**Chlorine MR PP****M113****0.02 - 3.5 mg/L Cl<sub>2</sub> <sup>a)</sup>****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 | $\lambda$ | Measuring Range                               |
|---|---------|-----------|---|
| MD 100, MD 600, MD 610,<br>MD 640, MultiDirect, PM 620,<br>PM 630 | ø 24 mm | 530 nm    | 0.02 - 3.5 mg/L Cl <sub>2</sub> <sup>a)</sup> |
| SpectroDirect, XD 7000, XD<br>7500                                | ø 24 mm | 510 nm    | 0.02 - 3.5 mg/L Cl <sub>2</sub> <sup>a)</sup> |

## 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 /<br>1000 pc. | 530183      |
| VARIO Chlorine Total DPD F10 | Powder / 100 pc.     | 530190      |
| VARIO Chlorine Total DPD F10 | Powder /<br>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
- 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.



## Determination of free chlorine MR, with powder pack

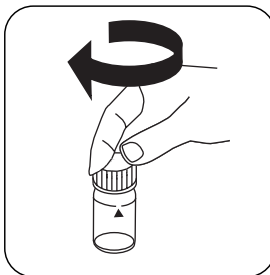
Select the method on the device.

In addition, choose the test: free

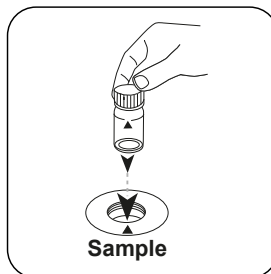
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



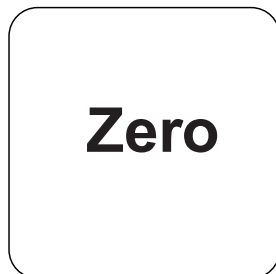
Fill 24 mm vial with **10 mL sample**.



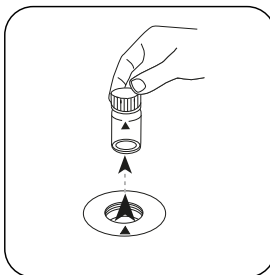
Close vial(s).



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

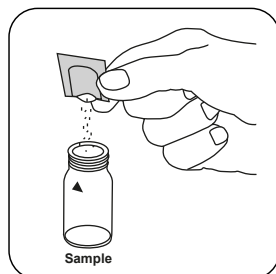


Press the **ZERO** button.

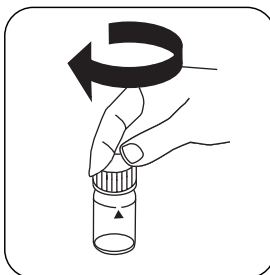


Remove the vial from the sample chamber.

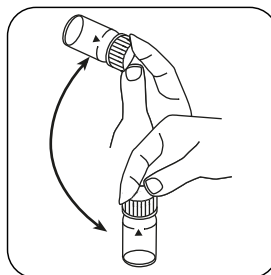
For devices that require **no ZERO measurement**, **start here**.



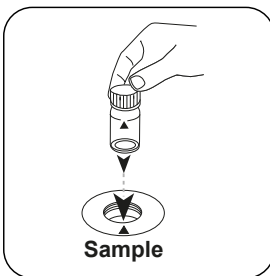
Add **VARIO Chlorine FREE-DPD/ F10 powder pack**.



Close vial(s).



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

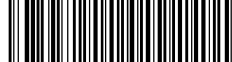


# Test

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.

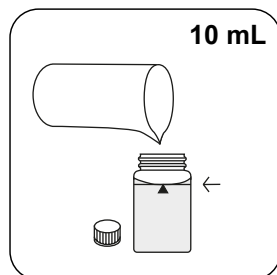


## Determination of Chlorine differentiated MR with powder packs

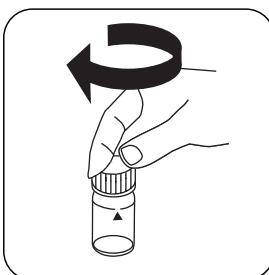
Select the method on the device.

