raw Water Treatment
- Galvanization

Notes

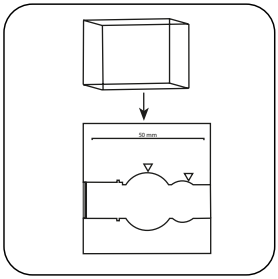
1. Only free Cyanide and Cyanides that can be destroyed by Chlorine are determined by this test.
2. The reagents are to be stored in closed containers at a temperature of +15 °C – +25 °C.

Implementation of the provision Cyanide with Reagents test

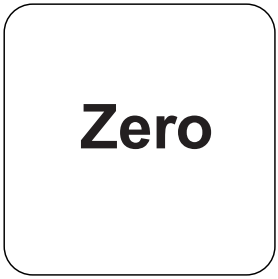
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



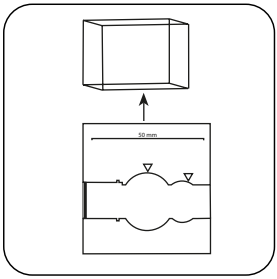
Fill 50 mm vial with **sample**.



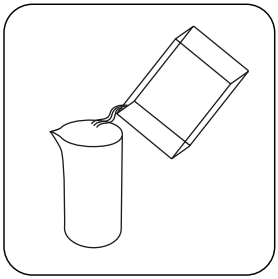
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



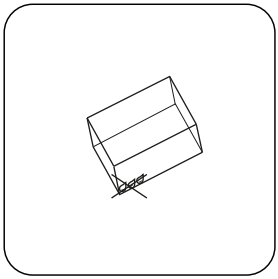
Press the **ZERO** button.



Remove **vial** from the sample chamber.

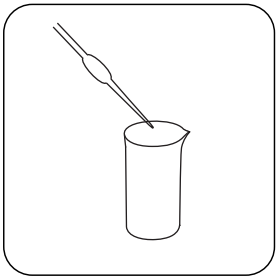


Empty vial.

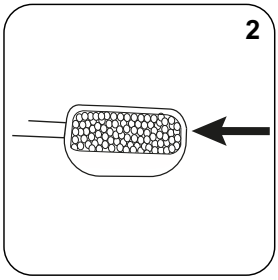


Dry the vial thoroughly.

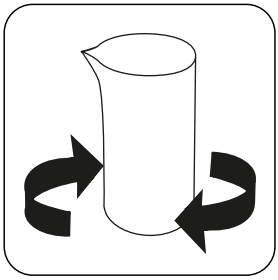
For devices that require **no ZERO measurement** , **start here**.



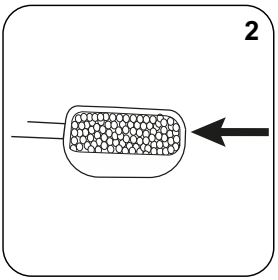
In the sample vessel, put **2 ml sample and 8 ml deionised water** .



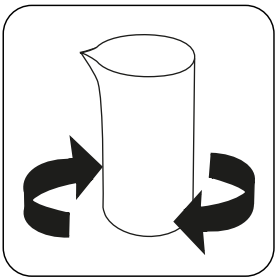
Add **2 level measuring scoop No. 4 (white) Cyanide-11** .



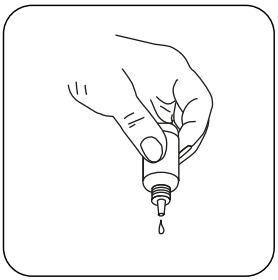
Invert several times to mix the contents.



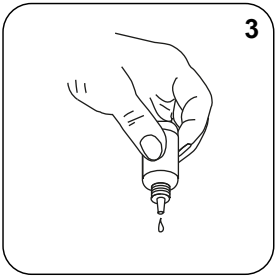
Add **2 level measuring scoop No. 4 (white) Cyanide-12** .



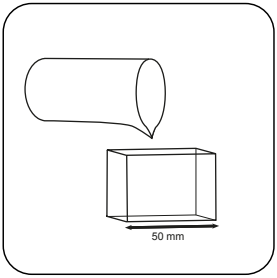
Invert several times to mix the contents.



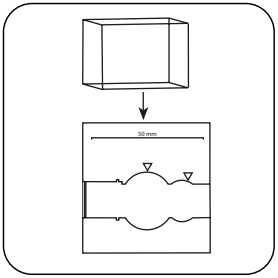
Hold cuvettes vertically and add equal drops by pressing slowly.



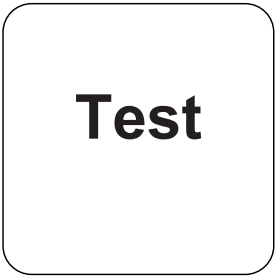
Add **3 drops Cyanide-13**.



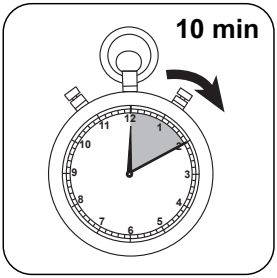
Fill 50 mm vial with **sample**.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **10 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically. The result in mg/l Cyanide appears on the display.

Chemical Method

Pyridine-barbituric Acid

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	□ **50 mm**
a	-1.81456 • 10^{+0}
b	1.76113 • 10^{+2}
c	5.62322 • 10^{+0}
d	
e	
f	

Interferences

Removeable Interferences

- Thiocyanate, heavy metal complexes, sulphide, colourants or aromatic amines interfere with the test. In the presence of an interfering substance, the cyanide must be separated out by distillation before the test is carried out.

Derived from

DIN 38405-D13

Cyanide L M157

0.01 - 0.5 mg/L CN^-

Pyridine-barbituric Acid

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect	ø 24 mm	580 nm	0.01 - 0.5 mg/L CN^-
SpectroDirect, XD 7000, XD 7500	ø 24 mm	585 nm	0.01 - 0.5 mg/L CN^-

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Cyanide Reagent Test 585 nm	1 pc.	2418875

Application List

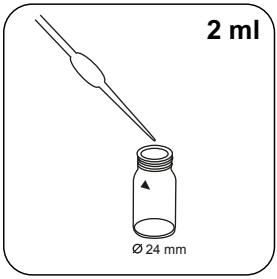
- Waste Water Treatment
- Raw Water Treatment
- Galvanization

Notes

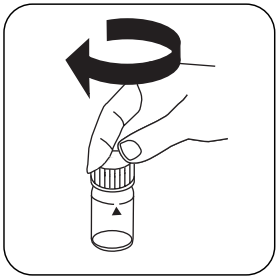
1. Only free Cyanide and Cyanides that can be destroyed by Chlorine are determined by this test.
2. The reagents are to be stored in closed containers at a temperature of +15 °C – +25 °C.

Implementation of the provision Cyanide with Reagents test

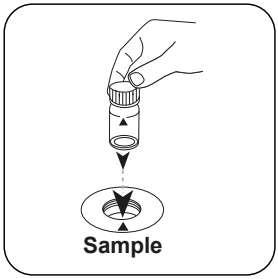
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



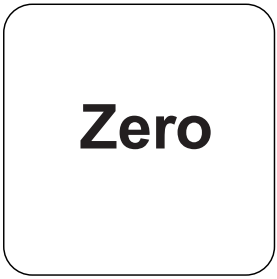
Put **2 ml sample** and **8 ml of deionised water** in the sample vessel.



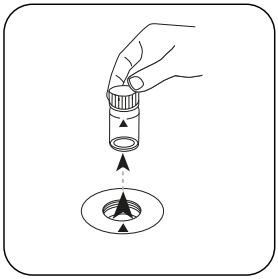
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

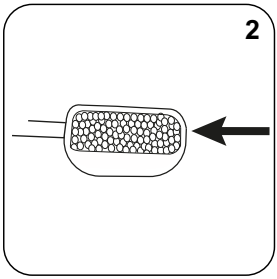


Press the **ZERO** button.

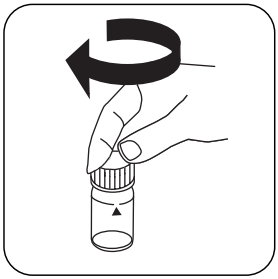


Remove the vial from the sample chamber.

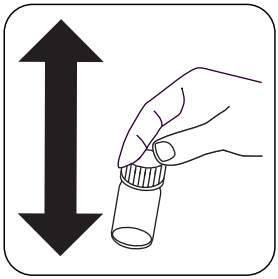
For devices that require **no ZERO measurement** , **start here**.



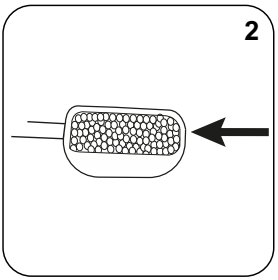
Add **2 level measuring scoop No. 4 (white) Cyanide-11** .



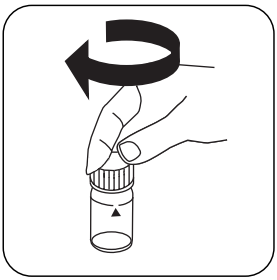
Close vial(s).



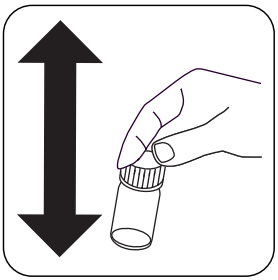
Mix the contents by shaking.



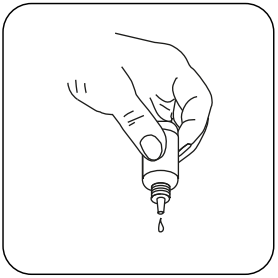
Add **2 level measuring scoop No. 4 (white) Cyanide-12** .



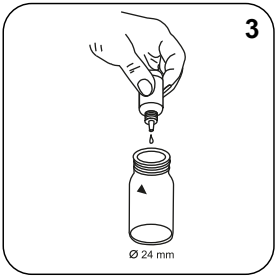
Close vial(s).



Mix the contents by shaking.

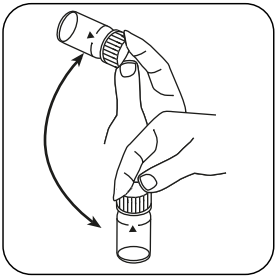


Hold cuvettes vertically and add equal drops by pressing slowly.

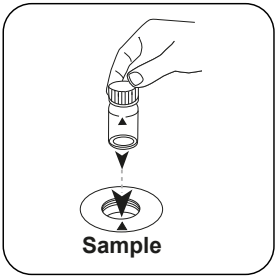


Add **3 drops Cynide -13**.

Close vial(s).

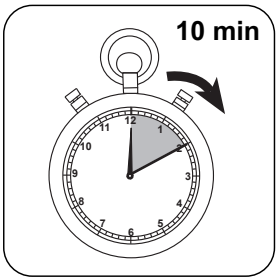


Invert several times to mix the contents.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

Press the **TEST** (XD: **START**)button.



Wait for **10 minute(s) reaction time**.
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Cyanide appears on the display.

Chemical Method

Pyridine-barbituric Acid

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ **10 mm**
a	-6.23212 • 10^{-3}	-6.23212 • 10^{-3}
b	4.2154 • 10^{-1}	9.06311 • 10^{-1}
c	6.94008 • 10^{-3}	3.20805 • 10^{-2}
d		
e		
f		

Interferences

Removeable Interferences

- Thiocyanate, heavy metal complexes, sulphide, colourants or aromatic amines interfere with the test. In the presence of an interfering substance, the cyanide must be separated out by distillation before the test is carried out.

Derived from

DIN 38405-D13

CyA T M160

10 - 160 mg/L CyA CyA

Melamine

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 110, MD 200, MD 600, MD 610, MD 640, MultiDirect, PM 600, PM 620, PM 630, SpectroDirect, XD 7000, XD 7500	ø 24 mm	530 nm	10 - 160 mg/L CyA

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
CyA-Test	Tablet / 100	511370BT
CyA-Test	Tablet / 250	511371BT
Deionised Water	100 mL	461275
Deionised Water	250 mL	457022

Application List

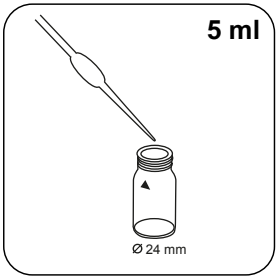
- Pool Water Control

Notes

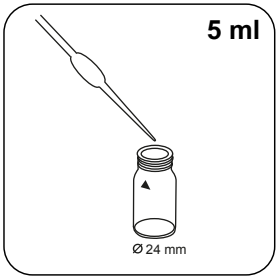
1. Cyanuric acid causes an extremely fine distributed turbidity with a milky appearance. Individual particles are not attributable to the presence of cyanuric acid.

Implementation of the provision Cyanuric Acid Test with Tablet

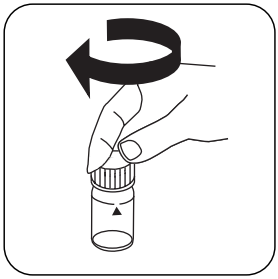
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



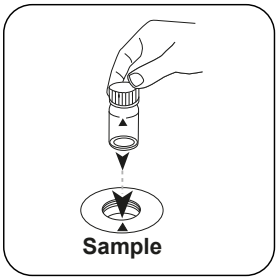
Fill 24 mm vial with **5 ml deionised water** .



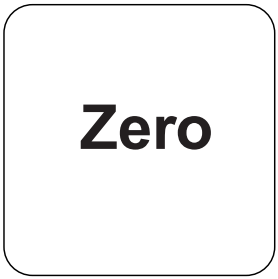
Put **5 ml sample** in the vial.



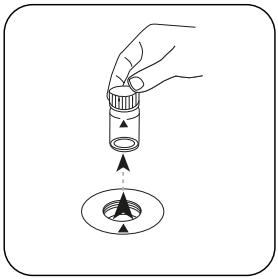
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

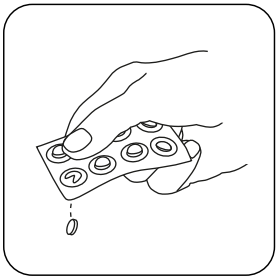


Press the **ZERO** button.

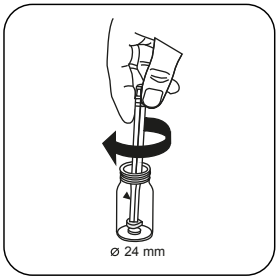


Remove the vial from the sample chamber.

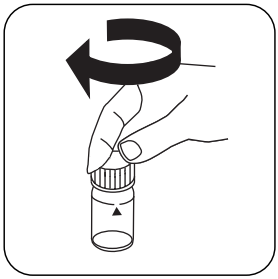
For devices that require **no ZERO measurement** , **start here**.



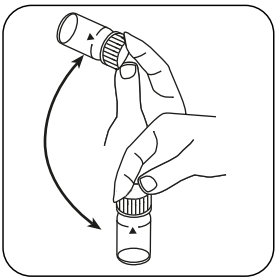
Add **CyA-Test tablet**.



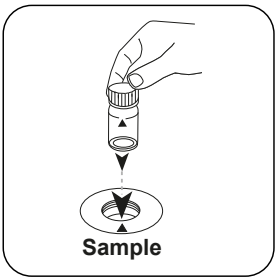
Crush tablet(s) by rotating slightly.



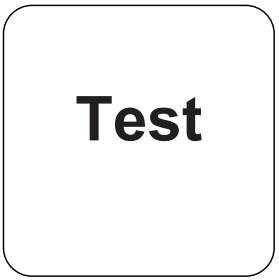
Close vial(s).



Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in mg/l Cyanuric Acid appears on the display.

Chemical Method

Melamine

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	-9.51421 • 10^{-1}	-9.51421 • 10^{-1}
b	6.99203 • 10^{+1}	1.50329 • 10^{+2}
c	6.14201 • 10^{+0}	2.83914 • 10^{+1}
d		
e		
f		

Interferences

Persistant Interferences

1. Undissolved particles may lead to higher results. Therefore, it is important to dissolve the Tablet completely.

CyA HR T M161

10 - 200 mg/L CyA CyAH

Melamine

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect, SpectroDirect	ø 24 mm	530 nm	10 - 200 mg/L CyA

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
CyA HR-Test	Tablet / 100	511430BT
CyA HR-Test	Tablet / 250	511431BT

Application List

- Pool Water Control

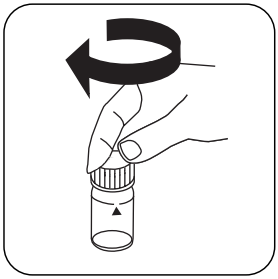
Notes

1. Cyanuric acid causes an extremely fine distributed turbidity with a milky appearance. Individual particles are not attributable to the presence of cyanuric acid.
2. After addition of the CyA-HR-Test tablet, it dissolves automatically within two minutes.
3. **The vial must not be moved after the addition of the CyA-HR-Test tablet.**

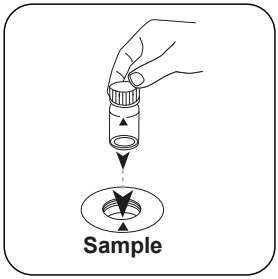
Implementation of the provision Cyanuric Acid Test with Tablet

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

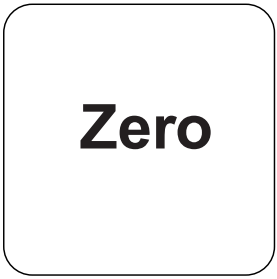
Fill 24 mm vial with **10 ml sample**.



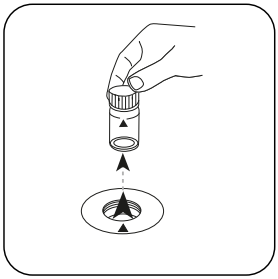
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

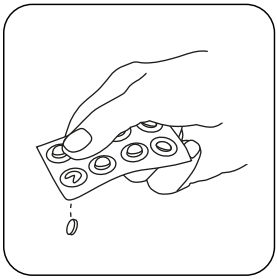


Press the **ZERO** button.

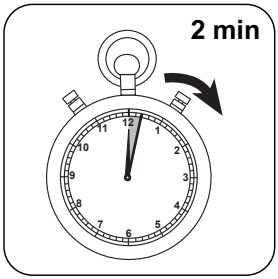


Remove the vial from the sample chamber.

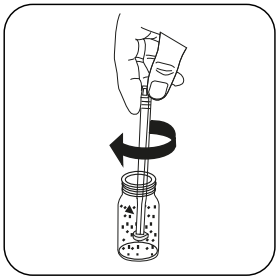
For devices that require **no ZERO measurement** , **start here**.



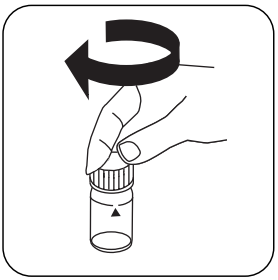
Add **CyA HR Test tablet**.



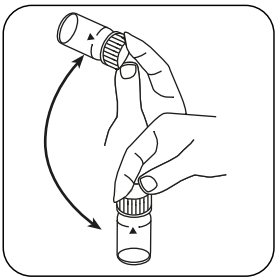
Wait for **2 minute(s) reaction time**.



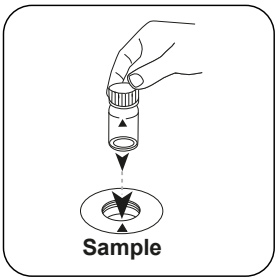
Dissolve the tablets using a clean stirring rod.



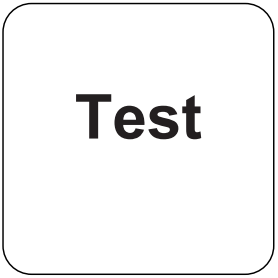
Close vial(s).



Invert several times to mix the contents (do not shake).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.
The result in mg/l Cyanuric Acid appears on the display.

Chemical Method

Melamine

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	$-8.76932 \cdot 10^{-2}$	$-8.76932 \cdot 10^{-2}$
b	$2.30609 \cdot 10^{+1}$	$4.95809 \cdot 10^{+1}$
c	$3.4216 \cdot 10^{+1}$	$1.58163 \cdot 10^{+2}$
d	$-5.87057 \cdot 10^{+1}$	$-5.83439 \cdot 10^{+2}$
e	$4.87923 \cdot 10^{+1}$	$1.04257 \cdot 10^{+3}$
f	$6.46693 \cdot 10^{+0}$	$2.97092 \cdot 10^{+2}$

Interferences

Persistant Interferences

1. Undissolved particles may lead to higher results.

Method Validation

Limit of Detection	2.07 mg/L
Limit of Quantification	6.2 mg/L
End of Measuring Range	200 mg/L
Sensitivity	77.47 mg/L / Abs
Confidence Intervall	4.6 mg/L
Standard Deviation	4.78 mg/L
Variation Coefficient	4.55 %

DEHA T (L) M165

0.02 - 0.5 mg/L DEHA

PPST

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect	ø 24 mm	560 nm	0.02 - 0.5 mg/L DEHA
SpectroDirect, XD 7000, XD 7500	ø 24 mm	562 nm	0.02 - 0.5 mg/L DEHA

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
DEHA Reagent Solution	15 mL	461185
DEHA Reagent Solution	100 mL	461181
DEHA	Tablet / 100	513220BT
DEHA	Tablet / 250	513221BT

Application List

- Boiler Water
- Cooling Water

Preparation

1. To avoid errors caused by iron deposits, rinse the glassware with Hydrochloric acid (approx. 20%) before the analysis and then rinse with deionised water.

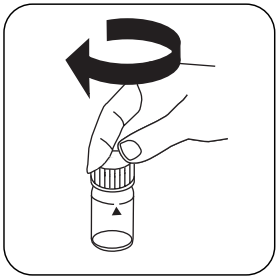
Notes

1. Because the reaction depends on temperature, the temperature must be maintained at 20 °C ± 2 °C.
2. Keep the sample vial in the dark or in the sample chamber during colour development time. If the Reagent solution is exposed to UV-light (sunlight) it causes high measurement results.

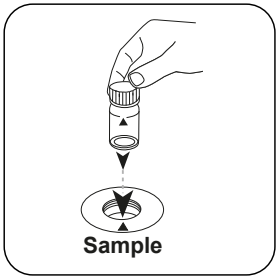
Implementation of the provision DEHA (N,N-Diethylhydroxylamine) with Tablet and Liquid Reagent

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

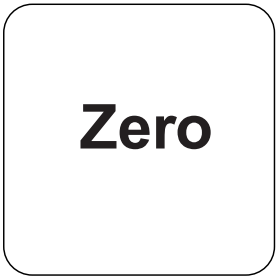
Fill 24 mm vial with **10 ml sample**.



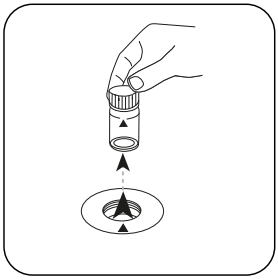
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

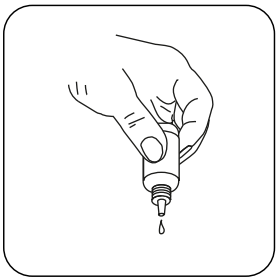


Press the **ZERO** button.

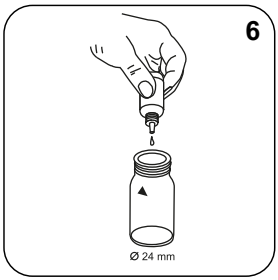


Remove the vial from the sample chamber.

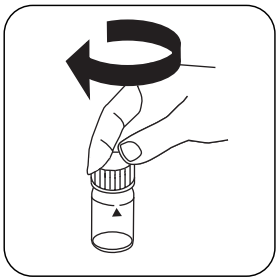
For devices that require **no ZERO measurement** , **start here**.



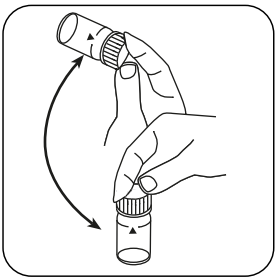
Hold cuvettes vertically and add equal drops by pressing slowly.



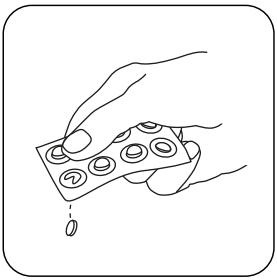
Add **6 drops DEHA Reagent Solution**.



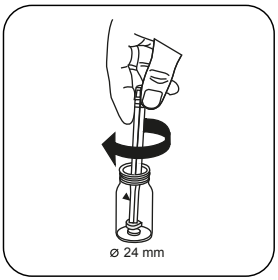
Close vial(s).



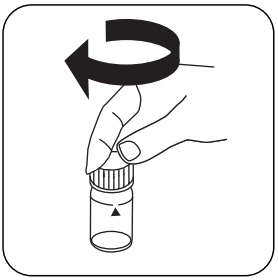
Invert several times to mix the contents.



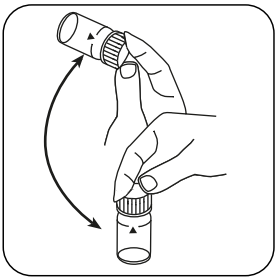
Add **DEHA tablet**.



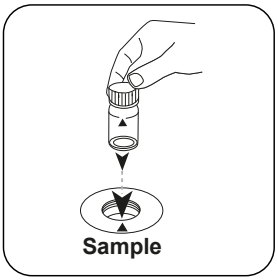
Crush tablet(s) by rotating slightly.



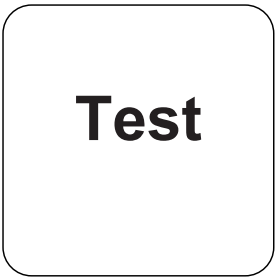
Close vial(s).



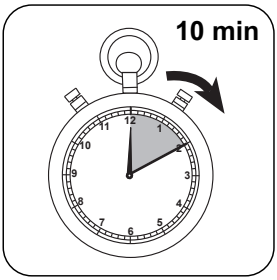
Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **10 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically. The result in DEHA appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	DEHA	1
µg/l	DEHA	1.000
mg/l	Hydrochinon	2.63
mg/l	MEKO	4.5
mg/l	Carbohydrazid	1.31
mg/l	ISA	3.9

Chemical Method

PPST

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^{2} + d•Abs^{3} + e•Abs^{4} + f•Abs^{5}

	ø 24 mm	□ 10 mm
a	-2.04216 • 10^{+1}	-2.04216 • 10^{+1}
b	3.46512 • 10^{+2}	7.45001 • 10^{+2}
c	2.52971 • 10^{+1}	1.16936 • 10^{+2}
d		
e		
f		

Interferences

Removeable Interferences

1. Iron (II) interferes at all concentrations: For the determination of iron (II) concentration, the test is repeated without the addition of DEHA solution. Should the concentration be over 20 µg/L, the displayed value will be deducted from the result of the DEHA test result.
2. Substances that reduce Iron (III), interfere. Substances that complex iron strongly, may also interfere.

Interference	from / [mg/L]
Zn	50
$Na_2B_4O_7$	500
Co	0,025
Cu	8
$CaCO_3$	1000
Lignosulfonate	0,05
Mn	0,8
Mo	80
Ni	0,8
PO_4^{3-}	10
$R\text{-}PO(OH)_2$	10
SO_4^{2-}	1000

Bibliography

Photometrische Analyseverfahren, Schwendt, Wissenschaftliche Verlagsgesellschaft mbH, Stuttgart 1989

DEHA PP M167

0.02 - 0.5 mg/L DEHA DEHA

PPST

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 110, MD 600, MD 610, MD 640, MultiDirect	ø 24 mm	560 nm	0.02 - 0.5 mg/L DEHA
SpectroDirect, XD 7000, XD 7500	ø 24 mm	562 nm	0.02 - 0.5 mg/L DEHA

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
VARIO DEHA Reagent Set	1 pc.	536000

Application List

- Boiler Water
- Cooling Water

Preparation

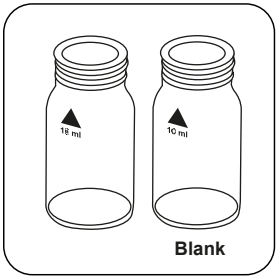
1. To avoid errors caused by iron deposits, rinse the glassware with Hydrochloric acid (approx. 20%) before the analysis and then rinse with deionised water.

Notes

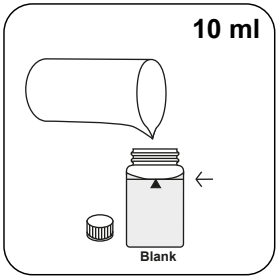
1. Because the reaction depends on temperature, the temperature must be maintained at 20 °C ± 2 °C.
2. Keep the sample vial in the dark or in the sample chamber during colour development time. If the Reagent solution is exposed to UV-light (sunlight) it causes high measurement results.

Implementation of the provision DEHA (N,N-Diethylhydroxylamine) with Vario Powder Pack and Fluid Reagent

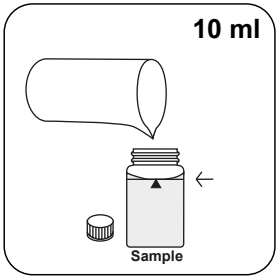
Select the method on the device



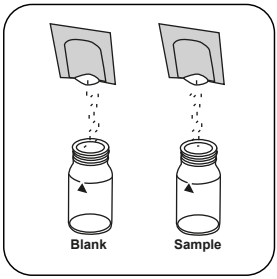
Prepare two clean 24 mm vials. Mark one as a blank.



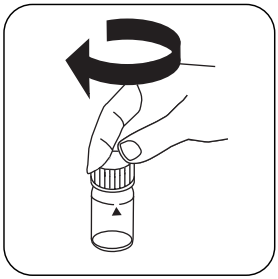
Put **10 ml deionised water** in the blank.



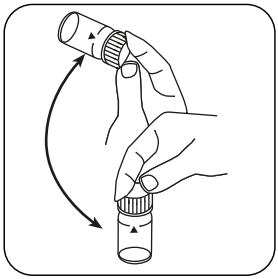
Put **10 ml sample** in the sample vial.



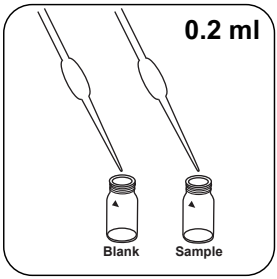
Add **a Vario OXYSCAV 1 Rgt powder pack** in each vial.



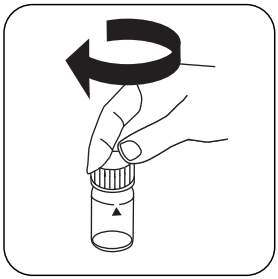
Close vial(s).



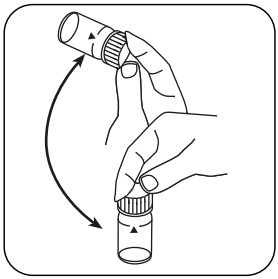
Invert several times to mix the contents.



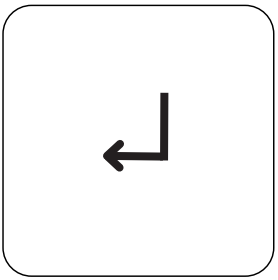
Add **0.2 ml Vario DEHA 2 Rgt solution** to each vial.



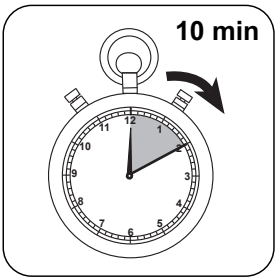
Close vial(s).



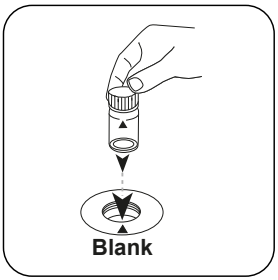
Invert several times to mix the contents.



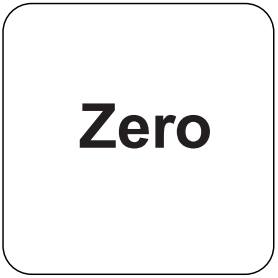
Press the **ENTER** button.



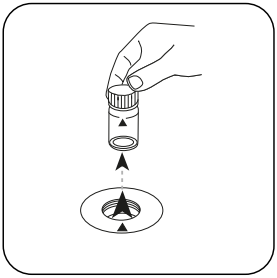
Wait for **10 minute(s) reaction time**.



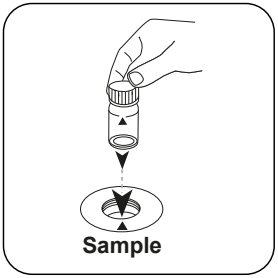
Place **blank** in the sample chamber. • Pay attention to the positioning.



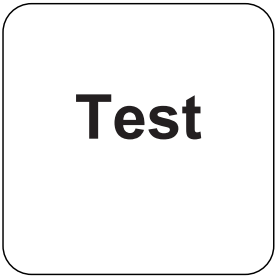
Press the **ZERO** button.



Remove the vial from the sample chamber.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.
The result in DEHA appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	DEHA	1
µg/l	DEHA	1.000
mg/l	Hydrochinon	2.63
mg/l	MEKO	4.5
mg/l	Carbohydrazid	1.31
mg/l	ISA	3.9

Chemical Method

PPST

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ 10 mm
a	-5.56499 • 10^{+0}	-5.56499 • 10^{+0}
b	3.87692 • 10^{+2}	8.33539 • 10^{+2}
c		
d		
e		
f		

Interferences

Removeable Interferences

1. Interference:
   Iron (II) interferes at all concentrations: For the determination of iron (II) concentration, the test is repeated without the addition of DEHA solution. Should the concentration be over 20 µg/L, the displayed value will be deducted from the result of the DEHA test result.
2. Substances that reduce Iron (III), interfere. Substances that complex iron strongly, may also interfere.

Interference	from / [mg/L]
Zn	50
$Na_2B_4O_7$	500
Co	0,025
Cu	8
$CaCO_3$	1000
Lignosulfonate	0,05
Mn	0,8
Mo	80
Ni	0,8
PO_4^{3-}	10
$R\text{-}PO(OH)_2$	10
SO_4^{2-}	1000

Bibliography

Photometrische Analyseverfahren, Schwendt, Wissenschaftliche Verlagsgesellschaft mbH, Stuttgart 1989

Fluoride L M170

0.05 - 2 mg/L F^- F

SPADNS

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 600, MD 610, MD 640, MultiDirect, SpectroDirect, XD 7000, XD 7500	ø 24 mm	580 nm	0.05 - 2 mg/L F^-

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
SPADNS Reagent Solution	250 mL	467481
SPADNS Reagent Solution	500 mL	467482
Calibration Standard Fluoride	30 mL	205630

Application List

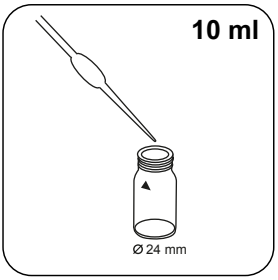
- Drinking Water Treatment
- Raw Water Treatment

Preparation

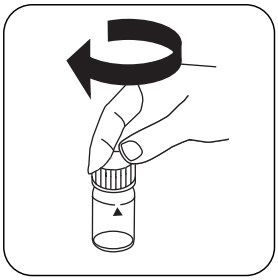
1. A user calibration (see photometer manual) must be carried out before the measurement.
2. The same batch of SPADNS reagent solution must be used for both the user calibration and test (see photometer description). The user calibration process needs to be performed for each new batch of SPADNS reagent solution (see Standard methods 20th, 1998, APHA, AWWA, WEF 4500 F D., S. 4-82).
3. For the user calibration and test, the zeroing and test must be carried out with the same vial, since the vials may have small tolerances.
4. The calibration solution and the water samples to be tested should have the same temperature (± 1 °C).
5. The test result is highly dependent on exact sample and reagent volumes. Sample and reagent volumes should always be measured using a 10 ml or 2 ml volumetric pipette (class A).
6. Seawater and waste water samples must be distilled.
7. It is better practice to use special vials with a larger volume.

Implementation of the provision Fluoride with liquid reagent

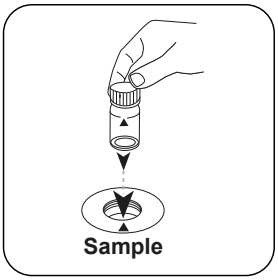
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500
Pay attention to the notes!



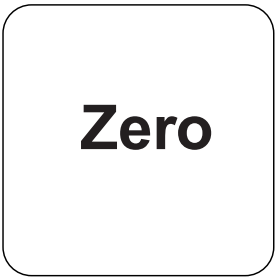
Add **exactly 10 ml sample** to the 450 mm vial.



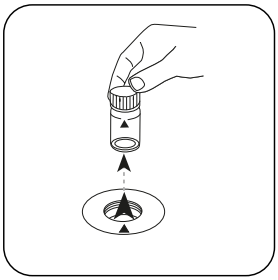
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

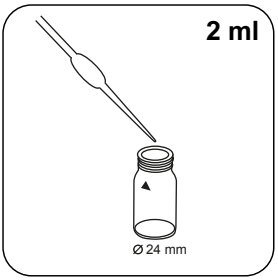


Press the **ZERO** button.

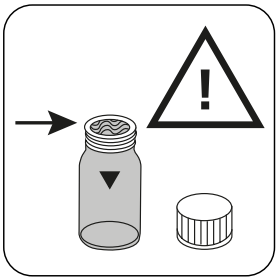


Remove the vial from the sample chamber.

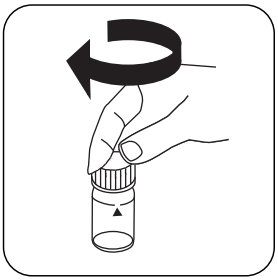
For devices that require **no ZERO measurement** , **start here**.



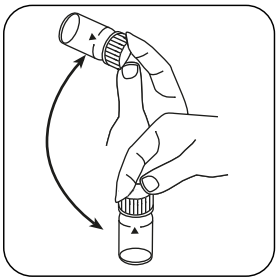
Add **exactly 2 ml** to the 24 mm vial.



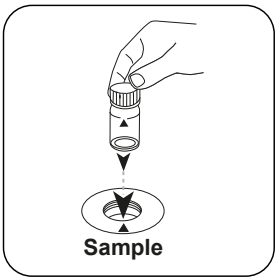
Note: Vial is filled to the top!



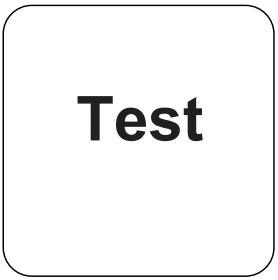
Close vial(s).



Invert several times to mix the contents.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in mg/l Fluorid appears on the display.

Chemical Method

SPADNS

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ **10 mm**
a	8.44253 • 10^{+0}	8.44253 • 10^{+0}
b	-1.41844 • 10^{+1}	-3.04965 • 10^{+1}
c	9.24803 • 10^{+0}	4.2749 • 10^{+1}
d	-2.3046 • 10^{+0}	-2.2904 • 10^{+1}
e		
f		

Interferences

Persistant Interferences

1. The accuracy decreases above a level of 1.2 mg/L Fluoride Although the results are sufficiently accurate for most applications, even more exact results can be achieved by a 1:1 dilution of the sample before use and by the subsequent multiplication of the result by 2.

Interference	**from / [mg/L]**
Cl_2	5

Bibliography

Standard Methods 20th, 1992, APHA, AWWA, WEF 4500 F D, S. 4-82

According to

US EPA 13A
APHA Method 4500 F D

Formaldehyde 10 M. L M175

1.00 - 5.00 mg/L HCHO

H_2SO_4 / Chromotropic acid

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	□ 10 mm	585 nm	1.00 - 5.00 mg/L HCHO

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Formaldehyde Spectroquant 1.14678.0001 tube test [d)]	25 pc.	420751

Application List

- Waste Water Treatment

Preparation

1. Before performing the test, you must read through the original instructions and safety advice that is delivered with the test kit (MSDS are available on the homepage of www.merckmillipore.com).

Notes

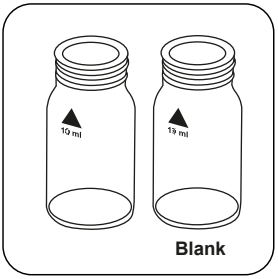
1. This method is adapted from MERCK.
2. Spectroquant® is a registered trademark of the company MERCK KGaA.
3. Appropriate safety precautions and good laboratory technique should be used during the whole procedure.
4. Sample volume should always be metered by using a 3ml volumetric pipette (class A).
5. Because the reaction depends on temperature, the sample temperature must be between 20 °C and 25 °C.

Variations in the length of the vial can extend the measuring range:

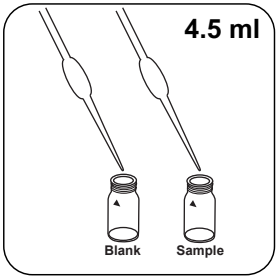
- 10 mm vial: 0.1 mg/L - 5 mg/L, solution: 0.01
- 20 mm vial: 0.05 mg/L - 2.5 mg/L, solution: 0.01
- 50 mm vial: 0.02 mg/L - 1.0 mg/L, solution: 0.001

Implementation of the provision Formaldehyde with MERCK Spectroquant® Test, No. 1.14678.0001

Select the method on the device

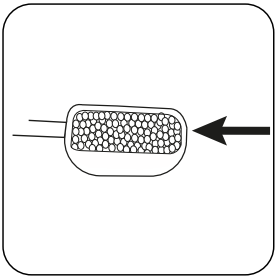


Prepare two clean 24 mm vials. Mark one as a blank.

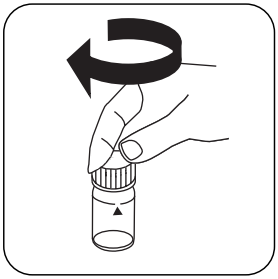


Add **4.5 ml HCHO-1 solution** to each vial.

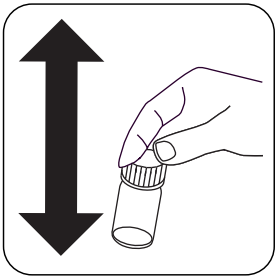
Note: Reagent contains concentrated Sulphuric acid!



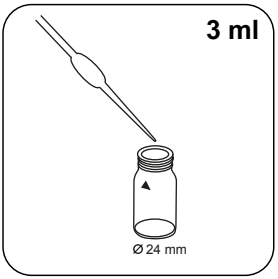
Add exactly **one level microspoon HCHO-2**.



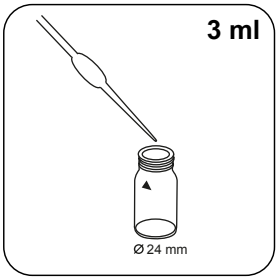
Close vial(s).



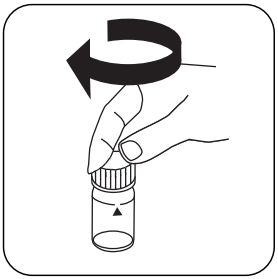
Dissolve the contents by shaking.



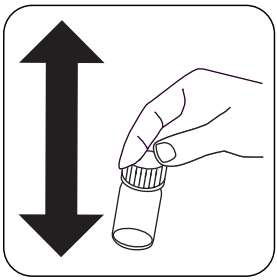
Put **3 ml deionised water** in the blank.



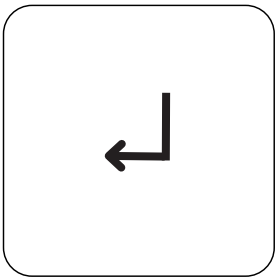
Put **3 ml sample** in the sample vial.



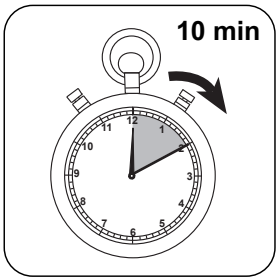
Close vial(s).



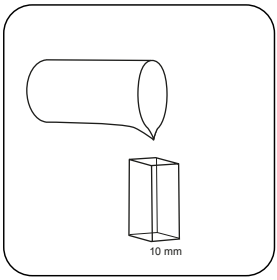
Mix the contents by shaking.



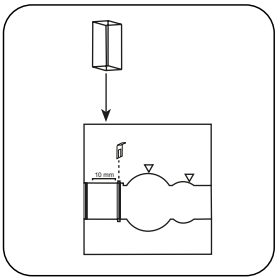
Press the **ENTER** button.



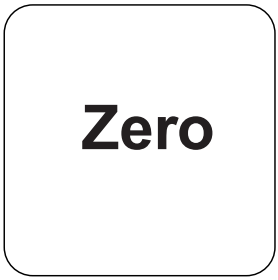
Wait for **10 minute(s) reaction time**.



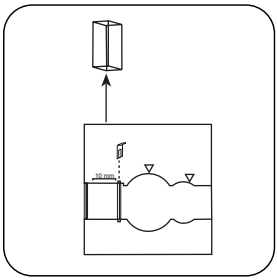
Fill **10 mm vial** with **zero sample** .



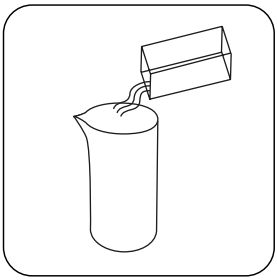
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



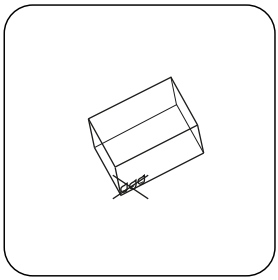
Press the **ZERO** button.



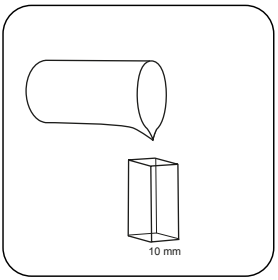
Remove **vial** from the sample chamber.



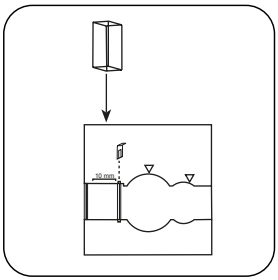
Empty vial.



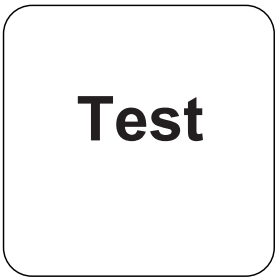
Dry the vial thoroughly.



Fill 10 mm vial with **sample**.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in mg/l Formaldehyde appears on the display.

Chemical Method

H_2SO_4 / Chromotropic acid

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	□ **10 mm**
a	$5.21412 \cdot 10^{-2}$
b	$3.77025 \cdot 10^{+0}$
c	
d	
e	
f	

Interferences

Interference	**from / [mg/L]**
Al	1000
Ca^{2+}	1000
Cd^{2+}	100
CN^-	100
CO_3^{2-}	100
Cr^{3+}	1000
$Cr_2O_7^{2-}$	1000
Cu^{2+}	100
F^-	100
Fe^{3+}	10
Hg^{2+}	1000
Mg^{2+}	1000
Mn^{2+}	1000
NH_4^+	1000
Ni^{2+}	100
NO_2^-	1

Interference	from / [mg/L]
NO_3^-	10
Pb^{2+}	100
PO_4^{3-}	100
S^{2-}	10
SCN^-	100
SiO_4^{4-}	100
SO_3^{2-}	100
Zn^{2+}	1000
EDTA	1000
$H_2N\text{-}NH_2$	100
Surfactants	100
H_2O_2	10
NaAc	0.05
NaCl	0.25
$NaNO_3$	0.005
Na_2SO_4	0.5

Bibliography

Georghiou P.E., Ho C.K., Can. J. Chem. 67, 871 (1989)

[d] Spectroquant® is a Merck KGaA Trademark

Formaldehyde 50 M. L M176

0.02 - 1.00 mg/L HCHO

H_2SO_4 / Chromotropic acid

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	□ 50 mm	585 nm	0.02 - 1.00 mg/L HCHO

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Formaldehyde Spectroquant 1.14678.0001 tube test [d)]	25 pc.	420751

The following accessories are required.

Accessories	Packaging Unit	Part Number
Semimicro cell, 50 mm with lid	1 pc.	71310045

Application List

- Waste Water Treatment

Preparation

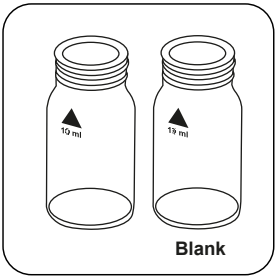
1. Before performing the test, you must read through the original instructions and safety advice that is delivered with the test kit (MSDS are available on the homepage of www.merckmillipore.com).

Notes

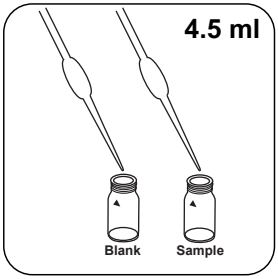
1. This method is adapted from MERCK.
2. Spectroquant® is a registered trademark of the company MERCK KGaA.
3. Appropriate safety precautions and good laboratory technique should be used during the whole procedure.
4. Sample volume should always be metered by using a 3ml volumetric pipette (class A).
5. Because the reaction depends on temperature, the sample temperature must be between 20 °C and 25 °C.

Implementation of the provision Formaldehyde with MERCK Spectroquant® Test, No. 1.14678.0001

Select the method on the device

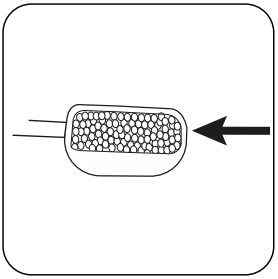


Prepare two clean 24 mm vials. Mark one as a blank.

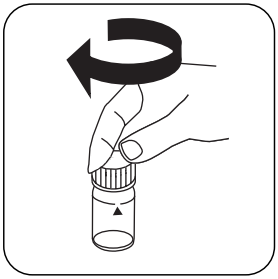


Add **4.5 ml HCHO-1 solution** to each vial.

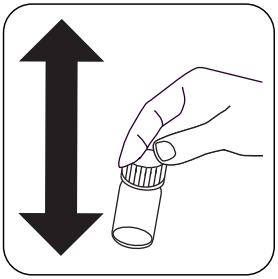
Note: Reagent contains concentrated Sulphuric acid!



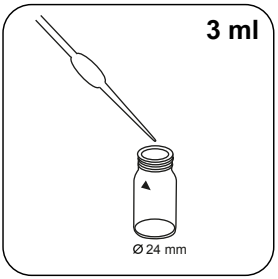
Add exactly **one level microspoon HCHO-2**.



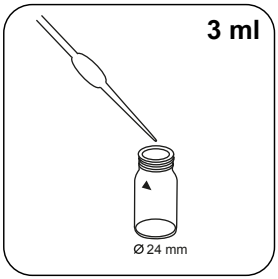
Close vial(s).



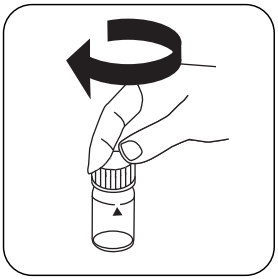
Dissolve the contents by shaking.



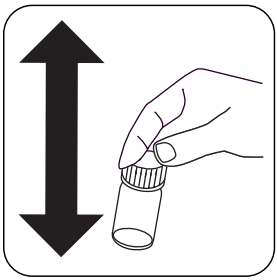
Put **3 ml deionised water** in the blank.



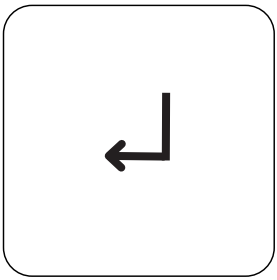
Put **3 ml sample** in the sample vial.



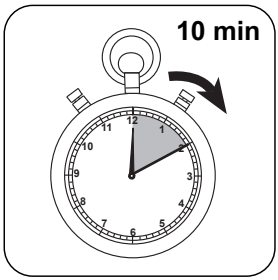
Close vial(s).



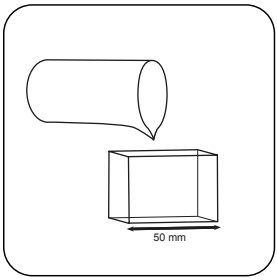
Mix the contents by shaking.



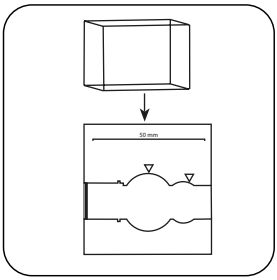
Press the **ENTER** button.



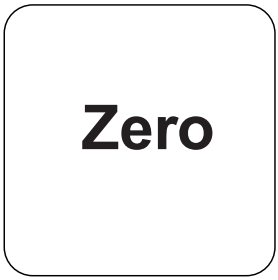
Wait for **10 minute(s) reaction time**.



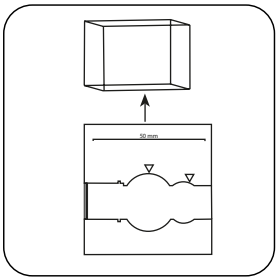
Fill **50 mm vial** with **zero sample** .



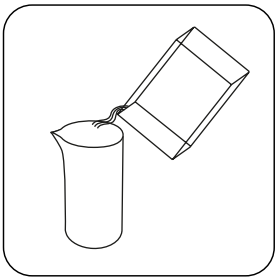
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



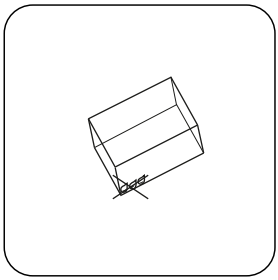
Press the **ZERO** button.



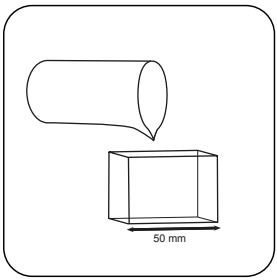
Remove **vial** from the sample chamber.



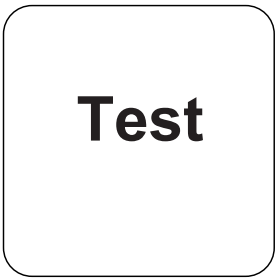
Empty vial.



Dry the vial thoroughly.



Fill 50 mm vial with **sample**.



Press the **TEST** (XD: **START**)button.

The result in mg/l Formaldehyde appears on the display.

Chemical Method

H_2SO_4 / Chromotropic acid

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	□ **50 mm**
a	$-3.74124 \cdot 10^{-3}$
b	$7.09703 \cdot 10^{-1}$
c	
d	
e	
f	

Interferences

Interference	**from / [mg/L]**
Al	1000
Ca^{2+}	1000
Cd^{2+}	100
CN^-	100
CO_3^{2-}	100
Cr^{3+}	1000
$Cr_2O_7^{2-}$	1000
Cu^{2+}	100
F^-	100
Fe^{3+}	10
Hg^{2+}	1000
Mg^{2+}	1000
Mn^{2+}	1000
NH_4^+	1000
Ni^{2+}	1000
NO_2^-	1

Interference	from / [mg/L]
NO_3^-	10
Pb^{2+}	10
PO_4^{3-}	100
S^{2-}	10
SCN^-	100
SiO_4^{4-}	100
SO_3^{2-}	100
Zn^{2+}	1000
EDTA	1000
$H_2N\text{-}NH_2$	100
Surfactants	100
H_2O_2	10
NaAc	0.05
NaCl	0.25
$NaNO_3$	0.005
Na_2SO_4	0.5

Bibliography

Georghiou P.E., Ho C.K., Can. J. Chem. 67, 871 (1989)

[d] Spectroquant® is a Merck KGaA Trademark

Formaldehyde M. TT M177

0.1 - 5 mg/L HCHO

H_2SO_4 / Chromotropic acid

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	ø 16 mm	575 nm	0.1 - 5 mg/L HCHO

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Formaldehyde Spectroquant 1.14500.0001 tube test [d)]	25 pc.	420752

Application List

- Waste Water Treatment

Preparation

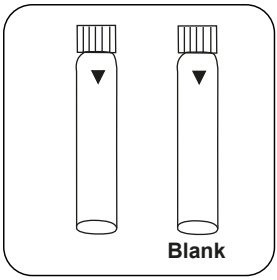
1. Before performing the test, you must read through the original instructions and safety advice that is delivered with the test kit (MSDS are available on the homepage of www.merckmillipore.com).

Notes

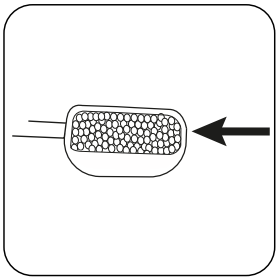
1. This method is adapted from MERCK.
2. Spectroquant® is a registered trademark of the company MERCK KGaA.
3. Appropriate safety precautions and good laboratory technique should be used during the whole procedure.
4. Sample volume should always be metered by using a 2ml volumetric pipette (class A).
5. Because the reaction depends on temperature, the sample temperature must be between 20 °C and 25 °C.
6. The reagents are to be stored in closed containers at a temperature of +15 °C – +25 °C.

Implementation of the provision Formaldehyde with MERCK Spectroquant® Test, No. 1.14500.0001

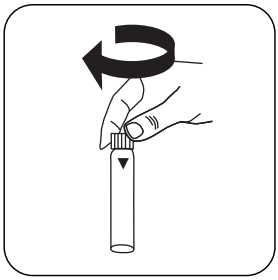
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500
Skip steps with Blank.



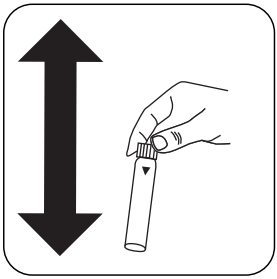
Prepare two **reaction vials**. Mark one as a blank.



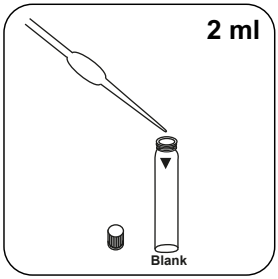
Add exactly **one level microspoon HCHO-1K**.



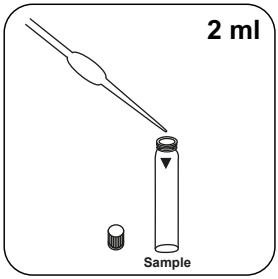
Close vial(s).



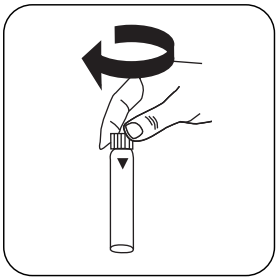
Dissolve the contents by shaking.



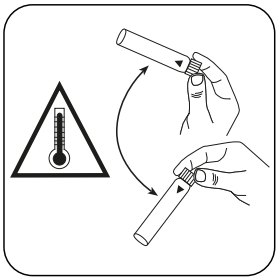
Put **2 ml deionised water** in the blank.



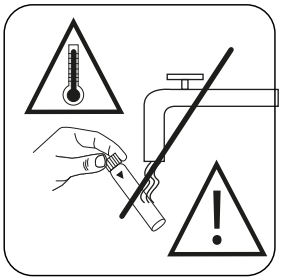
Put **2 ml sample** in the sample vial.



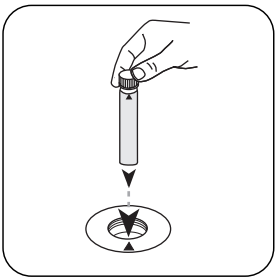
Close vial(s).



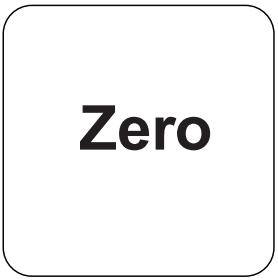
Carefully invert several times to mix the contents. **(NOTE: vial will be hot!)**



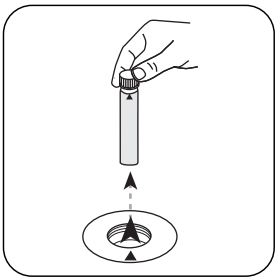
NOTE: Vial will be hot! Do not cool it with water!



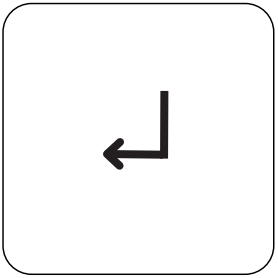
Place **blank** in the sample chamber. • Pay attention to the positioning.



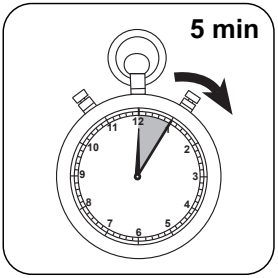
Press the **ZERO** button.



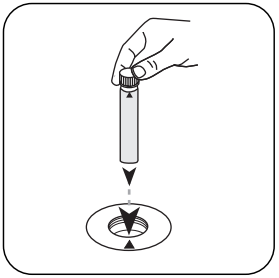
Remove **vial** from the sample chamber.



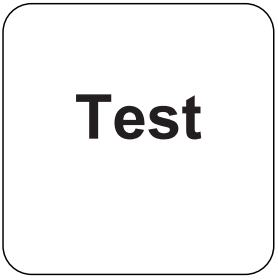
Press the **ENTER** button.



Wait for **5 minute(s) reaction time**.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.
The result in mg/l Formaldehyde appears on the display.

Chemical Method

H_2SO_4 / Chromotropic acid

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 16 mm
a	-6.32712 • 10^{-2}
b	3.24743 • 10^{+0}
c	
d	
e	
f	

Interferences

Bibliography

Kleinert, T. & Srepel, E. Mikrochim Acta (1948) 33: 328. doi:10.1007/BF01414370

[d] Spectroquant® is a Merck KGaA Trademark

Hardness Calcium (B) T M190

50 - 900 mg/L $CaCO_3$

Murexide

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect, XD 7000, XD 7500	ø 24 mm	560 nm	50 - 900 mg/L $CaCO_3$

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
CALCHECK	Tablet / 100	515650BT
CALCHECK	Tablet / 250	515651
CALCHECK	Tablet / 250	515651BT

Application List

- Cooling Water
- Boiler Water
- Drinking Water Treatment
- Raw Water Treatment

Preparation

1. Strong alkaline or acidic water samples should be adjusted between pH 4 and pH 10 before the analysis (use 1 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).
2. It is better practice to use special vials with a larger volume.

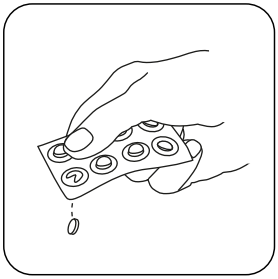
Notes

1. The method works in the high measuring range with greater tolerances than in the low measuring range. When diluting samples, always measure in the first third of the range.
2. This method was developed from a volumetric procedure for the determination of calcium. Due to undefined conditions, the deviations from the standardised method may be greater.

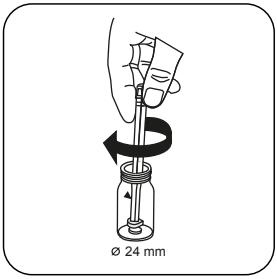
Implementation of the provision Hardness Calcium with Tablet

Select the method on the device

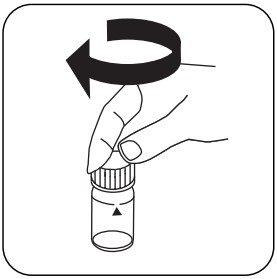
Fill 24 mm vial with **10 ml deionised water** .



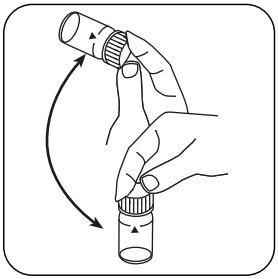
Add **CALCHECK tablet**.



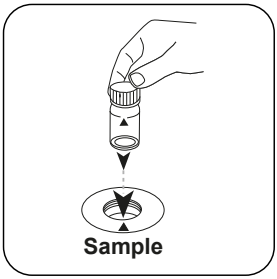
Crush tablet(s) by rotating slightly.



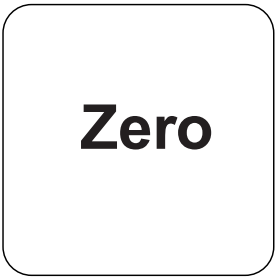
Close vial(s).



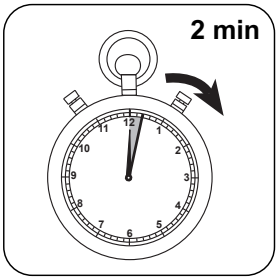
Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

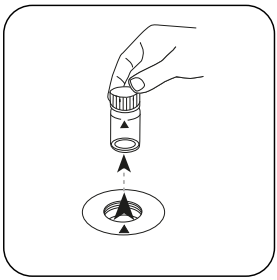


Press the **ZERO** button.
XD: Sampleblank

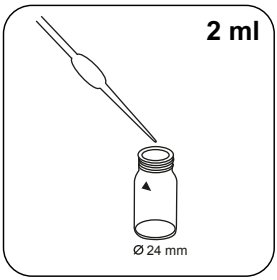


Wait for **2 minute(s) reaction time**.

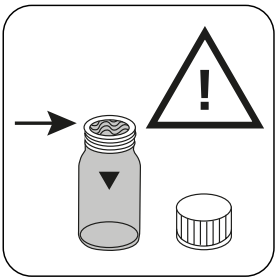
Once the reaction period is finished, the measurement takes place automatically.



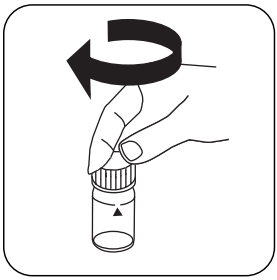
Remove the vial from the sample chamber.



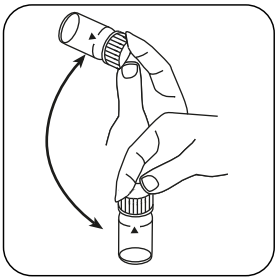
Put **2 ml sample** in the vial.



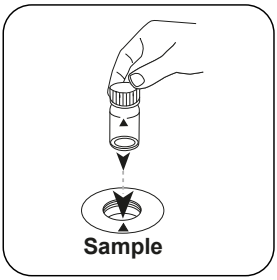
Note: Vial is filled to the top!



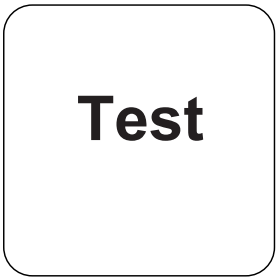
Close vial(s).



Invert several times to mix the contents (5x).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.
The result in Calcium Hardness appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	$CaCO_3$	1
	°dH	0.056
	°eH	0.07
	°fH	0.1
	°aH	1
mg/l	Ca	0.40043

Chemical Method

Murexide

Appendix

Interferences

Persistant Interferences

1. Silver, mercury, cadmium, cobalt and copper interfere with the test result.

Bibliography

Photometrische Analyse, Lange/ Vjedelek, Verlag Chemie 1980

Hardness Calcium (B) T M191

20 - 500 mg/L $CaCO_3$ CAH

Murexide

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 110, MD 200, MD 600, MD 610, MD 640, MultiDirect, PM 600, PM 620, PM 630, XD 7000, XD 7500	ø 24 mm	560 nm	20 - 500 mg/L $CaCO_3$

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Set Calcio H No. 1/No. 2 100 Pc.#	100 each	517761BT
Set Calcio H No. 1/No. 2 250 Pc.#	250 each	517762BT

Application List

- Cooling Water
- Boiler Water
- Pool Water Control
- Pool Water Treatment
- Drinking Water Treatment
- Raw Water Treatment

Preparation

1. Strong alkaline or acidic water samples should be adjusted between pH 4 and pH 10 before the analysis (use 1 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).

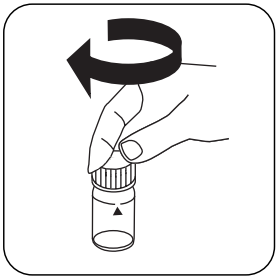
Notes

1. To optimise the readings, an optional batch-specific blind value method can be performed (see photometer description).
2. For accurate results, exactly 10 ml of water sample must be used for the test.
3. This method was developed from a volumetric procedure. Due to undefined boundary conditions, deviations from the standardised method may be greater.
4. The method works in the high measuring range with greater tolerances than in the low measuring range. When diluting samples, always measure in the first third of the range.

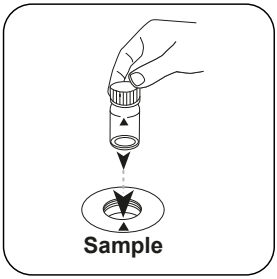
Implementation of the provision Hardness Calcium 2 with Tablet

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

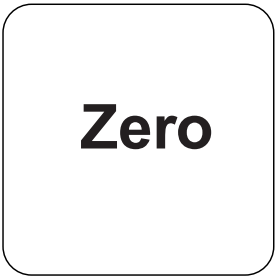
Fill 24 mm vial with **10 ml sample**.



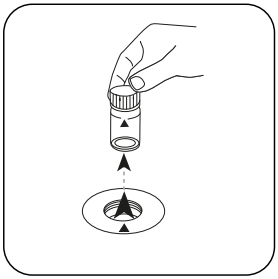
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

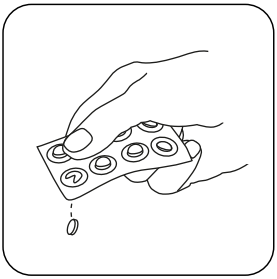


Press the **ZERO** button.

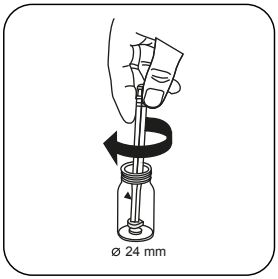


Remove the vial from the sample chamber.

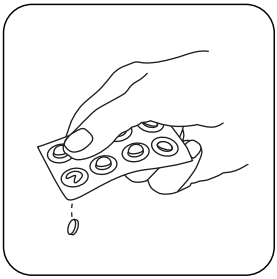
For devices that require **no ZERO measurement** , **start here**.



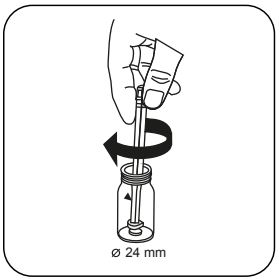
Add **CALCIO H No.1 tablet** .



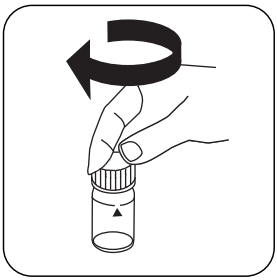
Crush tablet(s) by rotating slightly and dissolve.



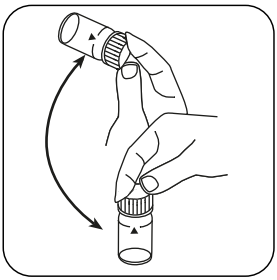
Add **CALCIO H No.2 tablet** .



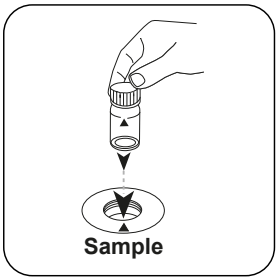
Crush tablet(s) by rotating slightly.



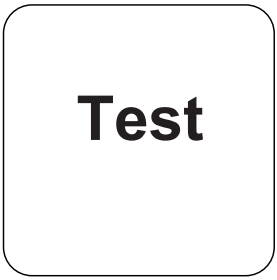
Close vial(s).



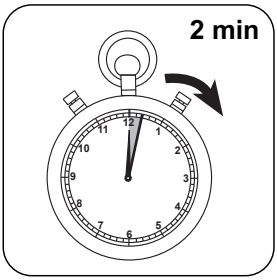
Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **2 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in Calcium Hardness appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	$CaCO_3$	1
	°dH	0.056
	°eH	0.07
	°fH	0.1
	°aH	1

Chemical Method

Murexide

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ 10 mm
a	$1.40008 \cdot 10^{+4}$	$1.40008 \cdot 10^{+4}$
b	$-6.16015 \cdot 10^{+4}$	$-1.32443 \cdot 10^{+5}$
c	$1.0917 \cdot 10^{+5}$	$5.04637 \cdot 10^{+5}$
d	$-9.63601 \cdot 10^{+4}$	$-9.57662 \cdot 10^{+5}$
e	$4.21873 \cdot 10^{+4}$	$9.01438 \cdot 10^{+5}$
f	$-7.31973 \cdot 10^{+3}$	$-3.3627 \cdot 10^{+5}$

Interferences

Persistant Interferences

1. Silver, mercury, cadmium, cobalt and copper interfere with the test result.

Interference	from / [mg/L]
Mg^{2+}	200 ($CaCO_3$)
Fe	10
Zn^{2+}	5

Bibliography

Photometrische Analyse, Lange/ Vjedelek, Verlag Chemie 1980

including stirring rod, 10 cm

Hardness total T — M200

2 - 50 mg/L $CaCO_3$ — tH1

Metallphthaleine

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 600, MD 610, MD 640, MultiDirect, PM 620, PM 630	ø 24 mm	560 nm	2 - 50 mg/L $CaCO_3$
SpectroDirect, XD 7000, XD 7500	ø 24 mm	571 nm	2 - 50 mg/L $CaCO_3$

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Hardcheck P	Tablet / 100	515660BT
Hardcheck P	Tablet / 250	515661BT

Application List

- Cooling Water
- Boiler Water
- Pool Water Treatment
- Drinking Water Treatment
- Raw Water Treatment

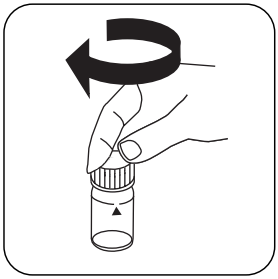
Preparation

1. Strong alkaline or acidic water samples should be adjusted between pH 4 and pH 10 before the analysis (use 1 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).

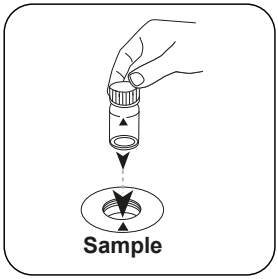
Implementation of the provision Hardness Calcium, Total with Tablet

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

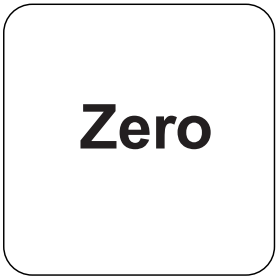
Fill 24 mm vial with **10 ml sample**.



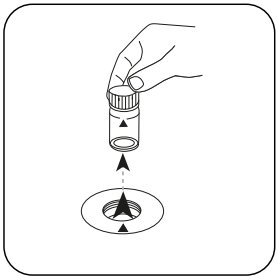
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

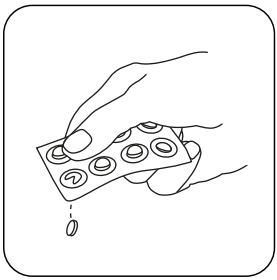


Press the **ZERO** button.

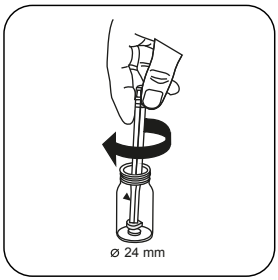


Remove the vial from the sample chamber.

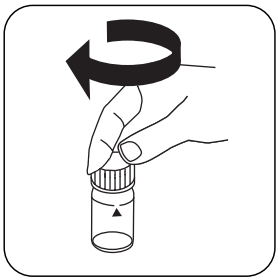
For devices that require **no ZERO measurement** , **start here**.



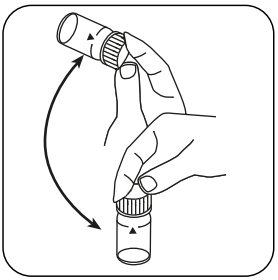
Add **HARDCHECK P tablet**.



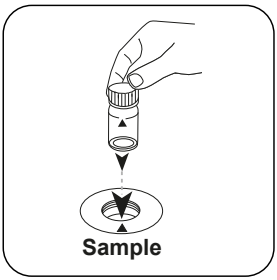
Crush tablet(s) by rotating slightly.



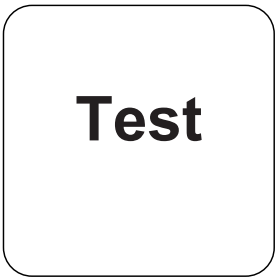
Close vial(s).



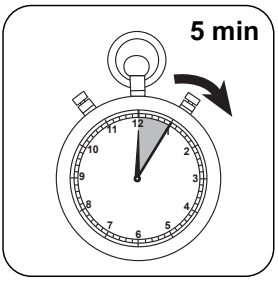
Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **5 minute(s) reaction time**.
Once the reaction period is finished, the measurement takes place automatically.
The result in total Hardness appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	$CaCO_3$	1
	°dH	0.056
	°eH	0.07
	°fH	0.1
	°aH	1
mg/l	Ca	0.40043

Chemical Method

Metallphthaleine

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ 10 mm
a	$-4.33652 \cdot 10^{+0}$	$-4.54265 \cdot 10^{+0}$
b	$5.47914 \cdot 10^{+1}$	$1.18846 \cdot 10^{+2}$
c	$-8.96251 \cdot 10^{+0}$	$-4.18717 \cdot 10^{+1}$
d		
e		
f		

Interferences

Removeable Interferences

1. Interference from zinc and magnesium can be eliminated by the addition of 8-hydroxychinoline.
2. Concentrations of strontium and barium that occur in waters and soils do not interfere.

Method Validation

Limit of Detection	0.88 mg/L
Limit of Quantification	2.64 mg/L
End of Measuring Range	50 mg/L
Sensitivity	42.5 mg/L / Abs
Confidence Intervall	2.62 mg/L
Standard Deviation	1.08 mg/L
Variation Coefficient	4.17 %

Bibliography

Photometrische Analyseverfahren, Schwendt, Wissenschaftliche Verlagsgesellschaft mbH, Stuttgart 1989

Hardness total HR T M201

20 - 500 mg/L $CaCO_3$ [i] tH2

Metallphthaleine

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 110, MD 600, MD 610, MD 640, MultiDirect, PM 620, PM 630	ø 24 mm	560 nm	20 - 500 mg/L $CaCO_3$ [i]
SpectroDirect, XD 7000, XD 7500	ø 24 mm	571 nm	20 - 500 mg/L $CaCO_3$ [i]

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Hardcheck P	Tablet / 100	515660BT
Hardcheck P	Tablet / 250	515661BT

Application List

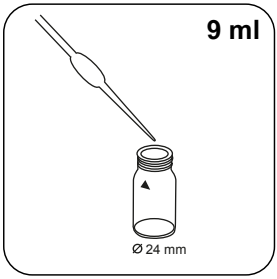
- Cooling Water
- Boiler Water
- Pool Water Treatment
- Drinking Water Treatment
- Raw Water Treatment

Preparation

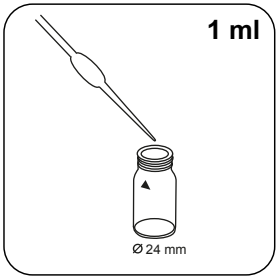
1. Strong alkaline or acidic water samples should be adjusted between pH 4 and pH 10 before the analysis (use 1 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).

Implementation of the provision Hardness total HR with tablet

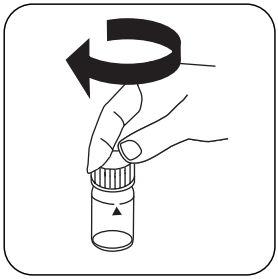
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



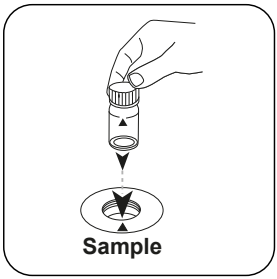
Fill 24 mm vial with **9 ml deionised water** .



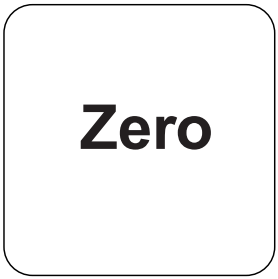
Put **1 ml sample** in the vial.



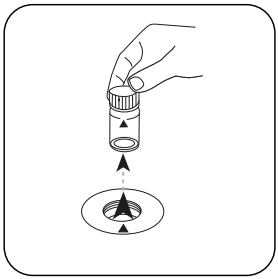
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

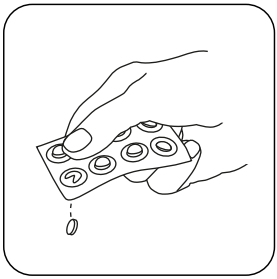


Press the **ZERO** button.

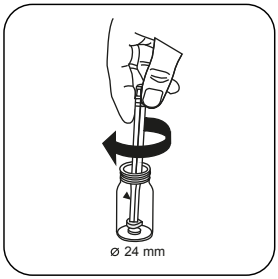


Remove the vial from the sample chamber.

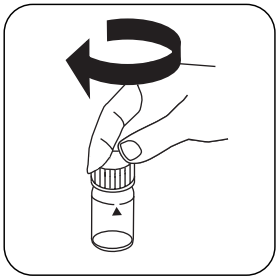
For devices that require **no ZERO measurement** , **start here**.



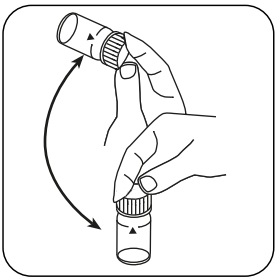
Add **HARDCHECK P tablet**.



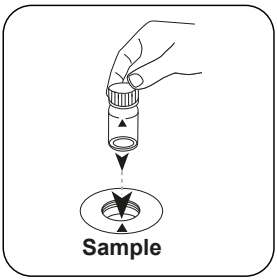
Crush tablet(s) by rotating slightly.



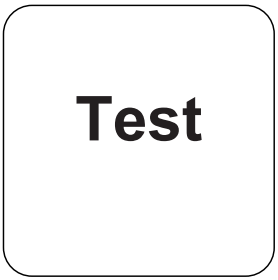
Close vial(s).



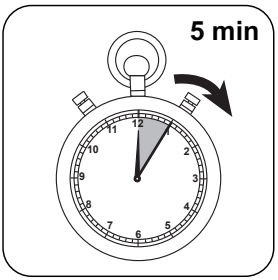
Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **5 minute(s) reaction time**.
Once the reaction period is finished, the measurement takes place automatically.
The result in total Hardness appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	$CaCO_3$	1
	°dH	0.056
	°eH	0.07
	°fH	0.1
	°aH	1
mg/l	Ca	0.40043

Chemical Method

Metallphthaleine

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ 10 mm
a	$-3.06466 \cdot 10^{+1}$	$-3.06466 \cdot 10^{+1}$
b	$5.0694 \cdot 10^{+2}$	$1.08992 \cdot 10^{+3}$
c	$-6.33317 \cdot 10^{+1}$	$-2.92751 \cdot 10^{+2}$
d		
e		
f		

Interferences

Removeable Interferences

1. Interference from zinc and magnesium can be eliminated by the addition of 8-hydroxychinoline.
2. Concentrations of strontium and barium that occur in waters and soils do not interfere.

Bibliography

Photometrische Analyseverfahren, Schwendt, Wissenschaftliche Verlagsgesellschaft mbH, Stuttgart 1989

[i] high range by dilution

Hazen 50 M203

10 - 500 mg/L Pt
(APHA) Platinum Cobalt Standard Method

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	□ 50 mm	455 nm	10 - 500 mg/L Pt

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
no reagent required		

Application List

- Waste Water Treatment
- Drinking Water Treatment
- Raw Water Treatment

Preparation

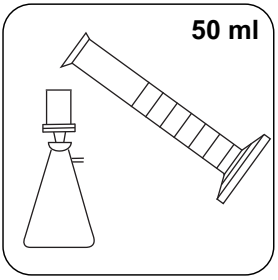
1. Sample collection, preservation and storage:
   Pour the water sample into clean glass or plastic containers and analyse as soon as possible after the sample is taken. If this is not possible, fill the container right up to the top and seal tightly. Do not stir the sample and avoid lengthy contact with the air. The sample may be stored in a dark place at a temperature of 4 °C for 24 hours. Before carrying out any measurements, the water sample should be brought up to room temperature.

Notes

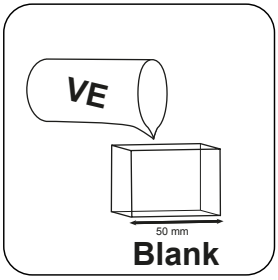
1. This colour scale was originally developed by A. Hazen as a visual comparison scale. It is therefore necessary to ascertain whether the extinction maximum of the water sample is in the range between 420 and 470 nm, as this method is only suitable for water samples with yellowish to yellowish-brown colouration. Where applicable, a decision should be made based on visual inspection of the water sample.
2. This method is calibrated on the basis of the standards specified by ”Standard Methods for the Examination of Water and Wastewater” (also see EN ISO 7887:1994). Pt-Co colour unit ^= 1 mg/L of platinum as chloroplatinate ion
3. Colour may be expressed as “true” or “apparent” colour. The apparent colour is defined as the colour of a solution due to dissolved substances and suspended particles in the sample. This manual describes the determination of true colour by filtration of the water sample. To determine the apparent colour, non-filtrated deionised water and sample are measured.
4. The estimated detection limit is 10 mg/L Pt.

Implementation of the provision Colour, true and apparent

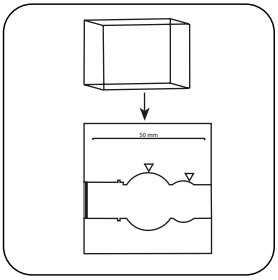
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



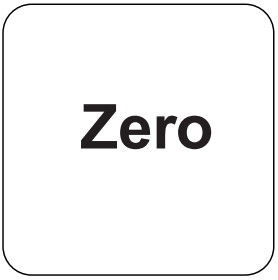
Filter approx. 50 ml sample with a pre-rinsed filter (pore size 0.45 µm).



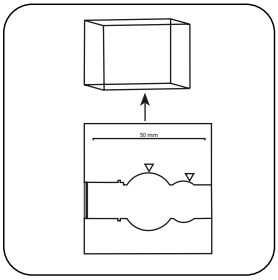
Fill **50 mm vial** with **deionised water** .



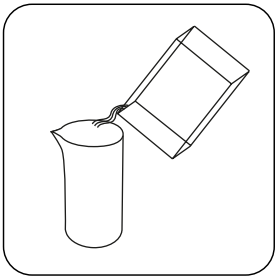
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **ZERO** button.

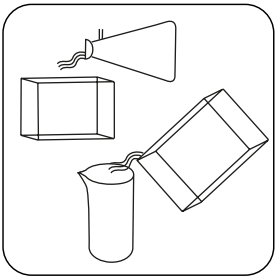


Remove **vial** from the sample chamber.

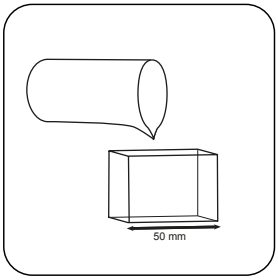


Empty vial.

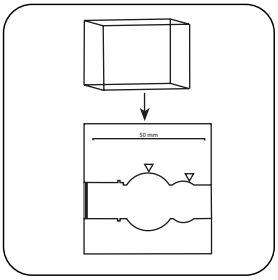
For devices that require **no ZERO measurement** , **start here**.



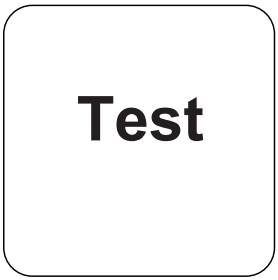
Pre-rinse vial with water sample.



Fill 50 mm vial with prepared sample.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.
The result in Pt-Co units appears on the display.

Chemical Method

(APHA) Platinum Cobalt Standard Method

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	□ **50 mm**
a	-3.54386 • 10^{+0}
b	7.57544 • 10^{+2}
c	
d	
e	
f	

According to

DIN 7887-C1
(WL 430, 455 nm;
Standard: 410 nm)

Hazen 24 M204

10 - 500 mg/L Pt PtCo

(APHA) Platinum Cobalt Standard Method

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 600, MD 610, MD 640, MultiDirect	ø 24 mm	430 nm	10 - 500 mg/L Pt
XD 7000, XD 7500	ø 24 mm	455 nm	10 - 500 mg/L Pt

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
no reagent required		

Application List

- Waste Water Treatment
- Drinking Water Treatment
- Raw Water Treatment

Preparation

1. Sample collection, preservation and storage:
   Pour the water sample into clean glass or plastic containers and analyse as soon as possible after the sample is taken. If this is not possible, fill the container right up to the top and seal tightly. Do not stir the sample and avoid lengthy contact with the air. The sample may be stored in a dark place at a temperature of 4 °C for 24 hours. Before carrying out any measurements, the water sample should be brought up to room temperature.

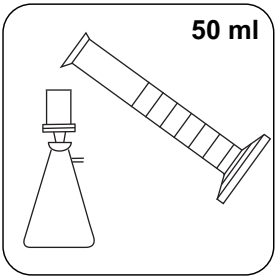
Notes

1. This colour scale was originally developed by A. Hazen as a visual comparison scale. It is therefore necessary to ascertain whether the extinction maximum of the water sample is in the range between 420 and 470 nm, as this method is only suitable for water samples with yellowish to yellowish-brown colouration. Where applicable, a decision should be made based on visual inspection of the water sample. 2. This method is

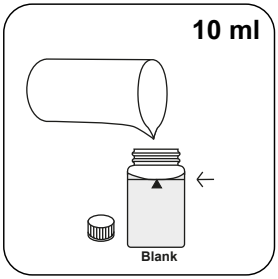
calibrated on the basis of the standards specified by ”Standard Methods for the Examination of Water and Wastewater” (also see EN ISO 7887:1994).
Pt-Co colour unit ^= 1 mg/L of platinum as chloroplatinate ion 3. Colour may be expressed as “true” or “apparent” colour. The apparent colour is defined as the colour of a solution due to dissolved substances and suspended particles in the sample.
This manual describes the determination of true colour by filtration of the water sample. To determine the apparent colour, non-filtrated deionised water and sample are measured. 4. The estimated detection limit for this method is 15 mg/L Pt.

Implementation of the provision Colour, true and apparent

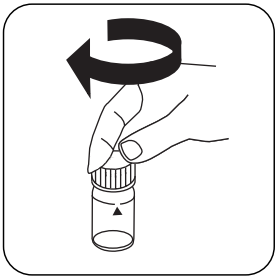
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



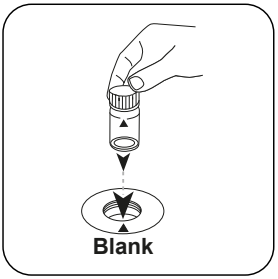
Filter approx. 50 ml sample with a pre-rinsed filter (pore size 0.45 µm).



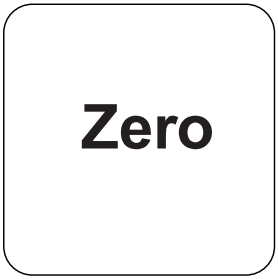
Put **10 ml deionised water** in the blank.



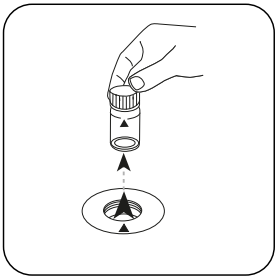
Close vial(s).



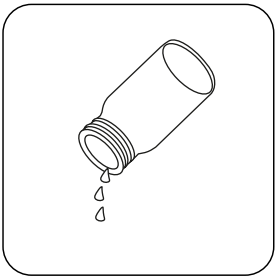
Place **blank** in the sample chamber. • Pay attention to the positioning.



Press the **ZERO** button.

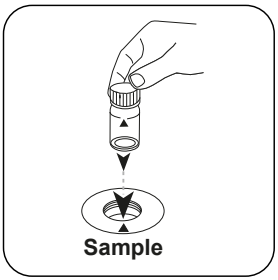


Remove the vial from the sample chamber.

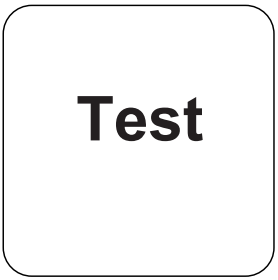


Empty vial.
For devices that require **no ZERO measurement** , **start here**.

Fill 24 mm vial with **10 ml prepared sample** .



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in Pt-Co units appears on the display.

Chemical Method

(APHA) Platinum Cobalt Standard Method

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	$-8.76424 \cdot 10^{-2}$	$6.76451 \cdot 10^{+0}$
b	$1.71832 \cdot 10^{+3}$	$3.6463 \cdot 10^{+3}$
c		
d		
e		
f		

Method Validation

Limit of Detection	10.26 mg/L
Limit of Quantification	30.77 mg/L
End of Measuring Range	500 mg/L
Sensitivity	1,719.12 mg/L / Abs
Confidence Intervall	10.25 mg/L
Standard Deviation	4.24 mg/L
Variation Coefficient	1.6 %

According to

DIN 7887-C1
(WL 430, 455 nm;
Standard: 410 nm)

Hydrazine P M205

0.05 - 0.5 mg/L N_2H_4 Hydr

Dimethylaminobenzaldehyde

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 110, MD 600, MD 610, MD 640, MultiDirect	ø 24 mm	430 nm	0.05 - 0.5 mg/L N_2H_4
SpectroDirect, XD 7000, XD 7500	ø 24 mm	455 nm	0.05 - 0.5 mg/L N_2H_4

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Hydrazine Test Powder	Powder / 30 g	462910

The following accessories are required.

Accessories	Packaging Unit	Part Number
Measuring spoon, 1 g	1 pc.	384930

Application List

- Boiler Water
- Cooling Water

Preparation

1. If the water sample is turbid, it must be filtered before performing the zeroing.
2. The sample's temperature should not exceed 21 °C.

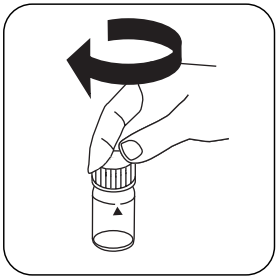
Notes

1. When using the hydrazine measuring spoon, 1 g is a level measuring spoon.
2. For removal of the reagents resulting in turbidity, ensure to use a quality membrane filter for medium deposits.
3. To check the reagent for prolonged storage and possible ageing, follow the test as described for tap water. Should the result of the value of the detection limit of 0.05 mg/L be exceeded, the reagent may only be used with restrictions (larger measured value deviations).

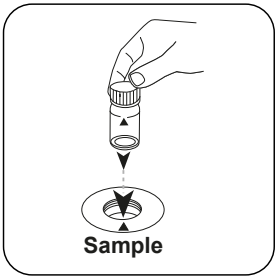
Implementation of the provision Hydrazine with Powder Reagent

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

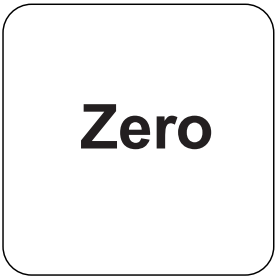
Fill 24 mm vial with **10 ml sample**.



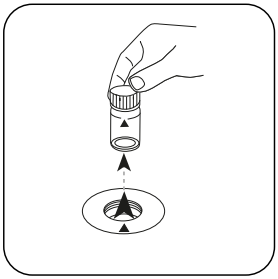
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

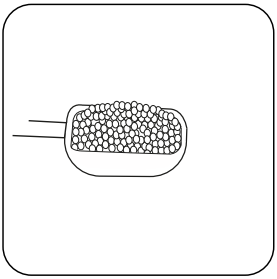


Press the **ZERO** button.

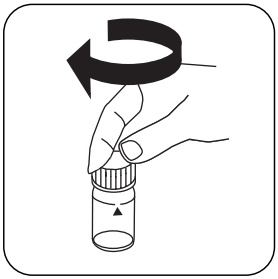


Remove the vial from the sample chamber.

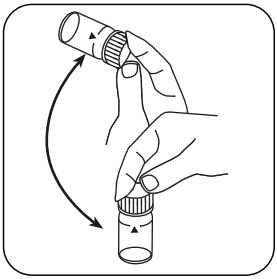
For devices that require **no ZERO measurement** , **start here**.



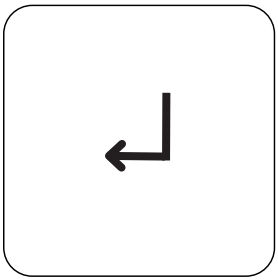
Add **1 g HYDRAZIN Test powder** .



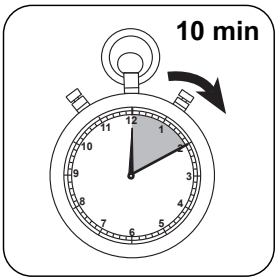
Close vial(s).



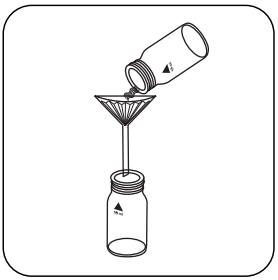
Invert several times to mix the contents.



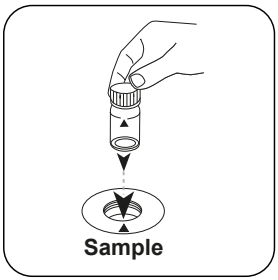
Press the **ENTER** button.



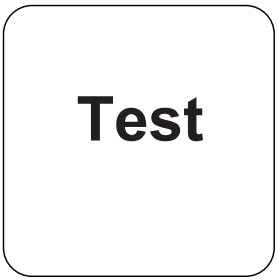
Wait for **10 minute(s) reaction time**.



Any slight turbidity that occurs must be removed by filtration.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in Hydrazine appears on the display.

Chemical Method

Dimethylaminobenzaldehyde

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^{2} + d•Abs^{3} + e•Abs^{4} + f•Abs^{5}

	ø 24 mm	**□ 10 mm**
a	-6.53427 • 10^{+0}	-3.53427 • 10^{+0}
b	3.34209 • 10^{+2}	7.12489 • 10^{+2}
c		
d		
e		
f		

Interferences

Removeable Interferences

1. Interferences as a result of highly coloured or turbid samples: Mix 1 part deionised water with 1 part household bleach. Add 1 drop of this mixture into a 25 ml water sample and mix. Use 10 ml prepared sample in place of deionised water in point 1. Note: For measuring water samples, an unprepared sample must be used. Principle: hydrazine is oxidised by household bleach. Colour interference will be eliminated by zeroing.

