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1. Photometer

1.1. Important notes

CAUTION

Reagents are formulated exclusively for chemical analysis and must not be used for any other purpose. Reagents must not get into the hands of children. Some of the ingredients contain substances which are not entirely harmless environmentally. Become familiar with the constituents and take proper care when disposing of the test solution.

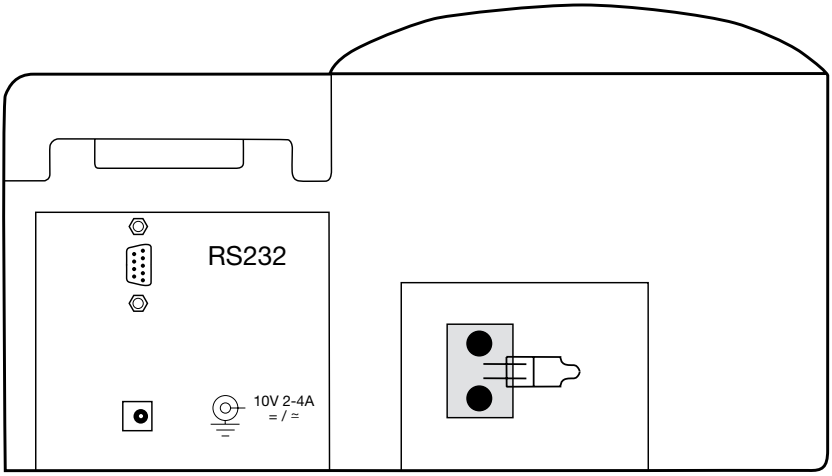
1.2 Delivery content

1 Photometer
1 Mains adapter
1 Set of operating instructions
1 Warranty certificate
1 CD-ROM with download software

Vials and reagent sets are not part of the standard scope of delivery.
Please see the current price list for details of available vials and reagent sets.

1. Photometer

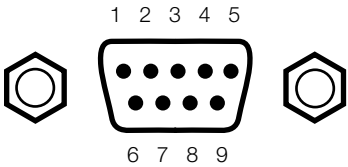
Back view



Replacement of the halogen lamp , see page 34.

Serial Interface (RS232)

5 – Mass
3 – TxData from PC$_{SPECTRO}$
2 – CTS to PC$_{SPECTRO}$



1. Photometer

1.3 Technical data

Dimensions (H x W x D):	165 x 275 x 340 mm
Power supply:	12 V DC/AC ; 2.5 A
Main adapter:	External transformer for 100 V-240 V ; 50-60 Hz
Interface:	serial RS 232 – 9 pins
Assignment:	2 – CTS at PC Spectro, 3 TxData from PC Spectro, 5 – GND, 1-,4-,6-,7-,8-,9-, free
Display:	9 lines, 21-place backlit graphic display
Wavelength range:	330 to 900 nm
Wavelength accuracy:	± 2 nm
Wavelength reproducibility:	± 1 nm
Spectral bandwidth:	10 nm
Light source:	pre-adjusted tungsten halogen lamp
Monochromator:	holographic grating
Photometric range:	- 0.3 to 2.5 Abs (extinction), 0.1 to 130 % T (transmission)
Photometric accuracy measured with filters (NIST traceable):	
	0.259 Abs < x < 0.273 Abs at 440 nm 0.250 Abs < x < 0.264 Abs at 635 nm 0.548 Abs < x < 0.568 Abs at 440 nm 0.542 Abs < x < 0.562 Abs at 635 nm 0.954 Abs < x < 0.994 Abs at 440 nm 0.907 Abs < x < 0.947 Abs at 635 nm
Drift:	± 0.005 Abs / h at 500 nm
Dispersion:	< 0.5 % at 340 and 400 nm
Detector:	silicon diode
Specific accuracy of the photometer only applies at 20 - 25 °C.	
Memory:	760 data sets
	Subject to technical modification!

1. Photometer

1.4 Data processing

1. Switch off computer and photometer, as applicable.

2. Connect the photometer (RS 232 interface) and the serial interface of the computer (COM 1, COM 2, COM 3, COM 4) or printer using a cable in line with the specified assignment.
   Software requirements for PC: Windows 95/98, NT, 2000.

3. Switch on the photometer and computer or printer.

1.4.1 Connection to a printer

Printer with a serial port are suitable for connection with the photometer; e.g. Epson, HP, Kyocera.

A suitable compact table printer is the thermal-printer DPU 414 from SEIKO.

This printer is available at specialized trade.

Before using the printer DPU 414 with the PC Spectro you should change the following standard adjustments:

Input method: serial

Print mode: Condensed printing (80 columns)

Baud rate: 9600 bps

(Detailed information of changing the adjustment you will find in the printer manual.)

1. Photometer

1.4.2 Data transfer to a PC

In the ”Spectrum” mode (see page 25) and the ”Kinetics” mode (see pages 32, 33), data can be transferred and edited in Excel. Individual test results can also be transferred to the PC using the PRINT key.

The required ”Data transfer” software is on the CD-ROM supplied with the PCSPECTRO.

The CD starts automatically when inserted in the CD-ROM drive (PC running on Win 95 or higher).

The software for data transfer is automatically installed on the PC together with the necessary settings.

1. Connect the serial interface of the photometer with the PC (see page 8).
2. Open the program “Datatransfer” with Start/Programme/Datatransfer PCSPECTRO.
3. Click on button "Test COM-Port".
4. Select the desired COM-Port.
5. Click on button "Open COM-Port".
6. Transfer data from the photometer (key PRINT at PCSPECTRO).
7. Click on button "Close COM-Port".
8. For leaving the program click on button "Quit".

Further buttons

Export
To select path and name. Storage of data as Excel-file.

Print
To print out of reported data in the window.

Clear
To delete the reported data in the window.

1. Photometer

1.5 Software/Download

Users need download software and a parameter list to update methods or languages. The download software is included on the CD-ROM supplied with the PCSPECTRO. The parameter lists with the latest methods (parameters Vx) and additional languages (language x) can be downloaded from our Internet homepage free of charge. The software and the parameter list should be saved on the harddisk of the PC under the same path as the download software.

Important!

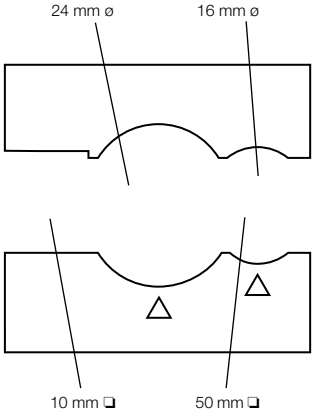
Before performing a **method update**, the user should transfer stored test results to the PC or print them out, as these data are deleted during the download process.

Stored polynomials or concentrations and the calibration of the method Fluoride remain stored.

1. Connect the serial interface of the photometer with the PC (see page 8).
2. Open program “download languages” or “download methods”.
3. Confirm the query for the password with OK or ”Enter” (only necessary for ”downlowd methods”)
4. Enter the desired version of the parameter list with LOAD .
5. Press ON/OFF for one second on the PCSPECTRO.
   The photometer changes in the stand-by modus.
6. Click on DOWNLOAD button at the PC.
7. In the appearing window select the used COM-Port and confirm with OK .
8. During data transfer at the PC appears ”Download” and in the photometer display “→ PC”.
9. After some time the data transfer is finished.
   (“→ PC” dissappears)
10. Switch the photometer on using ON/OFF key.

    You can find a detailed description in the Read me file of the CD-ROM.

2. General information



2.1 Sample chamber

The following cell types may be used:

10 mm rectangular cells – left-hand guide in sample chamber.

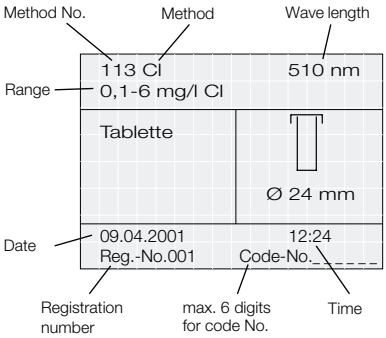
50 mm rectangular cells – long guide along the entire sample chamber.

Insert the rectangular vials so that a matt side points towards the viewer.

24 mm round vials – central round guide.

16 mm round vials – right-hand round guide.

Insert the round vials so that the marking on the vial is aligned with the marking on the sample chamber ▽△.



2.2 Display

The top line shows the method number and the mode or method.

The wavelength at which measurement takes place is shown on the right.

The next line shows the measuring range of the method.

A user instruction or the result is shown in the central area of the display.

The lower section of the display shows the date and time.

If a result can be stored, the registration number and code number are shown underneath.

tablet:	Tablets are necessary to perform these test.
s/l-Rgt:	Solid/liquid-reagent; liquid reagent or powder are necessary to perform these test.
vial:	Vial tests are necessary to perform these test.

2. General information

2.3. Overview of function keys

ON OFF	Switches the photometer on or off. To switch off press the ON/OFF key for 1 second.
↵	Confirmation of inputs.
ESC	The ESC key takes you to the start screen of the method. Pressing the ESC key again takes you to the method selection menu.
DEL	Pressing the DEL key deletes the last-written character provided that the display has not already been confirmed by pressing the [↵] key. If the cursor flashes under a plus or minus symbol, you can alternate between the symbols by pressing the DEL key.
PRINT	The displayed result is printed.
STORE	In the start screen of a method you can view all the results stored for this method by pressing the STORE key. If the display shows a result that has just been measured, you can store this result by pressing the STORE key. In the ”Concentration” and ”Polynoms” modes, you can store a user-defined method by pressing the STORE key.
0 ZERO	Pressing this key performs zero calibration. Otherwise, the ZERO key has a numeric key function.
.	Press this key for setting a decimal point.
△ ▽	You can move the cursor up or down in a list using Scroll UP/DOWN. Scroll LEFT/RIGHT shows the next page. When using this function, triangle symbols are shown in the display.
◁ ▷	During number input (for example) the cursor moves one character to the left or right without deleting a character.

3. Operation

Before each startup, make sure that the sample chamber is empty and the photometer lid closed, as the photometer always performs a self-test when it is switched on.

3.1 Self-test

During stand-by-mode date, time and the logo are shown in the display.

Switch the photometer on using the ON/OFF key.

Connect the instrument with the power supply unit to mains for operation.

PC SPECTRO 1.0

The display shows the logo and the software version.

CELLHOLDER EMPTY?

After a few seconds the display shows:

Confirm with the [↵] key.

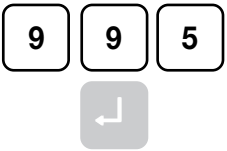
Self-test is checking the step-motor, the lamp, the wavelength adjustment and the memory as shown in the display (period: 2 minutes).

SELECT METHOD

After self-test verification the display shows:

3. Operation

3.2 Unit settings



1. Call up the "Configuration" mode by pressing [9] [9] [5] [↵].

2. A submenu appears with the following functions: Language, Date + Time, Profi mode, Factor, Beeper, Delete data, Polynoms 1-10.

3. Move the cursor to the desired function using Scroll UP/DOWN.

4. Confirm by pressing [↵].

Notes

Pressing ESC exits a function without making any changes.

3.2.1 Language selection

1. Select the language using Scroll UP/DOWN.

2. Confirm selection by pressing [↵].

Notes

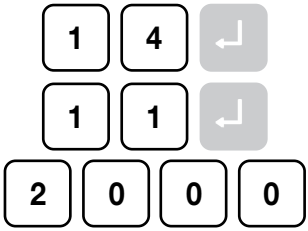
In normal status the photometer is set to English.

"Option" contains a language stored by the user (see Software / Download, page 10).

3.2.2 Date and time

1. Press [↵] to set the date.

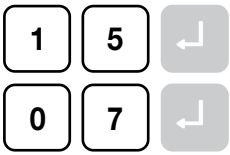
2. Enter the day and month in two-digit format, the year in 4-digit format.
   Example: 14. November 2000 = 14 11 2000



3. Enter [1][4][↵]
   [1][1][↵]
   [2][0][0][0][↵]
   consecutively.

4. Press [↵] to take the unit into input mode for the time.

5. Enter the hour(s) and minute(s) in 2-digit format.
   Example: 15 hours 7 minutes (3.07 pm) = 15 07



6. Enter [1][5][↵]
   [0][7][↵]
   consecutively.

7. The program then returns to the submenu of the "Configuration" mode.

Notes

If the date is correct and only the time needs to be adjusted, move the cursor to the time field using Scroll UP/DOWN and confirm by pressing [↵].

If the photometer is disconnected more than 30 hours from the mains, date and time are lost.

3.2.3 Lab function (Profi-mode)

1. Select between "ON" and "OFF" using Scroll UP/ DOWN.

2. Confirm by pressing [↵].

Notes

The following information is always stored in the methods:

a) Method

b) Measuring range

c) Date and time

d) Reg. no.

e) Code no.

f) Differentiation of results

g) Detailed user instructions

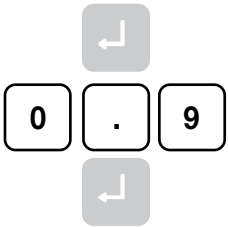
h) Compliance with colour reaction times

If the Profi mode is active, the photometer provides only a minimum of user instructions. The criteria specified above d, e, f, g, h are no longer included.

Storage of results is not possible!

The Profi mode is inactive in the normal status of the photometer.

3.2.4 Factor



1. Enter the method number of the method for which you want to change the factor and confirm by pressing [↵].
2. Enter the value for the factor – e.g. [0][.][9] and [↵].

Notes

The factor can have values of between 0.8 and 1.2. In normal status, the factor is F = 1.000.

If the value of the factor is different from 1.000, this is displayed in the measuring mode of the method.

The use of a code (e.g. $DA5C) indicated above the factor, allows to trace back the currently stored version of the method.

3.2.5 Acoustic signal (beeper)

1. Select between "ON" and "OFF" using Scroll UP/DOWN.
2. Confirm by pressing [↵].

Notes

In normal status, the acoustic signal for the keypad is switched on. In the case of analyses with waiting times, an acoustic signal still sounds during the last 10 seconds of the waiting time even if the beeper is switched off.

3.2.6 Deleting data sets

This function deletes all ! data sets.

DELETE DATA?

1. Select this function, the additional query ”DELETE DATA?” appears.

2. Press [↵] or ESC to retain the data in memory.

3. Press DEL to delete the data.

3.2.7 Polynoms

Polynoms: see pages 26, 27 for details of the creation and storage of a user-defined polynom.

3. Operation

3.3 Mode of operation

Before each startup, make sure that the sample chamber is empty and the photometer lid closed, as the photometer always performs a self-test when it is switched on.

1. Switch the unit on by pressing ON/OFF.

2. Self-test (see page 13).

3. Select the method using Scroll UP/DOWN

   or

   enter the method number directly – e.g. [3][5] (see list on page 37 ff)

4. Confirm by pressing [↵].

Notes

In some methods a submenu appears in which a method is subdivided into different measuring ranges. When in this submenu, make a selection as described above (pos. 3 and 4).

3.3.1 Serial no.

(assigned automatically)

- counts stored data sets
- increments continuously in 3-digit format
- when the result memory reaches 999, the next data set stored is assigned to location 000 (which is overwritten)
- if more than 950 result memory locations are assigned, a message appears when the self-test is complete
- is reset to zero by deleting the result memory (see page 18)

3.3.2 Code-No.

We advise you to enter a numeric code (up to 6 places) in the line "Code no.".

A code number can contain references to the user or the sample-taking site.

Confirm the input of the 6-digit code number by pressing [↵].

If a code number is not necessary, directly confirm by pressing [↵].

3.3.3 Differentiation

Differentiation is possible in some methods (e.g. chlorine). The Photometer then queries the type of measurement. Entering a number (e.g. [1] for Cl diff), "PREPARE ZERO" appears, as in the other methods.

3.3.4 Zero calibration

Fill a clean vial in line with the respective analysis regulations and place it in the sample chamber (positioning see page 11). Close the photometer lid.

Press the ZERO key.

Notes

It is advisable to perform a zero calibration and the base line in "Spectrum" mode using a full vial. Depending on the user-specific application, deionized water, a chemical blank or a water sample are suitable for this purpose.

3.3.5 Performing test

When zero calibration is complete, remove the vial from the sample chamber. Then perform the analysis as described under the respective method.

When the test results have been displayed:

- you can store and / or print out the results,
- perform additional tests using the same parameters, and
- select new parameters.

3.3.6 Saving the test result

Press STORE directly after the test result is displayed. The entire data set, complete with date, time, test number, code number, method and test result, is then stored.

STORED

"STORED" appears momentarily.

The test result is then shown again.

3.3.7 Printing the test result

If a printer is installed and switched on, it is possible to print out the test result (without storing it beforehand). To do this, press PRINT. The entire data set is printed, complete with date, time, test number, code number, method and test result.

3.3.8 Performing additional tests

SAME ZERO?

To perform further tests using the same method, press the [↵] key when the test result is displayed. The query "SAME ZERO?" appears.

To perform an additional test without a new zero calibration, confirm by pressing [↵].

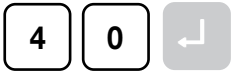
To perform a new zero calibration, confirm by pressing ZERO.

To perform a new zero calibration, you can press ZERO directly when the test result is displayed.

3.3.9 Ending the test

Press ESC.

3.3.10 Retrieving stored test results



1. Enter the method number – e.g. [4][0] and [↵].

2. Press STORE.

3. Scroll LEFT/RIGHT.

4. Pressing PRINT prints out the displayed data set stored under this method.

5. Terminate the process by pressing [↵] or ESC.

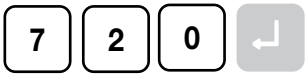
Notes

NO RESULT STORED

If no test result has yet been stored, "NO RESULT STORED " appears in the display momentarily.

4. Absorption / Transmission

Method no. 990



1. Enter the wavelength – e.g. [7][2][0] and [↵].

2. Press ZERO to perform zero calibration.

3. Press [↵] to perform measurement of the sample.

4. The result is shown in absorption units in the first line and as % transmission in the second line.

5. Press PRINT to print out the result.

Notes:

There is no storage option.

5. Multi WL

Method no. 980

In MULTI WL mode, two wavelengths are measured consecutively and the results shown in absorption units.

In the WL1/WL2 computation, inadmissible results are shown as "-.- - -".

-.- - -

1. Enter the first wavelength – e.g. [4][5][0] and [↵].

2. Enter the second wavelength – e.g. [5][5][5] and [↵].

3. Press ZERO to perform zero calibration.

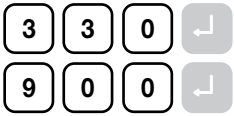
4. Press [↵] to perform measurement of the sample.

5. Press PRINT to print out the result.

Notes:
There is no storage option.

6. Spectrum

Method no. 985



1. Enter the start wavelength – e.g. [3][3][0] and [↵].
2. Enter the end wavelength – e.g. [9][0][0] and [↵].

   The end wavelength must be at least 5 nm higher than the start wavelength to permit a wavelength scan.