In addition, choose the test: differentiated

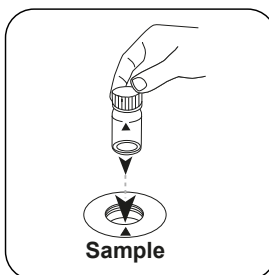
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



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



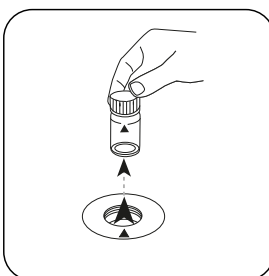
Close vial(s).



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

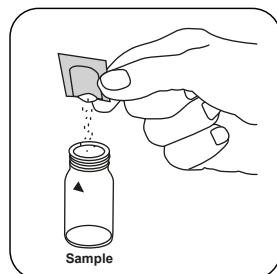


Press the **ZERO** button.

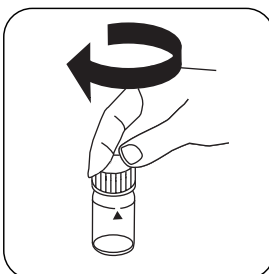


Remove the vial from the sample chamber.

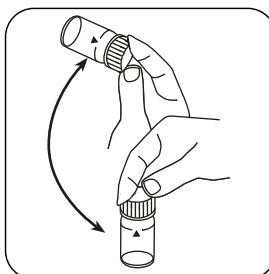
For devices that require **no ZERO measurement**, start here.



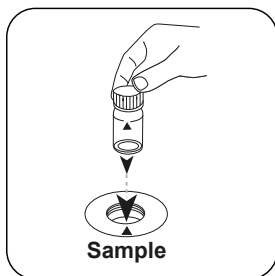
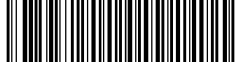
Add **VARIO Chlorine FREE-DPD/ F10 powder pack**.



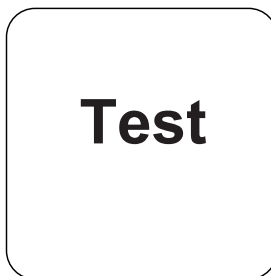
Close vial(s).



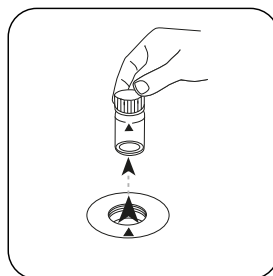
Invert several times to mix the contents (20 sec.).



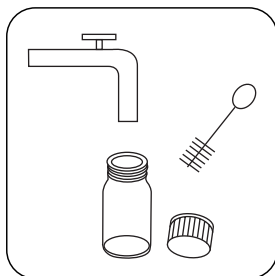
Place **sample vial** in the sample chamber. Pay attention to the positioning.



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



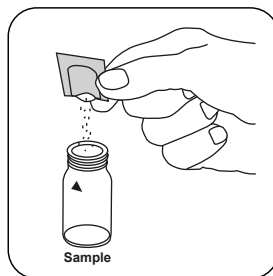
Remove the vial from the sample chamber.



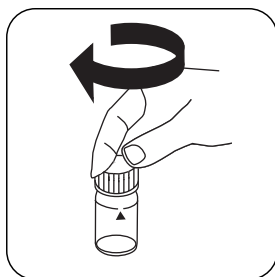
Thoroughly clean the vial and vial cap.



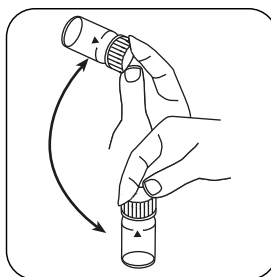
Fill 24 mm vial with **10 mL sample**.



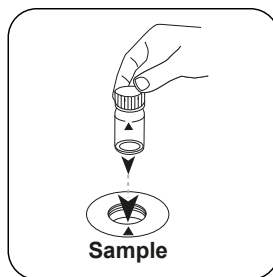
Add **Chlorine TOTAL-DPD/F10 powder pack**.