Interference	**from / [mg/L]**
NH_4^+	10
C_4H_9NO	10
VO_4^{3-}	1

Derived from

DIN 38413-P1

Hydrazine L M206

0.01 - 0.6 mg/L N_2H_4

Dimethylaminobenzaldehyde

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect	ø 24 mm	430 nm	0.01 - 0.6 mg/L N_2H_4
SpectroDirect, XD 7000, XD 7500	ø 24 mm	455 nm	5 - 600 µg/L N_2H_4

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
VARIO Hydra 2 Reagent	100 mL	531200

Application List

- Boiler Water
- Cooling Water

Preparation

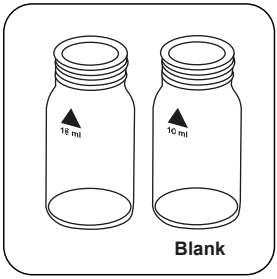
1. Samples cannot be preserved and must be analysed immediately.
2. Sample temperature should be 21 °C ± 4 °C.

Notes

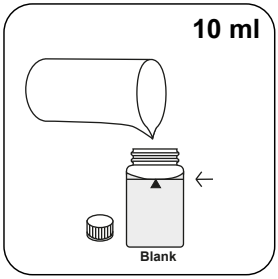
1. The blank may develop a faint yellow colour due to the reagent.
2. The unit mg/L is rounded. Measuring Range 0,01-0,6 mg/L.

Implementation of the provision Hydrazine with Vario Fluid Reagent

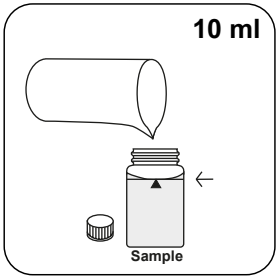
Select the method on the device



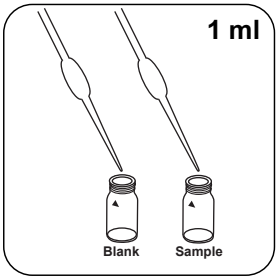
Prepare two clean 24 mm vials. Mark one as a blank.



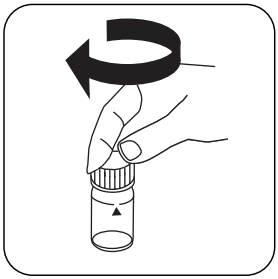
Put **10 ml deionised water** in the blank.



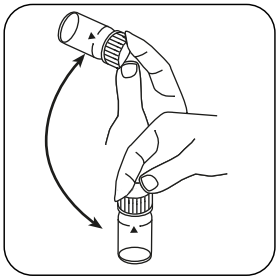
Put **10 ml sample** in the sample vial.



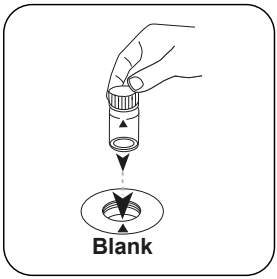
Add **1 ml Vario Hydra 2 Rgt solution** to each vial.



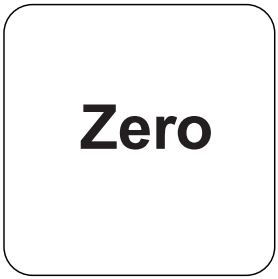
Close vial(s).



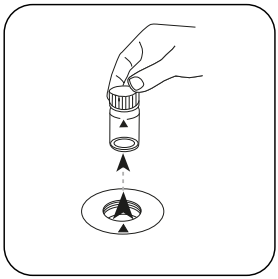
Invert several times to mix the contents.



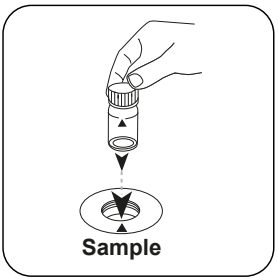
Place **blank** in the sample chamber. • Pay attention to the positioning.



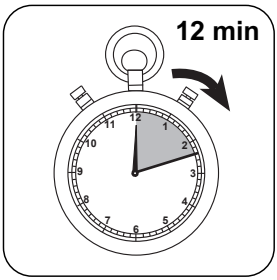
Press the **ZERO** button.



Remove the vial from the sample chamber.



Test



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

Press the **TEST** (XD: **START**)button.

Wait for **12 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically. The result in Hydrazine appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	N_2H_4	1
µg/l	N_2H_4	1000

Chemical Method

Dimethylaminobenzaldehyde

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ 10 mm
a	$-2.02787 \cdot 10^{+1}$	$-2.02787 \cdot 10^{+1}$
b	$3.38179 \cdot 10^{+2}$	$7.27086 \cdot 10^{+2}$
c	$-2.0392 \cdot 10^{+1}$	$-9.42622 \cdot 10^{+1}$
d		
e		
f		

Interferences

Removeable Interferences

1. Interferences as a result of highly coloured or turbid samples: Mix 1 part deionised water with 1 part household bleach. Add 1 drop of this mixture into a 25 ml water sample and mix. Use 10 ml prepared sample in place of deionised water in point 1. Note: For measuring water samples, an unprepared sample must be used. Principle: hydrazine is oxidised by household bleach. Colour interference will be eliminated by zeroing.

Interference	from / [mg/L]
NH_4^+	10
Morpholin	10
VO_4^{3-}	1

Derived from
DIN 38413-P1

Hydrazine C M207

0.01 - 0.7 mg/L N_2H_4 [c)]

PDMAB

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect	ø 13 mm	430 nm	0.01 - 0.7 mg/L N_2H_4 [c)]
XD 7000, XD 7500	ø 13 mm	455 nm	0.01 - 0.7 mg/L N_2H_4 [c)]

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Vacu-vial Hydrazine Test Kit	1 Set	380470

The following accessories are required.

Accessories	Packaging Unit	Part Number
Adapter (13 mm) MultiDirect for Vacu-vial	1 pc.	192075
Adapter for round cuvettes 13 mm	1 pc.	19802192

Application List

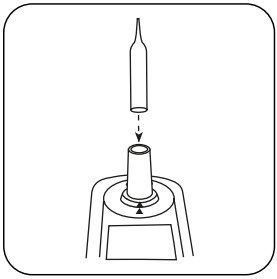
- Boiler Water
- Cooling Water

Notes

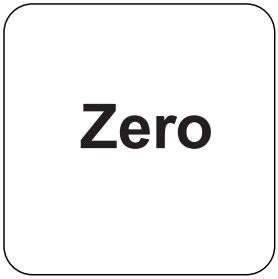
1. This method is adapted from a product by CHEMetrics. The measuring range and wavelength used for this photometer may differ from the data specified by CHEMetrics.
2. Before performing the test, you must read through the original instructions and safety data sheet that is delivered with the test kit (MSDS are also available on the homepage of www.chemetrics.com).
3. Vacu-vials® is a registered trademark of the company CHEMetrics, Inc. / Calverton, U.S.A.

Implementation of the provision Hydrazine with Vacu-vials® K-5003

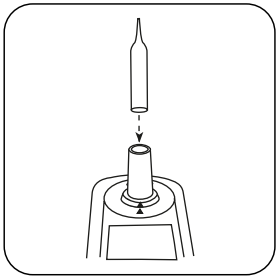
Select the method on the device



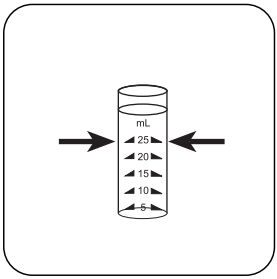
Place **Zero ampoule** in the sample chamber.



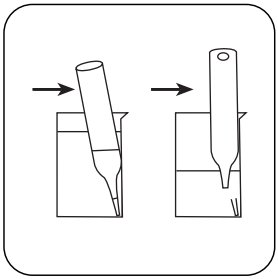
Press the **ZERO** button.



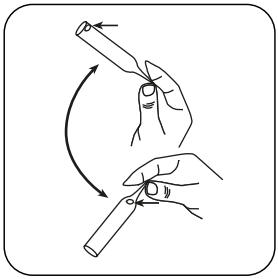
Remove zero ampoule from the sample chamber.



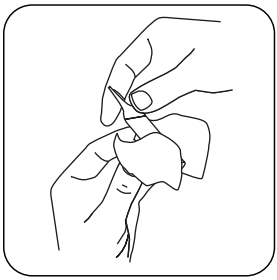
Fill the sample glass to the 25 ml mark with the sample.



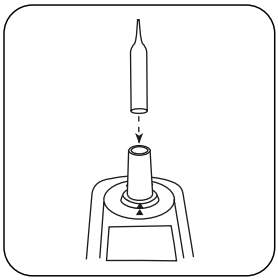
Place a Vacu-vial® ampoule in the sampling vessel. Break off the ampoule tip by applying light pressure against the vessel wall. Wait for the ampoule to fill completely.



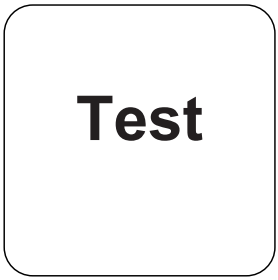
Invert the ampoule several times.



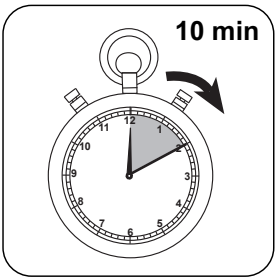
Dry the outside of the ampoule.



Place the ampoule in the sample chamber.



Press the **TEST** (XD: **START**)button.



Wait for **10 minute(s) reaction time**.
Once the reaction period is finished, the measurement takes place automatically.
The result in Hydrazine appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	N_2H_4	1
µg/l	N_2H_4	1000

Chemical Method

PDMAB

Appendix

Interferences

Removeable Interferences

1. Interferences as a result of highly coloured or turbid samples: Mix 1 part deionised water with 1 part household bleach. Add 1 drop of this mixture into a 25 ml water sample and mix. Use 10 ml prepared sample in place of deionised water in point 1. Note: For measuring water samples, an unprepared sample must be used. Principle: hydrazine is oxidised by household bleach. Colour interference will be eliminated by zeroing.

Interference	from / [mg/L]
NH_4^+	10
C_4H_9NO	10
VO_4^{3-}	1

Method Validation

Limit of Detection	0.0087 mg/L
Limit of Quantification	0.026 mg/L
End of Measuring Range	0.7 mg/L
Sensitivity	0.67 mg/L / Abs
Confidence Intervall	0.003 mg/L
Standard Deviation	0.001 mg/L
Variation Coefficient	0.42 %

Derived from

DIN 38413-P1

[c] MultiDirect: Adapter is necessary for Vacu-vials® (Order code 19 20 75)

H_2O_2 50 T M209

0.01 - 0.5 mg/L H_2O_2

DPD / Catalyst

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	□ 50 mm	510 nm	0.01 - 0.5 mg/L H_2O_2

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Hydrogen Peroxide LR	Tablet / 100	512380BT
Hydrogen Peroxide LR	Tablet / 250	512381BT

Application List

- Waste Water Treatment
- Drinking Water Treatment
- Raw Water Treatment
- Disinfection Control

Sampling

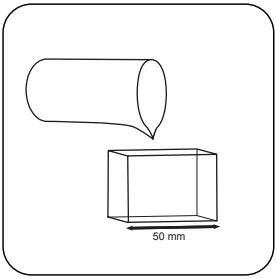
1. When preparing the sample, Hydrogen Peroxide outgassing, e.g. through the pipette or shaking, must be avoided.
2. The analysis must take place immediately after taking the sample.

Preparation

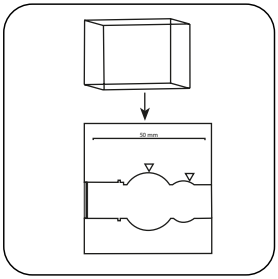
1. Cleaning of vials:
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, this can lead to lower results with the determination of Chlorine. To avoid measurement errors, the glassware used should be free of chlorine consumption. To achieve this, all glassware should be placed in a sodium hypochlorite solution (0.1 g/L) for one hour and then rinsed thoroughly with deionised water.
2. The DPD colour development is carried out at a pH value of 6.2 to 6.5.
   The reagents therefore contain a buffer for the pH adjustment. Strong alkaline or acidic water samples must therefore be adjusted between pH 6 and pH 7 before the analysis (use 0.5 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).

Implementation of the provision Hydrogen peroxide with Tablet

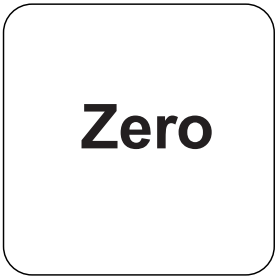
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



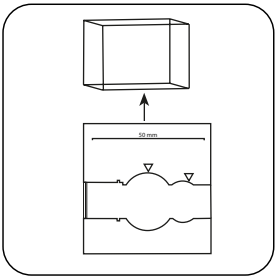
Fill 50 mm vial with **sample**.



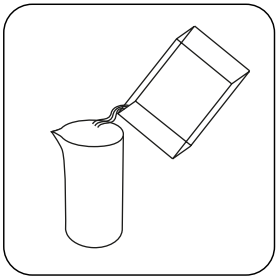
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



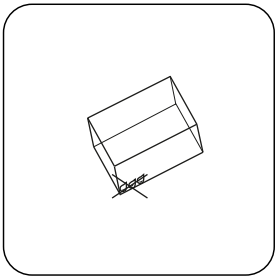
Press the **ZERO** button.



Remove **vial** from the sample chamber.

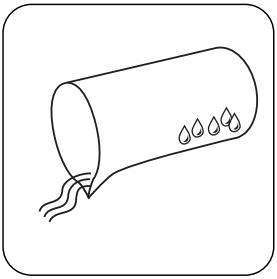


Empty vial.

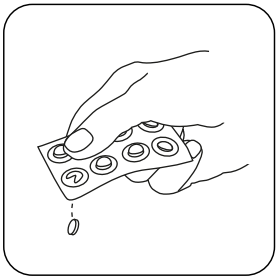


Dry the vial thoroughly.

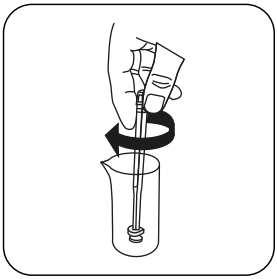
For devices that require **no ZERO measurement** , **start here**.



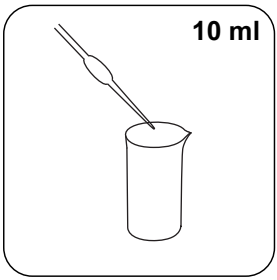
Rinse a beaker **with the sample and empty it, leaving a few drops remaining** in the beaker.



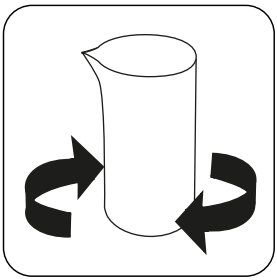
Add **HYDROGENPER-OXIDE LR tablet**.



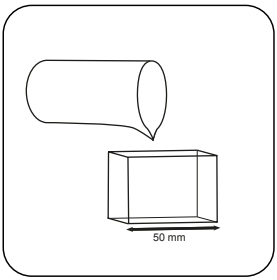
Crush tablet(s) by rotating slightly.



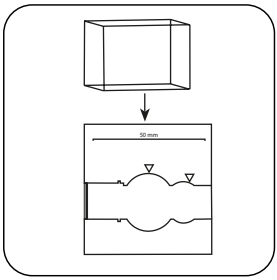
Put **10 ml sample** in the sample vessel.



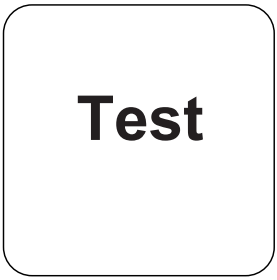
Dissolve tablet(s) by inverting.



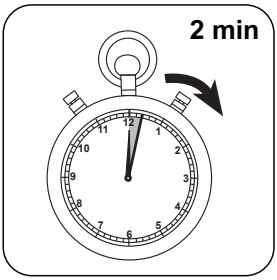
Fill 50 mm vial with **sample**.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **2 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Hydrogen Peroxide appears on the display.

Chemical Method

DPD / Catalyst

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	□ **50 mm**
a	$-4.28181 \cdot 10^{-3}$
b	$3.62669 \cdot 10^{-1}$
c	$-3.70491 \cdot 10^{-2}$
d	
e	
f	

Interferences

Persistant Interferences

1. All oxidising agents in the samples react like hydrogen peroxide, which leads to higher results.

Removeable Interferences

1. Concentrations above 5 mg/L hydrogen peroxide can lead to results within the measuring range of up to 0 mg/L. In this case, the water sample must be diluted with water that is free from hydrogen peroxide. 10 ml of the diluted sample should be mixed with the reagent and the measurement taken again (plausibility test).

Bibliography

Colorimetric Chemical Analytical Methods, 9th Edition, Lovibond

Derived from

US EPA 330.5
APHA 4500 Cl-G

H_2O_2 T M210

0.03 - 3 mg/L H_2O_2

DPD / Catalyst

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect	ø 24 mm	530 nm	0.03 - 3 mg/L H_2O_2
SpectroDirect	ø 24 mm	510 nm	0.03 - 1.5 mg/L H_2O_2
XD 7000, XD 7500	ø 24 mm	510 nm	0.03 - 3 mg/L H_2O_2

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Hydrogen Peroxide LR	Tablet / 100	512380BT
Hydrogen Peroxide LR	Tablet / 250	512381BT

Application List

- Waste Water Treatment
- Drinking Water Treatment
- Raw Water Treatment
- Disinfection Control

Sampling

1. When preparing the sample, Hydrogen Peroxide outgassing, e.g. through the pipette or shaking, must be avoided.
2. The analysis must take place immediately after taking the sample.

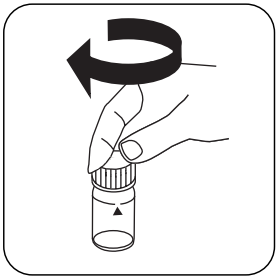
Preparation

1. Cleaning of vials:
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, this can lead to lower results with the determination of Chlorine. To avoid measurement errors, the glassware used should be free of chlorine consumption. To achieve this, all glassware should be placed in a sodium hypochlorite solution (0.1 g/L) for one hour and then rinsed thoroughly with deionised water.
2. The DPD colour development is carried out at a pH value of 6.2 to 6.5.
   The reagents therefore contain a buffer for the pH adjustment. Strong alkaline or acidic water samples must therefore be adjusted between pH 6 and pH 7 before the analysis (use 0.5 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).

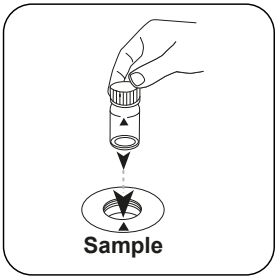
Implementation of the provision Hydrogen peroxide with Tablet

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

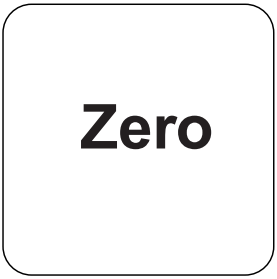
Fill 24 mm vial with **10 ml sample**.



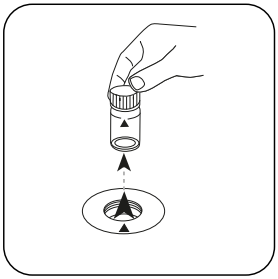
Close vial(s).



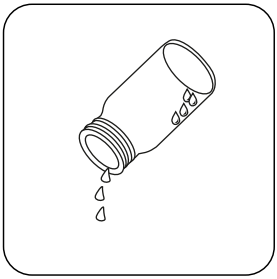
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **ZERO** button.

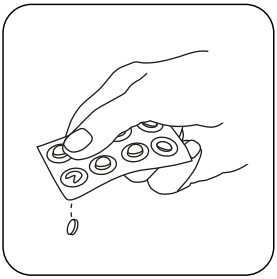


Remove the vial from the sample chamber.

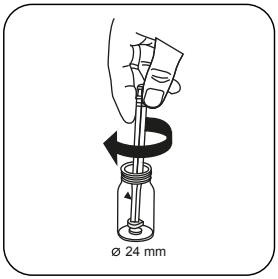


Empty vial except for a few drops.

For devices that require **no ZERO measurement** , **start here**.

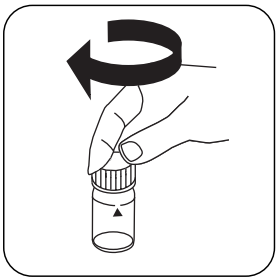


Add **HYDROGENPEROXIDE LR tablet**.

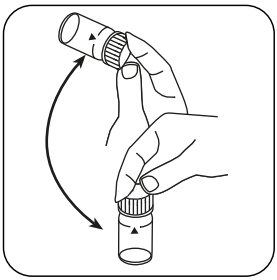


Crush tablet(s) by rotating slightly.

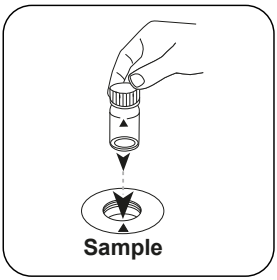
Fill up vial with **sample** to the **10 ml mark**.



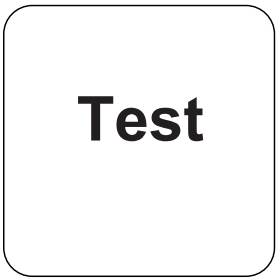
Close vial(s).



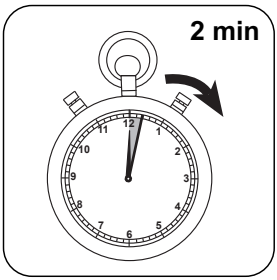
Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **2 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically. The result in mg/l H_2O_2 appears on the display.

Chemical Method

DPD / Catalyst

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ **10 mm**
a	-2.45214 • 10^{-2}	-2.45214 • 10^{-2}
b	8.8458 • 10^{-1}	1.90185 • 10^{+0}
c	-3.75083 • 10^{-2}	-1.73382 • 10^{-1}
d	5.27986 • 10^{-2}	5.24732 • 10^{-1}
e		
f		

Interferences

Persistant Interferences

1. All oxidising agents in the samples react like hydrogen peroxide, which leads to higher results.

Removeable Interferences

1. Concentrations above 5 mg/L hydrogen peroxide can lead to results within the measuring range of up to 0 mg/L. In this case, the water sample must be diluted with water that is free from hydrogen peroxide. 10 ml of the diluted sample should be mixed with the reagent and the measurement taken again (plausibility test).

Bibliography

Colorimetric Chemical Analytical Methods, 9th Edition, Lovibond

Derived from

US EPA 330.5
APHA 4500 Cl-G

Hypochlorite T M212

0.2 - 16 % NaOCl

Potassium Iodide

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect, PM 600, PM 620, PM 630	ø 24 mm	530 nm	0.2 - 16 % NaOCl
XD 7000, XD 7500	ø 24 mm	470 nm	0.2 - 17 % NaOCl

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Acidifying GP	Tablet / 100	515480BT
Acidifying GP	Tablet / 250	515481BT
Chlorine HR (KI)	Tablet / 100	513000BT
Chlorine HR (KI)	Tablet / 250	513001BT
Chlorine HR (KI)	Tablet / 100	501210
Chlorine HR (KI)	Tablet / 250	501211
Set Chlorine HR (KI)/Acidifying GP 100 Pc. #	100 each	517721BT
Set Chlorine HR (KI)/Acidifying GP 250 Pc. #	250 each	517722BT
Dilution set sodium hypochlorite	1 pc.	414470

Application List

- Disinfection Control

Notes

1. This method provides a fast and simple test. The test can be performed on site but the result will not be as precise as a laboratory method.
2. By strictly following the test procedure, an accuracy of +/- 1 weight % can be achieved.

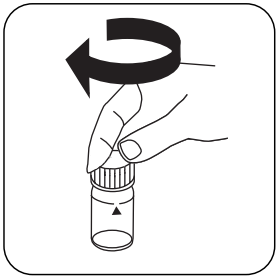
Implementation of the provision Sodium hypochlorite with Tablet

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500
The sample is diluted x2000.

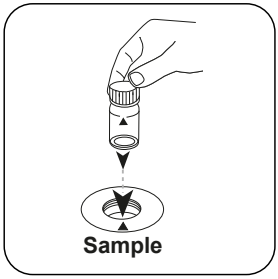
1. First rinse a 5 ml syringe with the solution to be examined and then fill to the 5 ml mark.
2. Empty the syringe into a 100-ml beaker.
3. Fill the measuring beaker up to the 100 ml mark with chlorine-free water.
4. Mix contents by stirring.
5. Fill a clean 5 ml syringe to the 1 ml mark with the diluted solution.
6. Empty the syringe into a clean 100 ml beaker.
7. Fill the measuring beaker up to the 100 ml mark with chlorine-free water.
8. Mix contents by stirring.

The test is performed with this solution.

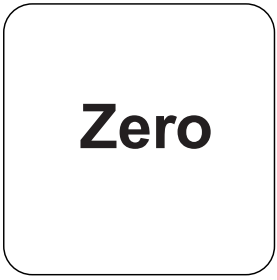
Fill 24 mm vial with **10 ml prepared sample** .



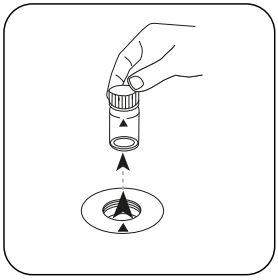
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

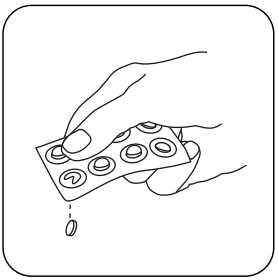


Press the **ZERO** button.

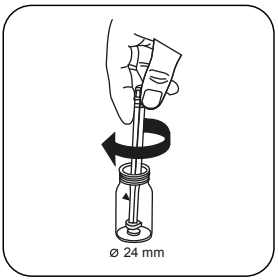


Remove the vial from the sample chamber.

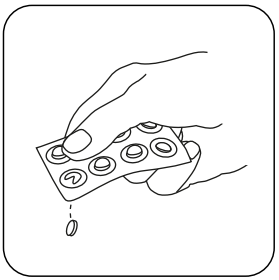
For devices that require **no ZERO measurement** , **start here**.



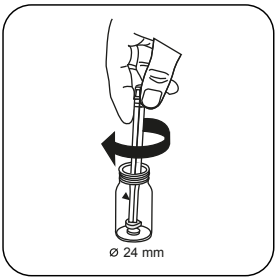
Add **CHLORINE HR (KI) tablet**.



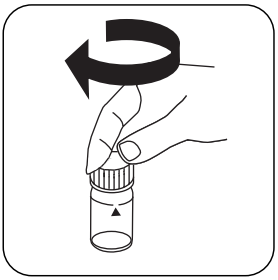
Crush tablet(s) by rotating slightly.



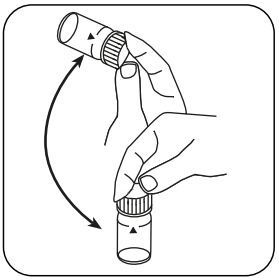
Add **ACIDIFYING GP tablet**.



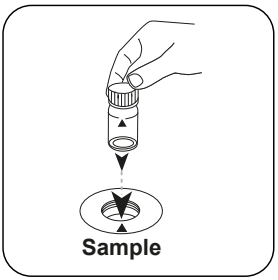
Crush tablet(s) by rotating slightly.



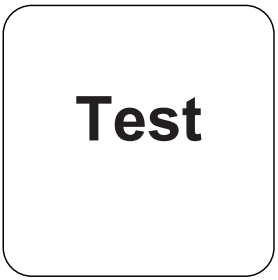
Close vial(s).



Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The display will show the content of effective chlorine in % by weight (w/w %) relative to the **undiluted** sodium hypochlorite solution.

Chemical Method

Potassium Iodide

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	2.01562 • 10^{-1}	2.01562 • 10^{-1}
b	9.7265 • 10^{+0}	2.0912 • 10^{+1}
c	-7.90521 • 10^{-1}	-3.65418 • 10^{+0}
d		
e		
f		

Method Validation

Limit of Detection	0.03 %
Limit of Quantification	0.1 %
End of Measuring Range	16.8 %
Sensitivity	9.21 % / Abs
Confidence Intervall	0.12 %
Standard Deviation	0.05 %
Variation Coefficient	0.55 %

Derived from

EN ISO 7393-3

including stirring rod, 10 cm

H_2O_2 LR L M213

1 - 50 mg/L H_2O_2 HP1

Titanium Tetrachloride / Acid

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 200, MD 600, MD 610, MD 640, MultiDirect, XD 7000, XD 7500	ø 16 mm	430 nm	1 - 50 mg/L H_2O_2

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Reagent for Hydrogen Peroxide	15 mL	424991

The following accessories are required.

Accessories	Packaging Unit	Part Number
Round cuvette 16 mm, set of 10	1 Set	197665

Hazard Notes

1. The reference reagent contains a 25% sulphuric acid solution. It is recommended to wear appropriate protective clothing (protective goggles/gloves).

Application List

- Waste Water Treatment
- Drinking Water Treatment
- Raw Water Treatment
- Disinfection Control

Preparation

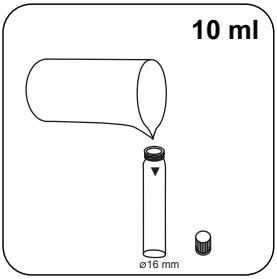
1. The determination is held in strong acid medium. In the case of strongly alkaline samples (pH > 10), the samples must be acidified before measurement (with a 5% sulphuric acid solution at a ratio of 1:1).

Notes

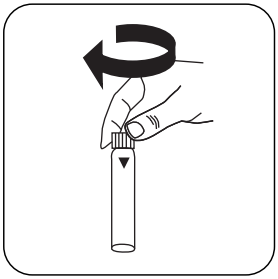
1. The sample can be measured even 24 hours after the colour reaction.

Implementation of the provision Hydrogen peroxide LR with fluid reagent

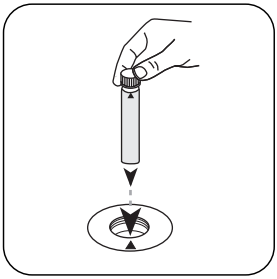
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



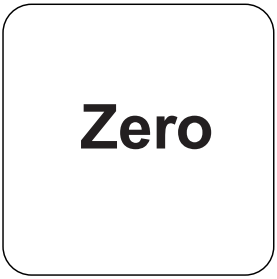
Fill 16 mm vial with **10 ml sample**.



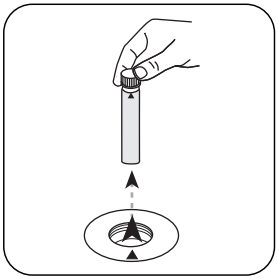
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

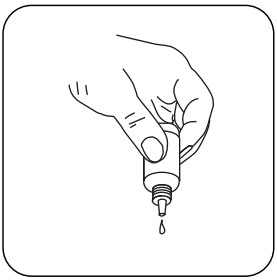


Press the **ZERO** button.

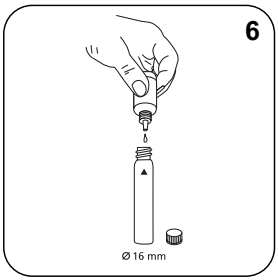


Remove **vial** from the sample chamber.

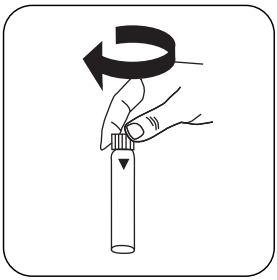
For devices that require **no ZERO measurement** , **start here**.



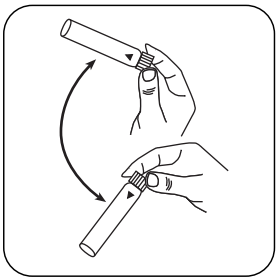
Hold cuvettes vertically and add equal drops by pressing slowly.



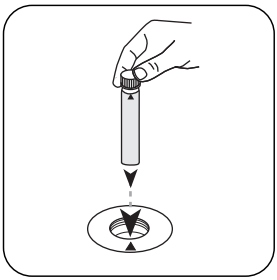
Add **6 drops H_2O_2-Reagent Solution**.



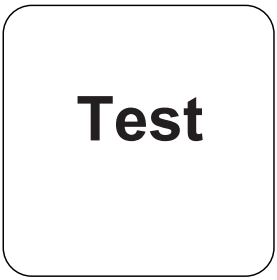
Close vial(s).



Invert several times to mix the contents.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in mg/l H_2O_2 appears on the display.

Chemical Method

Titanium Tetrachloride / Acid

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 16 mm
a	$-3.16583 \cdot 10^{-1}$
b	$3.74037 \cdot 10^{+1}$
c	
d	
e	
f	

Interferences

Removeable Interferences

1. Colour interference is eliminated as follows.
   A) Fill a clean vial with 10 ml of the water sample. Carry out zero calibration.
   b) Measure the sample without the addition of reagents. (Result B)
   c) Then measure the same sample with the addition of the reagents (Result A).
   Calculation of H_2O_2 Concentration = Result A - Result B.
2. Particles in the sample solution or turbidity distort the analysis and must be eliminated. This can be through centrifuging or simply filtering the sample solution prior to performing the measurement. Falsification of the measurement results should also be expected when working with coloured solutions.

H_2O_2 HR L — M214

40 - 500 mg/L H_2O_2 — HP2

Titanium Tetrachloride / Acid

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 200, MD 600, MD 610, MD 640, MultiDirect, PM 620, PM 630, XD 7000, XD 7500	ø 16 mm	530 nm	40 - 500 mg/L H_2O_2

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Reagent for Hydrogen Peroxide	15 mL	424991

Hazard Notes

1. The reference reagent contains a 25% sulphuric acid solution. It is recommended to wear appropriate protective clothing (protective goggles/gloves).

Application List

- Waste Water Treatment
- Drinking Water Treatment
- Raw Water Treatment
- Disinfection Control

Preparation

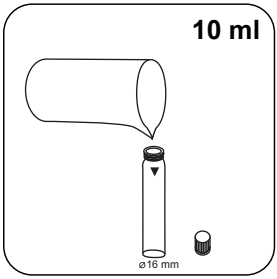
1. The determination is held in strong acid medium. In the case of strongly alkaline samples (pH > 10), the samples must be acidified before measurement (with a 5% sulphuric acid solution at a ratio of 1:1).

Notes

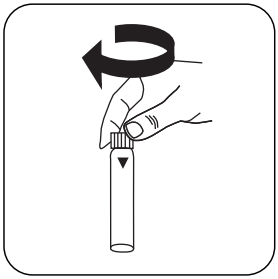
1. The sample can be measured even 24 hours after the colour reaction.

Implementation of the provision Hydrogen peroxide HR with fluid reagent

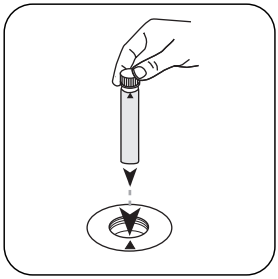
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



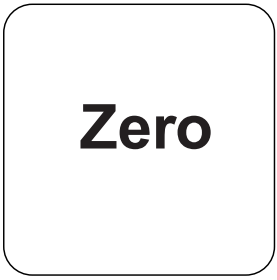
Fill 16 mm vial with **10 ml sample**.



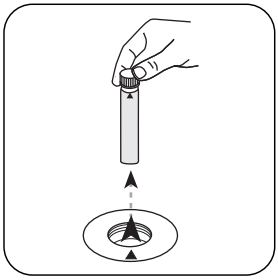
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

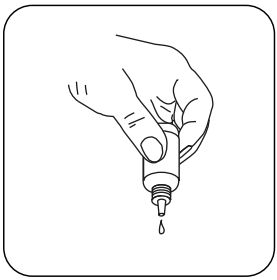


Press the **ZERO** button.

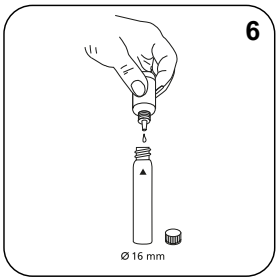


Remove **vial** from the sample chamber.

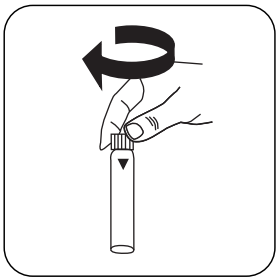
For devices that require **no ZERO measurement** , **start here**.



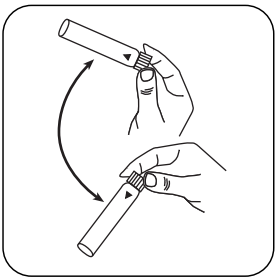
Hold cuvettes vertically and add equal drops by pressing slowly.



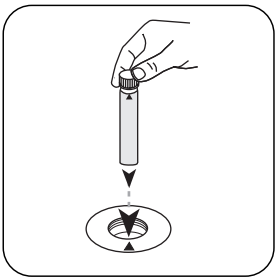
Add **6 drops H_2O_2-Reagent Solution**.



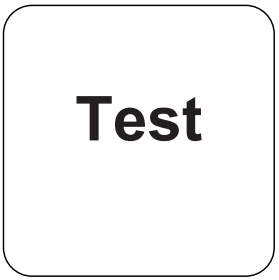
Close vial(s).



Invert several times to mix the contents.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in mg/l H_2O_2 appears on the display.

Chemical Method

Titanium Tetrachloride / Acid

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 16 mm
a	$7.35421 \cdot 10^{+0}$
b	$3.21189 \cdot 10^{+2}$
c	$3.50603 \cdot 10^{+1}$
d	
e	
f	

Interferences

Removeable Interferences

1. Colour interference is eliminated as follows.
   A) Fill a clean vial with 10 ml of the water sample. Carry out zero calibration.
   b) Measure the sample without the addition of reagents. (Result B)
   c) Then measure the same sample with the addition of the reagents (Result A).
   Calculation of H_2O_2 Concentration = Result A - Result B.
2. Particles in the sample solution or turbidity distort the analysis and must be eliminated. This can be through centrifuging or simply filtering the sample solution prior to performing the measurement. Falsification of the measurement results should also be expected when working with coloured solutions.

Iodine T M215

0.05 - 3.6 mg/L I

DPD

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect, PM 620, PM 630	ø 24 mm	530 nm	0.05 - 3.6 mg/L I
SpectroDirect, XD 7000, XD 7500	ø 24 mm	510 nm	0.05 - 3.6 mg/L I

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
DPD No. 1	Tablet / 100	511050BT
DPD No. 1	Tablet / 250	511051BT
DPD No. 1	Tablet / 500	511052BT
DPD No. 1 High Calcium [e)]	Tablet / 100	515740BT
DPD No. 1 High Calcium [e)]	Tablet / 250	515741BT
DPD No. 1 High Calcium [e)]	Tablet / 500	515742BT

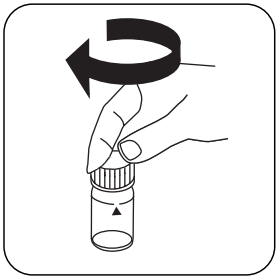
Application List

- Pool Water Control
- Pool Water Treatment
- Disinfection Control

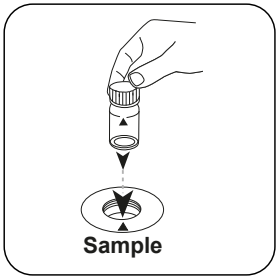
Implementation of the provision Iodine with Tablet

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

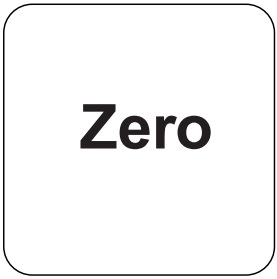
Fill 24 mm vial with **10 ml sample**.



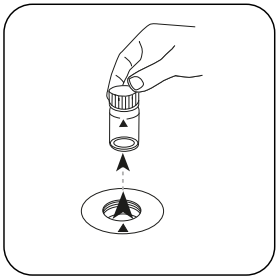
Close vial(s).



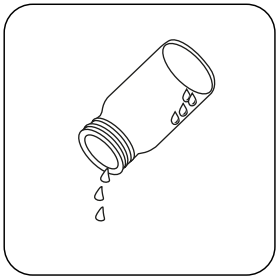
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **ZERO** button.

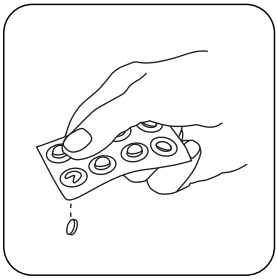


Remove the vial from the sample chamber.

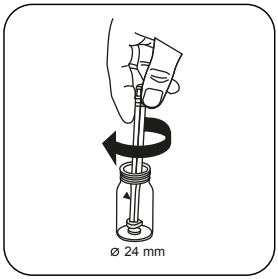


Empty vial except for a few drops.

For devices that require **no ZERO measurement** , **start here**.

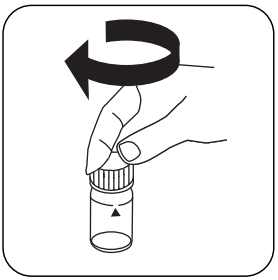


Add **DPD No. 1 tablet** .

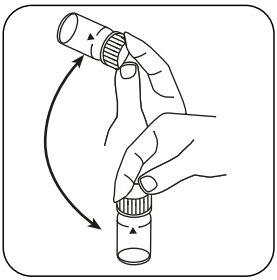


Crush tablet(s) by rotating slightly.

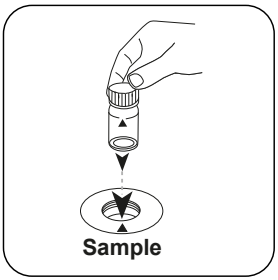
Fill up vial with **sample** to the **10 ml mark**.



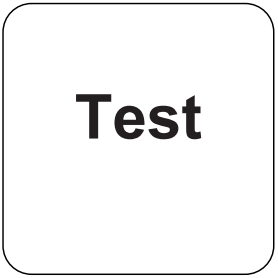
Close vial(s).



Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.
The result in mg/l Iodine appears on the display.

Chemical Method

DPD

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	$-5.02604 \cdot 10^{-2}$	$-5.02604 \cdot 10^{-2}$
b	$5.98475 \cdot 10^{+0}$	$1.28672 \cdot 10^{+1}$
c	$1.56046 \cdot 10^{-1}$	$7.21323 \cdot 10^{-1}$
d		
e		
f		

Interferences

Persistant Interferences

1. All oxidising agents in the samples react like Iodine, which leads to higher results.

Derived from

EN ISO 7393-2

[e)] alternative reagent, used instead of DPD No.1/No.3 in case of turbidity in the water sample caused by high concentration of calcium and/or high conductivity

Iron 10 T M218

0.05 - 1 mg/L Fe

Ferrozine / Thioglycolate

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	□ 10 mm	562 nm	0.05 - 1 mg/L Fe

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Iron II LR (Fe^{2+})	Tablet / 100	515420BT
Iron II LR (Fe^{2+})	Tablet / 250	515421BT
Iron LR (Fe^{2+} und Fe^{3+})	Tablet / 100	515370BT
Iron LR (Fe^{2+} und Fe^{3+})	Tablet / 250	515371BT

Application List

- Waste Water Treatment
- Cooling Water
- Boiler Water
- Galvanization
- Drinking Water Treatment
- Raw Water Treatment
- Pool Water Treatment

Preparation

1. Water that has been treated with organic compounds such as corrosion inhibitors, must be oxidised where necessary to break down the iron complex. 1 ml of concentrated Sulphuric acid (≥ 95 %) and 1 ml concentrated Nitric acid (≥ 65 %) is therefore added to to 100 ml water sample and boiled down to approximately half the volume. After cooling down, the digestion procedure is continued.

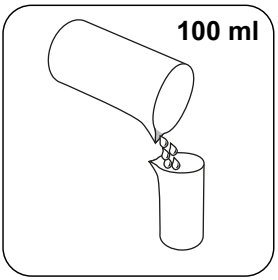
Notes

1. This method is for the determination of total dissolved Fe^{2+} and Fe^{3+}.
2. For the determination of Fe^{2+}, the IRON (II) LR Tablet, instead of the IRON LR Tablet is used.

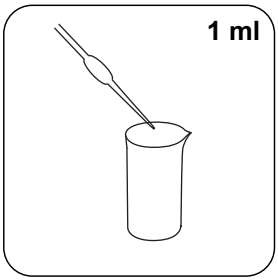
Variations in the length of the vial can extend the measuring range:

- 10 mm vial: 0.05 mg/L - 1 mg/L, solution: 0.01
- 20 mm vial: 0.025 mg/L - 0.5 mg/L, solution: 0.01
- 50 mm vial: 0,.1 mg/L - 0.2 mg/L, solution: 0.001

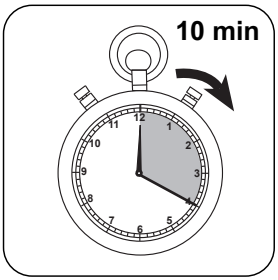
Digestion



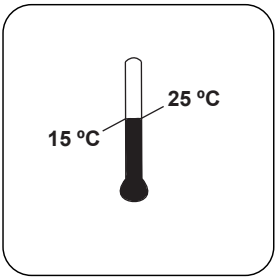
Fill a suitable sample vessel with **100 ml sample** .



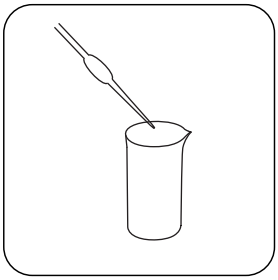
Add **1 ml concentrated sulfuric acid (≥ 95 %)** .



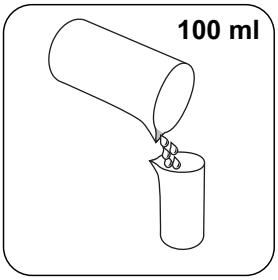
The sample is to be **heated for 10 minutes,** or for as long as it takes for everything to be completely dissolved.



Allow the sample to cool to room temperature.



Adjust **pH-value** of the sample with **ammonia solution (10-25 %) to 3-5**.

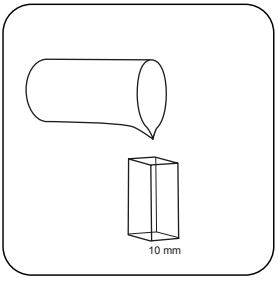


Fill the sample with **deionised water to 100 ml** .

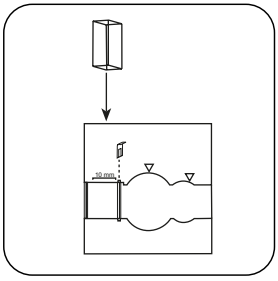
This sample is used for the analysis of total solved and dissolved Iron.

Implementation of the provision Iron (II,III), dissolved with Tablet

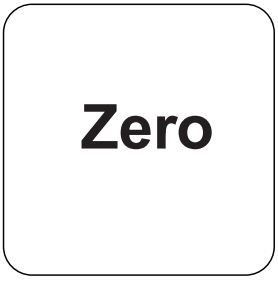
Select the method on the device
For testing of **total solved and dissolved Iron,** carry out the described **digestion**.
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



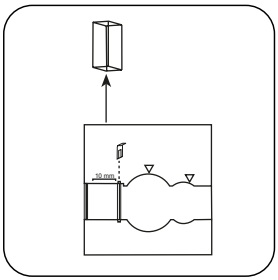
Fill 10 mm vial with **sample**.



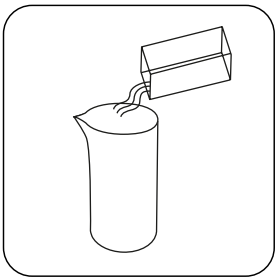
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



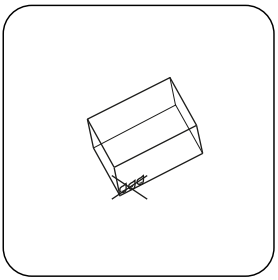
Press the **ZERO** button.



Remove **vial** from the sample chamber.

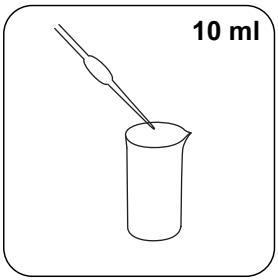


Empty vial.

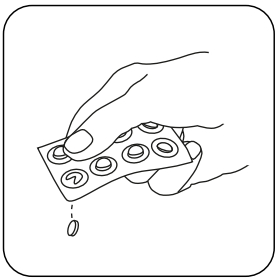


Dry the vial thoroughly.

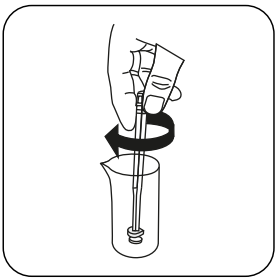
For devices that require **no ZERO measurement** , **start here**.



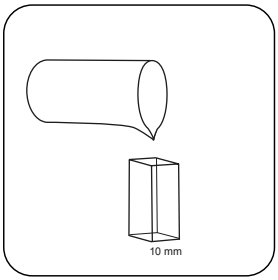
Fill a suitable sample vessel with **10 ml sample** .



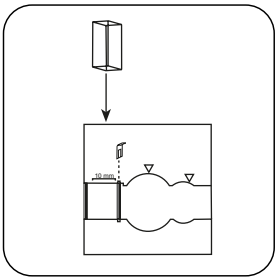
Add **IRON LR tablet**.



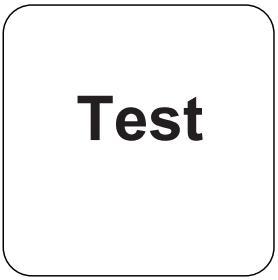
Crush tablet(s) by rotating slightly and dissolve.



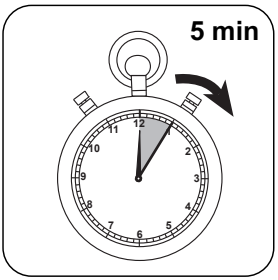
Fill 10 mm vial with **sample**.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **5 minute(s) reaction time**.
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Iron appears on the display.

Chemical Method

Ferrozine / Thioglycolate

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	□ **10 mm**
a	-3.64722 • 10^{-2}
b	1.98546 • 10^{+0}
c	
d	
e	
f	

Interferences

Removeable Interferences

1. The presence of copper increases the test result by 10%. At a concentration of 10 mg/L copper in the sample, the measurement result is increased by 1 mg/L iron. The interference can be eliminated by the addition of thiourea

Bibliography

Photometrische Analyse, Lange/ Vjedelek, Verlag Chemie 1980, p. 102

Iron 50 T M219

0.01 - 0.5 mg/L Fe

Ferrozine / Thioglycolate

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	□ 50 mm	562 nm	0.01 - 0.5 mg/L Fe

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Iron II LR (Fe^{2+})	Tablet / 100	515420BT
Iron II LR (Fe^{2+})	Tablet / 250	515421BT
Iron LR (Fe^{2+} und Fe^{3+})	Tablet / 100	515370BT
Iron LR (Fe^{2+} und Fe^{3+})	Tablet / 250	515371BT

Application List

- Waste Water Treatment
- Cooling Water
- Boiler Water
- Galvanization
- Drinking Water Treatment
- Raw Water Treatment
- Pool Water Treatment

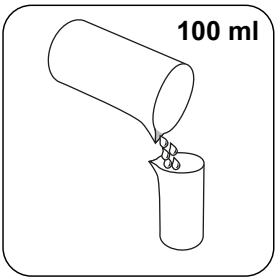
Preparation

1. Water that has been treated with organic compounds such as corrosion inhibitors, must be oxidised where necessary to break down the iron complex. 1 ml of concentrated Sulphuric acid (≥ 95 %) and 1 ml concentrated Nitric acid (≥ 65 %) is therefore added to to 100 ml water sample and boiled down to approximately half the volume. After cooling down, the digestion procedure is continued.

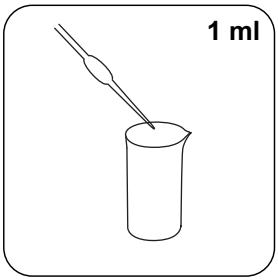
Notes

1. For the determination of Fe2+, the IRON (II) LR Tablet, as described, is used instead of the IRON LR Tablet.

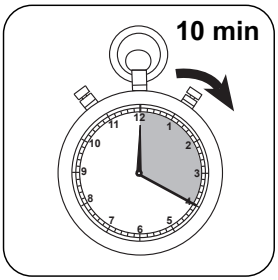
Digestion



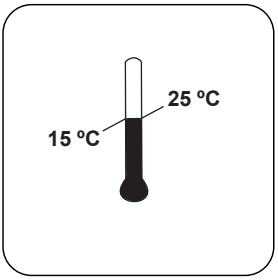
Fill a suitable sample vessel with **100 ml sample** .



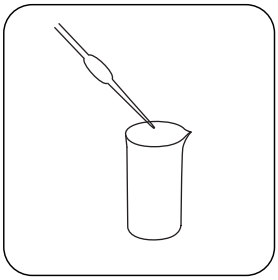
Add **1 ml concentrated sulfuric acid (≥ 95 %)** .



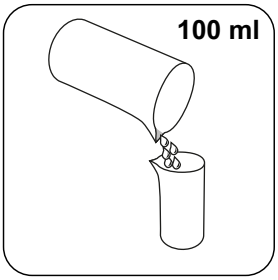
The sample is to be **heated for 10 minutes,** or for as long as it takes for everything to be completely dissolved.



Allow the sample to cool to room temperature.



Adjust **pH-value** of the sample with **ammonia solution (10-25 %) to 3-5**.

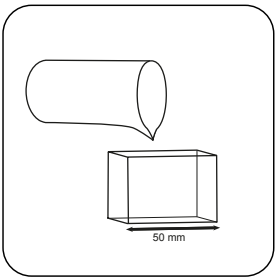


Fill the sample with **deionised water to 100 ml** .

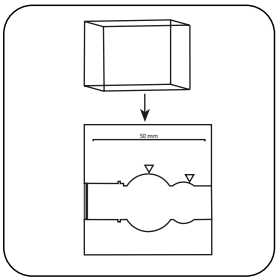
This sample is used for the analysis of total solved and dissolved Iron.

Implementation of the provision Iron (II,III), dissolved with Tablet

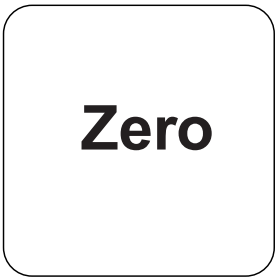
Select the method on the device
For testing of **dissolved and undissolved Iron,** carry out the described **digestion**.
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



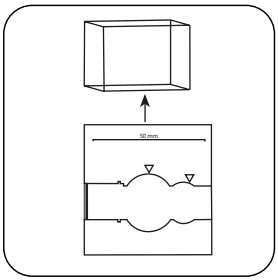
Fill 50 mm vial with **sample**.



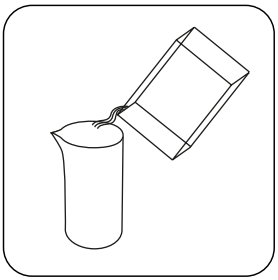
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



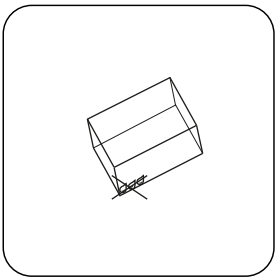
Press the **ZERO** button.



Remove **vial** from the sample chamber.

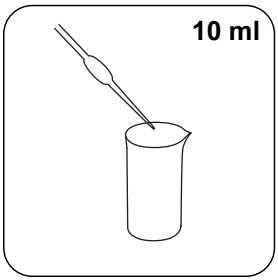


Empty vial.

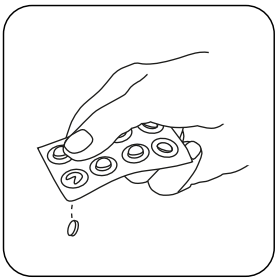


Dry the vial thoroughly.

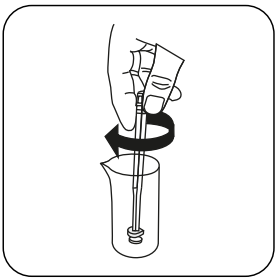
For devices that require **no ZERO measurement** , **start here**.



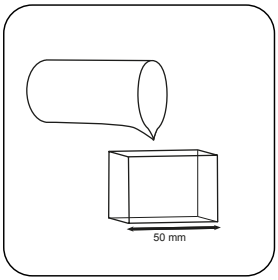
Fill a suitable sample vessel with **10 ml sample** .



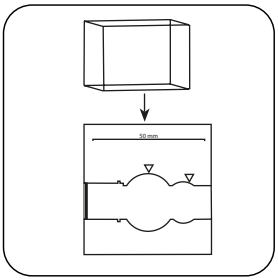
Add **IRON LR tablet**.



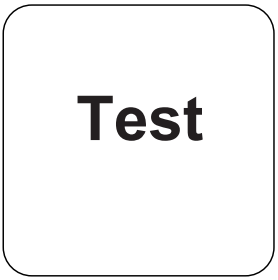
Crush tablet(s) by rotating slightly and dissolve.



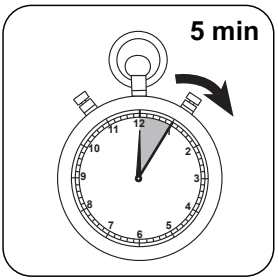
Fill 50 mm vial with **sample**.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **5 minute(s) reaction time**.
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Iron appears on the display.

Chemical Method

Ferrozine / Thioglycolate

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	□ **50 mm**
a	-6.71105 • 10^{-3}
b	4.0101 • 10^{-1}
c	
d	
e	
f	

Interferences

Removeable Interferences

1. The presence of copper increases the test result by 10%. At a concentration of 10 mg/L copper in the sample, the measurement result is increased by 1 mg/L iron. The interference can be eliminated by the addition of thiourea

Bibliography

Photometrische Analyse, Lange/ Vjedelek, Verlag Chemie 1980, p. 102

Iron T M220

0.02 - 1 mg/L Fe FE

Ferrozine / Thioglycolate

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 110, MD 200, MD 600, MD 610, MD 640, MultiDirect, PM 600, PM 620, PM 630	ø 24 mm	560 nm	0.02 - 1 mg/L Fe
SpectroDirect	ø 24 mm	562 nm	0.1 - 1 mg/L Fe
XD 7000, XD 7500	ø 24 mm	562 nm	0.02 - 1 mg/L Fe

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Iron II LR (Fe^{2+})	Tablet / 100	515420BT
Iron II LR (Fe^{2+})	Tablet / 250	515421BT
Iron LR (Fe^{2+} und Fe^{3+})	Tablet / 100	515370BT
Iron LR (Fe^{2+} und Fe^{3+})	Tablet / 250	515371BT

Application List

- Waste Water Treatment
- Cooling Water
- Boiler Water
- Galvanization
- Drinking Water Treatment
- Raw Water Treatment
- Pool Water Treatment

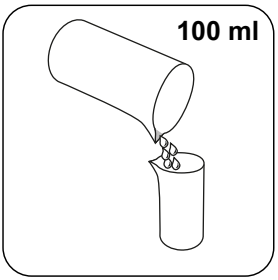
Preparation

1. Water that has been treated with organic compounds such as corrosion inhibitors, must be oxidised where necessary to break down the iron complex. 1 ml of concentrated Sulphuric acid (≥ 95 %) and 1 ml concentrated Nitric acid (≥ 65 %) is therefore added to to 100 ml water sample and boiled down to approximately half the volume. After cooling down, the digestion procedure is continued.

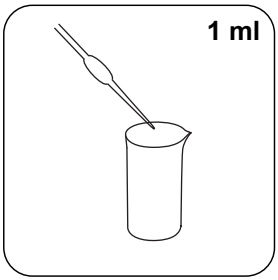
Notes

1. This method is for the determination of total dissolved Fe^{2+} and Fe^{3+}.
2. For the determination of Fe^{2+}, the IRON (II) LR Tablet, instead of the IRON LR Tablet is used.

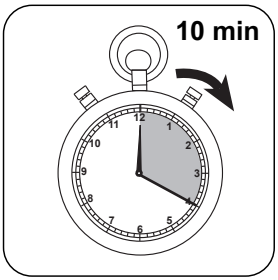
Digestion



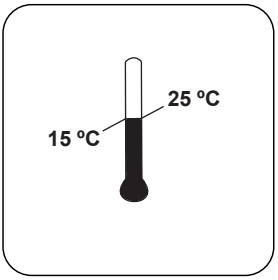
Fill a suitable sample vessel with **100 ml sample** .



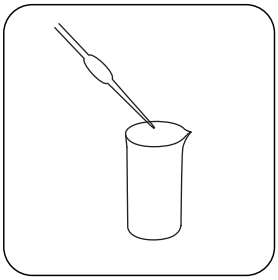
Add **1 ml concentrated sulfuric acid (≥ 95 %)** .



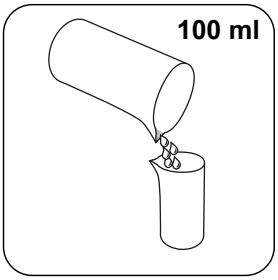
The sample is to be **heated for 10 minutes,** or for as long as it takes for everything to be completely dissolved.



Allow the sample to cool to room temperature.



Adjust **pH-value** of the sample with **ammonia solution (10-25 %) to 3-5**.



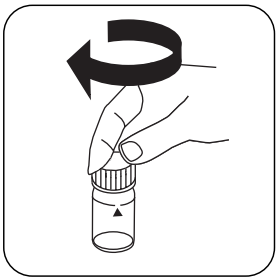
Fill the sample with **deionised water to 100 ml** .

This sample is used for the analysis of total solved and dissolved Iron.

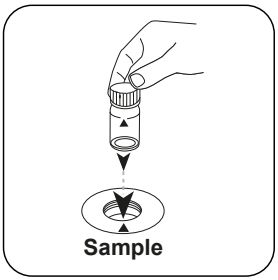
Implementation of the provision Iron (II,III), dissolved with Tablet

Select the method on the device
For testing of **dissolved and undissolved Iron,** carry out the described **digestion**.
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

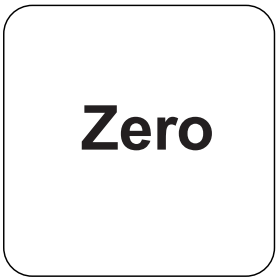
Fill 24 mm vial with **10 ml sample**.



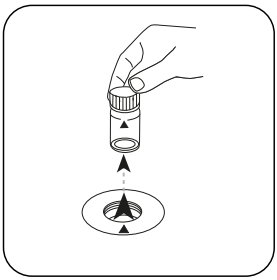
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

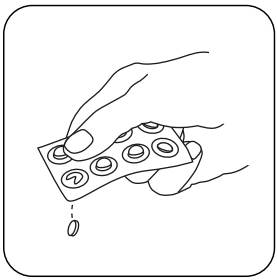


Press the **ZERO** button.

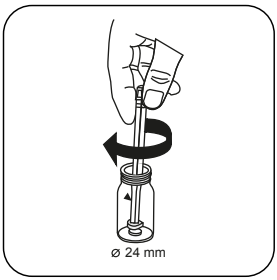


Remove the vial from the sample chamber.

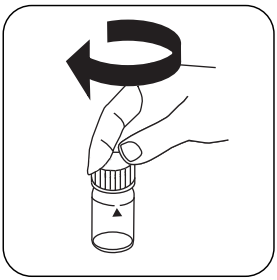
For devices that require **no ZERO measurement** , **start here**.



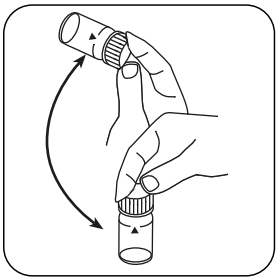
Add **IRON LR tablet**.



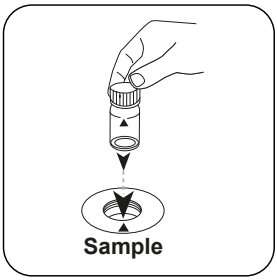
Crush tablet(s) by rotating slightly.



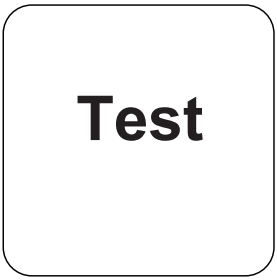
Close vial(s).



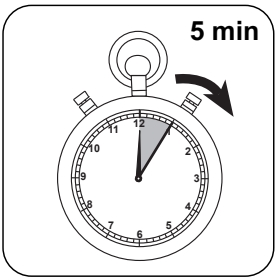
Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **5 minute(s) reaction time**.
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Iron appears on the display.

Chemical Method

Ferrozine / Thioglycolate

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	-8.94304 • 10^{-3}	-8.94304 • 10^{-3}
b	9.35824 • 10^{-1}	2.01202 • 10^{+0}
c		
d		
e		
f		

Interferences

Removeable Interferences

1. The presence of copper increases the test result by 10 %. At a concentration of 10 mg/L copper in the sample, the measurement result is increased by 1 mg/L iron. The interference can be eliminated by the addition of thiourea

Method Validation

Limit of Detection	0.01 mg/L
Limit of Quantification	0.016 mg/L
End of Measuring Range	1 mg/L
Sensitivity	0.92 mg/L / Abs
Confidence Intervall	0.013 mg/L
Standard Deviation	0.005 mg/L
Variation Coefficient	1.23 %

Bibliography

Photometrische Analyse, Lange/ Vjedelek, Verlag Chemie 1980, p. 102

Iron 50 PP M221

0.01 - 1.5 mg/L Fe[g)]

1,10-Phenanthroline

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	□ 50 mm	510 nm	0.01 - 1.5 mg/L Fe[g)]

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
VARIO Ferro F10	Powder / 100 pc.	530560
VARIO Ferro F10	Powder / 1000 pc.	530563

Application List

- Waste Water Treatment
- Cooling Water
- Boiler Water
- Galvanization
- Drinking Water Treatment
- Raw Water Treatment
- Pool Water Treatment

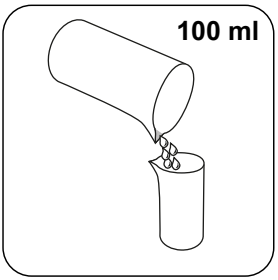
Preparation

1. Iron oxide requires mild, strong or Digesdahl digestion before the analysis (digestion process with acid).
2. Very strong alkaline or acidic water samples should be adjusted to between pH 3 and pH 5 before the analysis.
3. Water samples containing visible rust should be allowed to react for at least five minutes.
4. Water that has been treated with organic compounds such as corrosion inhibitors, must be oxidised where necessary to break down the iron complex. 1 ml of concentrated Sulphuric acid (≥ 95 %) and 1 ml concentrated Nitric acid (≥ 65 %) is therefore added to to 100 ml water sample and boiled down to approximately half the volume. After cooling down, the digestion procedure is continued.

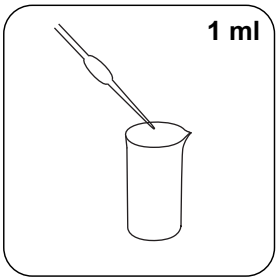
Notes

1. This method is for the determination of all forms of dissolved iron and most forms of undissolved iron.
2. Accuracy is not affected by undissolved powder.

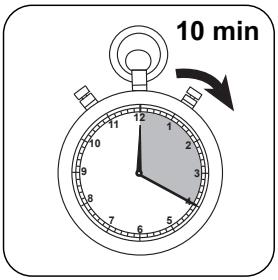
Digestion



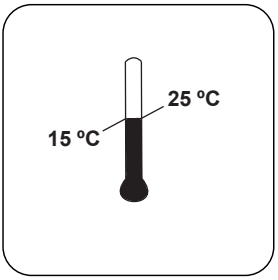
Fill a suitable sample vessel with **100 ml sample** .



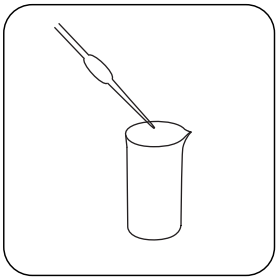
Add **1 ml concentrated sulfuric acid (≥ 95 %)** .



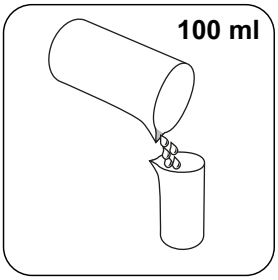
The sample is to be **heated for 10 minutes,** or for as long as it takes for everything to be completely dissolved.



Allow the sample to cool to room temperature.



Adjust **pH-value** of the sample with **ammonia solution (10-25 %) to 3-5**.

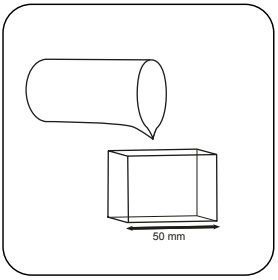


Fill the sample with **deionised water to 100 ml** .

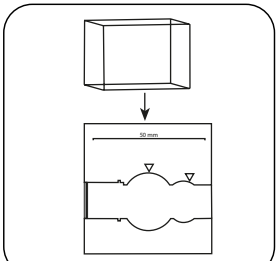
This sample is used for the analysis of total solved and dissolved Iron.

Implementation of the provision Iron (II,III), dissolved with Vario Powder Packs

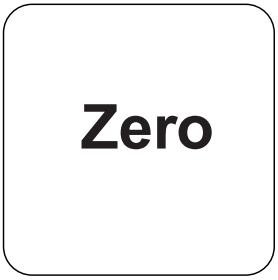
Select the method on the device
For testing of **Iron with tablet,** carry out the described **digestion**.
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



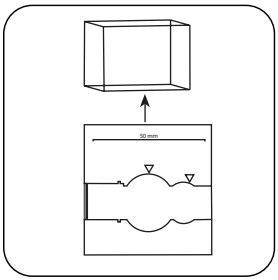
Fill 50 mm vial with **sample**.



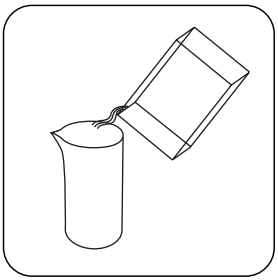
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



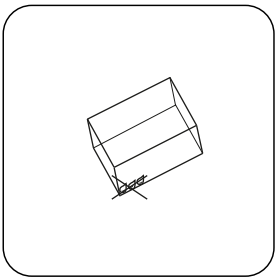
Press the **ZERO** button.



Remove **vial** from the sample chamber.

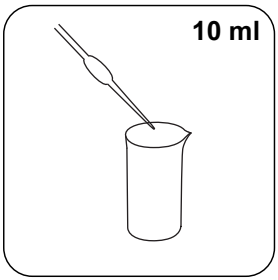


Empty vial.

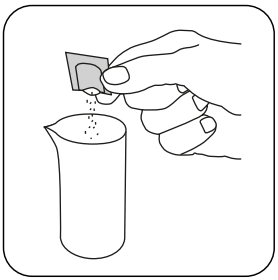


Dry the vial thoroughly.

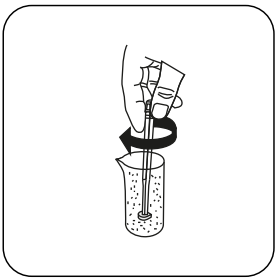
For devices that require **no ZERO measurement** , **start here**.



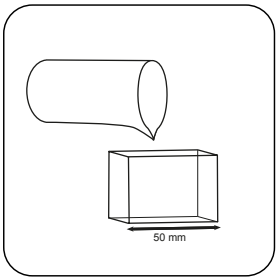
Fill a suitable sample vessel with **10 ml sample** .



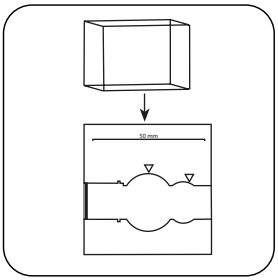
Add **Vario FERRO F10 powder pack**.



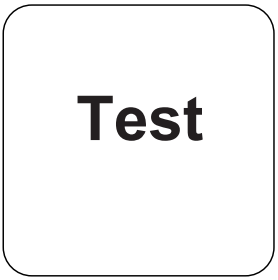
Dissolve the powder by mixing.



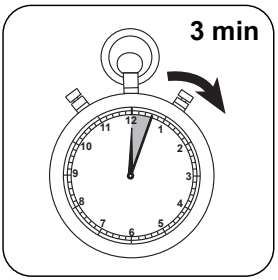
Fill 50 mm vial with **sample**.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **3 minute(s) reaction time**.
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Iron appears on the display.

Chemical Method

1,10-Phenanthroline

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	□ **50 mm**
a	0.00000 • 10^{+0}
b	9.85512 • 10^{-1}
c	
d	
e	
f	

Interferences

Persistant Interferences

1. Iridium interferes with the test.

Method Validation

Limit of Detection	0.01 mg/L
Limit of Quantification	0.03 mg/L
End of Measuring Range	1.5 mg/L
Sensitivity	0.96 mg/L / Abs
Confidence Intervall	0.13 mg/L
Standard Deviation	0.05 mg/L
Variation Coefficient	7.05 %

[9] Reagent recovers most insoluble iron oxides without digestion

Iron PP M222

0.02 - 3 mg/L Fe[g)] FE1

1,10-Phenanthroline

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 600, MD 610, MD 640, MultiDirect	ø 24 mm	530 nm	0.02 - 3 mg/L Fe[g)]
SpectroDirect	□ 50 mm	510 nm	0.01 - 1.5 mg/L Fe[g)]
XD 7000, XD 7500	ø 24 mm	510 nm	0.02 - 3 mg/L Fe[g)]

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
VARIO Ferro F10	Powder / 100 pc.	530560
VARIO Ferro F10	Powder / 1000 pc.	530563

Application List

- Waste Water Treatment
- Cooling Water
- Boiler Water
- Galvanization
- Drinking Water Treatment
- Raw Water Treatment
- Pool Water Treatment

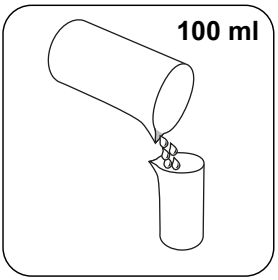
Preparation

1. Iron oxide requires mild, strong or Digesdahl digestion before the analysis (digestion process with acid).
2. Very strong alkaline or acidic water samples should be adjusted to between pH 3 and pH 5 before the analysis.
3. Water samples containing visible rust should be allowed to react for at least five minutes.
4. Water that has been treated with organic compounds such as corrosion inhibitors, must be oxidised where necessary to break down the iron complex. 1 ml of concentrated Sulphuric acid (≥ 95 %) and 1 ml concentrated Nitric acid (≥ 65 %) is therefore added to to 100 ml water sample and boiled down to approximately half the volume. After cooling down, the digestion procedure is continued.

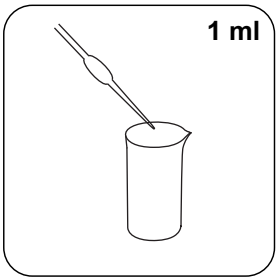
Notes

1. This method is for the determination of all forms of dissolved iron and most forms of undissolved iron.
2. Accuracy is not affected by undissolved powder.

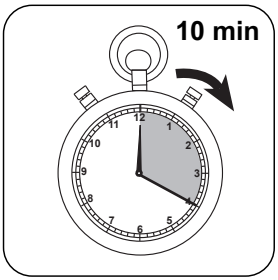
Digestion



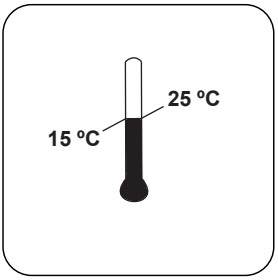
Fill a suitable sample vessel with **100 ml sample** .



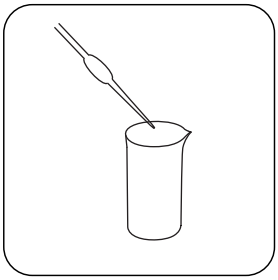
Add **1 ml concentrated sulfuric acid (≥ 95 %)** .



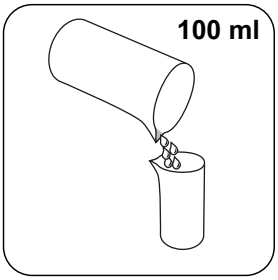
The sample is to be **heated for 10 minutes,** or for as long as it takes for everything to be completely dissolved.



Allow the sample to cool to room temperature.



Adjust **pH-value** of the sample with **ammonia solution (10-25 %) to 3-5**.



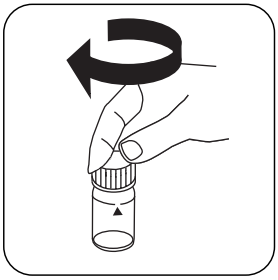
Fill the sample with **deionised water to 100 ml** .

This sample is used for the analysis of total solved and dissolved Iron.

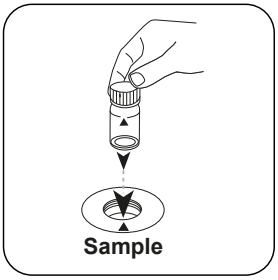
Implementation of the provision Iron (II,III), dissolved with Vario Powder Packs

Select the method on the device
For testing of **Iron with tablet,** carry out the described **digestion**.
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

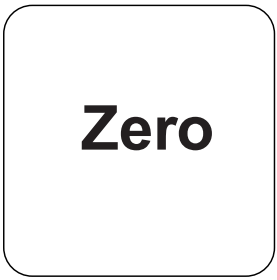
Fill 24 mm vial with **10 ml sample**.



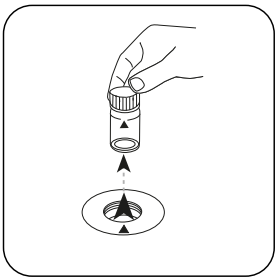
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

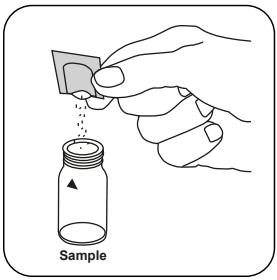


Press the **ZERO** button.

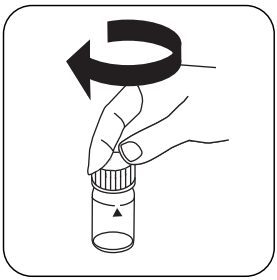


Remove the vial from the sample chamber.

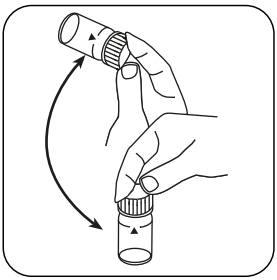
For devices that require **no ZERO measurement** , **start here**.



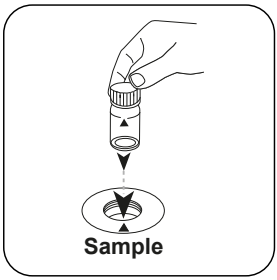
Add **Vario FERRO F10 powder pack**.



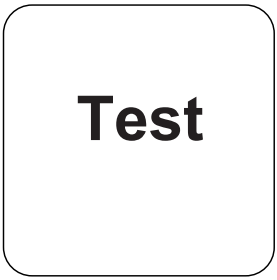
Close vial(s).



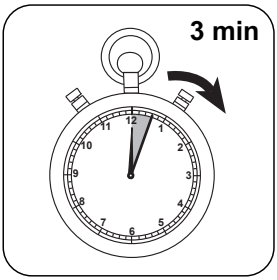
Invert several times to mix the contents.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **3 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically. The result in mg/l Iron appears on the display.

Chemical Method

1,10-Phenanthroline

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	-6.44557 • 10^{-2}	-6.44557 • 10^{-2}
b	2.39506 • 10^{+0}	5.14938 • 10^{+0}
c		
d		
e		
f		

Interferences

Persistant Interferences

1. Iridium interferes with the test.

According to

DIN 38406-E1
Standard Method 3500-Fe-1997
US EPA 40 CFR 136

[9] Reagent recovers most insoluble iron oxides without digestion

Iron (TPTZ) PP M223

0.02 - 1.8 mg/L Fe FE2

TPTZ

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 600, MD 610, MD 640, MultiDirect	ø 24 mm	580 nm	0.02 - 1.8 mg/L Fe
SpectroDirect	ø 24 mm	590 nm	0.1 - 1.8 mg/L Fe
XD 7000, XD 7500	ø 24 mm	590 nm	0.02 - 1.8 mg/L Fe

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
VARIO Iron TPTZ F10	Powder / 100 pc.	530550

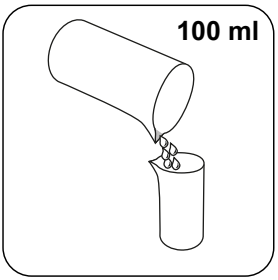
Application List

- Waste Water Treatment
- Cooling Water
- Boiler Water
- Galvanization
- Drinking Water Treatment
- Raw Water Treatment
- Pool Water Treatment

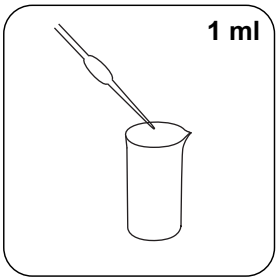
Preparation

1. Digestion is required for the determination of total Iron. The TPTZ reagent recovers most iron oxides without digestion.
2. All glassware must first be rinsed with diluted 1:1 Hydrochloric acid solution before the analysis and then rinsed with deionised water to remove iron deposits that can cause slightly high results.
3. Strong alkaline or acidic water samples should be adjusted between pH 3 and pH 8 before the analysis (use 0.5 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).
4. Water that has been treated with organic compounds such as corrosion inhibitors, must be oxidised where necessary to break down the iron complex. 1 ml of concentrated Sulphuric acid (≥ 95 %) and 1 ml concentrated Nitric acid (≥ 65 %) is therefore added to to 100 ml water sample and boiled down to approximately half the volume. After cooling down, the digestion procedure is continued.

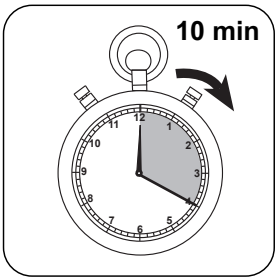
Digestion



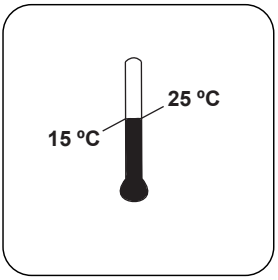
Fill a suitable sample vessel with **100 ml sample** .



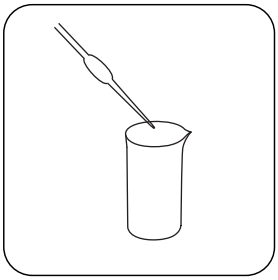
Add **1 ml concentrated sulfuric acid (≥ 95 %)** .



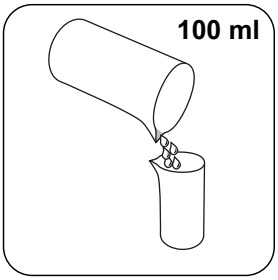
The sample is to be **heated for 10 minutes,** or for as long as it takes for everything to be completely dissolved.



Allow the sample to cool to room temperature.



Adjust **pH-value** of the sample with **ammonia solution (10-25 %) to 3-5**.

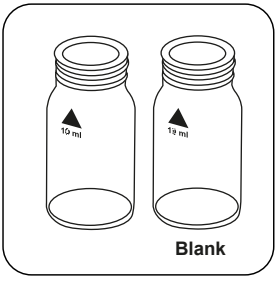


Fill the sample with **deionised water to 100 ml** .

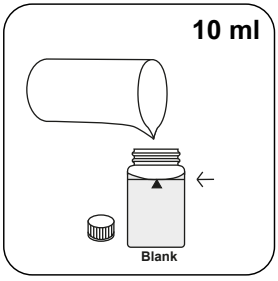
This sample is used for the analysis of total solved and dissolved Iron.

Implementation of the provision Iron, total with Vario Powder Pack

Select the method on the device
For testing of **total Iron,** carry out the described **digestion**.

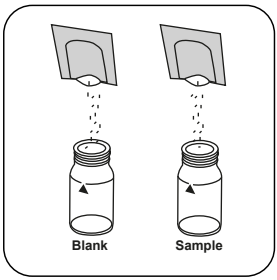


Prepare two clean 24 mm vials. Mark one as a blank.

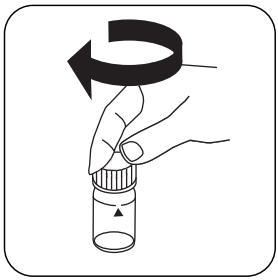


Put **10 ml deionised water** in the blank.

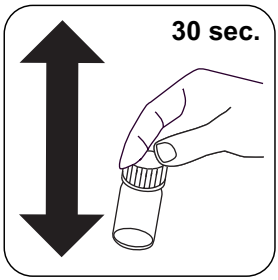
Put **10 ml sample** in the sample vial.



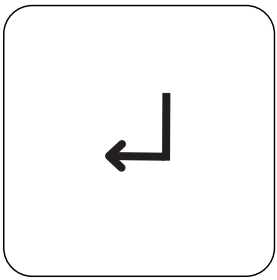
Add **a Vario IRON TPTZ F10 powder pack** in each vial.



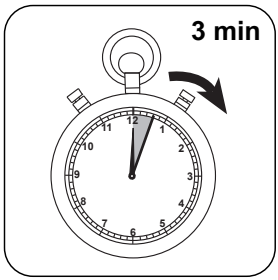
Close vial(s).



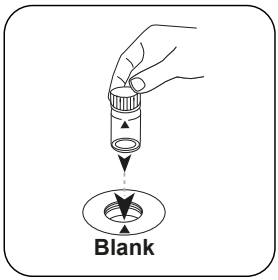
Mix the contents by shaking. (30 sec.).



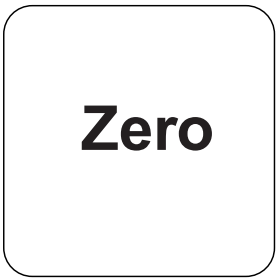
Press the **ENTER** button.



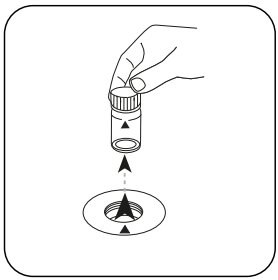
Wait for **3 minute(s) reaction time**.



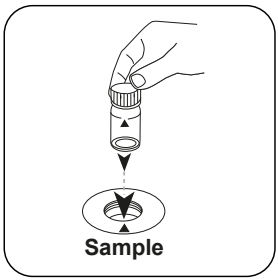
Place **blank** in the sample chamber. • Pay attention to the positioning.



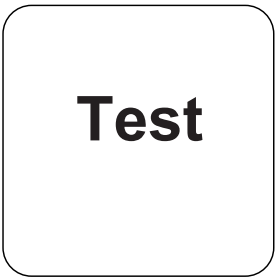
Press the **ZERO** button.



Remove the vial from the sample chamber.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.
The result in mg/l Iron appears on the display.

Chemical Method

TPTZ

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	-2.07334 • 10^{-2}	-2.07334 • 10^{-2}
b	1.26944 • 10^{+0}	2.7293 • 10^{+0}
c		
d		
e		
f		

Interferences

Persistant Interferences

When interferences occur, colour development is inhibited or a precipitate is formed. The values refer to a standard with an iron concentration of 0.5 mg/L.

Interference	**from / [mg/L]**
Ca	4
Cr^{3+}	0,25
Cr^{4+}	1,2
Co	0,05
Cu	0,6
CN^-	2,8
Mn	50
Hg	0.4
Mo	4
Ni	1
NO_2^-	0,8

Bibliography

G. Frederic Smith Chemical Co., The Iron Reagents, 3rd ed. (1980)

Iron in Mo PP (224) M224

0.01 - 1.8 mg/L Fe FEM

TPTZ

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 110, MD 600, MD 610, MD 640, MultiDirect, XD 7000, XD 7500	ø 24 mm	580 nm	0.01 - 1.8 mg/L Fe

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
VARIO Fe in MO Reagent Set	1 Set	536010

Application List

- Cooling Water
- Boiler Water

Sampling

1. Samples are to be collected in clean glass or plastic bottles. These should have been cleaned with 6 N (1:1) Hydrochloric acid and then rinsed with deionised water.
2. To preserve samples for later analysis, the pH value of the sample must be adjusted to less than 2. Approximately 2 ml per litre of concentrated Hydrochloric acid can be added to the sample. the sample is tested immediately, this addition is not necessary.
3. If determination of dissolved Iron is required, the sample must be filtered through a 0.45-micron filter or equivalent medium immediately after it has been collected and before acidification.
4. Preserved samples should be stored no longer than 6 months at room temperature.
5. The pH is to be adjusted to 3–5 by adding 5 N Sodium hydroxide solution before the analysis. A pH value of 5 must not be exceeded, since this can lead to precipitation of iron.
6. The test result needs to be corrected on the basis of the volume additions.

Preparation

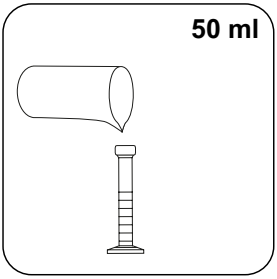
1. All glassware is to be cleaned with cleaning detergents and then rinsed with tap water. Afterwards, it should be reclaimed with Hydrochloric acid (1:1) and deionised water. These steps will remove any deposits that may cause slightly higher results.
2. If the sample contains 100 mg/L or more Molybdate (MoO_4^{2-}) then the sample reading must be taken immediately after zeroing the device.
3. For more accurate results, a reagent blank value can be determined for each new batch of reagent. Follow the procedure set out, using deionised water instead of the sample. The measured value that is obtained should be /subtracted from the readings of these results.

Notes

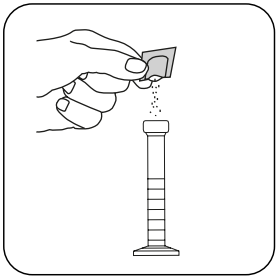
1. A blue colour develops in the presence of iron. A small amount of undissolved powder has no influence on the result.

Implementation of the provision Iron, total (Fe, Mo) in the presence of molybdate with Vario Powder Packs

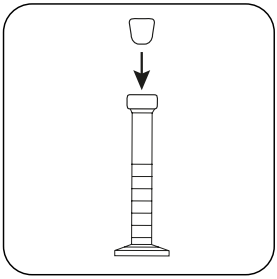
Select the method on the device



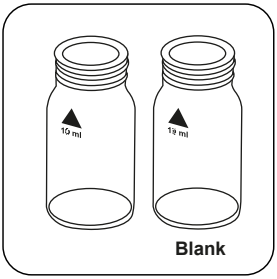
Put **50 ml sample** in 50 ml measuring cylinder



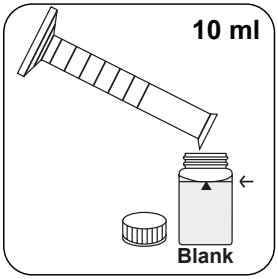
Add **Vario (Fe in Mo) Rgt 1 powder pack**.



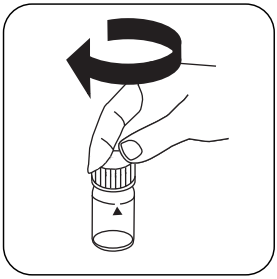
Stopper the mixing cylinder. Swirl around to dissolve the powder.



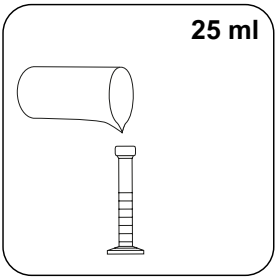
Prepare two clean 24 mm vials. Mark one as a blank.



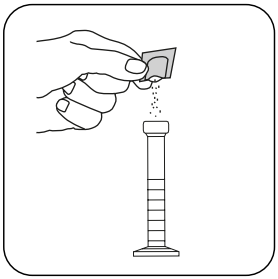
Fill blank with **10 ml prepared sample**.



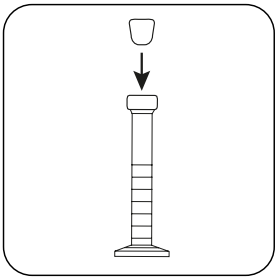
Close vial(s).



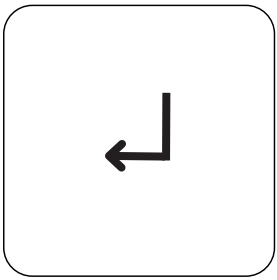
Put **25 ml prepared sample** in 25 ml measuring cylinder.



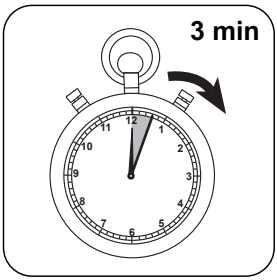
Add **Vario (Fe in Mo) Rgt 2 powder pack**.



Stopper the mixing cylinder. Swirl around to dissolve the powder.

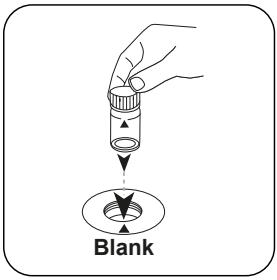


Press the **ENTER** button.

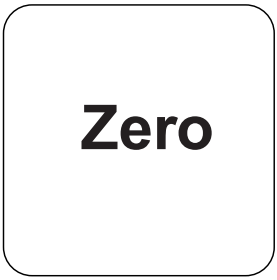


Wait for **3 minute(s) reaction time**.

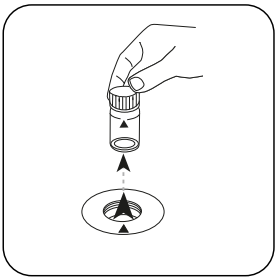
Put **10 ml sample** in the sample vial.



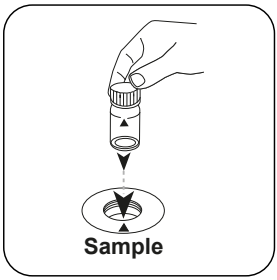
Place **blank** in the sample chamber. • Pay attention to the positioning.



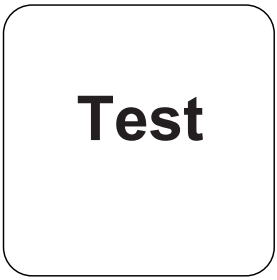
Press the **ZERO** button.



Remove the vial from the sample chamber.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in mg/l Fe appears on the display.

Chemical Method

TPTZ

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	-3.53705 • 10^{-2}	-3.53705 • 10^{-2}
b	1.45425 • 10^{+0}	3.12664 • 10^{+0}
c		
d		
e		
f		

Interferences

Removeable Interferences

1. PH interference: A sample pH after the addition of reagent, which is less than 3 or greater than 4, may inhibit colour formation since the developed colour fades too quickly, or can result in turbidity. This means that the pH value must be adjusted to between 3 and 5 in the measuring glass before the addition of the reagent:
   A suitable amount of iron-free acid or base, such as 1 N Sulphuric acid or 1 N Sodium hydroxide, can be added on a drop by drop basis.
   A volume correction must be carried out if significant volumes of acid or base are added.

Bibliography

G. Frederic Smith Chemical Co., The Iron Reagents, 3rd ed. (1980)

Iron LR L (A) M225

0.03 - 2 mg/L Fe FE

Ferrozine / Thioglycolate

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 110, MD 600, MD 610, MD 640, XD 7000, XD 7500	ø 24 mm	560 nm	0.03 - 2 mg/L Fe

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Iron LR 2 Reagent Set	1 Set	56R018990
KS135 Pa1/Alk1-Phenolphthalein Sub-Alk P	65 mL	56L013565
KS144-CH2-FC4-Calcium Hardness Buffer	65 mL	56L014465
KP962-Ammonium Persulphate Powder	Powder / 40 g	56P096240
KS63-FE6-Thioglycolate/Molybdate HR RGT	30 mL	56L006330
KS63-FE6-Thioglycolate/Molybdate HR RGT	65 mL	56L006365
KS61-FE5-Ferrozin/Thioglycolate	65 mL	56L006165

Application List

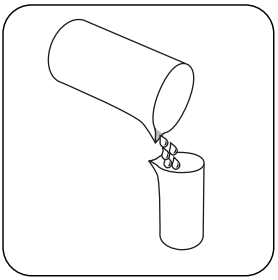
- Cooling Water
- Boiler Water
- Galvanization
- Raw Water Treatment

Preparation

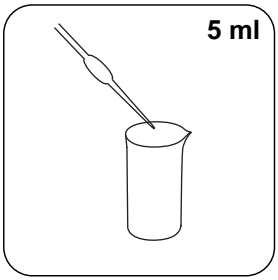
1. If there are strong complexing agents in the sample, the response time must be extended until no further colour development is seen. However, very strong iron complexes are not included in the measurement. In this event, the complexing agent must be destroyed by means of oxidation with acid/persulphate and the sample also neutralised to pH 6–9.
2. For the measurement of total iron, both suspended and dissolved, the sample must be boiled with acid/persulphate. It must be neutralised back to pH 6–9 and refilled to the original volume with deionised water.

Digestion

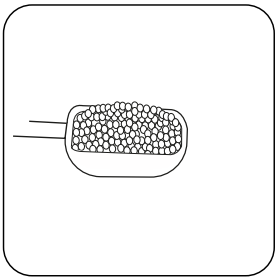
Total iron consists of suspended, soluble and complexed iron. The sample must be not filtered before measuring. To ensure homogenisation of the sample, deposed particles must be evenly distributed immediately prior to sampling by forcible shaking. A filtration of the sample is necessary for the determination of total soluble iron (including the complex iron compounds).The equipment required for the determination of total iron and reagents are not included in the standard delivery.



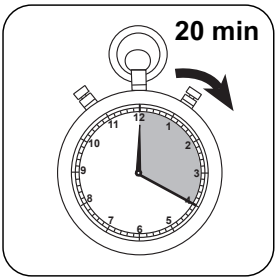
Fill a suitable digestion vessel with **50 ml homogenised sample**.



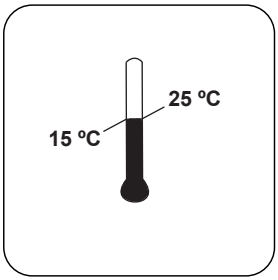
Add **5 ml 1:1 Hydrochloric acid**.



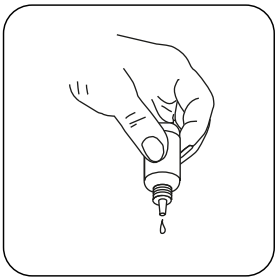
Add **a measuring scoop KP 962 (Ammonium Persulfat Powder)** .