3. Press ZERO for the base line.
4. Press [↵] to perform measurement of the sample.

   A scan across the entire wavelength range from 330 to 900 nm takes around 1½ minutes. During the scan, "MEASUREMENT" appears in the display.

MEASUREMENT

5. After measurement, a diagram of the spectrum is shown in the display.
   Selection between diagram and data list using Scroll LEFT/RIGHT.
   The data list shows the absorptions of the peaks (maximums) and valleys (minimums).

PRINT DATA
TRANSFER TO PC

6. Press PRINT, the following selection menu appears: "PRINT DATA" or "TRANSFER TO PC" (see page 9)
7. Make a selection using Scroll UP/DOWN and confirm by pressing [↵].

RESULT

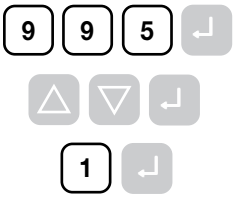
8. "DATA TRANSFER" appears in the display, then the result once again.

Notes:
There is no storage option. Choosing the option "PRINT DATA" prints out the data list but not the diagram.
The minimum time delay between two measurements is one minute. Pressing [↵] or ZERO after a measurement within the time delay of one minute leads to the indication of an hour-glass in the display. As long as the hour-glass is indicated it is not possible to use the keypad functions.

7. Polynom

Up to 10 polynoms can be defined and stored under the method numbers 900, 905, 910,...to 945.

7.1 Creation and storage of a user-defined polynom



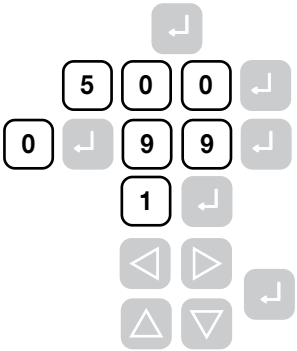
1. Call up the "Configuration" mode by pressing [9] [9] [5] [↵].

2. Select "POLYNOMS" using Scroll UP/DOWN and confirm by pressing [↵].

3. Enter a number from 1 to 10 for a polynom.

4. An input mask appears for the coefficients (A, B, C, D) of the polynom.
   It is possible to move the cursor within a line using Scroll LEFT/RIGHT and from one line to the next using Scroll UP/DOWN. E stands for an exponent from 0 to max. 9.

$Y = A + Bx + Cx^2 + Dx^3$



5. Confirm input by pressing [↵].

6. Enter the wavelength – e.g. [5][0][0] and [↵].

7. Enter the top and bottom limits for measuring range limitation – e.g. [0] [↵] and [9][9][9][9][↵].

8. Enter the number of places after the decimal point (max. 3) for result output – e.g. [1] and [↵].

9. To enter a method name (max. 10 characters), move the cursor in the character field using the scroll keys and enter the character in the name by pressing [↵] to confirm the character under which the cursor is flashing.

10. Confirm by pressing STORE.

11. Proceed as for method name input when entering the unit (max. 6 characters).

12. Confirm by pressing STORE.

STORED

13. All inputs are displayed with the confirmation "STORED"; the program then returns to the submenu of the mode "CONFIGURATION".

Notes:
The coefficients (A, B, C, D) of an entered polynom are not deleted but over-written if changes are made.

7. Polynom

7.2 Retrieving a stored polynom

1. Enter the method number of a polynom – e.g. [9][2][5] and [↵].

If no polynom is stored under this method number, "NOT DEFINED" appears in the display (definition, see above).

2. Press ZERO to perform zero calibration.

3. Press [↵] to perform measurement of the sample.

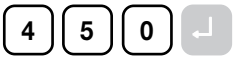
4. Press PRINT to print the result and/or STORE to store the result.

8. Concentration

In this mode methods can be stored with linear function by entering a known factor under the 4 method numbers 955, 960, 965, 970 or compute and store them by measuring 2 to 8 standards of known concentration.

8.1 Creation and storage of a method in "Concentration" mode

1. Call up the "Concentration" mode – e.g. [9] [5] [5] and [↵].



2. Enter the wavelength – e.g. [4][5][0] and [↵].

3. Enter the number of places after the comma (max. 3) for result output – e.g. [1] and [↵].

4. Select factor or standard using Scroll UP/DOWN and confirm by pressing [↵].

Input a factor

Enter the gradient of the line as the factor – e.g. [1][.][2] and [↵].

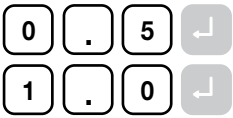
Notes:
Enter a negative factor for reactions with colour reduction (see DEL page 12).

If the line does not pass zero (A ≠ zero), chemical blank can either be used for zeroing or store the method with coefficients A and B as a polynom. Zeroing is done with deionized water or the water sample.

8. Concentration

Measurement of standards

1. Enter the number of standards to be measured (2-8) – e.g. [2] and [↵].



2. Enter the concentrations of the standards one after the other in ascending order. Confirm each concentration input by pressing [↵] – e.g. [0][.][5] [↵] and [1][.][0][↵].

3. Press ZERO to perform zero calibration.

4. Place the vial with the first standard in the sample chamber and press [↵].

5. Place the vial with the second standard in the sample chamber and press [↵].

6. Repeat this process until all standards have been measured.

Y = A + Bx

7. The result is gradient B and the point of intersection with y-axis A.

8. Confirm by pressing [↵].

8. Concentration

Storing the method

STORE METHOD?

After entering the factor or after the standard has been measured, "STORE METHOD?" appears in the display.

1. To store the method confirm "YES" by pressing [↵].

   Select "NO" using Scroll UP/DOWN and confirm by pressing [↵] and then the method will not be stored. The program then switches to zero calibration in measuring mode, where you can perform measurements using the entered or recorded data until you leave this mode.

2. Enter the top and bottom limits for measuring range limitation – e.g. [0] [↵] and [9][9][↵].

3. To enter a method name (max. 10 characters), move the cursor in the character field using the scroll keys and enter the character in the name by pressing [↵] to confirm the character under which the cursor is flashing.

4. Confirm by pressing STORE.

5. Proceed as for method name input when entering the unit (max. 6 characters).

6. Confirm by pressing STORE.

7. The program then switches to the information display of the measuring mode.

8. Concentration

8.2 Retrieving a method in ”Concentration” mode

1. Enter the method number (e.g. [9][5][5] and [↵]).

   If no method is stored, ”Input mode” is initiated (see page 28, point 8.1).

2. Press [↵] in the information display.

3. Press ZERO to perform zero calibration.

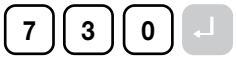
4. Press [↵] to perform measurement of the sample.

5. Press PRINT to print the result.

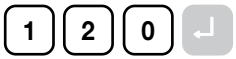
Notes:
No storage option exists for test results.

9. Kinetics

Method no. 975



1. Enter start wavelength – e.g. [7][3][0] and [↵].



2. Enter delay time (max. 240 seconds) for start of measurement - e.g. [1][2][0] and [↵].

3. Enter segment duration (min. 6 seconds, max. 240 seconds) – e.g. [6][0] and [↵].

4. Enter number (max. 25) of segments – e.g. [1][0] and [↵].

In the above example, measurement takes:
60 seconds x 10 = 10 minutes.

5. Select factor or standard using Scroll UP/DOWN and confirm by pressing [↵].

Factor

1. Enter factor - e.g. [0][.][7][5] and [↵].

2. The program then initiates zero calibration.(see "Measuring the sample").

Note:
It is possible to enter a negative factor (see DEL page 12).

9. Kinetics

Measuring a standard

1. Enter the concentration of the standard to measure and confirm by pressing [↵].

2. Press ZERO to perform zero calibration..

3. Press [↵] to measure the standard.

4. The result shown is the gradient.

5. Start the measuring process by pressing [↵] - (see "Measuring the sample").

Measuring the sample

1. Press ZERO to perform zero calibration.

2. Press [↵] to measure the sample.

MEASUREMENT

"MEASUREMENT" appears in the display during the measurement process.

3. Following measurement, the display shows a time characteristic diagram.
Select between the diagram and the data list using Scroll LEFT/RIGHT.

PRINT DATA
TRANSFER TO PC

4. Press PRINT to call up the following selection menu: "PRINT DATA" or "TRANSFER TO PC" (see page 9).

5. Choose an option using Scroll UP/DOWN and confirm by pressing [↵].

RESULT

6. "DATA TRANSFER" appears in the display, then the result once again.

Notes:
There is no storage option.
It is possible to print the data list (not the diagram) using the "PRINT DATA" option.

10. Error messages

Invalid inputs (such as 100 nm) are not accepted after confirmation (by pressing [↵]). Delete the input by pressing DEL and enter the correct value (e.g. 330 nm).

User messages in the display and possible causes

UNDERRANGE	The result is outside the low end of the measuring range, or light has entered the sample chamber due to the housing lid being open.
OVERRANGE	The result is outside the top end of the measuring range.
E87 LAMP OFF	It is recommended to switch the photometer OFF and then ON again. If the error appears again, replace the halogen lamp. **Caution: Never** touch the halogen lamp with your fingers. Take out the metal plate serving as the cover of light source. Unscrew and take the halogen lamp out with the fixing module. Take out the new readjusted halogen lamp module out of the packaging and fix it. Pull the screws tight and fix the cover (metal plate) into the slight.
E89 LOW/NO ENERGY	Several reasons may have caused this error. Please check if the self-test has been activated with a cell in the sample chamber. If so, please take cell out, then switch the photometer off and on again. The sample chamber may be dirty, especially in the area of the detector. Clean the sample chamber with a soft and fluffy-free tissue. This error may also occur by zeroing with very dark or cloudy sample. According to user defined requirements the sample should be diluted, decolourised or filtrated.
E . . .	An internal error has occurred. We recommend that you switch the unit off and on again. If the error occurs again, consult the service department. The same applies to all error messages listed below. When sending in the unit, please state the exact error message.

11. Methods

11.1 Important notes

Observe applications, instructions and matrix effects of the methods.

Appropriate protection equipment required.

MSD-sheets are required.

Ensure proper disposal of these reagent solutions.

11.2 Perform zero calibration

PREPARE ZERO
PRESS ZERO

The display shows: "PREPARE ZERO ; PRESS ZERO". Place the prepared blank (as described in the instructions) in the sample chamber, close the photometer lid and press the ZERO key.

11.3 Colour development time for vial tests

For vial tests the colour development time starts after addition of the (last) reagent.

Test procedure is as follow:

- Add reagent.
- Replace the cap tightly.
- Press [↵] at the photometer (count down starts).
- Invert the vial gently several times to mix the contents. Dissolve powder by shaking.
- Replace the vial in the sample chamber and close the cover on the the sample chamber.
- The measurement starts automatically at the end of the count down.

11. Methods

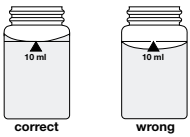
11.4 Troubleshooting: Guidelines for photometric measurements

1. Vials, caps and stirring rods should be cleaned thoroughly after each analysis to prevent influences. Even minor reagent residues can cause errors in the test results.
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. If there is no defined vial for the blank, the zero calibration and test must be carried out with the same vial as there may be slight differences in optical performance between vials.
4. The vials must be positioned in the sample chamber for zero calibration and test with the ∇-mark on the vial aligned with the Δ–mark on the instrument.
5. Bubbles on the inside of the vial may also lead to errors. In this case, replace the cap tightly and remove bubbles by swirling the contents before starting test.
6. Avoid spillage of water in the sample chamber. If water should leak into the photometer housing, it can damage electronic components and cause corrosion.
7. Contamination of the lens in the sample chamber can result in errors. If this is suspected check the condition of the windows.
8. The tablet reagents should be added to the water sample straight from the foil without touching them with the fingers.
9. Large temperature differentials between the photometer and the environment can lead to incorrect measurement due to the formation of condensate in the area of the lens or on the vial (e.g.).

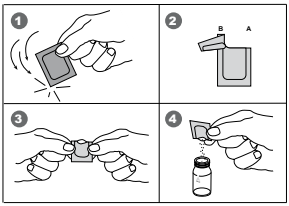
Notes

Always adhere to the sequence of reagent additon.

Correct filling of the vial



Correct opening of the Powder Packs



11. Methods

11.5 Parameters

No.	Function	Notice
900	Polynom 1	
905	Polynom 2	
910	Polynom 3	
915	Polynom 4	
920	Polynom 5	
925	Polynom 6	
930	Polynom 7	
935	Polynom 8	
940	Polynom 9	
945	Polynom 10	
955	Concentration 1	
960	Concentration 2	
965	Concentration 3	
970	Concentration 4	
975	Kinetic	
980	Multi WL	
985	Spectrum	
990	Abs / Trans	
995	Configuration	

11. Methods

11.5 Parameters

No.	Test	Symbol	Range				Cuvette [mm]
30	Aluminium	Al	0.01	-	0.25	mg/l Al	24
40	Alkalinity-m	Alka-m	5	-	200	mg/l $CaCO_3$	24
50	Alkalinity-p	Alka-p	5	-	300	mg/l $CaCO_3$	24
60	Arsenic	As	0.02	-	0.6	mg/l As	20
90	Bromine						
91		Br	0.05	-	1	mg/l Br	50
92		Br	0.1	-	3	mg/l Br	10
93		Br	0.1	-	6.5	mg/l Br	24
94		Br	0.1	-	4.5	mg/l Br	24
100	Cadmium	Cd	0.025	-	0.75	mg/l Cd	16 [*1] [*2]
110	Chlorine						
111		Cl	0.02	-	0.5	mg/l Cl	50
112		Cl	0.05	-	1.5	mg/l Cl	10
113		Cl	0.05	-	3	mg/l Cl	24
114		Cl	0.05	-	2	mg/l Cl	24
115		Cl (PP)	0.01	-	2	mg/l Cl	24
160	Chlorine HR	Cl HR (KI)	5	-	200	mg/l Cl	16
180	Chloride	Cld	5	-	60	mg/l Cl^-	24
200	Chlorine dioxide						
201		ClO2	0.04	-	1	mg/l ClO_2	50
202		ClO2	0.5	-	2.5	mg/l ClO_2	24
203		ClO2	0.5	-	2.5	mg/l ClO_2	24
230	Cyanide						
231		CN	0.005	-	0.2	mg/l CN	50
232		CN	0.02	-	0.5	mg/l CN	24

[*1] Vial test
[*2] adapted from Merck

11. Methods

11.5 Parameters

Nr.	Test	Symbol	Range				Cuvette [mm]
250	COD						
251		COD LR	0	-	150	mg/l COD	16 [*1]
252		COD MR	0	-	1500	mg/l COD	16 [*1]
253		COD HR	0	-	15	g/l COD	16 [*1]
260	Chromium						
261		Cr	0.005	-	0.5	mg/l Cr	50
262		Cr	0.02	-	2	mg/l Cr	16
270	Copper						
271		Cu (Biq)	0.05	-	1	mg/l Cu	50
272		Cu (Biq)	0.5	-	5	mg/l Cu	24
290	DEHA	DEHA	0.02	-	0.5	mg/l DEHA	24
300	Iron						
301		Fe	0.01	-	0.5	mg/l Fe	50
302		Fe	0.1	-	1	mg/l Fe	10
303		Fe	0.1	-	1	mg/l Fe	24
304		Fe (PP)	0.1	-	3	mg/l Fe	24
330	Hazen	Hazen	0	-	500	mg/l Pt-Co	50
340	Formaldehyde						
341		HCHO	1	-	5	mg/l HCHO	10 [*2]
342		HCHO	0.1	-	5	mg/l HCHO	16 [*1] [*2]
343		HCHO	0.02	-	1	mg/l HCHO	50 [*2]
350	Hydrogen peroxide						
351		H2O2	0.01	-	0.5	mg/l H_2O_2	50
352		H2O2	0.5	-	1.5	mg/l H_2O_2	24

[*1] Vial test
[*2] adapted from Merck

11. Methods

11.5 Parameters

No.	Test	Symbol	Range			Cuvette [mm]
400	Total Hardness	Hard-t	2	- 50	mg/l $CaCO_3$	24
420	Potassium	K	0.5	- 12	mg/l K	24
430	Surfactants	MBAS	0.05	- 2	mg/l MBAS	16 *1 *2
440	Manganese	Mn	0.05	- 4	mg/l Mn	24
450	Molybdate	MoO4	0.5	- 30	mg/l MoO_4	24
500	Ammonia					
501		NH4	0.02	- 1	mg/l N	24
502		NH4	0	- 0.5	mg/l N	24
503		NH4	0	- 2.5	mg/l N	16 *1
504		NH4	0	- 50	mg/l N	16 *1
530	Nickel					
531		Ni	0.02	- 1	mg/l Ni	50
532		Ni	0.2	- 7	mg/l Ni	24
570	Nitrite					
571		NO2	0.01	- 0.5	mg/l N	24
572		NO2 LR	0.03	- 0.6	mg/l N	16 *1
573		NO2 HR	0.3	- 3	mg/l N	16 *1
590	Nitrate	NO3-N	0.5	- 14	mg/l N	16 *1
610	Total nitrogen					
611		N-t LR	0.5	- 14	mg/l N	16 *1
612		N-t HR	14	- 140	mg/l N	16 *1
630	Ozone					
631		O3 DPD	0.02	- 0.5	mg/l O_3	50
632		O3 DPD	0.1	- 1	mg/l O_3	24
650	Lead					
651		Pb	0.1	- 5	mg/l Pb	10 *2
652		Pb	0.1	- 5	mg/l Pb	16 *1 *2

*1 Vial test
*2 adapted from Merck

11. Methods

11.5 Parameters

Nr.	Test	Symbol	Range				Cuvette [mm]
670	pH	pH (PR)	6.5	-	8.4	pH	24
680	Phenols	Phenols	0.1	-	5	C_6H_5OH	24
700	Phosphate						
701		PO4-o LR	0.05	-	4	mg/l PO_4	24
702		PO4-o VM	3	-	60	mg/l PO_4	16 *1
703		P-t LR	0.07	-	3	mg/l P	16 *1
704		P-t HR	1.5	-	20	mg/l P	16 *1
710	Sulphide	S	0.04	-	0.5	mg/l S	24
720	Spectral Absorption Cofficient						
721	436 nm	S Abs 1	0	-	50	m^{-1}	50
722	525 nm	S Abs 2	0	-	50	m^{-1}	50
723	620 nm	S Abs 3	0	-	50	m^{-1}	50
730	Silica	SiO2	0.05	-	3	mg/l SiO_2	24
740	Sulphite						
741		SO3	0.1	-	10	mg/l SO_3	10
742		SO3	0.05	-	4	mg/l SO_3	24
750	Sulphate	SO4	2	-	100	mg/l SO_4	24
760	TOC	TOC	50	-	800	TOC	16 *1 *2
770	Turbidity	Turbidity	5	-	500	FAU	50
790	Zinc	Zn	0.02	-	1	mg/l Zn	24
950	Fluorid	F^-	0.02	-	1.5	mg/l F^-	24

*1 Vial test
*2 adapted from Merck

11. Methods

30 Aluminium
with Powder Pack (PP) reagent
0.01-0.25 mg/l Al 24 mm Ø

Use two clean vials (24 mm ø) and mark one as blank for zeroing.