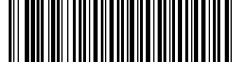
Close vial(s).



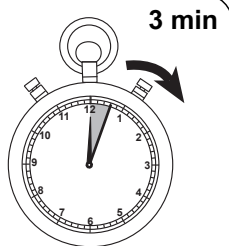
Invert several times to mix the contents (20 sec.).



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



# Test

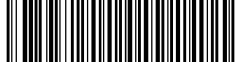


Press the **TEST** (XD:  
**START**) button.

Wait for **3 minute(s) reac-**  
**tion 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.



## Determination of total Chlorine MR with powder packs

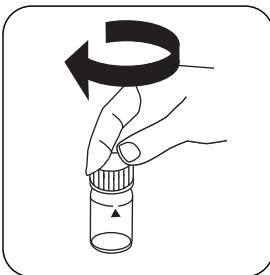
Select the method on the device.

In addition, choose the test: total

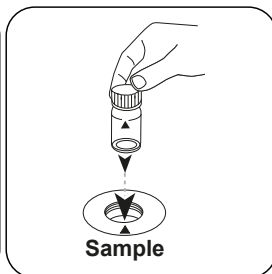
For this method, a ZERO measurement does not have to be carried out every time on the following devices: XD 7000, XD 7500



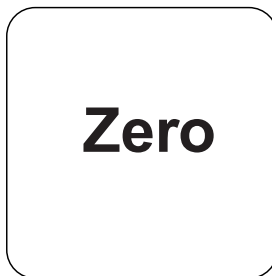
Fill 24 mm vial with **10 mL sample**.



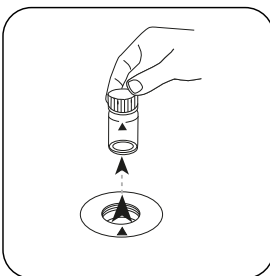
Close vial(s).



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

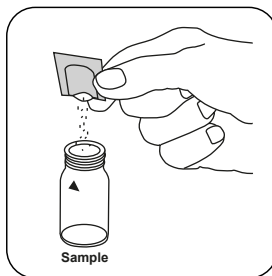


Press the **ZERO** button.

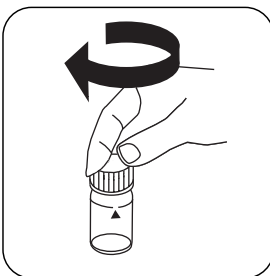


Remove the vial from the sample chamber.

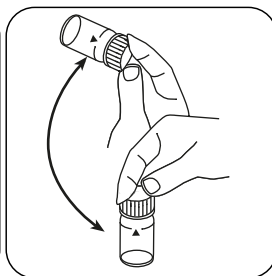
For devices that require **no ZERO measurement**, start here.



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

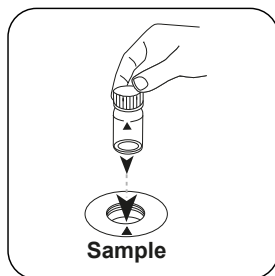
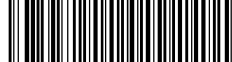


Close vial(s).

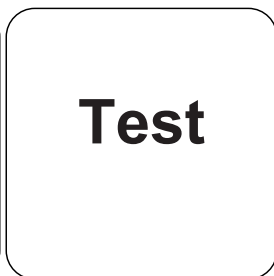


Invert several times to mix the contents (20 sec.).

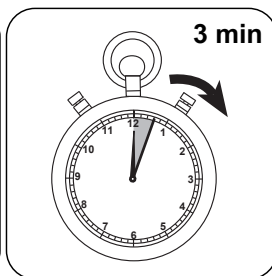




Place **sample vial** in the sample chamber. Pay attention to the positioning.



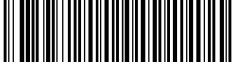
Press the **TEST** (XD: **START**) button.



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

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

|   | 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

### Persistent 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] |
|---------------------|---------------|
| $\text{CrO}_4^{2-}$ | 0.01          |
| $\text{MnO}_2$      | 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 %         |



<sup>a)</sup> determination of free, combined and total