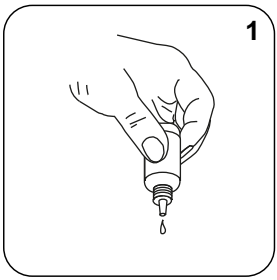
Boil the sample for **20 minutes** . A sample volume of about 25 ml should be retained;
If necessary, fill with deionised water.



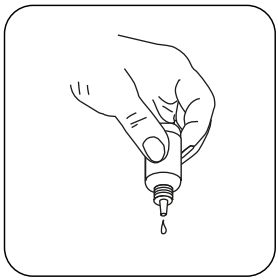
Allow the sample to cool to room temperature.



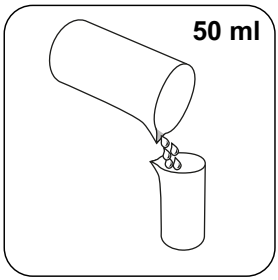
Hold cuvettes vertically and add equal drops by pressing slowly.



Add **1 drops KS135 (Phenolphthalein Substitute Indikator)**.



Add **KS 144 (Calcium Hardness Buffer)** drop by drop to the same sample until colouration turns from light pink to red. **(Note: make sure to swirl the vial after adding each drop!)**

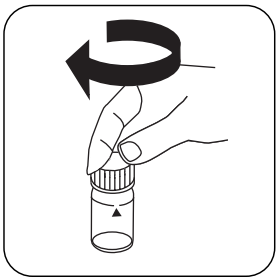


Fill the sample with **deionised water to 50 ml** .

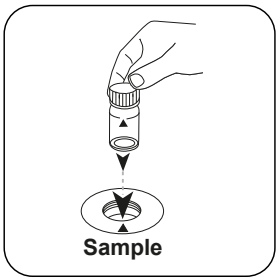
Implementation of the provision Iron, total LR (A) with liquid reagent

Select the method on the device
For testing of **Iron, total LR,** carry out the described **digestion**.
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

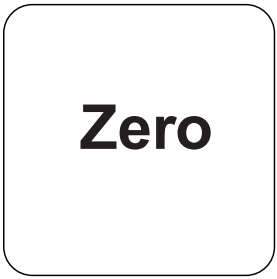
Fill 24 mm vial with **10 ml deionised water** .



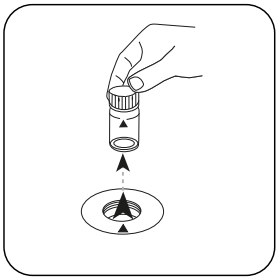
Close vial(s).



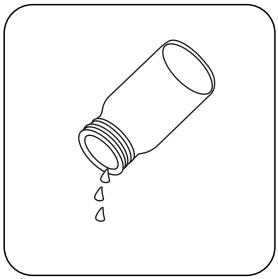
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **ZERO** button.



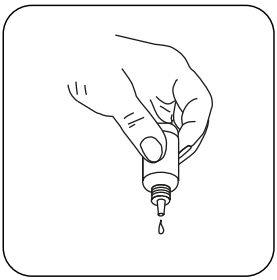
Remove the vial from the sample chamber.



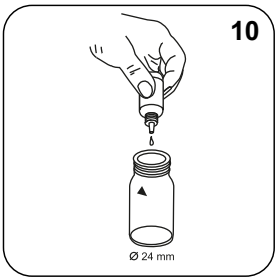
Empty vial.

For devices that require **no ZERO measurement** , **start here**.

Fill 24 mm vial with **10 ml prepared sample** .

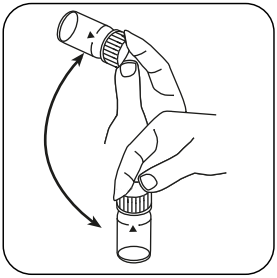


Hold cuvettes vertically and add equal drops by pressing slowly.

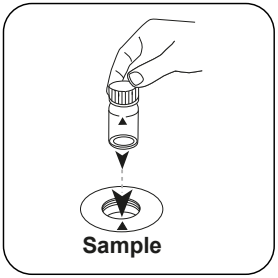


Add **10 drops KS61 (Ferrozine/ Thioglycolat)**.

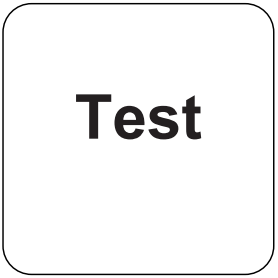
Close vial(s).



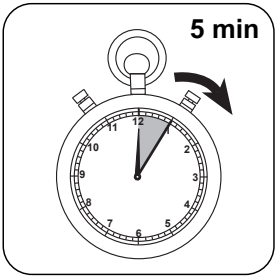
Invert several times to mix the contents.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



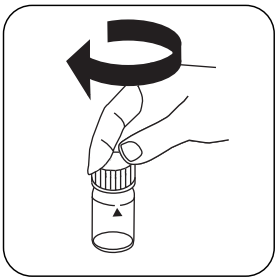
Wait for **5 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically. The result in mg/l total Iron or when using a filtrated sample, in mg/l totale soluble Iron appears on the display.

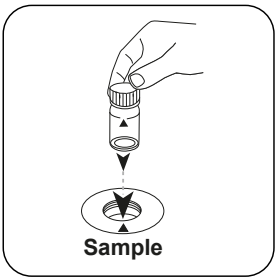
Implementation of the provision Iron LR (A) with liquid reagent

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500
For determination of total dissolved iron the sample must be filtered prior to the test (pore size 0,45 µm). Otherwise, iron particles and suspended iron are measured.

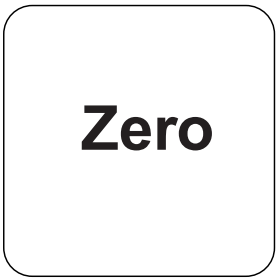
Fill 24 mm vial with **10 ml prepared sample** .



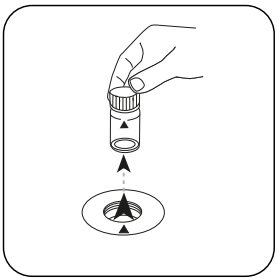
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

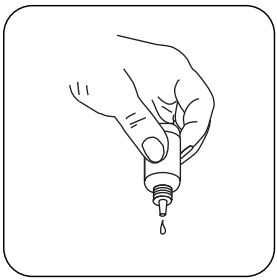


Press the **ZERO** button.

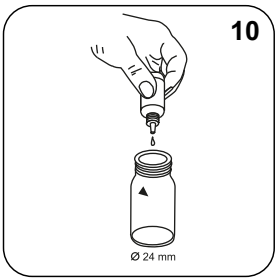


Remove the vial from the sample chamber.

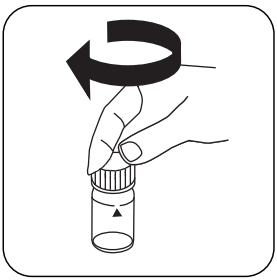
For devices that require **no ZERO measurement** , **start here**.



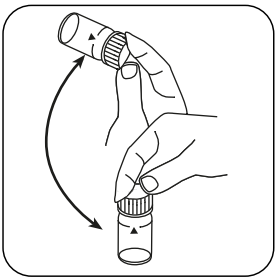
Hold cuvettes vertically and add equal drops by pressing slowly.



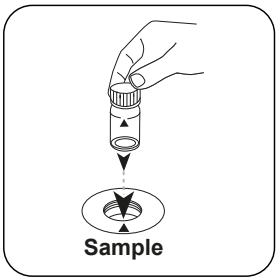
Add **10 drops KS61 (Ferrozine/ Thioglycolat)**.



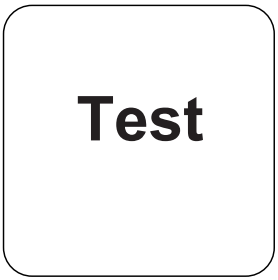
Close vial(s).



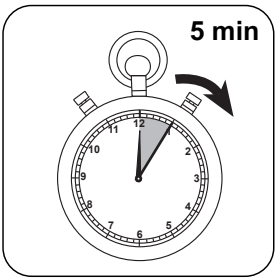
Invert several times to mix the contents.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **5 minute(s) reaction time**.
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Iron appears on the display.

Chemical Method

Ferrozine / Thioglycolate

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	-2.05635 • 10^{-2}	-2.05635 • 10^{-2}
b	9.74475 • 10^{-1}	2.09512 • 10^{+0}
c		
d		
e		
f		

Interferences

Removeable Interferences

1. If using KS61 (Ferrozine/Thioglycolate), a high concentration of molybdate will result in an intense yellow colour. In this instance, a chemical blank value is required:

- Use two clean **24 mm vials**.
- Mark one as blank for zeroing.
- Fill a clean vial (24 mm) with **10 ml of the sample** (blank).
- Add **10 drops of KS63 (Thioglycolate)** to the vial.
- Close the vial with the cap and swirl the contents to mix them.
- Place the blank in the sample chamber.
- Pay attention to the positioning.
- Press the **ZERO** button.
- Remove the vial from the sample chamber.
- Fill a second clean vial (24 mm) with **10 ml of the sample** (this is the sample vial).
- Add **10 drops of KS63 (Ferrozine/Thioglycolate)** and as before, follow the procedure as described.

Interference	from / [mg/L]
Co	8
Cu	2
Oxalat	500
CN^-	10
NO_2^-	

Bibliography

D. F. Boltz and J. A. Howell, eds., Colorimetric Determination of Nonmetals, 2nd ed., Vol. 8, p. 304 (1978). Carpenter, J.F. "A New Field Method for Determining the Levels of Iron Contamination in Oilfield Completion Brine", SPE International Symposium (2004)

Iron LR L (B) M226

0.03 - 2 mg/L Fe

Ferrozine / Thioglycolate

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, XD 7000, XD 7500	ø 24 mm	560 nm	0.03 - 2 mg/L Fe

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Iron LR 2 Reagent Set	1 pc.	56R023490
KS135 Pa1/Alk1-Phenolphthalein Sub-Alk P	30 mL	56L013530
KS135 Pa1/Alk1-Phenolphthalein Sub-Alk P	65 mL	56L013565
KS135 Pa1/Alk1-Phenolphthalein Sub-Alk P	500 mL	56L013597
KS135 Pa1/Alk1-Phenolphthalein Sub-Alk P - pck of 5	1 pc.	56L013572
KS144-CH2-FC4-Calcium Hardness Buffer	65 mL	56L014465
KS144-CH2-FC4-Calcium Hardness Buffer	65 mL	56L014472
KS144-CH2-FC4-Calcium Hardness	125 mL	56L014491
KP962-Ammonium Persulphate Powder	Powder / 40 g	56P096240

Application List

- Cooling Water
- Boiler Water
- Galvanization
- Raw Water Treatment

Preparation

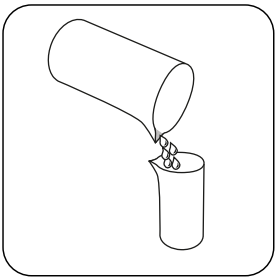
1. If there are strong complexing agents in the sample, the response time must be extended until no further colour development is seen. However, very strong iron complexes are not included in the measurement. In this event, the complexing agent must be destroyed by means of oxidation with acid/persulphate and the sample also neutralised to pH 6–9.
2. For the measurement of total iron, both suspended and dissolved, the sample must be boiled with acid/persulphate. It must be neutralised back to pH 6–9 and refilled to the original volume with deionised water.

Notes

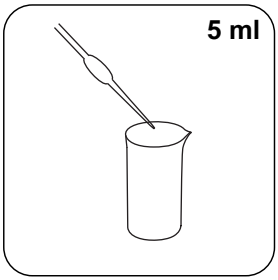
1. Do not add the reagent KS63 (Thioglycolate) if measuring Fe^{2+}.

Digestion

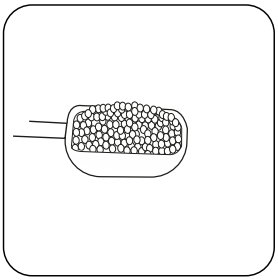
Total iron consists of suspended, soluble and complexed iron. The sample must be not filtered before measuring. To ensure homogenisation of the sample, deposed particles must be evenly distributed immediately prior to sampling by forcible shaking. A filtration of the sample is necessary for the determination of total soluble iron (including the complex iron compounds).The equipment required for the determination of total iron and reagents are not included in the standard delivery.



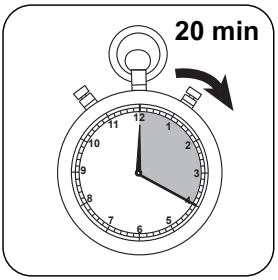
Fill a suitable digestion vessel with **50 ml homogenised sample**.



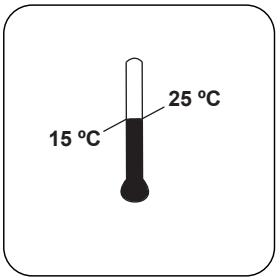
Add **5 ml 1:1 Hydrochloric acid**.



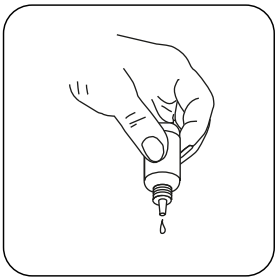
Add **a measuring scoop KP 962 (Ammonium Persulfat Powder)** .



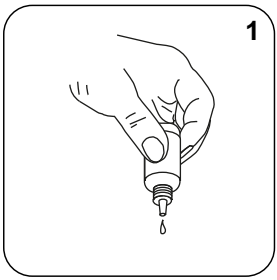
Boil the sample for **20 minutes** . A sample volume of about 25 ml should be retained;
If necessary, fill with deionised water.



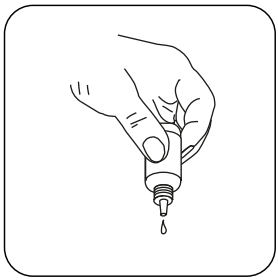
Allow the sample to cool to room temperature.



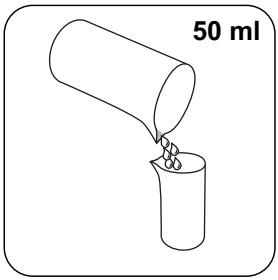
Hold cuvettes vertically and add equal drops by pressing slowly.



Add **1 drops KS135 (Phenolphthalein Substitute Indikator)**.



Add **KS 144 (Calcium Hardness Buffer)** drop by drop to the same sample until colouration turns from light pink to red. **(Note: make sure to swirl the vial after adding each drop!)**

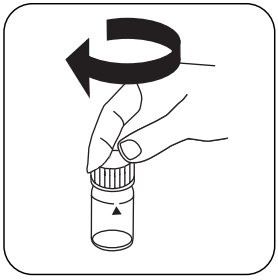


Fill the sample with **deionised water to 50 ml** .

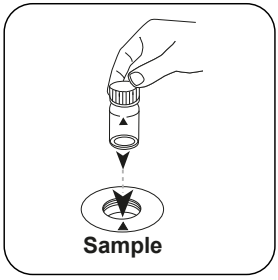
Implementation of the provision Iron LR (B) with Liquid Reagent

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500
For determination of total dissolved iron with a distinction between Fe^{2+} and Fe^{3+} the sample must be filtered prior to the test (pore size 0,45 µm). Otherwise, iron particles and suspended iron are measured.

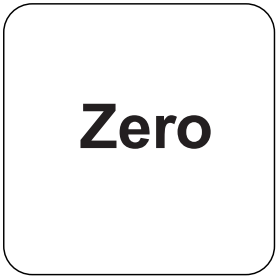
Fill 24 mm vial with **10 ml sample**.



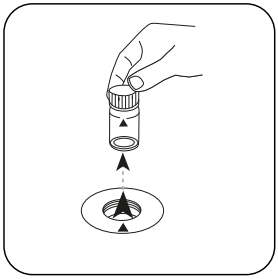
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

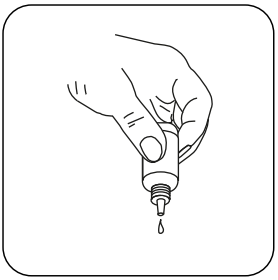


Press the **ZERO** button.

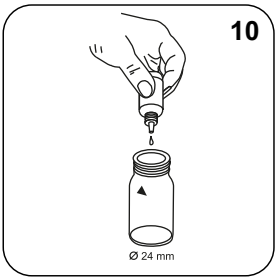


Remove the vial from the sample chamber.

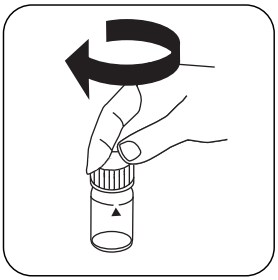
For devices that require **no ZERO measurement** , **start here**.



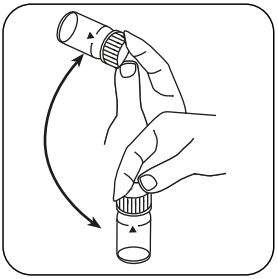
Hold cuvettes vertically and add equal drops by pressing slowly.



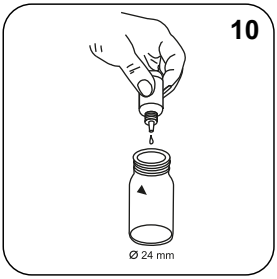
Add **10 drops KS60 (Acetate Buffer)**.



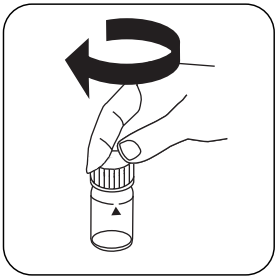
Close vial(s).



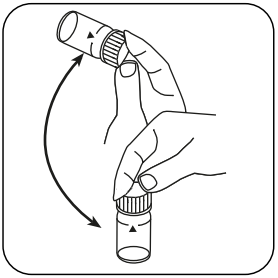
Invert several times to mix the contents.



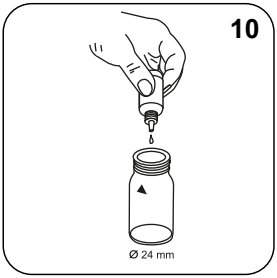
Add **10 drops KS63 (Thioglycolate)** .



Close vial(s).

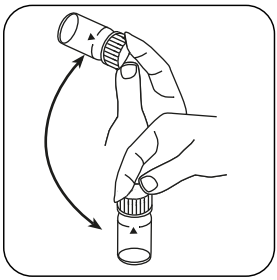


Invert several times to mix the contents.

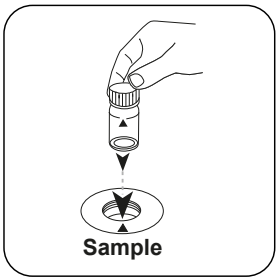


Add **10 drops KS65 (Ferrozine)** .

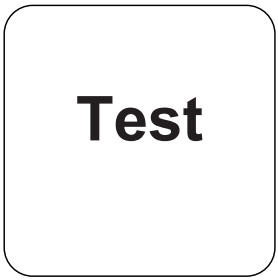
Close vial(s).



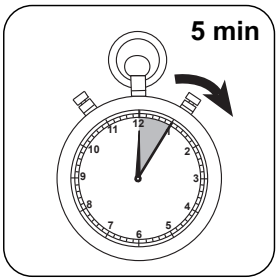
Invert several times to mix the contents.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



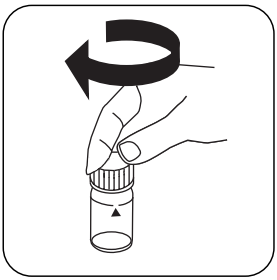
Wait for **5 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Fe^{2+}/Fe^{3+}. Fe^{3+} = $Fe_{2+/3+}$ - Fe^{2+} appears on the display.

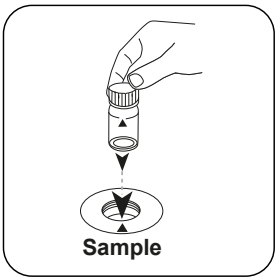
Implementation of the provision Iron, total LR 2 with liquid reagent

Select the method on the device
For testing of **Iron, total LR with liquid reagent,** carry out the described **digestion**.
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500
Total iron consists of suspended, soluble and complexed iron. The sample must be not filtered before measuring. To ensure homogenisation of the sample, deposed particles must be evenly distributed immediately prior to sampling by forcible shaking. A filtration of the sample is necessary for the determination of total soluble iron (including the complex iron compounds).The equipment required for the determination of total iron and reagents are not included in the standard delivery.

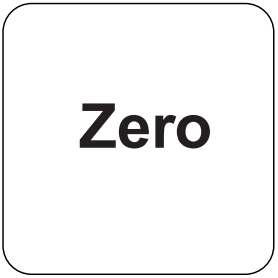
Fill 24 mm vial with **10 ml deionised water** .



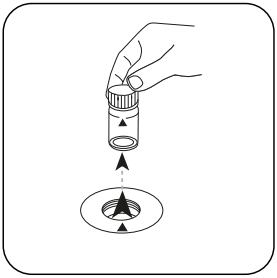
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **ZERO** button.

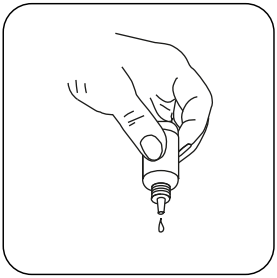


Remove the vial from the sample chamber.

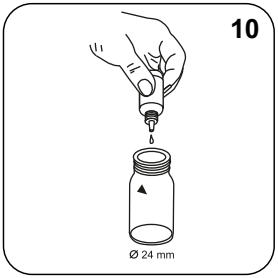
Empty vial.

For devices that require **no ZERO measurement** , **start here**.

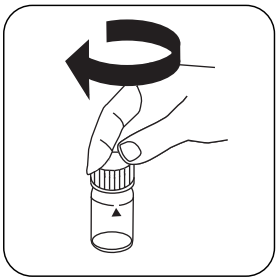
Fill 24 mm vial with **10 ml prepared sample** .



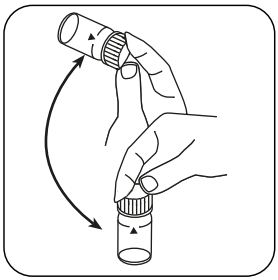
Hold cuvettes vertically and add equal drops by pressing slowly.



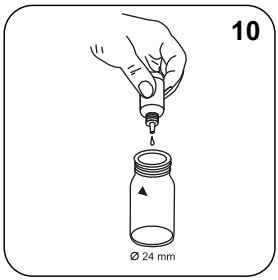
Add **10 drops KS60 (Acetate Buffer)**.



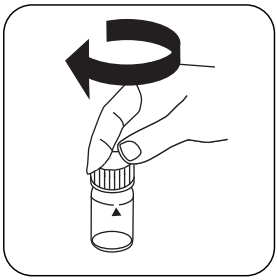
Close vial(s).



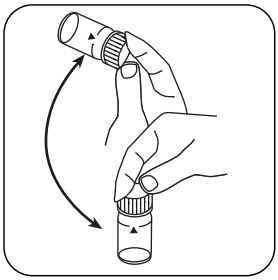
Invert several times to mix the contents.



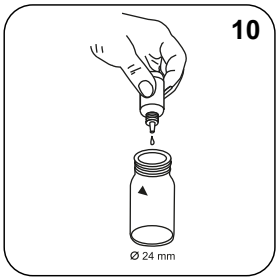
Add **10 drops KS63 (Thioglycolate)** .



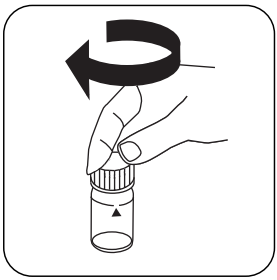
Close vial(s).



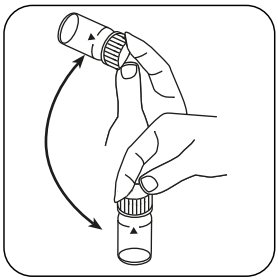
Invert several times to mix the contents.



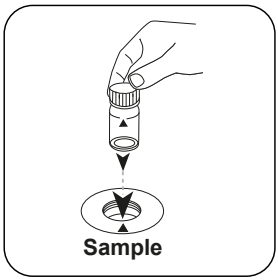
Add **10 drops KS65 (Ferrozine)** .



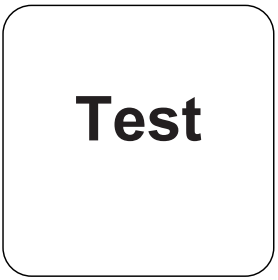
Close vial(s).

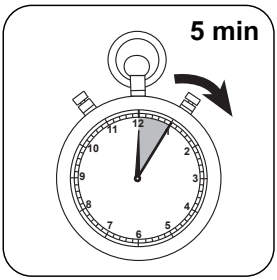


Invert several times to mix the contents.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.





Press the **TEST** (XD: **START**)button.

Wait for **5 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l total Iron or when using a filtrated sample, in mg/l totale soluble Iron appears on the display.

Chemical Method

Ferrozine / Thioglycolate

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	-2.46542 • 10^{-2}	-2.46542 • 10^{-2}
b	1.04803 • 10^{+0}	2.25326 • 10^{+0}
c		
d		
e		
f		

Interferences

Removeable Interferences

1. If using KS63 (Ferrozine/Thioglycolate), a high concentration of molybdate will result in an intense yellow colour. In this instance, a chemical blank value is required:
   - Use two clean 24 mm vials .
   - Mark one as blank for zeroing.
   - Fill a clean vial (24 mm) with 10 ml of the sample (blank).
   - Add **10 drops of KS63 (Thioglycolate)** to the vial.
   - Close the vial with the cap and swirl the contents to mix them.
   - Place the blank in the sample chamber. Pay attention to the positioning.
   - Press the **ZERO** button.
   - Remove the vial from the sample chamber.
   - Fill a second clean vial (24 mm) with **10 ml of the sample** (this is the sample vial).
   - Add **10 drops of KS60 (Actate Buffer)** and as before, follow the procedure as described.

Interference	from / [mg/L]
Co	8
Cu	2
Oxalat	500
CN^-	10
NO_2^-	

Bibliography

D. F. Boltz and J. A. Howell, eds., Colorimetric Determination of Nonmetals, 2nd ed., Vol. 8, p. 304 (1978). Carpenter, J.F. "A New Field Method for Determining the Levels of Iron Contamination in Oilfield Completion Brine", SPE International Symposium (2004)

Iron HR L M227

0.1 - 10 mg/L Fe

Thioglycolate

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, XD 7000, XD 7500	ø 24 mm	530 nm	0.1 - 10 mg/L Fe

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Iron HR Reagent Set	1 pc.	56R023590
KP962-Ammonium Persulphate Powder	Powder / 40 g	56P096240
KS135 Pa1/Alk1-Phenolphthalein Sub-Alk P	30 mL	56L013530
KS135 Pa1/Alk1-Phenolphthalein Sub-Alk P	65 mL	56L013565
KS135 Pa1/Alk1-Phenolphthalein Sub-Alk P	500 mL	56L013597
KS135 Pa1/Alk1-Phenolphthalein Sub-Alk P - pck of 5	1 pc.	56L013572
KS144-CH2-FC4-Calcium Hardness Buffer	65 mL	56L014465
KS144-CH2-FC4-Calcium Hardness	125 mL	56L014491
KS144-CH2-FC4-Calcium Hardness Buffer	65 mL	56L014472

Application List

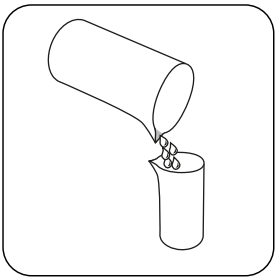
- Cooling Water
- Boiler Water
- Galvanization
- Raw Water Treatment

Preparation

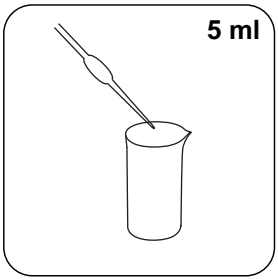
1. If there are strong complexing agents in the sample, the response time must be extended until no further colour development is seen. However, very strong iron complexes are not included in the measurement. In this event, the complexing agent must be destroyed by means of oxidation with acid/persulphate and the sample also neutralised to pH 6–9.
2. For the measurement of total iron, both suspended and dissolved, the sample must be boiled with acid/persulphate. It must be neutralised back to pH 6–9 and refilled to the original volume with deionised water.

Digestion

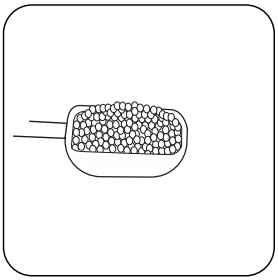
Total iron consists of suspended, soluble and complexed iron. The sample must be not filtered before measuring. To ensure homogenisation of the sample, deposed particles must be evenly distributed immediately prior to sampling by forcible shaking. A filtration of the sample is necessary for the determination of total soluble iron (including the complex iron compounds).The equipment required for the determination of total iron and reagents are not included in the standard delivery.



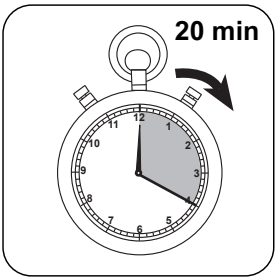
Fill a suitable digestion vessel with **50 ml homogenised sample**.



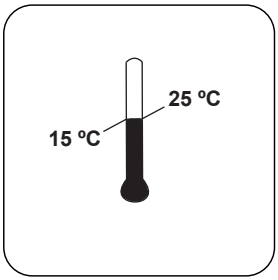
Add **5 ml 1:1 Hydrochloric acid**.



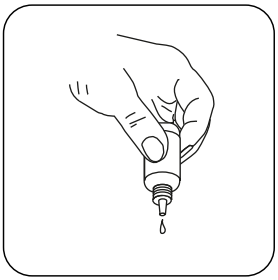
Add **a measuring scoop KP 962 (Ammonium Persulfat Powder)** .



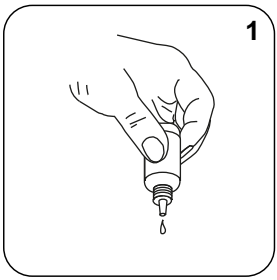
Boil the sample for **20 minutes** . A sample volume of about 25 ml should be retained;
If necessary, fill with deionised water.



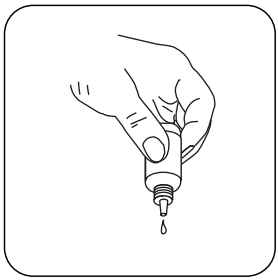
Allow the sample to cool to room temperature.



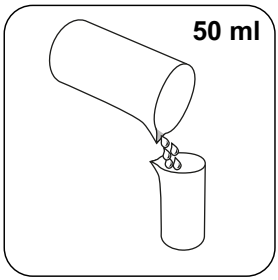
Hold cuvettes vertically and add equal drops by pressing slowly.



Add **1 drops KS135 (Phenolphthalein Substitute Indikator)**.



Add **KS 144 (Calcium Hardness Buffer)** drop by drop to the same sample until colouration turns from light pink to red. **(Note: make sure to swirl the vial after adding each drop!)**

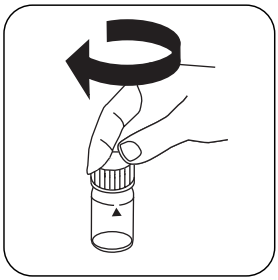


Fill the sample with **deionised water to 50 ml** .

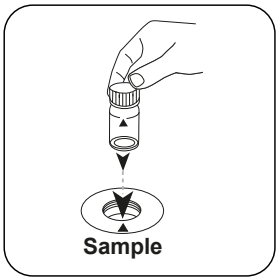
Implementation of the provision Iron, total HR with liquid reagent

Select the method on the device
For testing of **Iron, total HR with liquid reagent,** carry out the described **digestion**.
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500
Total iron consists of suspended, soluble and complexed iron. The sample must be not filtered before measuring. To ensure homogenisation of the sample, deposed particles must be evenly distributed immediately prior to sampling by forcible shaking. A filtration of the sample is necessary for the determination of total soluble iron (including the complex iron compounds).The equipment required for the determination of total iron and reagents are not included in the standard delivery.

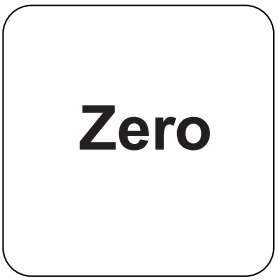
Fill 24 mm vial with **10 ml deionised water** .



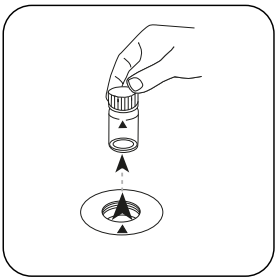
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **ZERO** button.

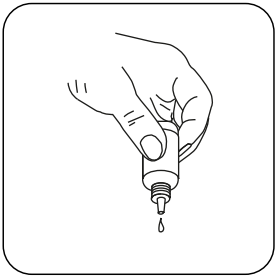


Remove the vial from the sample chamber.

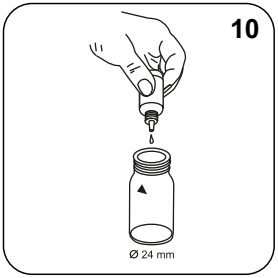
Empty vial.

For devices that require **no ZERO measurement** , **start here**.

Fill 24 mm vial with **10 ml prepared sample** .

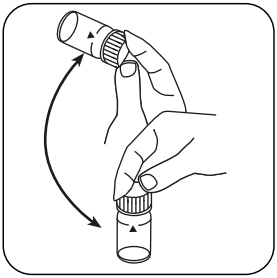


Hold cuvettes vertically and add equal drops by pressing slowly.

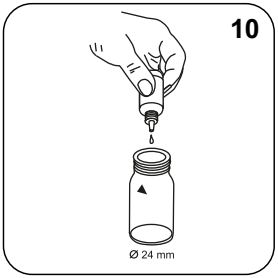


Add **10 drops KS63 (Thioglycolate)** .

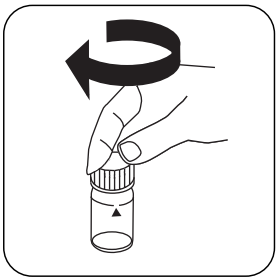
Close vial(s).



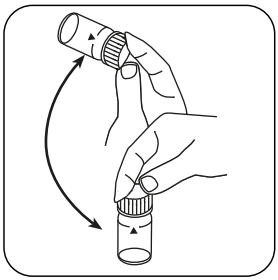
Invert several times to mix the contents.



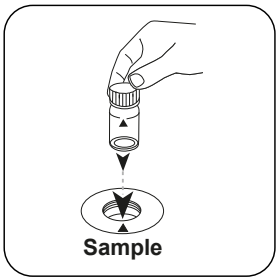
Add **10 drops KS160 (Total Hardness Buffer)**.



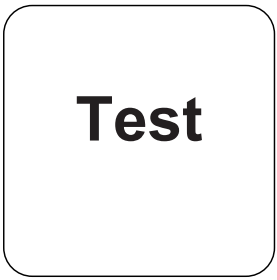
Close vial(s).



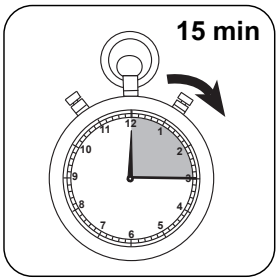
Invert several times to mix the contents.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



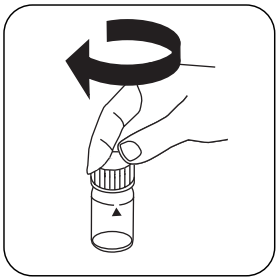
Wait for **15 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically. The result in mg/l total Iron or when using a filtrated sample, in mg/l totale soluble Iron appears on the display.

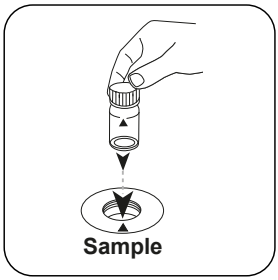
Implementation of the provision Iron HR with Liquid Reagent

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500
For determination of total dissolved iron with a distinction between Fe^{2+} and Fe^{3+} the sample must be filtered prior to the test (pore size 0,45 µm). Otherwise, iron particles and suspended iron are measured.

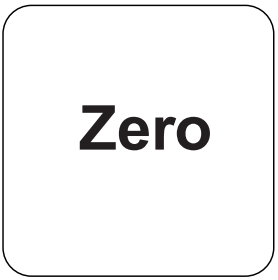
Fill 24 mm vial with **10 ml sample**.



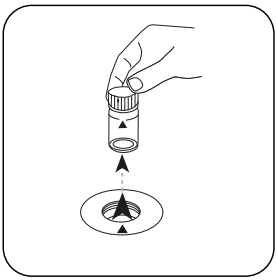
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

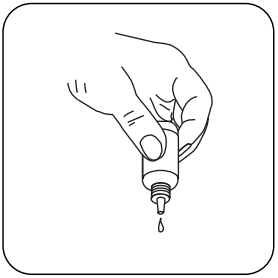


Press the **ZERO** button.

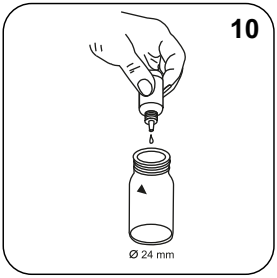


Remove the vial from the sample chamber.

For devices that require **no ZERO measurement** , **start here**.

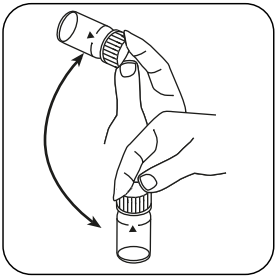


Hold cuvettes vertically and add equal drops by pressing slowly.

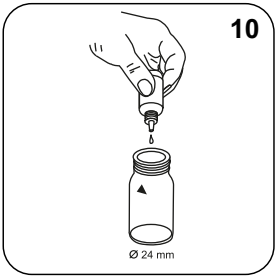


Add **10 drops KS63 (Thioglycolate)** .

Close vial(s).

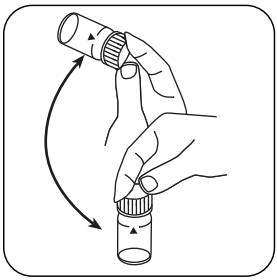


Invert several times to mix the contents.

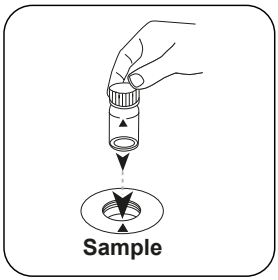


Add **10 drops KS160 (Total Hardness Buffer)**.

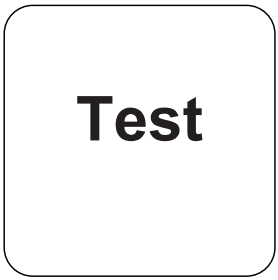
Close vial(s).



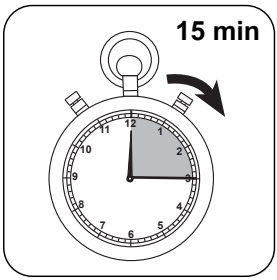
Invert several times to mix the contents.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **15 minute(s) reaction time**.
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Iron appears on the display.

Chemical Method

Thioglycolate

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^{2} + d•Abs^{3} + e•Abs^{4} + f•Abs^{5}

	ø 24 mm	**□ 10 mm**
a	-1.53212 • 10^{-1}	-1.53212 • 10^{-1}
b	7.33471 • 10^{+0}	1.57696 • 10^{+1}
c		
d		
e		
f		

Bibliography

E. Lyons (1927), Thioglycolic Acid As A Colour Test For Iron, J. Am. Chem. Soc., 49 (8), p.1916-1920

Lead 10 M232

0.1 - 5 mg/L Pb

4-(2-Pyridylazo-)-resorcine

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	□ 10 mm	520 nm	0.1 - 5 mg/L Pb

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Lead Spectroquant 1.09717.0001 reagent test [d)]	25 pc.	420753

Application List

- Waste Water Treatment
- Galvanization

Preparation

1. Before performing the test, you must read through the original instructions and safety advice that is delivered with the test kit (MSDS are available on the homepage of www.merckmillipore.com).
2. With the test process described, only Pb^{2+} ions are determined. To determine colloidal, undissolved and complex-bound lead, digestion is first required.

Notes

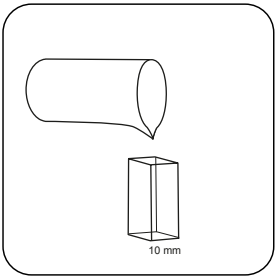
1. This method is adapted from MERCK.
2. Spectroquant® is a registered trademark of the company MERCK KGaA.
3. Appropriate safety precautions and good laboratory technique should be used during the whole procedure.
4. Reagents and samples must be metered using a suitable volumetric pipette (class A).

Variations in the length of the vial can extend the measuring range:

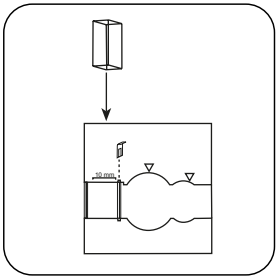
- 10 mm vial: 0.1 mg/L - 5 mg/L, solution: 0.01
- 20 mm vial: 0.05 mg/L - 2.5 mg/L, solution: 0.001
- 50 mm vial: 0.02 mg/L - 1 mg/L, solution: 0.001

Implementation of the provision Lead

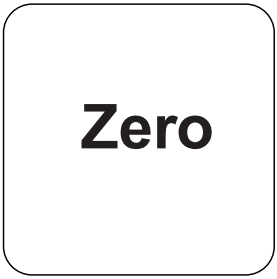
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



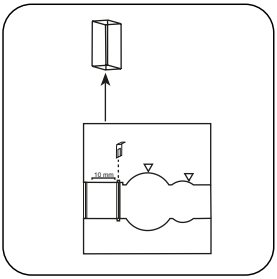
Fill 10 mm vial with **sample**.



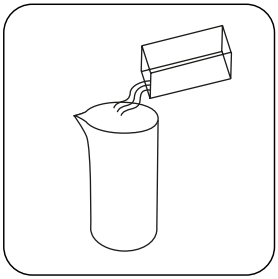
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



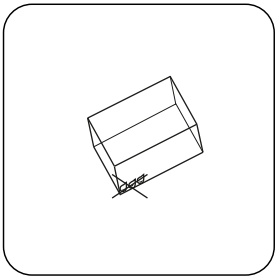
Press the **ZERO** button.



Remove **vial** from the sample chamber.



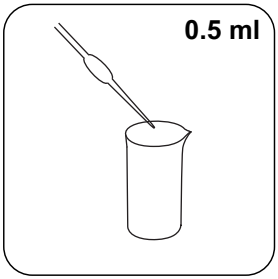
Empty vial.



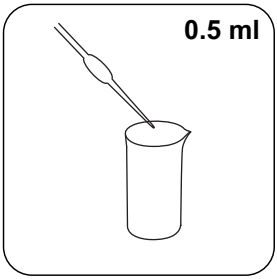
Dry the vial thoroughly.

For devices that require **no ZERO measurement** , **start here**.

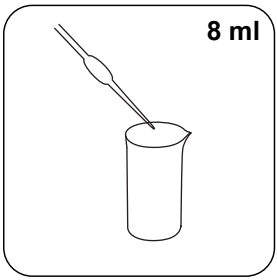
Note! Reagent Pb-1 contains Potassium cyanide! Adhere strictly to the specified dosage sequence!



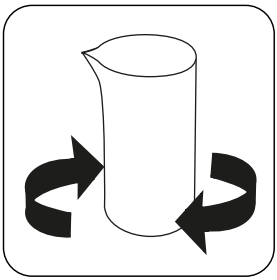
Place **0.5 ml Reagenz Pb-1** in a suitable sample vessel.



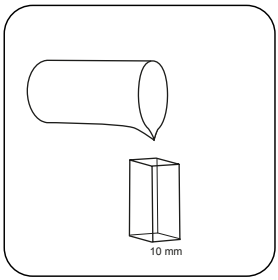
Add **0.5 ml Reagenz Pb-2**.



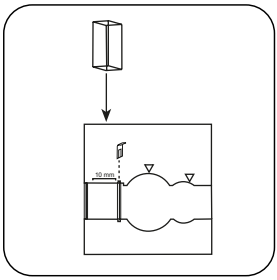
Add **8 ml sample**.



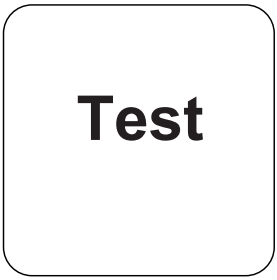
Invert several times to mix the contents.



Fill 10 mm vial with **sample**.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in mg/l Lead appears on the display.

Chemical Method

4-(2-Pyridylazo-)-resorcine

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	□ **10 mm**
a	$6.12438 \cdot 10^{-2}$
b	$6.16893 \cdot 10^{+0}$
c	
d	
e	
f	

Interferences

Interference	**from / [mg/L]**
Ag	50
Al	500
Ca	250
Cd^{2+}	25
Cr^{3+}	25
$Cr_2O_7^{2-}$	10
Cu^{2+}	100
Fe^{3+}	2
Hg^{2+}	50
Mg	250
Mn^{2+}	0,1
NH_4^+	1000
Ni^{2+}	100
NO_2^-	1000
PO_4^{3-}	50
Zn	25

Interference	from / [mg/L]
EDTA	0,25
Surfactants	500
Na-Ac	0,5
NaCl	0,5
$NaNO_3$	0.125
Na_2SO_4	0.375
Total Hardness	30° dH

Bibliography

Shvoeva, O.P., Dedkova, V.P. & Savvin, S.B. Journal of Analytical Chemistry (2001) 56: 1080

[d] Spectroquant® is a Merck KGaA Trademark

Lead (A) TT M234

0.1 - 5 mg/L Pb

4-(2-Pyridylazo-)-resorcine

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	ø 16 mm	515 nm	0.1 - 5 mg/L Pb

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Lead Spectroquant 1.14833.0001 tube test [d]	25 pc.	420754

Application List

- Waste Water Treatment
- Galvanization

Preparation

1. Before performing the test, you must read through the original instructions and safety advice that is delivered with the test kit (MSDS are available on the homepage of www.merckmillipore.com).
2. With the test process described, only Pb^{2+} ions are determined. To determine colloidal, undissolved and complex-bound lead, digestion is first required.
3. The pH value of the sample must be between 3 and 6.

Notes

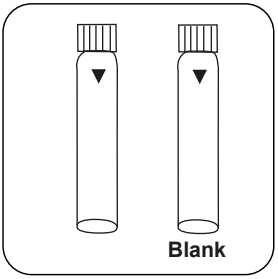
1. This method is adapted from MERCK.
2. Spectroquant® is a registered trademark of the company MERCK KGaA.
3. Appropriate safety precautions and good laboratory technique should be used during the whole procedure.
4. Sample volume should always be metered by using a 5ml volumetric pipette (class A).
5. Because the reaction depends on temperature, the sample temperature must be between 10 °C and 40 °C.
6. The reagents are to be stored in closed containers at a temperature of +15 °C – +25 °C.

Implementation of the provision Lead (Pb2+) in soft to medium-hard water

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500
Skip steps with Blank.

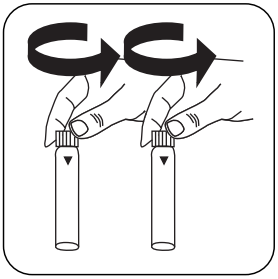
Method A

Use Method A for the determination of lead in soft to medium-hard water containing Ca^{2+} particles below 70 mg/l (approx. 10 ° dH).

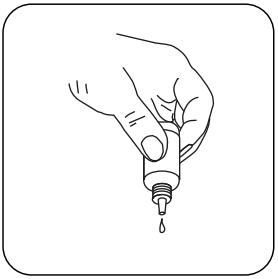


Prepare two **reaction vials**. Mark one as a blank.

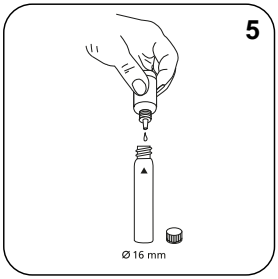
Note! Reagent tubes contain Potassium cyanide! Adhere strictly to the specified dosage sequence!



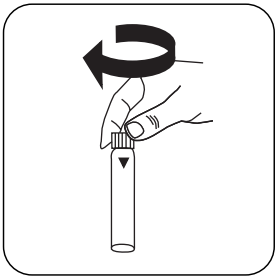
Open two **reaction vials** .



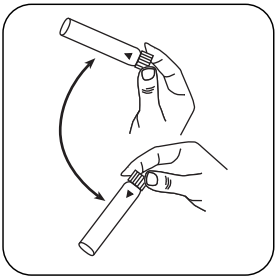
Hold cuvettes vertically and add equal drops by pressing slowly.



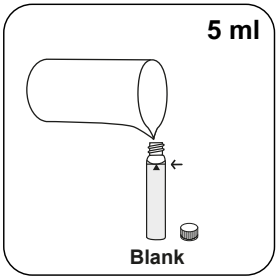
Add **5 drops Reagenz Pb-1K solution** to each vial.



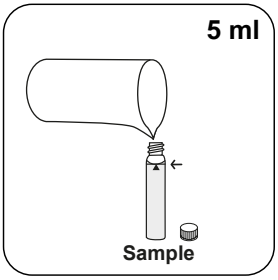
Close vial(s).



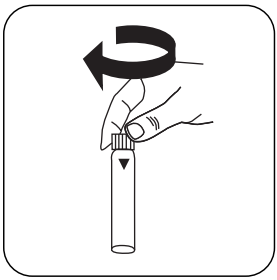
Invert several times to mix the contents.



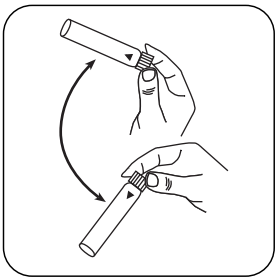
Put **5 ml deionised water** in the blank.



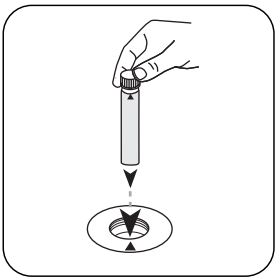
Put **5 ml sample** in the sample vial.



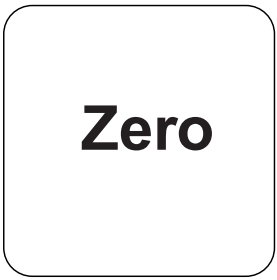
Close vial(s).



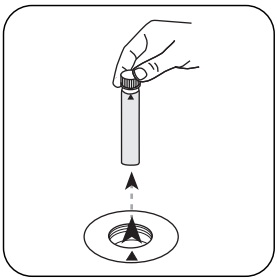
Invert several times to mix the contents.



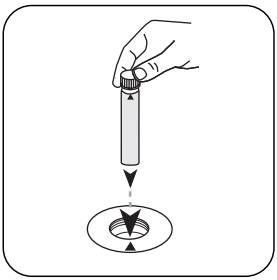
Place **blank** in the sample chamber. • Pay attention to the positioning.



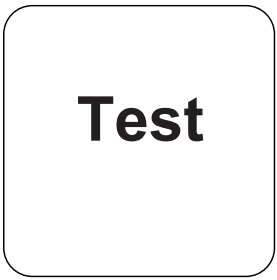
Press the **ZERO** button.



Remove **vial** from the sample chamber.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.
The result in mg/l Lead, in soft to medium hard waters (procedure A) appears on the display.

Chemical Method

4-(2-Pyridylazo-)-resorcine

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 16 mm
a	-3.23149 • 10^{-2}
b	4.63126 • 10^{+0}
c	
d	
e	
f	

Interferences

Interference	**from / [mg/L]**
Ag	100
Al	1000
Ca	70
Cd^{2+}	100
Cr^{3+}	10
$Cr_2O_7^{2-}$	50
Cu^{2+}	100
F^-	1000
Fe^{3+}	2
Hg^{2+}	50
Mg	100
Mn^{2+}	0,1
NH_4^+	1000
Ni^{2+}	100
NO_2^-	100
PO_4^{3-}	1000

Interference	from / [mg/L]
Zn	100
EDTA	0,1
Surfactants	1000
Na-Ac	0,2
$NaNO_3$	0.4
Na_2SO_4	0.02

Bibliography

Shvoeva, O.P., Dedkova, V.P. & Savvin, S.B. Journal of Analytical Chemistry (2001) 56: 1080

[d] Spectroquant® is a Merck KGaA Trademark

Lead (B) TT M235

0.1 - 5 mg/L Pb

4-(2-Pyridylazo-)-resorcine

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	ø 16 mm	515 nm	0.1 - 5 mg/L Pb

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Lead Spectroquant 1.14833.0001 tube test [d]	25 pc.	420754

Application List

- Waste Water Treatment
- Galvanization

Preparation

1. Before performing the test, you must read through the original instructions and safety advice that is delivered with the test kit (MSDS are available on the homepage of www.merckmillipore.com).
2. With the test process described, only Pb^{2+} ions are determined. To determine colloidal, undissolved and complex-bound lead, digestion is first required.
3. The pH value of the sample must be between 3 and 6.

Notes

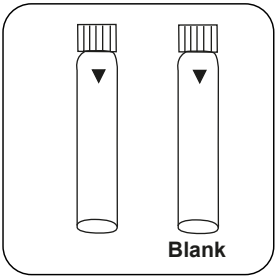
1. This method is adapted from MERCK.
2. Spectroquant® is a registered trademark of the company MERCK KGaA.
3. Appropriate safety precautions and good laboratory technique should be used during the whole procedure.
4. Sample volume should always be metered by using a 5ml volumetric pipette (class A).
5. Because the reaction depends on temperature, the sample temperature must be between 10 °C and 40 °C.
6. The reagents are to be stored in closed containers at a temperature of +15 °C – +25 °C.

Implementation of the provision Lead (Pb2+) in hard to very hard water

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500
Skip steps with Blank.

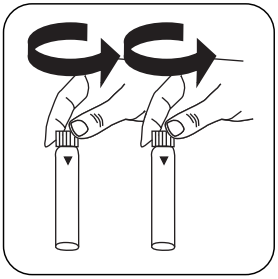
Method B

Use Method B for the determination of lead in hard to very hard water containing Ca^{2+} particles of 70 mg/l up to 500 mg/l (approx. 10-70° dH).

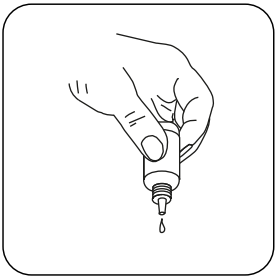


Prepare two **reaction vials**. Mark one as a blank.

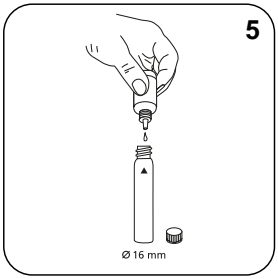
Note! Reagent tubes contain Potassium cyanide! Adhere strictly to the specified dosage sequence!



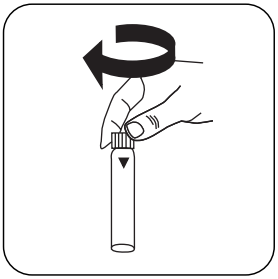
Open two **reaction vials** .



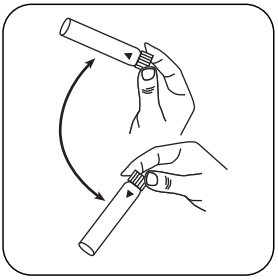
Hold cuvettes vertically and add equal drops by pressing slowly.



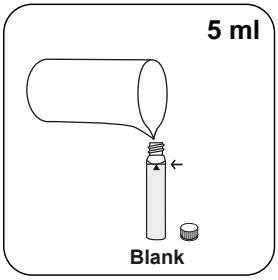
Add **5 drops Reagenz Pb-1K solution** to each vial.



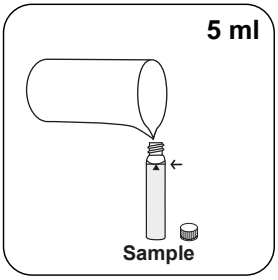
Close vial(s).



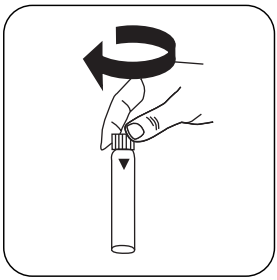
Invert several times to mix the contents.



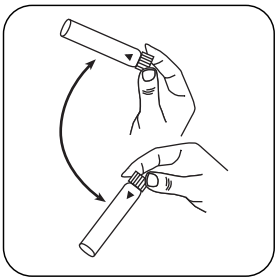
Put **5 ml deionised water** in the blank.



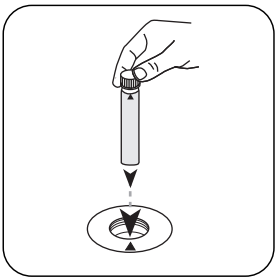
Put **5 ml sample** in the sample vial.



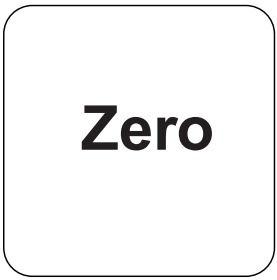
Close vial(s).



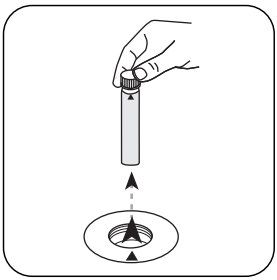
Invert several times to mix the contents.



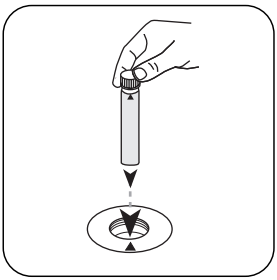
Place **blank** in the sample chamber. • Pay attention to the positioning.



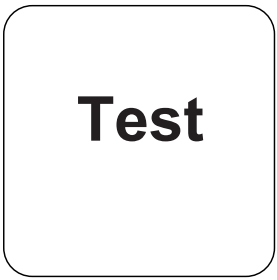
Press the **ZERO** button.



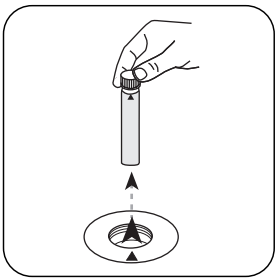
Remove **vial** from the sample chamber.



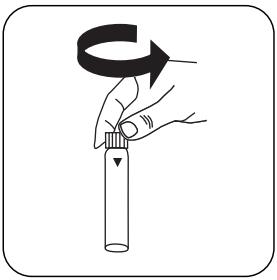
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



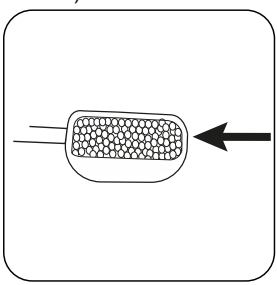
Press the **TEST** (XD: **START**)button.



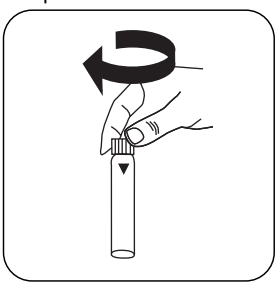
Remove **vial** from the sample chamber.



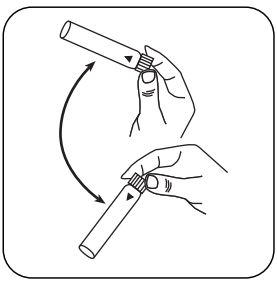
Open the sample vial.



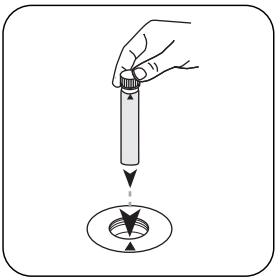
Add **one level microspoon Reagent Pb-2K**.



Close vial(s).



Swirl around to dissolve the powder.



Test

Place **sample vial** in the sample chamber. • Pay attention to the positioning.

Press the **TEST** (XD: **START**)button.

The result in mg/l Lead in hard to very hard waters (procedure B) appears on the display.

Lead content in mg/l = measured value A - measured value B

Chemical Method

4-(2-Pyridylazo-)-resorcine

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 16 mm
a	$-3.23149 \cdot 10^{-2}$
b	$4.63126 \cdot 10^{+0}$
c	
d	
e	
f	

Interferences

Interference	**from / [mg/L]**
Ag	100
Al	1000
Ca	500
Cd^{2+}	100
Cr^{3+}	10
$Cr_2O_7^{2-}$	50
Cu^{2+}	100
F^-	1000
Fe^{3+}	2
Hg^{2+}	50
Mg	250
Mn^{2+}	0,1
NH_4^+	1000
Ni^{2+}	100
NO_2^-	100
PO_4^{3-}	1000

Interference	from / [mg/L]
Zn	100
EDTA	0,1
Surfactants	1000
Na-Ac	0,2
$NaNO_3$	0.4
Na_2SO_4	0.02

Bibliography

Shvoeva, O.P., Dedkova, V.P. & Savvin, S.B. Journal of Analytical Chemistry (2001) 56: 1080

[d] Spectroquant® is a Merck KGaA Trademark

Manganese T M240

0.2 - 4 mg/L Mn Mn

Formaldoxime

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 600, MD 610, MD 640, MultiDirect	ø 24 mm	530 nm	0.2 - 4 mg/L Mn
SpectroDirect, XD 7000, XD 7500	ø 24 mm	450 nm	0.2 - 4 mg/L Mn

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Manganese LR 1	Tablet / 100	516080BT
Manganese LR 1	Tablet / 250	516081BT
Manganese LR 2	Tablet / 100	516090BT
Manganese LR 2	Tablet / 250	516091BT
Set Manganese LR 1/LR 2 100 Pc.#	100 each	517621BT
Set Manganese LR 1/LR 2 250 Pc.#	250 each	517622BT

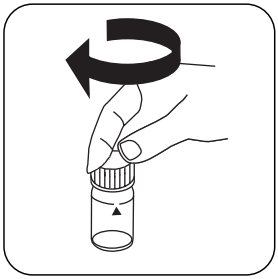
Application List

- Galvanization
- Drinking Water Treatment
- Raw Water Treatment

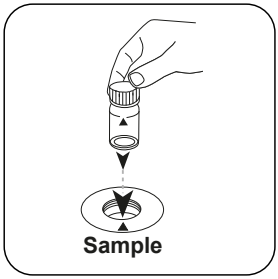
Implementation of the provision Manganese with Tablet

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

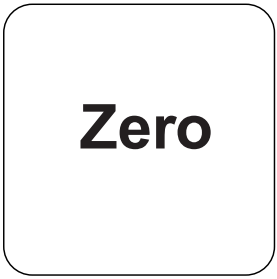
Fill 24 mm vial with **10 ml sample**.



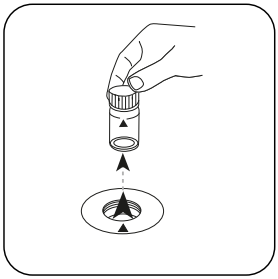
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

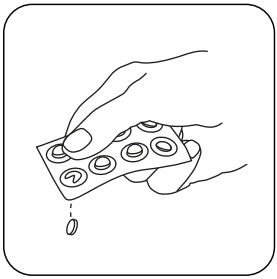


Press the **ZERO** button.

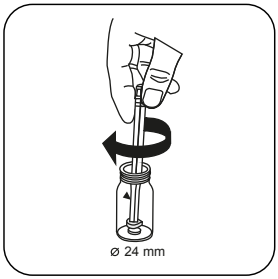


Remove the vial from the sample chamber.

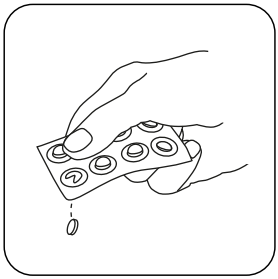
For devices that require **no ZERO measurement** , **start here**.



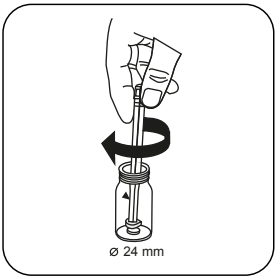
Add **MANGANESE LR 1 tablet** .



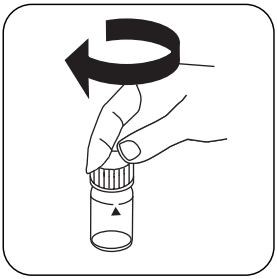
Crush tablet(s) by rotating slightly and dissolve.



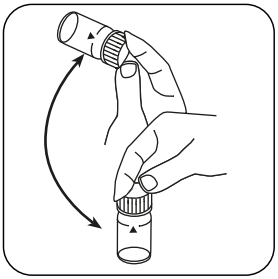
Add **MANGANESE LR 2 tablet** .



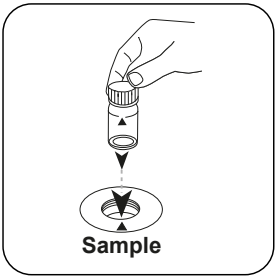
Crush tablet(s) by rotating slightly.



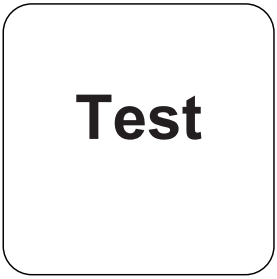
Close vial(s).



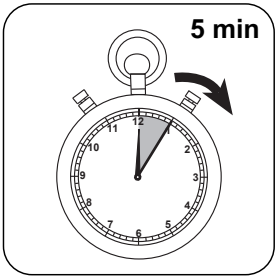
Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **5 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Manganese appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	Mn	1
mg/l	MnO_4	2.17
mg/l	$KMnO_4$	2.88

Chemical Method

Formaldoxime

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ 10 mm
a	$-1.42044 \cdot 10^{-1}$	$-1.42044 \cdot 10^{-1}$
b	$2.41852 \cdot 10^{+0}$	$5.19982 \cdot 10^{+0}$
c		
d		
e		
f		

Bibliography

Gottlieb, A. & Hecht, F. Mikrochim Acta (1950) 35: 337

According to

DIN 38406-E2

including stirring rod, 10 cm

Manganese LR PP M242

0.01 - 0.7 mg/L Mn Mn1

PAN

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 600, MD 610, MD 640, MultiDirect	ø 24 mm	560 nm	0.01 - 0.7 mg/L Mn
SpectroDirect, XD 7000, XD 7500	ø 24 mm	558 nm	0.01 - 0.7 mg/L Mn

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
VARIO Manganese Reagent, Set Low Range F10	1 pc.	535090
Vario Rochelle Salt Solution, 30 ml [h)]	30 mL	530640

Application List

- Galvanization
- Drinking Water Treatment
- Raw Water Treatment

Preparation

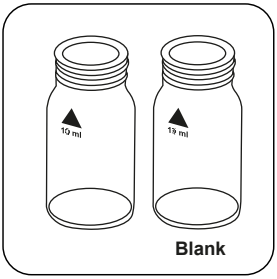
1. All lab glassware must first be rinsed with diluted nitric acid and then rinsed with deionised water.

Notes

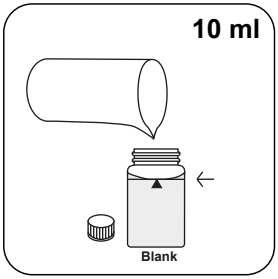
1. If water samples contain more than 300 mg/L $CaCO_3$ hardness, then after adding the Vario Ascorbic Acid powder pack, add an additional 10 drops of Rochelle Salt Solution.
2. After addition of the reagent solution “Alkaline-Cyanide” a cloudy or turbid solution may form in some water samples. Adding the PAN indicator solution should resolve the turbidity.
3. If the sample contains large amounts of iron (from 5 mg/L) a reaction period of 10 minutes must be adhered to.

Implementation of the provision Manganese LR with Vario Powder Packs

Select the method on the device

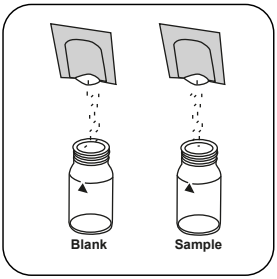


Prepare two clean 24 mm vials. Mark one as a blank.

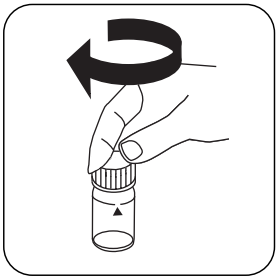


Put **10 ml deionised water** in the blank.

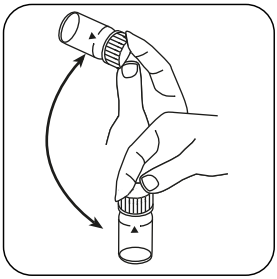
Put **10 ml sample** in the sample vial.



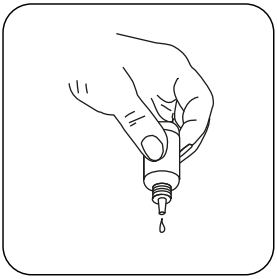
Add **a Vario Ascorbic Acid powder pack** in each vial.



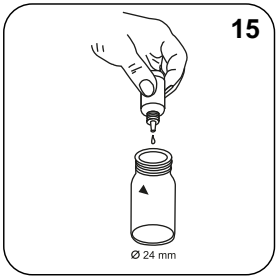
Close vial(s).



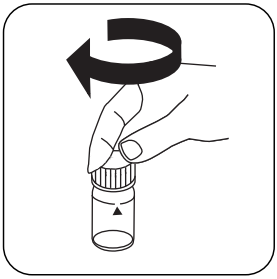
Invert several times to mix the contents.



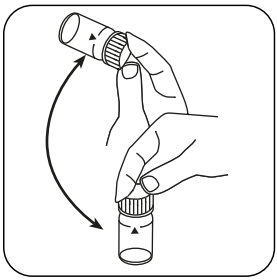
Hold cuvettes vertically and add equal drops by pressing slowly.



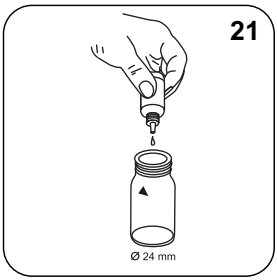
Add **15 drops Alkaline-Cyanide Reagenz**.



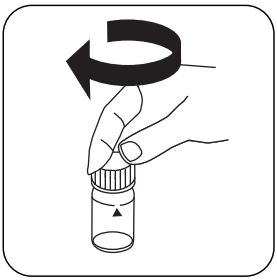
Close vial(s).



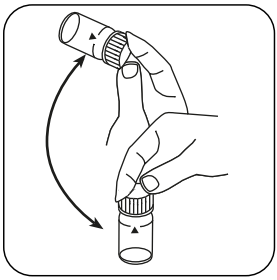
Invert several times to mix the contents.



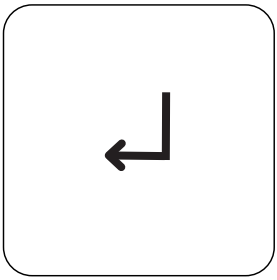
Add **21 drops PAN Indikator**.



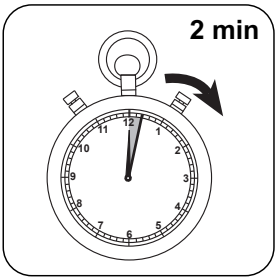
Close vial(s).



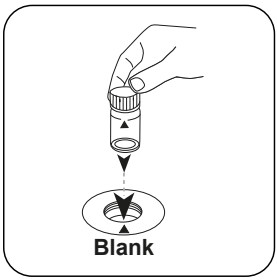
Invert several times to mix the contents.



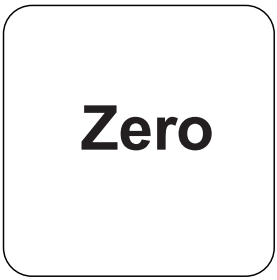
Press the **ENTER** button.



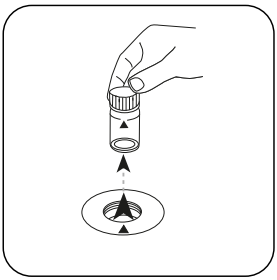
Wait for **2 minute(s) reaction time**.



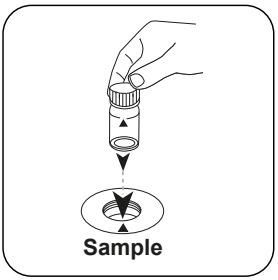
Place **blank** in the sample chamber. • Pay attention to the positioning.



Press the **ZERO** button.



Remove the vial from the sample chamber.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

Test

Press the **TEST** (XD: **START**)button.

The result in mg/l Manganese appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	Mn	1
mg/l	MnO_4	2.17
mg/l	$KMnO_4$	2.88

Chemical Method

PAN

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ 10 mm
a	$-3.05268 \cdot 10^{-2}$	$-3.05268 \cdot 10^{-2}$
b	$7.28484 \cdot 10^{-1}$	$1.56624 \cdot 10^{+0}$
c		
d		
e		
f		

Bibliography

Goto, K., et al., Talanta, 24, 652-3 (1977)

[h] additionally required for samples with hardness values above 300 mg/l $CaCO_3$

Manganese HR PP M243

0.1 - 18 mg/L Mn Mn2

Periodate Oxidation

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 600, MD 610, MD 640, MultiDirect	ø 24 mm	530 nm	0.1 - 18 mg/L Mn
SpectroDirect, XD 7000, XD 7500	ø 24 mm	525 nm	0.1 - 18 mg/L Mn

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
VARIO Manganese HR, Set High Range F10	1 Set	535100

Application List

- Galvanization
- Drinking Water Treatment
- Raw Water Treatment

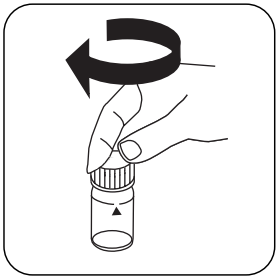
Preparation

1. Strongly buffered water samples or extreme pH values may exceed the buffering capacity of the reagents and pH values to be adjusted.
   If samples were acidified for storing, the pH value must be adjusted between 4 and 5 with 5 mol/l (5 N) Sodium hydroxide before the test. A pH value of 5 must not be exceeded, since this can lead to precipitation of manganese.

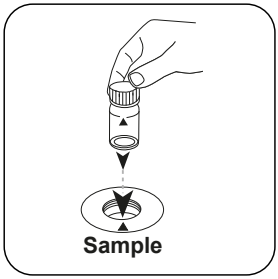
Implementation of the provision Manganese HR with Vario Powder Packs

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

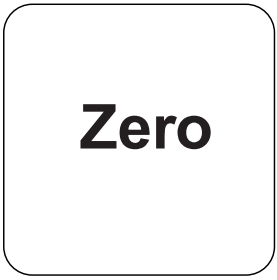
Fill 24 mm vial with **10 ml sample**.



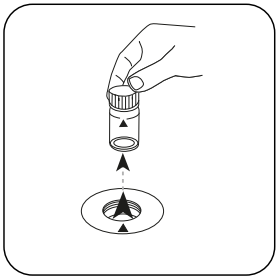
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

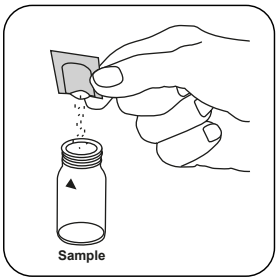


Press the **ZERO** button.

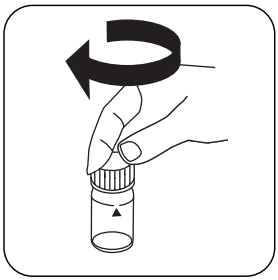


Remove the vial from the sample chamber.

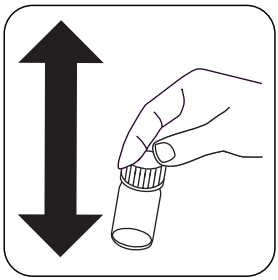
For devices that require **no ZERO measurement** , **start here**.



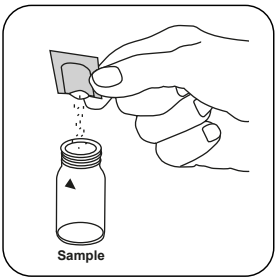
Add **Vario Manganese Citrate Buffer F10 powder pack**.



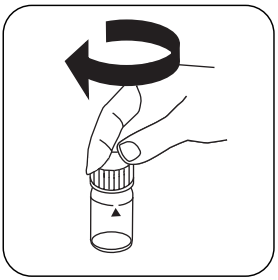
Close vial(s).



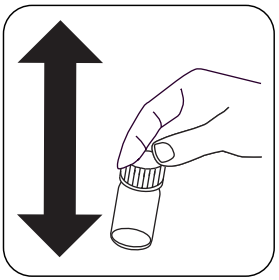
Mix the contents by shaking.



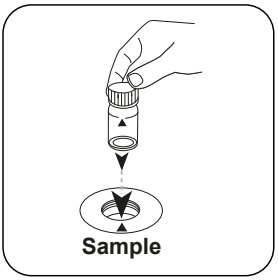
Add **Vario Sodium Periodate F10 powder pack**.



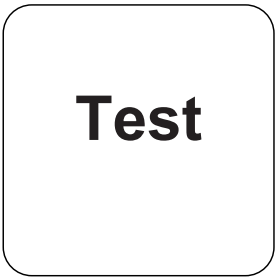
Close vial(s).



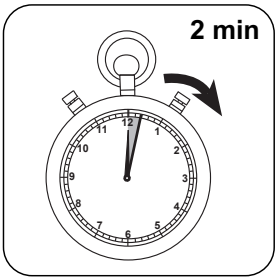
Mix the contents by shaking.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **2 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Manganese appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	Mn	1
mg/l	MnO_4	2.17
mg/l	$KMnO_4$	2.88

Chemical Method

Periodate Oxidation

Appendix

Interferences

Interference	from / [mg/L]
Ca	700
Cl^-	70000
Fe	5
Mg	100000

Method Validation

Limit of Detection	0.16 mg/L
Limit of Quantification	0.49 mg/L
End of Measuring Range	18 mg/L
Sensitivity	13.02 mg/L / Abs
Confidence Intervall	0.28 mg/L
Standard Deviation	0.12 mg/L
Variation Coefficient	1.29 %

According to

40 CFR 136 (US EPA approved HACH)

Manganese L M245

0.05 - 5 mg/L Mn

Formaldoxime

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640	ø 24 mm	430 nm	0.05 - 5 mg/L Mn
XD 7000, XD 7500	ø 24 mm	450 nm	0.05 - 5 mg/L Mn

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Mangan L, Reagent Set	1 pc.	56R024055

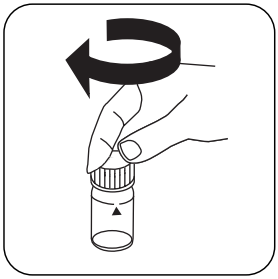
Application List

- Galvanization
- Drinking Water Treatment
- Raw Water Treatment

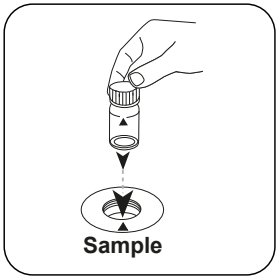
Implementation of the provision Manganese with Fluid reagent

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

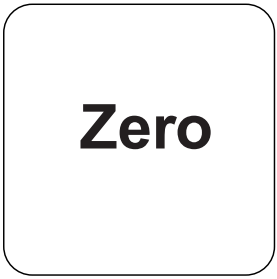
Fill 24 mm vial with **10 ml sample**.



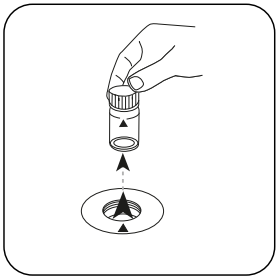
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

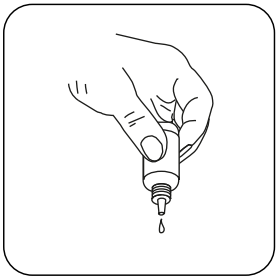


Press the **ZERO** button.

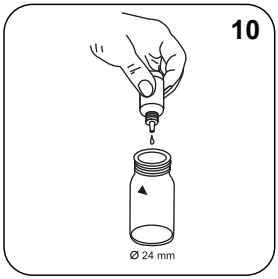


Remove the vial from the sample chamber.

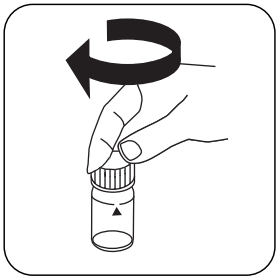
For devices that require **no ZERO measurement** , **start here**.



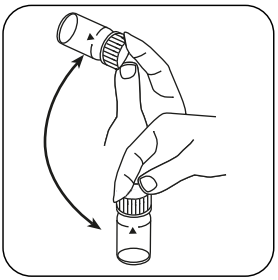
Hold cuvettes vertically and add equal drops by pressing slowly.



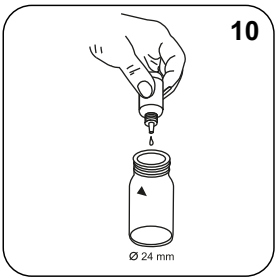
Add **10 drops KS265 (Manganese Reagent A)**.



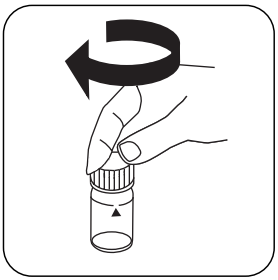
Close vial(s).



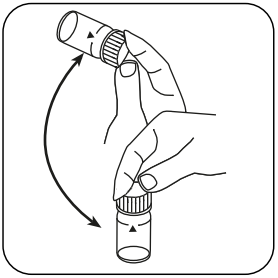
Invert several times to mix the contents.



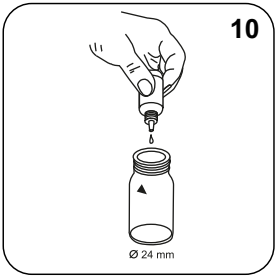
Add **10 drops KS266 (Manganese Reagent B)**.



Close vial(s).

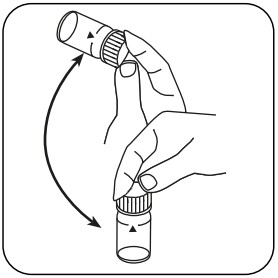


Invert several times to mix the contents.

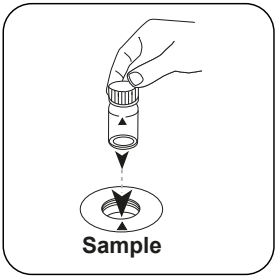


Add **10 drops KS304 (Manganese Reagent C)**.

Close vial(s).

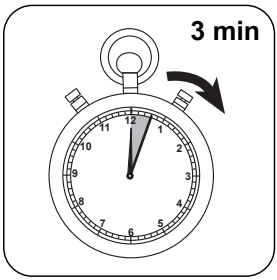


Invert several times to mix the contents.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

Press the **TEST** (XD: **START**)button.



Wait for **3 minute(s) reaction time**.
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Manganese appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	Mn	1
mg/l	MnO_4	2.17
mg/l	$KMnO_4$	2.88

Chemical Method

Formaldoxime

Appendix

Calibration function for 3rd-party photometers

Conc. = $a + b \cdot Abs + c \cdot Abs^2 + d \cdot Abs^3 + e \cdot Abs^4 + f \cdot Abs^5$

	ø 24 mm	□ 10 mm
a	$-6.20417 \cdot 10^{-2}$	$-5.24512 \cdot 10^{-2}$
b	$2.8192 \cdot 10^{+0}$	$6.04027 \cdot 10^{+0}$
c		
d		
e		
f		

Interferences

Interference	from / [mg/L]
Ca	500
Na	500
Ni	0,5
Fe	5
Cr	5

Method Validation

Limit of Detection	0.01 mg/L
Limit of Quantification	0.04 mg/L
End of Measuring Range	5 mg/L
Sensitivity	2.8 mg/L / Abs
Confidence Intervall	0.03 mg/L
Standard Deviation	0.01 mg/L
Variation Coefficient	0.46 %

Bibliography

Gottlieb, A. & Hecht, F. Mikrochim Acta (1950) 35: 337

According to

DIN 38406-E2

Molybdate T M250

1 - 50 mg/L MoO_4 Mo3

Thioglycolate

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect	ø 24 mm	430 nm	1 - 50 mg/L MoO_4
XD 7000, XD 7500	ø 24 mm	366 nm	1 - 50 mg/L MoO_4
MD 100	ø 24 mm	430 nm	0.6 - 50 mg/L MoO_4
SpectroDirect	ø 24 mm	366 nm	1 - 30 mg/L MoO_4

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Molybdate HR No. 1	Tablet / 100	513060BT
Molybdate HR No. 1	Tablet / 250	513061BT
Molybdate HR No. 2	Tablet / 100	513070BT
Molybdate HR No. 2	Tablet / 250	513071BT
Set Molybdate No. 1/No. 2 100 Pc.#	100 each	517631BT
Set Molybdate No. 1/No. 2 250 Pc.#	250 each	517632BT

Application List

- Boiler Water
- Cooling Water

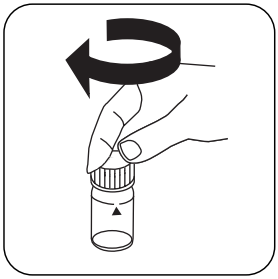
Notes

1. The tablets must be added in the correct sequence.

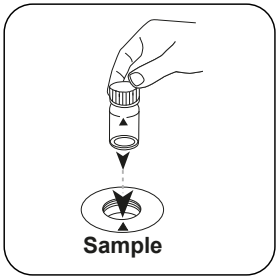
Implementation of the provision Molybdate HR with Tablet

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

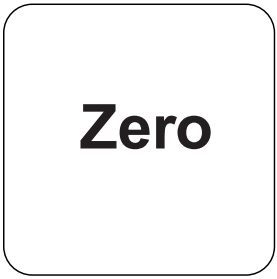
Fill 24 mm vial with **10 ml sample**.



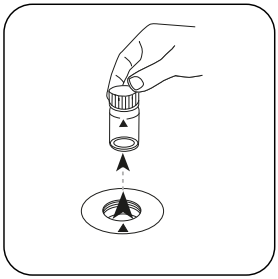
Close vial(s).



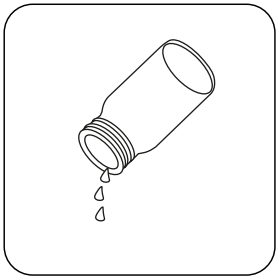
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **ZERO** button.

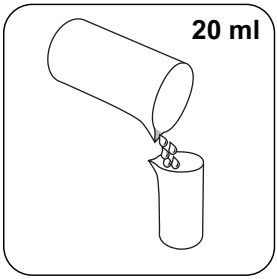


Remove the vial from the sample chamber.

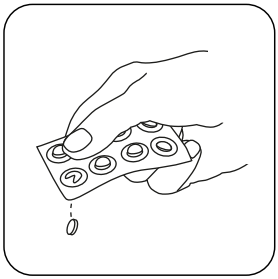


Empty vial.

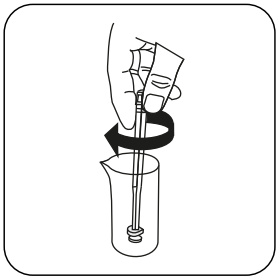
For devices that require **no ZERO measurement** , **start here**.



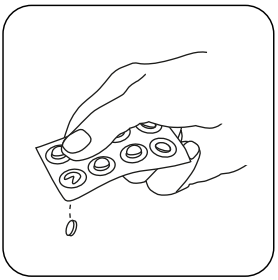
Put **20 ml sample** in 100 ml measuring beaker



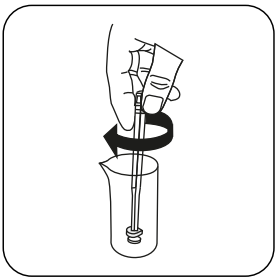
Add **MOLYBDATE HR No. 1 tablet** .



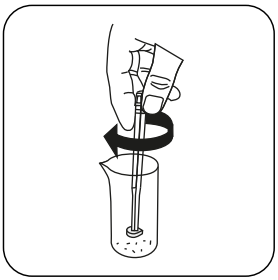
Crush tablet(s) by rotating slightly.



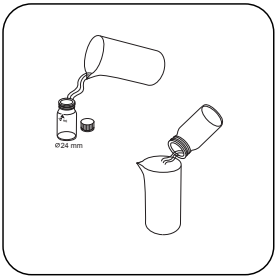
Add **MOLYBDATE HR No. 2 tablet** .



Crush tablet(s) by rotating slightly.

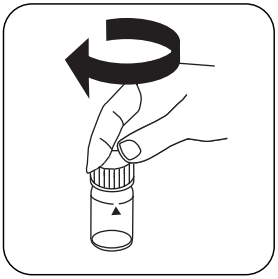


Dissolve the tablets using a clean stirring rod.

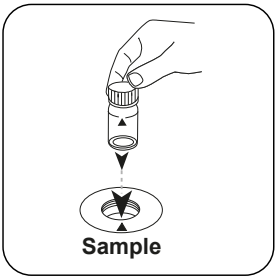


Rinse out vial with prepared sample .

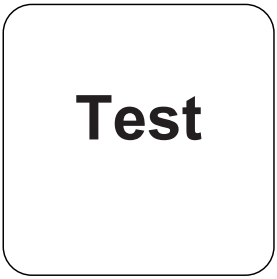
Fill up vial with **sample** to the **10 ml mark**.



Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in mg/l Molybdate/ Molybdenum appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	MoO_4	1
mg/l	Mo	0.6
mg/l	Na_2MoO_4	1.29

Chemical Method

Thioglycolate

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ **10 mm**
a	$-1.30232 \cdot 10^{+0}$	$-1.30232 \cdot 10^{+0}$
b	$1.7691 \cdot 10^{+1}$	$3.80356 \cdot 10^{+1}$
c		
d		
e		
f		

Interferences

Removeable Interferences

1. Interference from niobium, tantalum, titanium, and zirconium are masked with citric acid.
2. Interference from vanadium(V) is masked with potassium fluoride.
3. Under test conditions (pH 3.8 – 3.9) iron does not react. Other metals at levels likely to be found in industrial water systems do not interfere at any significant level either.

Bibliography

Photometrische Analyse, Lange/ Vjedelek, Verlag Chemie 1980

including stirring rod, 10 cm

Molybdate LR PP M251

0.03 - 3 mg/L Mo Mo1

Ternary Complex

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 110, MD 600, MD 610, MD 640, MultiDirect, SpectroDirect, XD 7000, XD 7500	ø 24 mm	610 nm	0.03 - 3 mg/L Mo

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
VARIO Molybdenum LR, Set F10	1 pc.	535450

The following accessories are required.

Accessories	Packaging Unit	Part Number
Mixing cylinder, 25 ml	1 pc.	19802650

Application List

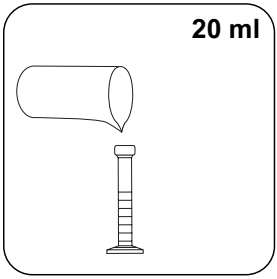
- Boiler Water
- Cooling Water

Preparation

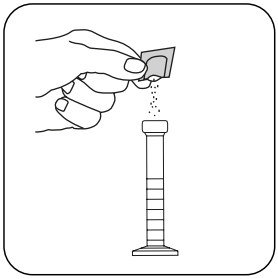
1. Strong alkaline or acidic water samples must be adjusted between pH 3 and pH 5 before the analysis (use 0.5 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).
2. To avoid errors caused by deposits, rinse the glassware with Hydrochloric acid (approx. 20%) before the analysis and then rinse with deionised water.

Implementation of the provision Molybdate LR with Vario Powder Packs

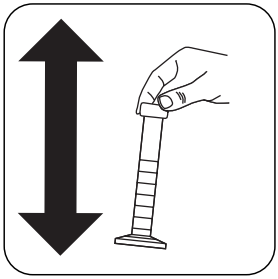
Select the method on the device



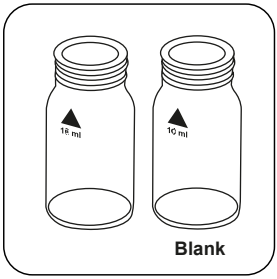
Put **20 ml sample** in 25 ml measuring cylinder



Add **Vario Molybdenum 1 LR F20 powder pack**.

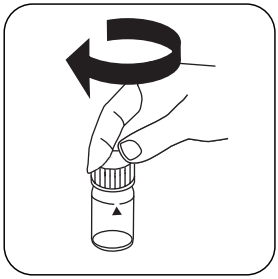


Stopper the mixing cylinder. Shake to dissolve the powder.

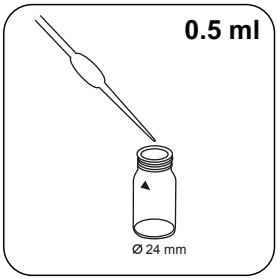


Prepare two clean 24 mm vials. Mark one as a blank.

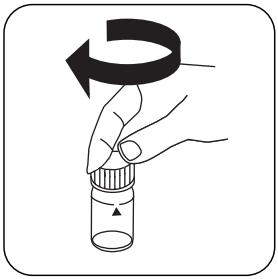
Place **10 ml sample** in each vial.



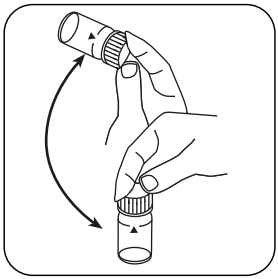
Firmly close the **blank** .



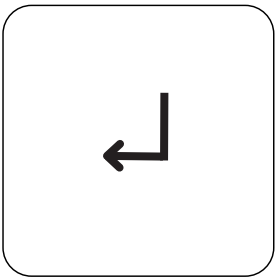
Place **0.5 ml Molybdenum 2 LR solution** in the test vial.



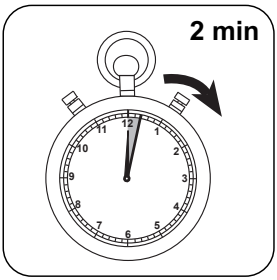
Close vial(s).



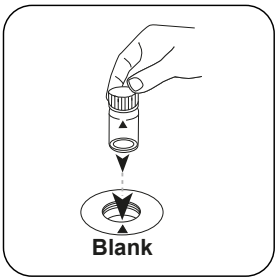
Invert several times to mix the contents.



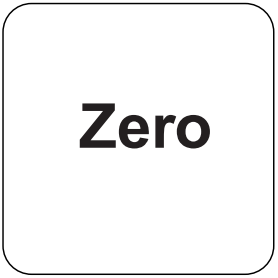
Press the **ENTER** button.



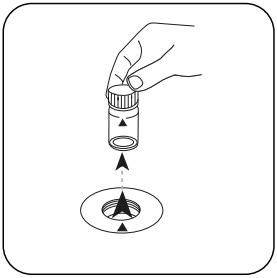
Wait for **2 minute(s) reaction time**.



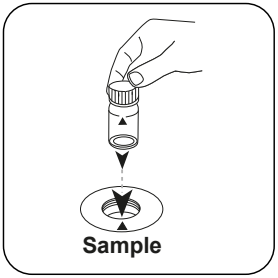
Place **blank** in the sample chamber. • Pay attention to the positioning.



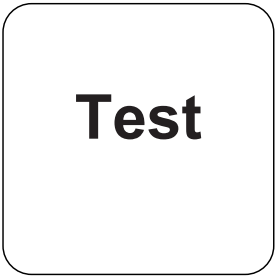
Press the **ZERO** button.



Remove the vial from the sample chamber.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.
The result in mg/l Molybdate/ Molybdenum appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	MoO_4	1
mg/l	Mo	0.6
mg/l	Na_2MoO_4	1.29

Chemical Method

Ternary Complex

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ 10 mm
a	$5.09465 \cdot 10^{-2}$	$5.09465 \cdot 10^{-2}$
b	$3.34565 \cdot 10^{+0}$	$7.19315 \cdot 10^{+0}$
c	$4.35719 \cdot 10^{-1}$	$2.01411 \cdot 10^{+0}$
d		
e		
f		

Interferences

Interference	from / [mg/L]	Influence
Al	50	
Cr	1000	
Fe	50	
Ni	50	
NO_2^-	in all quantities	
Cu	10	Leads to higher readings with a response time of more than 5 minutes

Bibliography

Analytical Chemistry, 25(9) 1363 (1953)

Molybdate HR PP M252

0.3 - 40 mg/L Mo MO2

Mercaptoacetic Acid

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 600, MD 610, MD 640, MultiDirect	ø 24 mm	430 nm	0.3 - 40 mg/L Mo
SpectroDirect, XD 7000, XD 7500	ø 24 mm	420 nm	0.3 - 40 mg/L Mo

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
VARIO Molybdenum HR, Set F10	1 Set	535300

Application List

- Boiler Water
- Cooling Water

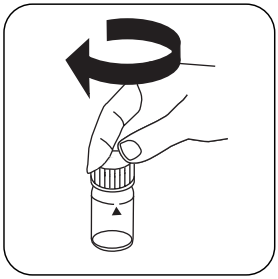
Preparation

1. Turbid water samples should be passed through a membrane filter prior to analysis.
2. Strongly buffered samples or samples with extreme pH values should, prior to analysis, be set to a pH of about 7 with 1 mol/l nitric acid or 1 mol/l sodium hydroxide solution.

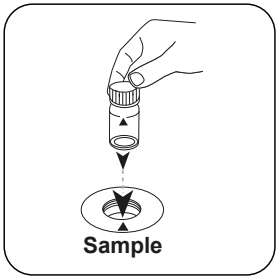
Implementation of the provision Molybdate HR with Vario Powder Packs

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

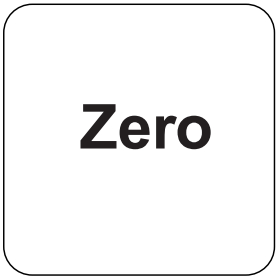
Fill 24 mm vial with **10 ml sample**.



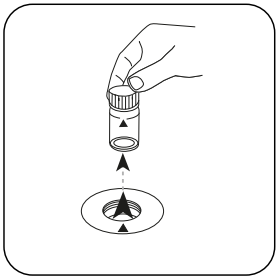
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

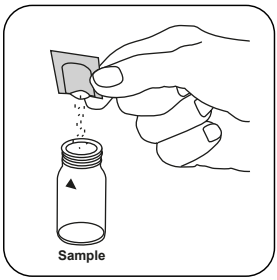


Press the **ZERO** button.