1. Fill 20 ml of water sample in a 100 ml beaker.
2. Add one Vario Aluminum ECR F20 powder pack straight from the foil to the water sample.
3. Dissolve the powder using a clean stirring rod.
4. **Wait for a reaction period of 30 seconds**.

After reaction period is finished proceed as follows:

5. Add one Vario Hexamine F20 powder pack straight from the foil to the same water sample.
6. Dissolve the powder using a clean stirring rod.
7. Add 1 drop of Vario Aluminum ECR Masking Reagent in the vial marked as blank.
8. Add 10 ml of the prepared water sample to the vial (this is the blank).
9. Add the remaining 10 ml of the prepared water sample in the second clean vial (this is the sample).
10. Close the vials with the caps tightly.
11. **Wait for a reaction period of 5 minutes**.

After reaction period is finished proceed as follows:

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

12. Perform zero calibration with the prepared blank. After zeroing the display shows:

11. Methods

13. After zeroing remove the vial from the sample chamber.

14. Place the vial (the sample) in the sample chamber and close the photometer lid.

15. Press [↵] key.

MEASURING The display shows:

RESULT The result is shown in the display as mg/l Al.

Notes

1. Before using clean the vials and the measuring cub with Hydrochloric acid (approx. 20%). Rinse then tightly with deionized water.

2. To get accurate results the sample temperature must be between 20°C and 25°C.

3. 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:

Fluoride	Displayed value: Aluminium [mg/l Al]					
[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	—-

Example: If the result of Aluminium determination is 0.15 mg/l Al and the Fluoride concentration is known to be 0.4 mg/l F, the true concentration of Aluminium is 0.17 mg/l Al.

11. Methods

40 Alkalinity-m
5 - 200 mg/l $CaCO_3$ 24 mm ∅

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (Ø 24 mm) with 10 ml of the water sample, replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber.

3. Test procedure:
   Add one ALKA-M-PHOTOMETER tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.

4. Replace the cap tightly and invert the vial gently several times to mix the contents.

5. Replace the vial in the sample chamber and close the photometer lid.

6. Press [↵] key.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l $CaCO_3$

Notes

1. The terms total alkalinity, alkalinity-m, m-value and the alkalinity to pH 4.3 are identical.

2. For accurate results exactly 10 ml of sample must be taken for the test.

Conversions

	Alkaline Earth Ions mmol/l	Alkaline Earth Ions m.equiv/l	ppm $CaCO_3$	German Deg. °d	English Deg. °e	French Deg. °f
1 mg/l $CaCO_3$	0.01	0.020	1.00	0.056	0.07	0.10

11. Methods

50 Alkalinity-p
5 - 300 mg/l $CaCO_3$ 24 mm Ø

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (Ø 24 mm) with 10 ml of the water sample, replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber.

3. Test procedure:
   Add one ALKA-P-PHOTOMETER tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.

4. Replace the cap tightly and invert the vial gently several times to mix the contents.

5. Replace the vial in the sample chamber and close the photometer lid.

6. Press [↵] key.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l $CaCO_3$

Notes

1. The terms p-alkalinity, p-value and the alkalinity to pH 8.2 are identical.

2. In order to obtain accurate test results it is important that the volume of sample taken is exactly 10 ml.

11. Methods

Conversions

	Alkaline Earth Ions mmol/l	Alkaline Earth Ions m.equiv/l	ppm $CaCO_3$	German Deg. °d	English Deg. °e	French Deg. °f
1 mg/l $CaCO_3$	0.01	0.020	1.00	0.056	0.07	0.100

By determining both the p- and m-alkalinity it is possible to classify the alkalinity as hydroxide, carbonate and hydrogen carbonate. The following differentiation is only valid if:

a) no other alkalis are present and

b) Hydroxide and hydrogen carbonate are not present in the same water sample.

If condition b) is not fulfilled please get additional information from Deutsche Einheitsverfahren zur Wasser-, Abwasser- und Schlammuntersuchung, D8.

Hence we have:

1. If the p-alkalinity = 0
Hydrogen carbonate = m
Carbonate = 0
Hydroxide = 0

2. If the p-alkalinity > 0 and the m-alkalinity > 2p
Hydrogen carbonate = m - 2p
Carbonate = 2p
Hydroxide = 0

3. If the p-alkalinity > 0 and the m-alkalinity < 2p
Hydrogen carbonate = 0
Carbonate = 2m - 2p
Hydroxide = 2p - m

Accuracy of the method

The present method was developed from a titration procedure. Due to undefined boundary conditions the deviations from standardised methods may be greater.

11. Methods

60 Arsenic
0.02 - 0.6 mg/l As 20 mm ❑ (Note 1)

Reagents (Note 2)

- 40 % Sulfuric Acid (H_2SO_4) p.a.
- Dissolve 8.33 g Potassium Iodide (KI) p.a. in 50 ml of deionized water

  Note: stored in a dark bottle it can be used for 1 week
- Dissolve 4.0 g Tin(II)-chloride-Dehydrate ($SnCl_2 \bullet 2H_2O$) p.a. in 10 ml Sodium Hydrochloric Acid (HCl) 25 % p.a.
- 2.0 g Zinc coarse powder (Zn; particle size about 0.3-1.5 mm) p.a.
- Absorption solution:

  Dissolve 0.25 g Silver Diethyldithiocarbamate ($C_5H_{10}AgNS_2$) p.a. and 0.02 g Brucine ($C_{23}H_{26}N_2O_4$) p.a. in 100 ml 1-Methyl-2-pyrrolidone extra pure (C_5H_9NO) 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:

  - use only dry glass vessels
  - stored in a dark glass bottle at max. 20°C the absorption solution can be used for about 1 week
  - store silver diethyldithiocarbamate at 4°C.

11. Methods

Test procedure: Reaction times must be exactly!

Prepare the *dry* reaction apparatus (note 3) and place it under a fume hood (toxic fumes!).

1. Pipette 50 ml water sample into a 100 ml Erlenmeyer flask (NS 29/32).

2. Add 30 ml Sulfuric Acid, 2.0 ml Potassium Iodide solution and 0.3 ml Tin(II)chloride.

3. Close the flask and shake. A **15 minute** reaction time will begin.

4. In the meantime: Measure 2.0 g Zinc. Fill the absorption vial with exact 5.0 ml of absorption solution (use pipette).

5. After end of the 15 minutes reaction time add 2.0 g Zinc to the Erlenmeyer flask and **immediately** assemble the apparatus with the prepared absorption vial.

6. The reaction starts (fume hood!). **1 hour** reaction time.

   Transfer the coloured absorption solution into a **20 mm** cell (note 1) and determine at 507 nm photometric (point 8).

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

8. Fill a clean **20 ml cell** (note 1) with deionized water. Perform zero calibration.
   After zeroing the display shows:

9. After zeroing remove the cell from the sample chamber. Empty the cell and dry well.

10. Fill the cell with the coloured absorption solution.

11. Replace the cell in the sample chamber and close the photometer lid.

12. Press [↵] key.

MEASURING

The display shows:

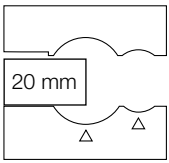
RESULT

The result is shown in the display in mg/l arsenic.

11. Methods

Notes

1. **Use a cell with 20 mm pathlength.** Order code: 60 10 50
   (The display shows 10 mm ❑, use of 20 mm cells with *pre-programmed* methods is normally not assigned.
   Positioning: insert cell on the left side in the sample chamber.

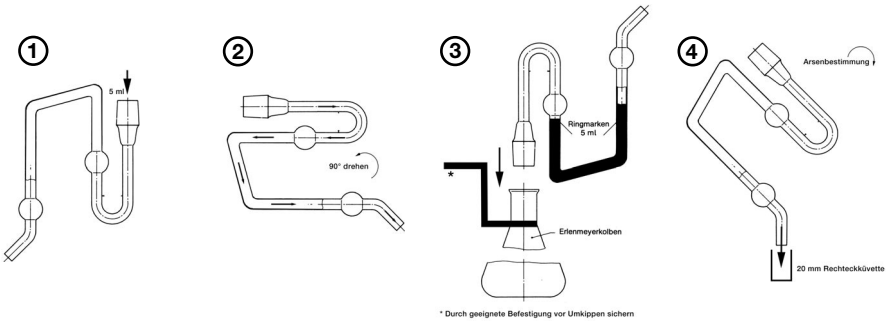


2. Reagents are commercially and should ordered locally.
   MSDS: please refer to your local reagent supplier. Ensure proper disposal of reagent solution.

3. Part list for glass apparatus:

100 ml Erlenmeyer flask (NS29/32)	Order code: 37 05 01
glass stopper (NS29/32)	Order code: 37 05 02
absorption vial (NS29,2/32)	Order code: 37 05 03

   Assembling of apparatus:
   * Fix apparatus to avoid fall over.



4. According to literature (G.Ackermann, J.Köthe:Fresenius Z.Anal. Chem. 323(1986),135) Sb, Se and Te interfere due to the same reaction; Thiosulfate interferes differently.

11. Methods

91 Bromine
0.05 - 1 mg/l Br 50 mm ❑

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean 50 mm cell with water sample.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the cell from the sample chamber. Empty the cell and dry well.

3. Test procedure:
   Rinse a beaker with the sample and empty it leaving a few drops in.
   Add one DPD No.1 tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.
   Add 10 ml water sample.
   Dissolve the tablet.

4. Fill the cell with the coloured test solution.

5. Replace the cell in the sample chamber and close the photometer lid.

6. Press [↵] key.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l bromine.

11. Methods

Notes

1. Vial cleaning
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, the subsequent determination of oxidation agents (e.g. bromine, chlorine) may show lower results. To avoid any measurement errors, only use glassware free of chlorine consumption.
   Preparation: Put all applicable glassware into sodium hypochlorite solution (0.1 g/l) for one hour, then rinse all glassware thoroughly with deionized water. For individual testing of free and total chlorine, the use of different sets of glassware is recommended (EN ISO 7393-2, 5.3).

2. Preparing the sample

   When preparing the sample, the escape of bromine gases, e.g. by pipetting or shaking, must be avoided. The analysis must take place immediately after taking the sample.

   The DPD colour development is carried out with a pH value of 6.3 - 6.5. The reagent tablets therefore contain a buffer for the pH value adjustment. Strongly alkaline or acidic water must, however, be neutralised before the analysis.

3. Turbidity (lead to errors)
   The use of the DPD No. 1 tablet in samples with high calcium ion content (and/or high conductivity) can lead to turbidity of the sample and therefore incorrect measurements. In this event, the reagent tablet **„DPD No. 1 High Calcium“** should be used as an alternative.

4. Exceeding of the measuring range
   Concentrations above 22,5 mg/l of bromine can produce results within the measuring range up to 0 mg/l. In this event, the water sample must be diluted and the measurement repeated.

   Oxidizing agents such as chlorine, ozone etc. , interfere as they react like bromine.

11. Methods

92 Bromine
0.1 - 3 mg/l Br 10 mm ❑

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean 10 mm cell with water sample.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the cell from the sample chamber. Empty the cell and dry well.

3. Test procedure:
   Rinse a beaker with the sample and empty it leaving a few drops in.
   Add one DPD No.1 tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.
   Add 10 ml water sample.
   Dissolve the tablet.

4. Fill the cell with the coloured test solution.

5. Replace the cell in the sample chamber and close the photometer lid.

6. Press [↵] key.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l bromine.

11. Methods

Notes

1. Vial cleaning
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, the subsequent determination of oxidation agents (e.g. bromine, chlorine) may show lower results. To avoid any measurement errors, only use glassware free of chlorine consumption.
   Preparation: Put all applicable glassware into sodium hypochlorite solution (0.1 g/l) for one hour, then rinse all glassware thoroughly with deionized water. For individual testing of free and total chlorine, the use of different sets of glassware is recommended (EN ISO 7393-2, 5.3).

2. Preparing the sample

   When preparing the sample, the escape of bromine gases, e.g. by pipetting or shaking, must be avoided. The analysis must take place immediately after taking the sample.

   The DPD colour development is carried out with a pH value of 6.3 - 6.5. The reagent tablets therefore contain a buffer for the pH value adjustment. Strongly alkaline or acidic water must, however, be neutralised before the analysis.

3. Turbidity (lead to errors)
   The use of the DPD No. 1 tablet in samples with high calcium ion content (and/or high conductivity) can lead to turbidity of the sample and therefore incorrect measurements. In this event, the reagent tablet **„DPD No. 1 High Calcium“** should be used as an alternative.

4. Exceeding of the measuring range
   Concentrations above 22,5 mg/l of bromine can produce results within the measuring range up to 0 mg/l. In this event, the water sample must be diluted and the measurement repeated.

   Oxidizing agents such as chlorine, ozone etc. , interfere as they react like bromine.

11. Methods

93 Bromine
0.1 - 6.5 mg/l Br 24 mm ∅

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (ø 24 mm) with 10 ml of the water sample, replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the cell from the sample chamber, empty the vial leaving a few drops in.

3. Test procedure:
   Add one DPD No.1 tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod. Add water sample to the 10 ml mark.

4. Replace the cap tightly and invert the vial gently several times to mix the contents.

5. Replace the vial in the sample chamber and close the photometer lid.

6. Press [↵] key.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l bromine.

11. Methods

Notes

1. Vial cleaning
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, the subsequent determination of oxidation agents (e.g. bromine, chlorine) may show lower results. To avoid any measurement errors, only use glassware free of chlorine consumption.
   Preparation: Put all applicable glassware into sodium hypochlorite solution (0.1 g/l) for one hour, then rinse all glassware thoroughly with deionized water. For individual testing of free and total chlorine, the use of different sets of glassware is recommended (EN ISO 7393-2, 5.3).

2. Preparing the sample

   When preparing the sample, the escape of bromine gases, e.g. by pipetting or shaking, must be avoided. The analysis must take place immediately after taking the sample.

   The DPD colour development is carried out with a pH value of 6.3 - 6.5. The reagent tablets therefore contain a buffer for the pH value adjustment. Strongly alkaline or acidic water must, however, be neutralised before the analysis.

3. Turbidity (lead to errors)
   The use of the DPD No. 1 tablet in samples with high calcium ion content (and/or high conductivity) can lead to turbidity of the sample and therefore incorrect measurements. In this event, the reagent tablet **„DPD No. 1 High Calcium“** should be used as an alternative.

4. Exceeding of the measuring range
   Concentrations above 22,5 mg/l of bromine can produce results within the measuring range up to 0 mg/l. In this event, the water sample must be diluted and the measurement repeated.

   Oxidizing agents such as chlorine, ozone etc. , interfere as they react like bromine.

11. Methods

94 Bromine with DPD-liquid reagents
0.1 - 4.5 mg/l Br 24 mm ∅

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (ø 24 mm) with 10 ml of the water sample, replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber and empty it leaving a few drops in.

3. Test procedure:
   Fill the vial with drops of the same size by holding the bottle vertically and squeeze it slowly.
   6 drops of DPD 1 buffer solution
   2 drops of DPD 1 reagent solution
   Add water sample to the 10 ml mark.

4. Replace the cap tightly and invert the vial gently several times to mix the contents.

5. Replace the vial in the sample chamber and close the photometer lid.

6. Press [↵] key.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l bromine.

11. Methods

Notes

1. Vial cleaning
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, the subsequent determination of oxidation agents (e.g. bromine, chlorine) may show lower results. To avoid any measurement errors, only use glassware free of chlorine consumption.
   Preparation: Put all applicable glassware into sodium hypochlorite solution (0.1 g/l) for one hour, then rinse all glassware thoroughly with deionized water. For individual testing of free and total chlorine, the use of different sets of glassware is recommended (EN ISO 7393-2, 5.3).

2. Preparing the sample
   When preparing the sample, the escape of bromine gases, e.g. by pipetting or shaking, must be avoided. The analysis must take place immediately after taking the sample.

   The DPD colour development is carried out with a pH value of 6.3 - 6.5.
   The reagent tablets therefore contain a buffer for the pH value adjustment. Strongly alkaline or acidic water must, however, be neutralised before the analysis.

3. Exceeding of the measuring range
   Concentrations above 9 mg/l of bromine can produce results within the measuring range up to 0 mg/l. In this event, the water sample must be diluted and the measurement repeated.
   Oxidizing agents such as chlorine, ozone etc., interfere as they react like bromine.

4. After use replace the bottle caps securely noting the colour coding.
   Store the reagent bottles in a cool, dry place ideally at between 6 °C and 10 °C.

11. Methods

100 Vial Test Cadmium
0.025 - 0.75 mg/l Cd 16 mm ∅
MERCK Spectroquant® Cadmium* Cell Test
Order Code: 1.14834.0001 (Note 1)

Determination of Cd^{2+}-ions (Note 4)

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Perform zero calibration with the supplied blank (Note 2, 3).
   After zeroing the display shows:
2. After zeroing remove the vial from the sample chamber.
3. Pipette 5 ml water sample directly into vial, close vial tightly and mix.
4. Add 3 drops reagent Cd-1K, close vial tightly and mix.
5. Add 1 level microspoon reagent Cd-2K.
6. Close the vial tightly and shake until the reagent is completely dissolved.
7. Place the vial in the sample chamber and carefully close the photometer lid as far as possible. (Note 2).
8. Press [↵] key.

Wait for a colour reaction time of 2 minutes.
The time remaining is displayed continuously starting from 2 minutes.
The beeper indicates the last 10 seconds.

REACTION TIME
2 min
2:00

The display shows:

MEASURING

The result is shown in the display in mg/l cadmium.

RESULT

11. Methods

Notes

This method is adapted from Merck:

1. Please find further information as working protection, waste management and general information in the information sheet in each test box.

2. As Merck cell tests use longer vials it is not possible to close the photometer lid completely.

3. To get reproduceable results, perform zero and measurement under the environmental same light conditions.

4. The test measures only Cd^{2+}-ions. Samples must be pretreated or decomposed by digestion before colloidal, undissolved, and complex-bound cadmium can be measured.

* Spectroquant® is a registered trade-mark of MerckKGaA.

11. Methods

110 Chlorine

The differentiation is available for the method 110 with submethods 111,112,113 and 114.

Cl diff = 1 **Cl free = 2** **Cl total = 3**

1. The display shows:

2. Press key [1] to select the differentiated determination of free, combined and total chlorine.

   Press key [2] to select the determination of free chlorine.

   Press key [3] to select the determination of total chlorine.

PREPARE ZERO **PRESS ZERO**

3. The display shows:

11. Methods

111 (1) Determination of differentiated chlorine
0.02 - 0.5 mg/l Cl 50 mm ❑

ZERO ACCEPTED
PREPARE T1
PRESS ↵

1. Fill a clean 50 mm cell with water sample.
   Perform zero calibration.
   After zeroing the display shows:
2. After zeroing remove the cell from the sample chamber, empty the cell and dry well.
3. Test procedure:
   Rinse a beaker with the sample and empty it leaving a few drops in.
   Add one DPD No.1 tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.
   Add 10 ml water sample.
   Dissolve the tablet.
4. Fill the cell with the coloured test solution.
5. Replace the cell in the sample chamber and close the photometer lid.