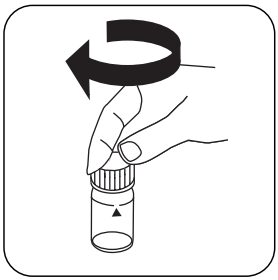


Remove the vial from the sample chamber.

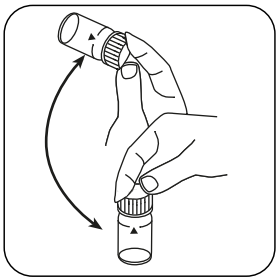
For devices that require **no ZERO measurement** , **start here**.



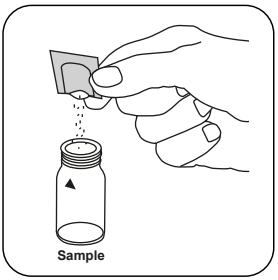
Add **Vario Molybdenum HR 1 F10 powder pack**.



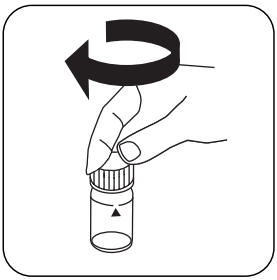
Close vial(s).



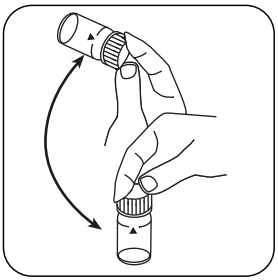
Swirl around to dissolve the powder.



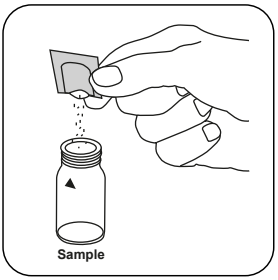
Add **Vario Molybdenum HR 2 F10 powder pack**.



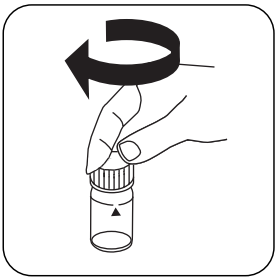
Close vial(s).



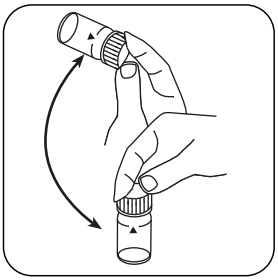
Invert several times to mix the contents.



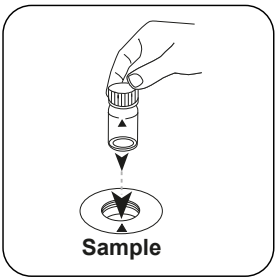
Add **Vario Molybdenum HR 3 F10 powder pack**.



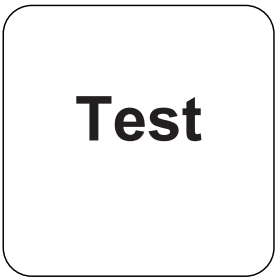
Close vial(s).



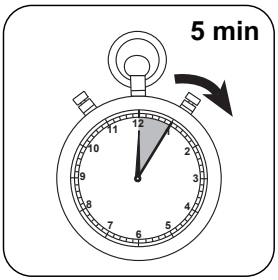
Swirl around to dissolve the powder.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **5 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically. The result in mg/l Molybdate/ Molybdenum appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	MoO_4	1
mg/l	Mo	0.6
mg/l	Na_2MoO_4	1.29

Chemical Method

Mercaptoacetic Acid

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ 10 mm
a	$-1.654•10^{-2}$	$-1.654•10^{-2}$
b	$2.49983•10^{+1}$	$5.37464•10^{+1}$
c		
d		
e		
f		

Interferences

Persistant Interferences

1. At concentrations of 10 mg/L Cu, more than the specified 5 minute response time leads to higher values. A rapid test performance is therefore particularly important.

Interference	from / [mg/L]
Al	50
Cr	1000
Fe	50
Ni	50
NO_2^-	in all quantities

Method Validation

Limit of Detection	0.16 mg/L
Limit of Quantification	0.47 mg/L
End of Measuring Range	40 mg/L
Sensitivity	25.04 mg/L / Abs
Confidence Intervall	0.712 mg/L
Standard Deviation	0.294 mg/L
Variation Coefficient	1.46 %

Bibliography

Analytical Chemistry, 25(9) 1363 (1953)

Molybdate HR L M254

1 - 100 mg/L MoO_4 Mo2

Thioglycolate

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 110, MD 600, MD 610, MD 640, XD 7000, XD 7500	ø 24 mm	430 nm	1 - 100 mg/L MoO_4

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
KS63-FE6-Thioglycolate/Molybdate HR RGT	65 mL	56L006365

Application List

- Boiler Water
- Cooling Water

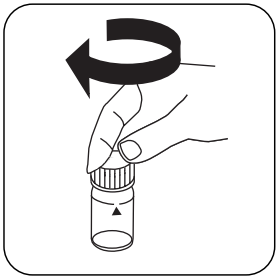
Sampling

1. The test must take place immediately after taking the sample. Molybdate is deposited on the walls of the sample vessels, which leads to lower measurement results.

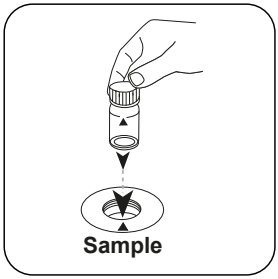
Implementation of the provision Molybdate HR with fluid reagent

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

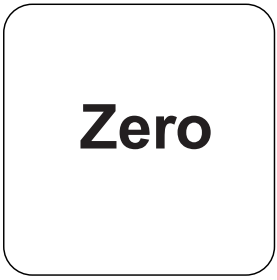
Fill 24 mm vial with **10 ml sample**.



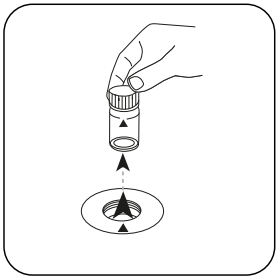
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

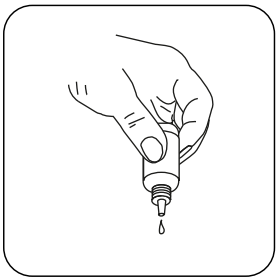


Press the **ZERO** button.

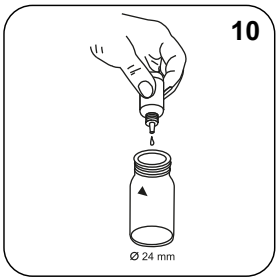


Remove the vial from the sample chamber.

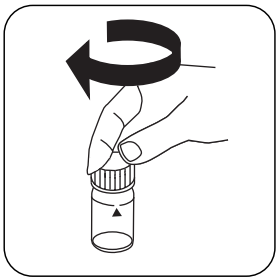
For devices that require **no ZERO measurement** , **start here**.



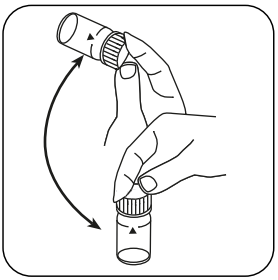
Hold cuvettes vertically and add equal drops by pressing slowly.



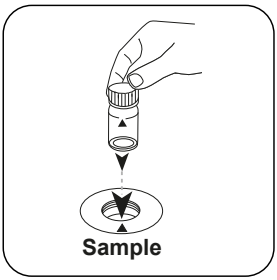
Add **10 drops KS63 (Thyoglycolate)** .



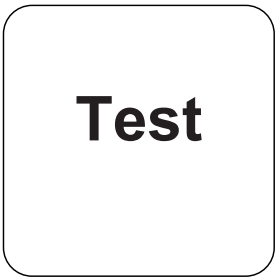
Close vial(s).



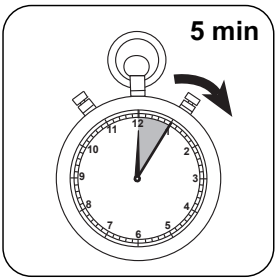
Invert several times to mix the contents.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **5 minute(s) reaction time**.
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Molybdate/ Molybdenum appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	MoO_4	1
mg/l	Mo	0.6
mg/l	Na_2MoO_4	1.29

Chemical Method

Thioglycolate

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ 10 mm
a	$2.04522 \cdot 10^{-1}$	$2.04522 \cdot 10^{-1}$
b	$5.4588 \cdot 10^{+1}$	$1.17364 \cdot 10^{+2}$
c		
d		
e		
f		

Interferences

Removeable Interferences

1. Interference from niobium, tantalum, titanium, and zirconium are masked with citric acid.
2. Interference from vanadium(V) is masked with potassium fluoride.

Bibliography

Photometrische Analyse, Lange/ Vjedelek, Verlag Chemie 1980

Nickel 50 L M255

0.02 - 1 mg/L Ni

Dimethylglyoxime

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	□ 50 mm	443 nm	0.02 - 1 mg/L Ni

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Nickel Reagent Test	1 pc.	2419033

The following accessories are required.

Accessories	Packaging Unit	Part Number
Measuring spoon no. 8, black	1 pc.	424513

Application List

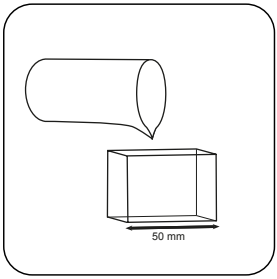
- Galvanization
- Raw Water Treatment
- Waste Water Treatment

Preparation

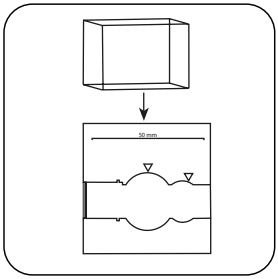
1. The test sample and the reagents should be at room temperature when undertaking the test.
2. The pH value of the sample must be between 3 and 10.

Implementation of the provision Nickel with Reagents test

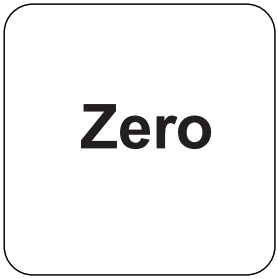
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



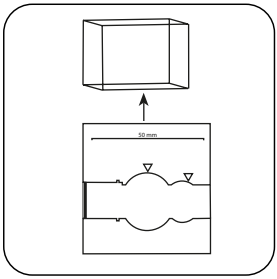
Fill 50 mm vial with **sample**.



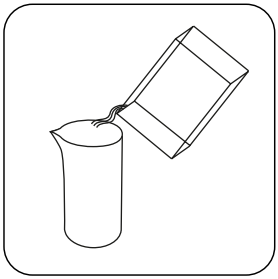
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



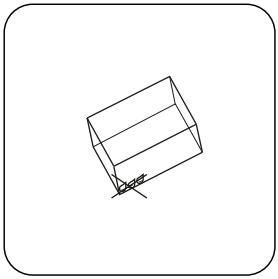
Press the **ZERO** button.



Remove **vial** from the sample chamber.

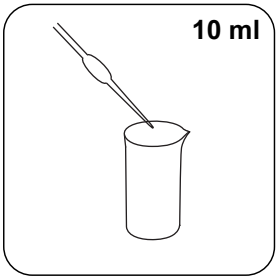


Empty vial.

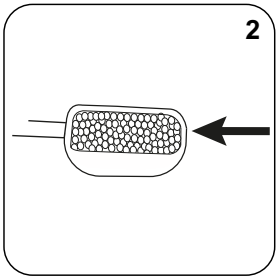


Dry the vial thoroughly.

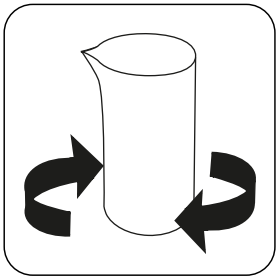
For devices that require **no ZERO measurement** , **start here**.



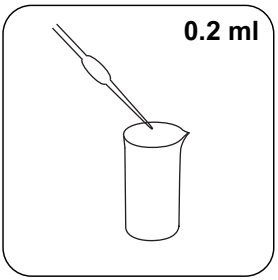
Fill a suitable sample vessel with **10 ml sample** .



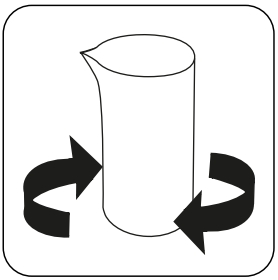
Add **2 level measuring scoop No. 8 (black) Nickel-51** .



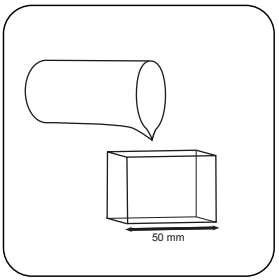
Invert several times to mix the contents.



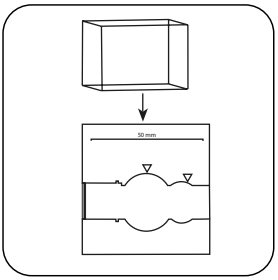
Add **0.2 ml Nickel-52**.



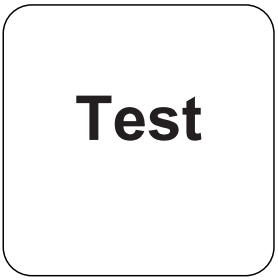
Invert several times to mix the contents.



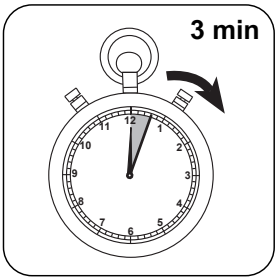
Fill 50 mm vial with **sample**.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **3 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Nickel appears on the display.

Chemical Method

Dimethylglyoxime

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	□ **50 mm**
a	-1.35208 • 10^{-2}
b	9.07687 • 10^{-1}
c	
d	
e	
f	

Bibliography

Photometrische Analyseverfahren, Schwedt, Wissenschaftliche Verlagsgesellschaft mbH, Stuttgart 1989

Nickel L M256

0.2 - 7 mg/L Ni

Dimethylglyoxime

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	ø 24 mm	443 nm	0.2 - 7 mg/L Ni
MD 600, MD 610, MD 640, MultiDirect	ø 24 mm	430 nm	0.2 - 7 mg/L Ni

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Nickel Reagent Test	1 pc.	2419033

Application List

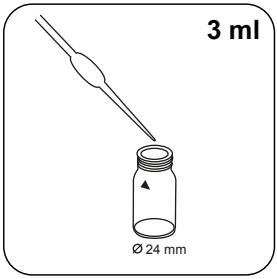
- Galvanization
- Raw Water Treatment
- Waste Water Treatment

Preparation

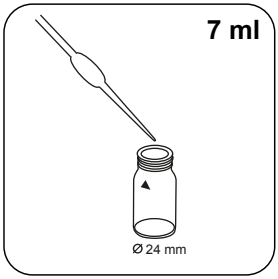
1. The test sample and the reagents should be at room temperature when undertaking the test.
2. The pH value of the sample must be between 3 and 10.

Implementation of the provision Nickel with Reagents test

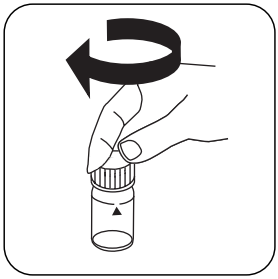
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



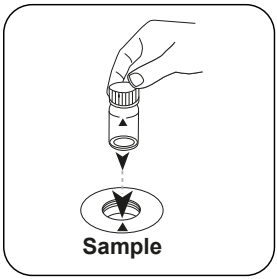
Put **3 ml sample** in the vial.



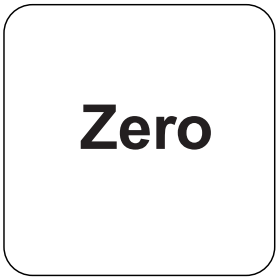
Fill 24 mm vial with **7 ml deionised water** .



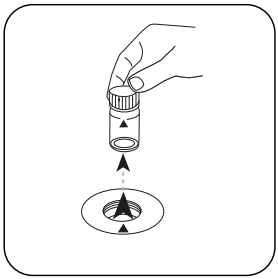
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

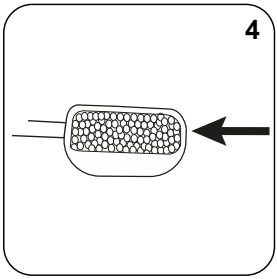


Press the **ZERO** button.

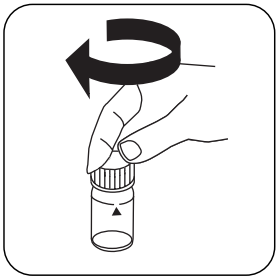


Remove the vial from the sample chamber.

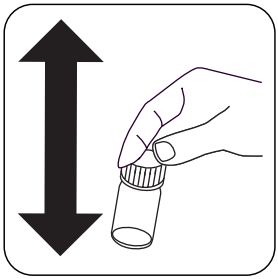
For devices that require **no ZERO measurement** , **start here**.



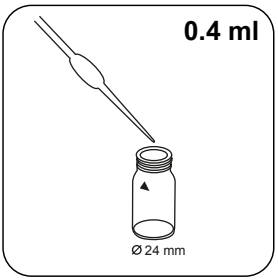
Add **4 level measuring scoop No. 8 (black) Nickel-51** .



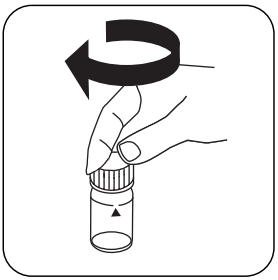
Close vial(s).



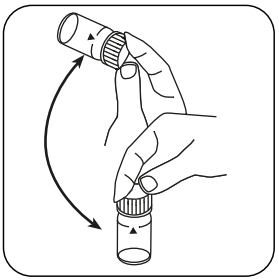
Mix the contents by shaking.



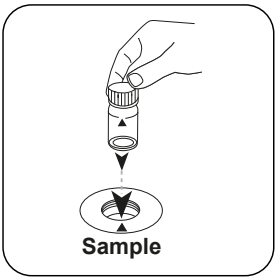
Add **0.4 ml Nickel-52**.



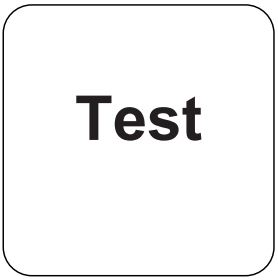
Close vial(s).



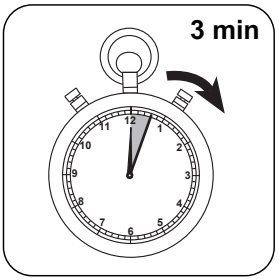
Invert several times to mix the contents.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **3 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Nickel appears on the display.

Chemical Method

Dimethylglyoxime

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	$-1.53212 \cdot 10^{-1}$	$-1.53212 \cdot 10^{-1}$
b	$7.07103 \cdot 10^{+0}$	$1.52027 \cdot 10^{+1}$
c		
d		
e		
f		

Interferences

Removeable Interferences

1. If large amounts of these metals should be present, nickel must be insulated before the test determination. The insulation is performed with a solution of Dimethylglyoxim in chloroform.
   Al, Co, Cu, Fe, Mn, Zn and phosphates do not pose an obstacle in biologically normal quantities. In most cases, the biological samples are first of all mineralised with a mixture of sulphuric acid and nitric acid.

Bibliography

Photometrische Analyseverfahren, Schwedt, Wissenschaftliche Verlagsgesellschaft mbH, Stuttgart 1989

Nitrate T M260

0.08 - 1 mg/L N

Zinc Reduction / NED

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
, MD 600, MD 610, MD 640, Test Kit, XD 7000, XD 7500	ø 24 mm	530 nm	0.08 - 1 mg/L N

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Nitrate Test	Tablet / 100	502810
Nitrite LR	Tablet / 100	512310BT
Nitrite LR	Tablet / 250	512311BT
Nitrate Test Pulver	Powder / 15 g	465230
Nitrate test tube	1 pc.	366220

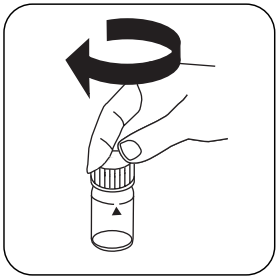
Application List

- Waste Water Treatment
- Drinking Water Treatment
- Raw Water Treatment

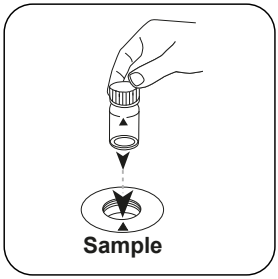
Implementation of the provision Nitrate with Tablet and Powder

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

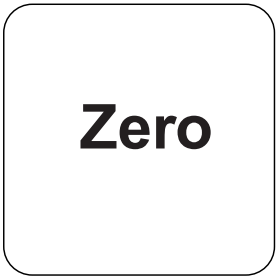
Fill 24 mm vial with **10 ml sample**.



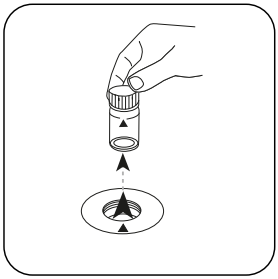
Close vial(s).



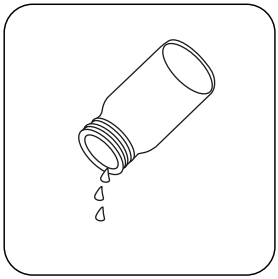
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **ZERO** button.

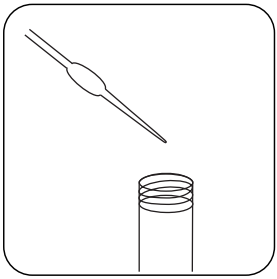


Remove the vial from the sample chamber.

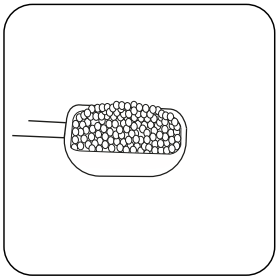


Empty vial.

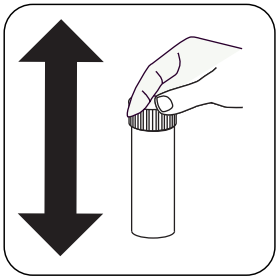
For devices that require **no ZERO measurement** , **start here**.



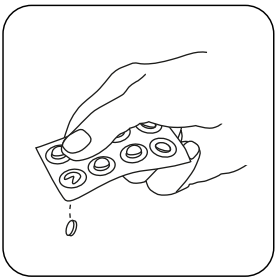
Fill a Nitratest tube with **20 ml sample**.



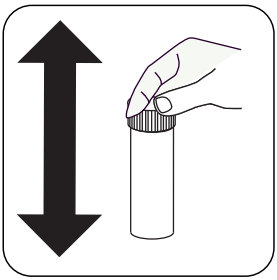
Add **one microspoon NITRATE TEST powder** .



Close the test tube with the lid and mix the contents by vigorously shaking for 1 minute.

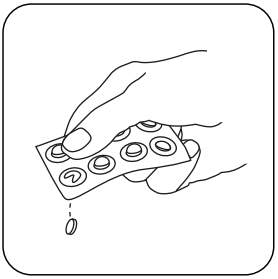


Add **NITRATE TEST tablet**.

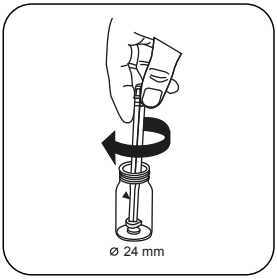


Close the test tube with the lid and mix the contents by vigorously shaking for 1 minute.

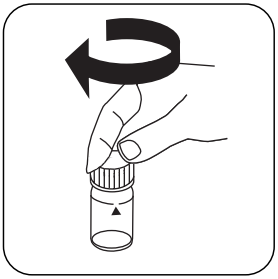
- Leave test tubes upright. Wait until the reducing agent has dropped off.
- Then turn the test tube three to four times around.
- Leave the test tube to stand for 2 minutes.
- Open the test tube and wipe the residue of the reduction with a clean cloth.
- Decant **10 ml of this sample** into a **24 mm vial** without causing a reducing agent.



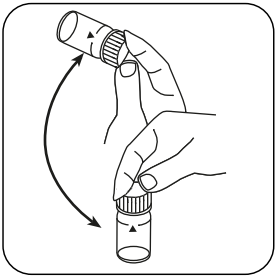
Add **NITRITE LR tablet**.



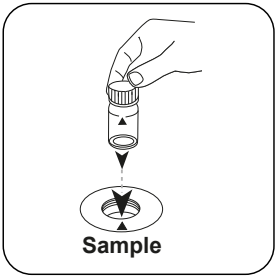
Crush tablet(s) by rotating slightly.



Close vial(s).

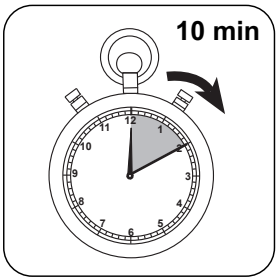


Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

Press the **TEST** (XD: **START**)button.



Wait for **10 minute(s) reaction time**.
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Nitrate appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	N	1
mg/l	NO_3	4.4268

Chemical Method

Zinc Reduction / NED

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ 10 mm
a	$-9.38065 \cdot 10^{-3}$	$-9.38065 \cdot 10^{-3}$
b	$3.20151 \cdot 10^{-1}$	$6.88325 \cdot 10^{-1}$
c	$2.5446 \cdot 10^{-3}$	$1.17624 \cdot 10^{-2}$
d		
e		
f		

Interferences

Persistant Interferences

1. Antimony (III), iron, lead, mercury (I), silver, Chloroplatinate, metavanadate, and bismuth create precipitation.
2. With the presence of Copper (II) there will be lower results, because it accelerates the degradation of diazonium salts.

Removeable Interferences

1. If there is nitrate in the original water sample, it will lead to high values of nitrate nitrogen. For correction, carry out a nitrite determination using method 270 in NO2-N and subtract the result from the nitrate reading for the correct result. The result displayed does not show the actual concentration of nitrate nitrogen in the water sample being analysed.
2. Concentration of nitrate nitrogen above 1 mg/L results in an erroneous measurement after the reaction time of 10 minutes (in this instance, a colour change to apricot colour instead of the reddish pink solution). The range of the test can be extended by first diluting the water sample with deionised water. The subsequent result of the test must then be multiplied by the dilution factor.

Derived from

ASTM D 3867-09
APHA 4500 NO3- E-2000
US EPA 353.3 (1983)

Nitrate TT M265

1 - 30 mg/L N

Chromotropic Acid

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect	ø 16 mm	430 nm	1 - 30 mg/L N
SpectroDirect, XD 7000, XD 7500	ø 16 mm	410 nm	1 - 30 mg/L N

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
VARIO Nitra X Reagent, Set	1 Set	535580

The following accessories are required.

Accessories	Packaging Unit	Part Number
Plastic funnel with handle (white)	1 pc.	471007

Application List

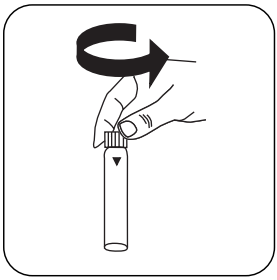
- Waste Water Treatment
- Drinking Water Treatment
- Raw Water Treatment

Notes

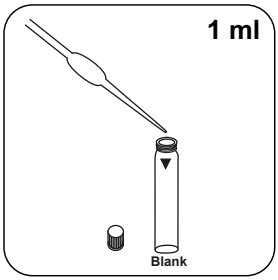
1. A small amount of solid material remains may be undissolved.

Implementation of the provision Nitrate with Vario Vial Test

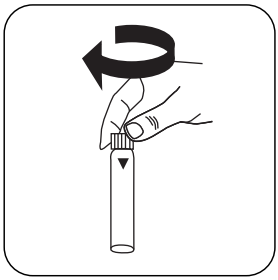
Select the method on the device



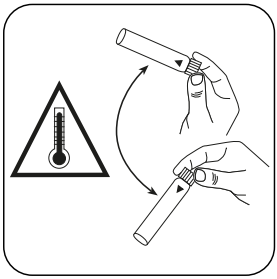
Open **digestion vial (Reagent A)** .



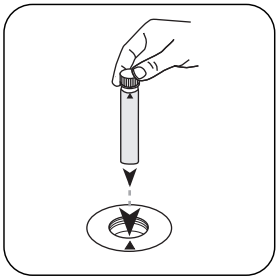
Put **1 ml sample** in the vial.



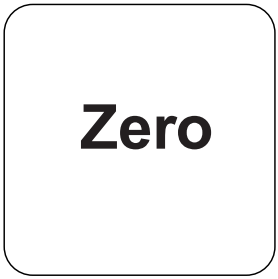
Close vial(s).



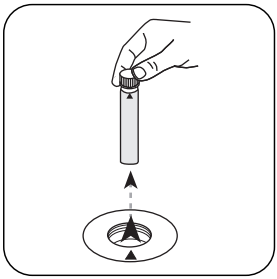
Carefully invert several times to mix the contents. **Note: Will get hot!**



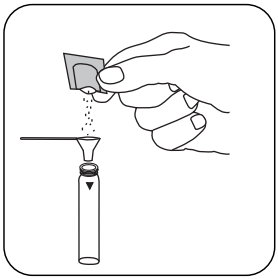
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



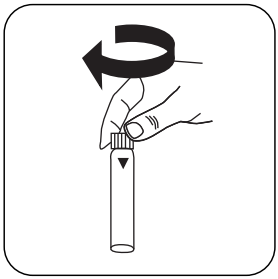
Press the **ZERO** button.



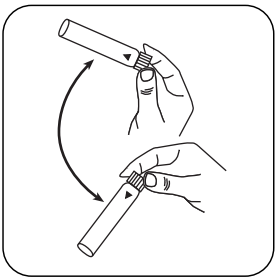
Remove **vial** from the sample chamber.



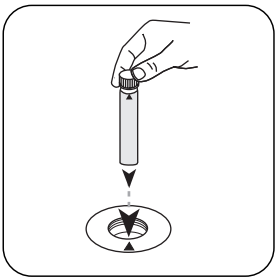
Add **Vario Nitrate Chromotropic powder pack**.



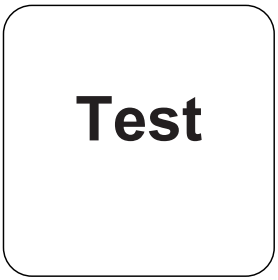
Close vial(s).



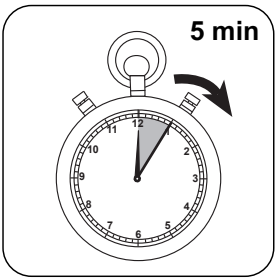
Invert several times to mix the contents (10 x).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **5 minute(s) reaction time**.
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Nitrate appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	N	1
mg/l	NO_3	4.43

Chemical Method

Chromotropic Acid

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 16 mm
a	$-3.25164 \cdot 10^{-1}$
b	$2.03754 \cdot 10^{+1}$
c	$1.45821 \cdot 10^{+0}$
d	
e	
f	

Interferences

Interference	from / [mg/L]
Ba	1
Cl^-	1000
Cu	in all quantities
NO_2^-	12

Bibliography

P. W. West, G. L. Lyles, A new method for the determination of nitrates, Analytica Chimica Acta, 23, 1960, p. 227-232

Nitrate LR2 TT M266

0.2 - 15 mg/L N

2,6-Dimethylphenole

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	ø 16 mm	340 nm	0.2 - 15 mg/L N

Material

Required material (partly optional):

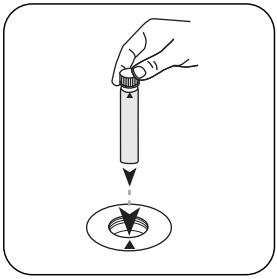
Reagents	Packaging Unit	Part Number
Nitrate-DMP LR2 / 25	25 pc.	2423330

Application List

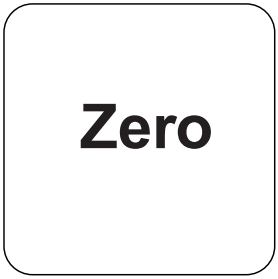
- Waste Water Treatment
- Drinking Water Treatment
- Raw Water Treatment

Implementation of the provision Nitrate LR2 with Vial Test

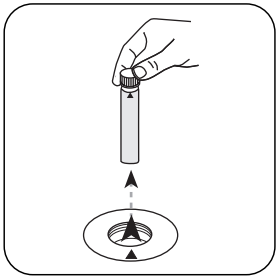
Select the method on the device



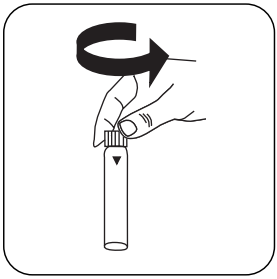
Place **blank** in the sample chamber. • Pay attention to the positioning.



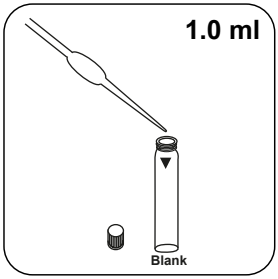
Press the **ZERO** button.



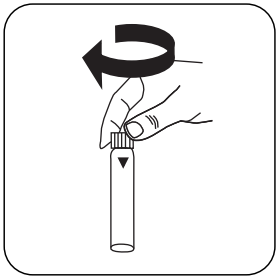
Remove **vial** from the sample chamber.



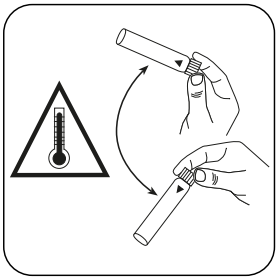
Open a **digestion vial**.



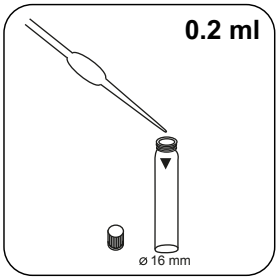
Put **1.0 ml sample** in the vial.



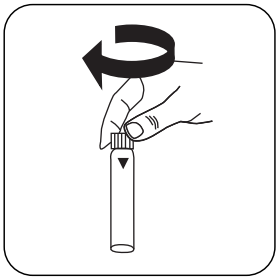
Close vial(s).



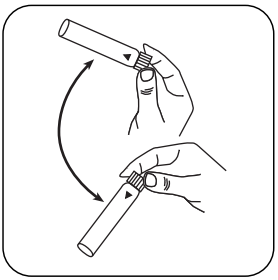
Carefully invert several times to mix the contents.
Note: Will get hot!



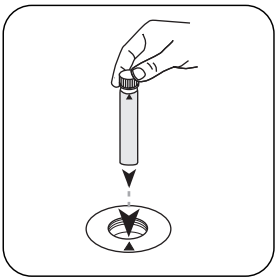
Add **0.2 ml Nitrate-111**.



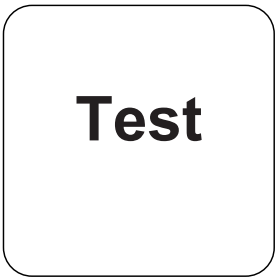
Close vial(s).



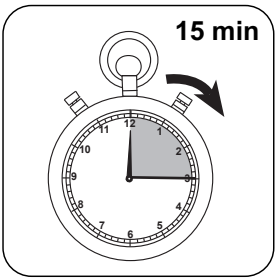
Invert several times to mix the contents.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **15 minute(s) reaction time**.
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l NO_3-N or NO_3 appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	N	1
mg/l	NO_3	4.4268

Chemical Method

2,6-Dimethylphenole

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 16 mm
a	$2.4531 \cdot 10^{-2}$
b	$1.34256 \cdot 10^{1}$
c	
d	
e	
f	

Interferences

Persistant Interferences

1. Nitrite concentrations above 2 mg/L result in higher results.
2. High levels of oxidisable organic substances (COD) lead to higher results.

Interference	from / [mg/L]
Cr^{6+}	2
Fe^{2+}	25
Sn^{2+}	25
Ca^{2+}	50
Co^{2+}	50
Cu^{2+}	50

Interference	from / [mg/L]
Fe^{3+}	50
Ni^{2+}	50
Pb^{2+}	50
Zn^{2+}	50
Cd^{2+}	100
K^{+}	250
NO_2^{-}	1
Cl^{-}	250

Method Validation

Limit of Detection	0.06 mg/L
Limit of Quantification	0.17 mg/L
End of Measuring Range	15.0 mg/L
Sensitivity	13.19 mg/L / Abs
Confidence Intervall	0.063 mg/L
Standard Deviation	0.026 mg/L
Variation Coefficient	0.71 %

Bibliography

Photometrische Analyseverfahren, Schwedt, Wissenschaftliche Verlagsgesellschaft mbH, Stuttgart 1989

Derived from

ISO 7890-1-1986
DIN 38405 D9

Nitrate LR TT M267

0.5 - 14 mg/L N

2,6-Dimethylphenole

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	ø 16 mm	340 nm	0.5 - 14 mg/L N

Material

Required material (partly optional):

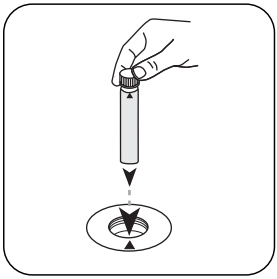
Reagents	Packaging Unit	Part Number
Nitrate-DMP LR / 25	25 pc.	2423340

Application List

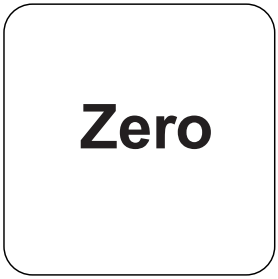
- Waste Water Treatment
- Drinking Water Treatment
- Raw Water Treatment

Implementation of the provision Nitrate LR with Vial Test

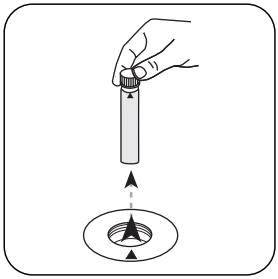
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



Place **blank** in the sample chamber. • Pay attention to the positioning.

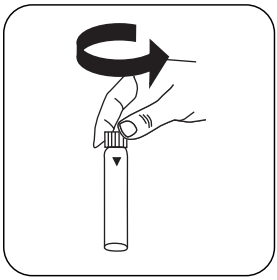


Press the **ZERO** button.

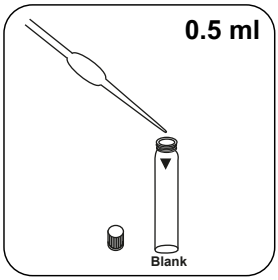


Remove **vial** from the sample chamber.

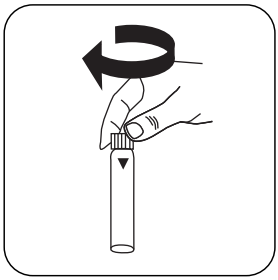
For devices that require **no ZERO measurement** , **start here**.



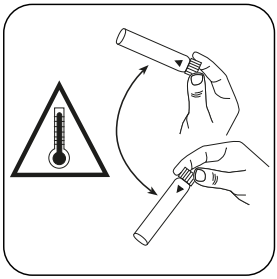
Open a **digestion vial**.



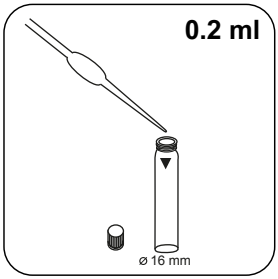
Put **0.5 ml sample** in the vial.



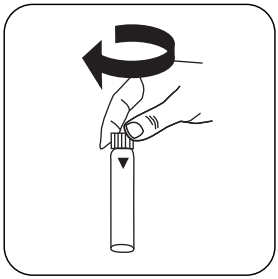
Close vial(s).



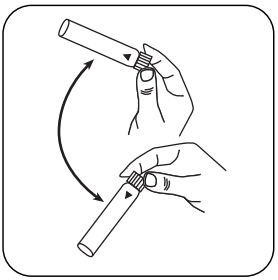
Carefully invert several times to mix the contents.
Note: Will get hot!



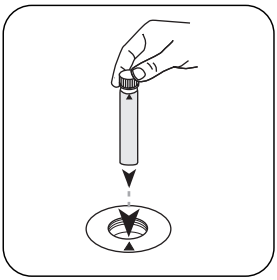
Add **0.2 ml Nitrate-111**.



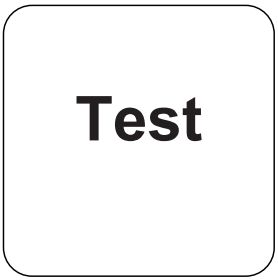
Close vial(s).



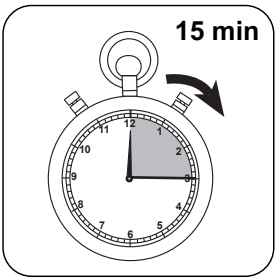
Invert several times to mix the contents.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **15 minute(s) reaction time**.
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l NO_3-N or NO_3 appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	N	1
mg/l	NO_3	4.4268

Chemical Method

2,6-Dimethylphenole

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 16 mm
a	$-3.34651 \cdot 10^{-1}$
b	$2.53157 \cdot 10^{+1}$
c	
d	
e	
f	

Interferences

Persistant Interferences

1. Nitrite concentrations above 2 mg/L result in higher results.
2. High levels of oxidisable organic substances (COD) lead to higher results.

Interference	from / [mg/L]
Cr^{6+}	5
Fe^{2+}	50
Sn^{2+}	50
Ca^{2+}	100
Co^{2+}	100
Cu^{2+}	100

Interference	from / [mg/L]
Fe^{3+}	100
Ni^{2+}	100
Pb^{2+}	100
Zn^{2+}	100
Cd^{2+}	200
K^{+}	500
NO_2^{-}	2
Cl^{-}	500

Bibliography

Photometrische Analyseverfahren, Schwedt, Wissenschaftliche Verlagsgesellschaft mbH, Stuttgart 1989

Derived from

ISO 7890-1-2-1986
DIN 38405 D9-2

Nitrate HR M268

1.2 - 35 mg/L N

2,6-Dimethylphenole

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	ø 16 mm	340 nm	1.2 - 35 mg/L N

Material

Required material (partly optional):

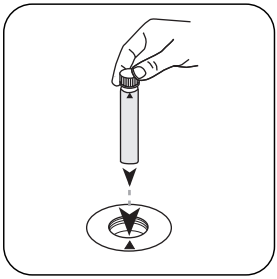
Reagents	Packaging Unit	Part Number
Nitrate-DMP HR / 25	25 pc.	2423370

Application List

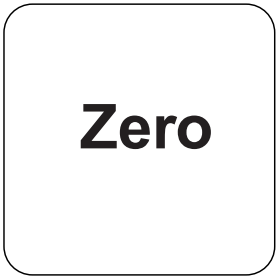
- Waste Water Treatment
- Drinking Water Treatment
- Raw Water Treatment

Implementation of the provision Nitrate HR with tube test

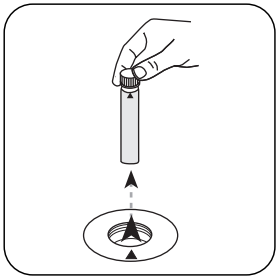
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



Place **blank** in the sample chamber. • Pay attention to the positioning.

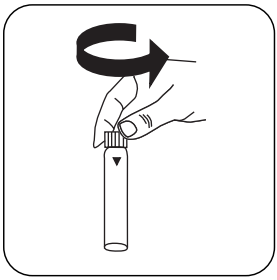


Press the **ZERO** button.

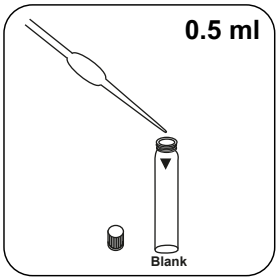


Remove **vial** from the sample chamber.

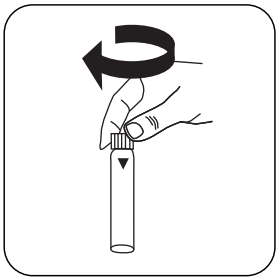
For devices that require **no ZERO measurement** , **start here**.



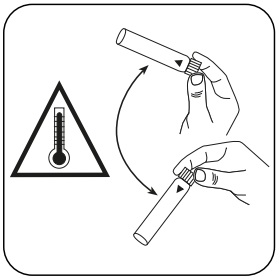
Open a **digestion vial**.



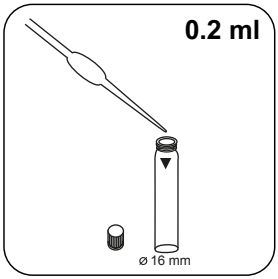
Put **0.5 ml sample** in the vial.



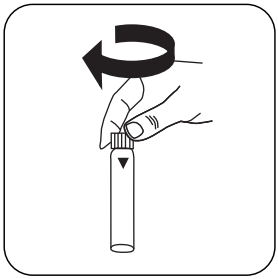
Close vial(s).



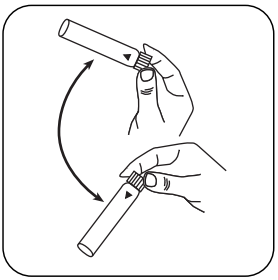
Carefully invert several times to mix the contents.
Note: Will get hot!



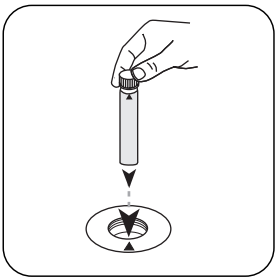
Add **0.2 ml Nitrate-111**.



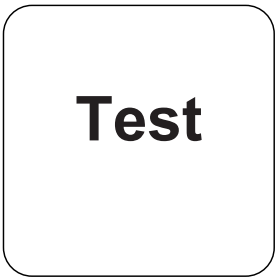
Close vial(s).



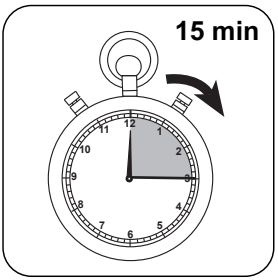
Invert several times to mix the contents.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **15 minute(s) reaction time**.
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l NO_3-N or NO_3 appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	N	1
mg/l	NO_3	4.4268

Chemical Method

2,6-Dimethylphenole

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 16 mm
a	$-2.73451 \cdot 10^{-1}$
b	$2.47521 \cdot 10^{+1}$
c	
d	
e	
f	

Interferences

Persistant Interferences

1. Nitrite concentrations above 2 mg/L result in higher results.
2. High levels of oxidisable organic substances (COD) lead to higher results.

Interference	from / [mg/L]
Cr^{6+}	5
Fe^{2+}	50
Sn^{2+}	50
Ca^{2+}	100
Co^{2+}	100
Cu^{2+}	100

Interference	from / [mg/L]
Fe^{3+}	100
Ni^{2+}	100
Pb^{2+}	100
Zn^{2+}	100
Cd^{2+}	200
K^{+}	500
NO_2^{-}	2
Cl^{-}	500

Bibliography

Photometrische Analyseverfahren, Schwedt, Wissenschaftliche Verlagsgesellschaft mbH, Stuttgart 1989

Derived from

ISO 7890-1-2-1986
DIN 38405 D9-2

Nitrite T M270

0.01 - 0.5 mg/L N

N-(1-Naphthyl)-ethylendiamine

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect	ø 24 mm	560 nm	0.01 - 0.5 mg/L N
SpectroDirect	ø 24 mm	545 nm	0.01 - 0.5 mg/L N
XD 7000, XD 7500	ø 24 mm	540 nm	0.01 - 0.5 mg/L N

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Nitrite LR	Tablet / 100	512310BT
Nitrite LR	Tablet / 250	512311BT

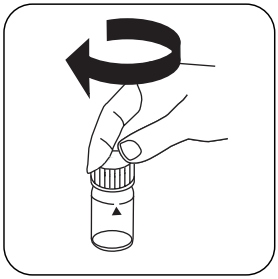
Application List

- Galvanization
- Waste Water Treatment
- Drinking Water Treatment
- Raw Water Treatment

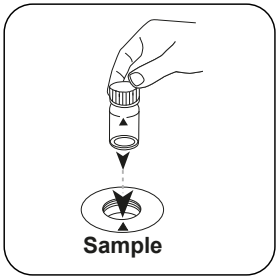
Implementation of the provision Nitrite with Tablet

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

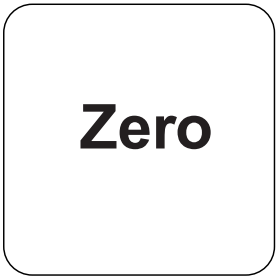
Fill 24 mm vial with **10 ml sample**.



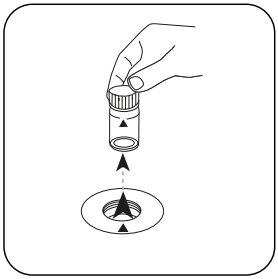
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

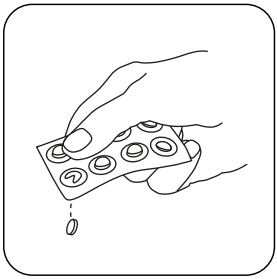


Press the **ZERO** button.

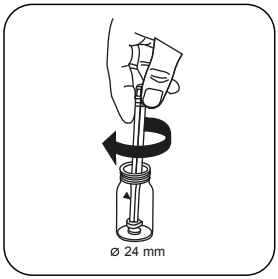


Remove the vial from the sample chamber.

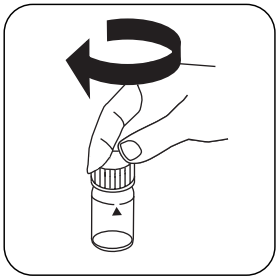
For devices that require **no ZERO measurement** , **start here**.



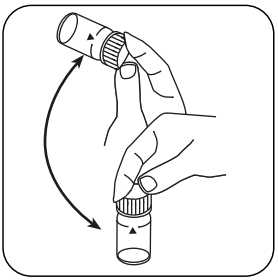
Add **NITRITE LR tablet**.



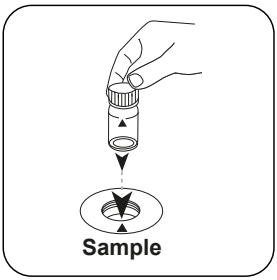
Crush tablet(s) by rotating slightly.



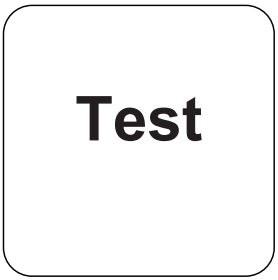
Close vial(s).



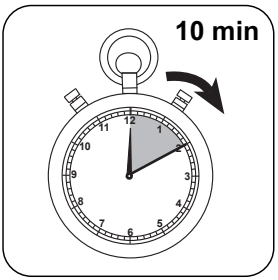
Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **10 minute(s) reaction time**.
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Nitrite appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	N	1
mg/l	NO_2	3.2846

Chemical Method

N-(1-Naphthyl)-ethylendiamine

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ 10 mm
a	$-5.14368 \cdot 10^{-3}$	$-5.14368 \cdot 10^{-3}$
b	$1.76663 \cdot 10^{-1}$	$3.79825 \cdot 10^{-1}$
c	$1.20299 \cdot 10^{-2}$	$5.56082 \cdot 10^{-2}$
d		
e		
f		

Interferences

Persistant Interferences

1. Antimony (III), iron (III), lead, mercury (I), silver, chloroplatinate, metavanadate, and bismuth can result in interference as a result of precipitation.
2. Copper(II) ions may give a low result as they accelerate the decomposition of the diazonium salt.
3. It is unlikely in practice that these interfering ions will occur in such high concentrations that they cause significant errors.

Derived from

DIN ISO 15923-1 D49

Nitrite VHR L M271

25 - 2500 mg/L NO_2^-

Ferrous Sulfate Method

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640	ø 24 mm	580 nm	25 - 2500 mg/L NO_2^-
XD 7000, XD 7500	ø 24 mm	585 nm	25 - 2500 mg/L NO_2^-

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Nitrite VHR L, 500 ml	500 mL	471170
Nitrite VHR L, 500 ml, Set	500 mL	471160

The following accessories are required.

Accessories	Packaging Unit	Part Number
Pipette, 1000 µl	1 pc.	365045
Pipette tips, 0,1-1 ml (white), 1000 pc.	1 pc.	419073

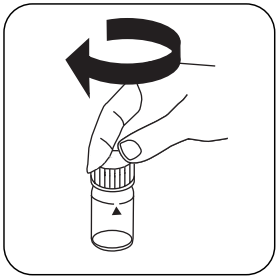
Application List

- Cooling Water

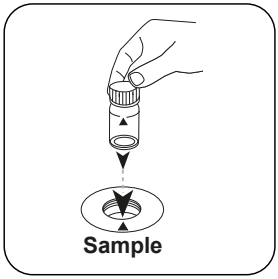
Implementation of the provision Nitrite VHR L

Select the method on the device

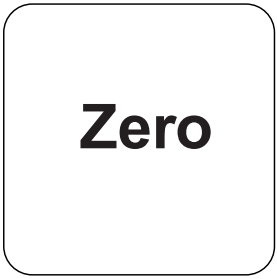
Place **10 ml Nitrite VHR L solution** in the test vial.



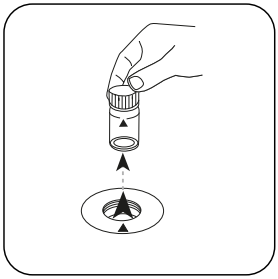
Close vial(s).



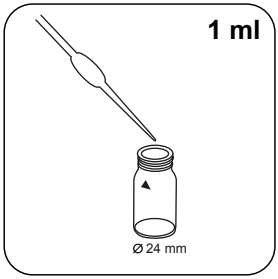
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



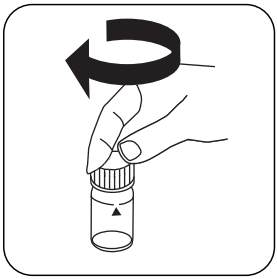
Press the **ZERO** button.



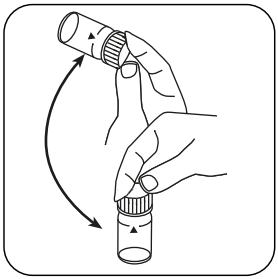
Remove the vial from the sample chamber.



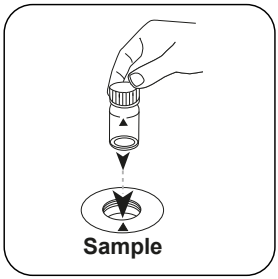
Add **1 ml sample**.



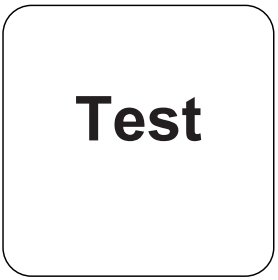
Close vial(s).



Invert several times to mix the contents (1-2 times).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD:
START)button.
The result in mg/l Nitrite appears on the display.

Chemical Method

Ferrous Sulfate Method

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	$1.45432 \cdot 10^{+0}$	$1.45432 \cdot 10^{+1}$
b	$1.22994 \cdot 10^{+3}$	$2.64437 \cdot 10^{+3}$
c		
d		
e		
f		

Method Validation

Limit of Detection	8.77 mg/L
Limit of Quantification	26.31 mg/L
End of Measuring Range	2500 mg/L
Sensitivity	1235.02 mg/L / Abs
Confidence Intervall	13.11 mg/L
Standard Deviation	5.42 mg/L
Variation Coefficient	0.43 %

Nitrite PP M272

0.01 - 0.3 mg/L N

Diazotation

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect	ø 24 mm	530 nm	0.01 - 0.3 mg/L N
SpectroDirect, XD 7000, XD 7500	ø 24 mm	507 nm	0.01 - 0.3 mg/L N

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
VARIO Nitri 3 F10	Powder / 100 pc.	530980

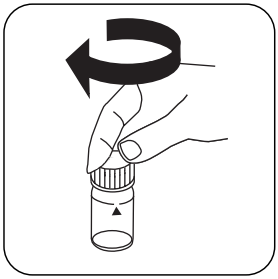
Application List

- Galvanization
- Waste Water Treatment
- Drinking Water Treatment
- Raw Water Treatment

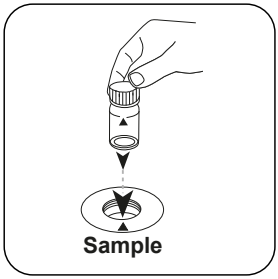
Implementation of the provision Nitrite with Vario Powder Pack

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

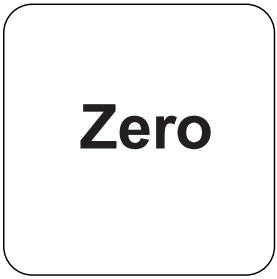
Fill 24 mm vial with **10 ml sample**.



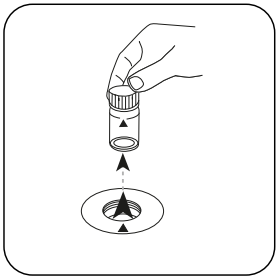
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

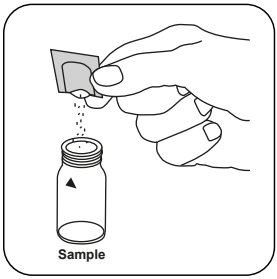


Press the **ZERO** button.

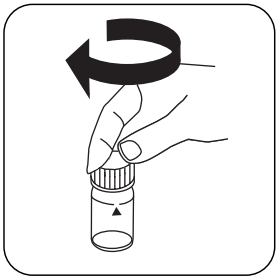


Remove the vial from the sample chamber.

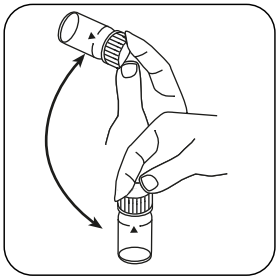
For devices that require **no ZERO measurement** , **start here**.



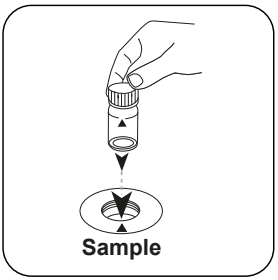
Add **Vario Nitri 3 F10 powder pack**.



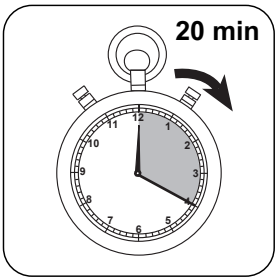
Close vial(s).



Invert several times to mix the contents.



Test



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

Press the **TEST** (XD: **START**)button.

Wait for **20 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Nitrite appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	N	1
mg/l	NO_2	3.2846

Chemical Method

Diazotation

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ **10 mm**
a	$-2.54687 \cdot 10^{-3}$	$-2.54687 \cdot 10^{-3}$
b	$1.89212 \cdot 10^{-1}$	$4.06806 \cdot 10^{-1}$
c	$1.10586 \cdot 10^{-2}$	$5.11184 \cdot 10^{-2}$
d		
e		
f		

Interferences

Persistant Interferences

1. Strong oxidising and reducing agents interfere at all concentrations.
2. Copper and Iron (II) ions may cause lower test results.
3. The following ions can produce interferences through precipitation: Antimony, Iron (III), Lead, Gold, Mercury, Silver, Chloroplatinate, Metavanadate and Bismuth.
4. At very high concentrations of nitrate (<100 mg/L N) a small amount of nitrite is always detected. This seems to be caused by a minor reduction of nitrate to nitrite, which occurs either spontaneously or over the course of the test.

Derived from

USGS I-4540-85

Nitrite LR TT M275

0.03 - 0.6 mg/L N

Sulfanilic / Naphthylamine

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	ø 16 mm	545 nm	0.03 - 0.6 mg/L N

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Nitrite LR / 25	1 pc.	2423420
Nitrite / 25	1 pc.	2419018

The following accessories are required.

Accessories	Packaging Unit	Part Number
Measuring spoon no. 8, black	1 pc.	424513

Application List

- Galvanization
- Waste Water Treatment
- Drinking Water Treatment
- Raw Water Treatment

Preparation

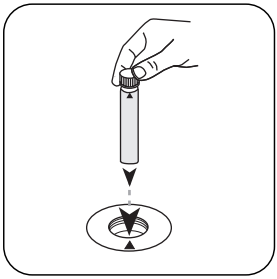
1. The test sample and the reagents should be at room temperature when undertaking the test.

Notes

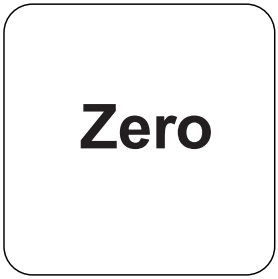
1. The reagents are to be stored in closed containers at a temperature of +4 °C – +8 °C.

Implementation of the provision Nitrite LR with Vial Test

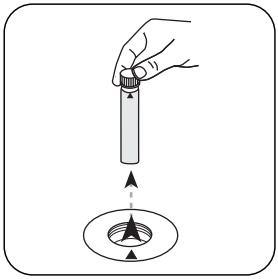
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



Place the supplied Zero vial (red sticker) in the sample chamber. • Pay attention to the positioning.

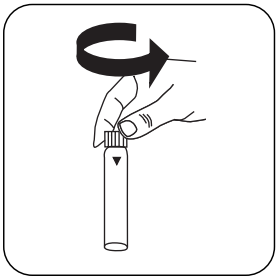


Press the **ZERO** button.

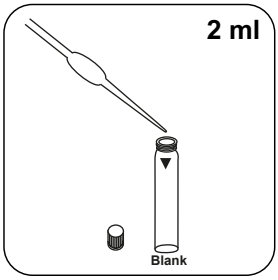


Remove **vial** from the sample chamber.

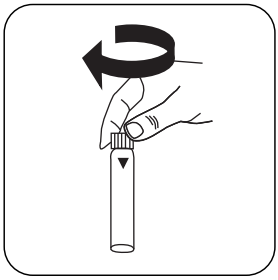
For devices that require **no ZERO measurement** , **start here**.



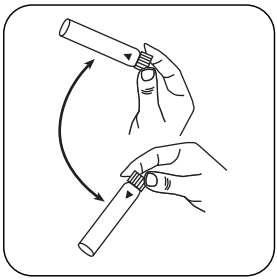
Open **digestion vial** .



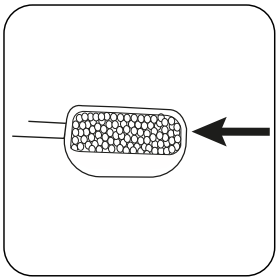
Put **2 ml sample** in the vial.



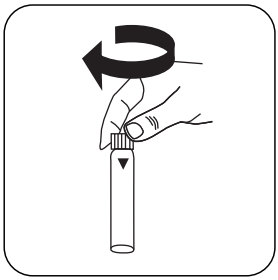
Close vial(s).



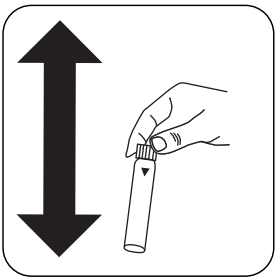
Invert several times to mix the contents.



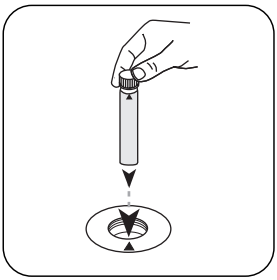
Add **a level measuring scoop No. 8 (black) Nitrite-101** .



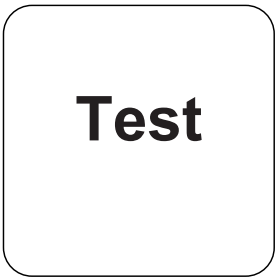
Close vial(s).



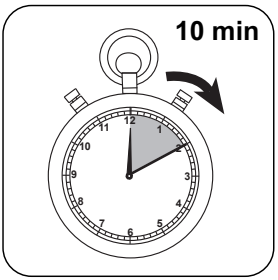
Dissolve the contents by shaking.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **10 minute(s) reaction time**.
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Nitrite appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	N	1
mg/l	NO_2	3.2846

Chemical Method

Sulfanilic / Naphthylamine

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 16 mm
a	$-4.32137 \cdot 10^{-2}$
b	$2.05096 \cdot 10^{+0}$
c	
d	
e	
f	

Interferences

Interference	from / [mg/L]
Fe^{3+}	5
Fe^{2+}	10
Cu^{2+}	100
Cr^{3+}	100
Al^{3+}	1000
Cd^{2+}	1000
total hardness	178,6 mmol/l (1000 °dH)
CrO_4^{2-}	0,5

Interference	from / [mg/L]
$p\text{-}PO_4$	2
S^{2-}	10
SO_3^{2-}	10
NO_3^-	25
HCO_3^-	35,8 mmol/l (100 °dH)
Hg^{2+}	250
Mn^{2+}	1000
NH_4^+	1000
Ni^{2+}	1000
Pb^{2+}	1000
Zn^{2+}	1000
Cl^-	1000
CN^-	250
EDTA	250
$o\text{-}PO_4^{3-}$	1000
SO_4^{2-}	1000

Method Validation

Limit of Detection	0.01 mg/L
Limit of Quantification	0.04 mg/L
End of Measuring Range	0.6 mg/L
Sensitivity	2.03 mg/L / Abs
Confidence Intervall	0.014 mg/L
Standard Deviation	0.006 mg/L
Variation Coefficient	1.79 %

Derived from

DIN EN 26777
ISO 6777

Nitrite HR TT M276

0.3 - 3 mg/L N

Sulfanilic / Naphthylamine

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	ø 16 mm	545 nm	0.3 - 3 mg/L N

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Nitrite HR / 25	1 pc.	2423470
Nitrite / 25	1 pc.	2419018

The following accessories are required.

Accessories	Packaging Unit	Part Number
Measuring spoon no. 8, black	1 pc.	424513

Application List

- Galvanization
- Waste Water Treatment
- Drinking Water Treatment
- Raw Water Treatment

Preparation

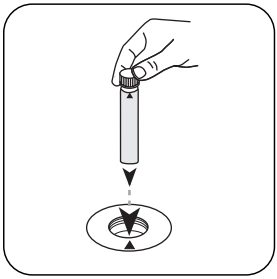
1. The test sample and the reagents should be at room temperature when undertaking the test.

Notes

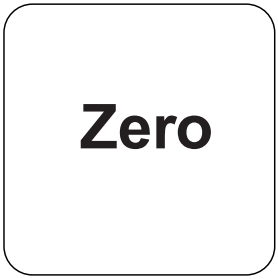
1. The reagents are to be stored in closed containers at a temperature of +4 °C – +8 °C.

Implementation of the provision Nitrite HR with Vial Test

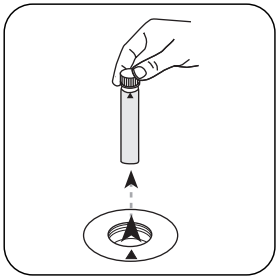
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



Place the supplied Zero vial (red sticker) in the sample chamber. • Pay attention to the positioning.

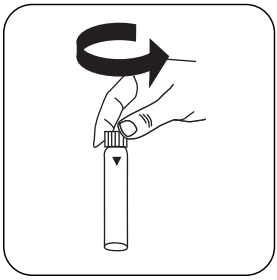


Press the **ZERO** button.

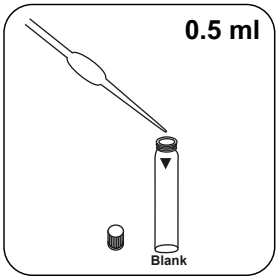


Remove **vial** from the sample chamber.

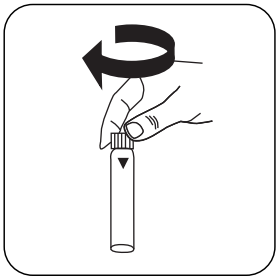
For devices that require **no ZERO measurement** , **start here**.



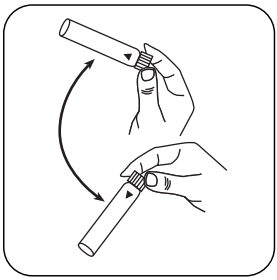
Open **digestion vial** .



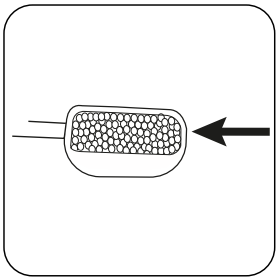
Put **0.5 ml sample** in the vial.



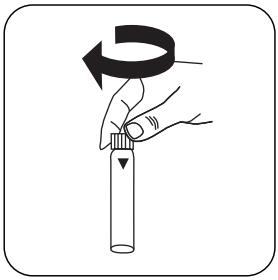
Close vial(s).



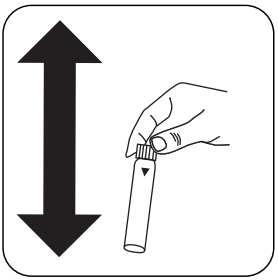
Invert several times to mix the contents.



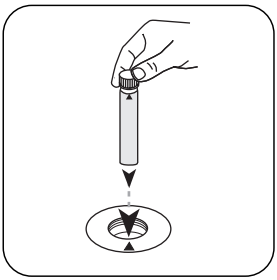
Add **a level measuring scoop No. 8 (black) Nitrite-101** .



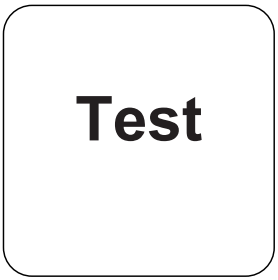
Close vial(s).



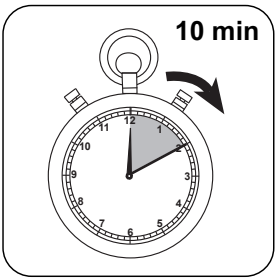
Dissolve the contents by shaking.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **10 minute(s) reaction time**.
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Nitrite appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	N	1
mg/l	NO_2	3.2846

Chemical Method

Sulfanilic / Naphthylamine

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 16 mm
a	$-3.31219 \cdot 10^{-2}$
b	$7.53948 \cdot 10^{+0}$
c	
d	
e	
f	

Interferences

Interference	from / [mg/L]
Fe^{3+}	20
Fe^{2+}	50
Cu^{2+}	500
Cr^{3+}	500
Al^{3+}	1000
Cd^{2+}	1000
total hardness	178,6 mmol/l (1000 °dH)
CrO_4^{2-}	0,5

Interference	from / [mg/L]
$p\text{-}PO_4$	10
S^{2-}	50
SO_3^{2-}	50
NO_3^-	100
HCO_3^-	143,2 mmol/l (400 °dH)
Hg^{2+}	1000
Mn^{2+}	1000
NH_4^+	1000
Ni^{2+}	1000
Pb^{2+}	1000
Zn^{2+}	1000
Cl^-	1000
CN^-	1000
EDTA	1000
$o\text{-}PO_4^{3-}$	1000
SO_4^{2-}	1000

Method Validation

Limit of Detection	0.05 mg/L
Limit of Quantification	0.15 mg/L
End of Measuring Range	3 mg/L
Sensitivity	8.54 mg/L / Abs
Confidence Intervall	0.61 mg/L
Standard Deviation	0.25 mg/L
Variation Coefficient	15.16 %

Derived from

DIN EN 26777
ISO 6777

TN LR TT M280

0.5 - 25 mg/L N[b)]

Persulphate Digestion

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect	ø 16 mm	430 nm	0.5 - 25 mg/L N[b)]
SpectroDirect, XD 7000, XD 7500	ø 16 mm	410 nm	0.5 - 25 mg/L N[b)]

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
VARIO Total Nitrogen LR, Set	1 Set	535550

The following accessories are required.

Accessories	Packaging Unit	Part Number
Thermoreactor RD 125	1 pc.	2418940

Application List

- Waste Water Treatment
- Drinking Water Treatment
- Raw Water Treatment

Preparation

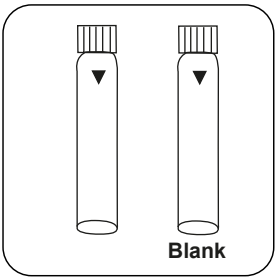
1. Large quantities of nitrogen free, organic compounds that are included in some water samples may reduce the effectiveness of the digestion by reacting with the Persulphate reagent. Samples which are well known to contents large quantities of organic compounds must be diluted and digestion and measurement must be repeated for checking the effectiveness of the digestion.

Notes

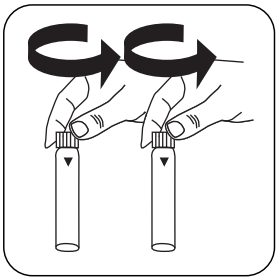
1. Persulphate reagent may not get on the vial threads. To remove spattered or spilt Persulphate reagent, thoroughly wipe the vial threads with a clean cloth.
2. Volumes for samples and blank should always be metered by using suitable 2 ml pipettes (class A).
3. One blank is sufficient for each set of samples.
4. The reagents TN hydroxide LR, TN persulphates RGT. and TN reagent B may not completely dissolve.
5. The blank (stored in the dark) can be used for 7 days, if the measured samples were prepared with the same batch of reagent.

Implementation of the provision Nitrogen, total LR with Vial Test

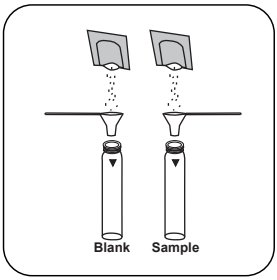
Select the method on the device



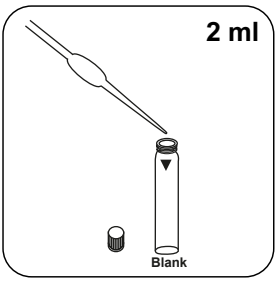
Prepare two **digestion vials TN Hydroxide LR** . Mark one as a blank.



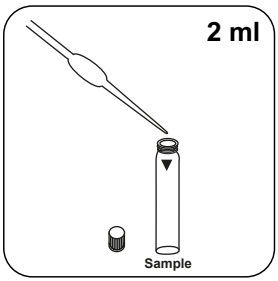
Open the vial.



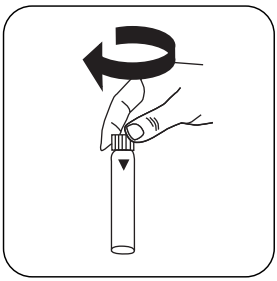
Add **a Vario TN Persulfate Rgt. powder pack** in each vial.



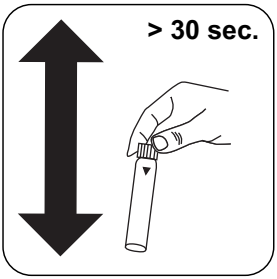
Put **2 ml deionised water** in the blank.



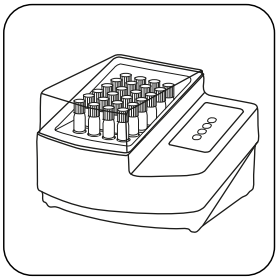
Put **2 ml sample** in the sample vial.



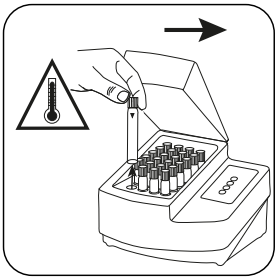
Close vial(s).



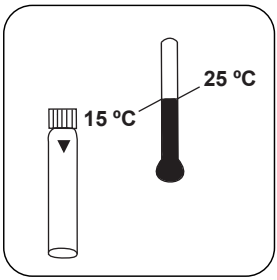
Mix the contents by shaking vigorously. (> 30 sec.).



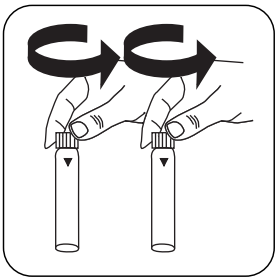
Seal the vials in the pre-heated thermoreactor for **30 minutes at 100 °C** .



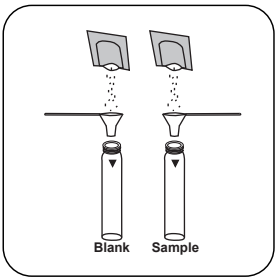
Remove the vial from the thermoreactor. **(Note: vial will be hot!)**



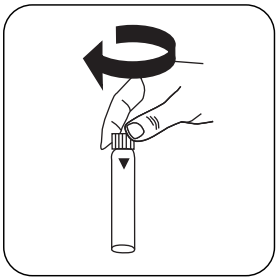
Allow the sample to cool to room temperature.



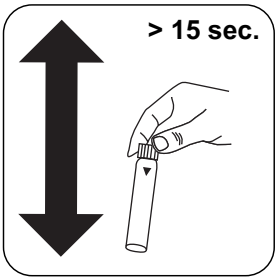
Open the vial.



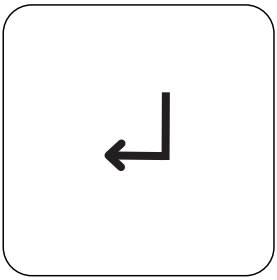
Add **a Vario TN Reagent A powder pack** in each vial.



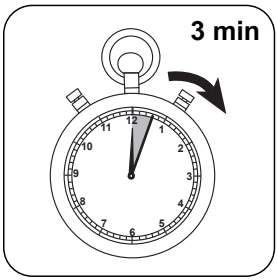
Close vial(s).



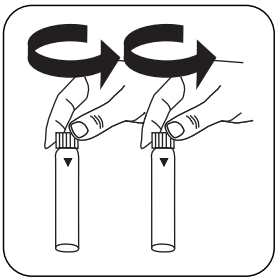
Mix the contents by shaking. (> 15 sec.).



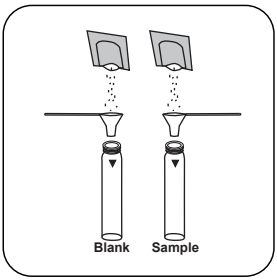
Press the **ENTER** button.



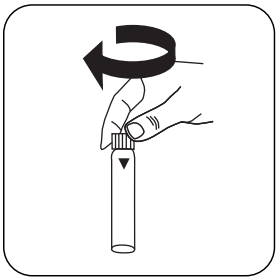
Wait for **3 minute(s) reaction time**.



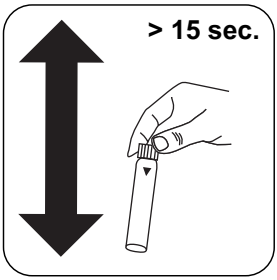
Open the vial.



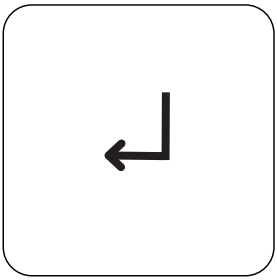
Add **a Vario TN Reagent B powder pack** in each vial.



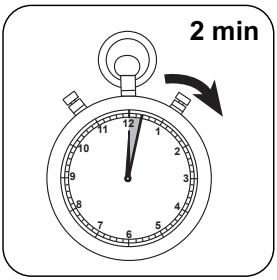
Close vial(s).



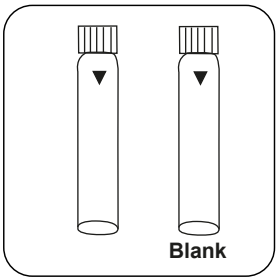
Mix the contents by shaking. (> 15 sec.).



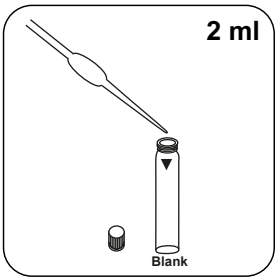
Press the **ENTER** button.



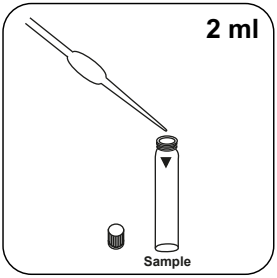
Wait for **2 minute(s) reaction time**.



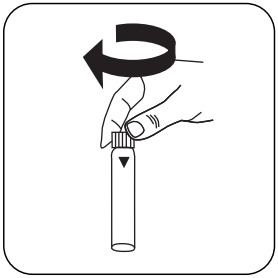
Prepare two **TN Acid LR/HR (Reagent C) vials** . Mark one as a blank.



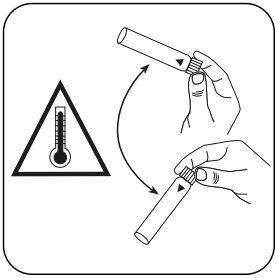
Place **2 ml of digested, pre-prepared zero sample** in the blank.



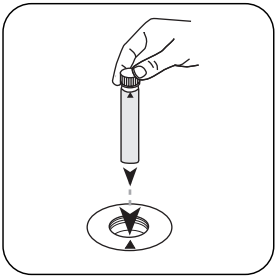
Fill sample vial with **2 ml prepared, digested sample**.



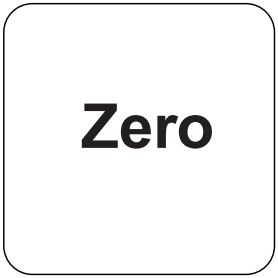
Close vial(s).



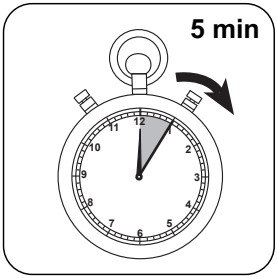
Invert several times to mix the contents (10 x). **Note: Will get hot!**



Place **blank** in the sample chamber. • Pay attention to the positioning.

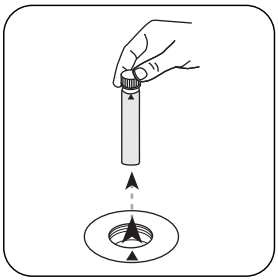


Press the **ZERO** button.

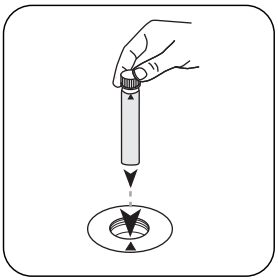


Wait for **5 minute(s) reaction time**.

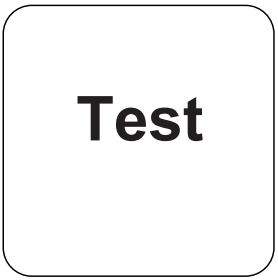
Once the reaction period is finished, the measurement takes place automatically.



Remove **vial** from the sample chamber.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in mg/l Nitrogen appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	N	1
mg/l	NH_4	1.288
mg/l	NH_3	1.22

Chemical Method

Persulphate Digestion

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 16 mm
a	$2.32198 \cdot 10^{-1}$
b	$4.83314 \cdot 10^{+1}$
c	
d	
e	
f	

Interferences

Interference	from / [mg/L]
Cr^{6+}	5
Fe^{2+}	50
Sn^{2+}	50
Ca^{2+}	100
Co^{2+}	100
Cu^{2+}	100
Fe^{3+}	100
Ni^{2+}	100
Pb^{2+}	100

Interference	from / [mg/L]
Zn^{2+}	100
Cd^{2+}	200
K^{+}	500
Cl^{-}	500

Bibliography

M. Hosomi, R. Sudo, Simultaneous determination of total nitrogen and total phosphorus in freshwater samples using persulphate digestion, Int. J. of. Env. Stud. (1986), 27 (3-4), p. 267-275

[b] Reactor is necessary for COD (150 °C), TOC (120 °C) and total -chromium, - phosphate, -nitrogen, (100 °C)

TN HR TT M281

5 - 150 mg/L N[b)]

Persulphate Digestion

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect	ø 16 mm	430 nm	5 - 150 mg/L N[b)]
SpectroDirect, XD 7000, XD 7500	ø 16 mm	410 nm	5 - 150 mg/L N[b)]

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
VARIO Total Nitrogen HR, Set	1 Set	535560

The following accessories are required.

Accessories	Packaging Unit	Part Number
Thermoreactor RD 125	1 pc.	2418940

Application List

- Waste Water Treatment
- Drinking Water Treatment
- Raw Water Treatment

Preparation

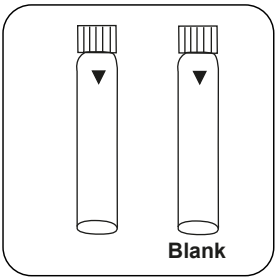
1. Large quantities of nitrogen free, organic compounds that are included in some water samples may reduce the effectiveness of the digestion by reacting with the Persulphate reagent. Samples which are well known to contents large quantities of organic compounds must be diluted and digestion and measurement must be repeated for checking the effectiveness of the digestion.

Notes

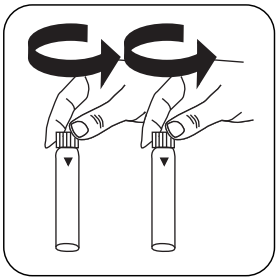
1. Persulphate reagent may not get on the vial threads. To remove spattered or spilt Persulphate reagent, thoroughly wipe the vial threads with a clean cloth.
2. Volumes for samples and blank should always be metered by using suitable pipettes (class A).
3. One blank is sufficient for each set of samples.
4. The reagents TN hydroxide LR, TN persulphates RGT. and TN reagent B may not completely dissolve.
5. The blank (stored in the dark) can be used for 7 days, if the measured samples were prepared with the same batch of reagent.

Implementation of the provision Nitrogen, total HR with Vial Test

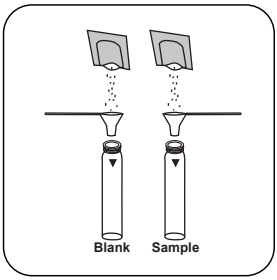
Select the method on the device



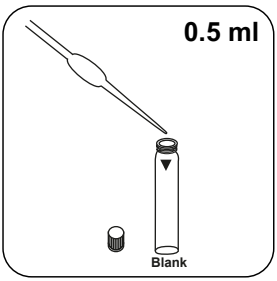
Prepare two **digestion vials TN Hydroxide HR** . Mark one as a blank.



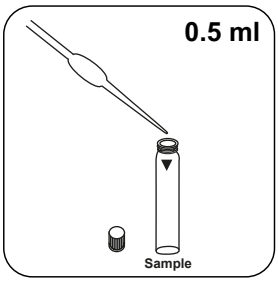
Open the vial.



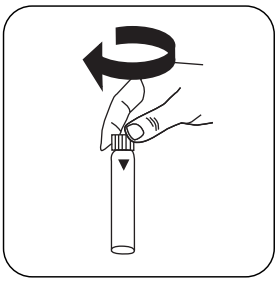
Add **a Vario TN Persulfate Rgt. powder pack** in each vial.



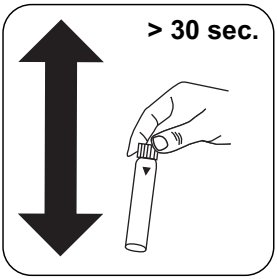
Put **0.5 ml deionised water** in the blank.



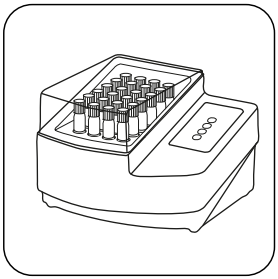
Put **0.5 ml sample** in the sample vial.



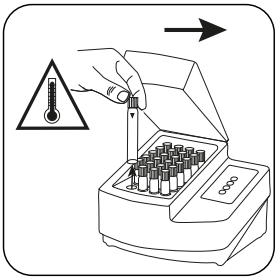
Close vial(s).



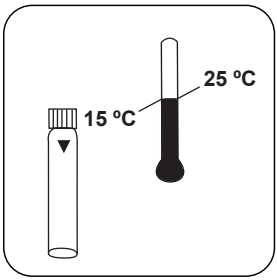
Mix the contents by shaking vigorously. (> 30 sec.).



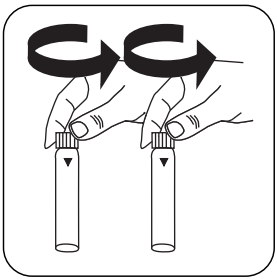
Seal the vials in the pre-heated thermoreactor for **30 minutes at 100 °C** .



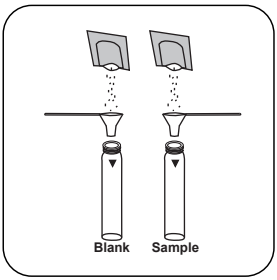
Remove the vial from the thermoreactor. **(Note: vial will be hot!)**



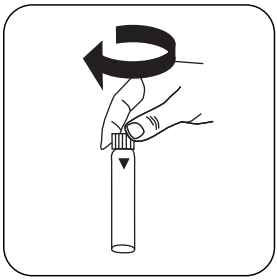
Allow the sample to cool to room temperature.



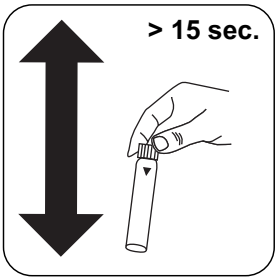
Open the vial.



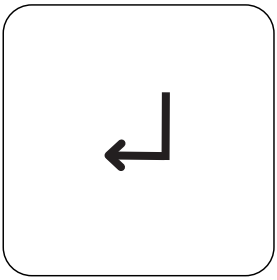
Add **a Vario TN Reagent A powder pack** in each vial.



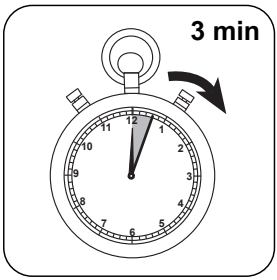
Close vial(s).



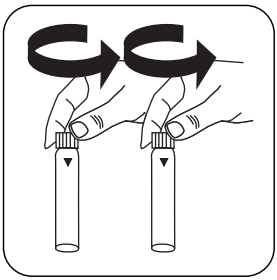
Mix the contents by shaking. (> 15 sec.).



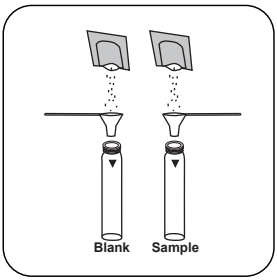
Press the **ENTER** button.



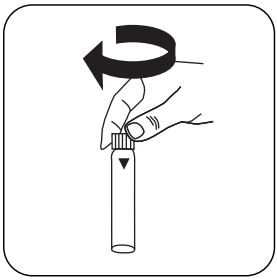
Wait for **3 minute(s) reaction time**.



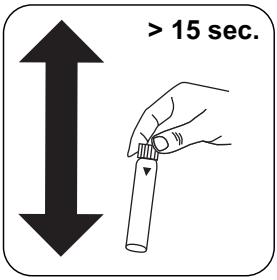
Open the vial.



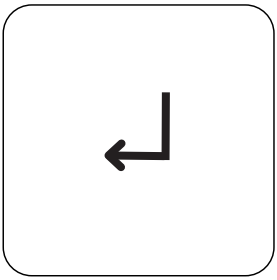
Add **a Vario TN Reagent B powder pack** in each vial.



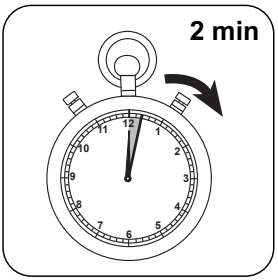
Close vial(s).



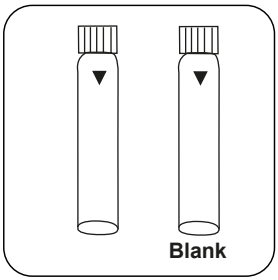
Mix the contents by shaking. (> 15 sec.).



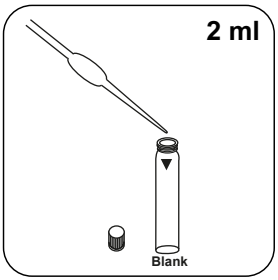
Press the **ENTER** button.



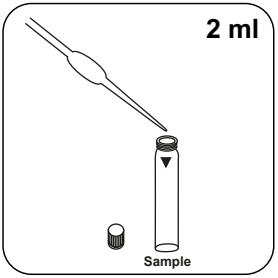
Wait for **2 minute(s) reaction time**.



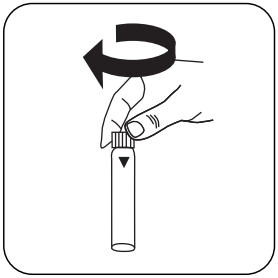
Prepare two **TN Acid LR/HR (Reagent C) vials** . Mark one as a blank.



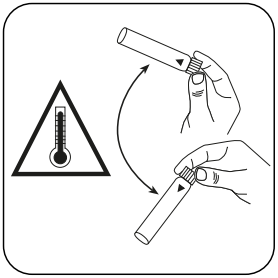
Place **2 ml of digested, pre-prepared zero sample** in the blank.



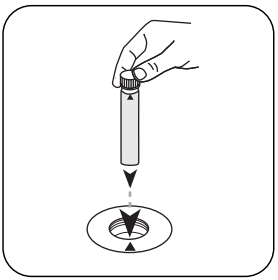
Fill sample vial with **2 ml prepared, digested sample**.



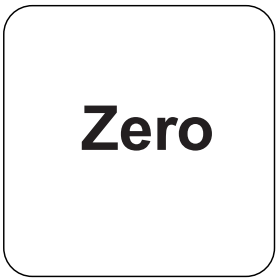
Close vial(s).



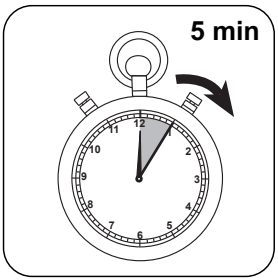
Invert several times to mix the contents (10 x). **Note: Will get hot!**



Place **blank** in the sample chamber. • Pay attention to the positioning.

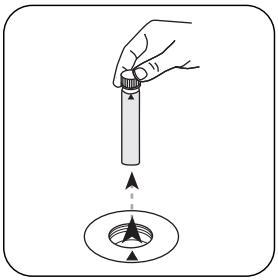


Press the **ZERO** button.

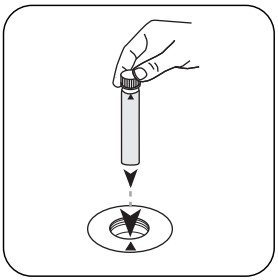


Wait for **5 minute(s) reaction time**.

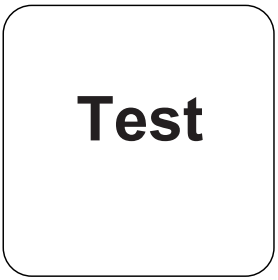
Once the reaction period is finished, the measurement takes place automatically.



Remove **vial** from the sample chamber.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in mg/l Nitrogen appears on the display.

Chemical Method

Persulphate Digestion

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 16 mm
a	-8.05265 • 10^{-1}
b	4.93335 • 10^{+1}
c	
d	
e	
f	

Interferences

Interference	**from / [mg/L]**
Cr^{6+}	5
Fe^{2+}	50
Sn^{2+}	50
Ca^{2+}	100
Co^{2+}	100
Cu^{2+}	100
Fe^{3+}	100
Ni^{2+}	100
Pb^{2+}	100
Zn^{2+}	100
Cd^{2+}	200
K^{+}	500
Cl^{-}	500

Bibliography

M. Hosomi, R. Sudo, Simultaneous determination of total nitrogen and total phosphorus in freshwater samples using persulphate digestion, Int. J. of Env. Stud. (1986), 27 (3-4), p. 267-275

[b] Reactor is necessary for COD (150 °C), TOC (120 °C) and total -chromium, - phosphate, -nitrogen, (100 °C)

TN LR 2 TT M283

0.5 - 14 mg/L N[b)]

2,6-Dimethylphenole

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	ø 16 mm	340 nm	0.5 - 14 mg/L N[b)]

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Total Nitrogen DMP LR / 25	1 pc.	2423540
Total Nitrogen	1 pc.	2420703

The following accessories are required.

Accessories	Packaging Unit	Part Number
Thermoreactor RD 125	1 pc.	2418940

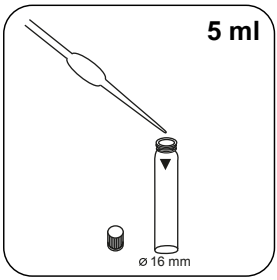
Application List

- Waste Water Treatment
- Drinking Water Treatment
- Raw Water Treatment

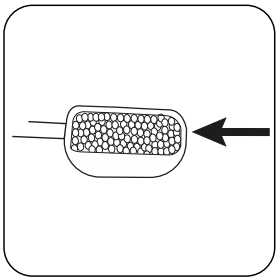
Notes

1. This test determines the inorganic compounds Ammonia, Nitrate and Nitrite, as well as organic compounds like amino acid, urea, complexing agents etc.

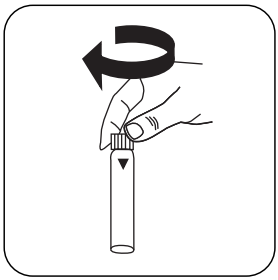
Digestion



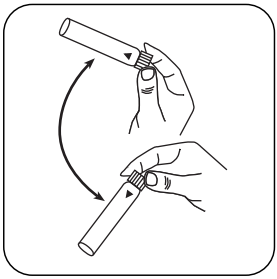
Put **5 ml sample** in the digestion vial.



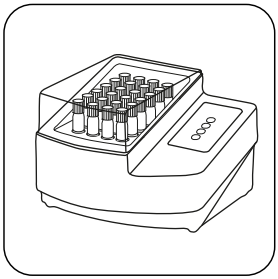
Add **a level measuring scoop No. 8 (black) Digestion Reagent** .



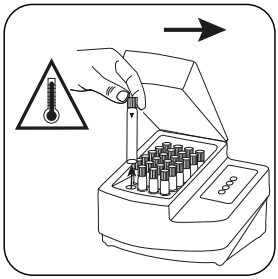
Close vial(s).



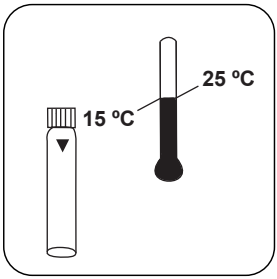
Invert several times to mix the contents.



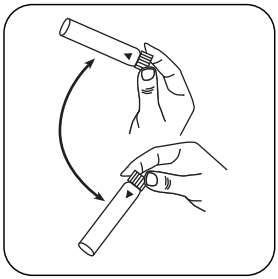
Seal the vials in the pre-heated thermoreactor for **60 minutes at 100 °C** .



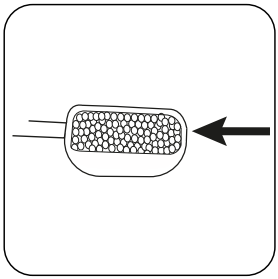
Remove the vial from the thermoreactor. **(Note: vial will be hot!)**



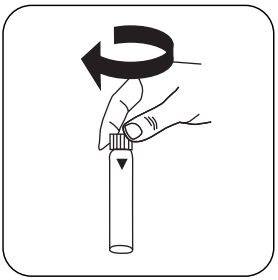
Allow the sample to cool to room temperature.



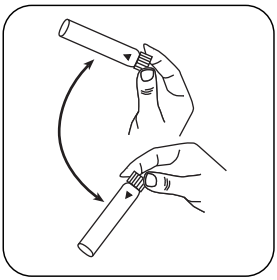
Invert several times to mix the contents.



Add **a level measuring scoop No. 4 (white) Compensation Reagent** .



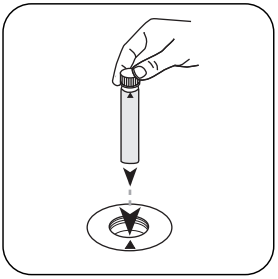
Close vial(s).



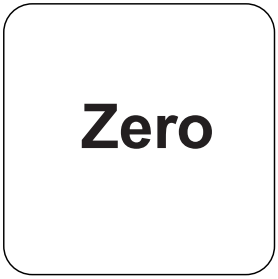
Invert several times to mix the contents.

Implementation of the provision Nitrogen, total LR with Vial Test

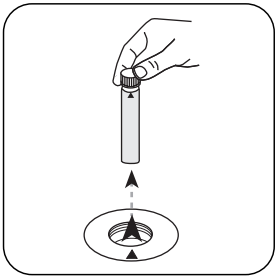
Select the method on the device
For testing of **Nitrogen, total LR with tube test,** carry out the described **digestion**.
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



Place the supplied Zero vial (red sticker) in the sample chamber. • Pay attention to the positioning.

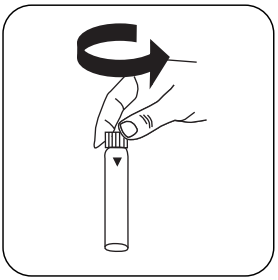


Press the **ZERO** button.

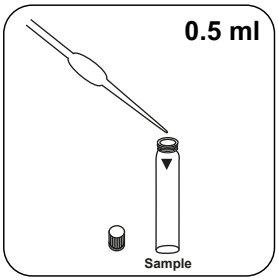


Remove **vial** from the sample chamber.

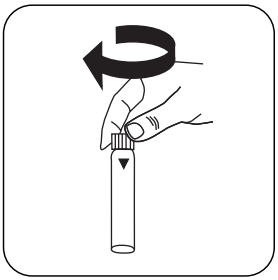
For devices that require **no ZERO measurement** , **start here**.



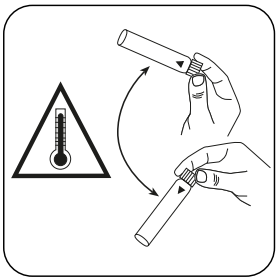
Open a **digestion vial**.



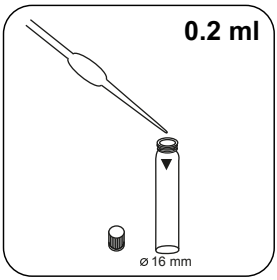
Fill sample vial with **0.5 ml prepared, digested sample**.



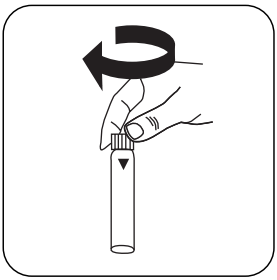
Close vial(s).



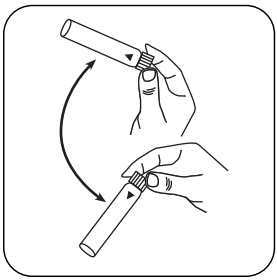
Carefully invert several times to mix the contents.
Note: Will get hot!



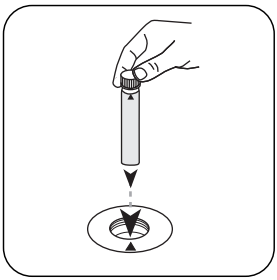
Add **0.2 ml Nitrate-111**.



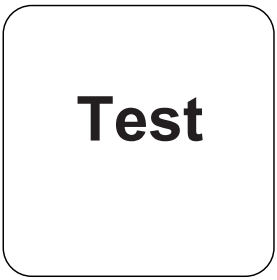
Close vial(s).



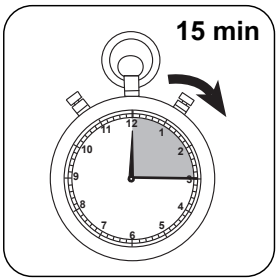
Invert several times to mix the contents.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **15 minute(s) reaction time**.
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Nitrogen appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	N	1
mg/l	NH_4	1.288
mg/l	NH_3	1.2158

Chemical Method

2,6-Dimethylphenole

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 16 mm
a	$2.35054 \cdot 10^{-1}$
b	$1.92879 \cdot 10^{+2}$
c	
d	
e	
f	

Interferences

Persistant Interferences

- Nitrogen compounds which are hardly to oxidise, as may be found in industrial sewage, are not digested or only partially.

According to

US EPA 40 CFR 141

Derived from

EN ISO 11905-1

[b] Reactor is necessary for COD (150 °C), TOC (120 °C) and total -chromium, - phosphate, -nitrogen, (100 °C)

TN HR 2 TT M284

5 - 140 mg/L N[b) i)]

2,6-Dimethylphenole

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	ø 16 mm	340 nm	5 - 140 mg/L N[b) i)]

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Total Nitrogen DMP HR / 25	1 pc.	2423570
Total Nitrogen	1 pc.	2420703

The following accessories are required.

Accessories	Packaging Unit	Part Number
Thermoreactor RD 125	1 pc.	2418940

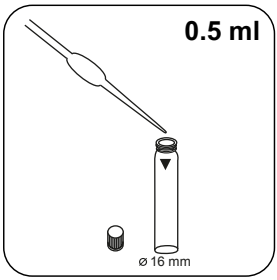
Application List

- Waste Water Treatment
- Drinking Water Treatment
- Raw Water Treatment

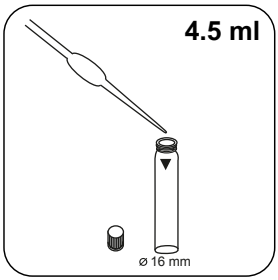
Notes

1. This test determines the inorganic compounds Ammonia, Nitrate and Nitrite, as well as organic compounds like amino acid, urea, complexing agents etc.

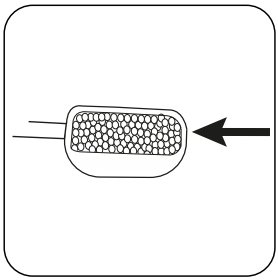
Digestion



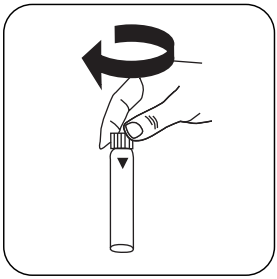
Put **0.5 ml sample** in the digestion vial.



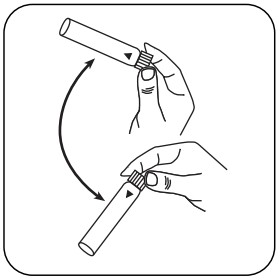
Put **4.5 ml deionised water** in the digestion vial.



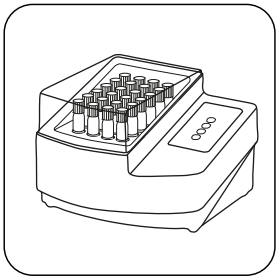
Add **a level measuring scoop No. 8 (black) Digestion Reagent** .



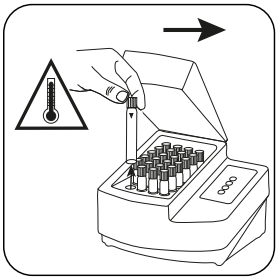
Close vial(s).



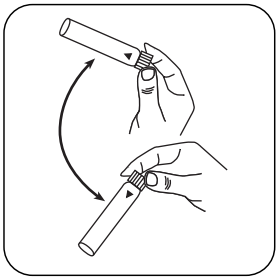
Invert several times to mix the contents.



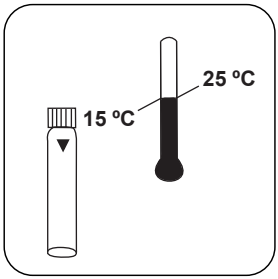
Seal the vials in the pre-heated thermoreactor for **60 minutes at 100 °C** .



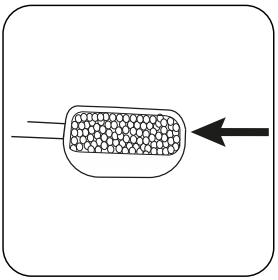
Remove the vial from the thermoreactor. **(Note: vial will be hot!)**



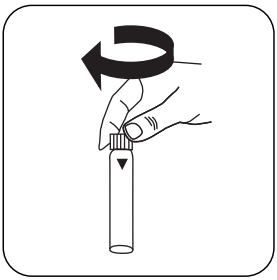
Invert several times to mix the contents.



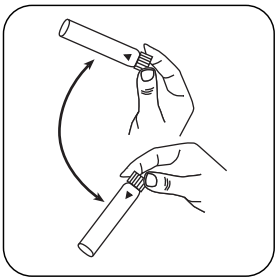
Allow the vial(s) to cool to room temperature.



Add **a level measuring scoop No. 4 (white) Compensation Reagent** .



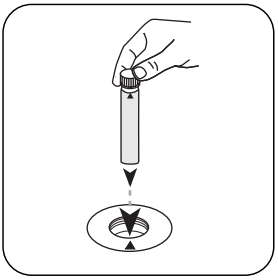
Close vial(s).



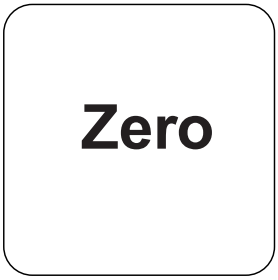
Invert several times to mix the contents.

Implementation of the provision Nitrogen, total HR with Vial Test

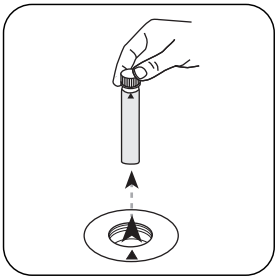
Select the method on the device
For testing of **Nitrogen, total HR with tube test,** carry out the described **digestion**.
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



Place the supplied Zero vial (red sticker) in the sample chamber. • Pay attention to the positioning.

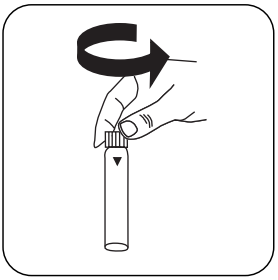


Press the **ZERO** button.

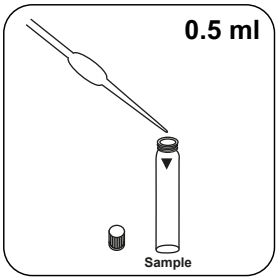


Remove **vial** from the sample chamber.

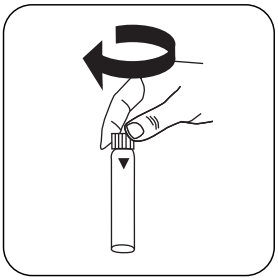
For devices that require **no ZERO measurement** , **start here**.



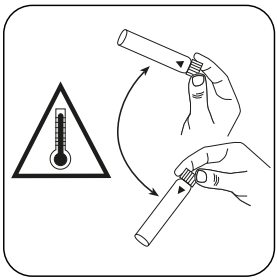
Open a **digestion vial**.



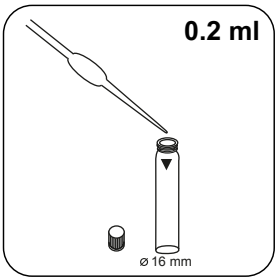
Fill sample vial with **0.5 ml prepared, digested sample**.



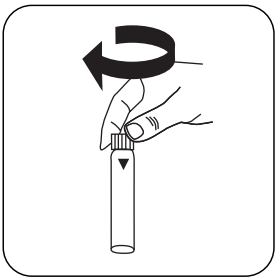
Close vial(s).



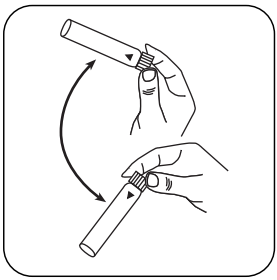
Carefully invert several times to mix the contents.
Note: Will get hot!



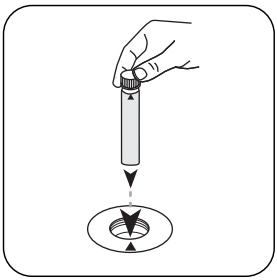
Add **0.2 ml Nitrate-111**.



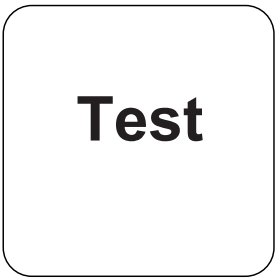
Close vial(s).



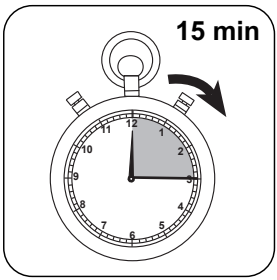
Invert several times to mix the contents.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **15 minute(s) reaction time**.
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Nitrogen appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	N	1
mg/l	NH_4	1.288
mg/l	NH_3	1.2158

Chemical Method

2,6-Dimethylphenole

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 16 mm
a	$-9.36243 \cdot 10^{-1}$
b	$2.51666 \cdot 10^{+1}$
c	
d	
e	
f	

Interferences

Persistant Interferences

- Nitrogen compounds which are hardly to oxidise, as may be found in industrial sewage, are not digested or only partially.

According to

US EPA 40 CFR 141

Derived from

EN ISO 11905-1

[b] Reactor is necessary for COD (150 °C), TOC (120 °C) and total -chromium, - phosphate, -nitrogen, (100 °C) | [i] high range by dilution

Oxygen active T M290

0.1 - 10 mg/L O_2

DPD

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect, PM 620, PM 630	ø 24 mm	530 nm	0.1 - 10 mg/L O_2
SpectroDirect, XD 7000, XD 7500	ø 24 mm	510 nm	0.1 - 10 mg/L O_2

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
DPD No. 4	Tablet / 100	511220BT
DPD No. 4	Tablet / 250	511221BT
DPD No. 4	Tablet / 500	511222BT

Application List

- Pool Water Control

Preparation

1. When preparing the sample, Oxygen outgassing, e.g. through the pipette or shaking, must be avoided.
2. The analysis must take place immediately after taking the sample.

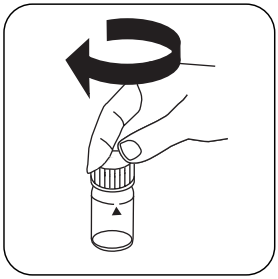
Notes

1. Active Oxygen is a synonym for a common disinfectant (based on “Oxygen“) in treating swimming pools.

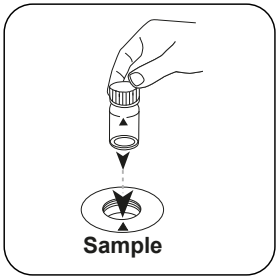
Implementation of the provision Oxygen, active with Tablet

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

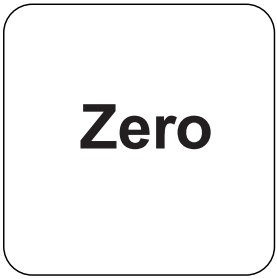
Fill 24 mm vial with **10 ml sample**.



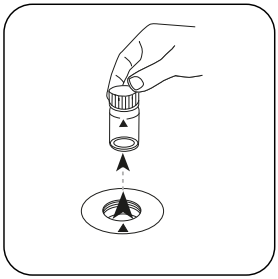
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

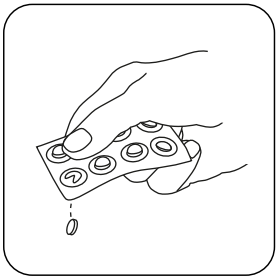


Press the **ZERO** button.

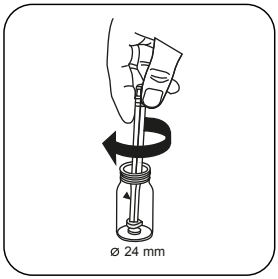


Remove the vial from the sample chamber.

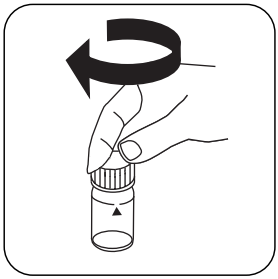
For devices that require **no ZERO measurement** , **start here**.



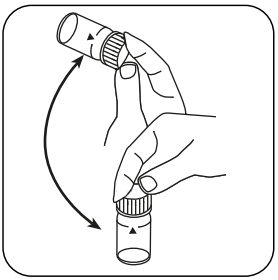
Add **DPD No. 4 tablet** .



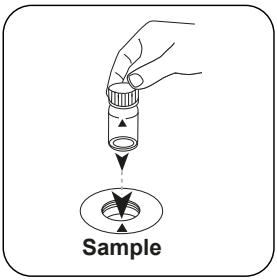
Crush tablet(s) by rotating slightly.



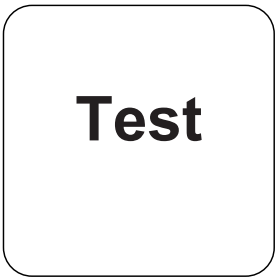
Close vial(s).



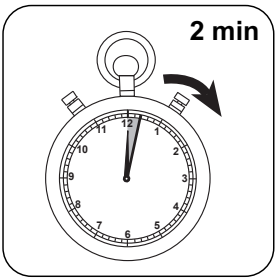
Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **2 minute(s) reaction time**.
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Active Oxygen appears on the display.

Chemical Method

DPD

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	5.11265 • 10^{-2}	5.11265 • 10^{-2}
b	7.65587 • 10^{+0}	1.64601 • 10^{+1}
c	1.01147 • 10^{+0}	4.67552 • 10^{+0}
d		
e		
f		

Oxygen dissolved C M292

10 - 800 µg/L O_2 [c] O2

Rhodazine D TM

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 110, MD 600, MD 610, MD 640, MultiDirect	ø 13 mm	530 nm	10 - 800 µg/L O_2 [c]
XD 7000, XD 7500	ø 13 mm	547 nm	10 - 1100 µg/L O_2 [c]

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Vacu-vial Oxygen Test Kit	1 Set	380450

The following accessories are required.

Accessories	Packaging Unit	Part Number
Adapter for round cuvettes 13 mm	1 pc.	19802192
Adapter (13 mm) MultiDirect for Vacu-vial	1 pc.	192075

Application List

- Boiler Water

Preparation

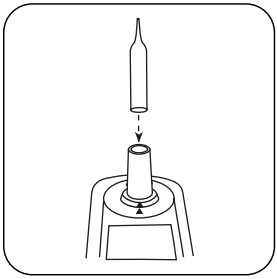
1. Before performing the test, you must read through the original instructions and safety advice that is delivered with the test kit (MSDS are available on the homepage of www.chemetrics.com).

Notes

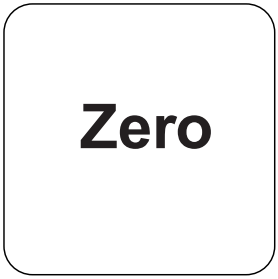
1. This method is adapted from a product by CHEMetrics. The measuring range and wavelength used for this photometer may differ from the data specified by CHEMetrics. 2. Keep Vacu-Vials® in the dark at room temperature. 4. Vacu-vials® is a registered trademark of the company CHEMetrics, Inc. / Calverton, U.S.A.

Implementation of the provision Oxygen, dissolved with Vacu Vials® K-7553

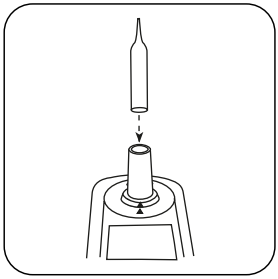
Select the method on the device



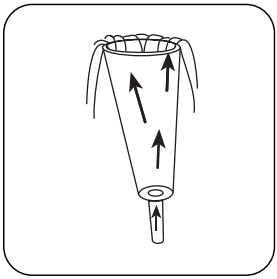
Place **Zero ampoule** in the sample chamber.



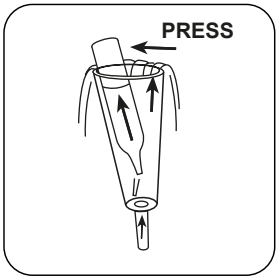
Press the **ZERO** button.



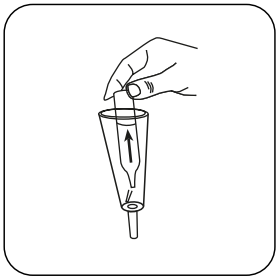
Remove zero ampoule from the sample chamber.



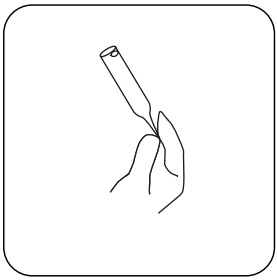
Run test water through the sampling vessel for several minutes from bottom to top to remove air bubbles.



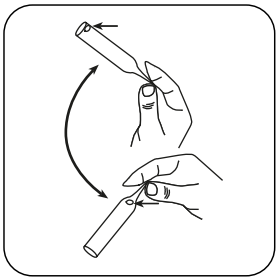
Place a Vacu-vial® ampoule in the sampling vessel. Break off the ampoule tip by applying light pressure against the vessel wall. Wait for the ampoule to fill completely.



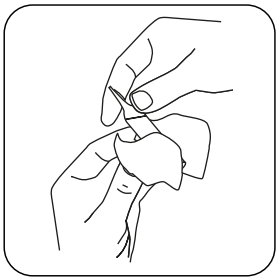
Then quickly remove the ampoule from the sampling vessel with the tip down.



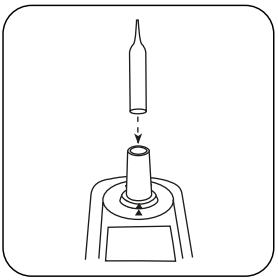
Close the opening with one finger, to avoid contact with the air.

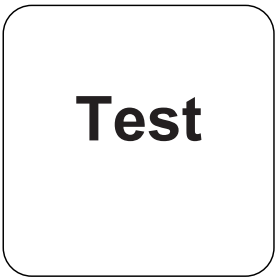


Invert the ampoule several times.



Dry the outside of the ampoule.





Place the ampoule in the sample chamber.

Press the **TEST** (XD: **START**)button.

The result in mg/l Oxygen appears on the display.

Chemical Method

Rhodazine D TM

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^{2} + d•Abs^{3} + e•Abs^{4} + f•Abs^{5}

	ø 13 mm
a	-2.60239 • 10^{+1}
b	9.19343 • 10^{+2}
c	
d	
e	
f	

Derived from

ASTM D 5543-15

[c] MultiDirect: Adapter is necessary for Vacu-vials® (Order code 19 20 75)

Ozone 50 T M299

0.02 - 0.5 mg/L O_3

DPD / Glycine

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	□ 50 mm	510 nm	0.02 - 0.5 mg/L O_3

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
DPD No. 1	Tablet / 100	511050BT
DPD No. 1	Tablet / 250	511051BT
DPD No. 1	Tablet / 500	511052BT
DPD No. 3	Tablet / 100	511080BT
DPD No. 3	Tablet / 250	511081BT
DPD No. 3	Tablet / 500	511082BT
DPD No. 1 High Calcium [e)]	Tablet / 100	515740BT
DPD No. 1 High Calcium [e)]	Tablet / 250	515741BT
DPD No. 1 High Calcium [e)]	Tablet / 500	515742BT
DPD No. 3 High Calcium [e)]	Tablet / 100	515730BT
DPD No. 3 High Calcium [e)]	Tablet / 250	515731BT
DPD No. 3 High Calcium [e)]	Tablet / 500	515732BT
Glycine [f)]	Tablet / 100	512170BT
Glycine [f)]	Tablet / 250	512171BT
Set DPD No. 1/No. 3 100 Pc.[#]	100 each	517711BT
Set DPD No. 1/No. 3 250 Pc.[#]	250 each	517712BT
Set DPD No. 1/No. 3 High Calcium 100 Pc. [#]	100 each	517781BT
Set DPD No. 1/No. 3 High Calcium 250 Pc. [#]	250 each	517782BT
Set DPD No. 1/Glycine 100 Stck. [#]	100 each	517731BT
Set DPD No. 1/Glycine 250 Stck. [#]	250 each	517732BT

Application List

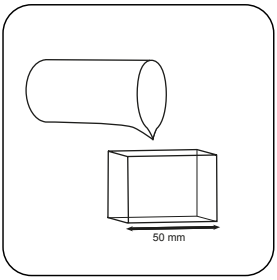
- Drinking Water Treatment
- Boiler Water
- Waste Water Treatment
- Raw Water Treatment
- Pool Water Treatment
- Disinfection Control

Preparation

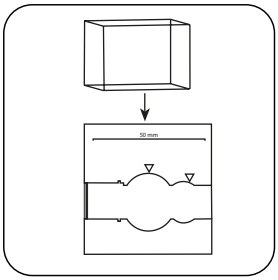
1. Cleaning of vials:
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, the subsequent determination of oxidising agents (e.g. ozone and chlorine) may show lower results. To avoid measurement errors, the glassware used should be free of chlorine consumption. To achieve this, all glassware should be placed in a sodium hypochlorite solution (0.1 g/L) for one hour and then rinsed thoroughly with deionised water.
2. When preparing the sample, Ozone outgassing, e.g. through the pipette or shaking, must be avoided. The analysis must take place immediately after taking the sample.
3. Strong alkaline or acidic water samples must be adjusted between pH 6 and pH 7 before the analysis (use 0.5 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).

Implementation of the provision Ozone, in presence of chlorine with tablet

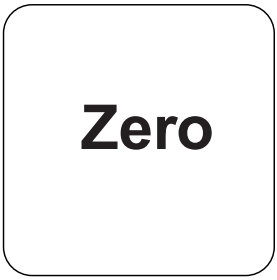
Select the method on the device
In addition, choose the test: in presence of Chlorine
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



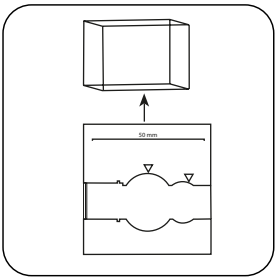
Fill 50 mm vial with **sample**.



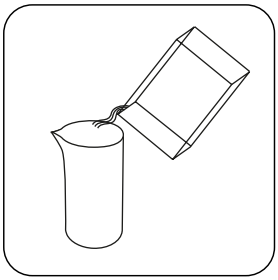
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



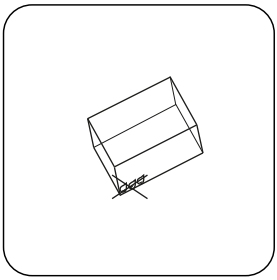
Press the **ZERO** button.



Remove **vial** from the sample chamber.

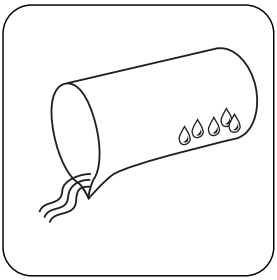


Empty vial.

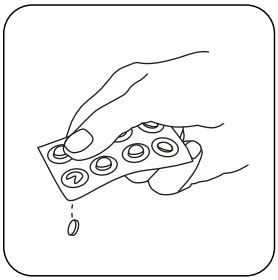


Dry the vial thoroughly.

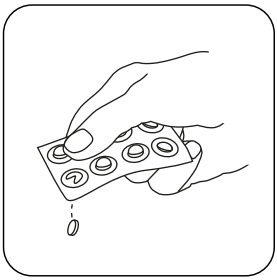
For devices that require **no ZERO measurement** , **start here**.



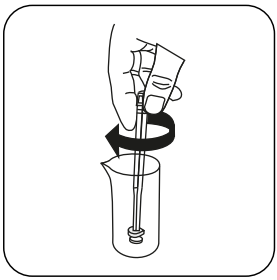
Rinse a beaker **with the sample and empty it, leaving a few drops remaining** in the beaker.



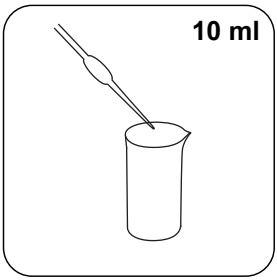
Add **DPD No. 1 tablet** .



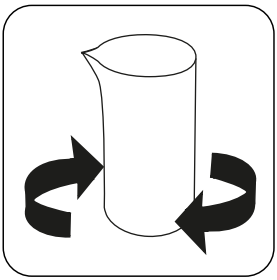
Add **DPD No. 3 tablet** .



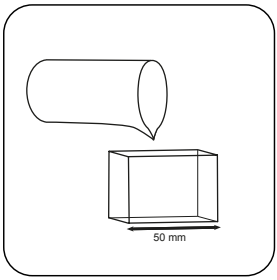
Crush tablet(s) by rotating slightly.



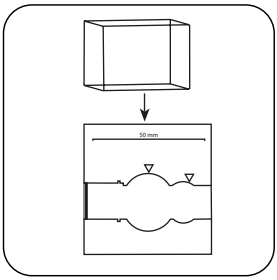
Add **10 ml sample**.



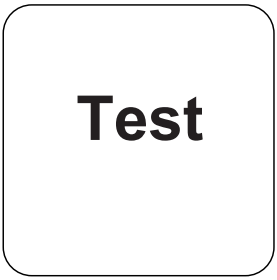
Dissolve tablet(s) by inverting.



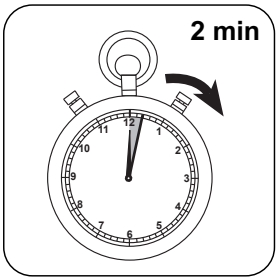
Fill 50 mm vial with **sample**.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

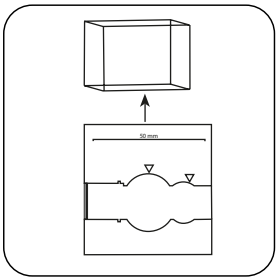


Press the **TEST** (XD: **START**)button.

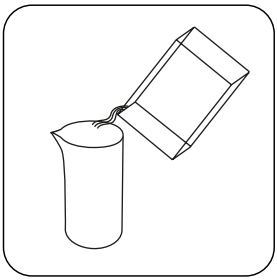


Wait for **2 minute(s) reaction time**.

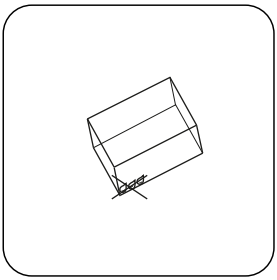
Once the reaction period is finished, the measurement takes place automatically.



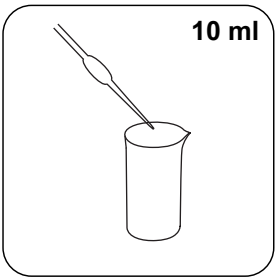
Remove **vial** from the sample chamber.



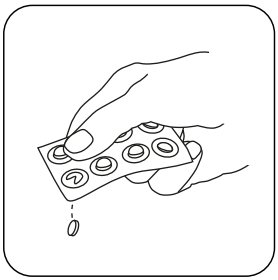
Empty vial.



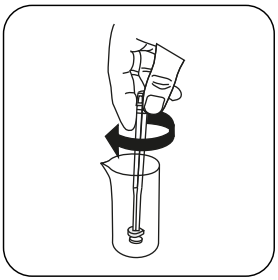
Dry the vial thoroughly.



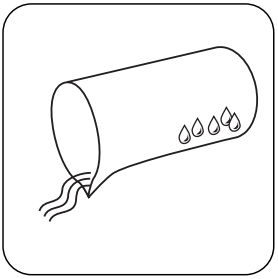
Fill a suitable sample vessel with **10 ml sample** .



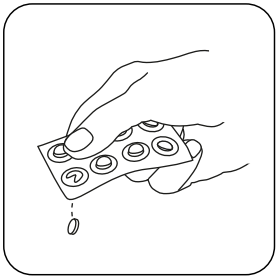
Add **Glycine tablet**.



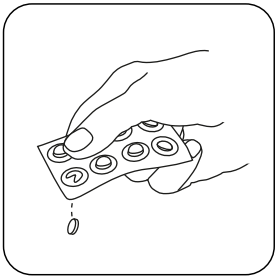
Crush tablet(s) by rotating slightly and dissolve.



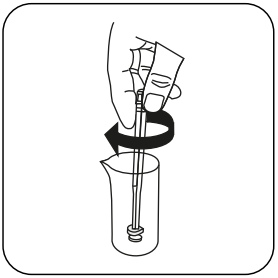
Rinse a beaker **with the sample and empty it, leaving a few drops remaining** in the beaker.



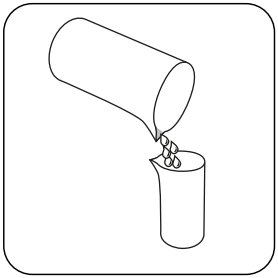
Add **DPD No. 1 tablet** .



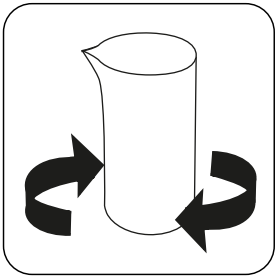
Add **DPD No. 3 tablet** .



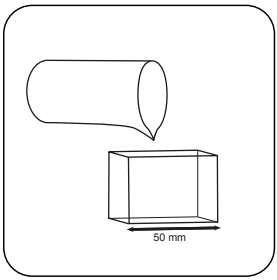
Crush tablet(s) by rotating slightly.



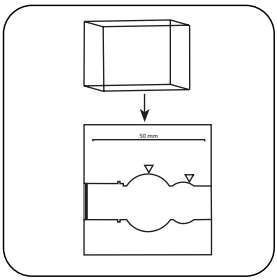
Fill prepared sample with prepared **glycine solution**.



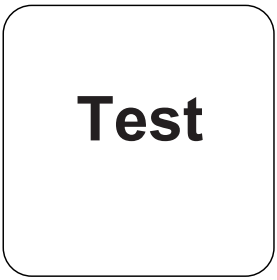
Dissolve tablet(s) by inverting.



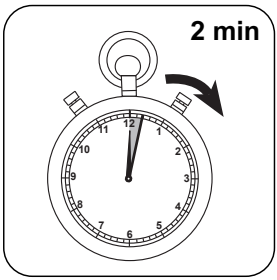
Fill 50 mm vial with **sample**.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

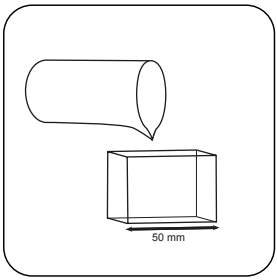


Wait for **2 minute(s) reaction time**.

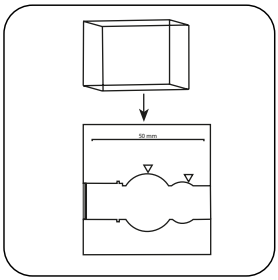
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Ozone; total chlorine appears on the display.

Implementation of the provision Ozone, in absence of chlorine with tablet

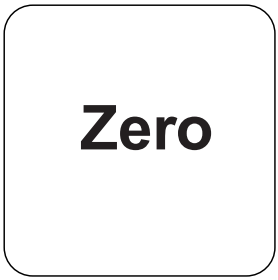
Select the method on the device
In addition, choose the test: without Chlorine
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



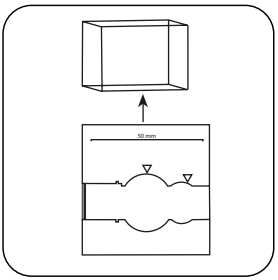
Fill 50 mm vial with **sample**.



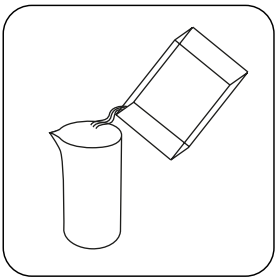
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



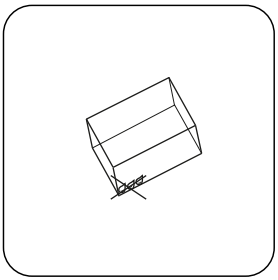
Press the **ZERO** button.



Remove **vial** from the sample chamber.

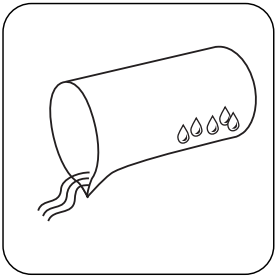


Empty vial.

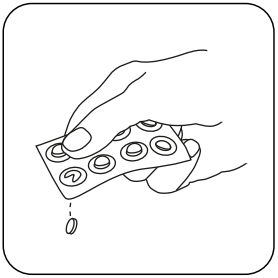


Dry the vial thoroughly.

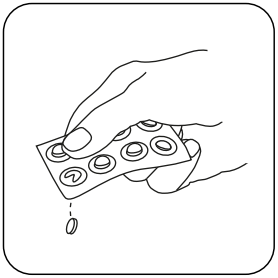
For devices that require **no ZERO measurement** , **start here**.



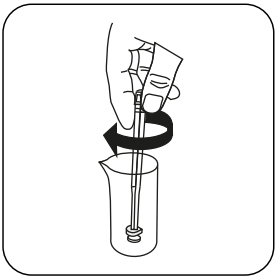
Rinse a beaker **with the sample and empty it, leaving a few drops remaining** in the beaker.



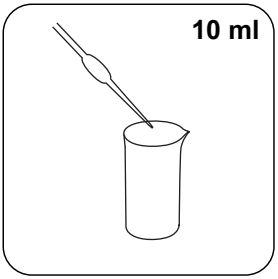
Add **DPD No. 1 tablet** .



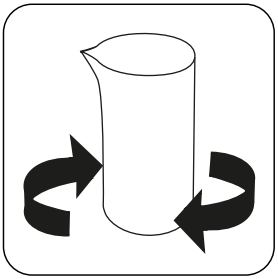
Add **DPD No. 3 tablet** .



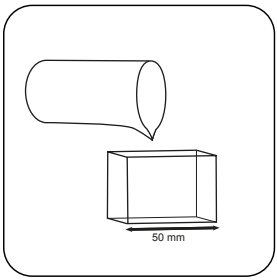
Crush tablet(s) by rotating slightly.



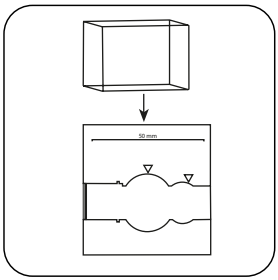
Add **10 ml sample**.



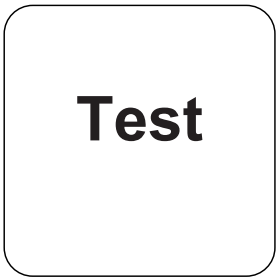
Dissolve tablet(s) by inverting.



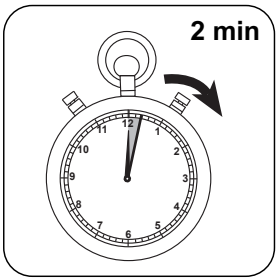
Fill 50 mm vial with **sample**.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **2 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically. The result in mg/l Ozone appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	O_3	1
mg/l	Cl_2	1.4771049

Chemical Method

DPD / Glycine

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	□ **50 mm**
a	$-3.25456 \cdot 10^{-3}$
b	$4.78036 \cdot 10^{-1}$
c	$-3.91741 \cdot 10^{-2}$
d	
e	
f	

Interferences

Persistant Interferences

1. All oxidising agents in the samples react like chlorine, which leads to higher results.
2. Concentrations above 6 mg/L Ozone can lead to results within the measuring range of up to 0 mg/L. In this case, the water sample must be diluted. 10 ml of the diluted sample should be mixed with the reagent and the measurement taken again (plausibility test).

Bibliography

Colorimetric Chemical Analytical Methods, 9th Edition, Lovibond

Derived from

DIN 38408-3:2011-04

[e)] alternative reagent, used instead of DPD No.1/No.3 in case of turbidity in the water sample caused by high concentration of calcium and/or high conductivity | [f)] additionally required for determination of bromine, chlorine dioxide and ozone in the presence of chlorine | [#] including stirring rod, 10 cm

Ozone T M300

0.02 - 2 mg/L O_3 O3

DPD / Glycine

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 110, MD 200, MD 600, MD 610, MD 640, MultiDirect, PM 600, PM 620, PM 630	ø 24 mm	530 nm	0.02 - 2 mg/L O_3
SpectroDirect	ø 24 mm	510 nm	0.02 - 1 mg/L O_3
XD 7000, XD 7500	ø 24 mm	510 nm	0.02 - 2 mg/L O_3

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
DPD No. 1	Tablet / 100	511050BT
DPD No. 1	Tablet / 250	511051BT
DPD No. 1	Tablet / 500	511052BT
DPD No. 3	Tablet / 100	511080BT
DPD No. 3	Tablet / 250	511081BT
DPD No. 3	Tablet / 500	511082BT
DPD No. 1 High Calcium [e)]	Tablet / 100	515740BT
DPD No. 1 High Calcium [e)]	Tablet / 250	515741BT
DPD No. 1 High Calcium [e)]	Tablet / 500	515742BT
DPD No. 3 High Calcium [e)]	Tablet / 100	515730BT
DPD No. 3 High Calcium [e)]	Tablet / 250	515731BT
DPD No. 3 High Calcium [e)]	Tablet / 500	515732BT
Glycine [f)]	Tablet / 100	512170BT
Glycine [f)]	Tablet / 250	512171BT
Set DPD No. 1/No. 3 100 Pc.#	100 each	517711BT
Set DPD No. 1/No. 3 250 Pc.#	250 each	517712BT
Set DPD No. 1/No. 3 High Calcium 100 Pc. #	100 each	517781BT
Set DPD No. 1/No. 3 High Calcium 250 Pc. #	250 each	517782BT
Set DPD No. 1/Glycine 100 Stck. #	100 each	517731BT
Set DPD No. 1/Glycine 250 Stck. #	250 each	517732BT

Application List

- Drinking Water Treatment
- Boiler Water
- Waste Water Treatment
- Raw Water Treatment
- Pool Water Treatment
- Disinfection Control

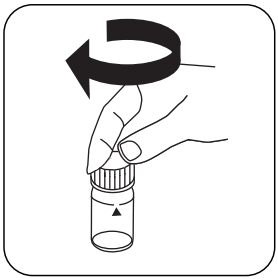
Preparation

1. Cleaning of vials:
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, the subsequent determination of oxidising agents (e.g. ozone and chlorine) may show lower results. To avoid measurement errors, the glassware used should be free of chlorine consumption. To achieve this, all glassware should be placed in a sodium hypochlorite solution (0.1 g/L) for one hour and then rinsed thoroughly with deionised water.
2. When preparing the sample, Ozone outgassing, e.g. through the pipette or shaking, must be avoided. The analysis must take place immediately after taking the sample.
3. Strong alkaline or acidic water samples must be adjusted between pH 6 and pH 7 before the analysis (use 0.5 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).

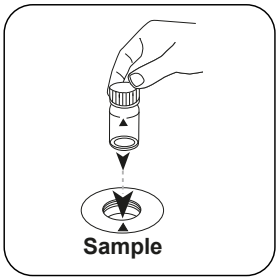
Implementation of the provision Ozone, in presence of Chlorine with tablet

Select the method on the device
In addition, choose the test: in presence of Chlorine
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

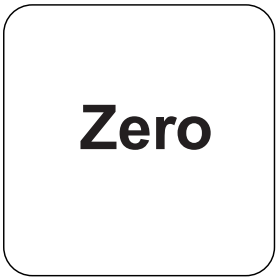
Fill 24 mm vial with **10 ml sample**.



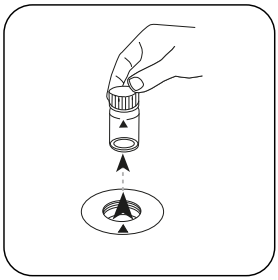
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



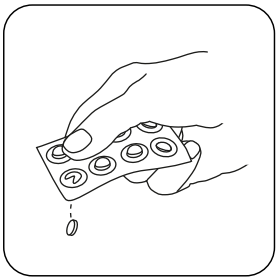
Press the **ZERO** button.



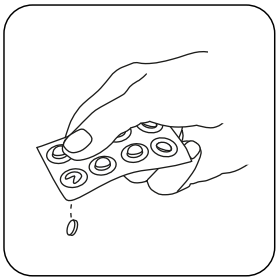
Remove the vial from the sample chamber.

Empty vial except for a few drops.

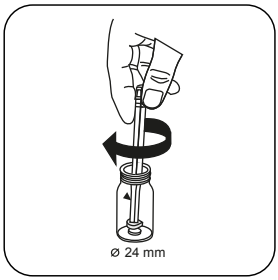
For devices that require **no ZERO measurement** , **start here**.



Add **DPD No. 1 tablet** .

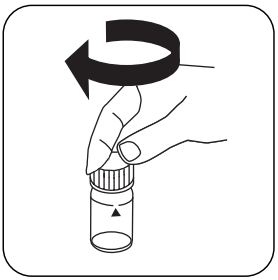


Add **DPD No. 3 tablet** .

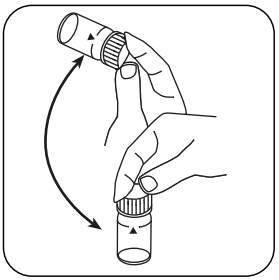


Crush tablet(s) by rotating slightly.

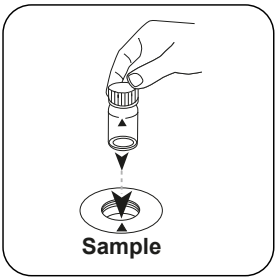
Fill up vial with **sample** to the **10 ml mark**.



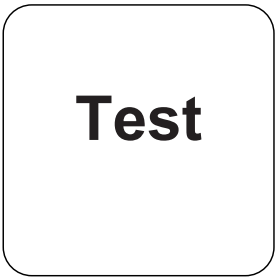
Close vial(s).



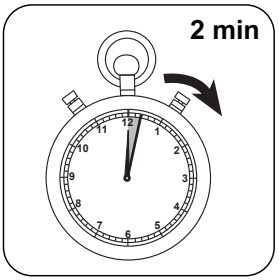
Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

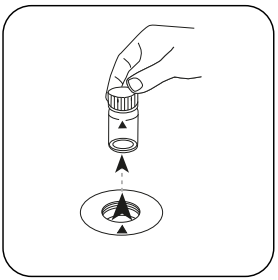


Press the **TEST** (XD: **START**)button.



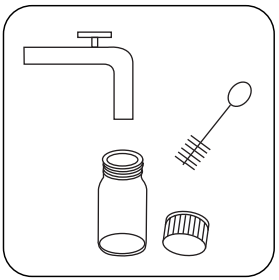
Wait for **2 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.



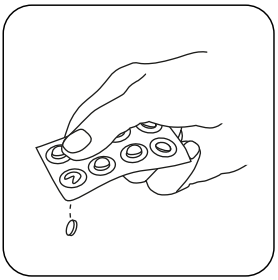
Remove the vial from the sample chamber.

Empty vial.

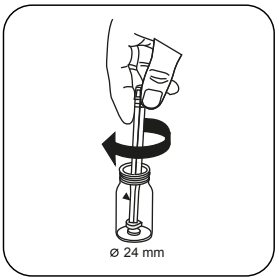


Thoroughly clean the vial and vial cap.

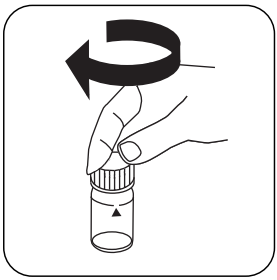
Fill a **second vial** with **10 ml sample** .



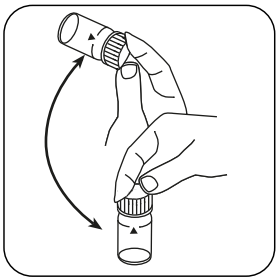
Add **GLYCINE tablet**.



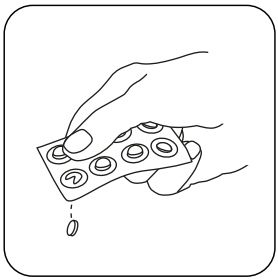
Crush tablet(s) by rotating slightly.



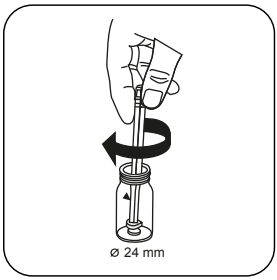
Close vial(s).



Dissolve tablet(s) by inverting.

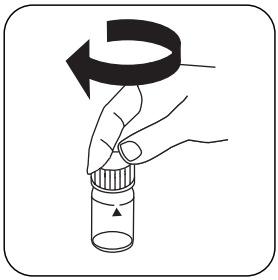


Add **one DPD No. 1 tablet** and **one DPD No. 3 tablet** straight from the foil into the first cleaned cuvette

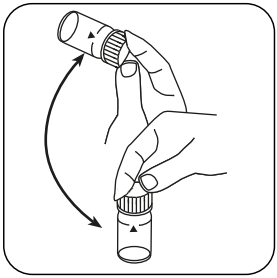


Crush tablet(s) by rotating slightly.

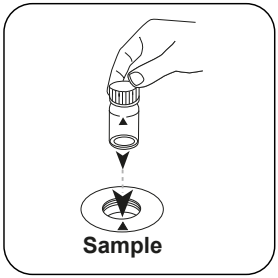
Fill prepared vial with prepared **glycine solution**.



Close vial(s).



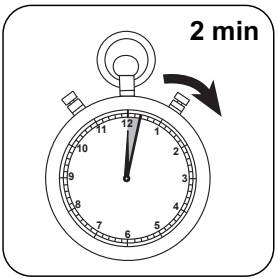
Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

Test

Press the **TEST** (XD: **START**)button.

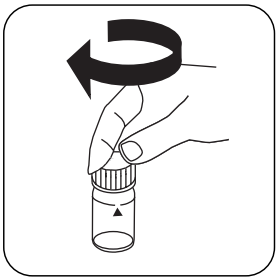


Wait for **2 minute(s) reaction time**.
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Ozone; mg/l total chlorine appears on the display.

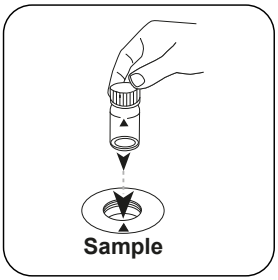
Implementation of the provision Ozone, in absence of chlorine with tablet

Select the method on the device
In addition, choose the test: without Chlorine
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

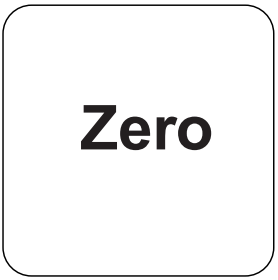
Fill 24 mm vial with **10 ml sample**.



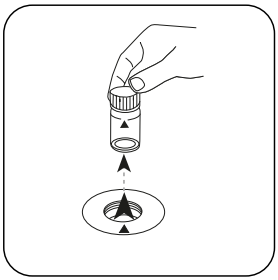
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



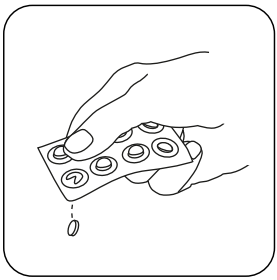
Press the **ZERO** button.



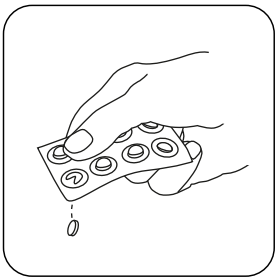
Remove the vial from the sample chamber.

Empty vial except for a few drops.

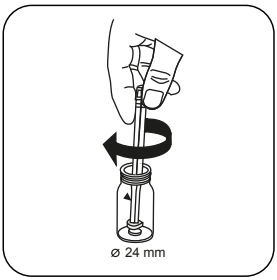
For devices that require **no ZERO measurement** , **start here**.



Add **DPD No. 1 tablet** .

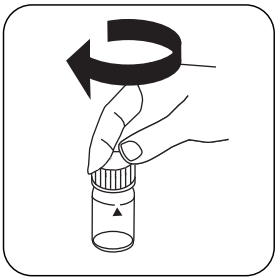


Add **DPD No. 3 tablet** .

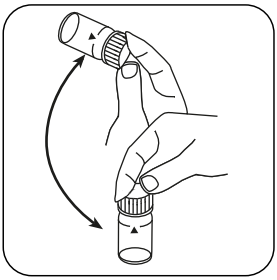


Crush tablet(s) by rotating slightly.

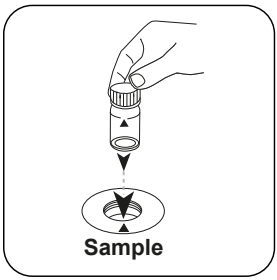
Fill up vial with **sample** to the **10 ml mark**.



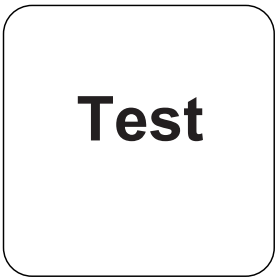
Close vial(s).



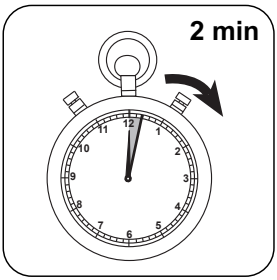
Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **2 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Ozone appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	O_3	1
mg/l	Cl_2	1.4771049

Chemical Method

DPD / Glycine

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ 10 mm
a	$-2.13541 \cdot 10^{-2}$	$-2.13541 \cdot 10^{-2}$
b	$1.19361 \cdot 10^{+0}$	$2.56626 \cdot 10^{+0}$
c	$-8.66457 \cdot 10^{-2}$	$-4.0052 \cdot 10^{-1}$
d	$9.31084 \cdot 10^{-2}$	$9.25346 \cdot 10^{-1}$
e		
f		

Interferences

Persistant Interferences

1. All oxidising agents in the samples react like chlorine, which leads to higher results.
2. Concentrations above 6 mg/L Ozone can lead to results within the measuring range of up to 0 mg/L. In this case, the water sample must be diluted. 10 ml of the diluted sample should be mixed with the reagent and the measurement taken again (plausibility test).

Bibliography

Colorimetric Chemical Analytical Methods, 9th Edition, Lovibond

Derived from

DIN 38408-3:2011-04

[e)] alternative reagent, used instead of DPD No.1/No.3 in case of turbidity in the water sample caused by high concentration of calcium and/or high conductivity | [f)] additionally required for determination of bromine, chlorine dioxide and ozone in the presence of chlorine | [#] including stirring rod, 10 cm

Ozone PP M301

0.015 - 2 mg/L O_3

DPD / Glycine

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640	ø 24 mm	530 nm	0.015 - 2 mg/L O_3
SpectroDirect, XD 7000, XD 7500	ø 24 mm	510 nm	0.015 - 2 mg/L O_3

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Chlorine Total DPD F10	Powder / 100 pc.	530120
Chlorine Total DPD F10	Powder / 1000 pc.	530123
Glycine [f)]	Tablet / 100	512170BT
Glycine [f)]	Tablet / 250	512171BT

Application List

- Drinking Water Treatment
- Boiler Water
- Waste Water Treatment
- Raw Water Treatment
- Pool Water Treatment
- Disinfection Control

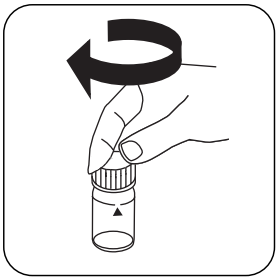
Preparation

1. Cleaning of vials:
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, the subsequent determination of oxidising agents (e.g. ozone and chlorine) may show lower results. To avoid measurement errors, the glassware used should be free of chlorine consumption. To achieve this, all glassware should be placed in a sodium hypochlorite solution (0.1 g/L) for one hour and then rinsed thoroughly with deionised water.
2. When preparing the sample, Ozone outgassing, e.g. through the pipette or shaking, must be avoided. The analysis must take place immediately after taking the sample.
3. Strong alkaline or acidic water samples must be adjusted between pH 6 and pH 7 before the analysis (use 0.5 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).

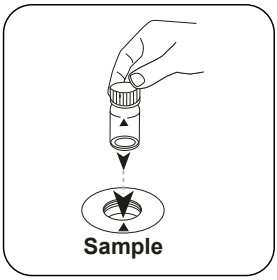
Implementation of the provision Ozone, in presence of chlorine with powder packs

Select the method on the device
In addition, choose the test: in presence of Chlorine
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

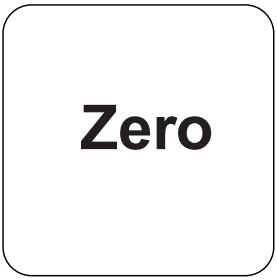
Fill 24 mm vial with **10 ml sample**.



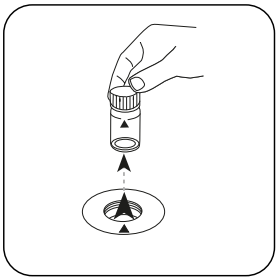
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

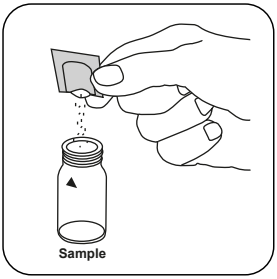


Press the **ZERO** button.

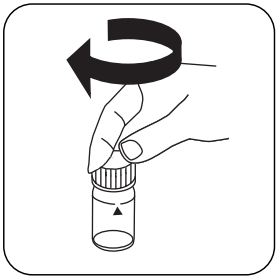


Remove the vial from the sample chamber.

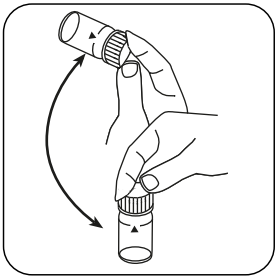
For devices that require **no ZERO measurement** , **start here**.



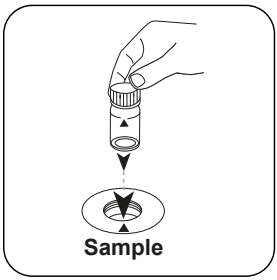
Add **Chlorine TOTAL-DPD/F 10 powder pack**.



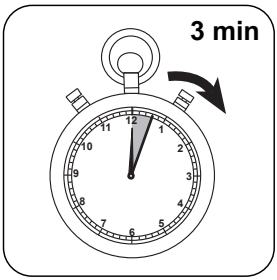
Close vial(s).



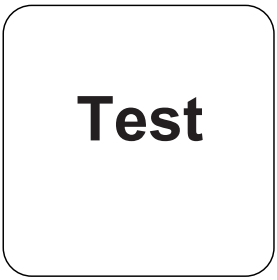
Invert several times to mix the contents (20 sec.).



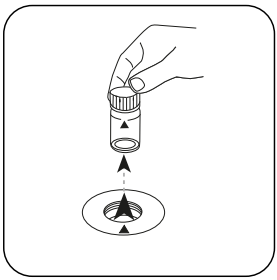
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Wait for **3 minute(s) reaction time**.



Press the **TEST** (XD: **START**)button.

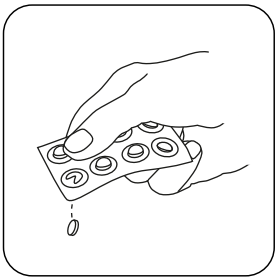


Remove the vial from the sample chamber.

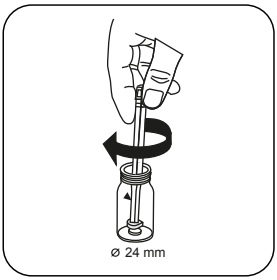
Empty vial.

Thoroughly clean the vial and vial cap.

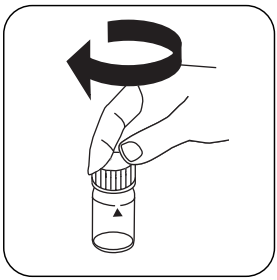
Fill 24 mm vial with **10 ml sample**.



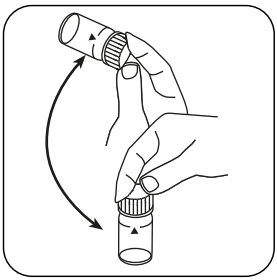
Add **GLYCINE tablet**.



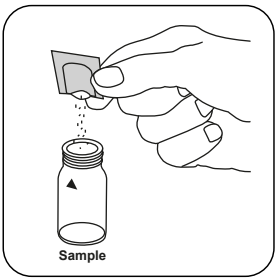
Crush tablet(s) by rotating slightly.



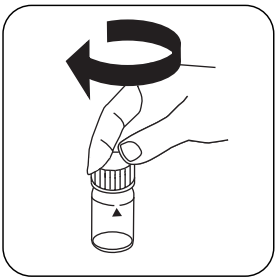
Close vial(s).



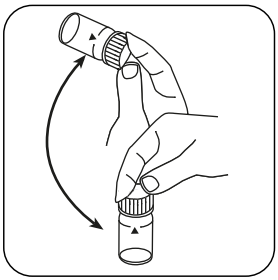
Dissolve tablet(s) by inverting.



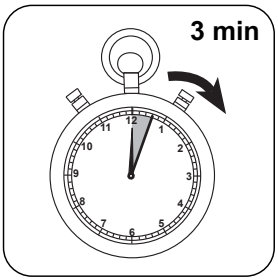
Add **Chlorine TOTAL-DPD/F 10 powder pack**.



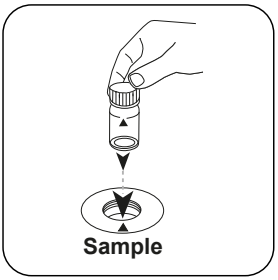
Close vial(s).



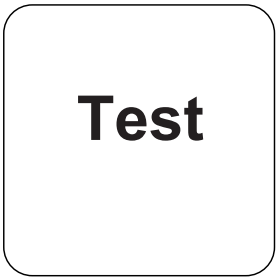
Invert several times to mix the contents (20 sec.).



Wait for **3 minute(s) reaction time**.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



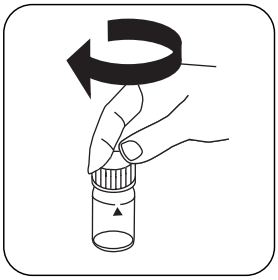
Press the **TEST** (XD: **START**)button.

The result in mg/l Ozone, mg/l total chlorine appears on the display.

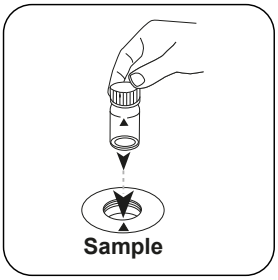
Implementation of the provision Ozone, in absence of chlorine with powder packs

Select the method on the device
In addition, choose the test: without Chlorine
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

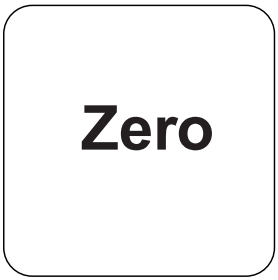
Fill 24 mm vial with **10 ml sample**.



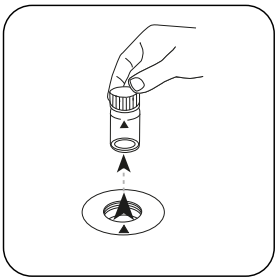
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

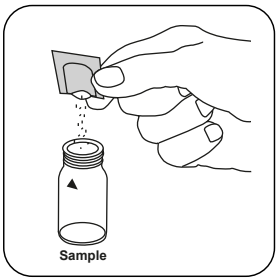


Press the **ZERO** button.

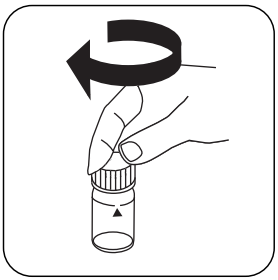


Remove the vial from the sample chamber.

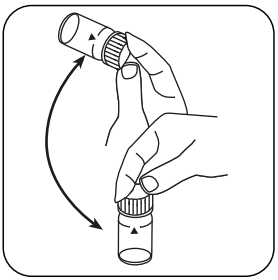
For devices that require **no ZERO measurement** , **start here**.



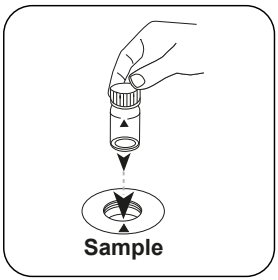
Add **Chlorine TOTAL-DPD/F 10 powder pack**.



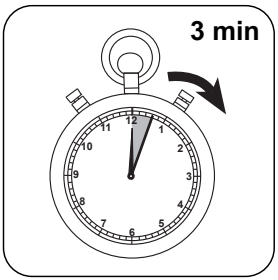
Close vial(s).



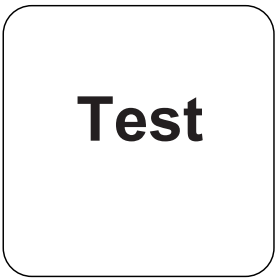
Invert several times to mix the contents (20 sec.).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Wait for **3 minute(s) reaction time**.



Press the **TEST** (XD: **START**)button.

The result in mg/l Ozone appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	O_3	1
mg/l	Cl_2	1.4771049

Chemical Method

DPD / Glycine

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ 10 mm
a	$-3.94263 \cdot 10^{-2}$	$-3.94263 \cdot 10^{-2}$
b	$1.70509 \cdot 10^{+0}$	$3.66594 \cdot 10^{+0}$
c		
d		
e		
f		

Interferences

Persistant Interferences

1. All oxidising agents in the samples react like chlorine, which leads to higher results.
2. Concentrations above 6 mg/L Ozone can lead to results within the measuring range of up to 0 mg/L. In this case, the water sample must be diluted. 10 ml of the diluted sample should be mixed with the reagent and the measurement taken again (plausibility test).

Method Validation

Limit of Detection	0.01 mg/L
Limit of Quantification	0.03 mg/L
End of Measuring Range	2 mg/L
Sensitivity	1.68 mg/L / Abs
Confidence Intervall	0.033 mg/L
Standard Deviation	0.014 mg/L
Variation Coefficient	1.34 %

[f] additionally required for determination of bromine, chlorine dioxide and ozone in the presence of chlorine

Phenol T M315

0.1 - 5 mg/L C_6H_5OH

4-Aminoantipyrine

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640	ø 24 mm	530 nm	0.1 - 5 mg/L C_6H_5OH
SpectroDirect, XD 7000, XD 7500	ø 24 mm	507 nm	0.1 - 5 mg/L C_6H_5OH

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Phenole No. 1	Tablet / 100	515950BT
Phenole No. 2	Tablet / 100	515960BT

Application List

- Waste Water Treatment
- Raw Water Treatment

Preparation

1. The aqueous sample solution should have a pH value between 3 and 11.

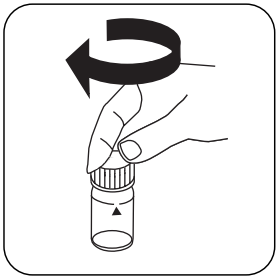
Notes

1. This method determines ortho- and metha-substituted phenols but not all para-substituted phenols (see: "Standard Methods of Examination of Water and Wastewater, 22nd Edition, 5-46ff.")

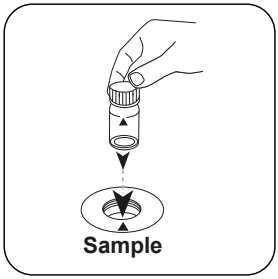
Implementation of the provision Phenol with Tablet

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

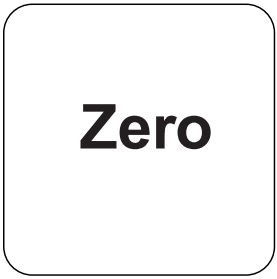
Fill 24 mm vial with **10 ml sample**.



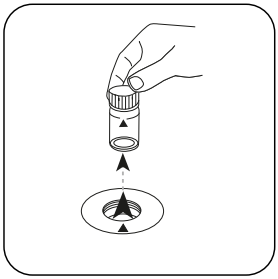
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

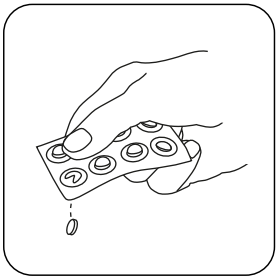


Press the **ZERO** button.

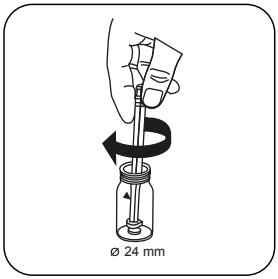


Remove the vial from the sample chamber.

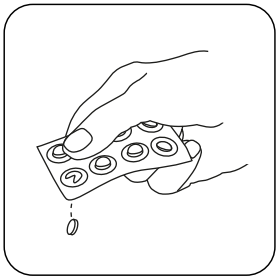
For devices that require **no ZERO measurement** , **start here**.



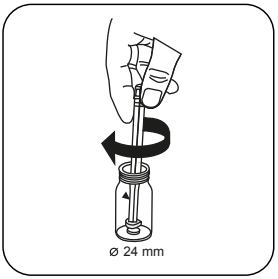
Add **PHENOLE No. 1 tablet** .



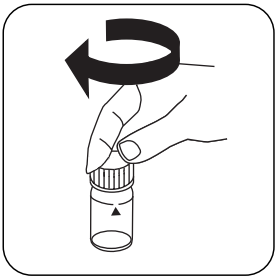
Crush tablet(s) by rotating slightly and dissolve.



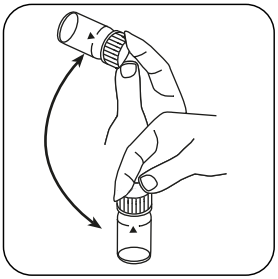
Add **PHENOLE No. 2 tablet** .



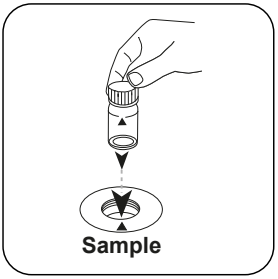
Crush tablet(s) by rotating slightly.



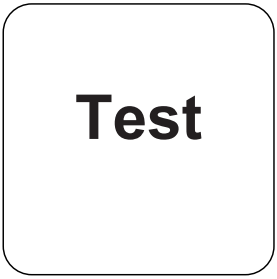
Close vial(s).



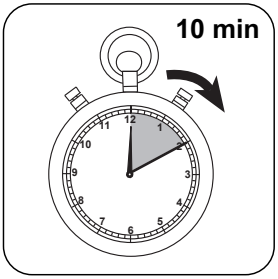
Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **10 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically. The result in mg/l Phenole appears on the display.

Chemical Method

4-Aminoantipyrine

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	-4.16246•10^{-2}	-4.16246•10^{-2}
b	3.18197•10^{+0}	6.84124•10^{+0}
c		
d		
e		
f		

Interferences

Removeable Interferences

1. In case of known or suspected interferences (e.g. phenol-decomposing bacteria, oxidizing agents, reducing agents, sulfur compounds and suspended solids) the sample should be pre-treated accordingly, see "Standard Methods for Examination of Water and Wastewater, 22nd Edition, 5-46 ff".

Method Validation

Limit of Detection	0.03 mg/L
Limit of Quantification	0.09 mg/L
End of Measuring Range	5 mg/L
Sensitivity	3.21 mg/L / Abs
Confidence Intervall	0.024 mg/L
Standard Deviation	0.01 mg/L
Variation Coefficient	0.39 %

According to

Standard Method 5530
US EPA Method 420.1

Phosphonate PP M316

0.2 - 125 mg/L PO_4

Persulfate UV Oxidation Method

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect	ø 24 mm	660 nm	0.2 - 125 mg/L PO_4
SpectroDirect, XD 7000, XD 7500	ø 24 mm	890 nm	0.2 - 125 mg/L PO_4

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Phosphonate Set	1 Set	535220

The following accessories are required.

Accessories	Packaging Unit	Part Number
UV Pen Lamp, 254 nm	1 pc.	400740

Application List

- Cooling Water

Preparation

1. All glassware must first be rinsed with diluted Hydrochloric acid (1:1) and then rinsed with deionised water. Do not use detergents with phosphates.

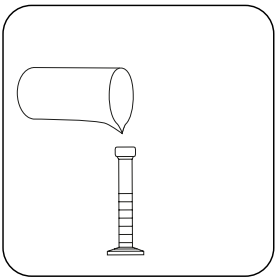
Notes

1. During UV digestion Phosphonates are converted to ortho-Phosphates. This step is normally completed in 10 minutes. Organic highly-loaded samples or a weak UV lamp can cause incomplete phosphate conversion to take place.
2. UV lamp available on request.
3. For handling of the UV lamp see manufacturer's manual. Do not touch the surface of the UV lamp. Fingerprints will erode the glass. Wipe the UV lamp with a soft and clean cloth between measurements.
4. The reagent Vario Phosphate Rgt. F10 is not completely dissolved.
5. The given reaction time of 2 minutes refers to a sample temperature of more than 15 °C. At a sample temperature lower than 15 °C, a reaction time of 4 minutes is required.

Digestion

Select the appropriate volume of sample according to the following table:

Expected measuring range (mg/L Phospho-nate)	Sample volume in ml	Factor
0 - 2.5	50	0.1
0 - 5.0	25	0.2
0 - 12.5	10	0.5
0 - 25	5	1.0
0 - 125	1	5.0

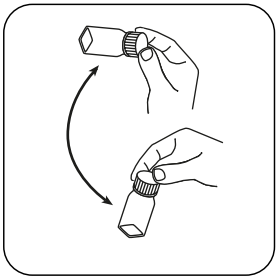


With the selected sample volume fill a 50 ml measuring cylinder. If necessary, fill up with demineralised water to 50 ml and mix.

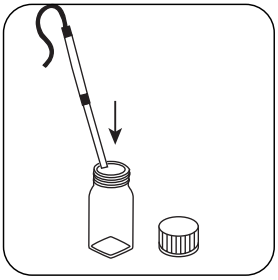
Fill one of the digestion vials with **25 ml of prepared sample**.

Add **Vario Potassium Persulfate F10 powder pack**.

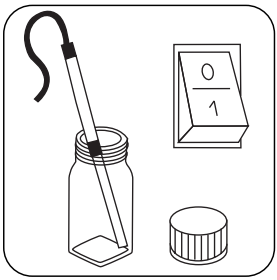
Close digestion vial



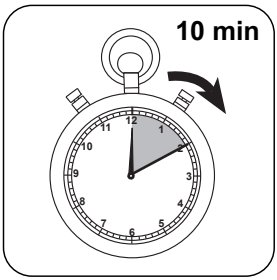
Swirl around to dissolve the powder.



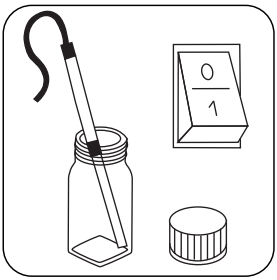
Keep the UV lamp in the sample. **Note: wear UV safety goggles!**



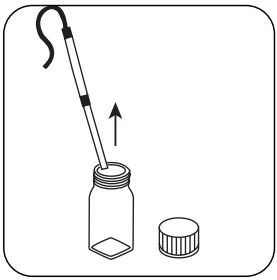
Turn on the UV lamp.



Wait for **10 minute(s) reaction time**.



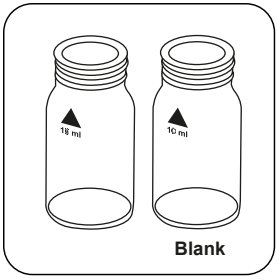
The UV lamp is switched off when the countdown is finished.



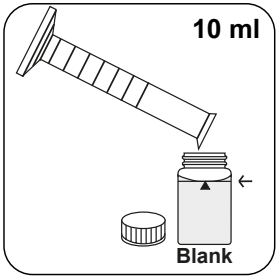
Remove the UV lamp from the sample.

Implementation of the provision Phosphonate Persulphate-UV oxidation method with Vario Powder Packs

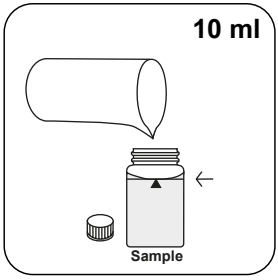
Select the method on the device
For testing of **Phosphonate with powder packs,** carry out the described **digestion**.



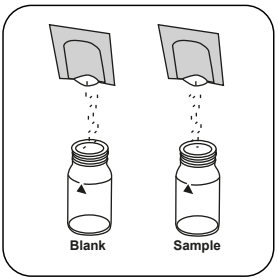
Prepare two clean 24 mm vials. Mark one as a blank.



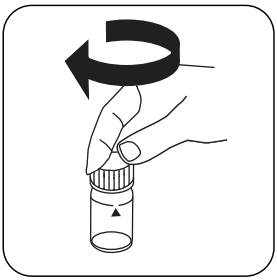
Fill blank with **10 ml prepared, not digested sample**.



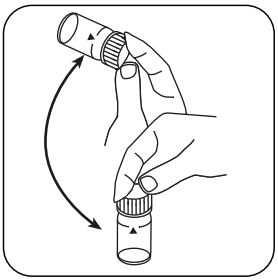
Fill sample vial with **10 ml prepared, digested sample**.



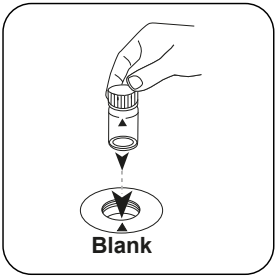
Add **a Vario Phosphate Rgt. F10 powder pack** in each vial.



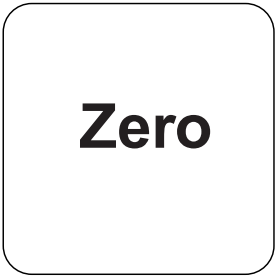
Close vial(s).



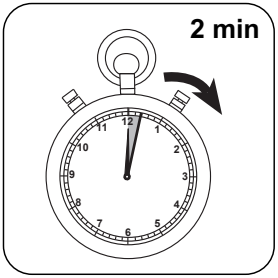
Invert several times to mix the contents (30 sec.).



Place **blank** in the sample chamber. • Pay attention to the positioning.

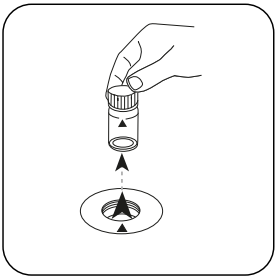


Press the **ZERO** button.

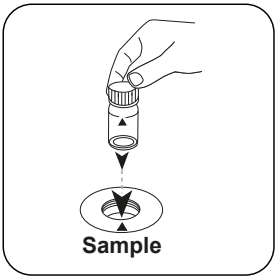


Wait for **2 minute(s) reaction time**.

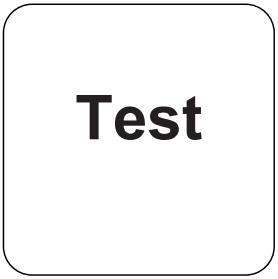
Once the reaction period is finished, the measurement takes place automatically.



Remove the vial from the sample chamber.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in mg/l PO_4^{3-} appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	PBTC	2.84
mg/l	NTP	1.05
mg/l	HEDPA	1.085
mg/l	EDTMPA	1.148
mg/l	HMDTMPA	1.295
mg/l	DETPMPA	1.207

Chemical Method

Persulfate UV Oxidation Method

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	$-9.32417 \cdot 10^{-1}$	$-9.32417 \cdot 10^{-1}$
b	$1.93355 \cdot 10^{+1}$	$4.15713 \cdot 10^{+1}$
c		
d		
e		
f		

Interferences

Interference	from / [mg/L]	Influence
Aluminium (from 100 mg/l)	1000	
Arsenic	in all concentrations	
Benzotriazoles	10	
HCO_3^-	1000	
Br^-	100	
Ca	5000	
CDTA	100	
Cl^-	5000	
CrO_4^{2-}	100	
Cu	100	
CN^-	100	
Diethanoldithiocarbamate	50	
EDTA	100	
Fe	200	
NO_3^-	200	
NTA	250	
PO_4^{3-}	15	
Phosphites, organic phosphorus compounds	Large quantities	Meta- and polyphosphates do not interfere
SiO_2	500	
$Si(OH)_4$	100	
SO_4^{2-}	2000	
S^{2-}	in all quantities	
SO_3^{2-}	100	
Thiourea (from 10 mg / l)	10	
Heavily buffered sample or samples with extreme pH values		May exceed the buffer capacity of the reagents

Bibliography

Blystone, P., Larson, P., A Rapid Method for Analysis of Phosphate Compounds, International Water Conference, Pittsburgh, PA. (Oct 26-28, 1981)

According to

Standard Method 4500-P I

Phosphate total LR TT M317

0.07 - 3 mg/L P[b)]

Phosphomolybdenum Blue

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	ø 16 mm	690 nm	0.07 - 3 mg/L P[b)]

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Phosphate-total LR/24	24 pc.	2419019

The following accessories are required.

Accessories	Packaging Unit	Part Number
Thermoreactor RD 125	1 pc.	2418940

Application List

- Waste Water Treatment
- Drinking Water Treatment
- Raw Water Treatment

Preparation

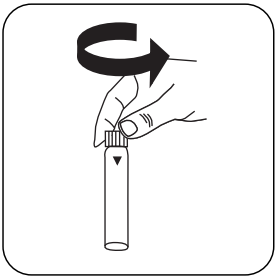
1. Strongly buffered samples or samples with extreme pH values should be adjusted to between pH 6 and pH 7 before the analysis (use 1 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).
2. Ortho-Phosphate ions react with the reagent to form an intense blue colour. Phosphate, which is found in organic and condensed, inorganic (meta-, pyro- and polyphosphate) forms, must therefore be converted into ortho-phosphate ions prior to analysis. The pretreatment of the sample with acid and heat creates the conditions for the hydrolysis of the condensed, inorganic forms. Organically bound phosphate can be converted into ortho-phosphate ions by heating with acid and Persulphate.
   The amount of organically bound phosphate can be calculated:
   mg/L organic Phosphate = mg/L Phosphate, total - mg/L Phosphate, can be hydrolysed in acid.

Notes

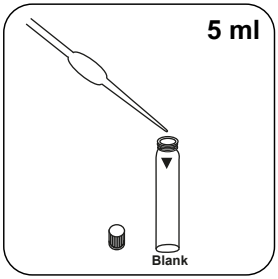
1. If a test is performed without digestion, only ortho-phosphates are recorded.

Implementation of the provision Phosphate, total LR with Vial Test

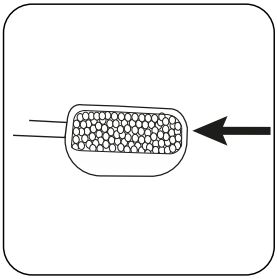
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



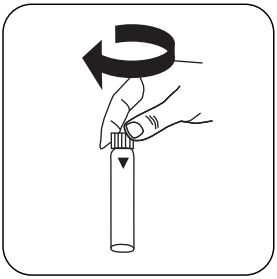
Open **digestion vial** .



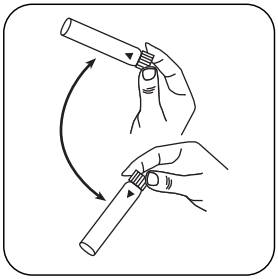
Put **5 ml sample** in the vial.



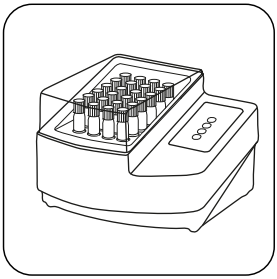
Add **a level measuring scoop No. 4 (white) Phosphate-103** .



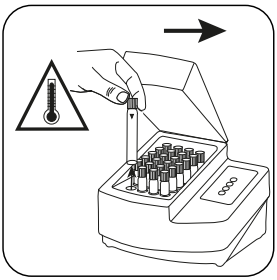
Close vial(s).



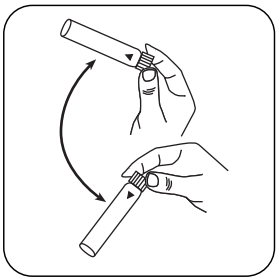
Invert several times to mix the contents.



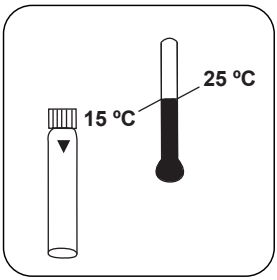
Seal the vials in the pre-heated thermoreactor for **30 minutes at 100 °C** .



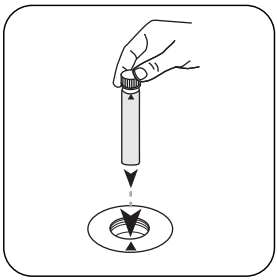
Remove the vial from the thermoreactor. **(Note: vial will be hot!)**



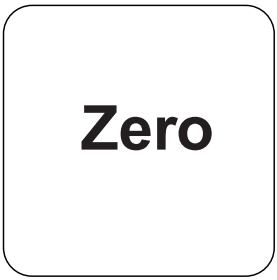
Invert several times to mix the contents.



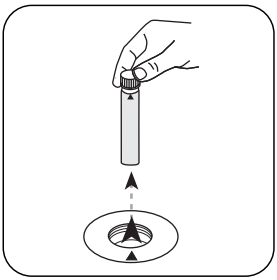
Allow the sample to cool to room temperature.



Place the supplied Zero vial (red sticker) in the sample chamber. • Pay attention to the positioning.

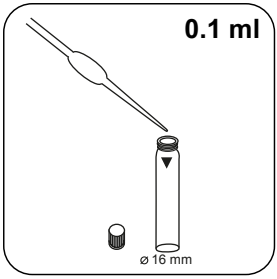


Press the **ZERO** button.

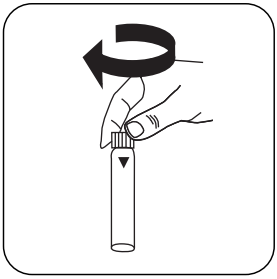


Remove **vial** from the sample chamber.

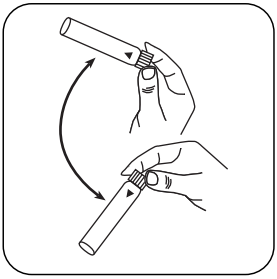
For devices that require **no ZERO measurement** , **start here**.



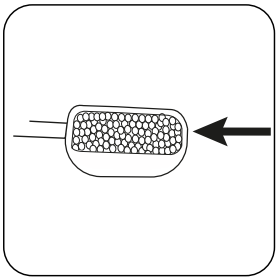
Add **0.1 ml (2 drops) Phosphate-101** to the digested sample.



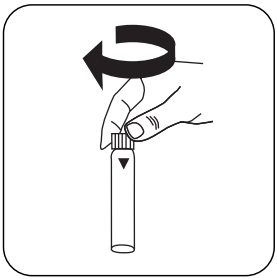
Close vial(s).



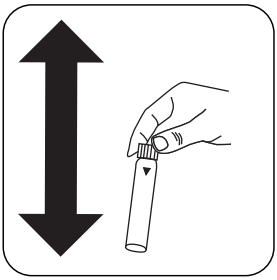
Invert several times to mix the contents.



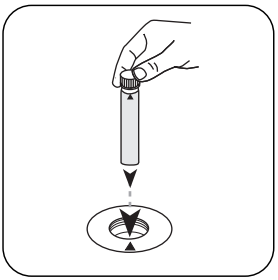
Add **a level measuring scoop No. 4 (white) Phosphate-102** .



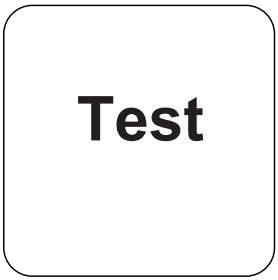
Close vial(s).



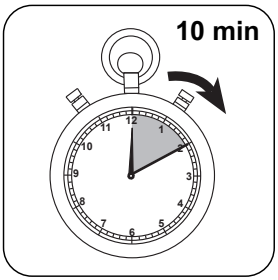
Dissolve the contents by shaking.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **10 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l total Phosphate appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	P	1
mg/l	PO_4^{3-}	3.066177
mg/l	P_2O_5	2.29137

Chemical Method

Phosphomolybdenum Blue

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 16 mm
a	$-6.41247 \cdot 10^{-2}$
b	$4.92913 \cdot 10^{+0}$
c	
d	
e	
f	

Interferences

Persistant Interferences

- Large amounts of unresolved solids can cause non-reproducible measurement results.

Interference	from / [mg/L]
Cu^{2+}	1
Ni^{2+}	10
Pb^{2+}	10
Fe^{2+}	100
Fe^{3+}	100

Interference	from / [mg/L]
Hg^{2+}	100
Hardness total	178,6 mmol/l (100 °dH)
NO_2^-	1
CrO_4^{2-}	10
p-PO_4	10
S^{2-}	10
SiO_2	10
CN^-	100
HCO_3^-	35,8 mmol/l (100 °dH)
Al^{3+}	500
Cr^{3+}	500
Cd^{2+}	1000
Mn^{2+}	1000
NH_4^+	1000
Zn^{2+}	1000
EDTA	100
Cl^-	1000
NO_3^-	1000
SO_4^{2-}	1000
SO_3^{2-}	1000

According to

ISO 6878-1-1986,
DIN 38405 D11-4
Standard Method 4500-P E
US EPA 365.2

[b] Reactor is necessary for COD (150 °C), TOC (120 °C) and total -chromium, - phosphate, -nitrogen, (100 °C)

Phosphate total HR TT M318

1.5 - 20 mg/L P[b)]

Phosphomolybdenum Blue

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	ø 16 mm	690 nm	1.5 - 20 mg/L P[b)]

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Phosphate-total HR/24	24 pc.	2420700

The following accessories are required.

Accessories	Packaging Unit	Part Number
Thermoreactor RD 125	1 pc.	2418940

Application List

- Waste Water Treatment
- Drinking Water Treatment
- Raw Water Treatment

Preparation

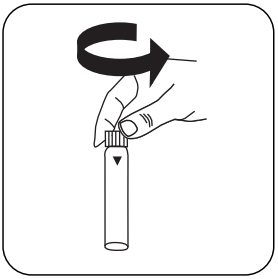
1. Strongly buffered samples or samples with extreme pH values should be adjusted to between pH 6 and pH 7 before the analysis (use 1 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).
2. Ortho-Phosphate ions react with the reagent to form an intense blue colour. Phosphate, which is found in organic and condensed, inorganic (meta-, pyro- and polyphosphate) forms, must therefore be converted into ortho-phosphate ions prior to analysis. The pretreatment of the sample with acid and heat creates the conditions for the hydrolysis of the condensed, inorganic forms. Organically bound phosphate can be converted into ortho-phosphate ions by heating with acid and Persulphate.
   The amount of organically bound phosphate can be calculated:
   mg/L organic Phosphate = mg/L Phosphate, total - mg/L Phosphate, can be hydrolysed in acid.

Notes

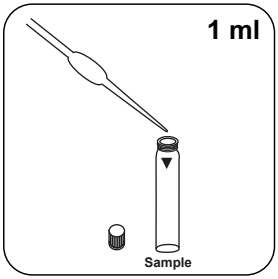
1. If a test is performed without digestion, only ortho-phosphates are recorded.

Implementation of the provision Phosphate, total HR with Vial Test

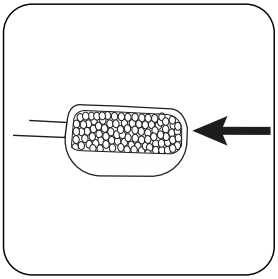
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



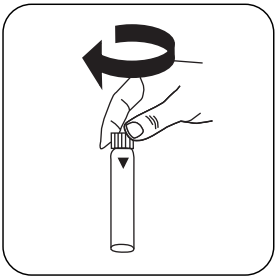
Open **digestion vial** .



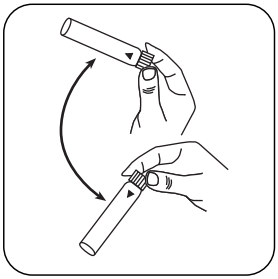
Put **1 ml sample** in the sample vial.



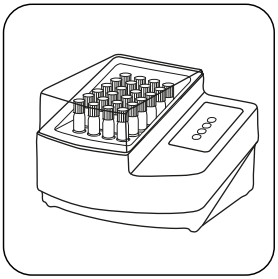
Add **a level measuring scoop No. 4 (white) Phosphate-103** .



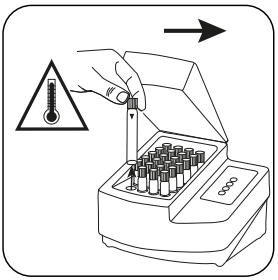
Close vial(s).



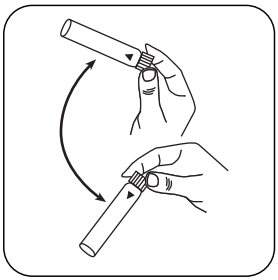
Invert several times to mix the contents.



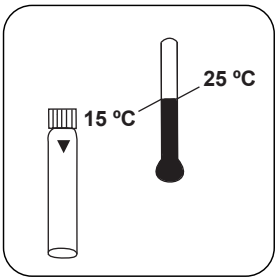
Seal the vials in the pre-heated thermoreactor for **30 minutes at 100 °C** .



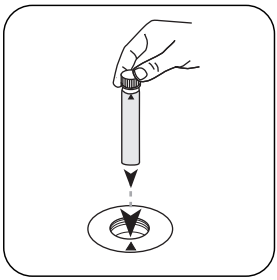
Remove the vial from the thermoreactor. **(Note: vial will be hot!)**



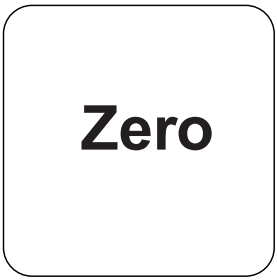
Invert several times to mix the contents.



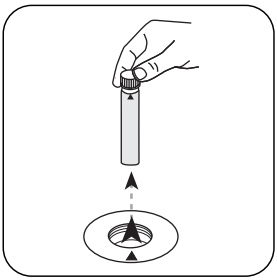
Allow the vial(s) to cool to room temperature.



Place the supplied Zero vial (red sticker) in the sample chamber. • Pay attention to the positioning.

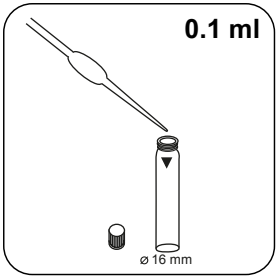


Press the **ZERO** button.

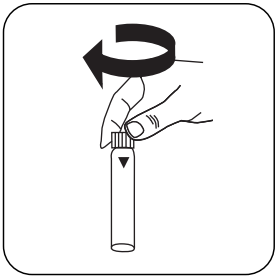


Remove **vial** from the sample chamber.

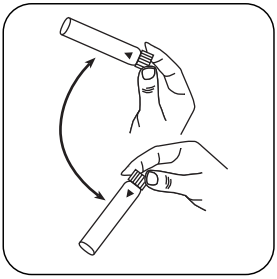
For devices that require **no ZERO measurement** , **start here**.



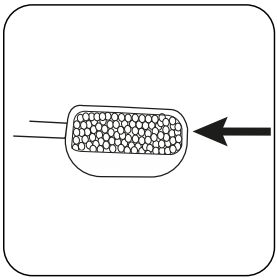
Add **0.1 ml (2 drops) Phosphate-101** to the digested sample.



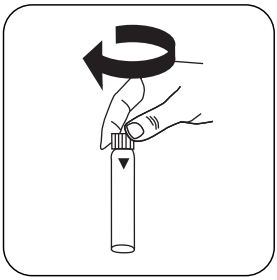
Close vial(s).



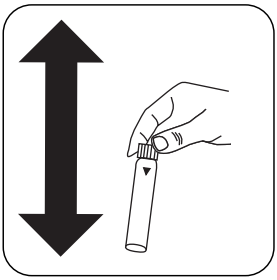
Invert several times to mix the contents.



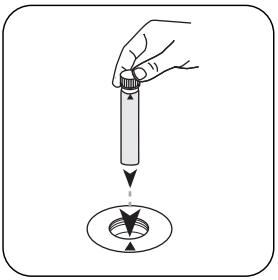
Add **a level measuring scoop No. 4 (white) Phosphate-102** .



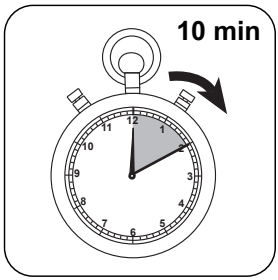
Close vial(s).



Dissolve the contents by shaking.



Test



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

Press the **TEST** (XD: **START**)button.