6. Press [↵] key.

T1 OK
PREPARE T2
PRESS ↵

The display shows:

7. Remove the cell from the sample chamber and return the coloured test solution completely to the beaker.

11. Methods

8. Add one DPD No.3 tablet straight from the foil to the same sample and mix to dissolve using a clean stirring rod. Dissolve the tablet completely.
9. Fill the cell with the coloured test solution.
10. Replace the cell in the sample chamber and close the photometer lid.

11. Press [↵] key.

REACTION TIME
2 min
2:00

Wait for a colour reaction time of 2 minutes. The time remaining is displayed continuously starting from 2 minutes. The beeper indicates the last 10 seconds.

MEASURING

The display shows:

Cl free = mg/l
Cl comb = mg/l
Cl total = mg/l

The result is shown in the display in:
mg/l free chlorine
mg/l combined chlorine
mg/l total chlorine

11. Methods

111 (2) Free chlorine
0.02 - 0.5 mg/l Cl 50 mm ❑

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean 50 mm cell with water sample.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the cell from the sample chamber. Empty the cell and dry well.

3. Test procedure:
   Rinse a beaker with the sample and empty it leaving a few drops in.
   Add one DPD No.1 tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.
   Add 10 ml water sample.
   Dissolve the tablet.

4. Fill the cell with the coloured test solution.

5. Replace the cell in the sample chamber and close the photometer lid.

Press [↵] key.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l free chlorine.

11. Methods

111 (3) Total chlorine
0.02 - 0.5 mg/l Cl **50 mm ❑**

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean 50 mm cell with water sample.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the cell from the sample chamber. Empty the cell and dry well.

3. Test procedure:
   Rinse a beaker with the sample and empty it leaving a few drops in.
   Add one DPD No.1 tablet and one DPD No.3 tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.
   Add 10 ml water sample.
   Dissolve the tablets completely.

4. Fill the cell with the coloured test solution.

5. Replace the cell in the sample chamber and close the photometer lid.

6. Press [↵] key.

REACTION TIME
2 min
2:00

Wait for a colour reaction time of 2 minutes. The time remaining is displayed continuously starting from 2 minutes. The beeper indicates the last 10 seconds.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l total chlorine.

11. Methoden

Notes

1. Vial cleaning
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, the subsequent determination of oxidation agents (e.g. bromine, chlorine) may show lower results.
   To avoid any measurement errors, only use glassware free of chlorine consumption.
   Preparation: Put all applicable glassware into sodium hypochlorite solution (0.1 g/l) for one hour, then rinse all glassware thoroughly with deionized water. For individual testing of free and total chlorine, the use of different sets of glassware is recommended (EN ISO 7393-2, 5.3).

2. Preparing the sample
   When preparing the sample, the escape of chlorine gases, e.g. by pipetting or shaking, must be avoided. The analysis must take place immediately after taking the sample. The DPD colour development is carried out with a pH value of 6.3 - 6.5. The reagent tablets therefore contain a buffer for the pH value adjustment. Strongly alkaline or acidic water must, however, be neutralised before the analysis.

3. Turbidity (lead to errors)
   The use of the DPD No. 1 tablet in samples with high calcium ion content (and/or high conductivity) can lead to turbidity of the sample and therefore incorrect measurements. In this event, the reagent tablet **„DPD No. 1 High Calcium“** should be used as an alternative. Even if the turbidity does not occur until after the DPD No. 3-tablet has been added, this can be prevented by using the **„DPD No. 1 High Calcium-tablet“**.

4. Exceeding of the measuring range
   Concentrations above 10 mg/l of chlorine can produce results within the measuring range up to 0 mg/l. In this event, the water sample must be diluted and the measurement repeated.
   Oxidizing agents such as bromine, ozone etc. , interfere as they react like chlorine.

5. Determination of total chlorine:
   For the determination of total chlorine (selection key 3) the tablet DPD No. 4 can be used instead of the both tablets DPD No.1 and DPD No.3.

11. Methods

112 (1) Determination of differentiated chlorine
0.05 - 1.5 mg/l Cl 10 mm ❑

ZERO ACCEPTED
PREPARE T1
PRESS ↵

1. Fill a clean 10 mm cell with water sample.
   Perform zero calibration.
   After zeroing the display shows:
2. After zeroing remove the cell from the sample chamber, empty the cell and dry well.
3. Test procedure:
   Rinse a beaker with the sample and empty it leaving a few drops in.
   Add one DPD No.1 tablet straight from the foil to the water sample, and mix to dissolve using a clean stirring rod.
   Add 10 ml water sample.
   Dissolve the tablet.
4. Fill the cell with the coloured test solution.
5. Replace the cell in the sample chamber and close the photometer lid.

6. Press [↵] key.

T1 OK
PREPARE T2
PRESS ↵

The display shows:

7. Remove the cell from the sample chamber and return the coloured test solution completely to the beaker.

11. Methods

8. Add one DPD No.3 tablet straight from the foil to the same sample and mix to dissolve using a clean stirring rod. Dissolve the tablet completely.
9. Fill the cell with the coloured test solution.
10. Replace the cell in the sample chamber and close the photometer lid.

11. Press [↵] key.

REACTION TIME
2 min
2:00

Wait for a colour reaction time of 2 minutes. The time remaining is displayed continuously starting from 2 minutes. The beeper indicates the last 10 seconds.

MEASURING

The display shows:

Cl free = mg/l
Cl comb = mg/l
Cl total = mg/l

The result is shown in the display in:
mg/l free chlorine
mg/l combined chlorine
mg/l total chlorine

11. Methods

112 (2) Free chlorine
0.05 - 1.5 mg/l Cl 10 mm ❑

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean 10 mm cell with water sample.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the cell from the sample chamber. Empty the cell and dry well.

3. Test procedure:
   Rinse a beaker with the sample and empty it leaving a few drops in.
   Add one DPD No.1 tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.
   Add 10 ml water sample.
   Dissolve the tablet.

4. Fill the cell with the coloured test solution.

5. Replace the cell in the sample chamber and close the photometer lid.

Press [↵] key.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l free chlorine.

11. Methods

112 (3) Total chlorine
0.5 - 1.5 mg/l Cl 10 mm ❑

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean 10 mm cell with sample.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the cell from the sample chamber. Empty the cell and dry well.

3. Test procedure:
   Rinse a beaker with the sample and empty it leaving a few drops in.
   Add one DPD No.1 tablet and one DPD No.3 tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.
   Add 10 ml sample.
   Dissolve the tablets completely.

4. Fill the cell with the coloured test solution.

5. Replace the cell in the sample chamber and close the photometer lid.

6. Press [↵] key.

REACTION TIME
2 min
2:00

Wait for a colour reaction time of 2 minutes. The time remaining is displayed continuously starting from 2 minutes. The beeper indicates the last 10 seconds.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l total chlorine.

11. Methods

Notes

1. Vial cleaning
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, the subsequent determination of oxidation agents (e.g. bromine, chlorine) may show lower results.
   To avoid any measurement errors, only use glassware free of chlorine consumption.
   Preparation: Put all applicable glassware into sodium hypochlorite solution (0.1 g/l) for one hour, then rinse all glassware thoroughly with deionized water. For individual testing of free and total chlorine, the use of different sets of glassware is recommended (EN ISO 7393-2, 5.3).

2. Preparing the sample
   When preparing the sample, the escape of chlorine gases, e.g. by pipetting or shaking, must be avoided. The analysis must take place immediately after taking the sample. The DPD colour development is carried out with a pH value of 6.3 - 6.5. The reagent tablets therefore contain a buffer for the pH value adjustment. Strongly alkaline or acidic water must, however, be neutralised before the analysis.

3. Turbidity (lead to errors)
   The use of the DPD No. 1 tablet in samples with high calcium ion content (and/or high conductivity) can lead to turbidity of the sample and therefore incorrect measurements. In this event, the reagent tablet **„DPD No. 1 High Calcium“** should be used as an alternative. Even if the turbidity does not occur until after the DPD No. 3-tablet has been added, this can be prevented by using the **„DPD No. 1 High Calcium-tablet“**.

4. Exceeding of the measuring range
   Concentrations above 10 mg/l of chlorine can produce results within the measuring range up to 0 mg/l. In this event, the water sample must be diluted and the measurement repeated.
   Oxidizing agents such as bromine, ozone etc. , interfere as they react like chlorine.

5. Determination of total chlorine:
   For the determination of total chlorine (selection key 3) the tablet DPD No. 4 can be used instead of the both tablets DPD No.1 and DPD No.3.

11. Methods

113 (1) Determination of differentiated chlorine
0.05 - 3 mg/l Cl 24 mm ∅

ZERO ACCEPTED
PREPARE T1
PRESS ↵

1. Fill a clean vial (ø 24 mm) with 10 ml of the water sample, replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:

2. Remove the vial from the sample chamber, empty the vial leaving a few drops in.

3. Test procedure:
   Add one DPD No.1 tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.
   Add water sample to the 10 ml mark.

4. Replace the cap tightly and invert the vial gently several times to mix the contents.

5. Replace the vial in the sample chamber and close the photometer lid.

6. Press [↵] key.

T1 OK
PREPARE T2
PRESS ↵

The display shows:

11. Methods

7. Remove the vial from the sample chamber.

8. Add one DPD No.3 tablet straight from the foil to the same sample and mix to dissolve using a clean stirring rod.

9. Replace the cap tightly and invert the vial gently several times to mix the contents.

10. Replace the vial in the sample chamber and close the photometer lid.

11. Press [↵] key.

REACTION TIME
2 min
2:00

Wait for a colour reaction time of 2 minutes. The time remaining is displayed continuously starting from 2 minutes. The beeper indicates the last 10 seconds.

MEASURING

12. The display shows:

Cl free = mg/l
Cl comb = mg/l
Cl total = mg/l

The result is shown in the display in:
mg/l free chlorine
mg/l combined chlorine
mg/l total chlorine

11. Methods

113 (2) Free Chlorine
0.05 - 3 mg/l Cl 24 mm ∅

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (ø 24 mm) with 10 ml of the water sample, replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:

2. Remove the vial from the sample chamber, empty the vial leaving a few drops in.

3. Test procedure:
   Add one DPD No.1 tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.
   Add water sample to the 10 ml mark.

4. Replace the cap tightly and invert the vial gently several times to mix the contents.

5. Replace the vial in the sample chamber and close the photometer lid.

6. Press [↵] key.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l free chlorine.

11. Methods

113 (3) Total Chlorine
0.05 - 3 mg/l Cl 24 mm ∅

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (ø 24 mm) with 10 ml of the water sample, replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:

2. Remove the vial from the sample chamber, empty the vial leaving a few drops in.

3. Test procedure:
   Add one DPD No.1 tablet and one DPD No.3 tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.
   Add water sample to the 10 ml mark.

4. Replace the cap tightly and invert the vial gently several times to mix the contents.

5. Replace the vial in the sample chamber and close the photometer lid.

6. Press [↵] key.

REACTION TIME
2 min
2:00

Wait for a colour reaction time of 2 minutes. The time remaining is displayed continuously starting from 2 minutes. The beeper indicates the last 10 seconds.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l total chlorine.

11. Methods

Notes

1. Vial cleaning
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, the subsequent determination of oxidation agents (e.g. bromine, chlorine) may show lower results.
   To avoid any measurement errors, only use glassware free of chlorine consumption.
   Preparation: Put all applicable glassware into sodium hypochlorite solution (0.1 g/l) for one hour, then rinse all glassware thoroughly with deionized water. For individual testing of free and total chlorine, the use of different sets of glassware is recommended (EN ISO 7393-2, 5.3).

2. Preparing the sample
   When preparing the sample, the escape of chlorine gases, e.g. by pipetting or shaking, must be avoided. The analysis must take place immediately after taking the sample. The DPD colour development is carried out with a pH value of 6.3 - 6.5. The reagent tablets therefore contain a buffer for the pH value adjustment. Strongly alkaline or acidic water must, however, be neutralised before the analysis.

3. Turbidity (lead to errors)
   The use of the DPD No. 1-tablet in samples with high calcium ion content (and/or high conductivity) can lead to turbidity of the sample and therefore incorrect measurements. In this event, the reagent tablet **„DPD No. 1 High Calcium“** should be used as an alternative. Even if the turbidity does not occur until after the DPD No. 3-tablet has been added, this can be prevented by using the **„DPD No. 1 High Calcium-tablet“**.

4. Exceeding of the measuring range
   Concentrations above 10 mg/l of chlorine can produce results within the measuring range up to 0 mg/l. In this event, the water sample must be diluted and the measurement repeated.
   Oxidizing agents such as bromine, ozone etc. , interfere as they react like chlorine.

5. Determination of total chlorine:
   For the determination of total chlorine (selection key 3) the tablet DPD No. 4 can be used instead of the both tablets DPD No.1 and DPD No.3.

11. Methods

114 (1) Determination of differentiated chlorine with DPD-liquid reagents
0.05 - 2 mg/l Cl 24 mm ∅

ZERO ACCEPTED
PREPARE T1
PRESS ↵

1. Fill a clean vial (ø 24 mm) with 10 ml of the water sample, replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:
2. After zeroing remove the vial from the sample chamber, empty the vial leaving a few drops in.
3. Test procedure:
   Fill the vial with drops of the same size by holding the bottle vertically and squeeze it slowly.
   6 drops of DPD 1 buffer solution
   2 drops of DPD 1 reagent solution
4. Add water sample to the 10 ml mark.
5. Replace the cap tightly and invert the vial gently several times to mix the contents.
6. Replace the vial in the sample chamber and close the photometer lid.

7. Press [↵] key.

T1 OK
PREPARE T2
PRESS ↵

The display shows:

11. Methods

8. Remove the vial from the sample chamber.
9. Add 3 drops of DPD 3 solution to the already coloured water sample.
10. Replace the cap tightly and invert the vial gently several times to mix the contents.
11. Replace the vial in the sample chamber and close the photometer lid.

12. Press [↵] key.

REACTION TIME
2 min
2:00

Wait for a colour reaction time of 2 minutes. The time remaining is displayed continuously starting from 2 minutes. The beeper indicates the last 10 seconds.

MEASURING

13. The display shows:

Cl free = mg/l
Cl comb = mg/l
Cl total = mg/l

The result is shown in the display in:
mg/l free chlorine
mg/l combined chlorine
mg/l total chlorine

11. Methods

114 (2) Free Chlorine
with DPD-liquid reagents
0.05 - 2 mg/l Cl 24 mm ∅

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (ø 24 mm) with 10 ml of the water sample, replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber, empty the vial leaving a few drops in.

3. Test procedure:
   Fill the vial with drops of the same size by holding the bottle vertically and squeeze it slowly.
   6 drops of DPD 1 buffer solution
   2 drops of DPD 1 reagent solution

4. Add water sample to the 10 ml mark.

5. Replace the cap tightly and invert the vial gently several times to mix the contents.

6. Replace the vial in the sample chamber and close the photometer lid.

7. Press [↵] key.

8. Remove the vial from the sample chamber.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l free chlorine.

11. Methods

114 (3) Total Chlorine
with DPD-liquid reagents
0.05 - 2 mg/l Cl 24 mm ∅

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (ø 24 mm) with 10 ml of the water sample, replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber, empty the vial leaving a few drops in.

3. Test procedure:
   Fill the vial with drops of the same size by holding the bottle vertically and squeeze it slowly.
   6 drops of DPD 1 buffer solution
   2 drops of DPD 1 reagent solution
   3 drops of DPD 3 solution

4. Add water sample to the 10 ml mark.

5. Replace the cap tightly and invert the vial gently several times to mix the contents.

6. Replace the vial in the sample chamber and close the photometer lid.

7. Press [↵] key.

REACTION TIME
2 min
2:00

Wait for a colour reaction time of 2 minutes. The time remaining is displayed continuously starting from 2 minutes. The beeper indicates the last 10 seconds.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l total chlorine.

11. Methods

Notes

1. Vial cleaning
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, the subsequent determination of oxidation agents (e.g. bromine, chlorine) may show lower results. To avoid any measurement errors, only use glassware free of chlorine consumption.
   Preparation: Put all applicable glassware into sodium hypochlorite solution (0.1 g/l) for one hour, then rinse all glassware thoroughly with deionized water. For individual testing of free and total chlorine, the use of different sets of glassware is recommended (EN ISO 7393-2, 5.3).

2. Preparing the sample
   When preparing the sample, the escape of chlorine gases, e.g. by pipetting or shaking, must be avoided. The analysis must take place immediately after taking the sample.

   The DPD colour development is carried out with a pH value of 6.3 - 6.5. The reagent tablets therefore contain a buffer for the pH value adjustment. Strongly alkaline or acidic water must, however, be neutralised before the analysis.

3. Exceeding of the measuring range
   Concentrations above 4 mg/l of chlorine can produce results within the measuring range up to 0 mg/l. In this event, the water sample must be diluted and the measurement repeated.
   Oxidizing agents such as bromine, ozone etc. , interfere as they react like chlorine.

4. After use replace the bottle caps securely noting the colour coding.
   Store the reagent bottles in a cool, dry place ideally at between 6 °C and 10 °C.

11. Methods

115 (1) Determination of differentiated chlorine with Powder Pack (PP) reagent
0.01 - 2 mg/l Cl_2 24 mm ∅

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (ø 24 mm) with 10 ml of water sample, replace the cap tightly .
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber.

3. Test procedure:
   Add the content of one VARIO Chlorine FREE-DPD/ F10 Powder Pack to the water sample.

4. Replace the cap tightly and shake for 20 seconds.

5. Replace the vial in the sample chamber and close the photometer lid.

6. Press [↵] key.

T1 OK
PREPARE T2
PRESS ↵

The display shows:

7. Remove the vial from the sample chamber and rinse tightly (first with deionized water and than with water sample). Fill the vial with 10 ml of water sample.

8. Add the content of one VARIO Chlorine TOTAL-DPD/ F10 Powder Pack.

11. Methods

9. Replace the cap tightly and shake for 20 seconds.

10. Replace the vial in the sample chamber and close the photometer lid.

11. Press [↵] key.

REACTION TIME
3 min
3:00

Wait for a reaction time of 3 minutes.
The time remaining is displayed continuously starting from 3 minutes.
The beeper indicates the last 10 seconds.

MEASURING

The display shows:

Cl free = mg/l
Cl comb = mg/l
Cl total = mg/l

The result is shown in the display in:
mg/l free chlorine
mg/l combined chlorine
mg/l total chlorine

11. Methods

115 (2) Free Chlorine
with Powder Pack (PP) reagenz
0.01 - 2 mg/l Cl_2 24 mm ∅

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (ø 24 mm) with 10 ml of water sample, replace the cap tightly .
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber.

3. Test procedure:
   Add the content of one VARIO Chlorine FREE-DPD/ F10 Powder Pack to the water sample.

4. Replace the cap tightly and shake for 20 seconds.

5. Replace the vial in the sample chamber and close the photometer lid.

6. Press [↵] key.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l free chlorine.

11. Methods

115 (3) Total Chlorine
with Powder Pack (PP) reagent
0.01 - 2 mg/l Cl_2 24 mm ∅

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (ø 24 mm) with 10 ml of water sample, replace the cap tightly .
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber.

3. Test procedure:
   Add the content of one VARIO Chlorine TOTAL-DPD/ F10 Powder Pack to the water sample.

4. Replace the cap tightly and shake for 20 seconds.

5. Replace the vial in the sample chamber and close the photometer lid.

6. Press [↵] key.

REACTION TIME
3 min
3:00

Wait for a reaction time of 3 minutes.
The time remaining is displayed continuously starting from 3 minutes.
The beeper indicates the last 10 seconds.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l total chlorine.

11. Methods

Notes

1. Vial cleaning
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, the subsequent determination of oxidation agents (e.g. bromine, chlorine) may show lower results.
   To avoid any measurement errors, only use glassware free of chlorine consumption.
   Preparation: Put all applicable glassware into sodium hypochlorite solution (0.1 g/l) for one hour, then rinse all glassware thoroughly with deionized water. For individual testing of free and total chlorine, the use of different sets of glassware is recommended (EN ISO 7393-2, 5.3).

2. Preparing the sample
   When preparing the sample, the escape of chlorine gases, e.g. by pipetting or shaking, must be avoided. The analysis must take place immediately after taking the sample. The DPD colour development is carried out with a pH value of 6.5. Strongly alkaline or acidic water must, however, be neutralised before the analysis.

3. Exceeding of the measuring range
   Concentrations above 10 mg/l of chlorine can produce results within the measuring range up to 0 mg/l. In this event, the water sample must be diluted and the measurement repeated.
   Oxidizing agents such as bromine, ozone etc. , interfere as they react like chlorine.

11. Methods

160 Chlorine HR (KI)
5 - 200 mg/l Cl 16 mm ∅

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (ø 16 mm) with 10 ml of the water sample, replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber.

3. Test procedure:
   Add one CHLORINE HR (KI) tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.

4. Add one ACIDIFYING GP tablet straight from the foil to the same sample and mix to dissolve using a clean stirring rod.

5. Replace the cap tightly and invert the vial gently several times to mix the contents.

6. Replace the vial in the sample chamber and close the photometer lid.

7. Press [↵] key.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l total chlorine.

Notes

Oxidizing agents interfere as they react like chlorine.

11. Methods

180 Chlorid
5 - 60 mg/l Cl^- 24 mm ∅

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (Ø 24 mm) with 1 ml of the water sample. Add deionized water to the 10 ml mark and replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber.

3. Test procedure:
   Add 3 drops of Chlorid-51 to the prepared water sample (point 1), replace the cap tightly and invert the vial gently several times to mix the contents.

4. Add 3 drops of Chlorid-52 to the same water sample.

5. Replace the cap tightly and invert the vial gently several times to mix the contents.

6. Replace the vial in the sample chamber and close the photometer lid.

7. Press [↵] key.

REACTION TIME
3 min
3:00

Wait for a colour reaction time of 3 minutes. The time remaining is displayed continuously starting from 3 minutes. The beeper indicates the last 10 seconds.

MEASUREMENT

The display shows:

RESULT

The result is shown in the display in mg/l chloride.

Notes

1. The test sample and the reagents should have room temperature for test performance.

2. The test sample should have a pH of between 3 and 9.

3. Store the reagent bottles in a cool, dry place ideally at between 4 °C and 8 °C.

11. Methods

201 Chlorine Dioxide (in absence of chlorine)
0.04 - 1 mg/l ClO_2 50 mm ❑

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean 50 mm cell with water sample.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the cell from the sample chamber. Empty the cell and dry well.

3. Test procedure:
   Rinse a beaker with the sample and empty it leaving a few drops in.
   Add one DPD No.1 tablet straight from the foil to the same sample and mix to dissolve using a clean stirring rod.
   Add 10 ml water sample.
   Dissolve the tablet.

2. Fill the cell with the coloured test solution.

3. Replace the cell in the sample chamber and close the photometer lid.

4. Press [↵] key.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l ClO_2.

5. **Conversion**

Chlorine dioxide (chlorine) = Chlorine dioxide (ClO_2) x 2.63

11. Methods

Notes

1. When preparing the sample, the escape of chlorine dioxide gases, e.g. by pipetting or shaking, must be avoided. The analysis must take place immediately after taking the sample.

2. The DPD colour development is carried out with a pH value of 6.3 - 6.5. The reagent tablets therefore contain a buffer for the pH value adjustment. Strongly alkaline or acidic water must, however, be neutralised before the analysis.

3. Exceeding of the measuring range
   Concentrations above 19 mg/l of chlorine dioxide can produce results within the measuring range up to 0 mg/l. In this event, the water sample must be diluted and the measurement repeated.

   This determination of chlorine dioxide is only possible when chlorine is absence.

   Oxidizing agents such as bromine, chlorine, ozone etc. , interfere as they react like chlorine dioxide.

11. Methods

202 Chlorine Dioxide (in absence of chlorine)
0.5 - 2.5 mg/l ClO_2 24 mm ∅

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (ø 24 mm) with 10 ml of the water sample, replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber, empty the vial leaving a few drops in.

3. Test procedure:
   Add one DPD No.1 tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.
   Add water sample to the 10 ml mark.

4. Replace the cap tightly and invert the vial gently several times to mix the contents.

5. Replace the vial in the sample chamber and close the photometer lid.

6. Press [↵] key.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l ClO_2.

7. **Conversion**

   Chlorine dioxide (chlorine) = Chlorine dioxide (ClO_2) x 2.63

11. Methods

Notes

1. When preparing the sample, the escape of chlorine dioxide gases, e.g. by pipetting or shaking, must be avoided. The analysis must take place immediately after taking the sample.

2. The DPD colour development is carried out with a pH value of 6.3 - 6.5. The reagent tablets therefore contain a buffer for the pH value adjustment. Strongly alkaline or acidic water must, however, be neutralised before the analysis.

3. Exceeding of the measuring range
   Concentrations above 7.6 mg/l of chlorine dioxide can produce results within the measuring range up to 0 mg/l. In this event, the water sample must be diluted and the measurement repeated.

   This determination of chlorine dioxide is only possible when chlorine is absence.

   Oxidizing agents such as bromine, chlorine, ozone etc. , interfere as they react like chlorine dioxide.

11. Methods

203 Chlorine Dioxide (in absence of chlorine) with DPD-liquid reagents
0.5 - 2.5 mg/l ClO_2 24 mm ∅

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (ø 24 mm) with 10 ml of the water sample, replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber, empty the vial leaving a few drops in.

3. Test procedure:
   Fill the vial with drops of the same size by holding the bottle vertically and squeeze it slowly.
   6 drops of DPD 1 buffer solution
   2 drops of DPD 1 reagent solution

4. Add water sample to the 10 ml mark.

5. Replace the cap tightly and invert the vial gently several times to mix the contents.

6. Replace the vial in the sample chamber and close the photometer lid.

7. Press [↵] key.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l ClO_2.

Conversion

Chlorine dioxide (chlorine) = Chlorine dioxide (ClO_2) x 2.63

11. Methods

Notes

1. When preparing the sample, the escape of chlorine dioxide gases, e.g. by pipetting or shaking, must be avoided. The analysis must take place immediately after taking the sample.

2. The DPD colour development is carried out with a pH value of 6.3 - 6.5. The reagent tablets therefore contain a buffer for the pH value adjustment. Strongly alkaline or acidic water must, however, be neutralised before the analysis.

3. Exceeding of the measuring range
   Concentrations above 7.5 mg/l of chlorine dioxide can produce results within the measuring range up to 0 mg/l. In this event, the water sample must be diluted and the measurement repeated.

   This determination of chlorine dioxide is only possible when chlorine is absence.

   Oxidizing agents such as bromine, chlorine, ozone etc. , interfere as they react like chlorine dioxide.

4. After use replace the bottle caps securely noting the colour coding.
   Store the reagent bottles in a cool, dry place ideally at between 6 °C and 10 °C.

11. Methods

231 Cyanide
0.005-0.2 mg/l CN 50 mm ❑

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean 50 mm cell with water sample.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the cell from the sample chamber. Empty the cell and dry well.

3. Test procedure:
   Fill a clean beaker with 2 ml water sample and 8 ml deionized water.
   Add 2 scoops No. 4 (grey) Cyanid-11.
   Dissolve reagent.

4. Add 2 scoops No. 4 (grey) Cyanid-12 to the water sample.
   Dissolve reagent.

5. Add 3 drops Cyanid-13 to the same water sample.
   Mix the contents.

6. Fill the cell with the coloured test solution.

7. Replace the cell in the sample chamber and close the photometer lid.

8. Press [↵] key.

REACTION TIME
10 min
10:00

Wait for a colour reaction time of 10 minutes.
The time remaining is displayed continuosly starting from 10 minutes.
The beeper indicates the last 10 seconds.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l CN.

Notes

1. The process measures only free cyanide and cyanides that can be destroyed by chlorine.

2. In the presence of thiocyanate, heavy metal complexes, sulphide, colorants or aromatic amines, the cyanide must be separated out by distillation before testing is performed.

3. The reagents should be stored in sealed containers at a temperature of +15 °C to +25 °C.

11. Methods

232 Cyanide
0.02-0.5 mg/l CN 24 mm ∅

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (∅ 24 mm) with 2 ml of the water sample.
   Add deionized water to the 10 ml mark and replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber.

3. Test procedure:
   Add 2 scoops No. 4 (grey) Cyanid-11 to the prepared water sample (point 1), replace the cap tightly and invert the vial gently several times to mix the contents.

4. Add 2 scoops No. 4 (grey) Cyanid-12 to the same water sample, replace the cap tightly and invert the vial gently several times to mix the contents.

5. Add 3 drops Cyanid-13 to the same water sample.

6. Replace the cap tightly and invert the vial gently several times to mix the contents.

7. Replace the vial in the sample chamber and close the photometer lid.

8. Press [↵] key.
   Wait for a colour reaction time of 10 minutes.
   The time remaining is displayed continuously starting from 10 minutes.
   The beeper indicates the last 10 seconds.

REACTION TIME
10 min
10:00

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l CN.

Notes

1. The process measures only free cyanide and cyanides that can be destroyed by chlorine.

2. In the presence of thiocyanate, heavy metal complexes, sulphide, colorants or aromatic amines, the cyanide must be separated out by distillation before testing is performed.

3. The reagents should be stored in sealed containers at a temperature of +15 °C to +25 °C.

11. Methods

251 Vial test COD vario low range (LR)
0 - 150 mg/l

1. Test procedure:
   Open the white cap of the vial (appropriate protection equipment required) and add 2 ml water sample.

2. Prepare a blank using 2 ml deionized water instead of the sample (Note 1).

3. Replace the cap tightly. Invert the vial gently several times to mix the contents **(The vial will became hot during mixing!)** and heat the vials for 2 hours in the reactor at a temperature of 148 °C.
   Invert the vial at least twice during this period to ensure thorough mixing **(Remember, the vial will be hot!)**.

4. After two hours remove the vials from the reactor and cool the vials to room temperature (at least 45 minutes) (Note 2).

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

5. Perform zero calibration with the blank (Note 3, 4). After zeroing the display shows:

6. After zeroing remove the vial from the sample chamber and store it with its lots of vials.

7. Place the sample vial (Note 3, 4) in the sample chamber and close the photometer lid.

8. Press [↵] key.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l COD.

Notes

1. Run samples and blanks with the same batch of vials. The blank is stable when stored in the dark and can be used for further measurements with vials of the same batch.

2. Do not place hot vials in the sample chamber. Cool the vials to room temperature for final measurements.

3. Suspended solids in the vial lead to incorrect measurements. For this reason it is important to place the vials carefully in the sample chamber. The precipitant at the bottom of the sample should not be suspended.

4. Clean the outside of the vials with a towel. Finger-prints or other marks will be removed.

5. For samples over 130 mg/l COD repeat the test with a diluted sample or continue using method 252 (COD vario MR).

6. Samples can be measured where the chloride content does not exceed 1000 mg/l.

7. In exceptional cases, compounds contained in the water can not be oxidized adequate, what results in minimum findings, compared with the reference method.

11. Methods

252 Vial test COD vario middle range (MR)
0 - 1500 mg/l

1. Test procedure:
   Open the white cap of the vial (appropriate protection equipment required) and add 2 ml water sample.

2. Prepare a blank using 2 ml deionized water instead of the sample (Note 1).

3. Replace the cap tightly. Invert the vial gently several times to mix the contents **(The vial will became hot during mixing!)** and heat the vials for 2 hours in the reactor at a temperature of 148 °C.
   Invert the vial at least twice during this period to ensure thorough mixing **(Remember, the vial will be hot!)**.

4. After two hours remove the vial from the reactor and cool the vials to room temperature (at least 45 minutes) (Note 2).

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

5. Perform zero calibration with the blank (Note. 3, 4). After zeroing the display shows:

6. After zeroing remove the vial from the sample chamber and store it with its lots of vials.

7. Place the sample vial (Note 3, 4) in the sample chamber and close the photometer lid.

8. Press [↵] key.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l COD.

Notes

1. Run samples and blanks with the same batch of vials. The blank is stable when stored in the dark and can be used for further measurements with vials of the same batch.

2. Do not place hot vials in the sample chamber. Cool the vials to room temperature for final measurements.

3. Suspended solids in the vial lead to incorrect measurements. For this reason it is important to place the vials carefully in the sample chamber. The precipitant at the bottom of the sample should not be suspended.

4. Clean the outside of the vials with a towel. Finger-prints or other marks will be removed.

5. For samples under 100 mg/l COD repeat the test with a diluted sample or continue using method 251 (COD vario LR).

6. Samples can be measured where the chloride content does not exceed 1000 mg/l.

7. In exceptional cases, compounds contained in the water can not be oxidized adequate, what results in minimum findings, compared with the reference method.

11. Methods

253 Vial test COD vario high range (HR)
0 - 15 g/l = 0 - 15000 mg/l

1. Test procedure:
   Open the white cap of the vial (appropriate protection equipment required) and add 0.2 ml water sample.

2. Prepare a blank using 0.2 ml deionized water instead of the sample (Note 1).

3. Replace the cap tightly. Invert the vial gently several times to mix the contents **(The vial will became hot during mixing!)** and heat the vials for 2 hours in the reactor at a temperature of 148 °C.
   Invert the vial at least twice during this period to ensure thorough mixing **(Remember, the vial will be hot!)**.

4. After two hours remove the vial from the reactor and cool the vials to room temperature (at least 45 minutes) (Note 2).

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

5. Perform zero calibration with the blank (Note 3, 4). After zeroing the display shows:

6. After zeroing remove the vial from the sample chamber and store it with its lots of vials.

7. Place the sample vial (Note 3, 4) in the sample chamber and close the photometer lid.

8. Press [↵] key.

MEASURING

The display shows:

RESULT

The result is shown in the display in **g/l** COD.

Notes

1. Run samples and blanks with the same batch of vials. The blank is stable when stored in the dark and can be used for further measurements with vials of the same batch.

2. Do not place hot vials in the sample chamber. Cool the vials to room temperature for final measurements.

3. Suspended solids in the vial lead to incorrect measurements. For this reason it is important to place the vials carefully in the sample chamber. The precipitant at the bottom of the sample should not be suspended.

4. Clean the outside of the vials with a towel. Finger-prints or other marks will be removed.

5. For samples under 1000 mg/l COD repeat the test with a diluted sample or continue using method 252 (COD vario MR).

6. Samples can be measured where the chloride content does not exceed 10000 mg/l.

7. In exceptional cases, compounds contained in the water can not be oxidized adequate, what results in minimum findings, compared with the reference method.

11. Methods

260 Chromium

The differentiation is available for the method 260 with sub methods 261 and 262.

Cr diff = 1 **Cr (VI) = 2** **Cr total = 3**

1. The display shows:

2. Press key [1] to select the differentiated determination of Cr (VI), Cr (III) and total chromium.

   Press key [2] to select the determination of Cr (VI).

   Press key [3] to select the determination of total chromium.

PREPARE ZERO **PRESS ZERO**

3. The display shows:

11. Methods

261 (1) Determination of differentiated chromium
0.005 - 0.5 mg/l Cr 50 mm ❑

1. Fill a clean vial (Ø 16 mm) with 10 ml of the water sample.
2. Add one PERSULF. RGT FOR CR reagent straight from the foil to the water sample.
3. Replace the cap tightly. Invert the vial several times to mix the contents and heat the vial for 2 hours in a reactor at a temperature of 100°C.
4. After two hours remove the vial from the reactor and cool the vial to room temperature.

ZERO ACCEPTED
PREPARE T1
PRESS ↵

5. Fill a clean 50 mm cell with water sample.
   Perform zero calibration.
   After zeroing the display shows:
6. After zeroing remove the cell from the sample chamber. Empty the cell and dry well.
7. Add one CHROMIUM HEXAVALENT reagent straight from the foil to the prepared water sample (from point 4).
8. Replace the cap tightly and invert the vial several times to mix the contents.
9. Transfer the content of the vial (Ø 16 mm) into the 50 mm cell and replace this cell in the sample chamber and close the photometer lid.
10. Press [↵] key.

11. Methods

REACTION TIME
5 min
5:00

Wait for a colour reaction time of 5 minutes.
The time remaining is displayed continuously starting from 5 minutes.
The beeper indicates the last 10 seconds.

T1 OK
PREPARE T2
PRESS ↵

The display shows:

11. After zeroing remove the cell from the sample chamber. Empty the cell and dry well.

12. Fill a second clean vial (∅ 16 mm) with 10 ml of the water sample.

13. Add one CHROMIUM HEXAVALENT reagent straight from the foil to the water sample.

14. Replace the cap tightly and invert the vial several times to mix the contents.

15. Transfer the content of the vial (∅ 16 mm) into the 50 mm cell and replace this cell in the sample chamber and close the photometer lid.

16. Press [↵] key.

REACTION TIME
5 min
5:00

Wait for a colour reaction time of 5 minutes.
The time remaining is displayed continuously starting from 5 minutes.
The beeper indicates the last 10 seconds.

MEASURING

The display shows:

Cr (VI) = mg/l
Cr (III) = mg/l
Cr total = mg/l

The result is shown in the display in:
mg/l Cr (VI)
mg/l Cr (III)
mg/l Cr total chromium

11. Methods

261 (2) Chromium (VI)
0.005 - 0.5 mg/l Cr 50 mm ❑

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean 50 mm cell with water sample.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the cell from the sample chamber. Empty the cell and dry well.

3. Fill a clean vial (Ø 16 mm) with 10 ml of the water sample.

4. Add one PERSULF. RTG FOR CR reagent straight from the foil to the water sample.

5. Replace the cap tightly and invert the vial several times to mix the contents.

6. Transfer the content of the vial (Ø 16 mm) into the 50 mm cell and replace this cell in the sample chamber and close the photometer lid.