Wait for **10 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l total Phosphate appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	P	1
mg/l	PO_4^{3-}	3.066177
mg/l	P_2O_5	2.29137

Chemical Method

Phosphomolybdenum Blue

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 16 mm
a	$-2.31245 \cdot 10^{-1}$
b	$2.78092 \cdot 10^{+1}$
c	$4.2385 \cdot 10^{+0}$
d	
e	
f	

Interferences

Interference	from / [mg/L]
Cu^{2+}	5
Ni^{2+}	25
Pb^{2+}	25
Fe^{2+}	250
Fe^{3+}	250
Hg^{2+}	250
Al^{3+}	1000
Cr^{3+}	1000

Interference	from / [mg/L]
Cd^{2+}	1000
Mn^{2+}	1000
NH_4^+	1000
Zn^{2+}	1000
Hardness total	446,5 (2500 °dH)
NO_2^-	5
CrO_4^{2-}	30
p-PO_4	30
S^{2-}	30
SiO_2	30
CN^-	250
HCO_3^-	89,5 mmol/l (250 °dH)
EDTA	250
Cl^-	1000
NO_3^-	1000
SO_4^{2-}	1000
SO_3^{2-}	1000

According to

DIN ISO 15923-1 D49
Standard Method 4500-P E
US EPA 365.2

[b] Reactor is necessary for COD (150 °C), TOC (120 °C) and total -chromium, - phosphate, -nitrogen, (100 °C)

Phosphate LR T M319

0.05 - 4 mg/L P P

Phosphomolybdenum Blue

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
PM 600, PM 620, PM 630	ø 24 mm	610 nm	0.05 - 4 mg/L P

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Phosphate No. 1 LR	Tablet / 100	513040BT
Phosphate No. 2 LR	Tablet / 100	513050BT
Phosphate No. 2 LR	Tablet / 250	513051BT
Set Phosphate No. 1 LR/No. 2 LR 100 Pc. #	100 each	517651BT

Application List

- Waste Water Treatment
- Boiler Water
- Drinking Water Treatment
- Raw Water Treatment
- Pool Water Control

Preparation

1. Strongly buffered samples or samples with extreme pH values should be adjusted to between pH 6 and pH 7 before the analysis (use 1 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).
2. Ortho-Phosphate ions react with the reagent to form an intense blue colour. Phosphate, which is found in organic and condensed, inorganic (meta-, pyro- and polyphosphate) forms, must therefore be converted into ortho-phosphate ions prior to analysis. The pretreatment of the sample with acid and heat creates the conditions for the hydrolysis of the condensed, inorganic forms. Organically bound phosphate can be converted into ortho-phosphate ions by heating with acid and Persulphate. The amount of organically bound phosphate can be calculated:
mg/L organic Phosphate = mg/L Phosphate, total - mg/L Phosphate, can be hydrolysed in acid.

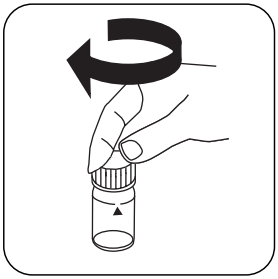
Notes

1. Only ortho-phosphate ions react.
2. The tablets must be added in the correct sequence.

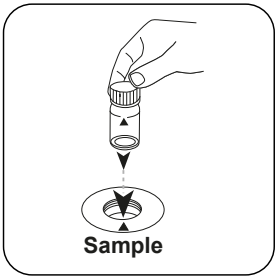
Implementation of the provision Phosphate, ortho LR with Tablet

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

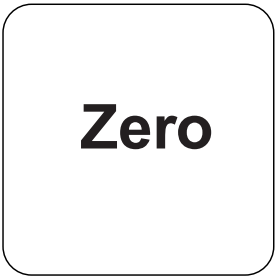
Fill 24 mm vial with **10 ml sample**.



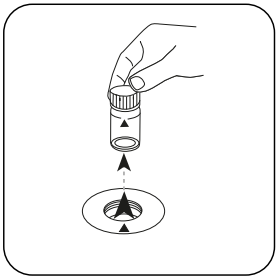
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

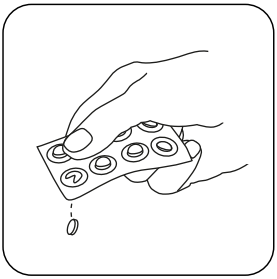


Press the **ZERO** button.

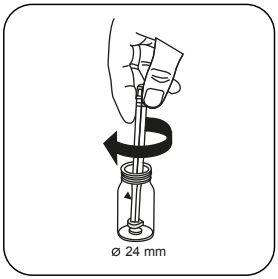


Remove the vial from the sample chamber.

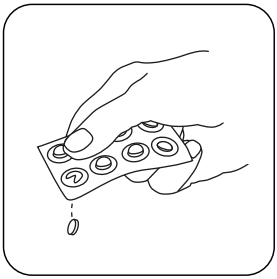
For devices that require **no ZERO measurement** , **start here**.



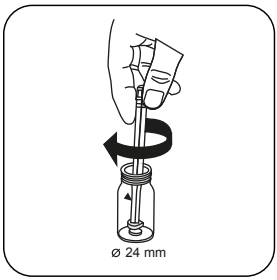
Add **PHOSPHATE No. 1 LR tablet**.



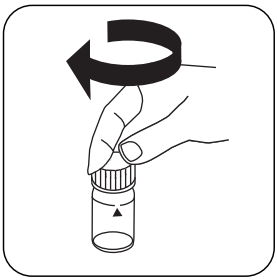
Crush tablet(s) by rotating slightly.



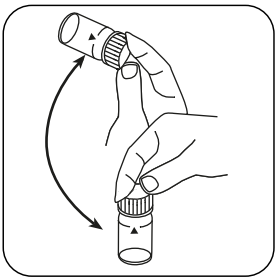
Add **PHOSPHATE No. 2 LR tablet**.



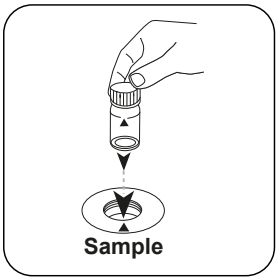
Crush tablet(s) by rotating slightly.



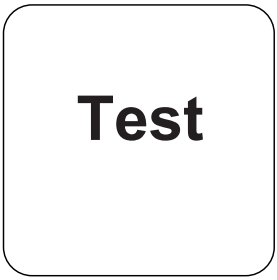
Close vial(s).



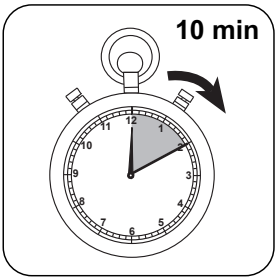
Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **10 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically. The result in mg/l ortho-Phosphate appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	P	1
mg/l	PO_4^{3-}	3.066177
mg/l	P_2O_5	2.29137

Chemical Method

Phosphomolybdenum Blue

Appendix

Interferences

Interference	from / [mg/L]
Al	200
AsO_4^{3-}	in allen Mengen
Cr	100
Cu	10
Fe	100
Ni	300
H_2S	in allen Mengen
SiO_2	50
S^{2-}	in allen Mengen
Zn	80
V(V)	große Mengen
W(VI)	große Mengen

According to

DIN ISO 15923-1 D49
Standard Method 4500-P E
US EPA 365.2

including stirring rod, 10 cm

Phosphate LR T M320

0.02 - 1.3 mg/L P PO4

Phosphomolybdenum Blue

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 110, MD 600, MD 610, MD 640, MultiDirect	ø 24 mm	660 nm	0.02 - 1.3 mg/L P
SpectroDirect	ø 24 mm	710 nm	0.02 - 1.3 mg/L P
XD 7000, XD 7500	ø 24 mm	710 nm	0.016 - 1.305 mg/L P

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Phosphate No. 1 LR	Tablet / 100	513040BT
Phosphate No. 2 LR	Tablet / 100	513050BT
Phosphate No. 2 LR	Tablet / 250	513051BT
Set Phosphate No. 1 LR/No. 2 LR 100 Pc. #	100 each	517651BT

Application List

- Waste Water Treatment
- Boiler Water
- Drinking Water Treatment
- Raw Water Treatment
- Pool Water Control

Preparation

1. Strongly buffered samples or samples with extreme pH values should be adjusted to between pH 6 and pH 7 before the analysis (use 1 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).
2. Ortho-Phosphate ions react with the reagent to form an intense blue colour. Phosphate, which is found in organic and condensed, inorganic (meta-, pyro- and polyphosphate) forms, must therefore be converted into ortho-phosphate ions prior to analysis. The pretreatment of the sample with acid and heat creates the conditions for the hydrolysis of the condensed, inorganic forms. Organically bound phosphate can be converted into ortho-phosphate ions by heating with acid and Persulphate. The amount of organically bound phosphate can be calculated:
mg/L organic Phosphate = mg/L Phosphate, total - mg/L Phosphate, can be hydrolysed in acid.

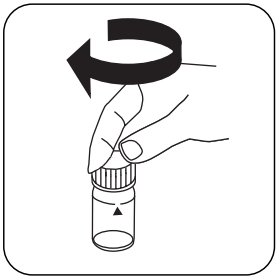
Notes

1. Only ortho-phosphate ions react.
2. The tablets must be added in the correct sequence.

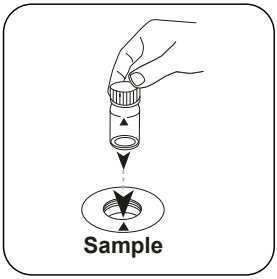
Implementation of the provision Phosphate, ortho LR with Tablet

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

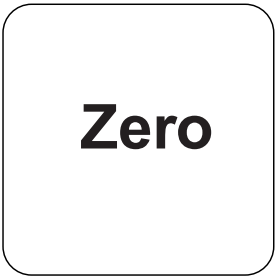
Fill 24 mm vial with **10 ml sample**.



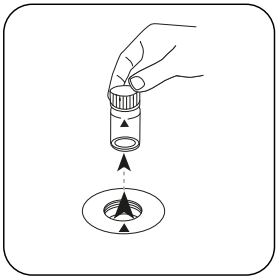
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

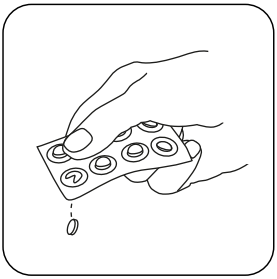


Press the **ZERO** button.

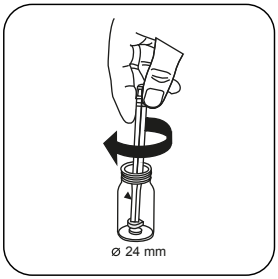


Remove the vial from the sample chamber.

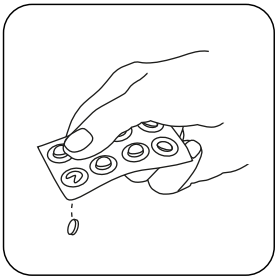
For devices that require **no ZERO measurement** , **start here**.



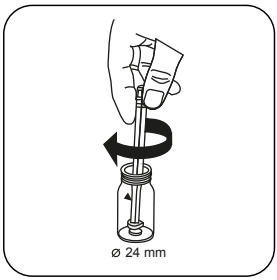
Add **PHOSPHATE No. 1 LR tablet**.



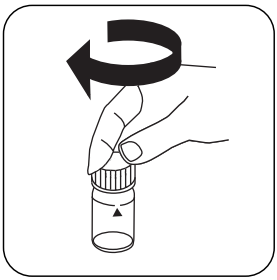
Crush tablet(s) by rotating slightly.



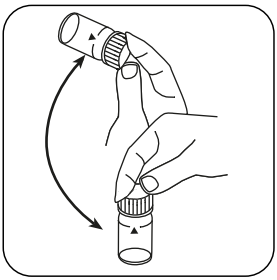
Add **PHOSPHATE No. 2 LR tablet**.



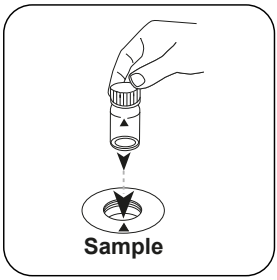
Crush tablet(s) by rotating slightly.



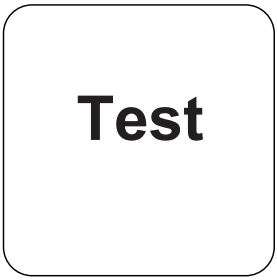
Close vial(s).



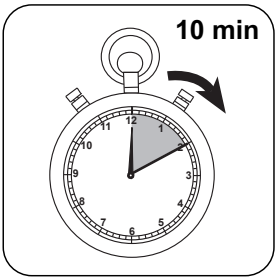
Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **10 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l ortho-Phosphate appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	P	1
mg/l	PO_4^{3-}	3.066177
mg/l	P_2O_5	2.29137

Chemical Method

Phosphomolybdenum Blue

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ 10 mm
a	$-3.51239 \cdot 10^{-2}$	$-3.51239 \cdot 10^{-2}$
b	$8.89272 \cdot 10^{-1}$	$1.91193 \cdot 10^{+0}$
c		
d		
e		
f		

Interferences

Interference	from / [mg/L]
Al	200
AsO_4^{3-}	in all quantities
Cr	100
Cu	10
Fe	100
Ni	300
H_2S	in all quantities
SiO_2	50

Interference	from / [mg/L]
S^{2-}	in all quantities
Zn	80
V(V)	large quantities
W(VI)	large quantities

According to

DIN ISO 15923-1 D49
Standard Method 4500-P E
US EPA 365.2

including stirring rod, 10 cm

Phosphate HR T M321

0.33 - 26 mg/L P

Vanadomolybdate

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect	ø 24 mm	430 nm	0.33 - 26 mg/L P
SpectroDirect	ø 24 mm	470 nm	0.33 - 26 mg/L P
XD 7000, XD 7500	ø 24 mm	470 nm	0.33 - 26.09 mg/L P

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Set Phosphate No. 1 HR/No. 2 HR 100 Pc. #	100 each	517661BT
Phosphate HR P1	Tablet / 100	515810BT
Phosphate HR P2	Tablet / 100	515820BT

Application List

- Waste Water Treatment
- Boiler Water
- Drinking Water Treatment
- Raw Water Treatment

Preparation

1. Strongly buffered samples or samples with extreme pH values should be adjusted to between pH 6 and pH 7 before the analysis (use 1 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).
2. Ortho-Phosphate ions react with the reagent to form an intense yellow colour. Phosphate, which is found in organic and condensed, inorganic (meta-, pyro- and polyphosphate) forms, must therefore be converted into ortho-phosphate ions prior to analysis. The pretreatment of the sample with acid and heat creates the conditions for the hydrolysis of the condensed, inorganic forms. Organically bound phosphate can be converted into ortho-phosphate ions by heating with acid and Persulphate. The amount of organically bound phosphate can be calculated:
mg/L organic Phosphate = mg/L Phosphate, total - mg/L Phosphate, can be hydrolysed in acid.

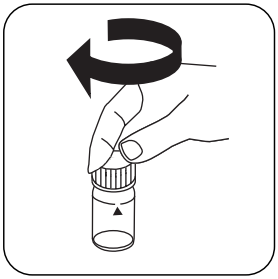
Notes

1. Only ortho-phosphate ions react.
2. For samples under 5 mg/L PO_4 it is recommended to analyse the water sample using Method 320 ”Phosphate ortho LR with Tablet“.

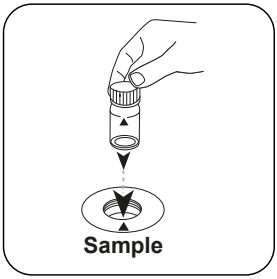
Implementation of the provision Phosphate, ortho HR with Tablet

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

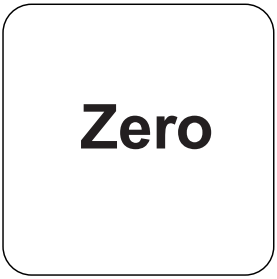
Fill 24 mm vial with **10 ml sample**.



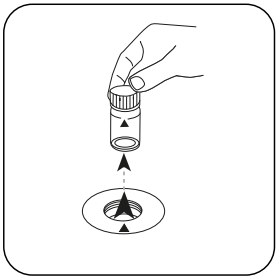
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

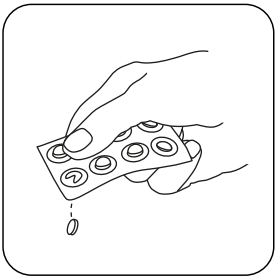


Press the **ZERO** button.

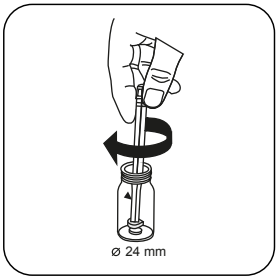


Remove the vial from the sample chamber.

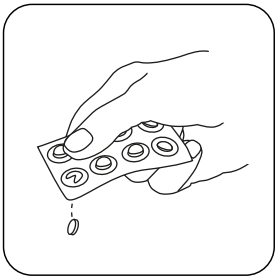
For devices that require **no ZERO measurement** , **start here**.



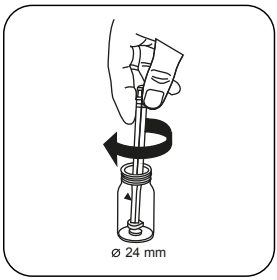
Add **PHOSPHATE HR P1 tablet** .



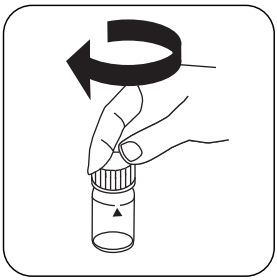
Crush tablet(s) by rotating slightly.



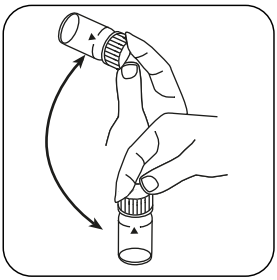
Add **PHOSPHATE HR P2 tablet** .



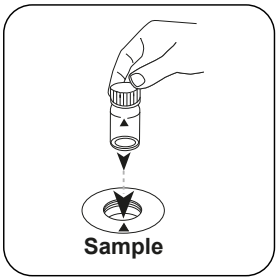
Crush tablet(s) by rotating slightly.



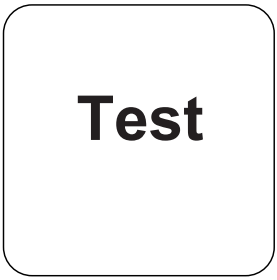
Close vial(s).



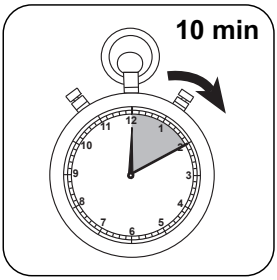
Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **10 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically. The result in mg/l ortho-Phosphate appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	P	1
mg/l	PO_4^{3-}	3.066177
mg/l	P_2O_5	2.29137

Chemical Method

Vanadomolybdate

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ 10 mm
a	$-2.62225 \cdot 10^{+0}$	$-2.62225 \cdot 10^{+0}$
b	$2.53376 \cdot 10^{+1}$	$5.44759 \cdot 10^{+1}$
c	$2.7388 \cdot 10^{+0}$	$1.26601 \cdot 10^{+1}$
d		
e		
f		

Interferences

Interference	from / [mg/L]
Al	200
AsO_4^{3-}	in all quantities
Cr	100
Cu	10
Fe	100
Ni	300
H_2S	in all quantities

Interference	from / [mg/L]
SiO_2	50
$Si(OH)_4$	10
S^{2-}	in all quantities
Zn	80

According to

Standard Method 4500-P E

including stirring rod, 10 cm

Phosphate HR TT M322

1 - 20 mg/L P

Vanadomolybdate

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect	ø 16 mm	438 nm	1 - 20 mg/L P
XD 7000, XD 7500	ø 16 mm	438 nm	0.98 - 19.57 mg/L P

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Phosphate-ortho/24	24 pc.	2420701

Application List

- Waste Water Treatment
- Boiler Water
- Drinking Water Treatment
- Raw Water Treatment

Preparation

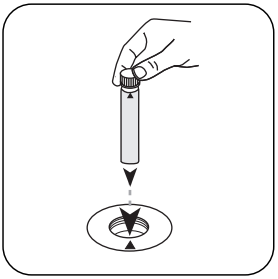
1. Strongly buffered samples or samples with extreme pH values should be adjusted to between pH 6 and pH 7 before the analysis (use 1 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).
2. Ortho-Phosphate ions react with the reagent to form an intense yellow colour. Phosphate, which is found in organic and condensed, inorganic (meta-, pyro- and polyphosphate) forms, must therefore be converted into ortho-phosphate ions prior to analysis. The pretreatment of the sample with acid and heat creates the conditions for the hydrolysis of the condensed, inorganic forms. Organically bound phosphate can be converted into ortho-phosphate ions by heating with acid and Persulphate.
   The amount of organically bound phosphate can be calculated:
   mg/L organic Phosphate = mg/L Phosphate, total - mg/L Phosphate, can be hydrolysed in acid.

Notes

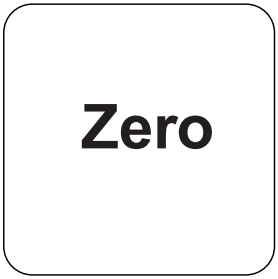
1. Only ortho-phosphate ions react.

Implementation of the provision Phosphate, ortho with Vial Test

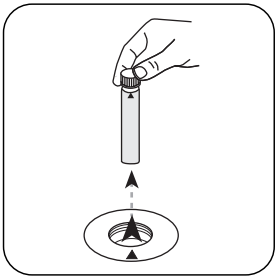
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



Place the supplied Zero vial (red sticker) in the sample chamber. • Pay attention to the positioning.

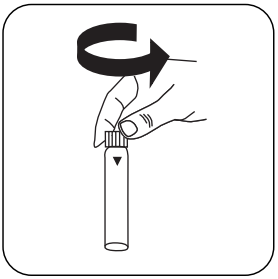


Press the **ZERO** button.

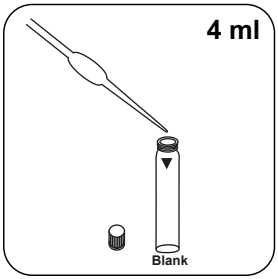


Remove **vial** from the sample chamber.

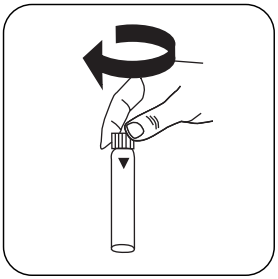
For devices that require **no ZERO measurement** , **start here**.



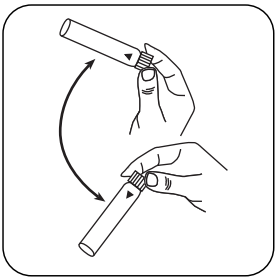
Open a **digestion vial**.



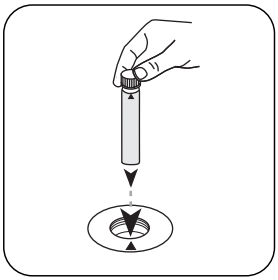
Put **4 ml sample** in the vial.



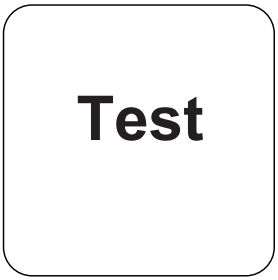
Close vial(s).



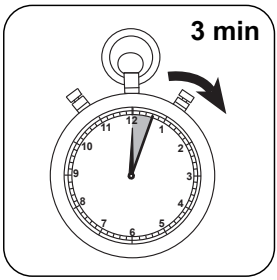
Invert several times to mix the contents.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **3 minute(s) reaction time**.
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l ortho-Phosphate appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	P	1
mg/l	PO_4^{3-}	3.066177
mg/l	P_2O_5	2.29137

Chemical Method

Vanadomolybdate

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 16 mm
a	$-6.17854 \cdot 10^{-1}$
b	$3.31124 \cdot 10^{+1}$
c	
d	
e	
f	

Interferences

Interference	from / [mg/L]
Al	200
AsO_4^{3-}	in all quantities
Cr	100
Cu	10
Fe	100
Ni	300
H_2S	in all quantities

Interference	from / [mg/L]
SiO_2	50
$Si(OH)_4$	10
S^{2-}	in all quantities
Zn	80

According to

Standard Method 4500-P E

Phosphate PP M323

0.02 - 0.8 mg/L P PO4

Phosphomolybdenum Blue

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 600, MD 610, MD 640, MultiDirect	ø 24 mm	660 nm	0.02 - 0.8 mg/L P
SpectroDirect	ø 24 mm	890 nm	0.02 - 0.8 mg/L P
XD 7000, XD 7500	ø 24 mm	890 nm	0.02 - 0.815 mg/L P

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
VARIO PHOS 3 F10	Powder / 100 pc.	531550

Application List

- Waste Water Treatment
- Boiler Water
- Drinking Water Treatment
- Raw Water Treatment
- Pool Water Control

Preparation

1. Strongly buffered samples or samples with extreme pH values should be adjusted to between pH 6 and pH 7 before the analysis (use 1 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).
2. Ortho-Phosphate ions react with the reagent to form an intense blue colour. Phosphate, which is found in organic and condensed, inorganic (meta-, pyro- and polyphosphate) forms, must therefore be converted into ortho-phosphate ions prior to analysis. The pretreatment of the sample with acid and heat creates the conditions for the hydrolysis of the condensed, inorganic forms. Organically bound phosphate can be converted into ortho-phosphate ions by heating with acid and Persulphate.
   The amount of organically bound phosphate can be calculated:
   mg/L organic Phosphate = mg/L Phosphate, total - mg/L Phosphate, can be hydrolysed in acid.

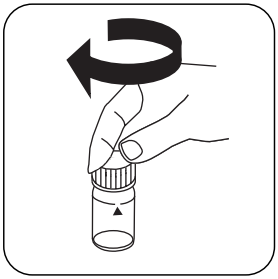
Notes

1. The reagent Vario Phosphate Rgt. F10 is not completely dissolved.

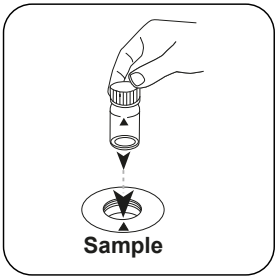
Implementation of the provision Phosphate, ortho with Vario Powder Packs

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

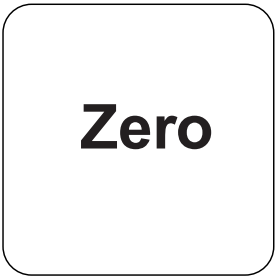
Fill 24 mm vial with **10 ml sample**.



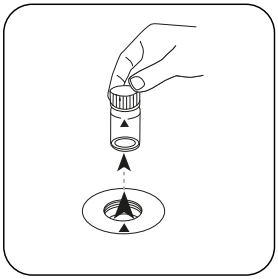
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

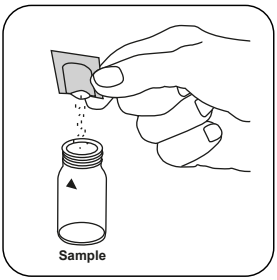


Press the **ZERO** button.

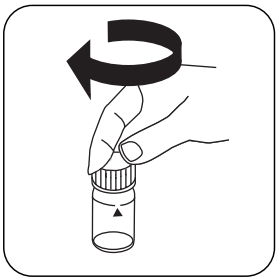


Remove the vial from the sample chamber.

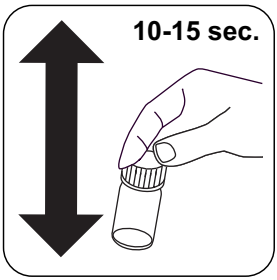
For devices that require **no ZERO measurement** , **start here**.



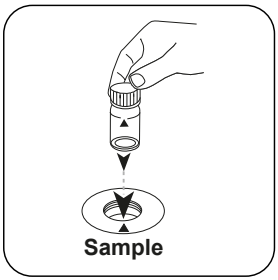
Add **Vario Phosphate Rgt. F10 powder pack**.



Close vial(s).



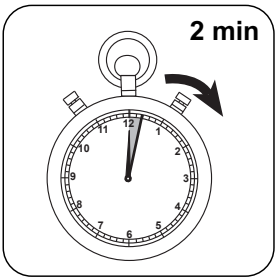
Mix the contents by shaking. (10-15 sec.).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

Test

Press the **TEST** (XD: **START**)button.



Wait for **2 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l ortho-Phosphate appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	P	1
mg/l	PO_4^{3-}	3.066177
mg/l	P_2O_5	2.29137

Chemical Method

Phosphomolybdenum Blue

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ 10 mm
a	$-2.76562 \cdot 10^{-2}$	$-2.76562 \cdot 10^{-2}$
b	$6.41362 \cdot 10^{-1}$	$1.37893 \cdot 10^{+0}$
c		
d		
e		
f		

Interferences

Interference	from / [mg/L]
Al	200
AsO_4^{3-}	in all quantities
Cr	100
Cu	10
Fe	100
Ni	300
H_2S	in all quantities

Interference	from / [mg/L]
SiO_2	50
$Si(OH)_4$	10
S^{2-}	in all quantities
Zn	80

According to

DIN ISO 15923-1 D49
Standard Method 4500-P E
US EPA 365.2

Phosphate TT M324

0.06 - 5 mg/L P

Phosphomolybdenum Blue

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect	ø 16 mm	660 nm	0.06 - 5 mg/L P
SpectroDirect	ø 16 mm	890 nm	0.02 - 1.6 mg/L P
XD 7000, XD 7500	ø 16 mm	890 nm	0.02 - 1.63 mg/L P

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
VARIO Phosphate-Ortho, Set	1 Set	535200

Application List

- Waste Water Treatment
- Boiler Water
- Drinking Water Treatment
- Raw Water Treatment

Preparation

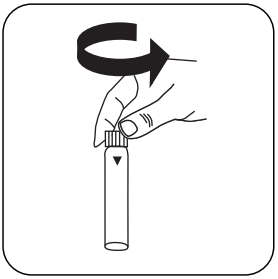
1. Strongly buffered samples or samples with extreme pH values should be adjusted to between pH 6 and pH 7 before the analysis (use 1 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).
2. Ortho-Phosphate ions react with the reagent to form an intense blue colour. Phosphate, which is found in organic and condensed, inorganic (meta-, pyro- and polyphosphate) forms, must therefore be converted into ortho-phosphate ions prior to analysis. The pretreatment of the sample with acid and heat creates the conditions for the hydrolysis of the condensed, inorganic forms. Organically bound phosphate can be converted into ortho-phosphate ions by heating with acid and Persulphate.
   The amount of organically bound phosphate can be calculated:
   mg/L organic Phosphate = mg/L Phosphate, total - mg/L Phosphate, can be hydrolysed in acid.

Notes

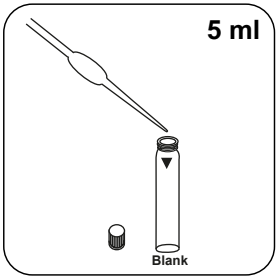
1. The reagent is not completely dissolved.

Implementation of the provision Phosphate, ortho with Vario Vial Test

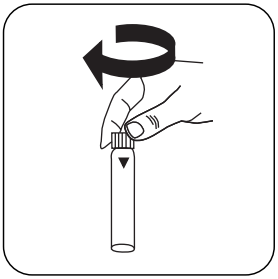
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



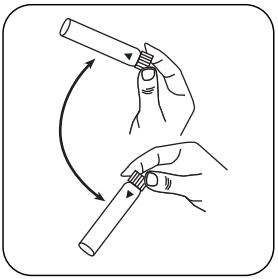
Open **digestion vial Phosphate Dilution** .



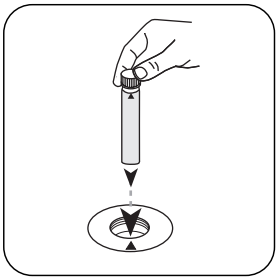
Put **5 ml sample** in the vial.



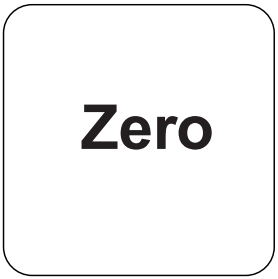
Close vial(s).



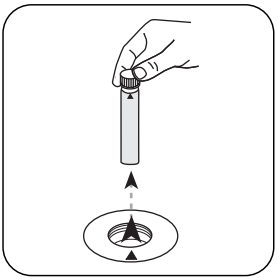
Invert several times to mix the contents.



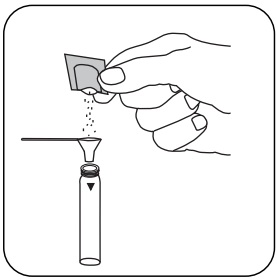
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



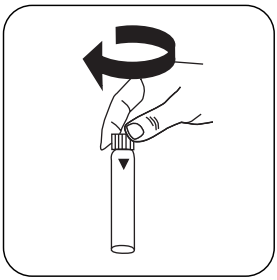
Press the **ZERO** button.



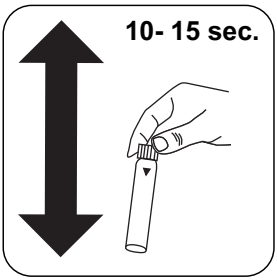
Remove **vial** from the sample chamber.
For devices that require **no ZERO measurement** , **start here**.



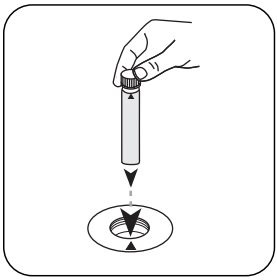
Add **Vario Phosphate Rgt. F10 powder pack**.



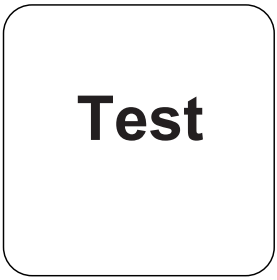
Close vial(s).



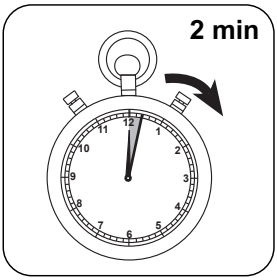
Mix the contents by shaking. (10- 15 sec.).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **2 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l ortho-Phosphate appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	P	1
mg/l	PO_4^{3-}	3.066177
mg/l	P_2O_5	2.29137

Chemical Method

Phosphomolybdenum Blue

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 16 mm
a	$2.18629 \cdot 10^{-2}$
b	$1.71913 \cdot 10^{+0}$
c	
d	
e	
f	

Interferences

Persistant Interferences

- Large amounts of unresolved solids can cause non-reproducible measurement results.

Interference	from / [mg/L]
Al	200
AsO_4^{3-}	in all quantities
Cr	100
Cu	10
Fe	100
Ni	300

Interference	from / [mg/L]
H_2S	in all quantities
SiO_2	50
$Si(OH)_4$	10
S^{2-}	in all quantities
Zn	80

According to

DIN ISO 15923-1 D49
Standard Method 4500-P E

Phosphate h. TT M325

0.02 - 1.6 mg/L P[b)]

Phosphomolybdenum Blue

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect	ø 16 mm	660 nm	0.02 - 1.6 mg/L P[b)]
SpectroDirect, XD 7000, XD 7500	ø 16 mm	890 nm	0.02 - 1.6 mg/L P[b)]

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
VARIO Phosphate, acid hydrolyzable, Total Set	1 Set	535250

The following accessories are required.

Accessories	Packaging Unit	Part Number
Thermoreactor RD 125	1 pc.	2418940

Application List

- Waste Water Treatment
- Drinking Water Treatment
- Raw Water Treatment

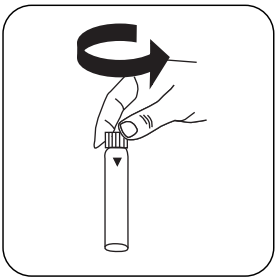
Preparation

1. Strongly buffered samples or samples with extreme pH values should be adjusted to between pH 6 and pH 7 before the analysis (use 1 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).
2. Ortho-Phosphate ions react with the reagent to form an intense blue colour. Phosphate, which is found in organic and condensed, inorganic (meta-, pyro- and polyphosphate) forms, must therefore be converted into ortho-phosphate ions prior to analysis. The pretreatment of the sample with acid and heat creates the conditions for the hydrolysis of the condensed, inorganic forms. Organically bound phosphate can be converted into ortho-phosphate ions by heating with acid and Persulphate. The amount of organically bound phosphate can be calculated:
mg/L organic Phosphate = mg/L Phosphate, total - mg/L Phosphate, can be hydrolysed in acid.

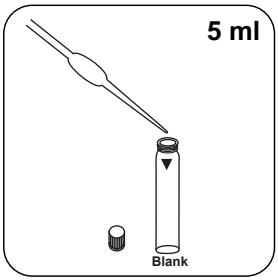
Notes

1. The reagent Vario Phosphat Rgt. F 10 need to be shaked directly after addition like described in the following procedure. If significant time elapsed before shaking precision can be decreased. After 10 to 15 sec. of shaking some parts of the reagent stay undissolved.

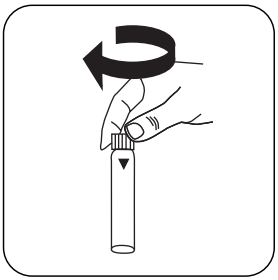
Digestion



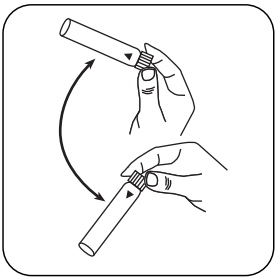
Open a digestion vial **PO_4-P Acid Reagent**.



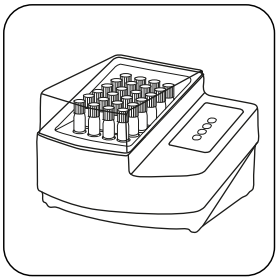
Put **5 ml sample** in the vial.



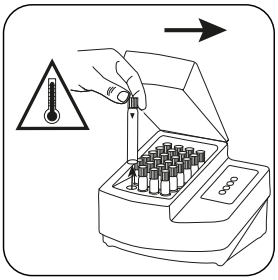
Close vial(s).



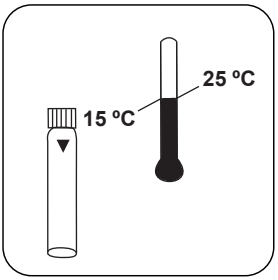
Invert several times to mix the contents.



Seal the vials in the pre-heated thermoreactor for **30 minutes at 100 °C** .



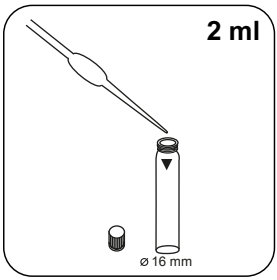
Remove the vial from the thermoreactor. **(Note: vial will be hot!)**



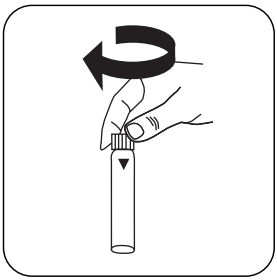
Allow the sample to cool to room temperature.

Implementation of the provision Phosphate, can be hydrolysed in acid, with Vario Vial Test

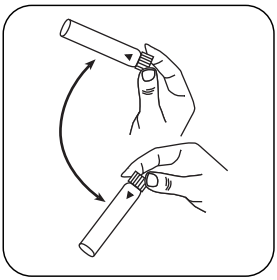
Select the method on the device
For testing of **Phosphate, acid hydrolyzable, with Vario tube tests,** carry out the described **digestion**.



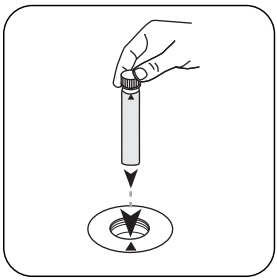
Add **2 ml 1,00 N Sodium Hydroxide solution** to the digested sample.



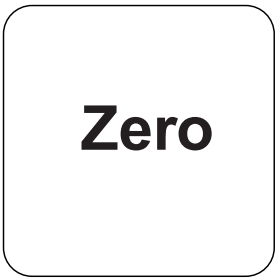
Close vial(s).



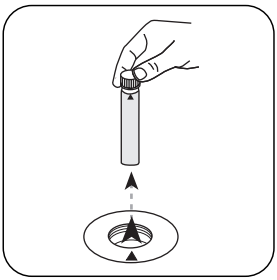
Invert several times to mix the contents.



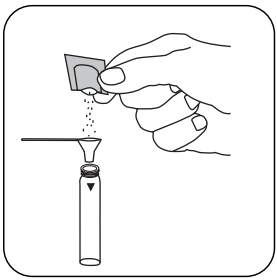
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



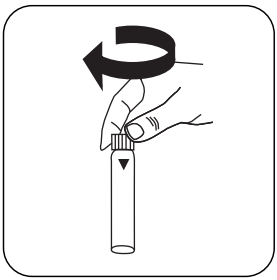
Press the **ZERO** button.



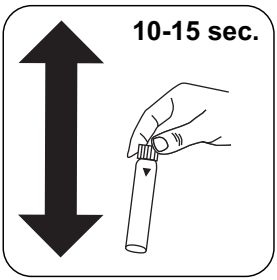
Remove **vial** from the sample chamber.



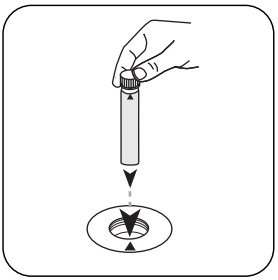
Add **Vario Phosphate Rgt. F10 powder pack**.



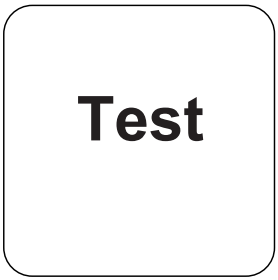
Close vial(s).



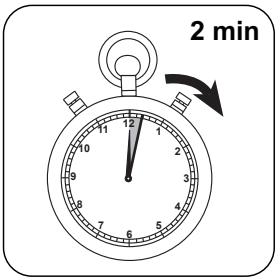
Mix the contents by shaking. (10-15 sec.).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **2 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l acid hydrolyzable Phosphate appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	P	1
mg/l	PO_4^{3-}	3.066177
mg/l	P_2O_5	2.29137

Chemical Method

Phosphomolybdenum Blue

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 16 mm
a	$-1.65745 \cdot 10^{-2}$
b	$1.75186 \cdot 10^{+0}$
c	
d	
e	
f	

Interferences

Persistant Interferences

- Large amounts of unresolved solids can cause non-reproducible measurement results.

Interference	from / [mg/L]
Al	200
AsO_4^{3-}	in all quantities
Cr	100
Cu	10
Fe	100

Interference	from / [mg/L]
Ni	300
H_2S	in all quantities
SiO_2	50
$Si(OH)_4$	10
S^{2-}	in all quantities
Zn	80

According to

ISO 6878-1-1986,
DIN 38405 D11-4
Standard Method 4500-P E
US EPA 365.2

[b] Reactor is necessary for COD (150 °C), TOC (120 °C) and total -chromium, - phosphate, -nitrogen, (100 °C)

Phosphate t. TT M326

0.02 - 1.1 mg/L P[b)]

Phosphomolybdenum Blue

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect	ø 16 mm	660 nm	0.02 - 1.1 mg/L P[b)]
SpectroDirect, XD 7000, XD 7500	ø 16 mm	890 nm	0.02 - 1.1 mg/L P[b)]

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
VARIO Phosphate, Total Set	1 Set	535210

The following accessories are required.

Accessories	Packaging Unit	Part Number
Thermoreactor RD 125	1 pc.	2418940

Application List

- Waste Water Treatment
- Drinking Water Treatment
- Raw Water Treatment

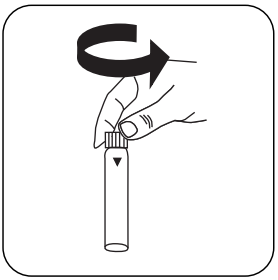
Preparation

1. Strongly buffered samples or samples with extreme pH values should be adjusted to between pH 6 and pH 7 before the analysis (use 1 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).
2. Ortho-Phosphate ions react with the reagent to form an intense blue colour. Phosphate, which is found in organic and condensed, inorganic (meta-, pyro- and polyphosphate) forms, must therefore be converted into ortho-phosphate ions prior to analysis. The pretreatment of the sample with acid and heat creates the conditions for the hydrolysis of the condensed, inorganic forms. Organically bound phosphate can be converted into ortho-phosphate ions by heating with acid and Persulphate. The amount of organically bound phosphate can be calculated:
mg/L organic Phosphate = mg/L Phosphate, total - mg/L Phosphate, can be hydrolysed in acid.

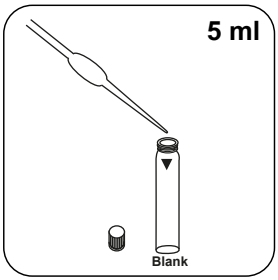
Notes

1. The reagent Vario Phosphat Rgt. F 10 need to be shaked directly after addition like described in the following procedure. If significant time elapsed before shaking precision can be decreased. After 10 to 15 sec. of shaking some parts of the reagent stay undissolved.

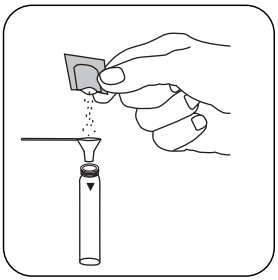
Digestion



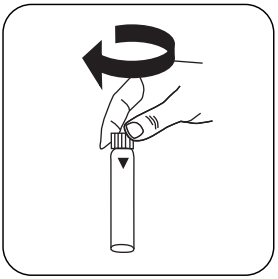
Open a digestion vial **PO_4-P Acid Reagent**.



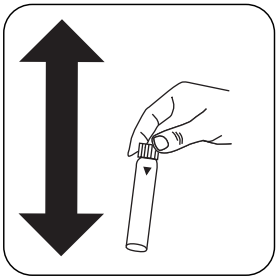
Put **5 ml sample** in the vial.



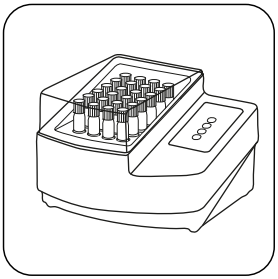
Add **Vario Potassium Persulfate F10 powder pack**.



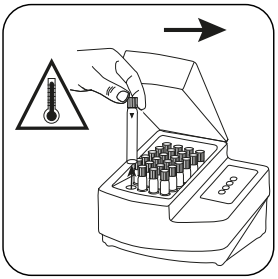
Close vial(s).



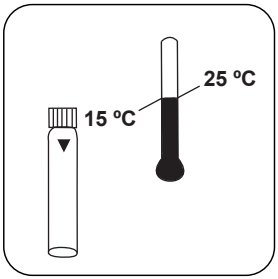
Mix the contents by shaking.



Seal the vials in the pre-heated thermoreactor for **30 minutes at 100 °C** .



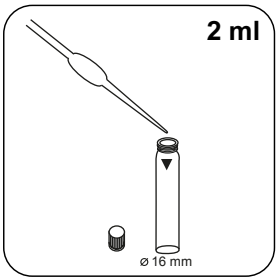
Remove the vial from the thermoreactor. **(Note: vial will be hot!)**



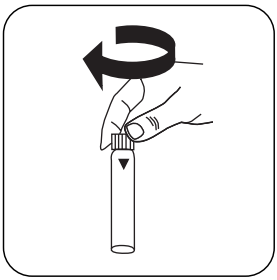
Allow the sample to cool to room temperature.

Implementation of the provision Phosphate, total with Vario Vial Test

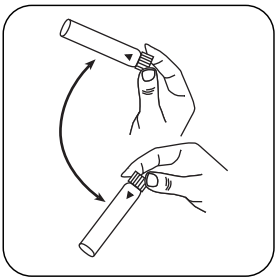
Select the method on the device
For testing of **Phosphate, total with Vario Vial Test,** carry out the described **digestion**.



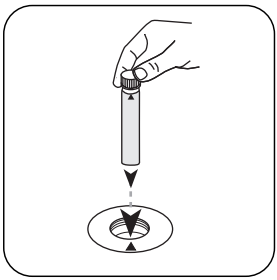
Add **2 ml 1,54 N Sodium Hydroxide Solution** to the digested sample.



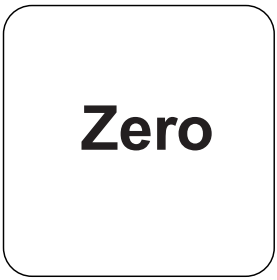
Close vial(s).



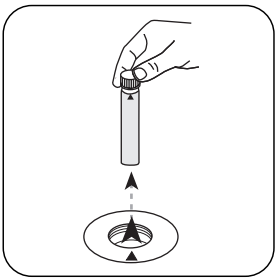
Invert several times to mix the contents.



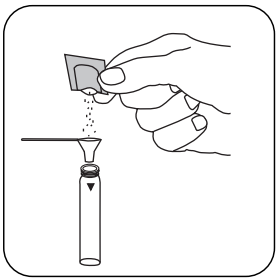
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



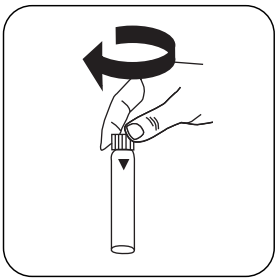
Press the **ZERO** button.



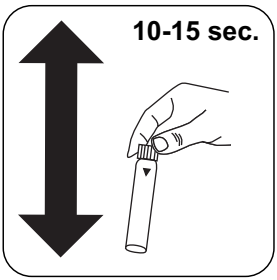
Remove **vial** from the sample chamber.



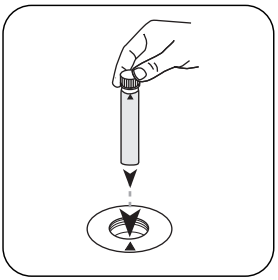
Add **Vario Phosphate Rgt. F10 powder pack**.



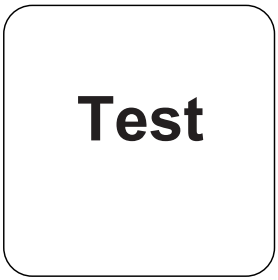
Close vial(s).



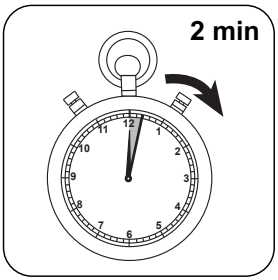
Mix the contents by shaking. (10-15 sec.).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **2 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l total Phosphate appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	P	1
mg/l	PO_4^{3-}	3.066177
mg/l	P_2O_5	2.29137

Chemical Method

Phosphomolybdenum Blue

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 16 mm
a	$-8.23365 \cdot 10^{-3}$
b	$1.74336 \cdot 10^{+0}$
c	
d	
e	
f	

Interferences

Persistant Interferences

- Large amounts of unresolved solids can cause non-reproducible measurement results.

Interference	from / [mg/L]
Al	200
AsO_4^{3-}	in all quantities
Cr	100
Cu	10
Fe	100

Interference	from / [mg/L]
Ni	300
H_2S	in all quantities
SiO_2	50
$Si(OH)_4$	10
S^{2-}	in all quantities
Zn	80

According to

ISO 6878-1-1986,
DIN 38405 D11-4
Standard Method 4500-P E
US EPA 365.2

[b] Reactor is necessary for COD (150 °C), TOC (120 °C) and total -chromium, - phosphate, -nitrogen, (100 °C)

Phosphate HR C M327

1.6 - 13 mg/L P[c)]

Vanadomolybdate

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect, XD 7000, XD 7500	ø 13 mm	430 nm	1.6 - 13 mg/L P[c)]

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Vacu-vial Phosphate Test Kit	1 Set	380460

The following accessories are required.

Accessories	Packaging Unit	Part Number
Adapter for round cuvettes 13 mm	1 pc.	19802192
Adapter (13 mm) MultiDirect for Vacu-vial	1 pc.	192075

Application List

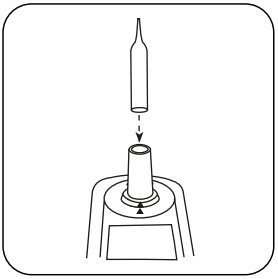
- Waste Water Treatment
- Boiler Water
- Drinking Water Treatment
- Raw Water Treatment

Notes

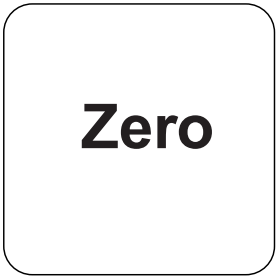
1. This method is adapted from a product by CHEMetrics. The measuring range and wavelength used for this photometer may differ from the data specified by CHEMetrics.
2. Before performing the test, you must read through the original instructions and safety data sheet that is delivered with the test kit (MSDS are also available on the homepage of www.chemetrics.com).
3. Vacu-vials® is a registered trademark of the company CHEMetrics, Inc. / Calverton, U.S.A.
4. Only ortho-phosphate ions react.

Implementation of the provision Phosphate HR, ortho with Vacu Vials® K-8503

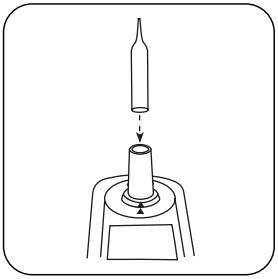
Select the method on the device



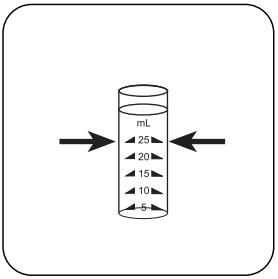
Place **Zero ampoule** in the sample chamber.



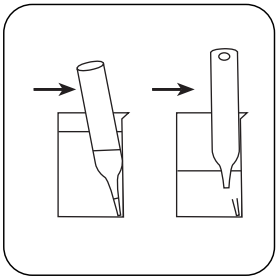
Press the **ZERO** button.



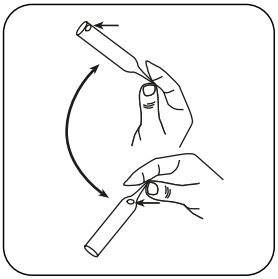
Remove zero ampoule from the sample chamber.



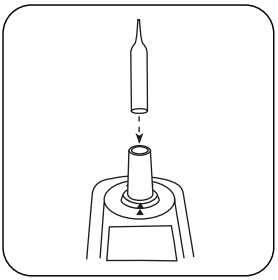
Fill the sample glass to the 25 ml mark with the sample.



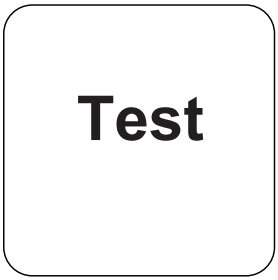
Place a Vacu-vial® ampoule in the sampling vessel. Break off the ampoule tip by applying light pressure against the vessel wall. Wait for the ampoule to fill completely.



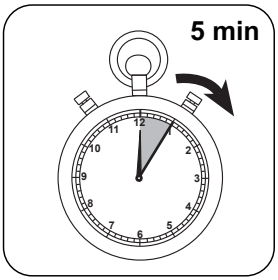
Invert the ampoule several times, allowing the bubble to move from one end to the other. Dry the outside.



Place the ampoule in the sample chamber.



Press the **TEST** (XD: **START**)button.



Wait for **5 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically. The result in mg/l ortho-Phosphate appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	P	1
mg/l	PO_4^{3-}	3.066
mg/l	P_2O_5	2.3

Chemical Method

Vanadomolybdate

Appendix

Interferences

Persistant Interferences

- Sulphide, thiosulphate, and Thiocyanide produce lower test results.

Interference	from / [mg/L]
Al	200
AsO_4^{3-}	in all quantities
Cr	100
Cu	10
Fe	100
Ni	300
SiO_2	50
$Si(OH)_4$	10
S^{2-}	in all quantities
Zn	80

According to

Standard Method 4500-P E

[c] MultiDirect: Adapter is necessary for Vacu-vials® (Order code 19 20 75)

Phosphate LR C M328

0.02 - 1.6 mg/L P[c)]

Stannous Chloride

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect	ø 13 mm	660 nm	0.02 - 1.6 mg/L P[c)]
XD 7000, XD 7500	ø 13 mm	660 nm	0.016 - 1.6 mg/L P[c)]

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Vacu-vial Phosphate Test Kit	1 Set	380480

The following accessories are required.

Accessories	Packaging Unit	Part Number
Adapter for round cuvettes 13 mm	1 pc.	19802192
Adapter (13 mm) MultiDirect for Vacu-vial	1 pc.	192075

Application List

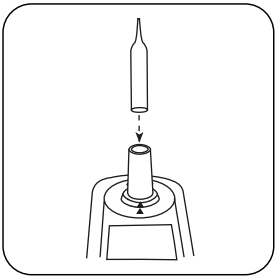
- Waste Water Treatment
- Boiler Water
- Drinking Water Treatment
- Raw Water Treatment

Notes

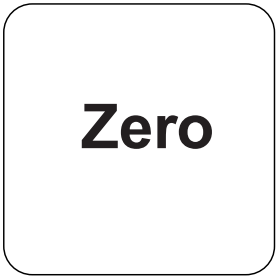
1. This method is adapted from a product by CHEMetrics. The measuring range and wavelength used for this photometer may differ from the data specified by CHEMetrics.
2. Before performing the test, you must read through the original instructions and safety data sheet that is delivered with the test kit (MSDS are also available on the homepage of www.chemetrics.com).
3. Vacu-vials® is a registered trademark of the company CHEMetrics, Inc. / Calverton, U.S.A.
4. Only ortho-phosphate ions react.

Implementation of the provision Phosphate LR, ortho with Vacu Vials® K-8513

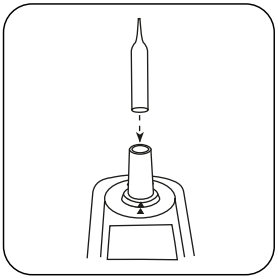
Select the method on the device



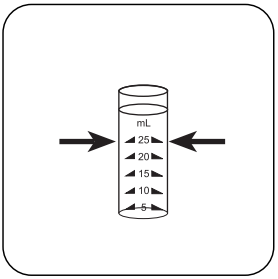
Place **Zero ampoule** in the sample chamber.



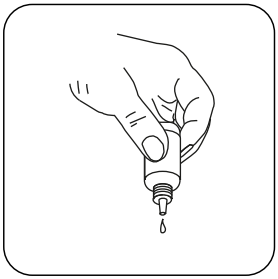
Press the **ZERO** button.



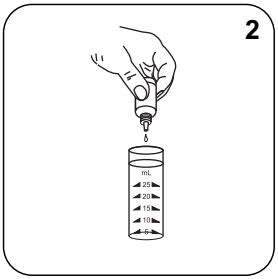
Remove zero ampoule from the sample chamber.



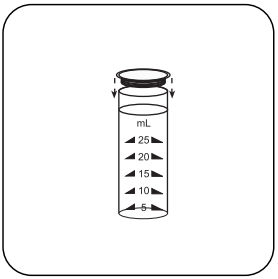
Fill the sample glass to the 25 ml mark with the sample.



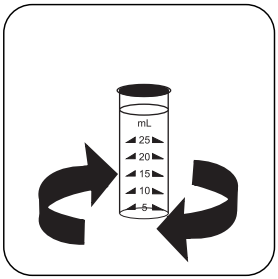
Hold cuvettes vertically and add equal drops by pressing slowly.



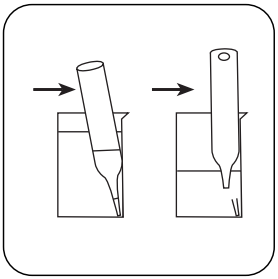
Add **2 drops A-8500-Activator Solution**.



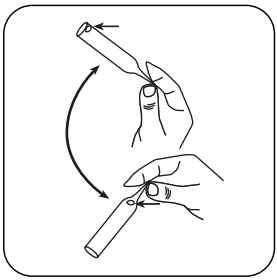
Close the sample glass with the lid.



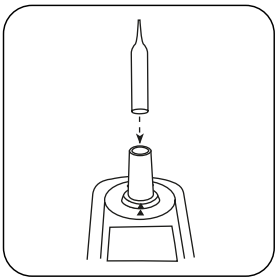
Invert several times to mix the contents.



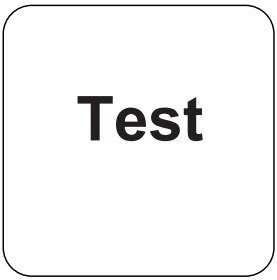
Place a Vacu-vial® ampoule in the sampling vessel. Break off the ampoule tip by applying light pressure against the vessel wall. Wait for the ampoule to fill completely.



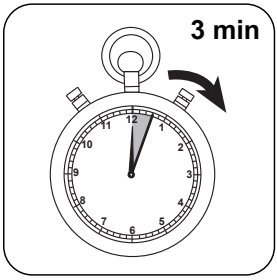
Invert the ampoule several times, allowing the bubble to move from one end to the other. Dry the outside.



Place the ampoule in the sample chamber.



Press the **TEST** (XD: **START**)button.



Wait for **3 minute(s) reaction time**.
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l ortho-Phosphate appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	P	1
mg/l	PO_4^{3-}	3.066
mg/l	P_2O_5	2.3

Chemical Method

Stannous Chloride

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 13 mm
a	$-2.51412 \cdot 10^{-2}$
b	$1.93277 \cdot 10^{+0}$
c	
d	
e	
f	

Interferences

Persistant Interferences

- Sulphide, thiosulphate, and Thiocyanide produce lower test results.

Interference	from / [mg/L]
Al	200
AsO_4^{3-}	in all quantities
Cr	100
Cu	10
Fe	100
Ni	300
SiO_2	50
$Si(OH)_4$	10
S^{2-}	in all quantities
Zn	80

According to

Standard Method 4500-P D

[c] MultiDirect: Adapter is necessary for Vacu-vials® (Order code 19 20 75)

pH-value LR T M329

5.2 - 6.8

Bromocresolpurple

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect, PM 620, PM 630, XD 7000, XD 7500	ø 24 mm	560 nm	- 6.8
MD 600, MD 610, MD 640, MultiDirect, PM 620, PM 630, XD 7000, XD 7500	ø 24 mm	560 nm	5.2 - 6.8

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Bromocresol Purple Photometer	Tablet / 100	515700BT
Bromocresol Purple Photometer	Tablet / 250	515701BT

Application List

- Boiler Water
- Pool Water Control
- Pool Water Treatment
- Raw Water Treatment

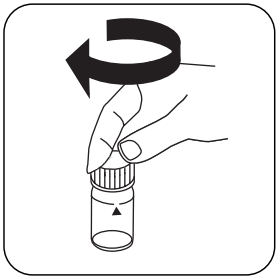
Notes

1. For photometric determination of pH values only use BROMCRESOL PURPLE tablets in black printed foil pack and marked with PHOTOMETER.
2. The accuracy of the colorimetric determination of pH values depends on various boundary conditions (buffer capacity of the sample, salt contents etc.).

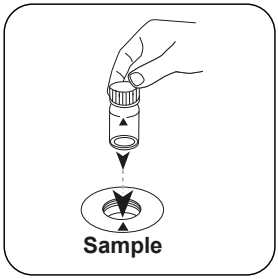
Implementation of the provision pH value LR with Tablet

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

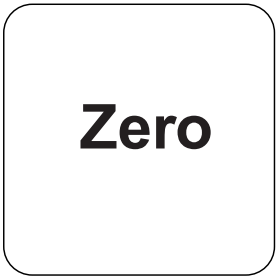
Fill 24 mm vial with **10 ml sample**.



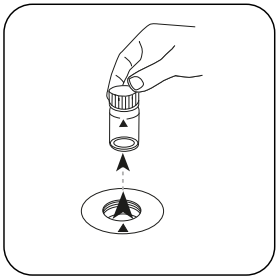
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

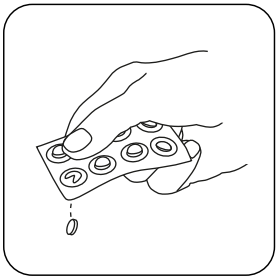


Press the **ZERO** button.

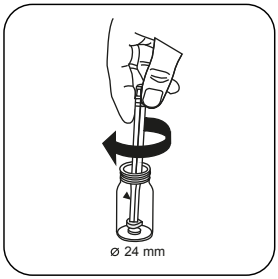


Remove the vial from the sample chamber.

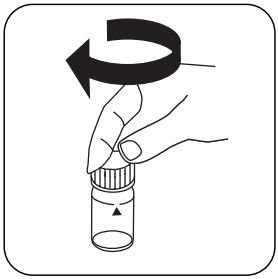
For devices that require **no ZERO measurement** , **start here**.



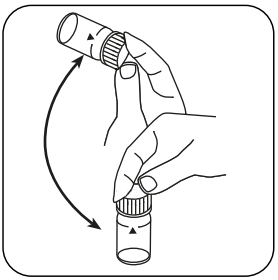
Add **BROM-CRESOLPURPLE PHOTOMETER tablet**.



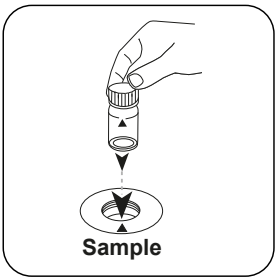
Crush tablet(s) by rotating slightly.



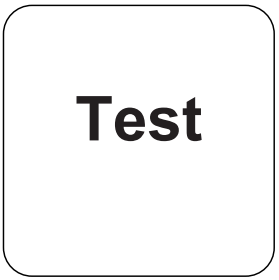
Close vial(s).



Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in pH value appears on the display.

Chemical Method

Bromocresolpurple

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ **10 mm**
a	4.59342 • 10^{+0}	4.59342 • 10^{+0}
b	2.8352 • 10^{+0}	6.09568 • 10^{+0}
c	-2.28986 • 10^{+0}	-1.05849 • 10^{+1}
d	9.993 • 10^{-1}	9.93142 • 10^{+0}
e	-1.5366 • 10^{-1}	-3.28333 • 10^{+0}
f		

Interferences

Persistant Interferences

- pH values below 5.2 and above 6.8 can produce results inside the measuring range. A plausibility test (pH-meter) is recommended.

Removeable Interferences

Salt error Correction of test results (average values) for samples with salt contents of:

Indicator	Salt content per sample		
Bromocre-solpurple	1 molar -0.26	2 molars -0.33	3 molars -0.31

The values of Parson and Douglas (1926) are based on the use of Clark and Lubs buffers. 1 Mol NaCl = 58.4 g/L = 5.8 %

Bibliography

Colorimetric Chemical Analytical Methods, 9th Edition, London

pH-value T M330

6.5 - 8.4 PH

Phenol Red

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 110, MD 200, MD 600, MD 610, MD 640, MultiDirect, PM 600, PM 620, PM 630	ø 24 mm	560 nm	- 8.4
MD 100, MD 110, MD 200, MD 600, MD 610, MD 640, MultiDirect, PM 600, PM 620, PM 630	ø 24 mm	560 nm	6.5 - 8.4
SpectroDirect, XD 7000, XD 7500	ø 24 mm	558 nm	6.5 - 8.4
Scuba II	ø 24 mm	530 nm	6.5 - 8.4

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Phenol Red Photometer	Tablet / 100	511770BT
Phenol Red Photometer	Tablet / 250	511771BT
Phenol Red Photometer	Tablet / 500	511772BT

Application List

- Boiler Water
- Pool Water Control
- Pool Water Treatment
- Raw Water Treatment

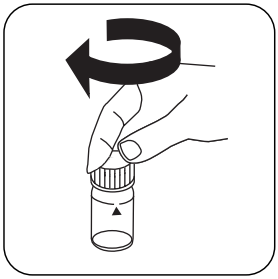
Notes

1. For photometric determination of pH values only use PHENOL RED tablets in black printed foil pack and marked with PHOTOMETER.

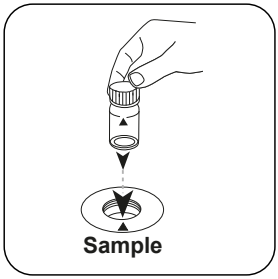
Implementation of the provision pH-value with Tablet

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

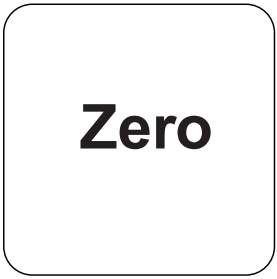
Fill 24 mm vial with **10 ml sample**.



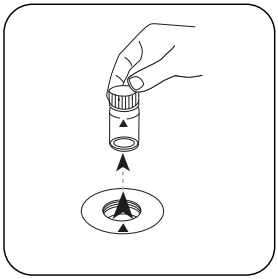
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

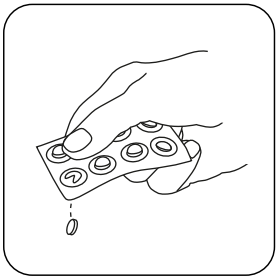


Press the **ZERO** button.

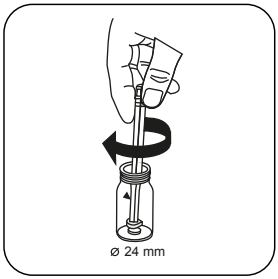


Remove the vial from the sample chamber.

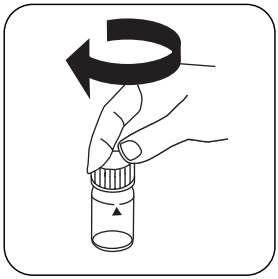
For devices that require **no ZERO measurement** , **start here**.



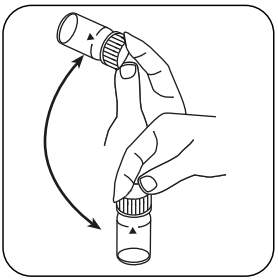
Add **PHENOL RED PHOTOMETER tablet**.



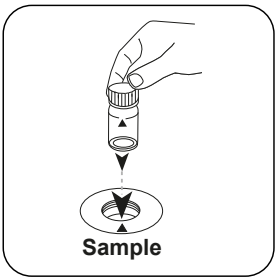
Crush tablet(s) by rotating slightly.



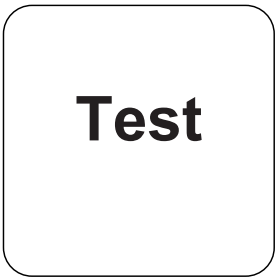
Close vial(s).



Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in pH value appears on the display.

Chemical Method

Phenol Red

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	$5.95215 \cdot 10^{+0}$	$5.95215 \cdot 10^{+0}$
b	$4.13767 \cdot 10^{+0}$	$8.89599 \cdot 10^{+0}$
c	$-5.29861 \cdot 10^{+0}$	$-2.44928 \cdot 10^{+1}$
d	$3.74419 \cdot 10^{+0}$	$3.72112 \cdot 10^{+1}$
e	$-1.25321 \cdot 10^{+0}$	$-2.6778 \cdot 10^{+1}$
f	$1.6149 \cdot 10^{-1}$	$7.41887 \cdot 10^{+0}$

Interferences

Persistant Interferences

1. Water samples with little Carbonate hardness* can lead to false pH values.
   *$K_{S4.3}$ < 0.7 mmol/l ≙ total alkalinity < 35 mg/L $CaCO_3$.

Removeable Interferences

1. pH values below 6.5 and above 8.4 can produce results inside the measuring range. A plausibility test (pH-meter) is recommended.
2. Salt error
   For salt concentrations below 2 g/L, no significant error, is expected due to the salt concentration of the reagent tablet. For higher salt concentrations the measurement values
   have to be adjusted as follows:

Salt content per sample in g/L	30 (seawater)	60	120	180
Correction	-0.15[1)]	-0.21[2)]	-0.26[2)]	-0.29[2)]

[1)] according to Kolthoff (1922)
[2)] according to Parson and Douglas (1926)

Bibliography

Colorimetric Chemical Analytical Methods, 9th Edition, London

pH value L M331

6.5 - 8.4 PH

Phenol Red

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 110, MD 200, MD 600, MD 610, MD 640, MultiDirect, PM 620, PM 630	ø 24 mm	560 nm	- 8.4
MD 100, MD 110, MD 200, MD 600, MD 610, MD 640, MultiDirect, PM 620, PM 630	ø 24 mm	560 nm	6.5 - 8.4
SpectroDirect, XD 7000, XD 7500	ø 24 mm	558 nm	6.5 - 8.4

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Phenol Red Solution	15 mL	471040
Phenol Red Solution	100 mL	471041
Phenol Red Solution in 6-pack	1 pc.	471046

Application List

- Boiler Water
- Pool Water Control
- Pool Water Treatment
- Raw Water Treatment

Preparation

1. Due to differing drop sizes results can show a discrepancy in accuracy by comparison with tablets.
   This can be minimised by using a pipette (0.18 ml equivalent to 6 drops).

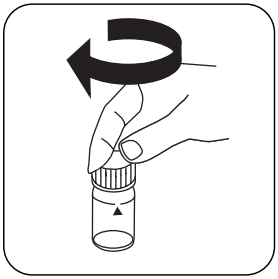
Notes

1. After use, ensure the cuvette is once again closed with the same-coloured screw caps.
2. Reagents are to be stored in the cool at +6 °C to +10 °C.

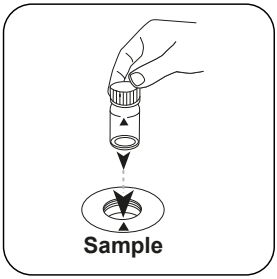
Implementation of the provision pH-value with fluid reagent

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

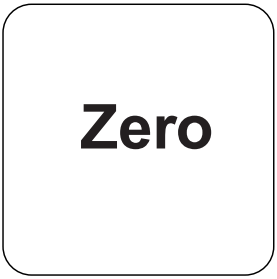
Fill 24 mm vial with **10 ml sample**.



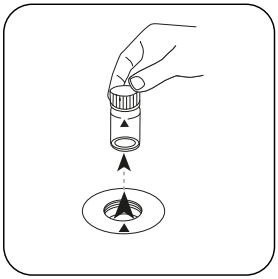
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

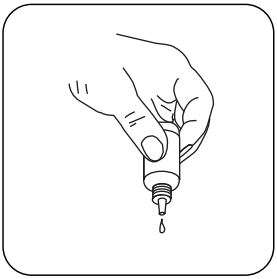


Press the **ZERO** button.

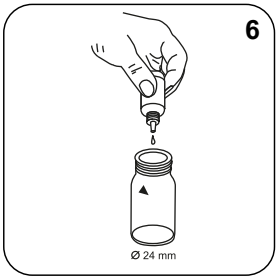


Remove the vial from the sample chamber.

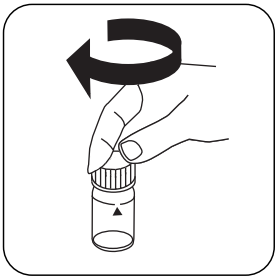
For devices that require **no ZERO measurement** , **start here**.



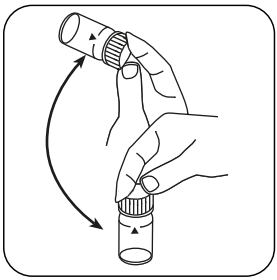
Hold cuvettes vertically and add equal drops by pressing slowly.



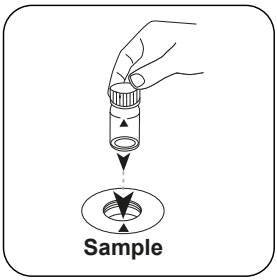
Add **6 drops PHENOL Red-Lösung**.



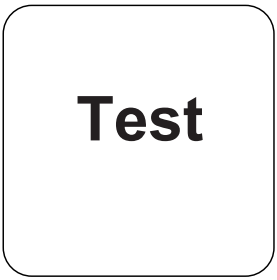
Close vial(s).



Invert several times to mix the contents.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in pH value appears on the display.

Chemical Method

Phenol Red

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ **10 mm**
a	5.95215 • 10^{+0}	5.95215 • 10^{+0}
b	4.13767 • 10^{+0}	8.89599 • 10^{+0}
c	-5.29861 • 10^{+0}	-2.44928 • 10^{+1}
d	3.74419 • 10^{+0}	3.72112 • 10^{+1}
e	-1.25321 • 10^{+0}	-2.6778 • 10^{+1}
f	1.6149 • 10^{-1}	7.41887 • 10^{+0}

Interferences

Removeable Interferences

1. Salt error Correction of test results (average values) for samples with salt contents of:

2.

Salt content of the sample	Correction
30 g/L (seawater)	-0.15 [1)]
60 g/L	-0.21 [2)]
120 g/L	-0.26 [2)]
180 g/L	-0.29 [2)]
[1)] according to Kolthoff (1922)	[2)] according to Parson and Douglas (1926)

3. When testing chlorinated water the residual chlorine contents can influence the colour reaction of the liquid reagent. This can be avoided by adding a small crystal of Sodiumthiosulphate ($Na_2S_2O_3$·5 H_2O) to the sample solution before adding the PHENOL RED solution.

Bibliography

Colorimetric Chemical Analytical Methods, 9th Edition, London

pH-value HR T M332

8.0 - 9.6

Thymol Blue

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 110, MD 600, MD 610, MD 640, MultiDirect, PM 620, PM 630, XD 7000, XD 7500	ø 24 mm	560 nm	- 9.6
MD 100, MD 110, MD 600, MD 610, MD 640, MultiDirect, PM 620, PM 630, XD 7000, XD 7500	ø 24 mm	560 nm	8.0 - 9.6

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Thymol Blue Photometer	Tablet / 100	515710BT
Thymol Blue Photometer	Tablet / 250	515711BT

Application List

- Boiler Water
- Pool Water Control
- Pool Water Treatment
- Raw Water Treatment

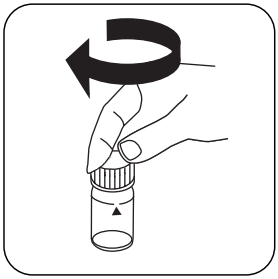
Notes

1. For photometric determination of pH values only use THYMOLBLUE tablets in black printed foil pack and marked with PHOTOMETER.
2. The accuracy of the colorimetric determination of pH values depends on various boundary conditions (buffer capacity of the sample, salt contents etc.).

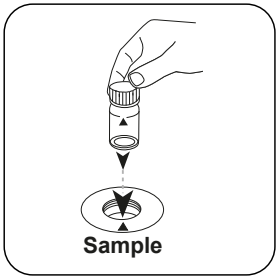
Implementation of the provision pH-value with Tablet

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

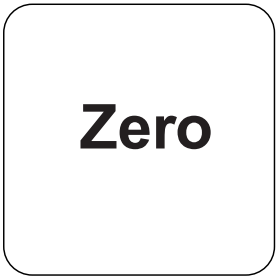
Fill 24 mm vial with **10 ml sample**.



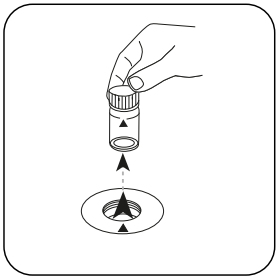
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

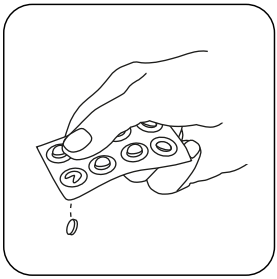


Press the **ZERO** button.

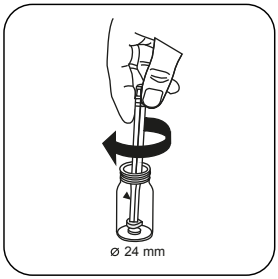


Remove the vial from the sample chamber.

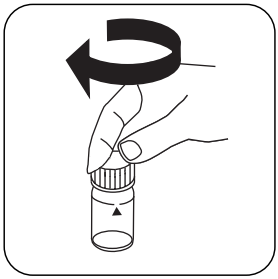
For devices that require **no ZERO measurement** , **start here**.



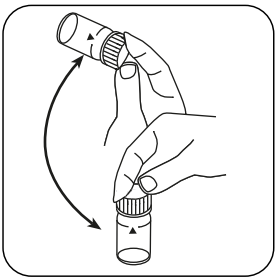
Add **THYMOLBLUE PHOTOMETER tablet**.



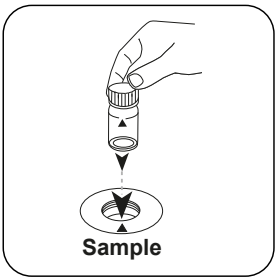
Crush tablet(s) by rotating slightly.



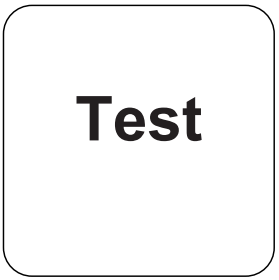
Close vial(s).



Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in pH value appears on the display.

Chemical Method

Thymol Blue

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ **10 mm**
a	7.35421 • 10^{+0}	7.35421 • 10^{+0}
b	2.35059 • 10^{+0}	5.05377 • 10^{+0}
c	-1.31655 • 10^{+0}	-6.08575 • 10^{+0}
d	3.4837 • 10^{-1}	3.46223 • 10^{+0}
e		
f		

Interferences

Persistant Interferences

1. pH values below 8.0 and above 9.6 can produce results inside the measuring range. A plausibility test (pH-meter) is recommended.

Removeable Interferences

Salt error Correction of test results (average values) for samples with salt contents of:

Indicator	Salt content per sample		
Thymolblue	1 molar -0.22	2 molars -0.29	3 molars -0.34

The values of Parson and Douglas (1926) are based on the use of Clark and Lubs buffers. 1 Mol NaCl = 58.4 g/L = 5.8 %

Bibliography

Colorimetric Chemical Analytical Methods, 9th Edition, London

Phosphate LR L M334

0.1 - 10 mg/L PO_4

Phosphomolybic Acid / Ascorbic Acid

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, XD 7000, XD 7500	ø 24 mm	660 nm	0.1 - 10 mg/L PO_4

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Phosphate LR Reagent Pack	1 pc.	56R023765
KS278-Sulphuric Acid 50 % V/V	65 mL	56L027865
KS135 Pa1/Alk1-Phenolphthalein Sub-Alk P	65 mL	56L013565
KS144-CH2-FC4-Calcium Hardness Buffer	65 mL	56L014465
KP962-Ammonium Persulphate Powder	Powder / 40 g	56P096240

Application List

- Waste Water Treatment
- Boiler Water
- Drinking Water Treatment
- Raw Water Treatment
- Pool Water Control

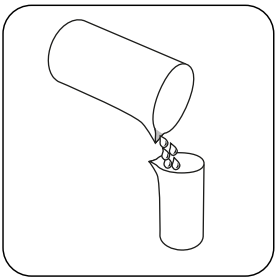
Preparation

1. Strongly buffered samples or samples with extreme pH values should be adjusted to between pH 6 and pH 7 before the analysis (use 1 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).
2. Prior digestion is required for the analysis of Polyphosphate and total phosphate.

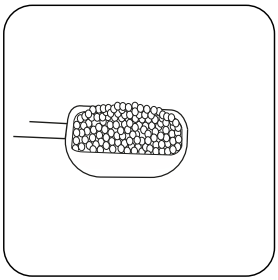
Notes

1. The measuring spoon supplied with the reagents must be used for the correct dosage.
2. The long scoop is for KP962. The short scoop is for KP119.

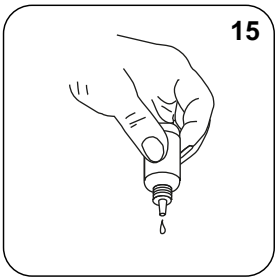
Digestion total Phosphate LR with liquid reagents



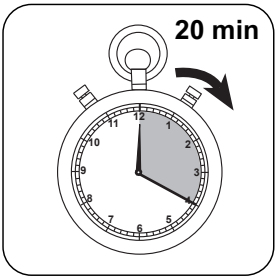
Fill a suitable digestion vessel with **50 ml homogenised sample**.



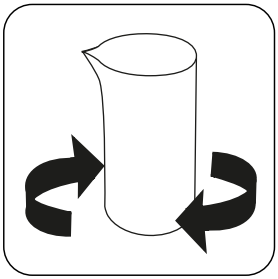
Add **a measuring scoop KP962 (Ammonium Persulfate Powder)** .



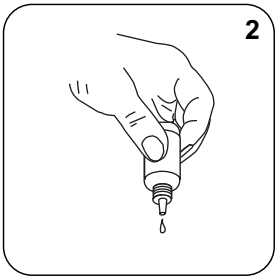
Add **15 drops KS278 (50% sulfuric acid)**.



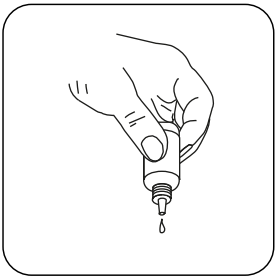
Boil the sample for **20 minutes** . A sample volume of about 25 ml should be retained;
If necessary, fill with deionised water.



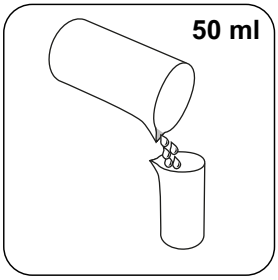
Invert the vial and allow to cool to room temperature.



Add **2 drops KS135 (Phenolphthalein Substitute Indikator)**.

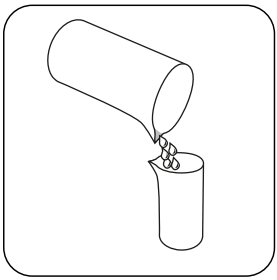


Add **KS 144 (Calcium Hardness Buffer)** drop by drop to the same sample until colouration turns from light pink to red. **(Note: make sure to swirl the vial after adding each drop!)**

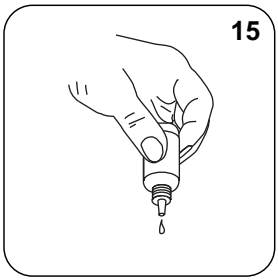


Fill the sample with **deionised water to 50 ml** .

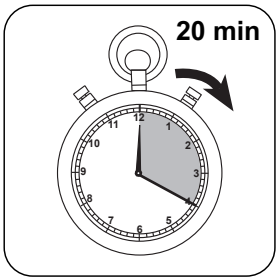
Digestion Polyphosphate LR with liquid reagents



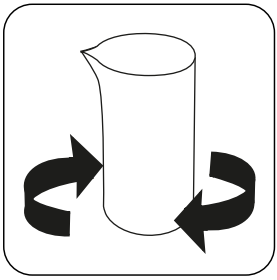
Fill a suitable digestion vessel with **50 ml homogenised sample**.



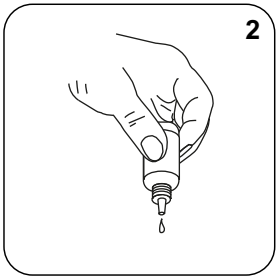
Add **15 drops KS278 (50% sulfuric acid)**.



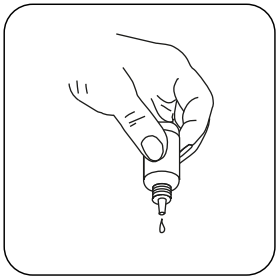
Boil the sample for **20 minutes** . A sample volume of about 25 ml should be retained;
If necessary, fill with deionised water.



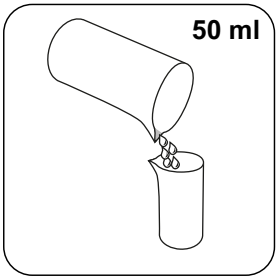
Invert the vial and allow to cool to room temperature.



Add **2 drops KS135 (Phenolphthalein Substitute Indikator)**.



Add **KS 144 (Calcium Hardness Buffer)** drop by drop to the same sample until colouration turns from light pink to red. **(Note: make sure to swirl the vial after adding each drop!)**

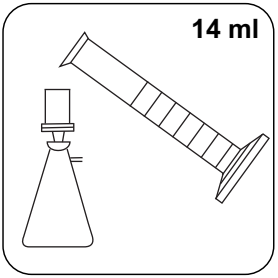


Fill the sample with **deionised water to 50 ml** .

Implementation of the provision Phosphate LR with fluid reagent

Select the method on the device

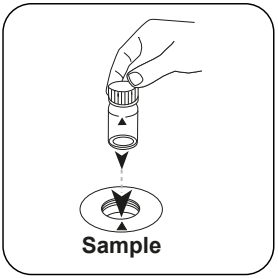
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



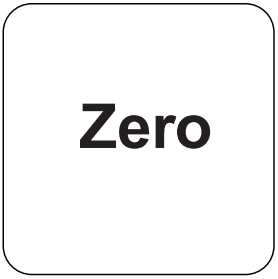
Filter approx. 14 ml sample with a pre-rinsed filter (pore size 0.45 µm).

Fill 24 mm vial with **10 ml prepared sample** .

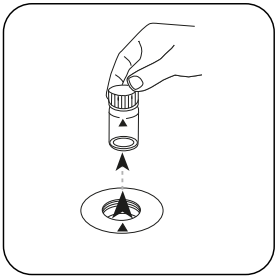
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

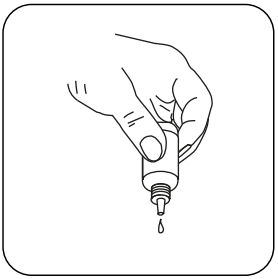


Press the **ZERO** button.

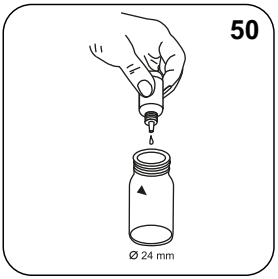


Remove the vial from the sample chamber.

For devices that require **no ZERO measurement** , **start here**.

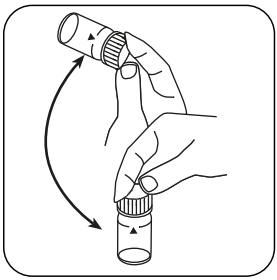


Hold cuvettes vertically and add equal drops by pressing slowly.

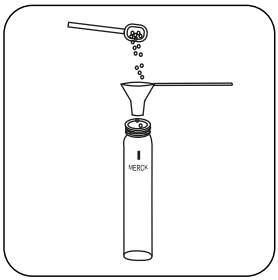


Add **50 drops KS80 (CRP)** .

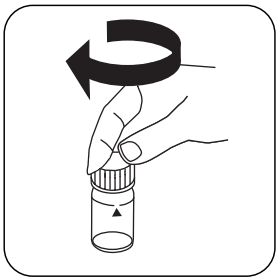
Close vial(s).



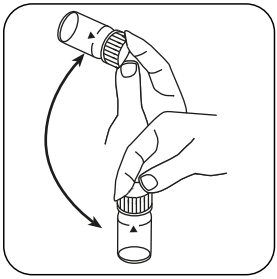
Invert several times to mix the contents.



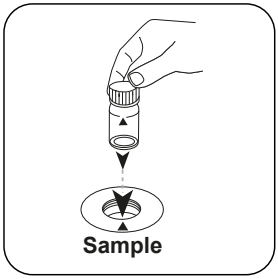
Add **a measuring scoop KP119 (Ascorbic Acid)** .



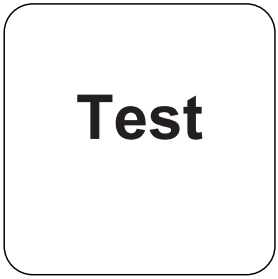
Close vial(s).



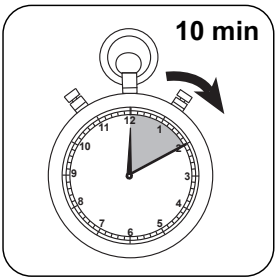
Swirl around to dissolve the powder.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **10 minute(s) reaction time**.
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Phosphate appears on the display.

Implementation of the provision Polyphosphate LR with liquid reagents

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500
For testing of **Polyphosphate LR with liquid reagents,** carry out the described **digestion**.
This test determines the content of inorganic total phosphate.The Polyphosphate content arises from the difference between inorganic and ortho phosphate.
The test for Polyphosphate LR with liquid reagents runs just as the test under Method 334, Phosphate LR with liquid reagents.
The result in mg/l anorganic Total Phosphate (ortho-Phosphate and Polyphosphate) appears on the display.

Implementation of the provision total Phosphate LR with liquid reagent

Select the method on the device
For testing of **total Phosphate LR with liquid reagents,** carry out the described **digestion**.
This test determines all compounds of phosphorus present in the sample, including ortho-phosphate, polyphosphate, and organic phosphorus compounds.
The test for total Phosphate LR with liquid reagents runs just as the test under Method 334, Phosphate LR with liquid reagents.
The result in mg/l total Phosphate appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	P	1
mg/l	PO_4^{3-}	3.066177
mg/l	P_2O_5	2.29137

Chemical Method

Phosphomolybic Acid / Ascorbic Acid

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ **10 mm**
a	$-4.14247 \cdot 10^{-2}$	$-4.14247 \cdot 10^{-2}$
b	$1.33552 \cdot 10^{+0}$	$2.87137 \cdot 10^{+0}$
c	$-2.89775 \cdot 10^{-1}$	$-1.33948 \cdot 10^{+0}$
d	$2.04577 \cdot 10^{-1}$	$2.03316 \cdot 10^{+0}$
e		
f		

Interferences

Persistant Interferences

- Large amounts of unresolved substances can cause non-reproducible measurement results.

Interference	from / [mg/L]
Al	200
AsO_4^{3-}	in all quantities
Cr	100
Cu	10
Fe	100
Ni	300
SiO_2	50
$Si(OH)_4$	10
S^{2-}	in all quantities
Zn	80

According to

DIN ISO 15923-1 D49
Standard Method 4500-P E
US EPA 365.2

Phosphate HR L M335

5 - 80 mg/L PO_4 PO4

Vanadomolybdate

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 110, MD 600, MD 610, MD 640, XD 7000, XD 7500	ø 24 mm	430 nm	5 - 80 mg/L PO_4

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Phosphat HR, Ortho Reagent Set	1 pc.	56R019090
KS278-Sulphuric Acid 50 % V/V	65 mL	56L027865
KS135 Pa1/Alk1-Phenolphthalein Sub-Alk P	65 mL	56L013565
KS144-CH2-FC4-Calcium Hardness Buffer	65 mL	56L014465
KP962-Ammonium Persulphate Powder	Powder / 40 g	56P096240

The following accessories are required.

Accessories	Packaging Unit	Part Number
Stirring rod and spoon	1 pc.	56A006601

Application List

- Waste Water Treatment
- Boiler Water
- Drinking Water Treatment
- Raw Water Treatment

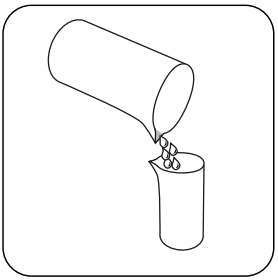
Preparation

1. Strongly buffered samples or samples with extreme pH values should be adjusted to between pH 6 and pH 7 before the analysis (use 1 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).
2. Prior digestion is required for the analysis of Polyphosphate and total phosphate.

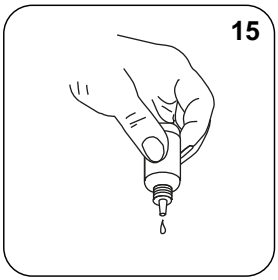
Notes

1. Reagents and accessories available on request.

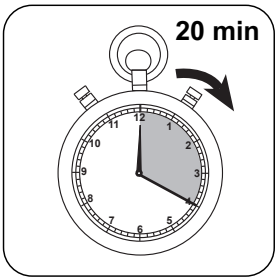
Digestion Polyphosphate HR with liquid reagents



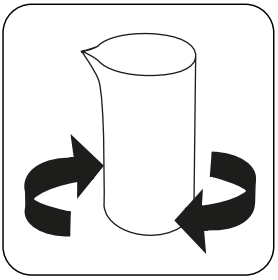
Fill a suitable digestion vessel with **50 ml homogenised sample**.



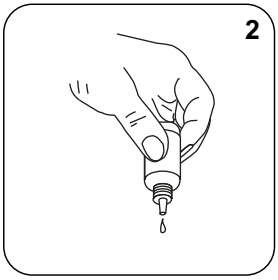
Add **15 drops KS278 (50% sulfuric acid)**.



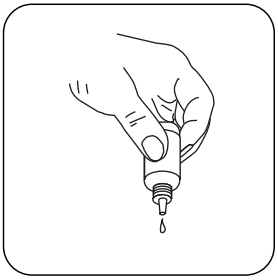
Boil the sample for **20 minutes** . A sample volume of about 25 ml should be retained; If necessary, fill with deionised water.



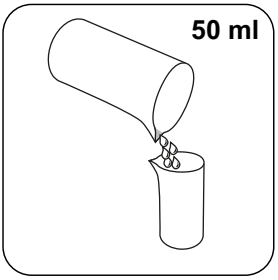
Invert the vial and allow to cool to room temperature.



Add **2 drops KS135 (Phenolphthalein Substitute Indikator)**.

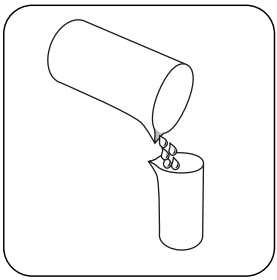


Add **KS 144 (Calcium Hardness Buffer)** drop by drop to the same sample until colouration turns from light pink to red. **(Note: make sure to swirl the vial after adding each drop!)**

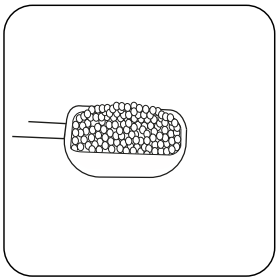


Fill the sample with **deionised water to 50 ml** .

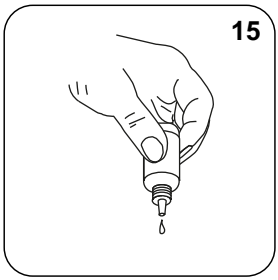
Digestion total Phosphate HR with with liquid reagents



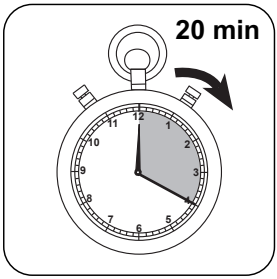
Fill a suitable digestion vessel with **50 ml homogenised sample**.



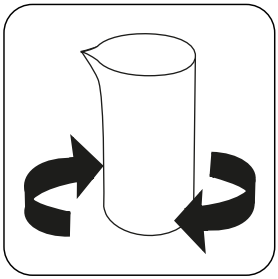
Add **a measuring scoop KP962 (Ammonium Persulfate Powder)** .



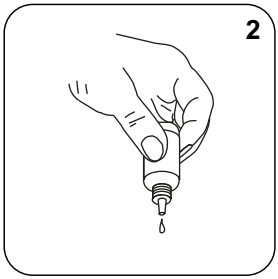
Add **15 drops KS278 (50% sulfuric acid)**.



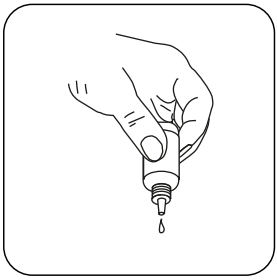
Boil the sample for **20 minutes** . A sample volume of about 25 ml should be retained;
If necessary, fill with deionised water.