7. Press [↵] key.

REACTION TIME
5 min
5:00

Wait for a colour reaction time of 5 minutes.
The time remaining is displayed continuously starting from 5 minutes.
The beeper indicates the last 10 seconds.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l chromium (VI).

11. Methods

261 (3) Total chromium (Cr (III) + Cr (VI))
0.005 - 0.5 mg/l Cr 50 mm ❑

1. Fill a clean vial (Ø 16 mm) with 10 ml of the water sample.
2. Add one PERSULF. RGT FOR CR reagent straight from the foil to the water sample.
3. Replace the cap tightly. Invert the vial several times to mix the contents and heat the vial for 2 hours in a reactor at a temperature of 100°C.
4. After two hours remove the vial from the reactor and cool the vials to room temperature.

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

5. Fill a clean 50 mm cell with water sample.
   Perform zero calibration.
   After zeroing the display shows:
6. After zeroing remove the cell from the sample chamber. Empty the cell and dry well.
7. Add one CHROMIUM HEXAVALENT reagent straight from the foil to the prepared water sample (from point 4).
8. Replace the cap tightly and invert the vial several times to mix the contents.
9. Transfer the content of the vial (Ø 16 mm) into the 50 mm cell and replace this cell in the sample chamber and close the photometer lid.

10. Press [↵] key.

REACTION TIME
5 min
5:00

Wait for a colour reaction time of 5 minutes.
The time remaining is displayed continuously starting from 5 minutes.
The beeper indicates the last 10 seconds.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l total chromium.

Conversion:
mg/l CrO_4 = mg/l Cr x 2,23

Notes

1. Clean the outside of the vials with a towel. Finger-prints or other marks will be removed.

2. The test sample should have a pH of between 3 and 9.

3. For information about interference especially in waste water and chemical waste water through metals and reducing or oxidising agents see DIN 38 405 – D 24 and Standard Methods of Water and Wastewater, 20 th Edition; 1998.

11. Methods

262 (1) Determination of differentiated chromium
0.02 - 2 mg/l Cr 16 mm ∅

1. Fill a clean vial (Ø 16 mm) with 10 ml of the water sample.
2. Add one PERSULF. RGT FOR CR reagent straight from the foil to the water sample.
3. Replace the cap tightly. Invert the vial gently several times to mix the contents and heat the vial for 2 hours in the reactor at a temperature of 100°C.
4. After two hours remove the vial from the reactor and cool the vial to room temperature.

ZERO ACCEPTED
PREPARE T1
PRESS ↵

5. Perform zero calibration with the prepared water sample (from point 4).
   After zeroing the display shows:
6. After zeroing remove the vial from the sample chamber.
7. Add one CHROMIUM HEXAVALENT reagent straight from the foil to these water sample.
8. Replace the cap tightly and invert the vial several times to mix the contents.
9. Replace the vial in the sample chamber and close the photometer lid.

10. Press [↵] key.

11. Methods

REACTION TIME
5 min
5:00

Wait for a colour reaction time of 5 minutes.
The time remaining is displayed continuously starting from 5 minutes.
The beeper indicates the last 10 seconds.

T1 OK
PREPARE T2
PRESS ↵

The display shows:

11. Fill a second clean vial (Ø 16 mm) with 10 ml of the water sample.

12. Add one CHROMIUM HEXAVALENT reagent straight from the foil to the water sample.

13. Replace the cap tightly and invert the vial several times to mix the contents.

14. Replace the vial in the sample chamber and close the photometer lid.

15. Press [↵] key.

REACTION TIME
5 min
5:00

Wait for a colour reaction time of 5 minutes.
The time remaining is displayed continuously starting from 5 minutes.
The beeper indicates the last 10 seconds.

MEASURING

The display shows:

Cr (VI) = mg/l
Cr (III) = mg/l
Cr total = mg/l

The result is shown in the display in:
mg/l Cr (VI)
mg/l Cr (III)
mg/l Cr total chromium

11. Methods

262 (2) Chromium (VI)
0.02 - 2 mg/l Cr 16 mm ∅

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (Ø 16 mm) with 10 ml of the water sample, replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber.

3. Add one CHROMIUM HEXAVALENT reagent straight from the foil to the water sample.

4. Replace the cap tightly and invert the vial several times to mix the contents.

5. Replace the vial in the sample chamber and close the photometer lid.

6. Press [↵] key.

REACTION TIME
5 min
5:00

Wait for a colour reaction time of 5 minutes.
The time remaining is displayed continuously starting from 5 minutes.
The beeper indicates the last 10 seconds.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l chromium (VI).

11. Methods

262 (3) Total chromium (Cr (III) + Cr (VI))
0.02 - 2 mg/l Cr 16 mm ∅

1. Fill a clean vial (Ø 16 mm) with 10 ml of the water sample.
2. Add one PERSULF. RGT FOR CR reagent straight from the foil to the water sample.
3. Replace the cap tightly. Invert the vial gently several times to mix the contents and heat the vial for 2 hours in the reactor at a temperature of 100°C.
4. After two hours remove the vial from the reactor and cool the vial to room temperature.

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

5. Perform zero calibration with the prepared water sample (from point 4).
   After zeroing the display shows:
6. After zeroing remove the vial from the sample chamber.
7. Add one CHROMIUM HEXAVALENT reagent straight from the foil to the water sample.
8. Replace the cap tightly and invert the vial several times to mix the contents.
9. Replace the vial in the sample chamber and close the photometer lid.

10. Press [↵] key.

REACTION TIME
5 min
5:00

Wait for a colour reaction time of 5 minutes.
The time remaining is displayed continuously starting from 5 minutes.
The beeper indicates the last 10 seconds.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l total chromium.

Conversion:
mg/l CrO_4 = mg/l Cr x 2,23

Notes

1. Clean the outside of the vials with a towel. Finger-prints or other marks will be removed.

2. The test sample should have a pH of between 3 and 9.

3. For information about interference especially in waste water and chemical waste water through metals and reductive or oxidic agents see DIN 38 405 – D 24 and Standard Methods of Water and Wastewater, 20 th Edition; 1998.

11. Methods

270 Copper (Biquinolin)

The differentiation is available for the method 270 with submethods 271 and 272.

Cu diff = 1 **Cu free = 2** **Cu total = 3**

1. The display shows:

2. Press key [1] to select the differentiated determination of free, combined and total copper.

Press key [2] to select the determination of free copper.

Press key [3] to select the determination of total copper.

PREPARE ZERO **PRESS ZERO**

3. The display shows:

11. Methods

271 (1) Determination of differentiated copper
0.05 - 1 mg/l Cu 50 mm ❑

ZERO ACCEPTED
PREPARE T1
PRESS ↵

1. Fill a clean 50 mm cell with water sample.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the cell from the sample chamber. Empty the cell and dry well.

3. Test procedure:
   Fill a clean beaker with 10 ml water sample.
   Add one COPPER No. 1 tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.
   Dissolve the tablet completely.

4. Fill the cell with the coloured test solution.

5. Replace the cell in the sample chamber and close the photometer lid.

6. Press [↵] key.

T1 OK
PREPARE T2
PRESS ↵

The display shows:

7. Remove the cell from the sample chamber and return the coloured test solution completely to the beaker.

11. Methods

8. Add one COPPER No.2 tablet straight from the foil to the same sample and mix to dissolve using a clean stirring rod.
   Dissolve the tablet completely.

9. Fill the cell with the coloured test solution.

10. Replace the cell in the sample chamber and close the photometer lid.

11. Press [↵] key.

MEASURING

The display shows:

Cu free = mg/l
Cu comb = mg/l
Cu total = mg/l

The result is shown in the display in:
mg/l free copper
mg/l combined copper
mg/l total copper

11. Methods

271 (2) Free Copper
0.05 - 1 mg/l Cu 50 mm ❑

ZERO ACCEPTED
PREPARE T1
PRESS ↵

1. Fill a clean 50 mm cell with water sample.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the cell from the sample chamber. Empty the cell and dry well.

3. Test procedure:
   Fill a clean beaker with 10 ml water sample.
   Add one COPPER No. 1 tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.
   Dissolve the tablet completely.

4. Fill the cell with the coloured test solution.

5. Replace the cell in the sample chamber and close the photometer lid.

6. Press [↵] key.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l free copper.

11. Methods

271 (3) Total Copper
0.05 - 1 mg/l Cu 50 mm ❑

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean 50 mm cell with water sample.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the cell from the sample chamber. Empty the cell and dry well.

3. Test procedure:
   Fill a clean beaker with 10 ml water sample.
   Add one COPPER No. 1 tablet and one COPPER No.2 tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.

   Dissolve the tablet completely.

4. Fill the cell with the coloured test solution.

5. Replace the cell in the sample chamber and close the photometer lid.

6. Press [↵] key.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l total copper.

11. Methods

272 (1) Determination of differentiated copper
0.5 - 5 mg/l Cu 24 mm ∅

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (Ø 24 mm) with 10 ml of the water sample, replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber.

3. Test procedure:
   Add one COPPER No. 1 tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.

4. Replace the cap tightly and invert the vial gently several times to mix the contents.

5. Replace the vial in the sample chamber and close the photometer lid.

6. Press [↵] key.

T1 OK
PREPARE T2
PRESS ↵

The display shows:

11. Methods

7. Remove the vial from the sample chamber.

8. Add one COPPER No.2 tablet straight from the foil to the same sample and mix to dissolve using a clean stirring rod.

9. Replace the cap tightly and invert the vial gently several times to mix the contents.

10. Replace the vial in the sample chamber and close the photometer lid.

11. Press [↵] key.

MEASURING

The display shows:

Cu free = mg/l
Cu comb = mg/l
Cu total = mg/l

The result is shown in the display in:
mg/l free copper
mg/l combined copper
mg/l total copper

11. Methods

272 (2) Free Copper
0.5 - 5 mg/l Cu 24 mm ∅

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (Ø 24 mm) with 10 ml of the water sample, replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber.

3. Test procedure:
   Add one COPPER No.1 tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.

4. Replace the cap tightly and invert the vial gently several times to mix the contents.

5. Replace the vial in the sample chamber and close the photometer lid.

6. Press [↵] key.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l free copper.

11. Methods

272 (3) Total Copper
0.5 - 5 mg/l Cu 24 mm ∅

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (Ø 24 mm) with 10 ml of the water sample, replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber.

3. Test procedure:
   Add one COPPER No.1 tablet and one COPPER No.2 tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.

4. Replace the cap tightly and invert the vial gently several times to mix the contents.

5. Replace the vial in the sample chamber and close the photometer lid.

Press [↵] key.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l total copper.

11. Methods

290 DEHA (N,N-Diethylhydroxylamine)
0.02 - 0.5 mg/l DEHA 24 mm ∅

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (Ø 24 mm) with 10 ml of the water sample, replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber.

3. Test procedure:
   Fill the vial with drops of the same size by holding the bottle vertically and squeeze it slowly:
   6 drops of (0,25 ml) DEHA-solution.

4. Replace the cap tightly and invert the vial gently several times to mix the contents.

5. Add one DEHA tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.

6. Replace the cap tightly and invert the vial gently several times to mix the contents.

7. Replace the vial in the sample chamber and close the photometer lid (note 1).

8. Press [↵] key.

REACTION TIME
10 min
10:00

Wait for a colour reaction time of 10 minutes. The time remaining is displayed continuously starting from 10 minutes. The beeper indicates the last 10 seconds.

MEASUREMENT

The display shows:

RESULT

The result is shown in the display in mg/l DEHA.

8. Conversions

Factors for the below listed oxygen scavengers (multiply the displayed value with the appropriate factor):

Hydroquinone	5
Erythorbic Acid	7
Methylethylketoxime	7

Notes

1. Keep the sample dark during colour development time. UV-light (sunlight) causes too high measurement results.

2. Ideal temperature for full colour development is 20 ºC ± 2 ºC.

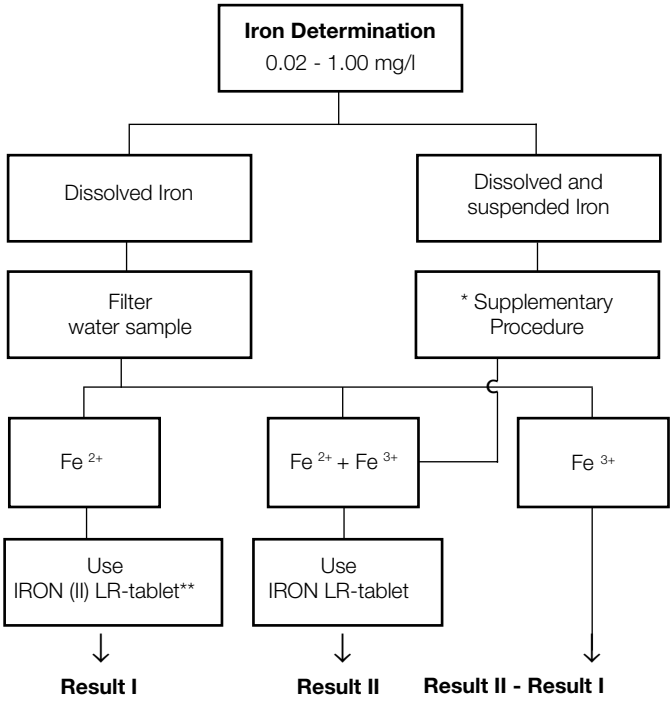
11. Methods

301 Iron (II + III)
0.01 - 0.5 mg/l Fe 50 mm ❑

ZERO ACCEPTED **PREPARE TEST** **PRESS ↵**	1. Fill a clean 50 mm cell with water sample. Perform zero calibration. After zeroing the display shows:
	2. After zeroing remove the cell from the sample chamber. Empty the cell and dry well.
	3. Test procedure: Fill a clean beaker with 10 ml water sample. Add one IRON LR tablet straight from the foil and mix to dissolve using a clean stirring rod. Dissolve the tablet completely.
	4. Fill the cell with the coloured test solution.
	5. Replace the cell in the sample chamber and close the photometer lid.
	6. Press [↵] key.
REACTION TIME **5 min** **5:00**	Wait for a colour reaction time of 5 minutes. The time remaining is displayed continuously starting from 5 minutes. The beeper indicates the last 10 seconds.
MEASURING	The display shows:
RESULT	The result is shown in the display in mg/l iron.

11. Methods

Notes



* Supplementary Procedure

Add 1 ml of concentrated sulphuric acid to 100 ml of the water sample. Heat and boil for 10 minutes or until all particles have dissolved. After cooling down the sample is set on a pH-value of 3 to 6 by using ammonia solution. Refill with destilled water to the previous volume of 10 ml. Mix well. Pour into the vial and fill to the 10 ml mark. Add an IRON LR tablet, crush and mix well to dissolve. Allow to stand for 5 minutes. Water which has been treated with organic compounds as corrosion inhibitors must be oxidised where necessary to break down the iron complexes - add 1 ml of concentrated sulphuric acid and 1 ml of concentrated nitric acid to a 100 ml sample and boil to approximately half volume. After cooling down proceed with the analysis as described above.

The IRON (II) LR tablet is used for differentiation - as described above - in place of the IRON LR tablet.

11. Methods

302 Iron (II + III)
0.1 - 1 mg/l Fe 10 mm ❑

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean 10 mm cell with water sample.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the cell from the sample chamber. Empty the cell and dry well.

3. Test procedure:
   Fill a clean beaker with 10 ml water sample.
   Add one IRON LR tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.
   Dissolve the tablet completely.

4. Fill the cell with the coloured test solution.

5. Replace the cell in the sample chamber and close the photometer lid.

6. Press [↵] key.

REACTION TIME
5 min
5:00

Wait for a colour reaction time of 5 minutes. The time remaining is displayed continuously starting from 5 minutes. The beeper indicates the last 10 seconds.

MEASURING

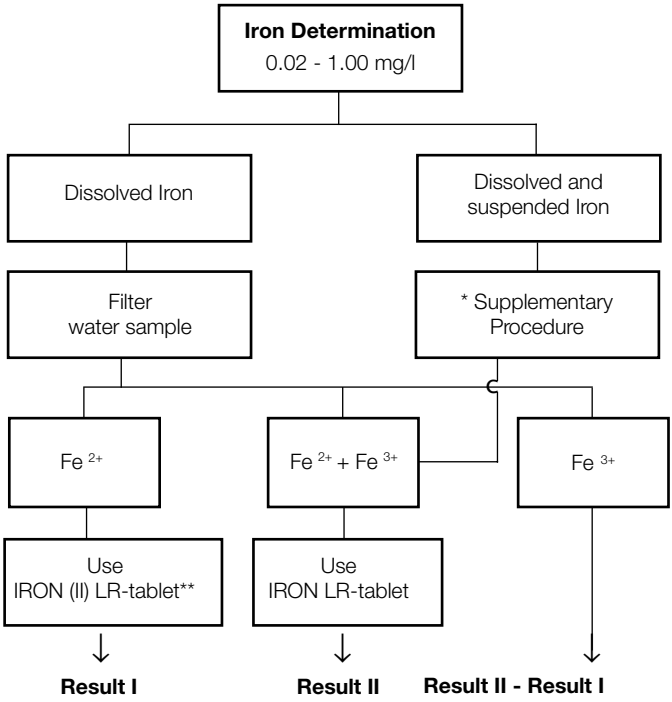
The display shows:

RESULT

The result is shown in the display in mg/l iron.

11. Methods

Notes



* Supplementary Procedure

Add 1 ml of concentrated sulphuric acid to 100 ml of the water sample. Heat and boil for 10 minutes or until all particles have dissolved. After cooling down the sample is set on a pH-value of 3 to 6 by using ammonia solution. Refill with destilled water to the previous volume of 10 ml. Mix well. Pour into the vial and fill to the 10 ml mark. Add an IRON LR tablet, crush and mix well to dissolve. Allow to stand for 5 minutes. Water which has been treated with organic compounds as corrosion inhibitors must be oxidised where necessary to break down the iron complexes - add 1 ml of concentrated sulphuric acid and 1 ml of concentrated nitric acid to a 100 ml sample and boil to approximately half volume. After cooling down proceed with the analysis as described above.

The IRON (II) LR tablet is used for differentiation - as described above - in place of the IRON LR tablet.

11. Methods

303 Iron
0.1 - 1 mg/l Fe(II+III) 24 mm ∅

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (Ø 24 mm) with 10 ml of the water sample, replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber.

3. Test procedure:
   Add one IRON LR tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.

4. Replace the cap tightly and invert the vial gently several times to mix the contents.

5. Replace the vial in the sample chamber and close the photometer lid.

6. Press [↵] key.

REACTION TIME
5 min
5:00

7. Wait for a colour reaction time of 5 minutes. The time remaining is displayed continuously starting from 5 minutes. The beeper indicates the last 10 seconds.