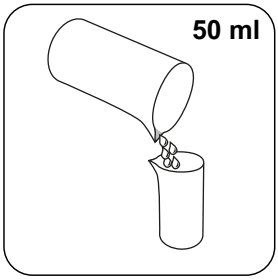
Invert the vial and allow to cool to room temperature.



Add **2 drops KS135 (Phenolphthalein Substitute Indikator)**.



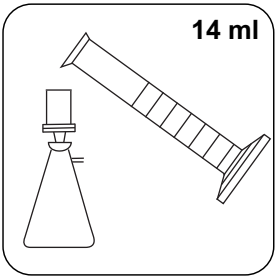
Add **KS 144 (Calcium Hardness Buffer)** drop by drop to the same sample until colouration turns from light pink to red. **(Note: make sure to swirl the vial after adding each drop!)**



Fill the sample with **deionised water to 50 ml** .

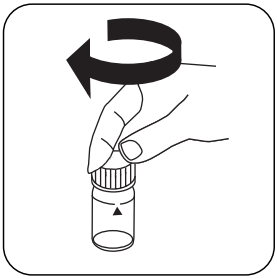
Implementation of the provision Phosphate HR with fluid reagent

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

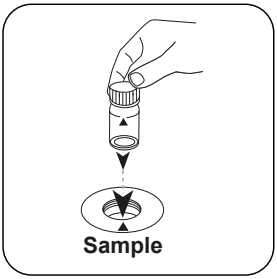


Filter approx. 14 ml sample with a pre-rinsed filter (pore size 0.45 µm).

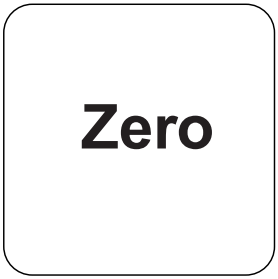
Fill 24 mm vial with **10 ml prepared sample** .



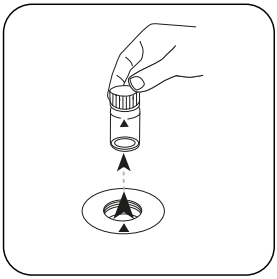
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

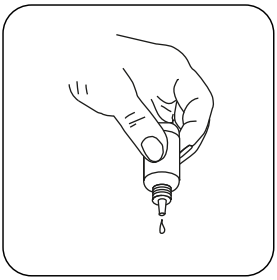


Press the **ZERO** button.

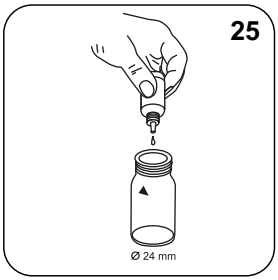


Remove the vial from the sample chamber.

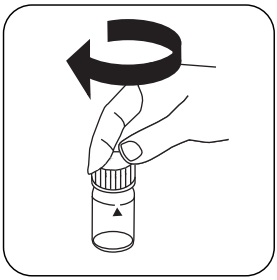
For devices that require **no ZERO measurement** , **start here**.



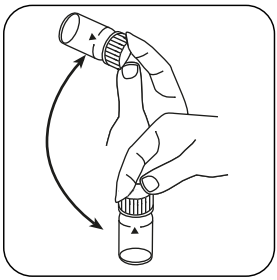
Hold cuvettes vertically and add equal drops by pressing slowly.



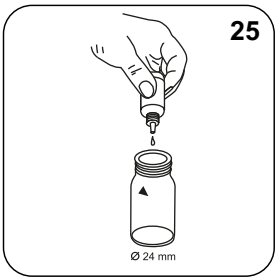
Add **25 drops KS228 (Ammonium Molybdate)**.



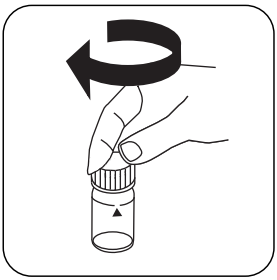
Close vial(s).



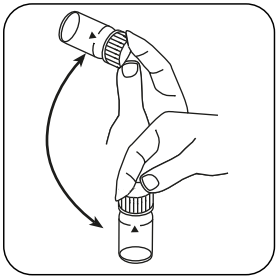
Invert several times to mix the contents.



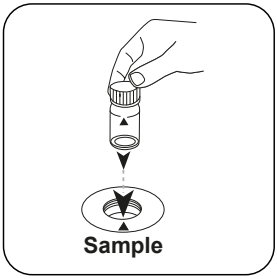
Add **25 drops KS229 (Ammonium Metavanadate)**.



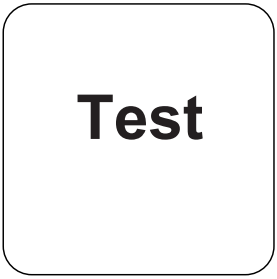
Close vial(s).



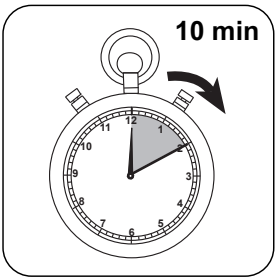
Invert several times to mix the contents.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **10 minute(s) reaction time**.
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Phosphate appears on the display.

Implementation of the provision Polyphosphate with liquid reagents

Select the method on the device
For testing of **Polyphosphate HR with liquid reagents,** carry out the described **digestion**.
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500
This test determines the content of inorganic total phosphate.The Polyphosphate content arises from the difference between inorganic and ortho phosphate.
The test for total Phosphate LR with liquid reagents runs just as the test under Method 335, Phosphate HR with liquid reagents.
The result in mg/l anorganic Total Phosphate (ortho-Phosphate and Polyphosphate) appears on the display.

Implementation of the provision total Phosphate with liquid reagents

Select the method on the device
For testing of **total Phosphate HR with liquid reagents,** carry out the described **digestion**.
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500
This test determines all compounds of phosphorus present in the sample, including ortho-phosphate, polyphosphate, and organic phosphorus compounds.
The test for total Phosphate HR with liquid reagent runs just as the test under Method 335, Phosphate HR with liquid reagent.
The result in mg/l total Phosphate appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	P	1
mg/l	PO_4^{3-}	3.066177
mg/l	P_2O_5	2.29137

Chemical Method

Vanadomolybdate

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ 10 mm
a	$-3.32247 \cdot 10^{-1}$	$-3.32247 \cdot 10^{-1}$
b	$1.37619 \cdot 10^{+1}$	$2.95881 \cdot 10^{+1}$
c		
d		
e		
f		

Interferences

Persistant Interferences

- Large amounts of unresolved substances can cause non-reproducible measurement results.

Interference	from / [mg/L]
Al	200
AsO_4^{3-}	in all quantities
Cr	100
Cu	10
Fe	100
Ni	300
SiO_2	50
$Si(OH)_4$	10
S^{2-}	in all quantities
Zn	80

According to

Standard Method 4500-P E

Polyacrylate L M338

1 - 30 mg/L Polyacryl POLY

Turbidity

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 110	ø 24 mm	530 nm	1 - 30 mg/L Polyacryl
MD 600, MD 610, MD 640, XD 7000, XD 7500	ø 24 mm	660 nm	1 - 30 mg/L Polyacryl

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Polyacrylat Reagent Set	1 pc.	56R019165
KS336-Propan-2-ol	65 mL	56L033665
Cartouche C18	1 pc.	56A020101
KS173-P2-2,4 Dinitrophenol Indicator	65 mL	56L017365
KS183-QA2-MO1-P3-Nitric Acid	65 mL	56L018365

Application List

- Cooling Water
- Boiler Water
- Raw Water Treatment

Preparation

- **Preparing the cartridge:**

1. Remove the plunger from a suitable syringe. Attach the C18 cartridge to the syringe cylinder.
2. Add 5 ml of KS336 (propane-2-ol) to the syringe cylinder.
3. Using the plunger, press the solvent by drop through the cartridge.
4. Remove the solvent that has passed through.
5. Remove the plunger again. Fill the syringe cylinder with 20 ml of deionised water.
6. With the help of the plunger, press the contents through the cartridge drop by drop.
7. Discard the deionised water that has flowed through.
8. The cartridge is now ready for use.

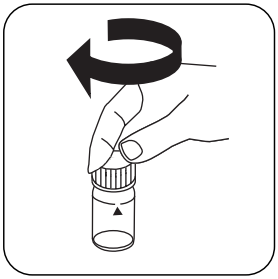
Notes

1. If little or no turbidity is present at correct dose concentrations, the sample will need a pre-concentration step in order to detect this level of polyacrylate/polymer.
2. Anomalous results occur when interferences are present as part of the sample components or from sample contaminants. In this case, the interference will need to be eliminated.
3. This test has been calibrated using polyacrylic acid 2'100 sodium salt in the range 1-30 mg/L. Other polyacrylates/polymers will give differing responses and therefore the test range will vary.

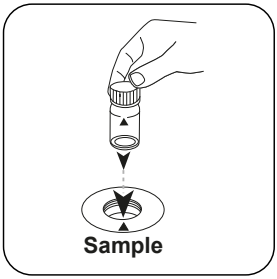
Implementation of the provision Polyacrylate with Fluid reagent

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

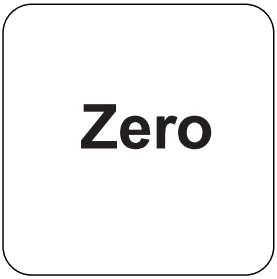
Fill 24 mm vial with **10 ml sample**.



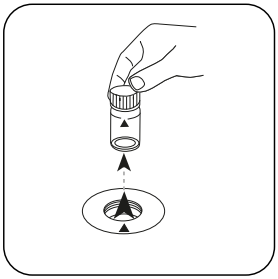
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

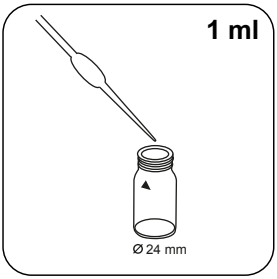


Press the **ZERO** button.

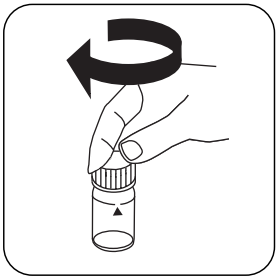


Remove the vial from the sample chamber.

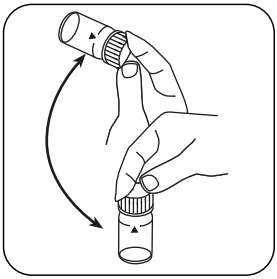
For devices that require **no ZERO measurement** , **start here**.



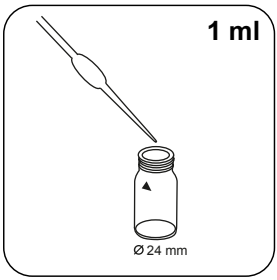
Place **1 ml (25 Tropfen) KS255 (Polyacrylate Reagenz 1) solution** in the test vial.



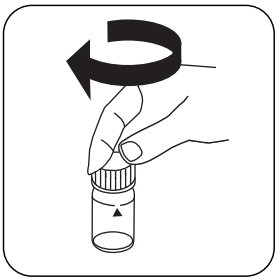
Close vial(s).



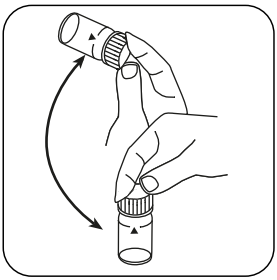
Invert several times to mix the contents.



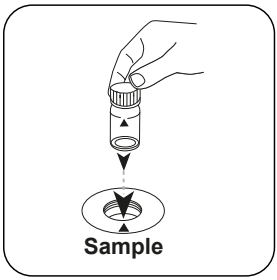
Place **1 ml (25 Tropfen) KS256 (Polyacrylate Reagenz 2) solution** in the test vial.



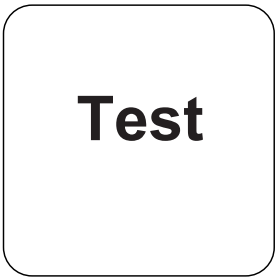
Close vial(s).



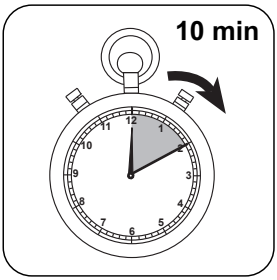
Invert several times to mix the contents.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **10 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically. The result in mg/l Polyacryl acid 2100 sodium salt appears on the display.

Chemical Method

Turbidity

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ **10 mm**
a	5.21463 • 10^{-1}	5.21463 • 10^{-1}
b	3.45852 • 10^{+1}	7.43583 • 10^{+1}
c	-2.38855 • 10^{+1}	-1.10411 • 10^{+2}
d	1.52167 • 10^{+1}	1.51229 • 10^{+2}
e		
f		

Bibliography

W.B. Crummett, R.A. Hummel (1963), The Determination of Polyacrylamides in Water, American Water Works Association, 55 (2), pp. 209-219

Potassium T M340

0.7 - 16 mg/L K

Tetraphenylborat Turbidity

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect	ø 24 mm	660 nm	0.7 - 16 mg/L K
SpectroDirect, XD 7000, XD 7500	ø 24 mm	730 nm	0.7 - 16 mg/L K

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Potassium-T	Tablet / 100	515670BT
Potassium-T	Tablet / 250	515671BT

Application List

- Waste Water Treatment
- Drinking Water Treatment
- Raw Water Treatment

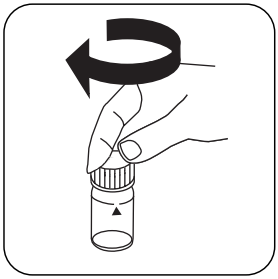
Notes

1. Potassium causes a finely distributed turbidity with a milky appearance. Individual particles are not attributable to the presence of Potassium.

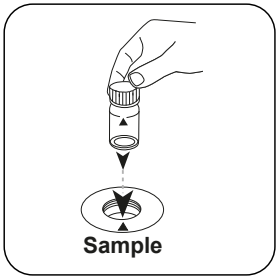
Implementation of the provision Potassium with Tablet

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

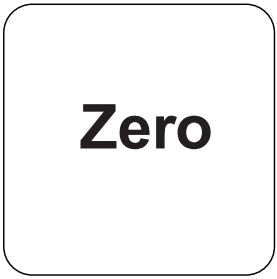
Fill 24 mm vial with **10 ml sample**.



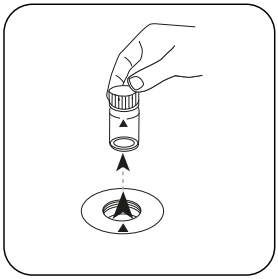
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

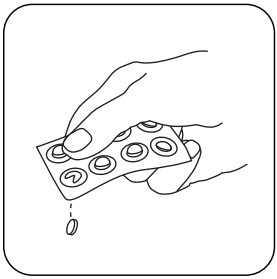


Press the **ZERO** button.

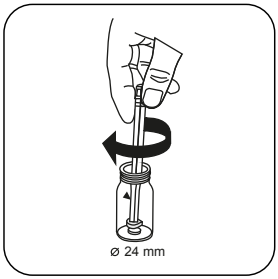


Remove the vial from the sample chamber.

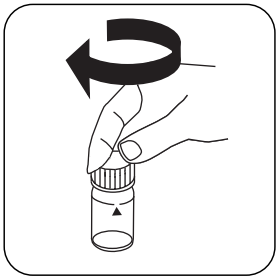
For devices that require **no ZERO measurement** , **start here**.



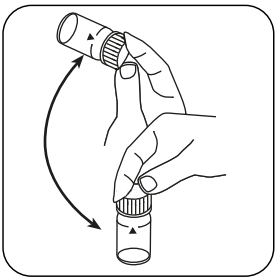
Add **POTASSIUM T tablet**.



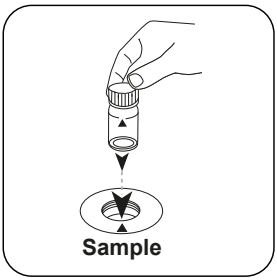
Crush tablet(s) by rotating slightly.



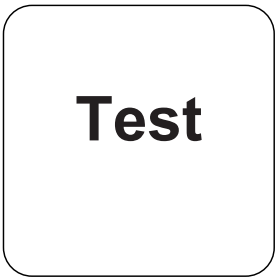
Close vial(s).



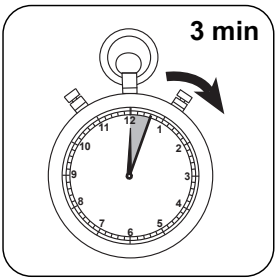
Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **3 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically. The result in mg/l Potassium appears on the display.

Chemical Method

Tetraphenylborat Turbidity

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	6.25019 • 10^{-1}	6.25019 • 10^{-1}
b	6.44037 • 10^{+0}	1.38468 • 10^{+1}
c	-1.32631 • 10^{+0}	-6.13087 • 10^{+0}
d	4.95714 • 10^{-1}	4.92659 • 10^{+0}
e		
f		

Method Validation

Limit of Detection	0.04 mg/L
Limit of Quantification	0.13 mg/L
End of Measuring Range	16 mg/L
Sensitivity	6.11 mg/L / Abs
Confidence Intervall	0.54 mg/L
Standard Deviation	0.24 mg/L
Variation Coefficient	2.89 %

Bibliography

R.T. Pflaum, L.C. Howick (1956), Spectrophotometric Determination of Potassium with Tetraphenylborate, Anal. Chem., 28 (10), pp. 1542-1544

SAC 254 nm (344) M344

0.5 - 50 m^{-1}

Direct Reading EN ISO 7887:1994

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
XD 7500	□ 50 mm	254 nm	0.5 - 50 m^{-1}

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
no reagent required		

Application List

- Drinking Water Treatment
- Waste Water Treatment

Preparation

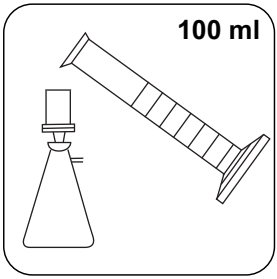
1. The deionised water for zero calibration should be passed through a membrane filter with a pore width of 0.45 µm.

Notes

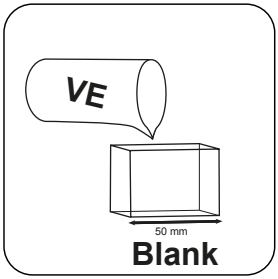
1. Because the colouration is dependent on pH value and temperature, these should be determined together with the optical measurement and specified along with the result.
2. The spectral absorption coefficient is a variable used to describe the true colouration of a water sample. The ”true colouration“ of a water sample is the colouration caused solely by dissolved substances in the sample. This is why the water sample has to be filtered prior to measurement. Measurement at a wavelength of 436 nm is obligatory and is adequate for natural waters and the outflow of municipal sewage plants. As industrial waste waters often have no pronounced extinction maxima, additional measurements are required at the wavelengths 525 nm and 620 nm. In case of doubt, you should perform a wavelength scan from 330 to 780 nm using the spectrum function (Mode 53).

Implementation of the provision Spectral absorption coefficient at 436 nm

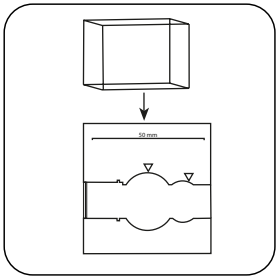
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



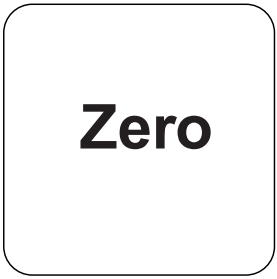
Filter approx. 100 ml sample with a pre-rinsed filter (pore size 0.45 µm).



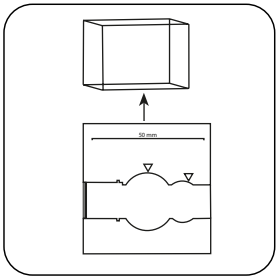
Fill **50 mm vial** with **deionised water** .



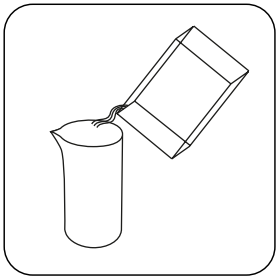
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **ZERO** button.

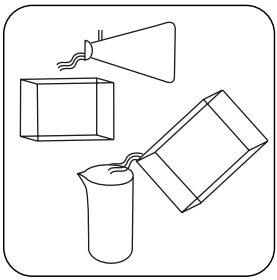


Remove **vial** from the sample chamber.

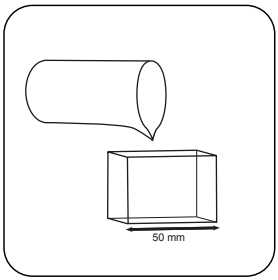


Empty vial.

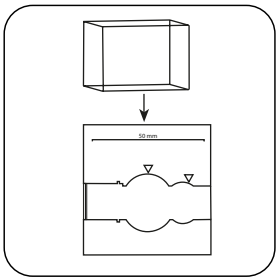
For devices that require **no ZERO measurement** , **start here**.



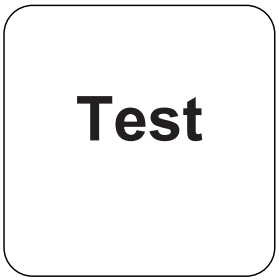
Rinse out vial with prepared sample .



Fill 50 mm vial with **sample**.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.
The result in (m^{-1}) appears on the display.

Chemical Method

Direct Reading EN ISO 7887:1994

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	□ **50 mm**
a	$-5.46584 \cdot 10^{-1}$
b	$1.00631 \cdot 10^{+2}$
c	
d	
e	
f	

According to

EN ISO 7887:1994, main section 3

SAC 436 nm M345

0.5 - 50 m^{-1}

Direct Reading EN ISO 7887:1994

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	□ 50 mm	436 nm	0.5 - 50 m^{-1}

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
no reagent required		

Application List

- Drinking Water Treatment

Preparation

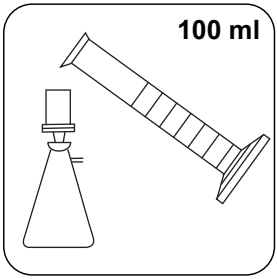
1. The deionised water for zero calibration should be passed through a membrane filter with a pore width of 0.45 µm.

Notes

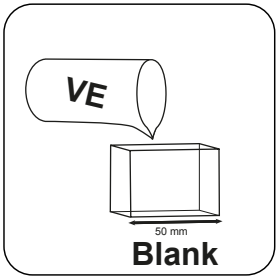
1. Because the colouration is dependent on pH value and temperature, these should be determined together with the optical measurement and specified along with the result.
2. The spectral absorption coefficient is a variable used to describe the true colouration of a water sample. The ”true colouration“ of a water sample is the colouration caused solely by dissolved substances in the sample. This is why the water sample has to be filtered prior to measurement. Measurement at a wavelength of 436 nm is obligatory and is adequate for natural waters and the outflow of municipal sewage plants. As industrial waste waters often have no pronounced extinction maxima, additional measurements are required at the wavelengths 525 nm and 620 nm. In case of doubt, you should perform a wavelength scan from 330 to 780 nm using the spectrum function (Mode 53).

Implementation of the provision Spectral absorption coefficient at 436 nm

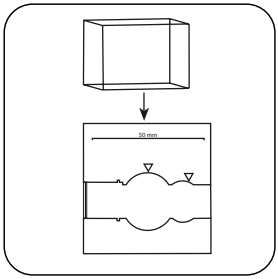
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



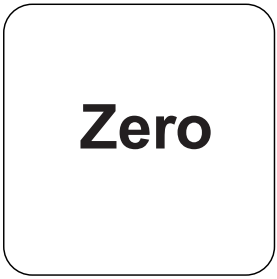
Filter approx. 100 ml sample with a pre-rinsed filter (pore size 0.45 µm).



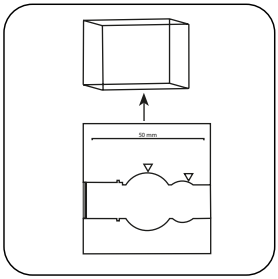
Fill **50 mm vial** with **deionised water** .



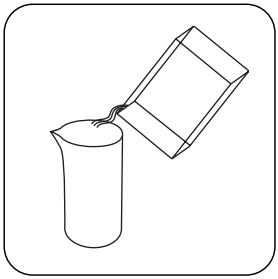
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **ZERO** button.

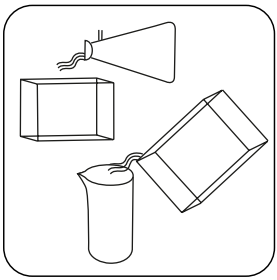


Remove **vial** from the sample chamber.

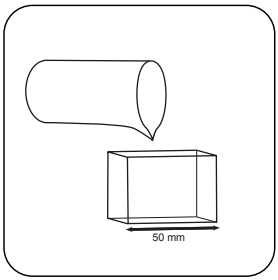


Empty vial.

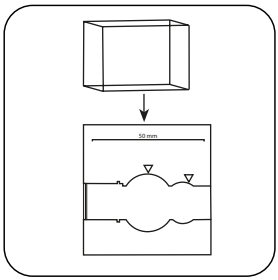
For devices that require **no ZERO measurement** , **start here**.



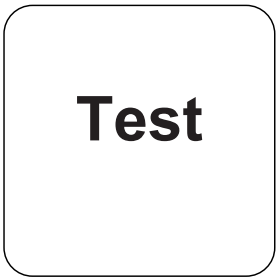
Rinse out vial with prepared sample .



Fill 50 mm vial with **sample**.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.
The result in (m^{-1}) appears on the display.

Chemical Method

Direct Reading EN ISO 7887:1994

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	□ **50 mm**
a	$-5.4658 \cdot 10^{-1}$
b	$1.00631 \cdot 10^{+2}$
c	
d	
e	
f	

According to

EN ISO 7887:1994, main section 3

SAC 525 nm M346

0.5 - 50 m^{-1}

Direct Reading EN ISO 7887:1994

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	□ 50 mm	525 nm	0.5 - 50 m^{-1}

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
no reagent required		

Application List

- Waste Water Treatment

Preparation

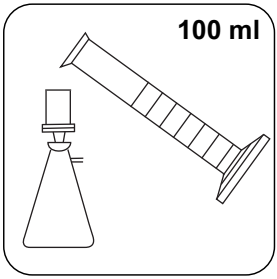
1. The deionised water for zero calibration should be passed through a membrane filter with a pore width of 0.45 µm.

Notes

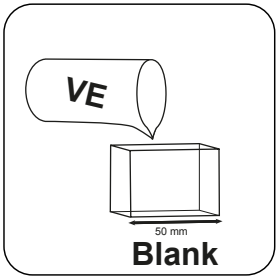
1. Because the colouration is dependent on pH value and temperature, these should be determined together with the optical measurement and specified along with the result.
2. The spectral absorption coefficient is a variable used to describe the true colouration of a water sample. The ”true colouration“ of a water sample is the colouration caused solely by dissolved substances in the sample. This is why the water sample has to be filtered prior to measurement. Measurement at a wavelength of 436 nm is obligatory and is adequate for natural waters and the outflow of municipal sewage plants. As industrial waste waters often have no pronounced extinction maxima, additional measurements are required at the wavelengths 525 nm and 620 nm. In case of doubt, you should perform a wavelength scan from 330 to 780 nm using the spectrum function (Mode 53).

Implementation of the provision Spectral absorption coefficient at 525 nm

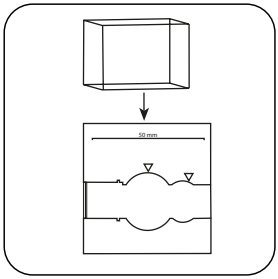
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



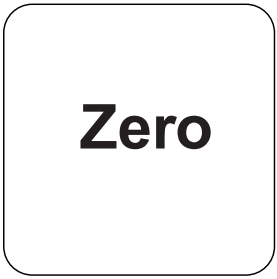
Filter approx. 100 ml sample with a pre-rinsed filter (pore size 0.45 µm).



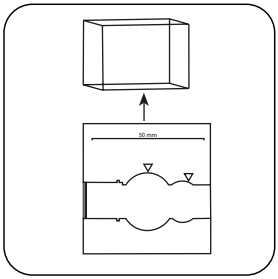
Fill **50 mm vial** with **deionised water** .



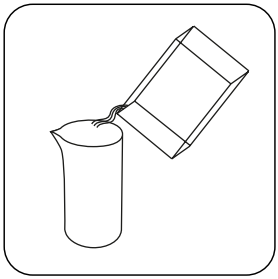
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **ZERO** button.

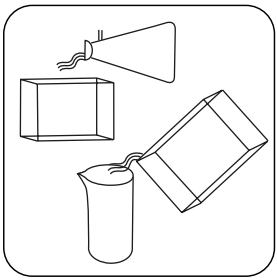


Remove **vial** from the sample chamber.

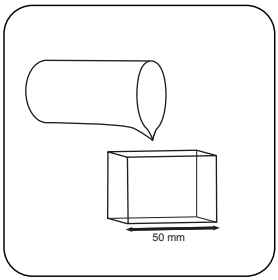


Empty vial.

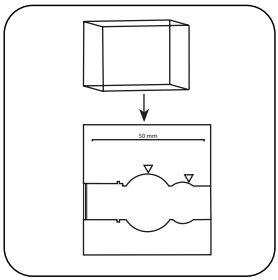
For devices that require **no ZERO measurement** , **start here**.



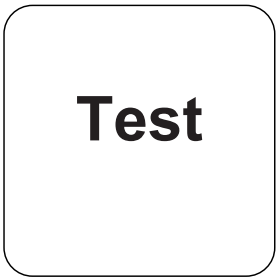
Rinse out vial with prepared sample .



Fill 50 mm vial with **sample**.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.
The result in (m^{-1}) appears on the display.

Chemical Method

Direct Reading EN ISO 7887:1994

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	□ **50 mm**
a	$-5.4658 \cdot 10^{-1}$
b	$1.00631 \cdot 10^{+2}$
c	
d	
e	
f	

According to

EN ISO 7887:1994, main section 3

SAC 620 nm M347

0.5 - 50 m^{-1}

Direct Reading EN ISO 7887:1994

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	□ 50 mm	620 nm	0.5 - 50 m^{-1}

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
no reagent required		

Application List

- Waste Water Treatment

Preparation

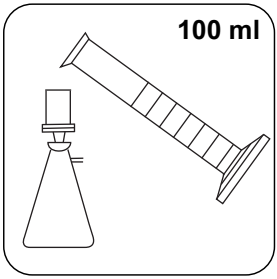
1. The deionised water for zero calibration should be passed through a membrane filter with a pore width of 0.45 µm.

Notes

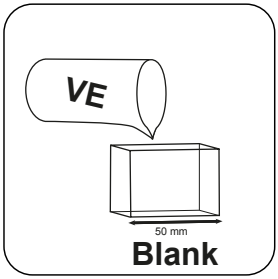
1. Because the colouration is dependent on pH value and temperature, these should be determined together with the optical measurement and specified along with the result.
2. The spectral absorption coefficient is a variable used to describe the true colouration of a water sample. The ”true colouration“ of a water sample is the colouration caused solely by dissolved substances in the sample. This is why the water sample has to be filtered prior to measurement. Measurement at a wavelength of 436 nm is obligatory and is adequate for natural waters and the outflow of municipal sewage plants. As industrial waste waters often have no pronounced extinction maxima, additional measurements are required at the wavelengths 525 nm and 620 nm. In case of doubt, you should perform a wavelength scan from 330 to 780 nm using the spectrum function (Mode 53).

Implementation of the provision Spectral absorption coefficient at 620 nm

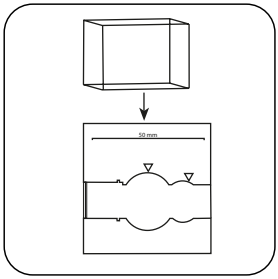
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



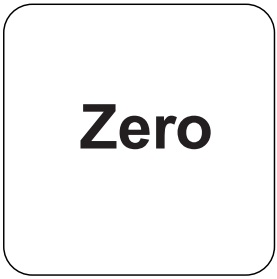
Filter approx. 100 ml sample with a pre-rinsed filter (pore size 0.45 µm).



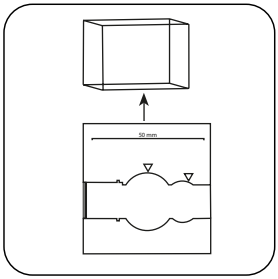
Fill **50 mm vial** with **deionised water** .



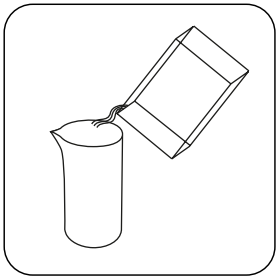
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **ZERO** button.

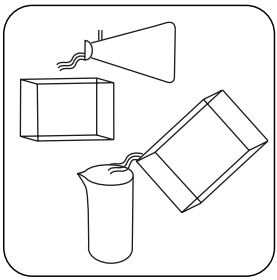


Remove **vial** from the sample chamber.

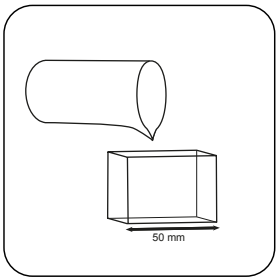


Empty vial.

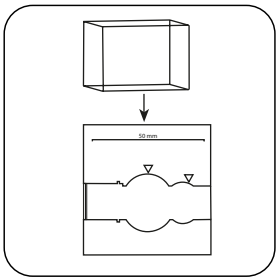
For devices that require **no ZERO measurement** , **start here**.



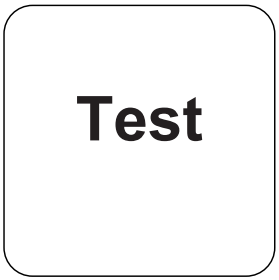
Rinse out vial with prepared sample .



Fill 50 mm vial with **sample**.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.
The result in (m^{-1}) appears on the display.

Chemical Method

Direct Reading EN ISO 7887:1994

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	□ **50 mm**
a	$-5.4658 \cdot 10^{-1}$
b	$1.00631 \cdot 10^{+2}$
c	
d	
e	
f	

According to

EN ISO 7887:1994, main section 3

Silica VLR PP M349

0.005 - 0.5 mg/L SiO_2

Heteropolyblue

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	□ 50 mm	820 nm	0.005 - 0.5 mg/L SiO_2

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Silicate VLR PP Reagent Set	1 Set	5443002

The following accessories are required.

Accessories	Packaging Unit	Part Number
W100/OG/50MM Rectangular cell, optical glass	1 pc.	601070
Universal Container - Cap	1 mL	424648

Application List

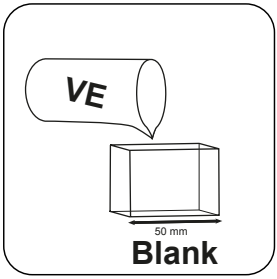
- Boiler Water

Notes

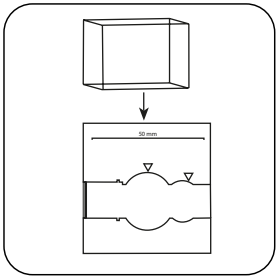
1. The test sample should have a pH value between 1 and 2 after the Heptamolybdate Reagent has been added.
2. Use a plastic sample container (›15 ml) with cap (for example part number 424648).

Implementation of the provision Silica VLR PP

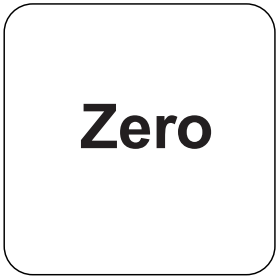
Select the method on the device



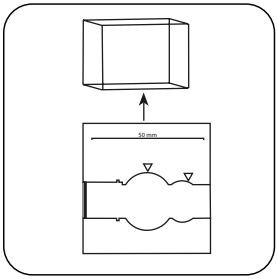
Fill **50 mm vial** with **deionised water** .



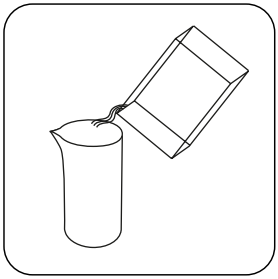
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



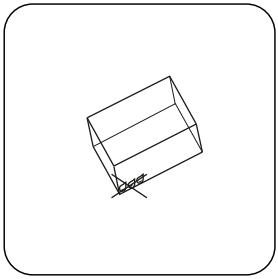
Press the **ZERO** button.



Remove **vial** from the sample chamber.

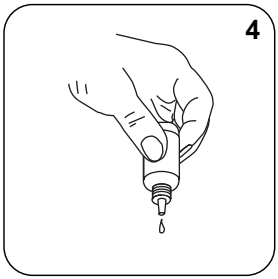


Empty vial.

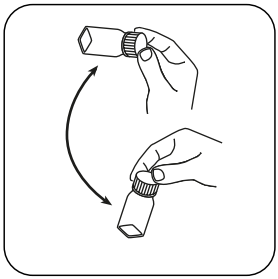


Dry the vial thoroughly.

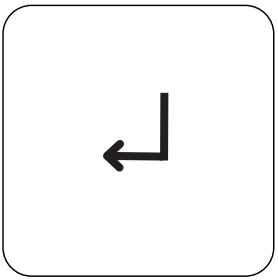
Fill a suitable sample vessel with **10 ml sample** .



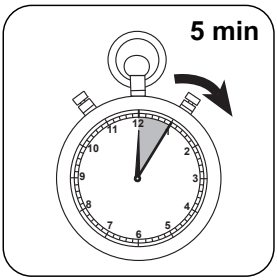
Add **4 drops Heptamolybdate Reagent**.



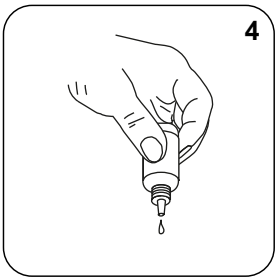
Invert several times to mix the contents.



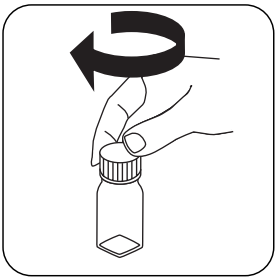
Press the **ENTER** button.



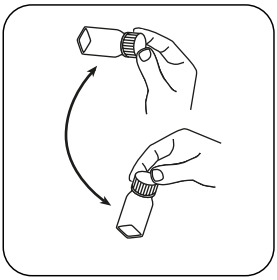
Wait for **5 minute(s) reaction time**.



Add **4 drops Tartaric Acid Reagent**.

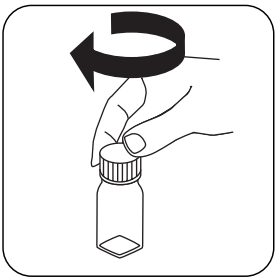


Close digestion vial

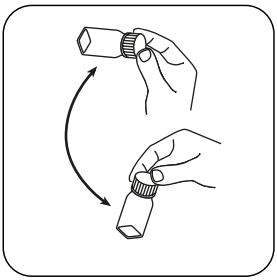


Invert several times to mix the contents.

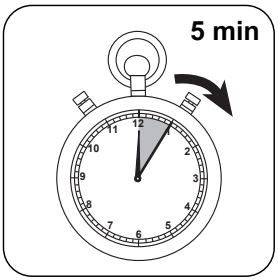
Add **Vario Silica Amino Acid F10 powder pack**.



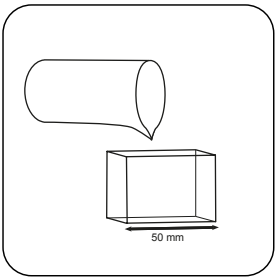
Close digestion vial



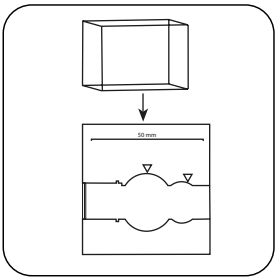
Swirl around to dissolve the powder.



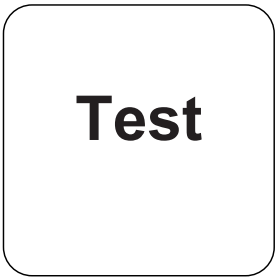
Wait for **5 minute(s) reaction time**.



Fill 50 mm vial with **sample**.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in mg/l SiO_2 appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	SiO2	1
mg/l	Si	0.47

Chemical Method

Heteropolyblue

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	□ **50 mm**
a	$0.00000 \cdot 10^{-2}$
b	$5.77158 \cdot 10^{-1}$
c	
d	
e	
f	

Method Validation

Limit of Detection	0.003 mg/L
Limit of Quantification	0.008 mg/L
End of Measuring Range	0.5 mg/L
Sensitivity	0.58 mg/L / Abs
Confidence Intervall	0.004 mg/L
Standard Deviation	0.002 mg/L
Variation Coefficient	0.73 %

Silcate T M350

0.05 - 4 mg/L SiO_2 Si

Silicomolybdenum Blue

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 600, MD 610, MD 640, MultiDirect	ø 24 mm	660 nm	0.05 - 4 mg/L SiO_2
SpectroDirect, XD 7000, XD 7500	ø 24 mm	820 nm	0.05 - 4 mg/L SiO_2

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Silica No. 1	Tablet / 100	513130BT
Silica No. 1	Tablet / 250	513131BT
Silica No. 2	Tablet / 100	513140BT
Silica No. 2	Tablet / 250	513141BT
Silica PR	Tablet / 100	513150BT
Silica PR	Tablet / 250	513151BT
Set Silica No. 1/No. 2 100 Pc.#	100 each	517671BT
Set Silica No. 1/No. 2 250 Pc.#	250 each	517672BT

Application List

- Boiler Water
- Raw Water Treatment

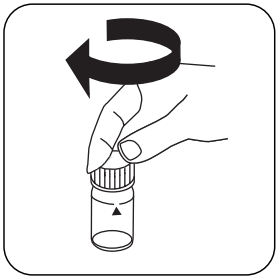
Notes

1. The tablets must be added in the correct sequence.

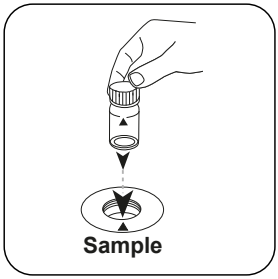
Implementation of the provision Silicon Dioxide with Tablet

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

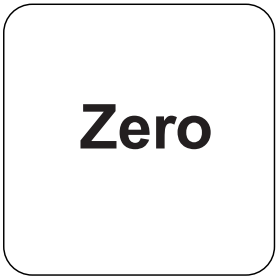
Fill 24 mm vial with **10 ml sample**.



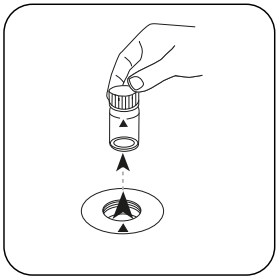
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

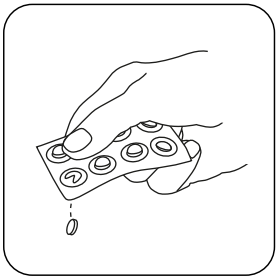


Press the **ZERO** button.

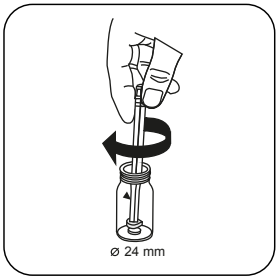


Remove the vial from the sample chamber.

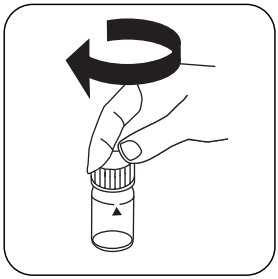
For devices that require **no ZERO measurement** , **start here**.



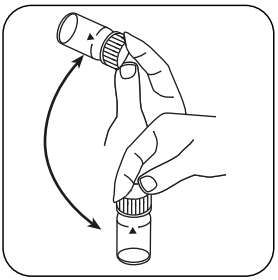
Add **SILICA No. 1 tablet** .



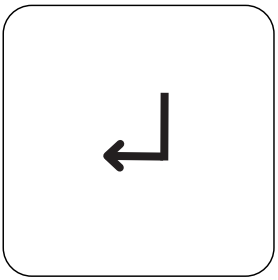
Crush tablet(s) by rotating slightly.



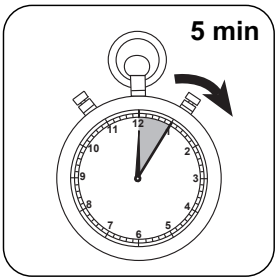
Close vial(s).



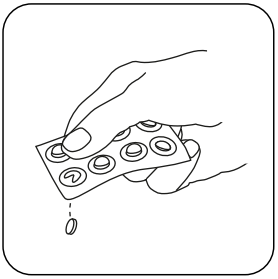
Dissolve tablet(s) by inverting.



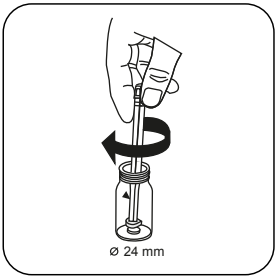
Press the **ENTER** button.



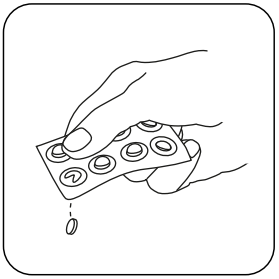
Wait for **5 minute(s) reaction time**.



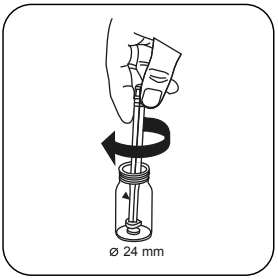
Add **SILICA PR tablet**.



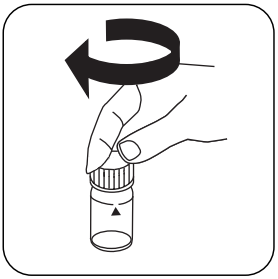
Crush tablet(s) by rotating slightly.



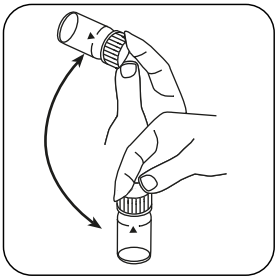
Add **SILICA No. 2 tablet** .



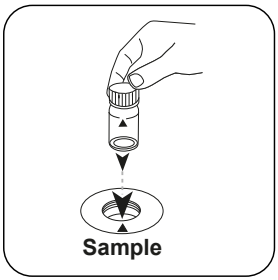
Crush tablet(s) by rotating slightly.



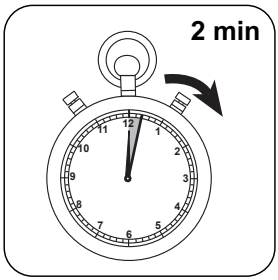
Close vial(s).



Dissolve tablet(s) by inverting.



Test



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

Press the **TEST** (XD: **START**)button.

Wait for **2 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Silica appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	SiO_2	1
mg/l	Si	0.47

Chemical Method

Silicomolybdenum Blue

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ 10 mm
a	$-4.74138 \cdot 10^{-2}$	$-4.74138 \cdot 10^{-2}$
b	$1.53143 \cdot 10^{+0}$	$3.29257 \cdot 10^{+0}$
c		
d		
e		
f		

Interferences

Removeable Interferences

- Phosphate does not interfere under the reaction conditions.

Derived from

Standard Method 4500-SiO2 C

including stirring rod, 10 cm

Silicate LR PP M351

0.1 - 1.6 mg/L SiO_2 SiLr

Heteropolyblue

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 600, MD 610, MD 640, MultiDirect	ø 24 mm	660 nm	0.1 - 1.6 mg/L SiO_2
SpectroDirect, XD 7000, XD 7500	ø 24 mm	815 nm	0.05 - 1.6 mg/L SiO_2

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
VARIO Silica LR, Set F10	1 Set	535690

Application List

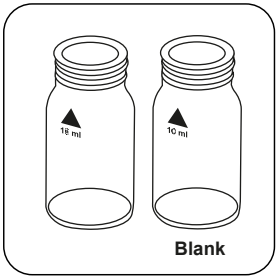
- Boiler Water

Notes

1. The given reaction time of 4 minutes refers to a sample temperature of 20 °C. At a sample temperature of 30 °C, a reaction time is 4 minutes and at 10 °C, a reaction time of 8 minutes.

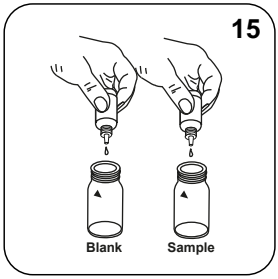
Implementation of the provision Silicon dioxide LR with Vario Powder Packs and liquid reagent

Select the method on the device

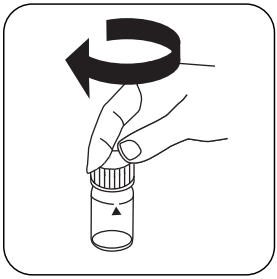


Prepare two clean 24 mm vials. Mark one as a blank.

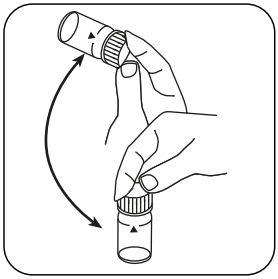
Place **10 ml sample** in each vial.



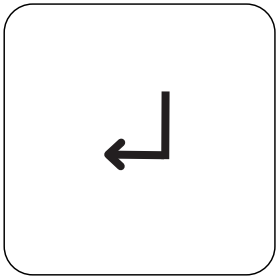
Add **15 drops Vario Molybdate 3 Reagenz-solution** to each vial.



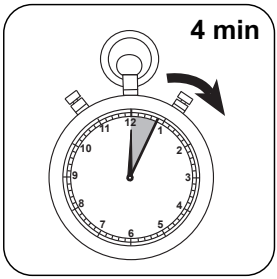
Close vial(s).



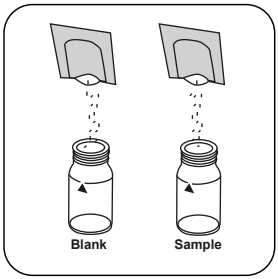
Invert several times to mix the contents.



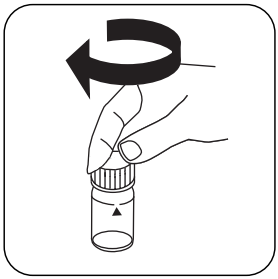
Press the **ENTER** button.



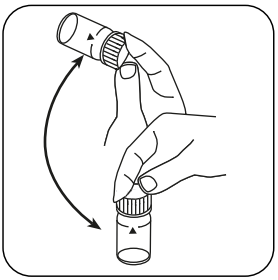
Wait for **4 minute(s) reaction time**.



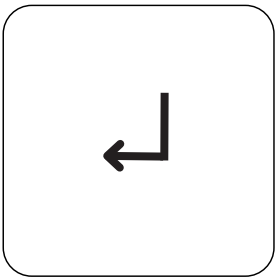
Add **a Vario Silica Citric Acid F10 powder pack** in each vial.



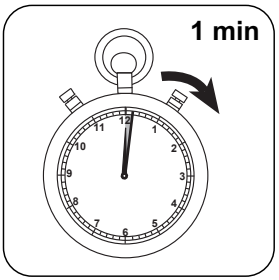
Close vial(s).



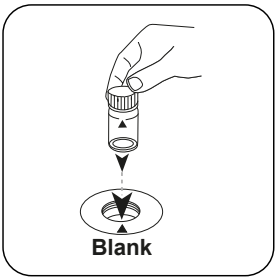
Swirl around to dissolve the powder.



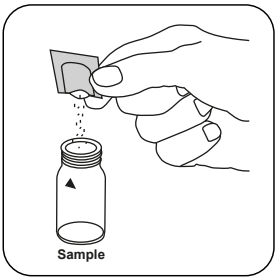
Press the **ENTER** button.



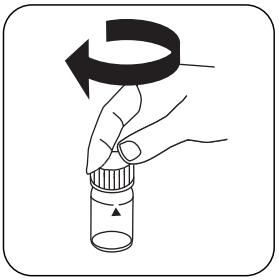
Wait for **1 minute(s) reaction time**.



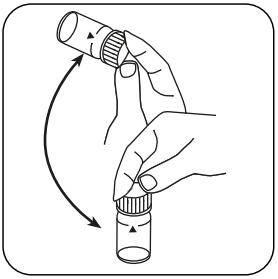
Place **blank** in the sample chamber. • Pay attention to the positioning.



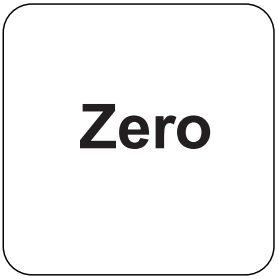
Add a **Vario Silica Amino Acid F10 powder pack** to the sample vial.



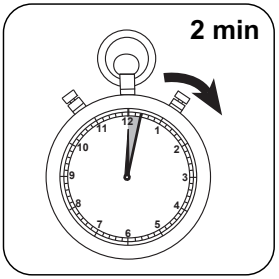
Close vial(s).



Swirl around to dissolve the powder.

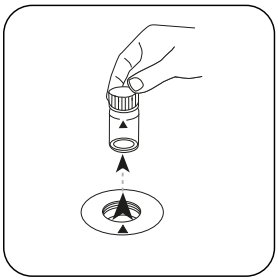


Press the **ZERO** button.

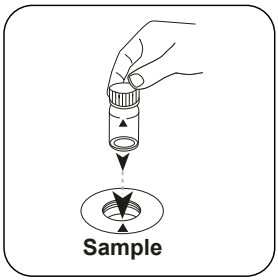


Wait for **2 minute(s) reaction time**.

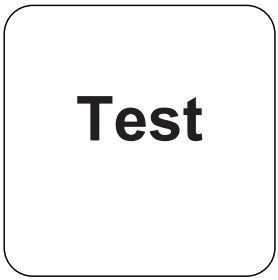
Once the reaction period is finished, the measurement takes place automatically.



Remove the vial from the sample chamber.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in mg/l Silica appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	SiO_2	1
mg/l	Si	0.47

Chemical Method

Heteropolyblue

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ 10 mm
a	$-3.52432 \cdot 10^{-2}$	$-3.52432 \cdot 10^{-2}$
b	$1.45158 \cdot 10^{+0}$	$3.1209 \cdot 10^{+0}$
c	$-7.19729 \cdot 10^{-2}$	$-3.32695 \cdot 10^{-1}$
d		
e		
f		

Interferences

Removeable Interferences

1. Close the vials with the cap immediately after adding the Vario Molybdate 3 reagent solution, otherwise low readings may result.
2. Occasionally water samples contain forms of silica which reacts very slowly with Molybdate. The nature of these forms is not known. A pre-treatment with Sodium hydrogencarbonate and then with Sulphuric Acid will make these forms reactive to Molybdate (pre-treatment is given in “Standard Methods for the Examination of Water and Wastewater” under “ Silica Digestion with Sodium Bicarbonate”).

Interference	from / [mg/L]
Fe	large quantities
PO_4^{3-}	50
S^{2-}	in all quantities

Method Validation

Limit of Detection	0.01 mg/L
Limit of Quantification	0.03 mg/L
End of Measuring Range	1.6 mg/L
Sensitivity	1.35 mg/L / Abs
Confidence Intervall	0.01 mg/L
Standard Deviation	0.004 mg/L
Variation Coefficient	0.46 %

Derived from

Standard Method 4500-SiO2 D

Silicate HR PP M352

1 - 90 mg/L SiO_2 SiHr

Silicomolybdate

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 110, MD 600, MD 610, MD 640, MultiDirect	ø 24 mm	430 nm	1 - 90 mg/L SiO_2
SpectroDirect, XD 7000, XD 7500	ø 24 mm	452 nm	1 - 100 mg/L SiO_2

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
VARIO Silica HR Reagent, Set F10	1 Set	535700

Application List

- Boiler Water
- Raw Water Treatment

Preparation

1. The temperature of the sample should be between 15 °C and 25 °C.

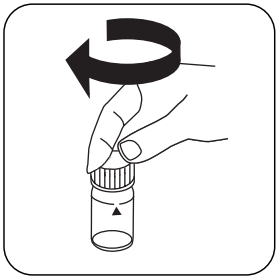
Notes

1. The method measures in the flank of the absorption curve of the resulting coloration. For filter photometers, the accuracy of the method can therefore be improved, if necessary, by user adjustment using a silicate standard (approx. 70 mg/L SiO_2).

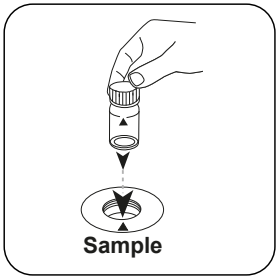
Implementation of the provision Silicate dioxide HR with Vario Powder Packs

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

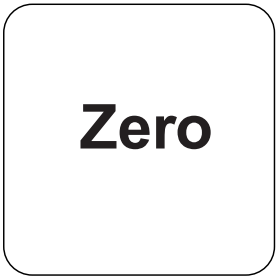
Fill 24 mm vial with **10 ml sample**.



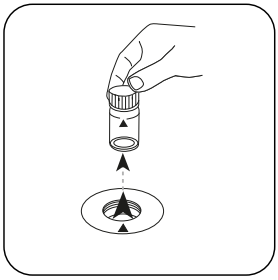
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

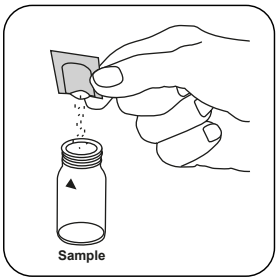


Press the **ZERO** button.

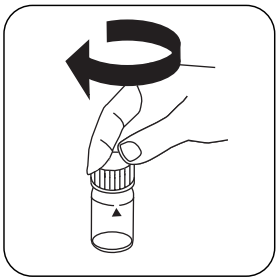


Remove the vial from the sample chamber.

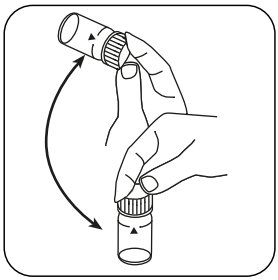
For devices that require **no ZERO measurement** , **start here**.



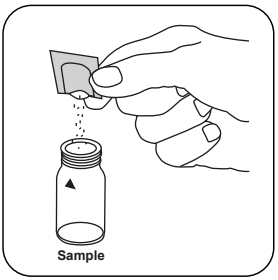
Add **Vario Silica HR Molybdate F10 powder pack**.



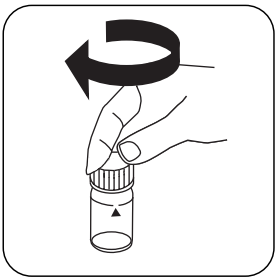
Close vial(s).



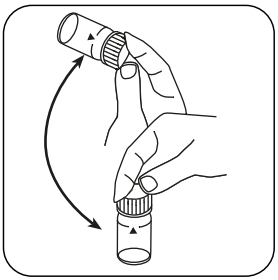
Swirl around to dissolve the powder.



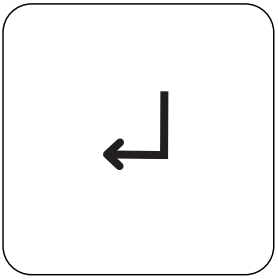
Add **Vario Silica HR Acid Rgt. F10 powder pack**.



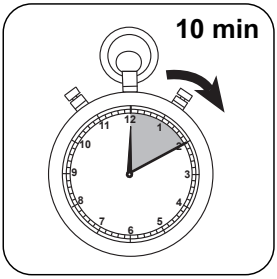
Close vial(s).



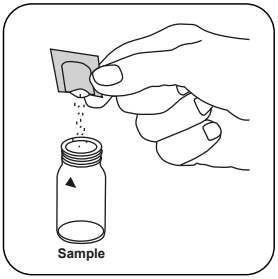
Invert several times to mix the contents.



Press the **ENTER** button.

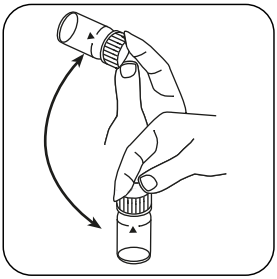


Wait for **10 minute(s) reaction time**.

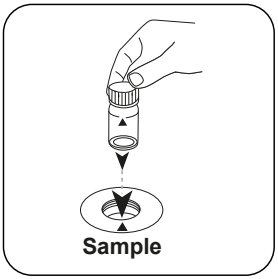


Add **Vario Silica Citric Acid F10 powder pack**.

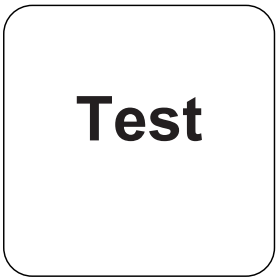
Close vial(s).



Swirl around to dissolve the powder.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

Wait for **2 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Silica appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	SiO_2	1
mg/l	Si	0.47

Chemical Method

Silicomolybdate

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ 10 mm
a	$-4.11457 \cdot 10^{-1}$	$-4.11457 \cdot 10^{-1}$
b	$1.18844 \cdot 10^{+2}$	$2.55514 \cdot 10^{+2}$
c		
d		
e		
f		

Interferences

Removeable Interferences

- Occasionally water samples contain forms of silica which reacts very slowly with Molybdate. The nature of these forms is not known. A pre-treatment with Sodium hydrogencarbonate and then with Sulphuric Acid will make these forms reactive to Molybdate (pre-treatment is given in “Standard Methods for the Examination of Water and Wastewater” under “ Silica Digestion with Sodium Bicarbonate”).
- If silicon dioxide or phosphate are present, a yellow colour develops.
  The yellow colour caused by phosphate is eliminated by the addition of silica citric acid F10 powder packets.

Interference	from / [mg/L]	Influence
Fe	large quantities	
PO_4^{3-}	50	
PO_4^{3-}	60	The disturbance is about -2 %
PO_4^{3-}	75	The disturbance is about -11 %
S^{2-}	in all quantities	

Method Validation

Limit of Detection	0.38 mg/L
Limit of Quantification	1.14 mg/L
End of Measuring Range	100 mg/L
Sensitivity	120 mg/L / Abs
Confidence Intervall	1.69 mg/L
Standard Deviation	0.70 mg/L
Variation Coefficient	1.38 %

Derived from

Standard Method 4500-SiO2 C

Silicate L M353

0.1 - 8 mg/L SiO_2

Heteropolyblue

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, XD 7000, XD 7500	ø 24 mm	660 nm	0.1 - 8 mg/L SiO_2

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Silica LR L	1 Set	56R023856

Application List

- Boiler Water
- Raw Water Treatment

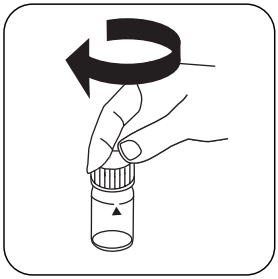
Preparation

1. The measuring spoon supplied with the reagents must be used for the correct dosage.
2. To get accurate results the sample temperature must be between 20 °C and 30 °C.

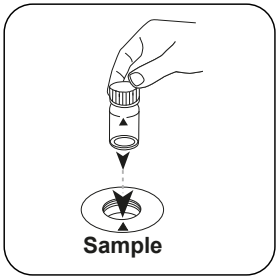
Implementation of the provision Silicon dioxide with liquid reagent

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

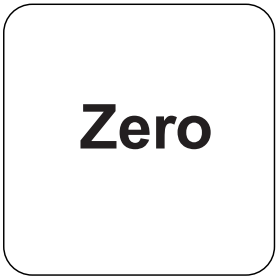
Fill 24 mm vial with **10 ml sample**.



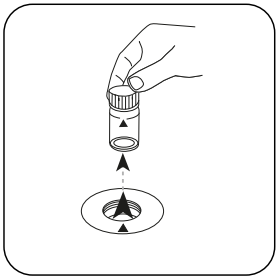
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

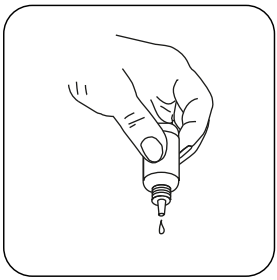


Press the **ZERO** button.

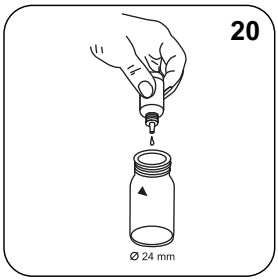


Remove the vial from the sample chamber.

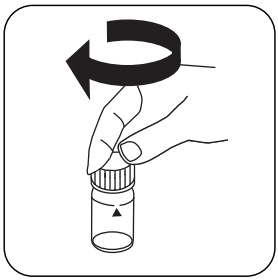
For devices that require **no ZERO measurement** , **start here**.



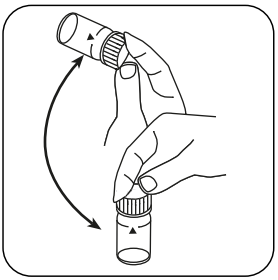
Hold cuvettes vertically and add equal drops by pressing slowly.



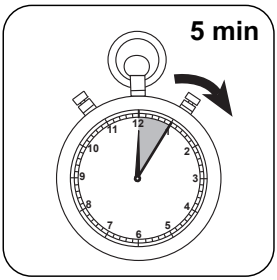
Add **20 drops KS104 (Silica Reagent 1)**.



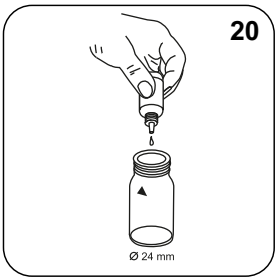
Close vial(s).



Invert several times to mix the contents.

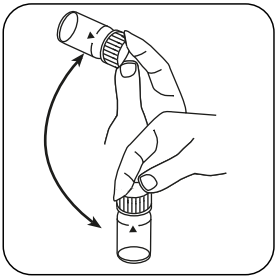


Wait for **5 minute(s) reaction time**.

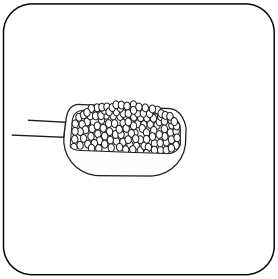


Add **20 drops KS105 (Silica Reagent 2)**.

Close vial(s).

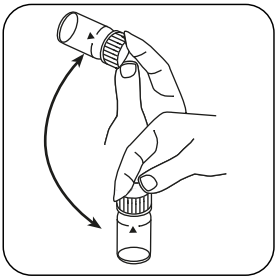


Invert several times to mix the contents.

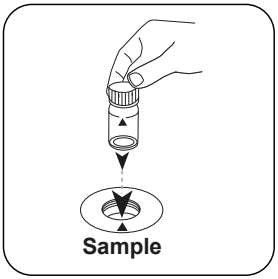


Add **a measuring scoop KP106 (Silica Reagent 3)** .

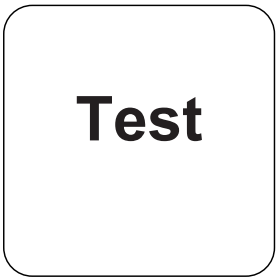
Close vial(s).

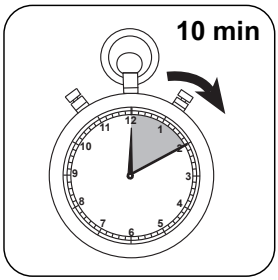


Swirl around to dissolve the powder.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.





Press the **TEST** (XD: **START**)button.

Wait for **10 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Silica appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	SiO_2	1
mg/l	Si	0.47

Chemical Method

Heteropolyblue

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ 10 mm
a	$-7.53464 \cdot 10^{-1}$	$-7.53464 \cdot 10^{-1}$
b	$4.10695 \cdot 10^{+0}$	$8.82994 \cdot 10^{+0}$
c		
d		
e		
f		

Interferences

Persistant Interferences

- At a temperature below 20 °C no complete reaction occurs, thus reducing findings are to be expected.

Derived from

Standard Method 4500-SiO2 D

Sulphate T M355

5 - 100 mg/L SO_4^{2-}

Bariumsulphate Turbidity

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect, PM 620, PM 630, XD 7000, XD 7500	ø 24 mm	610 nm	5 - 100 mg/L SO_4^{2-}

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Sulfate Turbidity	Tablet / 100	515450BT
Sulfate Turbidity	Tablet / 250	515451BT

Application List

- Waste Water Treatment
- Cooling Water
- Drinking Water Treatment
- Pool Water Treatment
- Raw Water Treatment

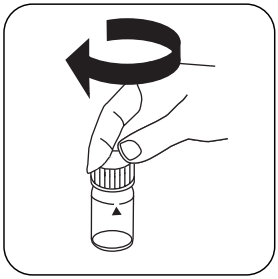
Notes

1. Sulphate causes a finely distributed turbidity with a milky appearance.

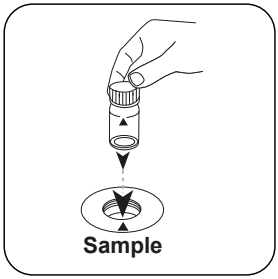
Implementation of the provision Sulphate with Tablet

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

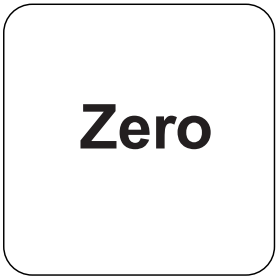
Fill 24 mm vial with **10 ml sample**.



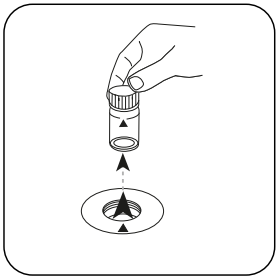
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

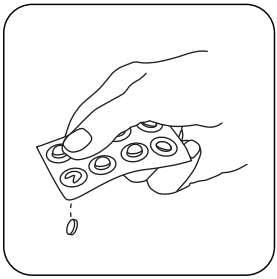


Press the **ZERO** button.

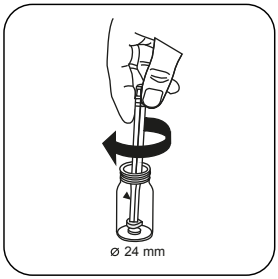


Remove the vial from the sample chamber.

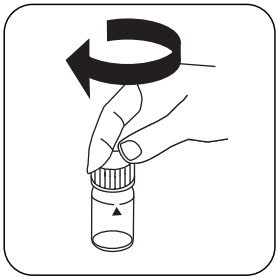
For devices that require **no ZERO measurement** , **start here**.



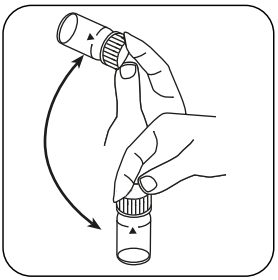
Add **SULFATE T tablet**.



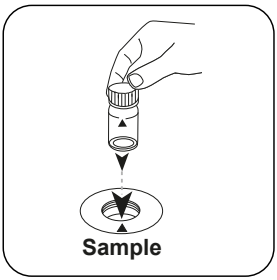
Crush tablet(s) by rotating slightly.



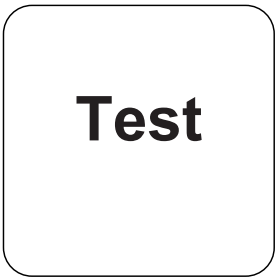
Close vial(s).



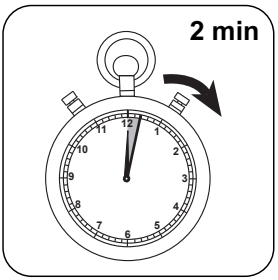
Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **2 minute(s) reaction time**.
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Sulphate appears on the display.

Chemical Method

Bariumsulphate Turbidity

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^{2} + d•Abs^{3} + e•Abs^{4} + f•Abs^{5}

	ø 24 mm	**□ 10 mm**
a	3.70245 • 10^{+0}	3.70245 • 10^{+0}
b	1.39439 • 10^{+2}	2.99793 • 10^{+2}
c		
d		
e		
f		

Derived from

DIN ISO 15923-1 D49

Sulphate PP M360

5 - 100 mg/L SO_4^{2-} SO4

Bariumsulphate Turbidity

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 110, MD 600, MD 610, MD 640, MultiDirect, PM 620, PM 630, SpectroDirect, XD 7000, XD 7500	ø 24 mm	530 nm	5 - 100 mg/L SO_4^{2-}

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
VARIO Sulfa 4 F10	Powder / 100 pc.	532160

Application List

- Waste Water Treatment
- Cooling Water
- Drinking Water Treatment
- Pool Water Treatment
- Raw Water Treatment

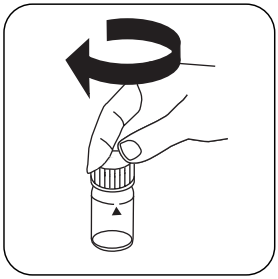
Notes

1. Sulphate causes a finely distributed turbidity.

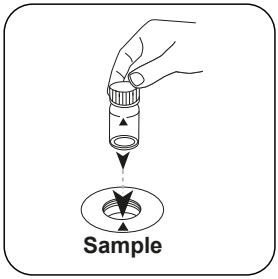
Implementation of the provision Sulphate with Vario Powder Pack

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

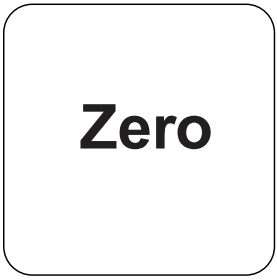
Fill 24 mm vial with **10 ml sample**.



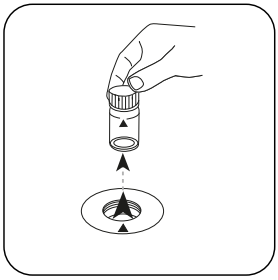
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

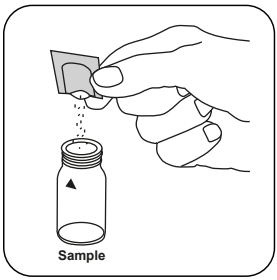


Press the **ZERO** button.

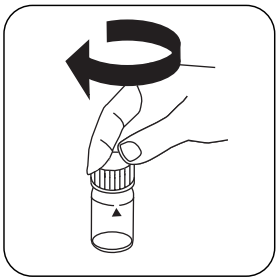


Remove the vial from the sample chamber.

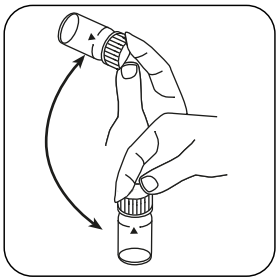
For devices that require **no ZERO measurement** , **start here**.



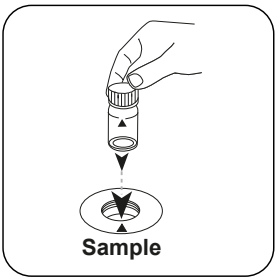
Add **Vario Sulpha 4/ F10 powder pack**.



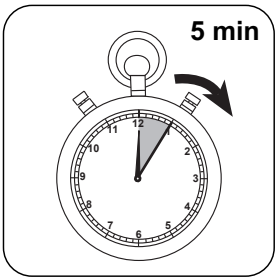
Close vial(s).



Invert several times to mix the contents.



Test



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

Press the **TEST** (XD: **START**)button.

Wait for **5 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Sulphate appears on the display.

Chemical Method

Bariumsulphate Turbidity

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	2.42421 • 10^{+0}	2.42421 • 10^{+0}
b	1.07243 • 10^{+2}	2.30572 • 10^{+2}
c	-1.11466 • 10^{+2}	-5.15249 • 10^{+2}
d	7.93311 • 10^{+1}	7.88423 • 10^{+2}
e	-1.88194 • 10^{+1}	-4.02123 • 10^{+2}
f		

According to

Standard Method 4500-SO42- E
US EPA 375.4

Derived from

DIN ISO 15923-1 D49

Sulphate HR PP M361

50 - 1000

Bariumsulphate Turbidity

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect, SpectroDirect, XD 7000, XD 7500	ø 24 mm	530 nm	50 - 1000

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
VARIO Sulfa 4 F10	Powder / 100 pc.	532160
Deionised Water	100 mL	461275
Deionised Water	250 mL	457022

The following accessories are required.

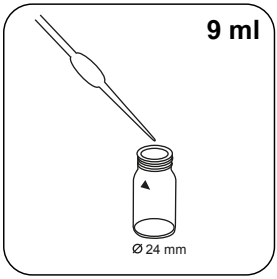
Accessories	Packaging Unit	Part Number
Round cuvette 24 mm, set of 5	1 Set	197629
Automatic pipette, 1-5 ml	1 pc.	419076
Pipette tips, 1-5 ml (white) 100 pc.	1 pc.	419066

Application List

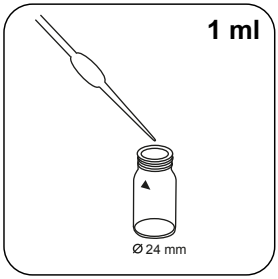
- Waste Water Treatment
- Cooling Water
- Drinking Water Treatment
- Pool Water Treatment
- Raw Water Treatment

Implementation of the provision Sulphate HR with powder packs

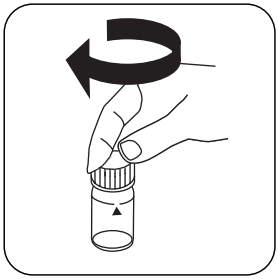
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



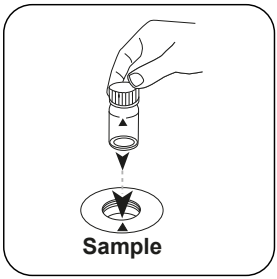
Fill 24 mm vial with **9 ml deionised water** .



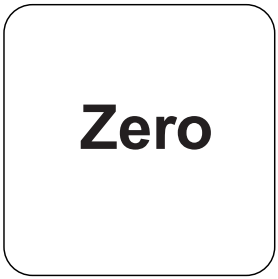
Put **1 ml sample** in the vial.



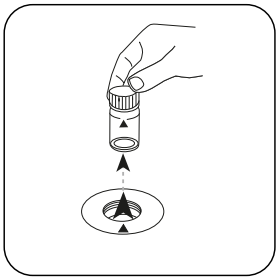
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

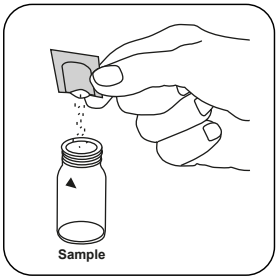


Press the **ZERO** button.

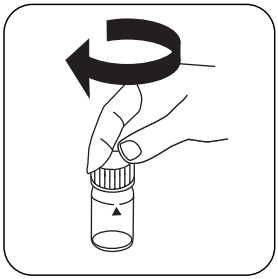


Remove the vial from the sample chamber.

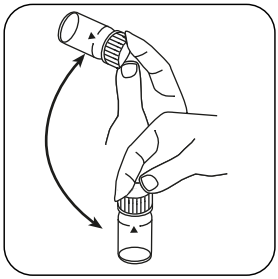
For devices that require **no ZERO measurement** , **start here**.



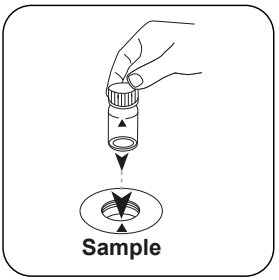
Add **Vario Sulpha 4/ F10 powder pack**.



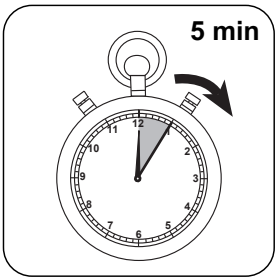
Close vial(s).



Invert several times to mix the contents.



Test



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

Press the **TEST** (XD: **START**)button.

Wait for **5 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Sulphate appears on the display.

Chemical Method

Bariumsulphate Turbidity

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	2.42421 • 10^{+1}	2.42421 • 10^{+1}
b	1.07243 • 10^{+3}	2.30572 • 10^{+3}
c	-1.11466 • 10^{+3}	-5.15249 • 10^{+3}
d	7.93311 • 10^{+2}	7.88423 • 10^{+3}
e	-1.88194 • 10^{+2}	-4.02124 • 10^{+3}
f		

Method Validation

Limit of Detection	2.91 mg/L
Limit of Quantification	8.74 mg/L
End of Measuring Range	1,000 mg/L
Sensitivity	516 mg/L / Abs
Confidence Intervall	56.16 mg/L
Standard Deviation	23.22 mg/L
Variation Coefficient	4.42 %

Selenium M363

0.05 - 1.6 mg/L Se

3,3'-Diaminobenzidine in Toluene

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect	□ 50 mm	445 nm	0.05 - 1.6 mg/L Se
XD 7000, XD 7500	□ 50 mm	445 nm	0.05 - 2 mg/L Se

Sampling

- Turbid samples must be filtered through a 0.45 µm pore size membrane filter.

Preparation

The following reagents need to be purchased:
1. Formic acid 98-100% for analysis (CAS-No.: 64-18-6)
2. 3,3′-Diaminobenzidine tetrahydrochloride-hydrate (CAS-No.: 868272-85-9)
3. Ammonia water 25% for analysis (CAS-No.: 1336-21-6)
4. EDTA disodium salt solution 0.1 mol/l (CAS-No.: 139-33-3)
5. Toluene for gaschromatography (CAS-No.: 108-33-3)
6. pH-indicator strips, pH 2.0 - 9.0
7. Sodium sulfate anhydrous for analysis (CAS-No.: 7757-82-6)
8. Water for analysis

Other materials:
1. membrane filter (pore size: 0.45 µm)

- The pH-value of the sample should be almost neutral before the analysis.

Notes

- The result is given in mg/L Se^{4+}

Implementation of the provision Selenium

Select the method on the device
Reagent 1
- Bring 9.4 ml formic acid p.a. into a 100-ml-volumetric flask
- Fill with water p.a. up to the mark.

Reagent 2
- Solve 0.5 g 3,3′-diaminobenzidine tetrahydrochloride-hydrate in 100 ml cooled water p.a.
- This reagent needs to be freshly prepared per working day and stored in an amber bottle.

Reagent 3
- Bring 48 ml ammonia water 25% p.a. into a 100-ml-volumetric flask.
- Fill with water p.a. up to the mark.

1. Fill 50 mm cell with toluene.
2. Place cell in sample chamber, making sure the positioning is correct.
3. Press **Zero** key.
4. Remove the cell from the sample chamber. Empty the cell and dry completely.
5. Add **60 ml** of the **sample** into a beaker.
6. Add **4 ml Reagent 1.**
7. Add **4 ml EDTAsolution.**
8. Add **4 ml Reagent 2.**
9. Mix reagents using a stirring rod.
10. Set the pH-value to **2.5 using Reagent 3**.
11. Store beaker at a dark place for **45 minutes** .
12. Set the pH-value to **7.0 using Reagent 3.**
13. Transfer the sample into a 250-ml-separatory funnel.
14. Add **30ml water for analysis.**
15. Add **14 ml toluene.**
16. Shake for **1 minute.**
17. Discard the lower aqueous phase.
18. Transfer the toluene phase into a small (25-50 ml) Erlenmeyer flask.
19. Add one spade point tip of **sodium sulfate anhydrous.**
20. Mix reagent by shaking the beaker gently.
21. Decant the toluene extract into a 50 mm cell.
22. Place cell in sample chamber, making sure the positioning is correct.
23. Press **Test** key.

The result in mg/l Selenium appears on the display.

Chemical Method

3,3'-Diaminobenzidine in Toluene

Sulphide T M365

0.04 - 0.5 mg/L S^{2-}

DPD / Catalyst

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect	ø 24 mm	660 nm	0.04 - 0.5 mg/L S^{2-}
SpectroDirect, XD 7000, XD 7500	ø 24 mm	668 nm	0.04 - 0.5 mg/L S^{2-}

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Sulfide No. 1	Tablet / 100	502930
Sulfide No. 2	Tablet / 100	502940

Application List

- Drinking Water Treatment
- Raw Water Treatment
- Waste Water Treatment

Sampling

1. To avoid loss of sulphide, the sample shall be taken carefully under minimal exposure to air. Also, the test must be performed immediately after sampling.

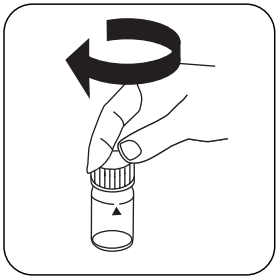
Notes

1. The tablets must be added in the correct sequence.

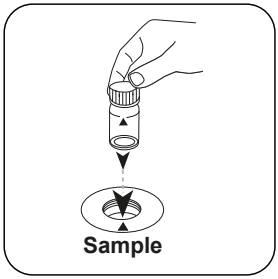
Implementation of the provision Sulphide with Tablet

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

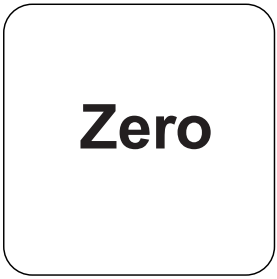
Fill 24 mm vial with **10 ml sample**.



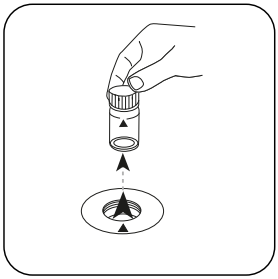
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

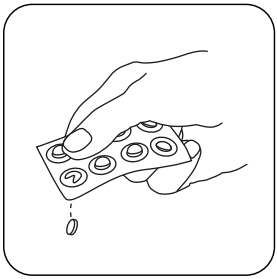


Press the **ZERO** button.

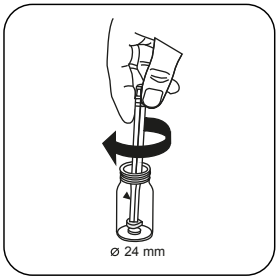


Remove the vial from the sample chamber.

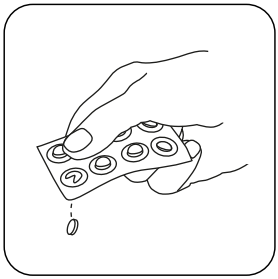
For devices that require **no ZERO measurement** , **start here**.



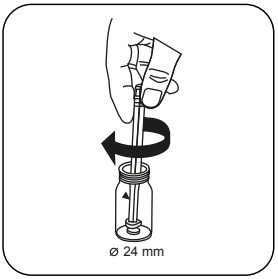
Add **SULFIDE No. 1 tablet** .



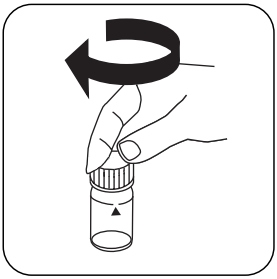
Crush tablet(s) by rotating slightly.



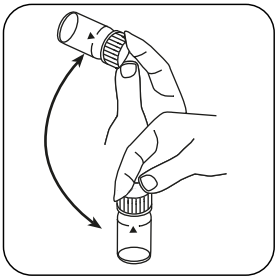
Add **SULFIDE No. 2 tablet** .



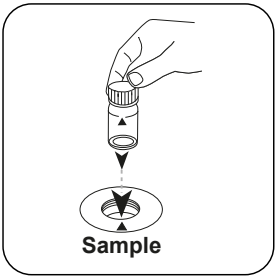
Crush tablet(s) by rotating slightly.



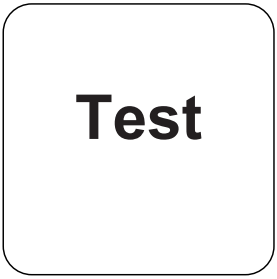
Close vial(s).



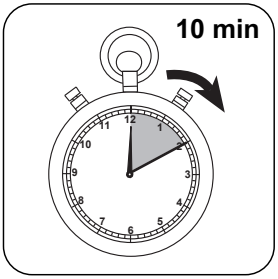
Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **10 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically. The result in mg/l Sulphide appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	S^{2-}	1
mg/l	H_2S	1.0629

Chemical Method

DPD / Catalyst

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	□ 10 mm
a	$-5.52335 \cdot 10^{-2}$	$-5.52335 \cdot 10^{-2}$
b	$3.44705 \cdot 10^{-1}$	$7.41116 \cdot 10^{-1}$
c	$-2.88766 \cdot 10^{-2}$	$-1.33482 \cdot 10^{-1}$
d		
e		
f		

Interferences

Removeable Interferences

- Chlorine and other oxidising agents that react with DPD, do not interfere with the test
- The recommended analysis temperature is 20 ° C. Deviations from the temperature can lead to excess or may show lower results.

Bibliography

Photometrische Analyseverfahren, Schwedt, Wissenschaftliche Verlagsgesellschaft mbH, Stuttgart 1989
Photometrische Analyse, Lange/ Vjedelek, Verlag Chemie 1980

Derived from

DIN 38405-D26/27

Sulphite 10 T M368

0.1 - 10 mg/L SO_3

DTNB

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	□ 10 mm	405 nm	0.1 - 10 mg/L SO_3

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Sulfite LR	Tablet / 100	518020BT

Application List

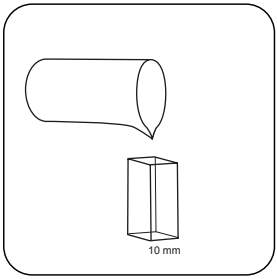
- Waste Water Treatment
- Galvanization

Notes

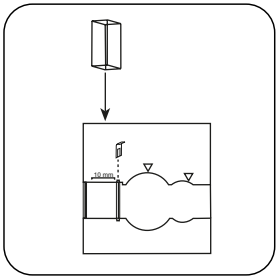
Variations in the length of the vial can extend the measuring range:
- 10 mm vial: 0.1 mg/L - 10 mg/L, solution: 0.01
- 20 mm vial: 0.05 mg/L - 5 mg/L, solution: 0.01
- 50 mm vial: 0.02 mg/L - 2 mg/L, solution: 0.001

Implementation of the provision Sulphite with Tablet

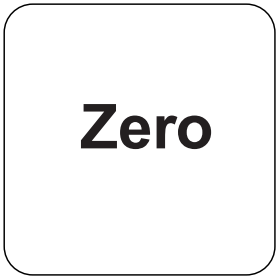
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



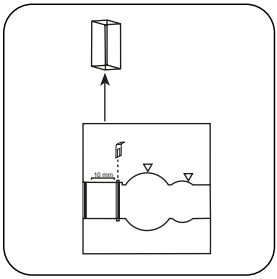
Fill 10 mm vial with **sample**.



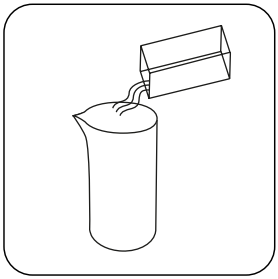
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



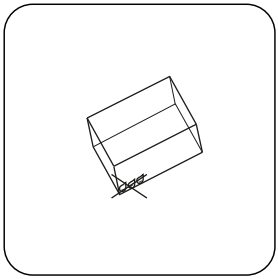
Press the **ZERO** button.



Remove **vial** from the sample chamber.

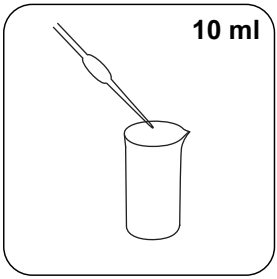


Empty vial.

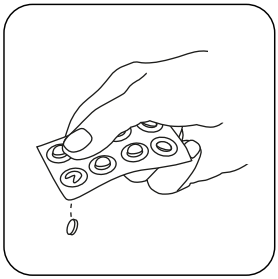


Dry the vial thoroughly.

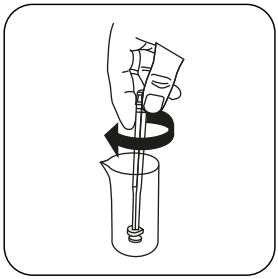
For devices that require **no ZERO measurement** , **start here**.



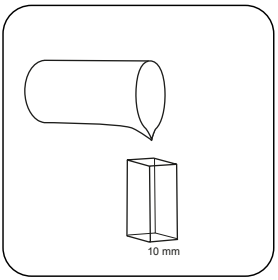
Put **10 ml sample** in the sample vessel.



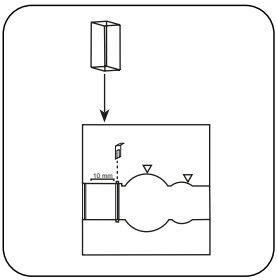
Add **SULFITE LR tablet**.



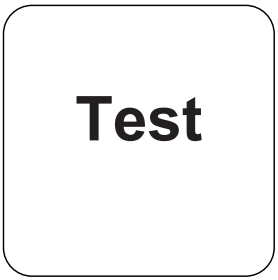
Crush tablet(s) by rotating slightly and dissolve.



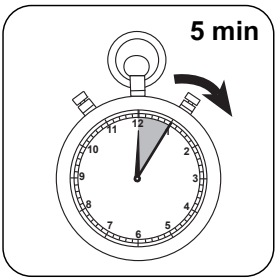
Fill 10 mm vial with **sample**.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **5 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Sulphite appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	SO_3^{2-}	1
mg/l	Na_2SO_3	1.5743

Chemical Method

DTNB

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	□ **10 mm**
a	$-4.72981 \cdot 10^{-1}$
b	$6.87211 \cdot 10^{+0}$
c	
d	
e	
f	

Bibliography

R.E. Humphrey, M.H. Ward, W. Hinze, Spectrophotometric determination of sulphite with 4,4'-dithio-dipyridine and 5,5'-dithiobis(2-nitrobenzoic acid), Anal. Chem., 1970, 42 (7), pp 698–702

Sulphite T M370

0.1 - 5 mg/L SO_3

DTNB

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect	ø 24 mm	430 nm	0.1 - 5 mg/L SO_3
SpectroDirect	ø 24 mm	405 nm	0.05 - 4 mg/L SO_3
XD 7000, XD 7500	ø 24 mm	405 nm	0.1 - 5 mg/L SO_3

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Sulfite LR	Tablet / 100	518020BT

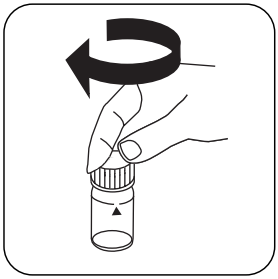
Application List

- Waste Water Treatment
- Galvanization

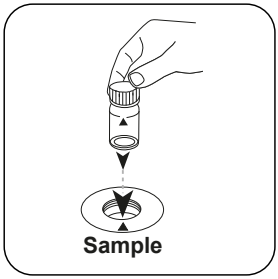
Implementation of the provision Sulphite with Tablet

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

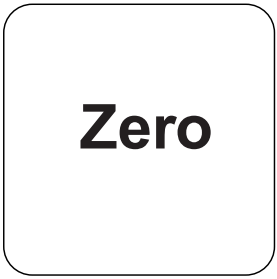
Fill 24 mm vial with **10 ml sample**.



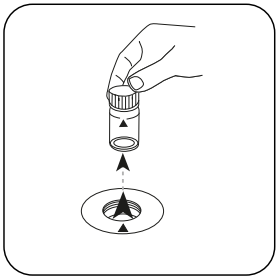
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

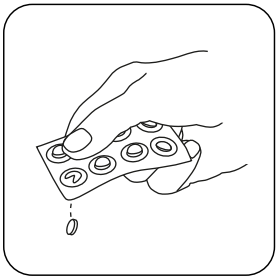


Press the **ZERO** button.

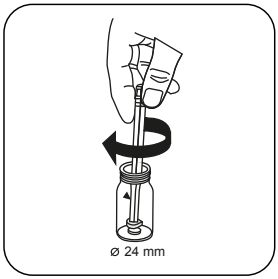


Remove the vial from the sample chamber.

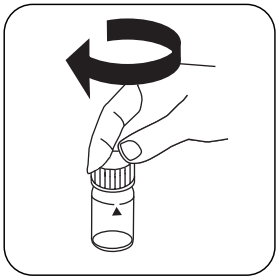
For devices that require **no ZERO measurement** , **start here**.



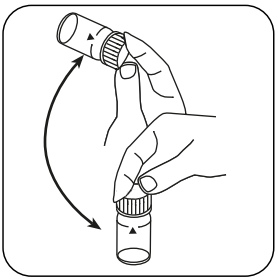
Add **SULFITE LR tablet**.



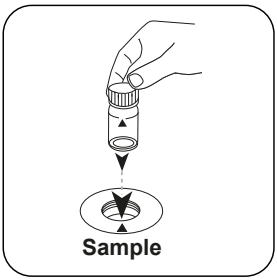
Crush tablet(s) by rotating slightly.



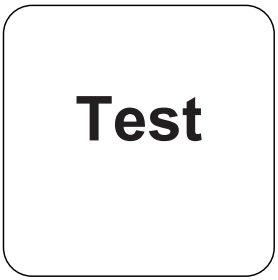
Close vial(s).



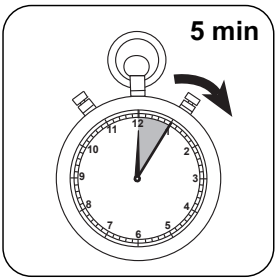
Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **5 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically. The result in mg/l Sulphite appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	SO_3^{2-}	1
mg/l	Na_2SO_3	1.5743

Chemical Method

DTNB

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	$-2.67453 \cdot 10^{-1}$	$-4.42153 \cdot 10^{-1}$
b	$2.78503 \cdot 10^{+0}$	$6.69645 \cdot 10^{+0}$
c		
d		
e		
f		

Method Validation

Limit of Detection	0.04 mg/L
Limit of Quantification	0.118 mg/L
End of Measuring Range	6.0 mg/L
Sensitivity	2.815 mg/L / Abs
Confidence Intervall	0.081 mg/L
Standard Deviation	0.033 mg/L
Variation Coefficient	1.41 %

Bibliography

R.E. Humphrey, M.H. Ward, W. Hinze, Spectrophotometric determination of sulphite with 4,4'-dithio-dipyridine and 5,5'-dithiobis(2-nitrobenzoic acid), Anal. Chem., 1970, 42 (7), pp 698–702

Surfactants M. (anion.) TT M376

0.05 - 2 mg/L SDSA

Methylene Blue

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect, SpectroDirect, XD 7000, XD 7500	ø 16 mm	660 nm	0.05 - 2 mg/L SDSA

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Surfactants (anionic) Spectroquant 1.02552.0001 tube test [d)]	25 pc.	420763

Application List

- Waste Water Treatment

Preparation

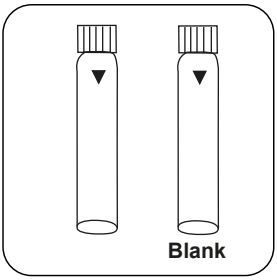
1. Because the reaction depends on temperature, the temperature must be maintained at 10-20 °C (for the reaction vial and the water sample).
2. Invert the vial prior to the measurement. Should the lower phase be turbid, warm the cell briefly with the hand.