MEASURING

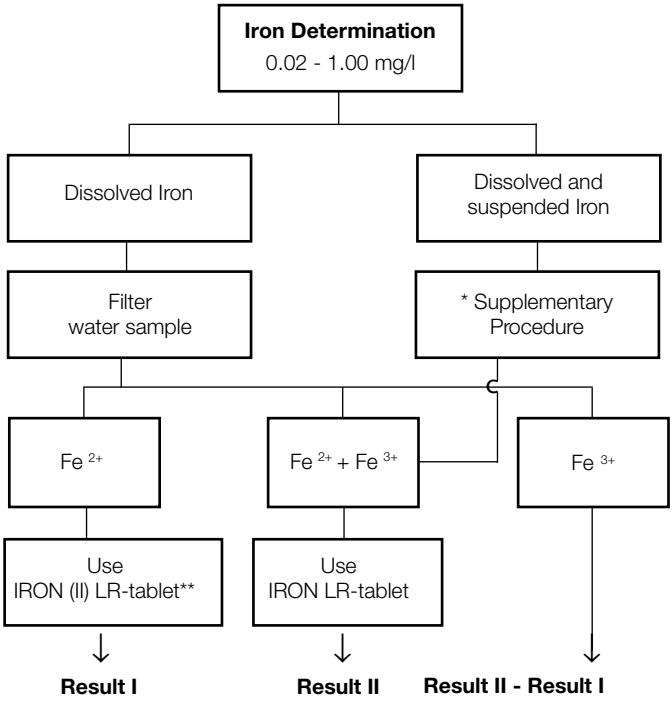
The display shows:

RESULT

The result is shown in the display in mg/l iron.

11. Methods

Notes



* Supplementary Procedure

Add 1 ml of concentrated sulphuric acid to 100 ml of the water sample. Heat and boil for 10 minutes or until all particles have dissolved. After cooling down the sample is set on a pH-value of 3 to 6 by using ammonia solution. Refill with destilled water to the previous volume of 10 ml. Mix well. Pour into the vial and fill to the 10 ml mark. Add an IRON LR tablet, crush and mix well to dissolve. Allow to stand for 5 minutes. Water which has been treated with organic compounds as corrosion inhibitors must be oxidised where necessary to break down the iron complexes - add 1 ml of concentrated sulphuric acid and 1 ml of concentrated nitric acid to a 100 ml sample and boil to approximately half volume. After cooling down proceed with the analysis as described above.

The IRON (II) LR tablet is used for differentiation - as described above - in place of the IRON LR tablet.

11. Methods

304 Iron (Note 1)
with Powder Pack (PP) reagent
0.1 - 3 mg/l Fe 24 mm ∅

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (ø 24 mm) with 10 ml of water sample, replace the cap tightly .
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber.

3. Test procedure:
   Add the content of one VARIO Ferro F10 Powder Pack to the water sample.

4. Replace the cap tightly and swirl to mix.

5. Replace the vial in the sample chamber and close the photometer lid.

6. Press [↵] key.

REACTION TIME
3 min
3:00

Wait for a reaction time of 3 minutes.
The time remaining is displayed continuously starting from 3 minutes.
The beeper indicates the last 10 seconds.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l total chlorine.

Notes

1. VARIO Ferro F10 reagent reacts with all soluble iron and most insoluble forms of iron in the water sample. To determine total iron digestion is requested.

2. Strongly alkaline or acidic water must be adjust to a pH-value of 3-5 before analysis.

11. Methods

330 Hazen
0-500 mg/l Pt-Co-units 50 mm ❑

1. Preparation of sample:
   Filter the water sample through a membrane filter with a pore width of 0.45 µm.
   (Approx. 50 ml of the water sample should be filtrated).
2. Fill a clean 50 mm cell with deionized water (Note1).
3. Perform zero calibration.

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

4. After zeroing the display shows:
5. After zeroing remove the cell from the sample chamber. Empty the cell.
6. Use some of the filtered water sample to rinse out the vial, then fill the sample into the vial.
7. Replace the cell in the sample chamber and close the photometer lid.

Press [↵] key.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l Pt/Co-units.

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 from 420 nm to 470 nm, as this method is only suitable for water samples with yellowish to yellowish-brown coloration. Where applicable, a decision should be made based on visual inspection of the water sample.

2. Method 330 – Hazen – 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). 1 Pt-Co colour unit = 1 mg/l of platinum as chloroplatinate ion

3. Sample taking, 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; 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 performing measurements, the water sample must be brought up to room temperature.

11. Methods

341 Formaldehyde
1-5 mg/l HCHO 10 mm ❑
Reagents: MERCK Spectroquant®
Formaldehyde-Test*
Order Code: 1.14678.0001 (Note 1)

Prepare a blank for each test.

Use 3 ml deionised water instead of water sample.

1. Place 3 ml reagent HCHO-1 (reagent temperature must be 20-25°C) into an empty vial with cap using one of the enclosed plastic syringes **(Eye protection! Reagent contains conc. Sulphuric Aacid! Note 1)**.

2. Add 1 level microspoon reagent HCHO-2, close vial tightly and dissolve contents by shaking.

3. Add 3 ml water sample using pipette, close vial tightly and mix. (Water sample temperature must be 20-25°C.)

4. **Wait 10 minutes before proceeding.**

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

5. Fill a clean 10 mm cell with the prepared blank. Perform zero calibration. After zeroing the display shows:

6. After zeroing remove the cell from the sample chamber. Empty the cell and dry well.

7. Fill the cell with the coloured test solution.

8. Replace the cell in the sample chamber and close the photometer lid.

9. Press [↵] key.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l formaldehyde.

11. Methods

Notes

This method is adapted from Merck:

1. Please find further information as working protection, waste management and general information in the information sheet in each test box.

* Spectroquant® ia registered trade-mark of MerckKGaA.

11. Methods

342 Vial Test Formaldehyde
0.1 - 5 mg/l HCHO 16 mm ∅
Reagents: MERCK Spectroquant®
Formaldehyde-Cell Test*
Order Code: 1.14500.0001 (Note 1)

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Perform zero calibration with the supplied blank (Note 2, 3).
   After zeroing the display shows:
2. After zeroing remove blank from the sample chamber.
3. Place 1 level microspoon HCHO-1K directly into vial. (Vial temperature must be 20-25°C.)
4. Close vial tightly and shake vigorously until reagent is completely dissolved.
5. Add 2 ml water sample (water sample temperature must be 20-25°C) with pipette. **(Eye protection! Vial becomes hot! Note 1)**. Close vial tightly and mix. Hold the vial only at the screw cap.
6. **Wait for 5 minutes before proceeding.** Do not cool down with water!
7. Place the vial in the sample chamber and carefully close the photometer lid as far as possible. (note 2).

8. Press [↵] key.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l formaldehyde.

11. Methods

Notes

This method is adapted from Merck:

1. Please find further information as working protection, waste management and general information in the information sheet in each test box.

2. As Merck cell tests use longer vials it is not possible to close the photometer lid completely.

3. To get reproduceable results, perform zero and measurement under the environmental same light conditions.

* Spectroquant® ia registered trade-mark of MerckKGaA.

11. Methods

343 Formaldehyde
0.02-1 mg/l HCHO 50 mm ❑
Reagents: MERCK Spectroquant®
Formaldehyde-Test*
Order Code: 1.14678.0001 (Note1)

Prepare a blank for each test.
Use 3 ml deionised water instead of water sample.

1. Place 3 ml reagent HCHO-1 (reagent temperature must be 20-25°C) into an empty vial with cap using one of the enclosed plastic syringes **(Eye protection! Reagent contains conc. Sulphuric Acid! Note 1).**
2. Add 1 level microspoon reagent HCHO-2, close vial tightly and dissolve contents by shaking.
3. Add 3 ml water sample using pipette, close vial tightly and mix. (Water sample temperature must be 20-25°C.)
4. **Wait 10 minutes before proceeding.**

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

5. Fill a clean 50 mm cell with the prepared blank. Perform zero calibration. After zeroing the display shows:
6. After zeroing remove the cell from the sample chamber. Empty the cell and dry well.
7. Fill the cell with the coloured test solution.
8. Replace the cell in the sample chamber and close the photometer lid.

9. Press [↵] key.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l formaldehyde.

11. Methods

Notes

This method is adapted from Merck:

1. Please find further information as working protection, waste management and general information in the information sheet in each test box.

* Spectroquant® is a registered trade-mark of MerckKGaA.

11. Methods

351 Hydrogen Peroxide
0.01 - 0.5 mg/l H_2O_2 50 mm ❑

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean 50 mm cell with water sample.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the cell from the sample chamber. Empty the cell and dry well.

3. Test procedure:
   Rinse a beaker with the sample and empty it leaving a few drops in.
   Add one HYDROGENPEROXIDE LR tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.
   Add 10 ml water sample.
   Dissolve the tablet completely.

4. Fill the cell with the coloured test solution.

5. Replace the cell in the sample chamber and close the photometer lid.

Press [↵] key.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l H_2O_2.

11. Methods

Notes

1. Vial cleaning
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, the subsequent determination of oxidation agents (e.g. bromine, chlorine) may show lower results.
   To avoid any measurement errors, only use glassware free of chlorine consumption.
   Preparation: Put all applicable glassware into sodium hypochlorite solution (0.1 g/l) for one hour, then rinse all glassware thoroughly with deionized water. For individual testing of free and total chlorine, the use of different sets of glassware is recommended (EN ISO 7393-2, 5.3).

2. Preparing the sample
   When preparing the sample, the escape of hydrogen peroxide gases, e.g. by pipetting or shaking, must be avoided. The analysis must take place immediately after taking the sample. The DPD colour development is carried out with a pH value of 6.3 - 6.5. The reagent tablets therefore contain a buffer for the pH value adjustment. Strongly alkaline or acidic water must, however, be neutralised before the analysis.

3. Exceeding of the measuring range
   Concentrations above 5 mg/l of hydrogen peroxide can produce results within the measuring range up to 0 mg/l. In this event, the water sample must be diluted and the measurement repeated.
   Oxidizing agents such as bromine, ozone etc. , interfere as they react like hydrogen peroxide .

11. Methods

352 Hydrogen Peroxide
0.5 - 1.5 mg/l H_2O_2 24 mm ∅

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (Ø 24 mm) with the water sample, replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber, empty it leaving a few drops in.

3. Test procedure:
   Add one HYDROGENPEROXIDE LR tablet straight from the foil to the water sample, and mix to dissolve using a clean stirring rod.
   Add water sample to the 10 ml mark.

4. Replace the cap tightly and invert the vial gently several times to mix the contents.

5. Replace the vial in the sample chamber and close the photometer lid.

6. Press [↵] key.

REACTION TIME
2 min
2:00

Wait for a colour reaction time of 2 minutes. The time remaining is displayed continuously starting from 2 minutes. The beeper indicates the last 10 seconds.

MEASURING

7. The display shows:

RESULT

The result is shown in the display in mg/l H_2O_2.

11. Methods

Notes

1. Vial cleaning
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, the subsequent determination of oxidation agents (e.g. bromine, chlorine) may show lower results.
   To avoid any measurement errors, only use glassware free of chlorine consumption.
   Preparation: Put all applicable glassware into sodium hypochlorite solution (0.1 g/l) for one hour, then rinse all glassware thoroughly with deionized water. For individual testing of free and total chlorine, the use of different sets of glassware is recommended (EN ISO 7393-2, 5.3).

2. Preparing the sample
   When preparing the sample, the escape of hydrogen peroxide gases, e.g. by pipetting or shaking, must be avoided. The analysis must take place immediately after taking the sample. The DPD colour development is carried out with a pH value of 6.3 - 6.5. The reagent tablets therefore contain a buffer for the pH value adjustment. Strongly alkaline or acidic water must, however, be neutralised before the analysis.

3. Exceeding of the measuring range
   Concentrations above 5 mg/l of hydrogen peroxide can produce results within the measuring range up to 0 mg/l. In this event, the water sample must be diluted and the measurement repeated.
   Oxidizing agents such as bromine, ozone etc. , interfere as they react like hydrogen peroxide .

11. Methods

400 Total hardness
2 - 50 mg/l $CaCO_3$ 24 mm ∅

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (Ø 24 mm) with 10 ml of the water sample, replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber.

3. Test procedure:
   Add one HARDCHECK P tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.

4. Replace the cap tightly and invert the vial gently several times to mix the contents.

5. Replace the vial in the sample chamber and close the photometer lid.

6. Press [↵] key.

REACTION TIME
5 min
5:00

Wait for a colour reaction time of 5 minutes. The time remaining is displayed continuously starting from 5 minutes. The beeper indicates the last 10 seconds.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l $CaCO_3$.

11. Methods

Notes

1. Strongly alkaline or acidic water must be brought within the pH values of 4 and 10 before the tablet is added.

2. The test operates with higher tolerances at the upper end of the test range than at the lower end. For best accuracy the sample should be diluted if necessary with deionized water to bring the result in the bottom third of the range.

Conversions

	Alkaline Earth ions	Alkaline Earth ions	ppm $CaCO_3$	German degrees °d	English degrees °e	French degrees °f
1 mg/l $CaCO_3$	0.01	0.020	1.00	0.056	0.07	0.10

Accuracy of the method

The present method was developed from a titration procedure. Due to undefined boundary conditions the deviations from standardised methods may be greater.

11. Methods

420 Potassium
0.5 - 12 mg/l K 24 mm ∅

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (Ø 24 mm) with 10 ml of the water sample, replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber.

3. Test procedure:
   Add one POTASSIUM T tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.

4. Replace the cap tightly and invert the vial gently several times to mix the contents.

5. Replace the vial in the sample chamber and close the photometer lid.

6. Press [↵] key.

REACTION TIME
2 min
2:00

7. Wait for a colour reaction time of 2 minutes. The time remaining is displayed continuously starting from 2 minutes. The beeper indicates the last 10 seconds.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l potassium.

11. Methods

430 Vial test Surfactants (anionic)
0.05 - 2 mg/l MBAS 16 mm ∅
Reagents: MERCK Spectroquant® Surfactants* (anionic)-Cell Test
Order Code: 1.14697.0001 (Note 1)

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Perform zero calibration with the supplied blank (Note 2, 3).
   After zeroing the display shows:
2. After zeroing remove blank from the sample chamber.
3. Pipette 5 ml water sample (10-20°C) directly into vial (10-20°C). **Do not mix content!**
4. Add 3 drops reagent T-1K. **Do not mix content!**
5. Add 2 drops reagnet T-2K, close vial tightly and shake for 30 seconds.
6. **Wait for 10 minutes before proceeding.**
7. **Swirl the vial**, than place the vial in the sample chamber and carefully close the photometer lid as far as possible. (note 2).

8. Press [↵] key.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l MBAS.

11. Methods

Notes

This method is adapted from Merck:

1. Please find further information as working protection, waste management and general information in the information sheet in each test box.

2. As Merck cell tests use longer tubes it is not possible to close the photometer lid completely.

3. To get reproduceable results, perform zero and measurement under the environmental same light conditions.

4. MBAS = **M**ethylene **B**lue **A**ctive **S**ubstances, calculated as sodium 1-dodecanesulfonate.

* Spectroquant® is a registered trade-mark of MerckKGaA.

11. Methods

440 Manganese
0.05 - 4 mg/l Mn 24 mm ∅

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (Ø 24 mm) with 10 ml of the water sample, replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber.

3. Test procedure:
   Add one MANGANESE LR 1 tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.

4. Add one MANGANESE LR 2 tablet straight from the foil to the same water sample and mix to dissolve using a clean stirring rod.

5. Replace the cap tightly and invert the vial gently several times to mix the contents.

6. Replace the vial in the sample chamber and close the photometer lid.

7. Press [↵] key.

REACTION TIME
5 min
5:00

Wait for a colour reaction time of 5 minutes.
The time remaining is displayed continuously starting from 5 minutes.
The beeper indicates the last 10 seconds.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l Mn.

11. Methods

450 Molybdate
0.5 - 30 mg/l MoO_4 24 mm ∅

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (Ø 24 mm) with 10 ml of the water sample, replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber and empty the vial.

3. Test procedure:
   Fill a clean beaker with 20 ml of the water sample.
   Add one MOLYBDATE No.1 HR tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.

4. Add one MOLYBDATE No.2 HR tablet straight from the foil to the same water sample and mix to dissolve using a clean stirring rod.

   Dissolve the tablets.

5. Fill the vial with the solution and replace the cap tightly.

6. Replace the vial in the sample chamber and close the photometer lid.

7. Press [↵] key.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l MoO_4.

8. Conversion
   mg/l Na_2Mo_4 = mg/l MoO_4 x 1.3
   mg/l Mo = mg/l MoO_4 x 0.6

11. Methods

501 Ammonia
0.02 - 1 mg/l N **24 mm ∅**

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (Ø 24 mm) with 10 ml of the water sample, replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber.

3. Test procedure:
   Add one AMMONIA No.1 tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.

4. Add one AMMONIA No.2 tablet straight from the foil to the same sample and mix to dissolve using a clean stirring rod.

5. Replace the cap tightly and invert the vial gently several times to mix the contents.

6. Replace the vial in the sample chamber and close the photometer lid.

7. Press [↵] key.

REACTION TIME
10 min
10:00

Wait for a colour reaction time of 10 minutes. The time remaining is displayed continuously starting from 10 minutes. The beeper indicates the last 10 seconds.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l N.

8. Conversion
   NH_3 = N x 1.22
   NH_4 = N x 1.29

11. Methods

Notes

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

2. The AMMONIA No. 1 tablet will only dissolve completely after the AMMONIA No. 2 tablet has been added.

3. The temperature of the sample is important for full colour development.

11. Methods

502 Ammonia
with Powder Pack (PP)-Reagent
0-0.5 mg/l N 24 mm ∅

1. Fill a clean vial (∅ 24 mm) with 10 ml of water sample.
2. Prepare a blank using 10 ml deionized water instead of the sample.
3. Add a VARIO AMMONIA Salicylate F10 Powder Pack to each vial.
4. Replace the cap tightly. Invert several times to mix the contents.
5. **Wait 3 minutes before proceeding.**
6. Add a VARIO AMMONIA Cyanurate F10 Powder Pack to each vial.
7. Replace the cap tightly. Invert several times to mix the contents.
8. **Wait 15 minutes before proceeding.**

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

9. Perform zero calibration with the prepared blank. After zeroing the display shows:
10. After zeroing remove the vial from the sample chamber.
11. Place the sample vial in the sample chamber and close the photometer lid.

12. Press [↵] key.

MEASURING

The display shows:

RESULT

The result is shown in the display as mg/l N.

11. Methods

Notes

1. Extremely basic or acidic water samples should be adjusted with 0.5 mol/l (1 N) Sulphuric Acid Solution or 1 mol/l (1 N) Sodium Hydroxide Solution to pH 7.

11. Methods

503 Vial test Ammonia vario low range (LR)
0-2.5 mg/l N 16 mm ∅

1. Test procedure:
   Open the white cap of the vial and add 2 ml water sample.
2. Prepare a blank using 2 ml deionized water instead of the sample.
3. Add a VARIO AMMONIA Salicylate F5 Powder Pack to each vial.
4. Replace the cap tightly. Invert several times to mix the contents.
5. Add a VARIO AMMONIA Cyanurate F5 Powder Pack to each vial.
6. Replace the cap tightly. Invert several times to mix the contents.
7. **Wait 20 minutes before proceeding.**

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

8. Perform zero calibration with the prepared blank. After zeroing the display shows:
9. After zeroing remove the vial from the sample chamber.
10. Place the sample vial in the sample chamber and close the photometer lid.