Notes

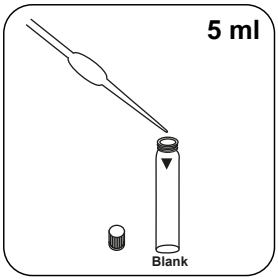
1. This method is adapted from MERCK.
2. Spectroquant® is a registered trademark of the company MERCK KGaA.
3. Appropriate safety precautions and good laboratory technique should be used during the whole procedure.
4. Before performing the test, you must read through the original instructions and safety advice that is delivered with the test kit (MSDS are available on the homepage of www.merckmillipore.com).
5. Sample volume should always be metered by using a 5ml volumetric pipette (class A).
6. The reagents are to be stored in closed containers at a temperature of +15 °C – +25 °C.
7. MBAS = **M**ethylene**b**lue**a**ctive **S**ubstances, calculated as sodium 1-dodecanesulfonate

Implementation of the provision Anionic surfactants with MERCK Spectroquant® Cell Test, No. 1.14697.0001

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500
Skip steps with Blank.

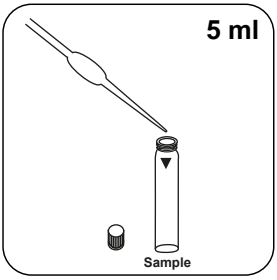


Prepare two **reaction vials**. Mark one as a blank.



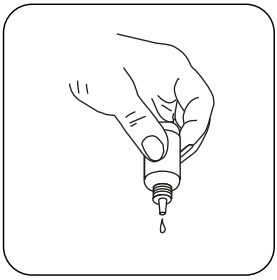
Put **5 ml deionised water** in the blank.

Do not mix the contents

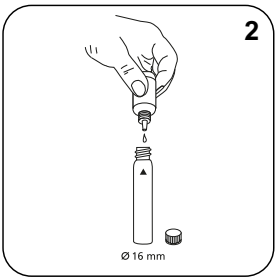


Put **5 ml sample** in the sample vial.

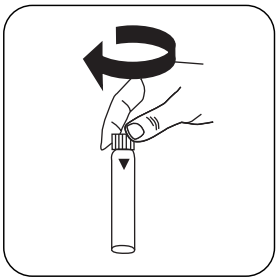
Do not mix the contents



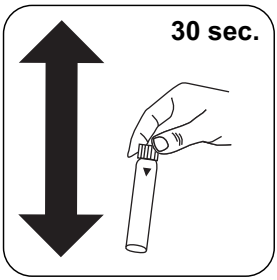
Hold cuvettes vertically and add equal drops by pressing slowly.



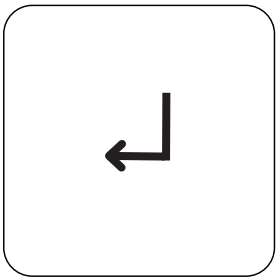
Add **2 drops Reagenz T-1 K solution** to each vial.



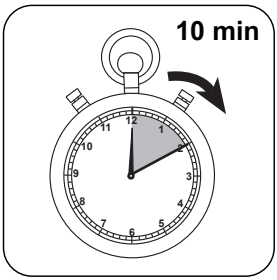
Close vial(s).



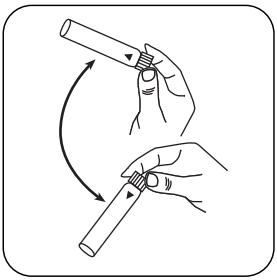
Mix the contents by shaking. (30 sec.).



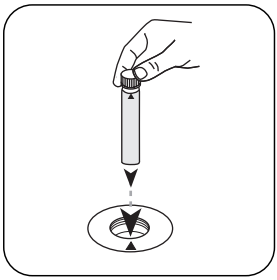
Press the **ENTER** button.



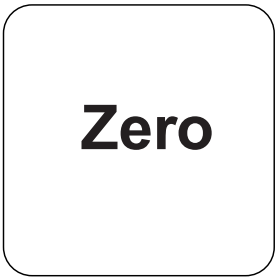
Wait for **10 minute(s) reaction time**.



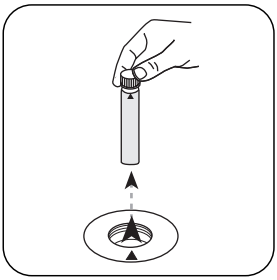
Invert **zero cuvette**.



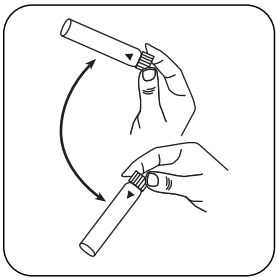
Place **blank** in the sample chamber. • Pay attention to the positioning.



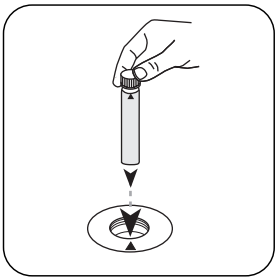
Press the **ZERO** button.



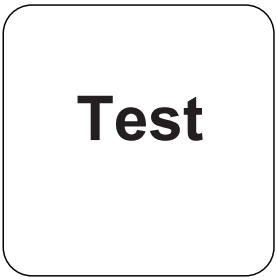
Remove **vial** from the sample chamber.



Invert the **sample vial** .



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in mg/l MBAS appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	SDBS	1.28
mg/l	SDS	1.06
mg/l	SDOSSA	1.63

Chemical Method

Methylene Blue

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 16 mm
a	$1.36547 \cdot 10^{-2}$
b	$1.8329 \cdot 10^{+0}$
c	
d	
e	
f	

According to

DIN EN 903:1994

[d] Spectroquant® is a Merck KGaA Trademark

Surfactants M. (not ionic) TT M377

0.1 - 7.5 mg/L Triton X-100

TBPE

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect, SpectroDirect, XD 7000, XD 7500	ø 16 mm	610 nm	0.1 - 7.5 mg/L Triton X-100

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Surfactants (non ionic) Spectroquant 1.01787.0001 tube test [d)]	25 pc.	420764

Application List

- Waste Water Treatment
- Galvanization

Preparation

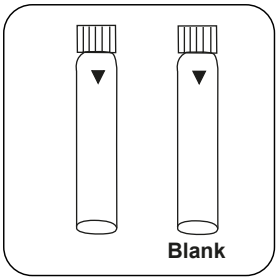
1. Before performing the test read the original test instructions (delivered with the test) and the MSDS (available at www.merckmillipore.com).
2. Appropiate safety precautions and good lab technique should be used during the whole procedure.
3. Because reaction depends on temperature, sample and tube temperature must be between 20 and 25 °C.
4. The test sample should have a pH value between 3 and 9.

Notes

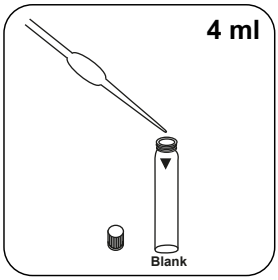
1. This method is adapted from MERCK.
2. Spektroquant® is a registered trade mark of the company MERCK KGaA.
3. Sample volume should always be metered by using volumetric pipette (class A).
4. Triton® is a registered trade mark of the company DOW Chemical Company.

Implementation of the provision Non-ionic surfactants with MERCK Spectroquant® Cell Test, No. 1.01787.0001

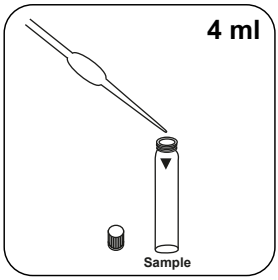
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500
Skip steps with Blank.



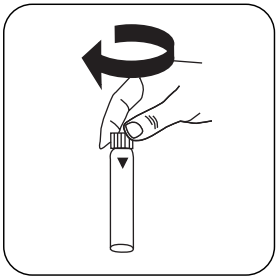
Prepare two **reaction vials**. Mark one as a blank.



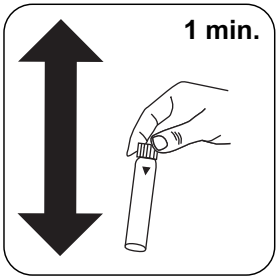
Put **4 ml deionised water** in the blank.



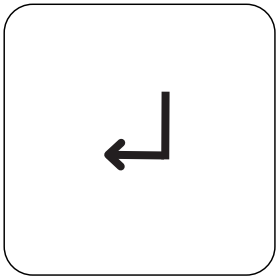
Put **4 ml sample** in the sample vial.



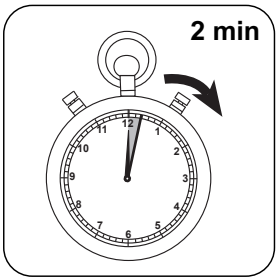
Close vial(s).



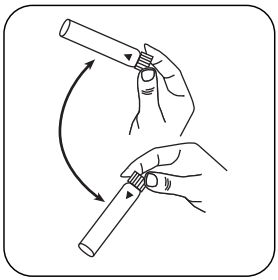
Mix the contents by shaking vigorously. (1 min.).



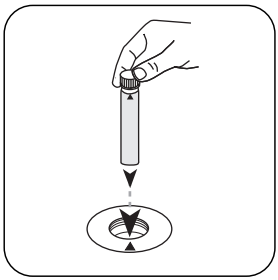
Press the **ENTER** button.



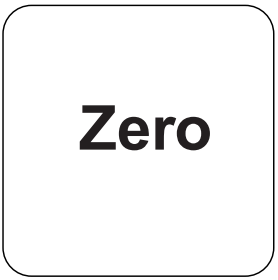
Wait for **2 minute(s) reaction time**.



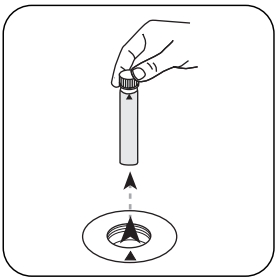
Invert **zero cuvette**.



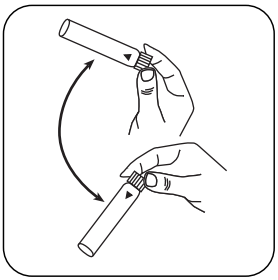
Place **blank** in the sample chamber. • Pay attention to the positioning.



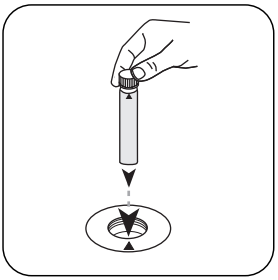
Press the **ZERO** button.



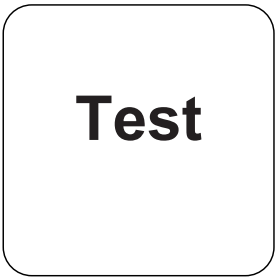
Remove **vial** from the sample chamber.



Invert the **sample vial** .



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in mg/l Triton X-100 appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	NP10	1.1

Chemical Method

TBPE

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 16 mm
a	$5.64524 \cdot 10^{-2}$
b	$5.9893 \cdot 10^{+0}$
c	
d	
e	
f	

According to

DIN EN 903:1994

[d] Spectroquant® is a Merck KGaA Trademark

Surfactants M. (cation.) TT M378

0.05 - 1.5 mg/L CTAB

Disulphine Blue

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect, SpectroDirect, XD 7000, XD 7500	ø 16 mm	610 nm	0.05 - 1.5 mg/L CTAB

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Surfactants (cationic) Spectroquant 1.01764.0001 tube test [d)]	25 pc.	420765

Application List

- Waste Water Treatment

Preparation

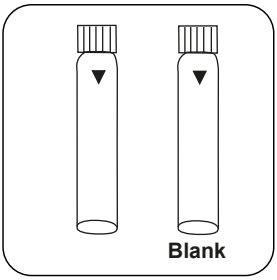
1. Before performing the test read the original test instructions (delivered with the test) and the MSDS (available at www.merckmillipore.com).
2. Appropiate safety precautions and good lab technique should be used during the whole procedure.
3. Because reaction depends on temperature, sample and tube temperature must be between 20 and 25 °C.
4. The test sample should have a pH value between 3 and 8.

Notes

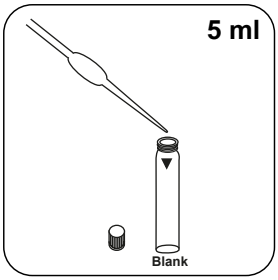
1. This method is adapted from MERCK.
2. Spektroquant® is a registered trade mark of the company MERCK KGaA.
3. Sample volume should always be metered by using volumetric pipette (class A).
4. Triton® is a registered trade mark of the company DOW Chemical Company.
5. CTAB = calculated as N-cetyl-N,N,N-trimethylammonium bromide.
6. Should the lower phase be turbid, warm the cell briefly with the hand.

Implementation of the provision Cationic surfactants with MERCK Spectroquant® Cell Test, No. 1.01764.0001

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500
Skip steps with Blank.

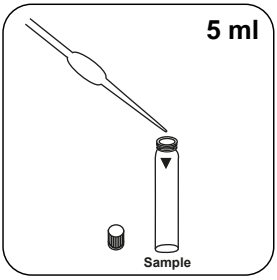


Prepare two **reaction vials**. Mark one as a blank.



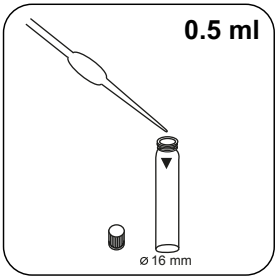
Put **5 ml deionised water** in the blank.

Do not mix the contents

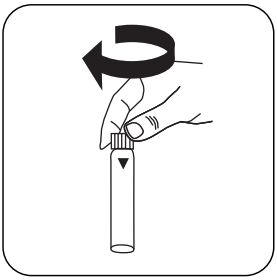


Put **5 ml sample** in the sample vial.

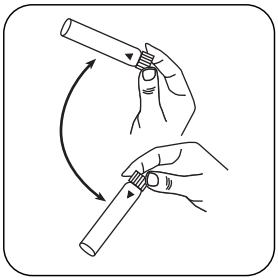
Do not mix the contents



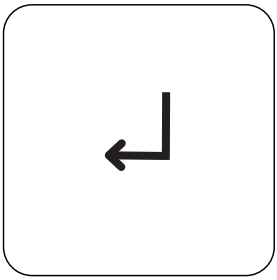
Add **0.5 ml Reagenz T-1 K** .



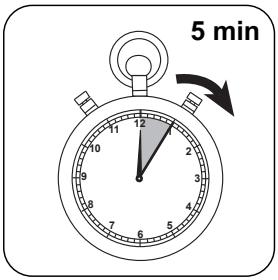
Close vial(s).



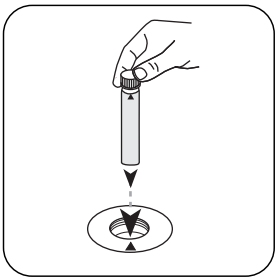
Invert several times to mix the contents (30 sec.).



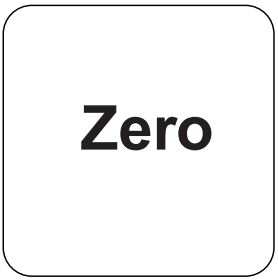
Press the **ENTER** button.



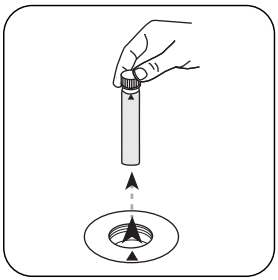
Wait for **5 minute(s) reaction time**.



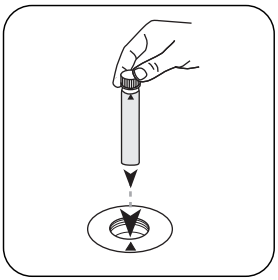
Place **blank** in the sample chamber. • Pay attention to the positioning.



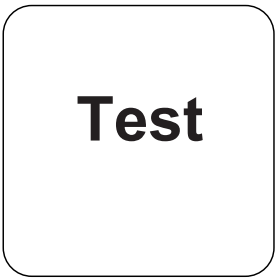
Press the **ZERO** button.



Remove **vial** from the sample chamber.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in mg/l CTAB appears on the display.

Chemical Method

Disulphine Blue

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 16 mm
a	8.75489 • 10^{-3}
b	1.90333 • 10^{+0}
c	
d	
e	
f	

According to

DIN EN 903:1994

[d] Spectroquant® is a Merck KGaA Trademark

TOC LR M. TT M380

5 - 80 mg/L TOC[b)]

H_2SO_4 / Persulphate / Indicator

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, XD 7000, XD 7500	ø 16 mm	610 nm	5 - 80 mg/L TOC[b)]
SpectroDirect	ø 16 mm	596 nm	5 - 80 mg/L TOC[b)]

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
TOC Spectroquant 1.14878.0001 tube test [d)]	25 pc.	420761

The following accessories are required.

Accessories	Packaging Unit	Part Number
Thermoreactor RD 125	1 pc.	2418940
Screw caps TOC	1 Set	420757

Application List

- Drinking Water Treatment
- Waste Water Treatment
- Raw Water Treatment

Preparation

1. Before performing the test, you must read through the original instructions and safety advice that is delivered with the test kit (MSDS are available on the homepage of www.merckmillipore.com).

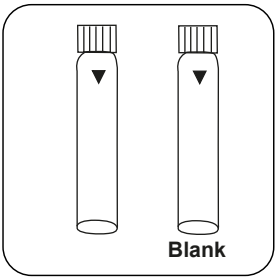
Notes

1. This method is adapted from MERCK.
2. Spectroquant® is a registered trademark of the company MERCK KGaA.
3. Appropriate safety precautions and good laboratory technique should be used during the whole procedure.
4. Sample volume should always be metered by using a volumetric pipette (class A).
5. TOC = **T**otal **O**rganic **C**arbon
6. Aluminium caps can be reused (see Merck).

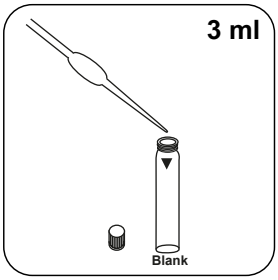
Implementation of the provision TOC LR with MERCK Spectroquant® Cell Test, No. 1.14878.0001

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500
Skip steps with Blank.
• Use two clean suitable glass vessels. • Mark one glass vessel for zeroing.

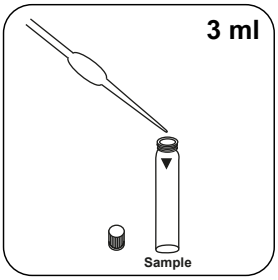
1. Put **25 ml deionised water** in the zero sample.
2. Put **25 ml sample** in the sample vessel.
3. Add **3 drops of reagent TOC-1K** and mix.
4. The pH value of the sample should be under 2.5. If necessary, add sulphuric acid.
5. Stir for **10 minutes** at a medium speed. (Magnetic stirrer, stirring stick)



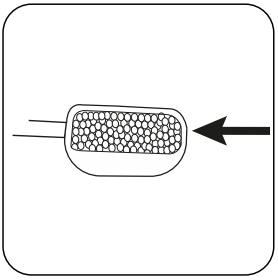
Prepare two **reaction vials**. Mark one as a blank.



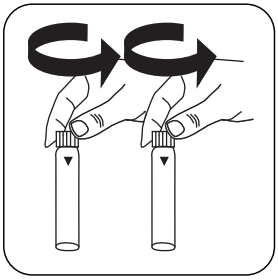
Place **3 ml of prepared zero sample** in the blank.



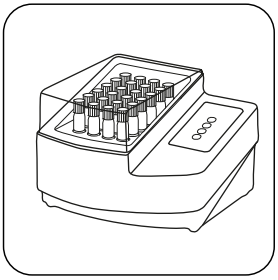
Put **3 ml sample** in the sample vial.



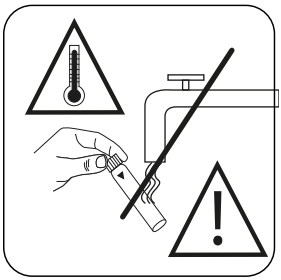
Add exactly **one level microspoon TOC-2K**.



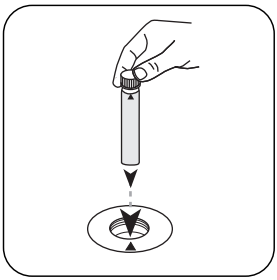
Close the vial(s) **immediately** with the aluminium caps



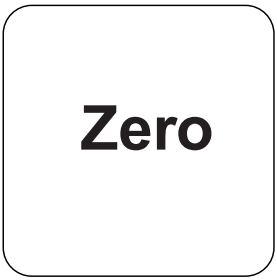
Warm vial for **120 minutes at 120 ºC** in a pre-heated thermoreactor **in inverted position** .



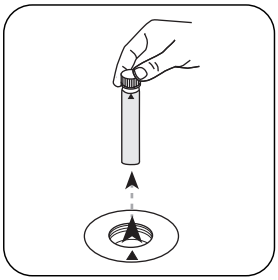
Allow vial to stand inverted for 1 hour and to cool. **Do not cool it with water!** After cooling down, rotate it and measure in the photometer **within 10 min**
.



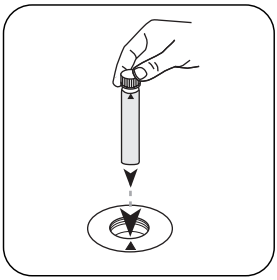
Place **blank** in the sample chamber. • Pay attention to the positioning.



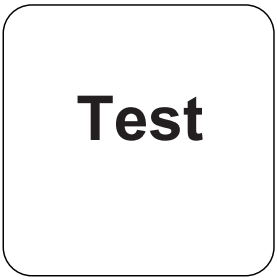
Press the **ZERO** button.



Remove **vial** from the sample chamber.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in mg/l TOC appears on the display.

Chemical Method

H_2SO_4 / Persulphate / Indicator

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 16 mm
a	$9.84368 \cdot 10^{+1}$
b	$-3.32135 \cdot 10^{+1}$
c	$-2.14517 \cdot 10^{+1}$
d	
e	
f	

Derived from

EN 1484:1997
Standard Method 5310 C

[b] Reactor is necessary for COD (150 °C), TOC (120 °C) and total -chromium, - phosphate, -nitrogen, (100 °C) | [d] Spectroquant® is a Merck KGaA Trademark

TOC HR M. TT M381

50 - 800 mg/L TOC[b)]

H_2SO_4 / Persulphate / Indicator

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect, XD 7000, XD 7500	ø 16 mm	610 nm	50 - 800 mg/L TOC[b)]
SpectroDirect	ø 16 mm	596 nm	50 - 800 mg/L TOC[b)]

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
TOC Spectroquant 1.14879.0001 tube test [d)]	25 pc.	420756

The following accessories are required.

Accessories	Packaging Unit	Part Number
Thermoreactor RD 125	1 pc.	2418940
Screw caps TOC	1 Set	420757

Application List

- Drinking Water Treatment
- Waste Water Treatment
- Raw Water Treatment

Preparation

1. Before performing the test, you must read through the original instructions and safety advice that is delivered with the test kit (MSDS are available on the homepage of www.merckmillipore.com).

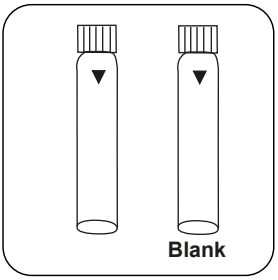
Notes

1. This method is adapted from MERCK.
2. Spectroquant® is a registered trademark of the company MERCK KGaA.
3. Appropriate safety precautions and good laboratory technique should be used during the whole procedure.
4. Sample volume should always be metered by using a volumetric pipette (class A).
5. TOC = Total Organic Carbon.
6. Aluminium caps can be reused (see Merck).

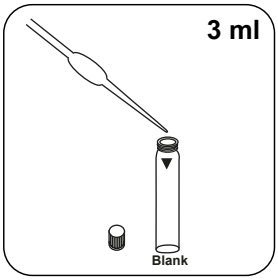
Implementation of the provision TOC HR with MERCK Spectroquant® Cell Test, No. 1.14879.0001

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500
Skip steps with Blank.
• Use two clean suitable glass vessels. • Mark one glass vessel for zeroing.

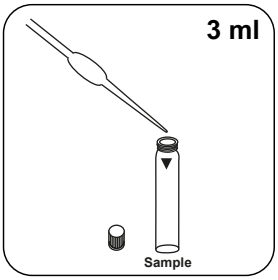
1. Put **10 ml deionised water** in the zero sample.
2. Put **1 ml sample and 9 ml deionised water** in the sample vessel and mix.
3. Add **2 drops of reagent TOC-1K** and mix.
4. The pH value of the sample should be under 2.5. If necessary, add sulphuric acid.
5. Stir for **10 minutes** at a medium speed. (Magnetic stirrer, stirring stick)



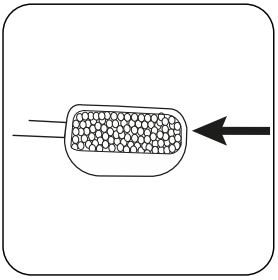
Prepare two **reaction vials**. Mark one as a blank.



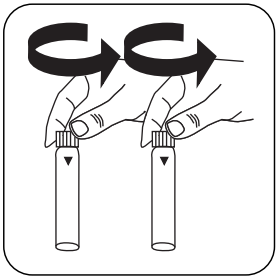
Place **3 ml of prepared zero sample** in the blank.



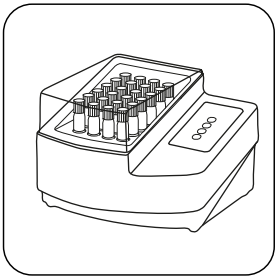
Place **3 ml of prepared sample** in the sample vial.



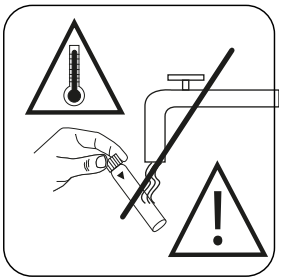
Add exactly **one level microspoon TOC-2K**.



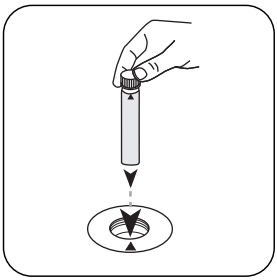
Close the vial(s) **immediately** with the aluminium caps



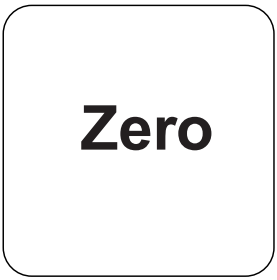
Warm vial for **120 minutes at 120 ºC** in a pre-heated thermoreactor **in inverted position** .



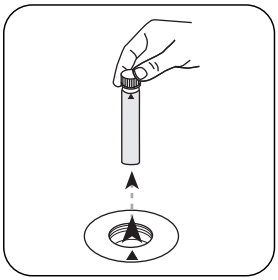
Allow vial to stand inverted for 1 hour and to cool. **Do not cool it with water!** After cooling down, rotate it and measure in the photometer **within 10 min**
.



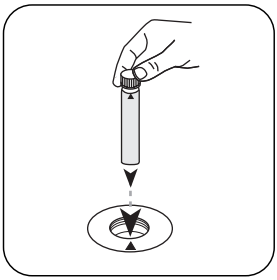
Place **blank** in the sample chamber. • Pay attention to the positioning.



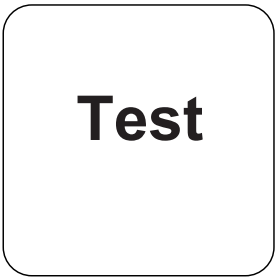
Press the **ZERO** button.



Remove **vial** from the sample chamber.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in mg/l TOC appears on the display.

Chemical Method

H_2SO_4 / Persulphate / Indicator

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 16 mm
a	9.90014 • 10^{+2}
b	-3.44796 • 10^{+2}
c	-2.08152 • 10^{+2}
d	
e	
f	

Interferences

Interference	**from / [mg/L]**
Ca	1000
Mg	1000
NH_4-N	1000
TIC (total inorganic carbon)	250
NaCl	25
$NaNO_3$	100
Na_2SO_4	100

Derived from

EN 1484:1997
Standard Method 5310 C

[b] Reactor is necessary for COD (150 °C), TOC (120 °C) and total -chromium, - phosphate, -nitrogen, (100 °C) | [d] Spectroquant® is a Merck KGaA Trademark

Suspended solids 50 M383

10 - 750 mg/L TSS

Turbidity / Attenuated Radiation Method

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	□ 50 mm	810 nm	10 - 750 mg/L TSS

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
no reagent required		

Application List

- Drinking Water Treatment
- Waste Water Treatment
- Raw Water Treatment

Sampling

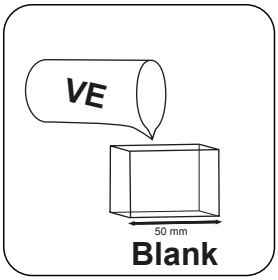
1. Measure the water sample as soon as possible after sampling. It is possible to store the sample at 4 °C for 7 days s in plastic or glass containers. The measurement should be at the same temperature as the sample. Temperature differences between measurement and sampling can change the result of the measurement.

Notes

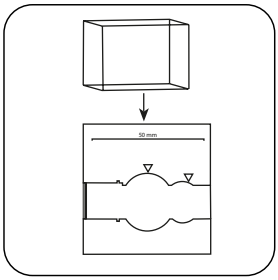
1. The photometric determination of Suspended Solids is based on a gravimetric method. In a laboratory this is usually done by evaporation of the filter residue of a filtrated water sample in a furnace at 103 °C – 105 °C and weighing of the dried residue.
2. When higher accuracy is required perform a gravimetric determination of a water sample. The result can be used to calibrate the photometer with the same water sample.
3. The estimated detection limit is 20 mg/L TSS.

Implementation of the provision Total suspended solids

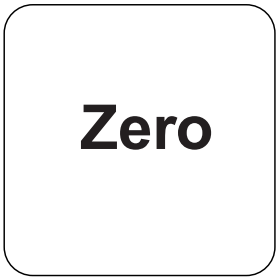
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500
Homogenize 500 ml of the water sample in a blender on high speed for 2 minutes



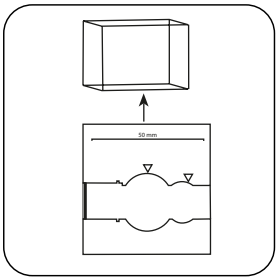
Fill **50 mm vial** with **deionised water** .



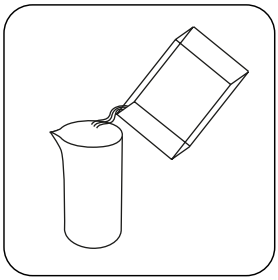
Place **blank** in the sample chamber. • Pay attention to the positioning.



Press the **ZERO** button.

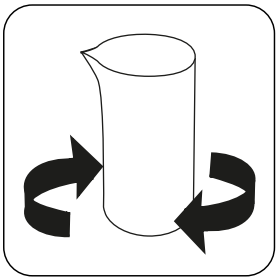


Remove **vial** from the sample chamber.

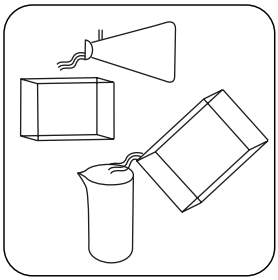


Empty vial.

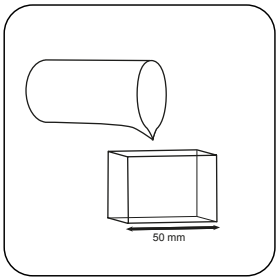
For devices that require **no ZERO measurement** , **start here**.



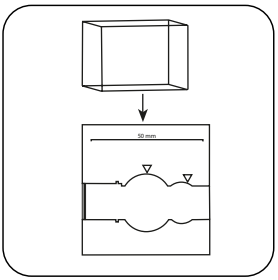
Mix homogenised water sample thoroughly.



Rinse out vial with prepared sample .



Fill 50 mm vial with **sample**.



Test

Place **sample vial** in the sample chamber. • Pay attention to the positioning.

Press the **TEST** (XD: **START**)button.

The result in mg/l TSS (Total Suspended Solids) appears on the display.

Chemical Method

Turbidity / Attenuated Radiation Method

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	□ **50 mm**
a	8.02365 • 10^{+0}
b	1.44739 • 10^{+2}
c	7.70483 • 10^{+1}
d	-3.84183 • 10^{+1}
e	9.71408 • 10^{+0}
f	

Interferences

Removeable Interferences

- Air bubbles interfere and can be removed by swirling the vial gently.
- Colour interferes if light is absorbed at 660 nm.

Method Validation

Limit of Detection	0.42 mg/L
Limit of Quantification	1.27 mg/L
End of Measuring Range	750 mg/L
Sensitivity	272.94 mg/L / Abs
Confidence Intervall	3.96 mg/L
Standard Deviation	2.06 mg/L
Variation Coefficient	0.54 %

Derived from

EN 872:2005

Suspended solids 24 M384

10 - 750 mg/L TSS SuS

Turbidity / Attenuated Radiation Method

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 600, MD 610, MD 640, MultiDirect	ø 24 mm	660 nm	10 - 750 mg/L TSS
XD 7000, XD 7500	ø 24 mm	810 nm	10 - 750 mg/L TSS

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
no reagent required		

Application List

- Drinking Water Treatment
- Waste Water Treatment
- Raw Water Treatment

Sampling

1. Measure the water sample as soon as possible after sampling. It is possible to store the sample at 4 °C for 7 days s in plastic or glass containers. The measurement should be at the same temperature as the sample. Temperature differences between measurement and sampling can change the result of the measurement.

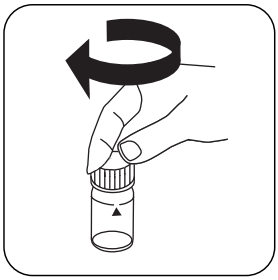
Notes

1. The photometric determination of Suspended Solids is based on a gravimetric method. In a laboratory this is usually done by evaporation of the filter residue of a filtrated water sample in a furnace at 103 °C – 105 °C and weighing of the dried residue.
2. When higher accuracy is required perform a gravimetric determination of a water sample. The result can be used to calibrate the photometer with the same water sample.
3. The estimated detection limit is 20 mg/L TSS.

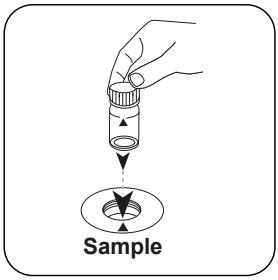
Implementation of the provision Total suspended solids

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500
Homogenize ml of the water sample in a blender on high speed for minutes

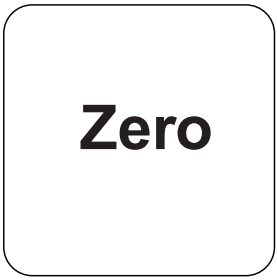
Fill 24 mm vial with **10 ml deionised water** .



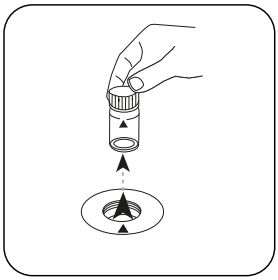
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

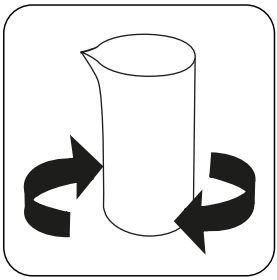


Press the **ZERO** button.

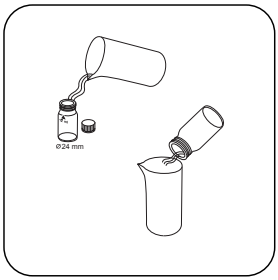


Remove the vial from the sample chamber.

For devices that require **no ZERO measurement** , **start here**.

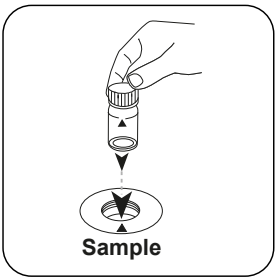


Mix homogenised water sample thoroughly.



Pre-rinse vial with water sample.

Fill 24 mm vial with **10 ml prepared sample** .



Test

Place **sample vial** in the sample chamber. • Pay attention to the positioning.

Press the **TEST** (XD: **START**)button.

The result in mg/l TSS (Total Suspended Solids) appears on the display.

Chemical Method

Turbidity / Attenuated Radiation Method

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	5.32451 • 10^{+0}	5.32451 • 10^{+0}
b	4.51473 • 10^{+2}	9.70666 • 10^{+2}
c	6.79429 • 10^{+1}	3.14066 • 10^{+2}
d		
e		
f		

Interferences

Persistant Interferences

- Colour interferes if light is absorbed at 660 nm.

Removeable Interferences

- Air bubbles interfere and can be removed by swirling the vial gently.

Method Validation

Limit of Detection	10 mg/L
Limit of Quantification	30 mg/L
End of Measuring Range	750 mg/L
Sensitivity	550 mg/L / Abs
Confidence Intervall	4.24 mg/L
Standard Deviation	1.79 mg/L
Variation Coefficient	0.47 %

Derived from

EN 872:2005

Turbidity 50 M385

5 - 500 FAU

Attenuated Radiation Method

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
SpectroDirect, XD 7000, XD 7500	□ 50 mm	860 nm	5 - 500 FAU

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
no reagent required		

Application List

- Waste Water Treatment
- Raw Water Treatment

Sampling

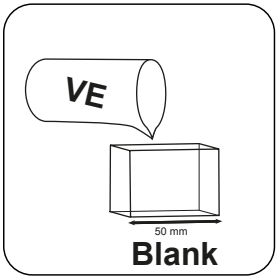
1. Measure the water sample as soon as possible after sampling. It is possible to store the sample at 4 °C for 48 hours in plastic or glass containers. The measurement should be at the same temperature as the sample. Temperature differences between measurement and sampling can change the turbidity of the sample.

Notes

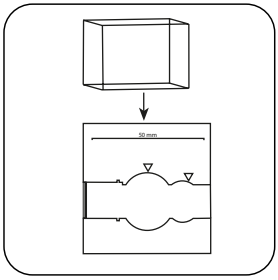
1. This test uses an attenuated radiation method for the reading of Formazin Attenuation Units (FAU). The results can not be used for documenting purposes, but may be used for routine measurements because the attenuated radiation method is different from the Nephelometric method.

Implementation of the provision Turbidity

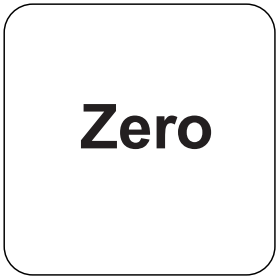
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



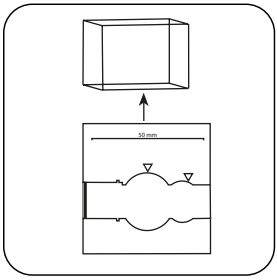
Fill **50 mm vial** with **deionised water** .



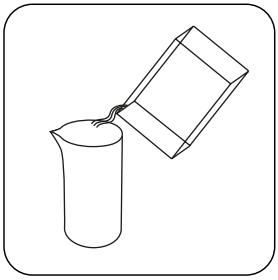
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **ZERO** button.

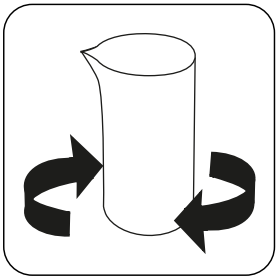


Remove **vial** from the sample chamber.

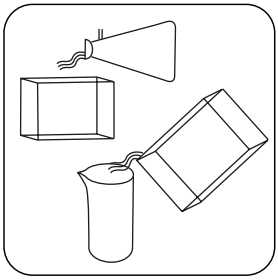


Empty vial.

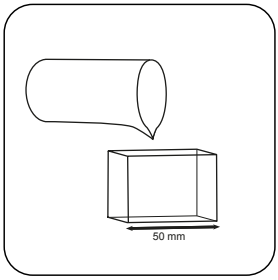
For devices that require **no ZERO measurement** , **start here**.



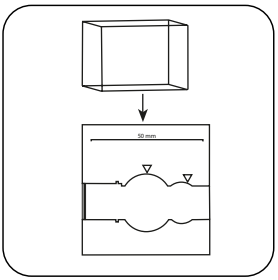
Mix water sample thoroughly.



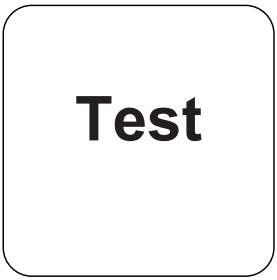
Rinse out vial with prepared sample .



Fill 50 mm vial with **sample**.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in FAU appears on the display.

Chemical Method

Attenuated Radiation Method

Appendix

Interferences

Removeable Interferences

- Air bubbles interfere with turbidity measurements. These can be removed using an ultrasonic bath.
- By measuring at 860 nm, colour interference is reduced to a minimum. At 860 nm light absorption and gas bubbles disturb the measurement.

Method Validation

Limit of Detection	0.9 FAU
Limit of Quantification	2.7 FAU
End of Measuring Range	500 FAU
Sensitivity	253 FAU / Abs
Confidence Intervall	3.42 FAU
Standard Deviation	1.49 FAU
Variation Coefficient	0.59 %

Bibliography

FWPCA Methods for Chemical Analysis of Water and Wastes, 275 (1969)

Turbidity 24 M386

10 - 1000 FAU

Attenuated Radiation Method

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect	ø 24 mm	530 nm	10 - 1000 FAU
XD 7000, XD 7500	ø 24 mm	860 nm	10 - 1000 FAU

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
no reagent required		

Application List

- Waste Water Treatment
- Raw Water Treatment

Sampling

1. Measure the water sample as soon as possible after sampling. It is possible to store the sample at 4 °C for 48 hours in plastic or glass containers. The measurement should take place at the same temperature as the sample, as temperature differences between measurement and sample collection can effect the turbidity of the sample.

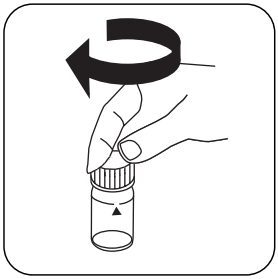
Notes

1. This test uses an attenuated radiation method for the reading of Formazin Attenuation Units (FAU). The results can not be used for documenting purposes, but may be used for routine measurements because the attenuated radiation method is different from the Nephelometric method.
2. The estimated detection limit is 20 FAU.

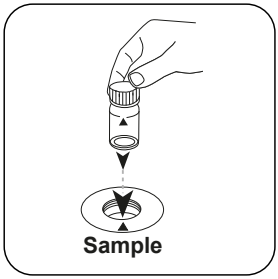
Implementation of the provision Turbidity

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

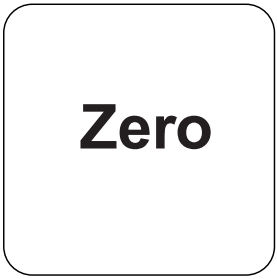
Fill 24 mm vial with **10 ml deionised water** .



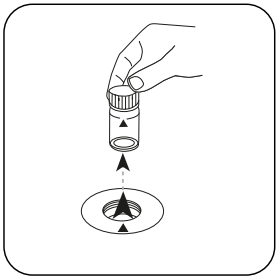
Close vial(s).



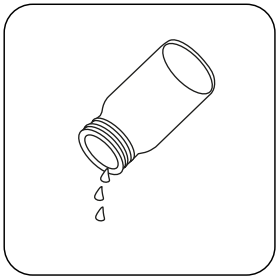
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **ZERO** button.

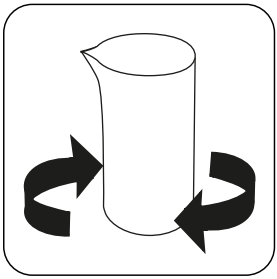


Remove the vial from the sample chamber.

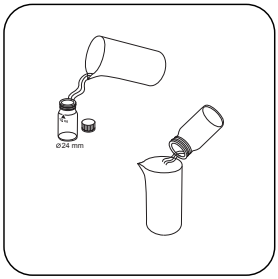


Empty vial.

For devices that require **no ZERO measurement** , **start here**.

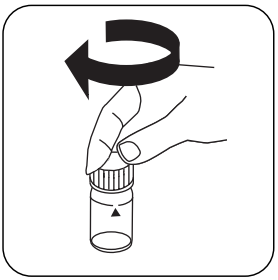


Mix water sample thoroughly.

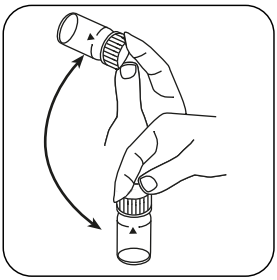


Pre-rinse vial with water sample.

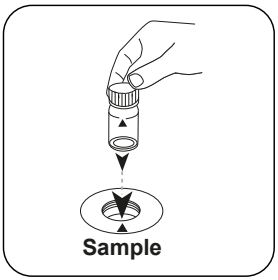
Fill 24 mm vial with **10 ml sample**.



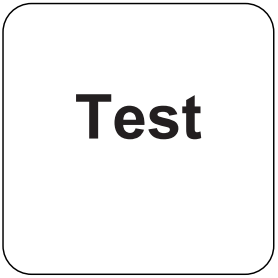
Close vial(s).



Invert several times to mix the contents.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.
The result in FAU appears on the display.

Chemical Method

Attenuated Radiation Method

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	8.61245•10^{+0}	8.61245•10^{+0}
b	4.97947•10^{+2}	1.07059•10^{+3}
c	8.71462•10^{+1}	4.02833•10^{+2}
d		
e		
f		

Interferences

Removeable Interferences

- Air bubbles interfere with turbidity measurements. These can be removed using an ultrasonic bath.
- Colour interferes if light is absorbed at 530 nm.
  For strong coloured water samples a filtrated portion of the sample can be used for zeroing instead of the deionised water.

Method Validation

Limit of Detection	1.59 FAU
Limit of Quantification	4.76 FAU
End of Measuring Range	1000 FAU
Sensitivity	642 FAU / Abs
Confidence Intervall	4.27 FAU
Standard Deviation	1.85 FAU
Variation Coefficient	0.37 %

Bibliography

FWPCA Methods for Chemical Analysis of Water and Wastes, 275 (1969)

Triazole PP M388

1 - 16 mg/L Benzotriazole or Tolyltriazole tri

Catalyzed UV Digestion

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 110, MD 600, MD 610, MD 640, XD 7000, XD 7500	ø 24 mm	430 nm	1 - 16 mg/L Benzotriazole or Tolyltriazole

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
VARIO Triazole Rgt Powder Pack F25	Powder / 100 pc.	532200
Vario Rochelle Salt Solution, 30 ml [h)]	30 mL	530640

The following accessories are required.

Accessories	Packaging Unit	Part Number
UV Pen Lamp, 254 nm	1 pc.	400740

Hazard Notes

While the UV lamp is in operation, UV safety goggles must be worn.

Application List

- Boiler Water

Sampling

1. Measure the water sample as soon as possible after sampling.

Preparation

1. To get accurate results the sample temperature must be between 20 °C and 25 °C.
2. Nitrites or borax-containing water must be adjusted between pH 4 and pH 6 before the analysis (with 1N Sulphuric acid).
3. If the sample contains more than 500 mg/L $CaCO_3$ hardness, 10 drops of Rochelle Salt Solution are to be added.

Notes

1. Triazole Reagent Powder Packs and UV maps available on request.
2. For handling of the UV lamp see manufacturer's manual. Do not touch the surface of the UV lamp. Fingerprints will erode the glass. Wipe the UV lamp with a soft and clean cloth between measurements.
3. The test does not distinguish between Tolyltriazole and Benzotriazole.

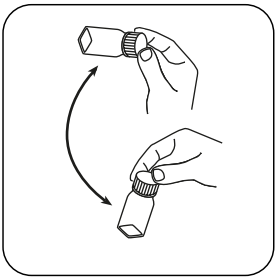
Implementation of the provision Benzotriazole / Tolyltriazole with Vario Powder Packs

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

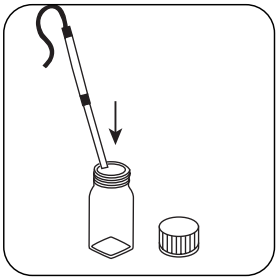
Fill the digestion vial with **25 ml** sample.

Add **powder pack**.

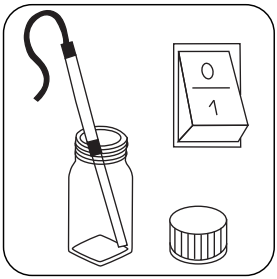
Close digestion vial.



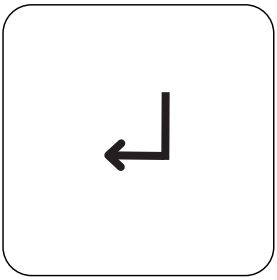
Swirl around to dissolve the powder.



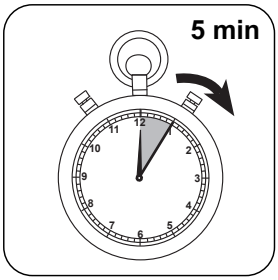
Keep the UV lamp in the sample. **Note: wear UV safety goggles!**



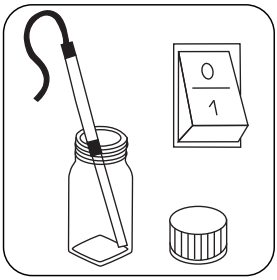
Turn on the UV lamp.



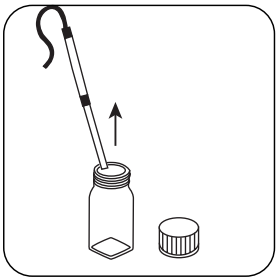
Press the **ENTER** button.



Wait for **5 minute(s) reaction time**.

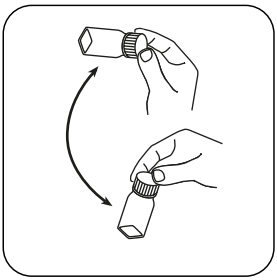


The UV lamp is switched off when the countdown is finished.



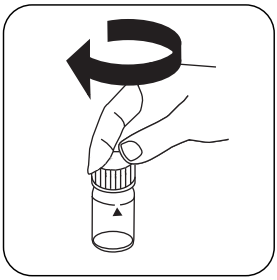
Remove the UV lamp from the sample.

Close digestion vial.

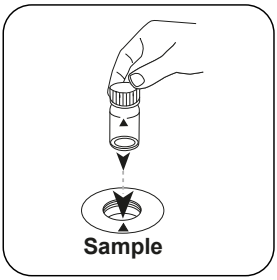


Invert several times to mix the contents.

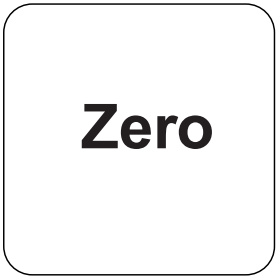
Fill 24 mm vial with **10 ml deionised water** .



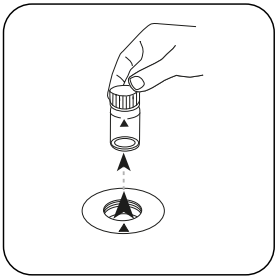
Close vial(s).



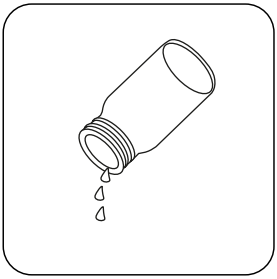
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **ZERO** button.

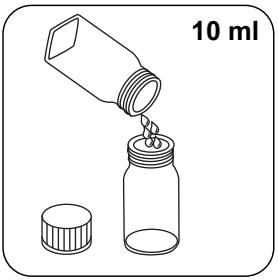


Remove the vial from the sample chamber.

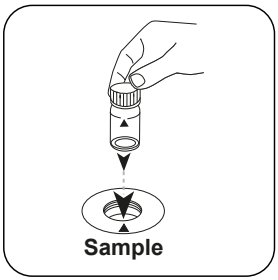


Empty vial.

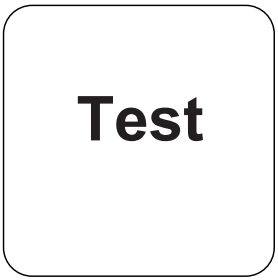
For devices that require **no ZERO measurement** , **start here**.



Fill 24 mm vial with **10 ml prepared sample** .



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in mg/l Benzotriazole or Tolyltriazole appears on the display.

Analyses

The following table identifies the output values can be converted into other citation forms.

Unit	Cite form	Scale Factor
mg/l	Benzotriazole	1
mg/l	Tolyltriazole	1.1177

Chemical Method

Catalyzed UV Digestion

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	$-2.31524 \cdot 10^{-1}$	$-2.31524 \cdot 10^{-1}$
b	$1.75481 \cdot 10^{+1}$	$3.77285 \cdot 10^{+1}$
c		
d		
e		
f		

Interferences

Persistant Interferences

- Should the photolysis be carried out for more or less than 5 minutes, this can lead to may show lower results.

Bibliography

Harp, D., Proceedings 45th International Water Conference, 299 (October 22-24, 1984)

[h] additionally required for samples with hardness values above 300 mg/l $CaCO_3$

Tannin L M389

0.5 - 20 mg/L Tannin

Folin Phenol

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640	ø 24 mm	660 nm	0.5 - 20 mg/L Tannin

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Tannin Reagent 1	30 mL	SDT181
Tannin Reagent 2	30 mL	SDT249

Application List

- Boiler Water

Sampling

1. If samples are turbid, filter before testing using GF/C filter papers.
2. For tannin concentrations higher than 20 mg/L the sample may be suitably diluted with distilled water prior to analysis. The result must then be multiplied by the dilution factor.

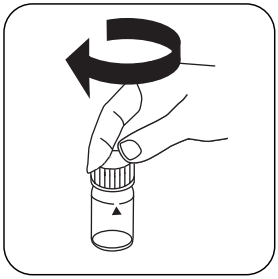
Notes

1. This test is very sensitive to the reaction period time. The sample must be read as close as possible to 5 minutes, starting from the addition of Tannin Reagent 2 being added to the pressing of the TEST key. Incorrect results will be displayed if this is not strictly followed.

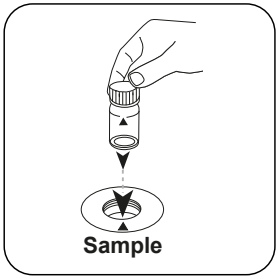
Implementation of the provision Tannin with liquid reagents

Select the method on the device

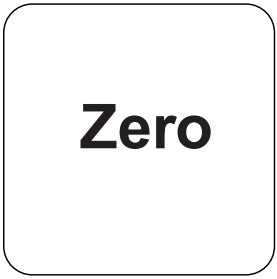
Fill 24 mm vial with **10 ml sample**.



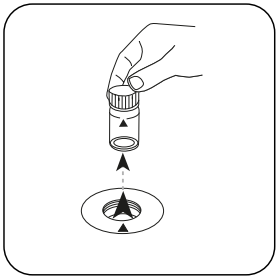
Close vial(s).



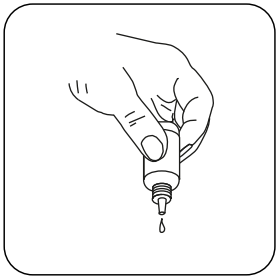
Place **sample vial** in the sample chamber. • Pay attention to the positioning.



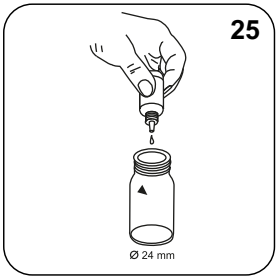
Press the **ZERO** button.



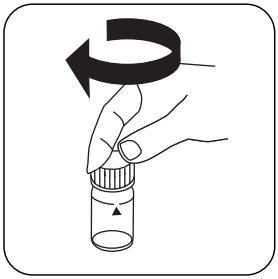
Remove the vial from the sample chamber.



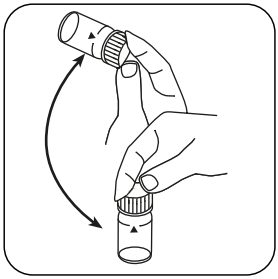
Hold cuvettes vertically and add equal drops by pressing slowly.



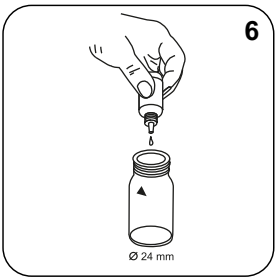
Add **25 drops Tannin Reagent 1**.



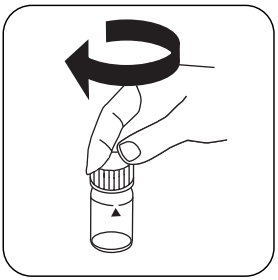
Close vial(s).



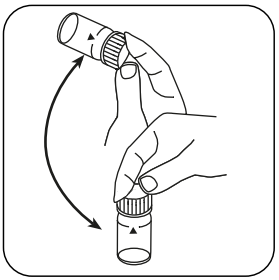
Invert several times to mix the contents.



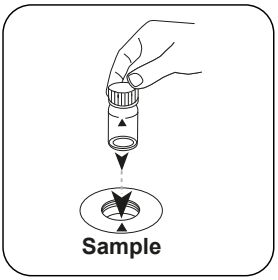
Add **6 drops Tannin Reagent 2**.



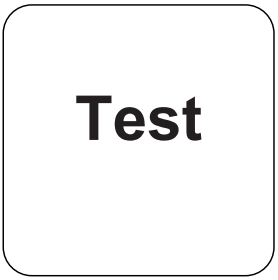
Close vial(s).



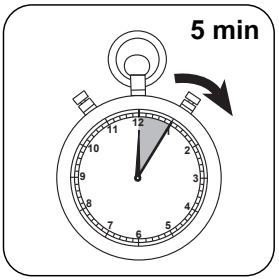
Invert several times to mix the contents.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** button.



Wait for **5 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically. The result in mg/l Tannin appears on the display.

Chemical Method

Folin Phenol

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	3.28646•10^{+0}	3.28646•10^{+0}
b	7.84007•10^{+0}	1.68562•10^{+1}
c		
d		
e		
f		

Method Validation

Limit of Detection	0.13 mg/L
Limit of Quantification	0.26 mg/L
End of Measuring Range	20 mg/L
Sensitivity	7.72 mg/L / Abs
Confidence Intervall	0.93 mg/L
Standard Deviation	0.38 mg/L
Variation Coefficient	0.65 %

Derived from

5550 B Standard Method

Urea T M390

0.1 - 2.5 mg/L Urea Ur1

Indophenol / Urease

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 200, MD 600, MD 610, MD 640, MultiDirect, PM 620, PM 630	ø 24 mm	610 nm	0.1 - 2.5 mg/L Urea
SpectroDirect	ø 24 mm	676 nm	0.1 - 2 mg/L Urea
XD 7000, XD 7500	ø 24 mm	676 nm	0.1 - 2.5 mg/L Urea

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
UREA Reagent 1	15 mL	459300
UREA Reagent 2	10 mL	459400
Ammonia No. 1	Tablet / 100	512580BT
Ammonia No. 1	Tablet / 250	512581BT
Ammonia No. 2	Tablet / 100	512590BT
Ammonia No. 2	Tablet / 250	512591BT
Set Ammonia No. 1/No. 2 100 Pc.#	100 each	517611BT
Set Ammonia No. 1/No. 2 250 Pc.#	250 each	517612BT
Ammonia Conditioning Powder	Powder / 15 g	460170
Urea Pretreat (compensates for the interference of free Chlorine up to 2 mg/l)	Tablet / 100	516110BT
UREA Reagent Set	1 Set	517800BT

Application List

- Pool Water Control

Preparation

1. The temperature of the sample should be between 20 °C and 30 °C.
2. The analysis must take place within one hour after taking the sample at the latest.
3. With the analysis of sea water samples, before the addition of Ammonia No. 1 Tablet, 1 scoop of ammonium conditioning powder must be added to the sample and dissolved by swirling.

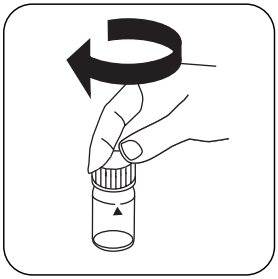
Notes

1. The AMMONIA No. 1 tablet will only dissolve completely after the AMMONIA No. 2 Tablet has been added.
2. Ammonium and chloramines are accounted for in the urea determination.

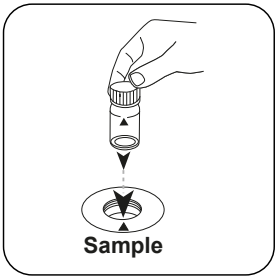
Implementation of the provision Urea with Tablet and Liquid Reagent

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

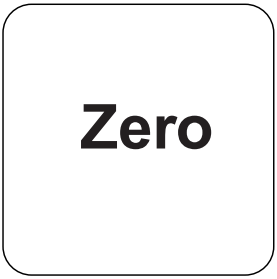
Fill 24 mm vial with **10 ml sample**.



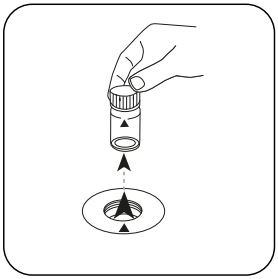
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

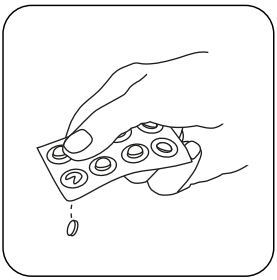


Press the **ZERO** button.

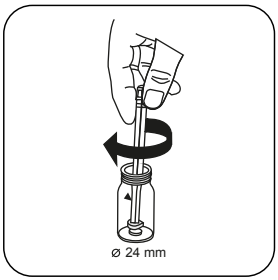


Remove the vial from the sample chamber.

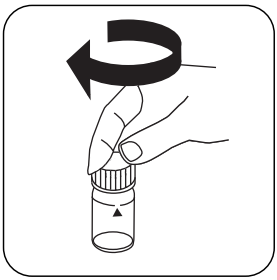
For devices that require **no ZERO measurement** , **start here**.



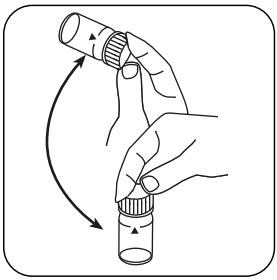
If free chlorine (HOCl) is present, add **a UREA PRETREAT tablet**.



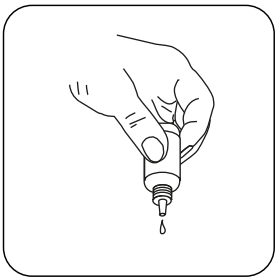
Crush tablet(s) by rotating slightly.



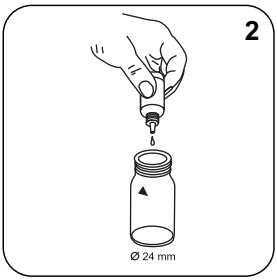
Close vial(s).



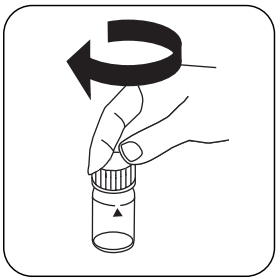
Dissolve tablet(s) by inverting.



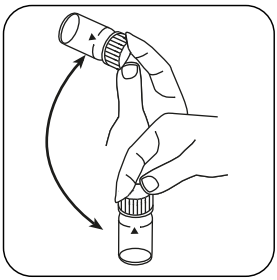
Hold cuvettes vertically and add equal drops by pressing slowly.



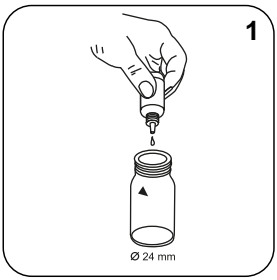
Add **2 drops Urea Reagenz 1**.



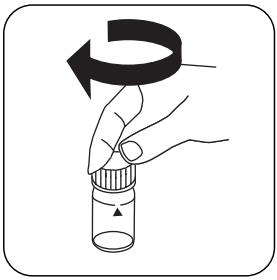
Close vial(s).



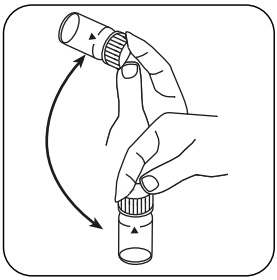
Invert several times to mix the contents.



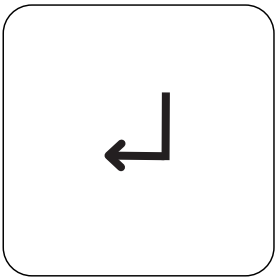
Add **1 drops Urea Reagenz 2**.



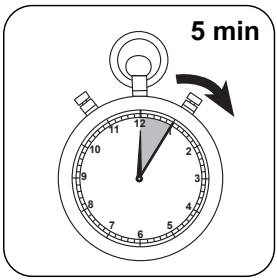
Close vial(s).



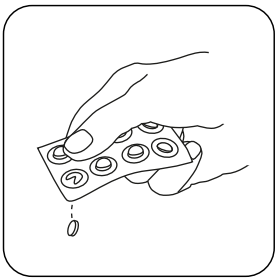
Invert several times to mix the contents.



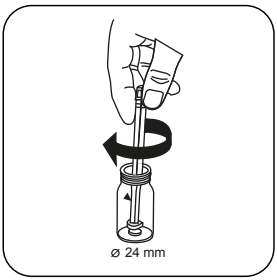
Press the **ENTER** button.



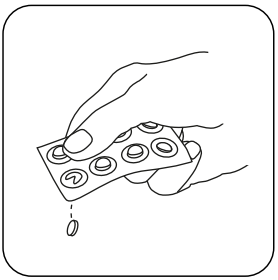
Wait for **5 minute(s) reaction time**.



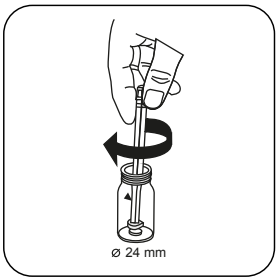
Add **AMMONIA No.1 tablet** .



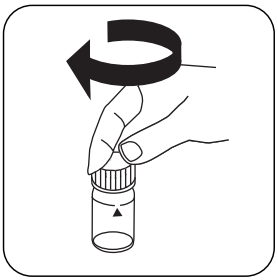
Crush tablet(s) by rotating slightly.



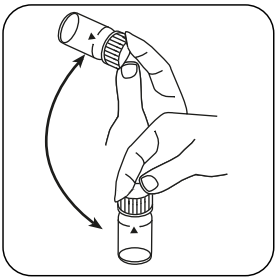
Add **AMMONIA No.2 tablet** .



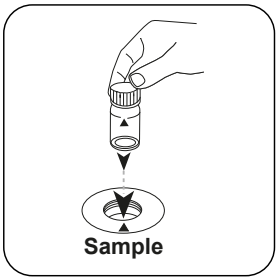
Crush tablet(s) by rotating slightly.



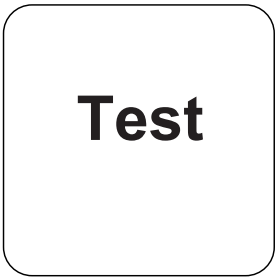
Close vial(s).



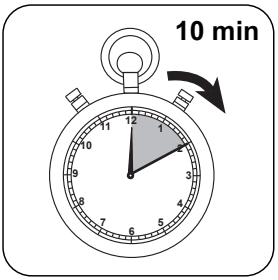
Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **10 minute(s) reaction time**.
Once the reaction period is finished, the measurement takes place automatically.
The result in mg/l Urea appears on the display.

Chemical Method

Indophenol / Urease

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	$-2.32974 \cdot 10^{-1}$	$-2.32974 \cdot 10^{-1}$
b	$1.24957 \cdot 10^{+0}$	$2.68658 \cdot 10^{+0}$
c		
d		
e		
f		

Interferences

Persistant Interferences

- Concentrations above 2 mg/L urea can lead to results within the measuring range. In this case, the water sample must be diluted with water that is free from urea and the measurement must be repeated (plausibility test).

Removeable Interferences

- A UREA PRETREAT Tablet eliminates the interference of free chlorine up to 2 mg/L (two tablets up to 4 mg/L, 3 tablets up to 6 mg/L).

Interference	**from / [mg/L]**
Cl_2	2

Bibliography

R.J. Creno, R.E. Wenk, P. Bohling, Automated Micromeasurement of Urea Using Urease and the Berthelot Reaction, American Journal of Clinical Pathology (1970), 54 (6), p. 828-832

including stirring rod, 10 cm

Urea T M391

0.2 - 5 mg/L Urea[i)] Ur2

Indophenol / Urease

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100	ø 24 mm	610 nm	0.2 - 5 mg/L Urea[i)]

Material

Required material (partly optional):

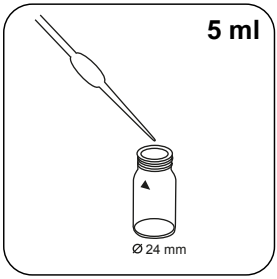
Reagents	Packaging Unit	Part Number
UREA Reagent 1	15 mL	459300
UREA Reagent 2	10 mL	459400
Ammonia No. 1	Tablet / 100	512580BT
Ammonia No. 1	Tablet / 250	512581BT
Ammonia No. 2	Tablet / 100	512590BT
Ammonia No. 2	Tablet / 250	512591BT
Set Ammonia No. 1/No. 2 100 Pc.[#]	100 each	517611BT
Set Ammonia No. 1/No. 2 250 Pc.[#]	250 each	517612BT
Ammonia Conditioning Powder	Powder / 15 g	460170
Urea Pretreat (compensates for the interference of free Chlorine up to 2 mg/l)	Tablet / 100	516110BT
UREA Reagent Set	1 Set	517800BT

Application List

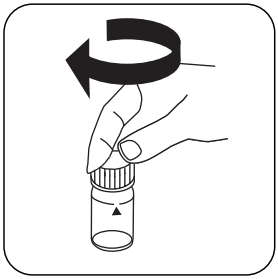
- Pool Water Control

Implementation of the provision Urea with Tablet and Liquid Reagent

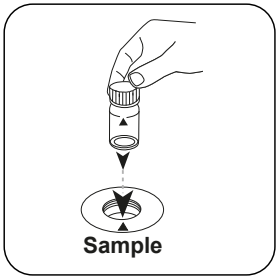
Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



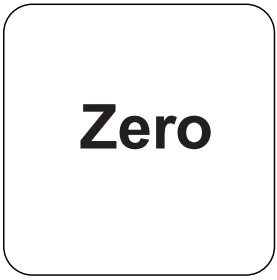
Put **5 ml sample** and **5 ml of deionised water** in the sample vessel.



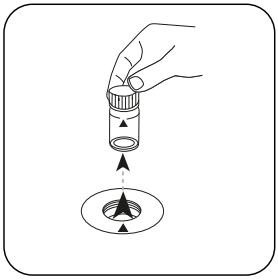
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

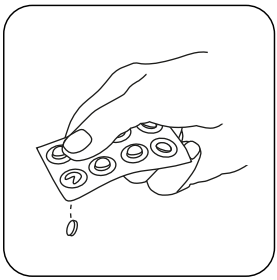


Press the **ZERO** button.

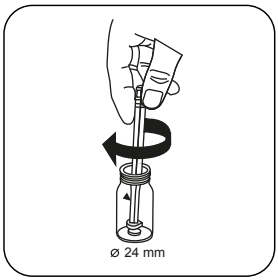


Remove the vial from the sample chamber.

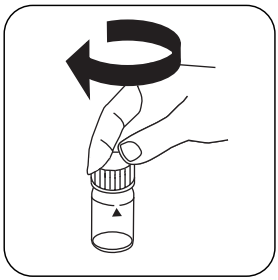
For devices that require **no ZERO measurement** , **start here**.



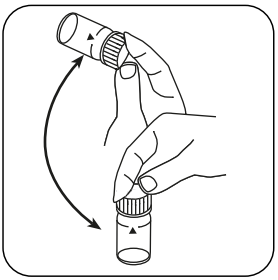
If free chlorine (HOCl) is present, add **a UREA PRETREAT tablet**.



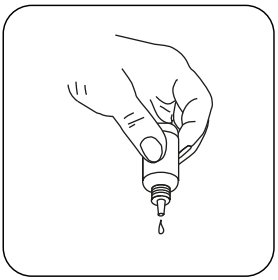
Crush tablet(s) by rotating slightly.



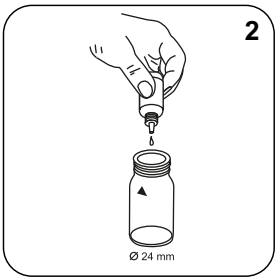
Close vial(s).



Dissolve tablet(s) by inverting.

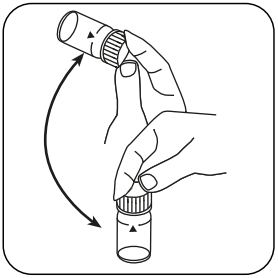


Hold cuvettes vertically and add equal drops by pressing slowly.

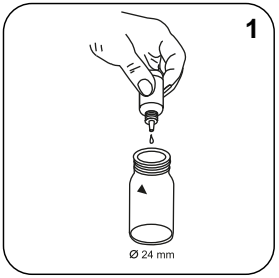


Add **2 drops UREA Reagenz 1**.

Close vial(s).

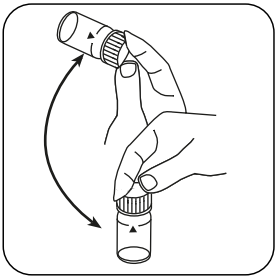


Invert several times to mix the contents.

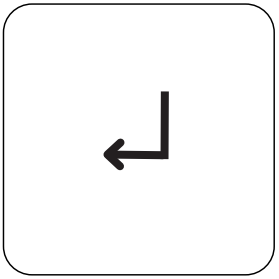


Add **1 drops UREA Reagenz 2**.

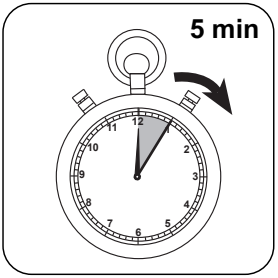
Close vial(s).



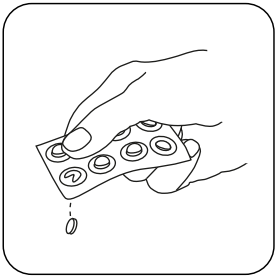
Invert several times to mix the contents.



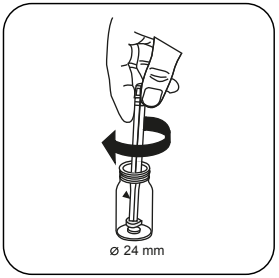
Press the **ENTER** button.



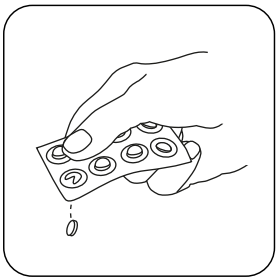
Wait for **5 minute(s) reaction time**.



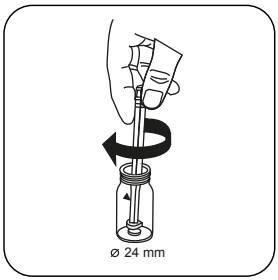
Add **AMMONIA No. 1 tablet** .



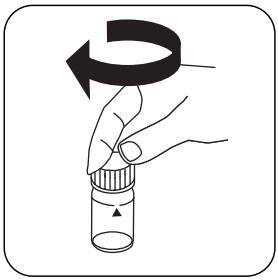
Crush tablet(s) by rotating slightly.



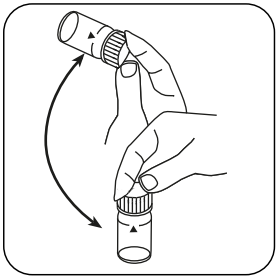
Add **AMMONIA No. 2 tablet** .



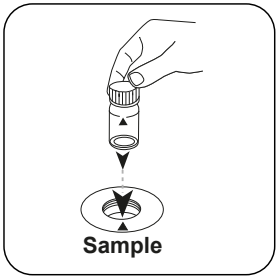
Crush tablet(s) by rotating slightly.



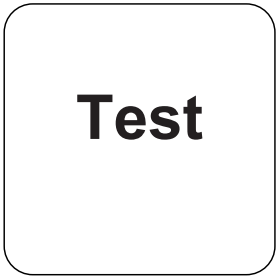
Close vial(s).



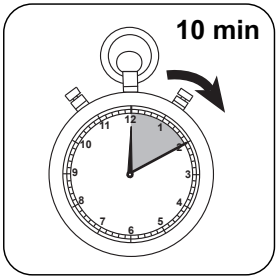
Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.



Wait for **10 minute(s) reaction time**.

Once the reaction period is finished, the measurement takes place automatically. The result in mg/l Urea appears on the display.

Chemical Method

Indophenol / Urease

[1] high range by dilution | [#] including stirring rod, 10 cm

Zinc T M400

0.02 - 1 mg/L Zn

Zincon

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 600, MD 610, MD 640, MultiDirect	ø 24 mm	610 nm	0.02 - 1 mg/L Zn
SpectroDirect	ø 24 mm	616 nm	0.02 - 0.5 mg/L Zn
XD 7000, XD 7500	ø 24 mm	616 nm	0.02 - 1 mg/L Zn

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Copperr/Zinc LR	Tablet / 100	512620BT
Copperr/Zinc LR	Tablet / 250	512621BT
EDTA in presence of copper	Tablet / 100	512390BT
EDTA in presence of copper	Tablet / 250	512391BT
Dechlor in presence of chlorine	Tablet / 100	512350BT

Application List

- Waste Water Treatment
- Raw Water Treatment
- Cooling Water
- Galvanization

Preparation

1. In the case of high levels of residual chlorine, perform the analysis with a dechlorinated water sample. To dechlorinate the sample, add a DECHLOR tablet to a 24mm vial with the water sample. Then add the Copper/Zinc LR tablet (point 2) and continue with the test procedure as described.
2. Strong alkaline or acidic water samples should be adjusted between to about pH 7 before the analysis (use 1 mol/l Sulphuric acid or 1 mol/l Sodium hydroxide).

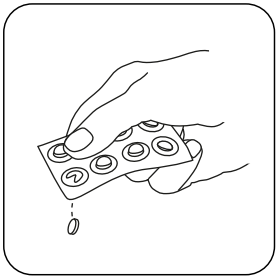
Notes

1. When using the copper/zinc LR tablets, the Zincon indicator reacts with both the zinc and the copper. Therefore, the specified measuring range may possibly refer to the total concentration of both ions.
2. The addition of an EDTA tablet during the second step of the analysis ensures that any copper presence is not measured.

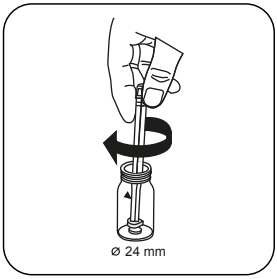
Implementation of the provision Zinc with Tablet

Select the method on the device

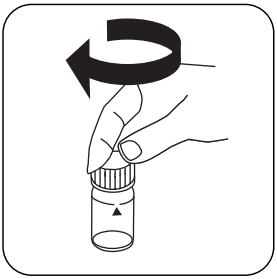
Fill 24 mm vial with **10 ml sample**.



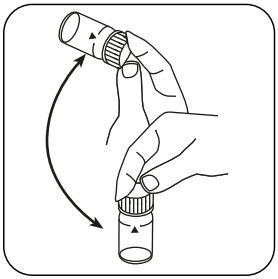
Add **COPPER/ ZINK LR tablet**.



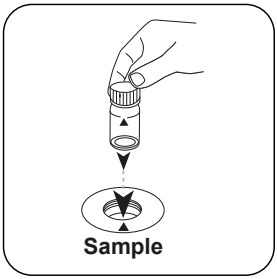
Crush tablet(s) by rotating slightly.



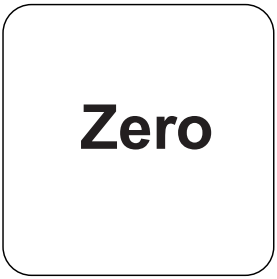
Close vial(s).



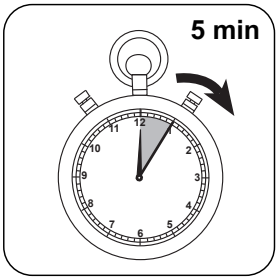
Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

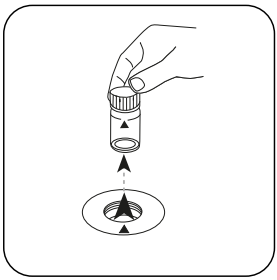


Press the **ZERO** button.

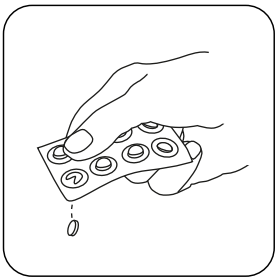


Wait for **5 minute(s) reaction time**.

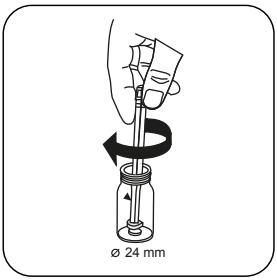
Once the reaction period is finished, the measurement takes place automatically.



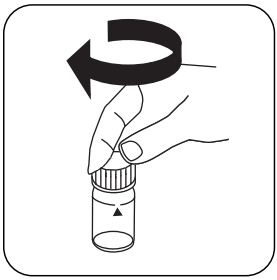
Remove the vial from the sample chamber.



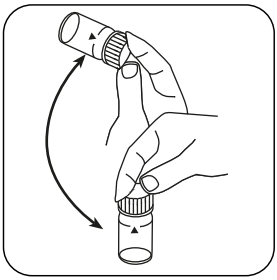
Add **EDTA tablet**.



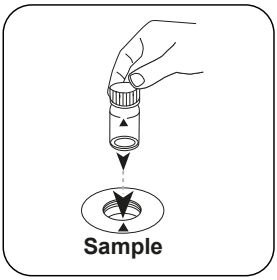
Crush tablet(s) by rotating slightly.



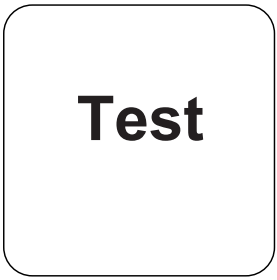
Close vial(s).



Dissolve tablet(s) by inverting.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.
The result in mg/l Zinc appears on the display.

Chemical Method

Zincon

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	1.76244 • 10^{-2}	1.76244 • 10^{-2}
b	-1.07009 • 10^{+0}	-2.30069 • 10^{+0}
c	-2.01229 • 10^{+0}	-9.30181 • 10^{+0}
d	-2.13062 • 10^{+1}	-2.11749 • 10^{+2}
e	-5.56685 • 10^{+1}	-1.1895 • 10^{+3}
f	-4.52617 • 10^{+1}	-2.07933 • 10^{+3}

Interferences

Removeable Interferences

- If there is a presence of interfering metals, pre-isolation of zinc is recommended by means of an ion exchanger, precipitation of the metals with ammonia, pre-extraction of the zinc from hydrochloric acid medium using methyldioctylamine or triisooctylamine solution in methyl isobutyl ketone, etc..
- Concentrations above 1 mg/L can lead to results within the measuring range. A plausibility test (dilution of the sample) is recommended.

Interference	**from / [mg/L]**
Cu	2E-3
Co	0,03
Ni	0,02
Al	0,005
Fe	0,01
Cd	0,001
Mn	0,01

Derived from

Hach Method 8009 US EPA approved for Wastewater

Zinc L M405

0.1 - 2.5 mg/L Zn Zn

Zincon / EDTA

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 100, MD 110, MD 600, MD 610, MD 640, XD 7000, XD 7500	ø 24 mm	610 nm	0.1 - 2.5 mg/L Zn

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
Zinc Reagent 1/Zinc Reagent 2	1 pc.	56R023965
KS 89 - Cationic Suppressor	65 mL	56L008965

Application List

- Waste Water Treatment
- Raw Water Treatment
- Cooling Water
- Galvanization

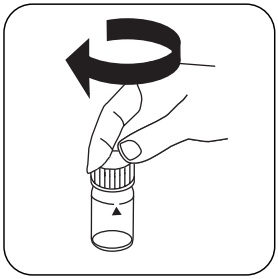
Notes

1. The measuring spoon supplied with the reagents must be used for the correct dosage.
2. This test is suitable for the determination of free soluble zinc. Zinc, which is bound to strong complexifying agents, is not measured.

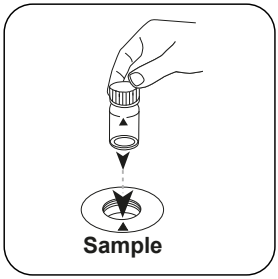
Implementation of the provision Zinc with liquid reagent and powder

Select the method on the device
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500

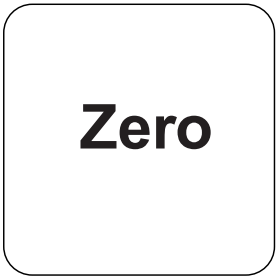
Fill 24 mm vial with **10 ml sample**.



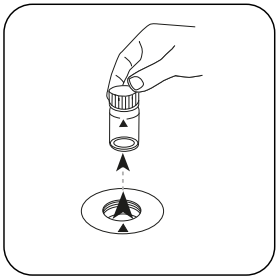
Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.

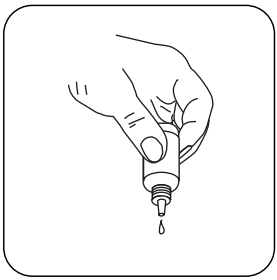


Press the **ZERO** button.

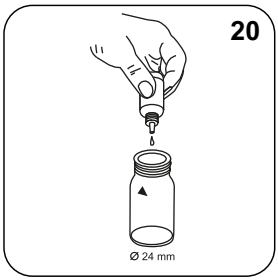


Remove the vial from the sample chamber.

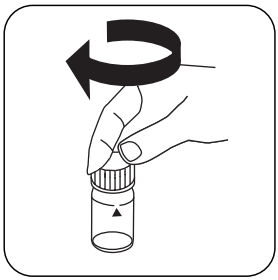
For devices that require **no ZERO measurement** , **start here**.



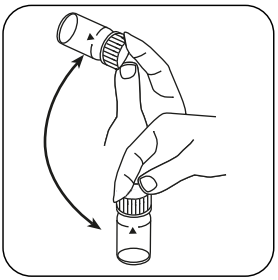
Hold cuvettes vertically and add equal drops by pressing slowly.



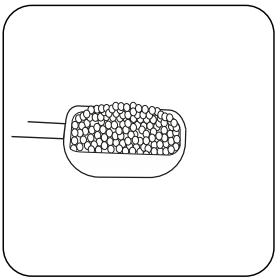
Add **20 drops KS243 (Zinc Reagent 1)**.



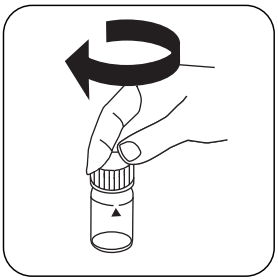
Close vial(s).



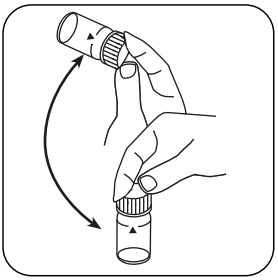
Invert several times to mix the contents.



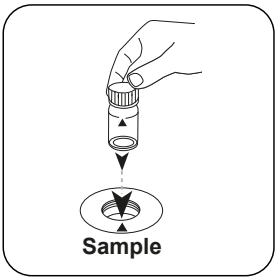
Add **a measuring scoop KP244 (Zinc Reagent 2)** .



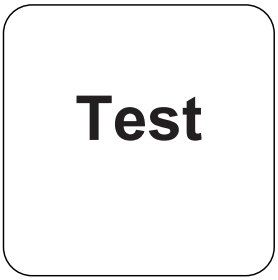
Close vial(s).



Swirl around to dissolve the powder.



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.

The result in mg/l Zinc appears on the display.

Chemical Method

Zincon / EDTA

Appendix

Calibration function for 3rd-party photometers

Conc. = a + b•Abs + c•Abs^2 + d•Abs^3 + e•Abs^4 + f•Abs^5

	ø 24 mm	**□ 10 mm**
a	$-2.34614 \cdot 10^{-1}$	$-2.34614 \cdot 10^{-1}$
b	$2.37378 \cdot 10^{+0}$	$5.10363 \cdot 10^{+0}$
c	$-1.49877 \cdot 10^{+0}$	$-6.92806 \cdot 10^{+0}$
d	$7.39829 \cdot 10^{-1}$	$7.3527 \cdot 10^{+0}$
e		
f		

Interferences

Removeable Interferences

- Cationics such as quaternary ammonium compounds will cause the colour to change from rose red to purple, depending upon the level of copper present. In this event add drops of KS89 (cationic suppressor) one at a time, until it turns orange/blue. Note: After adding each drop, swirl the vial.

Bibliography

Photometrische Analyseverfahren, Schwedt, Wissenschaftliche Verlagsgesellschaft mbH, Stuttgart 1989
S.M. Khopkar, Basic Concepts of Analytical Chemistry (2004), New Age International Ltd. Publishers, New Dheli, p. 75

PTSA M500

10 - 1000 ppb

Fluorescence

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 640	ø 24 mm	395 nm	10 - 1000 ppb

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
no reagent required		

Application List

- Cooling Water

Preparation

1. Calibrate the instrument if verifikation result is not 200 ± 20 ppb.
2. The below mentioned calibration set should be used to calibrate the instument.
3. Before use, clean the vials and the accessories.
4. The outside of the vial must be clean and dry before starting the analysis. Clean the outside of the vialswith a towel. Fingerprints or other marks will be removed.
5. The photometre is already factory calibrated, or the instrument was calibrated by the user. It is recommended to verify calibration accuracy by a 200 ppb Standard measurement:

- when in doubt about last calibration or accuracy of results
- once a mounth
  The verification measurement shall be done like a sample measurement and the result of 200 ppb standard shall be at 200 ± 20 ppb.

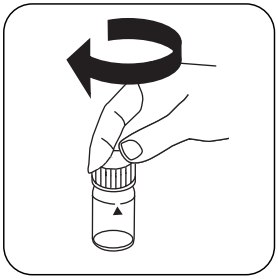
Notes

1. Use only vials with black lids for PTSA measurements.
2. Large temperature differences between the instrument and the environment can lead to errors. For best results, perform tests with sample temperatures between 20 °C (68 °F) and 25 °C (77 °F).
3. Vials and caps should be cleaned thoroughly **after each analysis** to prevent interferences.
4. To ensure maximum accuracy of test results, always use the reagent system supplied by the instrument manufacturer.
5. Do not pour used standards back into the bottle.
6. Spiking procedure possible (see Instruction Manual Photometer).

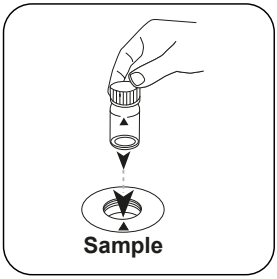
Implementation of the provision PTSA

Select the method on the device

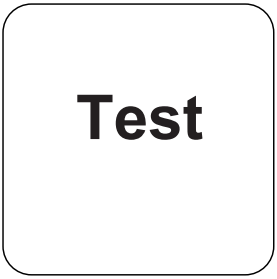
Fill PTSA mm vial with **10 ml sample**.



Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.
The result in ppb PTSA appears on the display.

Chemical Method

Fluorescence

PTSA M501

10 - 400 ppb

Fluorescence

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 640	ø 24 mm	395 nm	10 - 400 ppb

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
no reagent required		

Application List

- Cooling Water

Preparation

1. Before use, clean the vials and the accessories.
2. The outside of the vial must be clean and dry before starting the analysis. Clean the outside of the vials with a towel. Fingerprints or other marks will be removed.
3. The photometre is already factory calibrated, or the instrument was calibrated by the user. It is recommended to verify calibration accuracy by a Standard measurement:

- when in doubt about last calibration or accuracy of results
- once a mounth
  The verification measurement shall be done like a sample measurement.

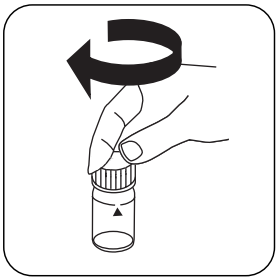
Notes

1. Use only vials with black lids for PTSA measurements.
2. Large temperature differences between the instrument and the environment can lead to errors. For best results, perform tests with sample temperatures between 20 °C (68 °F) and 25 °C (77 °F).
3. Vials and caps should be cleaned thoroughly **after each analysis** to prevent interferences.
4. To ensure maximum accuracy of test results, always use the reagent system supplied by the instrument manufacturer.
5. Do not pour used standards back into the bottle.
6. Spiking procedure possible (see Instruction Manual Photometer).

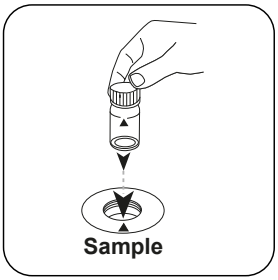
Implementation of the provision PTSA

Select the method on the device

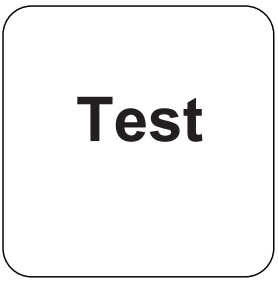
Fill PTSA mm vial with **10 ml sample**.



Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.
The result in ppb PTSA appears on the display.

Chemical Method

Fluorescence

Fluorescein M510

10 - 400 ppb

Fluorescence

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 640		395 nm	10 - 400 ppb

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
no reagent required		

Application List

- Cooling Water

Preparation

1. Calibrate the instrument if verification result is not 75 ± 8 ppb.
2. The Fluorescein Calibration Set should be used to calibrate the instrument.
3. Before use, clean the vials and the accessories.
4. The outside of the vial must be clean and dry before starting the analysis. Clean the outside of the vials with a towel. Fingerprints or other marks will be removed.
5. The photometer is already factory calibrated, or the instrument was calibrated by the user. It is recommended to verify calibration accuracy by a 75 ppb Standard measurement:

- when in doupt about last calibration or accuracy of results
- once a month
  The verification measurement shall be done like a sample measurement and the result of a 75 ppb standard shall be 75 ± 8 ppb.

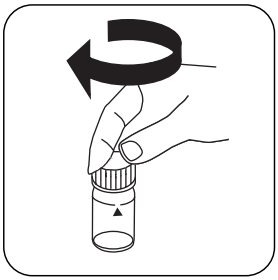
Notes

1. Use only vials with black lids for Fluorescein measurements.
2. Lage temperature differences between the instrument and the environment can lead to errors. For best results, perform tests with sample temperatures between 20 °C (68 °F) and 25 °C (77 °F).
3. Vials and caps should be cleaned thoroughly after each analysis to prevent interferences.
4. To ensure maximum accuracy of test results, always use the reagent systems supplied by the instrument manufacturer.
5. Do not pour used standards back into the bottle.
6. Implementation of a spiking procedure possible (see manual).

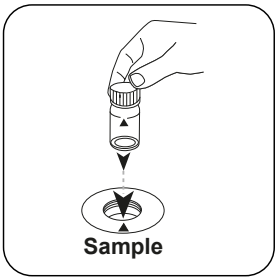
Implementation of the provision Fluorescein

Select the method on the device

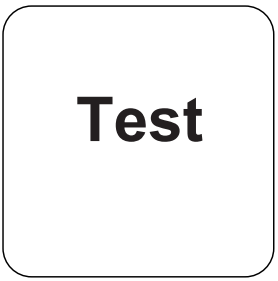
Fill Fluorescein mm vial with **10 ml sample**.



Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.
The result in ppb Fluorescein appears on the display.

Chemical Method

Fluorescence

Fluorescein M511

10 - 300 ppb

Fluorescence

Instrument specific information

The test can be performed on the following devices. In addition, the required cuvette and the absorption range of the photometer are indicated.

Instrument Type	Cuvette	λ	Measuring Range
MD 640		395 nm	10 - 300 ppb

Material

Required material (partly optional):

Reagents	Packaging Unit	Part Number
no reagent required		

Application List

- Cooling Water

Preparation

1. The Fluorescein Calibration Set should be used to calibrate the instrument.
2. Before use, clean the vials and the accessories.
3. The outside of the vial must be clean and dry before starting the analysis. Clean the outside of the vials with a towel. Fingerprints or other marks will be removed.
4. The photometer is already factory calibrated, or the instrument was calibrated by the user. It is recommended to verify calibration accuracy by a Standard measurement:

- when in doupt about last calibration or accuracy of results
- once a month
  The verification measurement shall be done like a sample measurement.

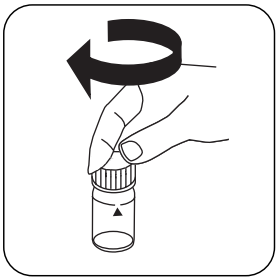
Notes

1. Use only vials with black lids for Fluorescein measurements.
2. Lage temperature differences between the instrument and the environment can lead to errors. For best results, perform tests with sample temperatures between 20 °C (68 °F) and 25 °C (77 °F).
3. Vials and caps should be cleaned thoroughly after each analysis to prevent interferences.
4. To ensure maximum accuracy of test results, always use the reagent systems supplied by the instrument manufacturer.
5. Do not pour used standards back into the bottle.
6. Implementation of a spiking procedure possible (see manual).

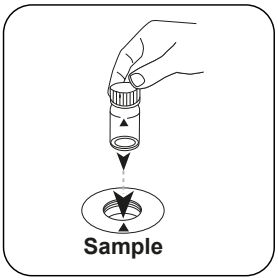
Implementation of the provision Fluorescein

Select the method on the device

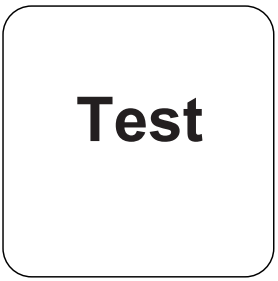
Fill Fluorescein mm vial with **10 ml sample**.



Close vial(s).



Place **sample vial** in the sample chamber. • Pay attention to the positioning.



Press the **TEST** (XD: **START**)button.
The result in ppb Fluorescein appears on the display.

Chemical Method

Fluorescence

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