Press [↵] key.

MEASURING

The display shows:

RESULT

The result is shown in the display as mg/l N.

11. Methods

504 Vial test Ammonia vario high range (HR)
0-50 mg/l N 16 mm ∅

1. Test procedure:
   Open the white cap of the vial and add 0.1 ml water sample.
2. Prepare a blank using 0.1 ml deionized water instead of the sample.
3. Add a VARIO AMMONIA Salicylate F5 Powder Pack to each vial.
4. Replace the cap tightly. Invert several times to mix the contents.
5. Add a VARIO AMMONIA Cyanurate F5 Powder Pack to each vial.
6. Replace the cap tightly. Invert several times to mix the contents.
7. **Wait 20 minutes before proceeding.**

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

8. Perform zero calibration with the prepared blank. After zeroing the display shows:
9. After zeroing remove the vial from the sample chamber.
10. Place the sample vial in the sample chamber and close the photometer lid.

11. Press [↵] key.

MEASURING

The display shows:

RESULT

The result is shown in the display as mg/l N.

11. Methods

Notes

1. For water samples with concentrations below 2 mg/l N please continue using method Vial Test Ammonia vario low range (LR).

11. Methods

531 Nickel
0.02-1 mg/l Ni 50 mm ❑

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean 50 mm cell with water sample.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the cell from the sample chamber. Empty the cell and dry well.

3. Test procedure:
   Fill a clean beaker with 10 ml water sample.
   Add two scoops No. 8 (black) Nickel-51.
   Dissolve reagent.

4. Add 0,2 ml Nickel-52 to the same water sample. Mix the contents.

5. Fill the cell with the coloured test solution.

6. Replace the cell in the sample chamber.

7. Press [↵] key.

REACTION TIME
3 min
3:00

Wait for a colour reaction time of 3 minutes.
The time remaining is displayed continuosly starting from 3 minutes.
The beeper indicates the last 10 seconds.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l Ni.

Notes

1. The test sample and the reagents should have room temperature for test performance.

2. The test sample should have a pH of between 3 and 10.

11. Methods

532 Nickel
0.2-7 mg/l Ni 24 mm ∅

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (∅ 24 mm) with 3 ml of the water sample.
   Add deionized water to the 10 ml mark and replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber.

3. Test procedure:
   Add two scoops No. 8 (black) Nickel-51 to the prepared water sample (point 1), replace the cap tightly and invert the vial gently several times to mix the contents.

4. Add 0,2 ml Nickel-52 to the same water sample.

5. Replace the cap tightly and invert the vial gently several times to mix the contents.

6. Replace the vial in the sample chamber and close the photometer lid.

7. Press [↵] key.
   Wait for a colour reaction time of 3 minutes.
   The time remaining is displayed continuously starting from 3 minutes.
   The beeper indicates the last 10 seconds.

REACTION TIME
3 min
3:00

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l Ni.

Notes

1. The test sample and the reagents should have room temperature for test performance.

2. The test sample should have a pH of between 3 and 10.

11. Methods

571 Nitrite LR
0.01 - 0.5 mg/l N 24 mm ∅

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (Ø 24 mm) with 10 ml of the water sample, replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber.

3. Test procedure:
   Add one NITRITE LR tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.

4. Replace the cap tightly and invert the vial gently several times to mix the contents.

5. Replace the vial in the sample chamber and close the photometer lid.

6. Press [↵] key.

REACTION TIME
10 min
10:00

Wait for a colour reaction time of 10 minutes. The time remaining is displayed continuously starting from 10 minutes. The beeper indicates the last 10 seconds.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l N.

7. Conversion:
   mg/l NO_2 = mg/l N x 3.29

11. Methods

Notes

1. The following ions can produce interference since under the reaction conditions they cause precipitation: antimony (III), iron (III), lead, mercury (I), silver, chloroplatinate, meta-vanadate and bismuth.

   Copper (II) ions may give a low result as they accelerate the decomposition of the diazonium salt.

   It is improbable in practice that these interfering ions will occur in such high concentrations that they cause significant errors.

11. Methods

572 Vial test Nitrite low range (LR)
0.03 - 0.6 mg/l N

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Perform zero calibration with the blank (red labelled vial).
   After zeroing the display shows:

2. After zeroing remove the blank from the sample chamber.

3. Test procedure:
   Open a vial and add 2 ml water sample.

4. Replace the cap tightly and invert several times to mix the contents.

5. Add one scoop No. 8 (black colour) Nitrit-101.

6. Replace the cap tightly.
   Press [↵] (count-down starts).
   Dissolve reagent by shaking.

7. Place the vial in the sample chamber and close the photometer lid.

REACTION TIME
10 min
10:00

Wait for a colour development time of 10 minutes. The time remaining is displayed continuously starting from 10 minutes.
The beeper indicates the last 10 seconds.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l N.

8. Conversion:
   mg/l NO_2 = mg/l N x 3.29

Notes

Store the reagents in a cool, dry place ideally at between 4 °C and 8 °C.

11. Methods

573 Vial test Nitrite high range (HR)
0.3 - 3 mg/l N

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Perform zero calibration with the blank (red labelled vial).
   After zeroing the display shows:

2. After zeroing remove the blank from the sample chamber.

3. Test procedure:
   Open a vial and add 0.5 ml water sample.

4. Replace the cap tightly and invert several times to mix the contents.

5. Add one scoop No. 8 (black) Nitrit-101.

6. Replace the cap tightly.
   Press [↵] (count-down starts).
   Dissolve reagent by shaking.

7. Place the vial in the sample chamber and close the photometer lid.

REACTION TIME
10 min
10:00

Wait for a colour development time of 10 minutes. The time remaining is displayed continuously starting from 10 minutes.
The beeper indicates the last 10 seconds.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l N.

8. Conversion:
   mg/l NO_2 = mg/l N x 3.29

Notes

Store the reagents in a cool, dry place ideally at between 4 °C and 8 °C.

11. Methods

590 Vial test Nitrate
0.5 - 14 mg/l N

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Perform zero calibration with the blank (red labelled vial).
   After zeroing the display shows:

2. After zeroing remove the blank from the sample chamber.

3. Test procedure:
   Open a vial and add 0.5 ml water sample.

4. Replace the cap tightly and invert the vial gently several times to mix the contents.

5. Add 0.2 ml Nitrat-111.

6. Replace the cap tightly.
   Press [↵] (count-down starts).
   Invert the vial gently several times to mix the contents.

7. Place the vial in the sample chamber and close the photometer lid.

REACTION TIME
15 min
15:00

8. Wait for a colour development time of 15 minutes. The time remaining is displayed continuously starting from 15 minutes.
   The beeper indicates the last 10 seconds.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l N.

9. Conversion:
   mg/l NO_3 = mg/l N x 4.43

11. Methods

611 Vial test Total Nitrogen
0.5 - 14 mg/l N

Digestion:

1. Fill an empty vial (Ø 16 mm with cap) with 5 ml water sample.
2. Add one scoop No. 8 (black) digestion reagent (label: “Aufschlussreagenz”).
3. Replace the cap tightly. Invert the vial gently several times to mix the contents and heat the vial for 1 hour in the reactor at a temperature of 100 °C.
4. After one hour remove the vial from the reactor and cool the vials to room temperature (Note 2).
5. Add one scoop No. 4 (grey) compensation reagent (label: “Kompensationsreagenz”)
6. Replace the cap tightly. Invert the vial gently several times to mix the contents.
7. Use this pretreated sample for the test procedure.

Test procedure:

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

8. Perform zero calibration with the blank (red labelled vial).
   After zeroing the display shows:
9. After zeroing remove the vial from the sample chamber.

11. Methods

10. Open a vial and add 0.5 ml of the prepared sample (point 7).

11. Replace the cap tightly. Invert the vial gently several times to mix the contents.

12. Add 0.2 ml Nitrat-111.

13. Replace the cap tightly.
Press [↵] (count-down starts).
Invert the vial gently several times to mix the contents.

14. Place the vial in the sample chamber and close the cover on the sample chamber.

REACTION TIME
15 min
15:00

Wait for a colour development time of 15 minutes. The time remaining is displayed continuously starting from 15 minutes.
The beeper indicates the last 10 seconds.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l N.

11. Methods

612 Vial test Total Nitrogen
14 - 140 mg/l N

Digestion:

1. Fill an empty vial (Ø 16 mm with cap) with 0.5 ml water sample and 4.5 ml deionized water.
2. Add one scoop No. 8 (black) digestion reagent (label: “Aufschlussreagenz”)
3. Replace the cap tightly. Invert the vial gently several times to mix the contents and heat the vial for 1 hour in the reactor at a temperature of 100 °C.
4. After one hour remove the vial from the reactor and cool the vials to room temperature (Note 2).
5. Add one scoop No. 4 (grey) compensation reagent (label: “Kompensationsreagenz”).
6. Replace the cap tightly. Invert the vial gently several times to mix the contents.
7. Use this pretreated sample for the test procedure.

Test procedure:

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

8. Perform zero calibration with the blank (red labelled vial).
   After zeroing the display shows:
9. After zeroing remove the vial from the sample chamber.

11. Methods

10. Open a vial and add 0.5 ml of the prepared water sample (point 7).

11. Replace the cap tightly. Invert the vial gently several times to mix the contents.

12. Add 0.2 ml Nitrat-111.

13. Replace the cap tightly.
Press [↵] (count-down starts).
Invert the vial gently several times to mix the contents.

14. Place the vial in the sample chamber and close the cover on the sample chamber.

REACTION TIME
15 min
15:00

Wait for a colour development time of 15 minutes. The time remaining is displayed continuously starting from 15 minutes.
The beeper indicates the last 10 seconds.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l N.

11. Methods

630 Ozone

The differentiation is available for the method 630 with submethods 631 and 632.

O3/Cl =1 **O3 = 2**	1. The display shows:
	2. Press key [1] to select the determination of ozone in the present of chlorine.
	Press key [2] to select the determination of ozone in the absence of chlorine.
PREPARE ZERO **PRESS ZERO**	3. The display shows:

11. Methods

631 (1) Ozone in present of chlorine
0.02 - 0.5 mg/l O_3 50 mm ❑

ZERO ACCEPTED
PREPARE T1
PRESS ↵

1. Fill a clean 50 mm cell with the water sample.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the cell from the sample chamber, empty the cell and dry well.

3. Test procedure:
   Rinse a beaker with the sample and empty it leaving a few drops in.
   Add one DPD No.1 tablet and one DPD No.3 tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.
   Add 10 ml water sample.
   Dissolve the tablets completely.

4. Fill the cell with the coloured test solution.

5. Replace the cell in the sample chamber and close the photometer lid.

6. Press [↵] key.

REACTION TIME
2 min
2:00

Wait for a colour reaction time of 2 minutes. The time remaining is displayed continuously starting from 2 minutes. The beeper indicates the last 10 seconds.

T1 OK
PREPARE T2
PRESS ↵

The display shows:

7. Remove the cell from the sample chamber. Empty the cell and dry well.

11. Methods

8. Rinse a beaker with the sample and empty it leaving a few drops in.
   Add one DPD No.1 tablet and one DPD No.3 tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.

9. Fill a second vial (ø 24 mm) with 10 ml water sample.
   Add one DPD-GLYCINE tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.
   Dissolve the tablet.

10. Transfer the contents of the second vial into the prepared first vial.
    Dissolve the tablets.

11. Fill the cell with the coloured test solution.

12. Replace the cell in the sample chamber and close the photometer lid.

13. Press [↵] key.

REACTION TIME
2 min
2:00

Wait for a colour reaction time of 2 minutes. The time remaining is displayed continuously starting from 2 minutes. The beeper indicates the last 10 seconds.

MEASURING

The display shows:

O3 = mg/l
Cl total = mg/l

The result is shown in the display in:
mg/l ozone
mg/l total chlorine

11. Methods

631 (2) Ozone in absence of chlorine
0.02 - 0.5 mg/l O_3 50 mm ❑

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean 50 mm cell with water sample.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the cell from the sample chamber. Empty the cell and dry well.

3. Test procedure:
   Rinse a beaker with the sample and empty it leaving a few drops in.
   Add one DPD No.1 tablet and one DPD No.3 tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.
   Add 10 ml water sample.
   Dissolve the tablets completely.

4. Fill the cell with the coloured test solution.

5. Replace the cell in the sample chamber and close the photometer lid.

6. Press [↵] key.

REACTION TIME
2 min
2:00

Wait for a colour reaction time of 2 minutes. The time remaining is displayed continuously starting from 2 minutes. The beeper indicates the last 10 seconds.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l ozone.

11. Methods

Notes

1. Vial cleaning
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, the subsequent determination of oxidation agents (e.g. bromine, chlorine) may show lower results.
   To avoid any measurement errors, only use glassware free of chlorine consumption.
   Preparation: Put all applicable glassware into sodium hypochlorite solution (0.1 g/l) for one hour, then rinse all glassware thoroughly with deionized water. For individual testing of free and total chlorine, the use of different sets of glassware is recommended (EN ISO 7393-2, 5.3).

2. Preparing the sample
   When preparing the sample, the escape of ozone gases, e.g. by pipetting or shaking, must be avoided. The analysis must take place immediately after taking the sample. The DPD colour development is carried out with a pH value of 6.3 - 6.5. The reagent tablets therefore contain a buffer for the pH value adjustment. Strongly alkaline or acidic water must, however, be neutralised before the analysis.

3. Turbidity (lead to errors)
   The use of the DPD No. 1-tablet in samples with high calcium ion content (and/or high conductivity) can lead to turbidity of the sample and therefore incorrect measurements. In this event, the reagent tablet **„DPD No. 1 High Calcium“** should be used as an alternative. Even if the turbidity does not occur until after the DPD No. 3-tablet has been added, this can be prevented by using the **„DPD No. 1 High Calcium-tablet“**.

4. Exceeding of the measuring range
   Concentrations above 6.5 mg/l of ozone can produce results within the measuring range up to 0 mg/l. In this event, the water sample must be diluted and the measurement repeated.
   Oxidizing agents such as bromine, chlorine etc., interfere as they react like ozone.

11. Methods

632 (1) Ozone in present chlorine
0.1 - 1 mg/l O_3 24 mm ∅

ZERO ACCEPTED
PREPARE T1
PRESS ↵

1. Fill a clean vial (Ø 24 mm) with 10 ml of the water sample, replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber and empty it leaving a few drops in.

3. Test procedure:
   Add one DPD No.1 tablet and one DPD No.3 tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.
   Add water sample to the 10 ml mark.

4. Replace the cap tightly and invert the vial gently several times to mix the contents.

5. Replace the vial in the sample chamber and close the photometer lid.

6. Press [↵] key.

REACTION TIME
2 min
2:00

Wait for a colour reaction time of 2 minutes. The time remaining is displayed continuously starting from 2 minutes. The beeper indicates the last 10 seconds.

T1 OK
PREPARE T2
PRESS ↵

The display shows:

7. Remove the vial from the sample chamber, empty the vial, rinse vial and cap several times leaving a few drops in.

11. Methods

8. Add one DPD No.1 tablet and one DPD No.3 tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.

9. Fill a second vial (Ø 24 mm) with 10 ml of water sample. Add one DPD-GLYCINE tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.
Dissolve the tablet.

10. Transfer the content of the second vial into the prepared first vial.

11. Replace the cap tightly and invert the vial gently several times to mix the contents.

12. Replace the vial in the sample chamber and close the photometer lid.

13. Press [↵] key.

REACTION TIME
2 min
2:00

Wait for a colour reaction time of 2 minutes. The time remaining is displayed continuously starting from 2 minutes. The beeper indicates the last 10 seconds.

MEASURING

The display shows:

O3 = mg/l
Cl total = mg/l

The result is shown in the display in:
mg/l ozone
mg/l total chlorine

11. Methods

632 (2) Ozone in absence of chlorine
0.1 - 1 mg/l O_3 24 mm ∅

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (Ø 24 mm) with 10 ml of the water sample, replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber and empty the vial leaving a few drops in.

3. Test procedure:
   Add one DPD No.1 tablet and one DPD No.3 tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.
   Add water sample to the 10 ml mark.

4. Replace the cap tightly and invert the vial gently several times to mix the contents.

5. Replace the vial in the sample chamber and close the photometer lid.

6. Press [↵] key.

REACTION TIME
2 min
2:00

Wait for a colour reaction time of 2 minutes. The time remaining is displayed continuously starting from 2 minutes. The beeper indicates the last 10 seconds.

MEASURING

7. Remove the vial from the sample chamber.
   The display shows:

RESULT

The result is shown in the display in mg/l ozone.

11. Methods

Notes

1. Vial cleaning
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, the subsequent determination of oxidation agents (e.g. bromine, chlorine) may show lower results.
   To avoid any measurement errors, only use glassware free of chlorine consumption.
   Preparation: Put all applicable glassware into sodium hypochlorite solution (0.1 g/l) for one hour, then rinse all glassware thoroughly with deionized water. For individual testing of free and total chlorine, the use of different sets of glassware is recommended (EN ISO 7393-2, 5.3).

2. Preparing the sample
   When preparing the sample, the escape of ozone gases, e.g. by pipetting or shaking, must be avoided. The analysis must take place immediately after taking the sample. The DPD colour development is carried out with a pH value of 6.3 - 6.5. The reagent tablets therefore contain a buffer for the pH value adjustment. Strongly alkaline or acidic water must, however, be neutralised before the analysis.

3. Turbidity (lead to errors)
   The use of the DPD No. 1-tablet in samples with high calcium ion content (and/or high conductivity) can lead to turbidity of the sample and therefore incorrect measurements. In this event, the reagent tablet **„DPD No. 1 High Calcium“** should be used as an alternative. Even if the turbidity does not occur until after the DPD No. 3-tablet has been added, this can be prevented by using the **„DPD No. 1 High Calcium-tablet“**.

4. Exceeding of the measuring range
   Concentrations above 6.5 mg/l of ozone can produce results within the measuring range up to 0 mg/l. In this event, the water sample must be diluted and the measurement repeated.
   Oxidizing agents such as bromine, chlorine etc., interfere as they react like ozone.

11. Methods

651 Lead
0.1 - 5 mg/l Pb 10 mm ❑
Reagents:
MERCK Spectroquant® Lead-Test*
Order Code: 1.09717.0001 (Note 1)

Determination of Pb^{2+}-ions (Note 2)

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean 10 mm cell with water sample.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the cell from the sample chamber. Empty the cell and dry well.

   Caution! Reagent Pb-1 contains Potassium Cyanide! Adhere to the specified dosage sequence! (Note 1)

3. Pipette 0.5 ml reagent Pb-1 into a suitable beaker.

4. Add 0.5 ml reagent Pb-2 using pipette and mix.

5. Add 8 ml water sample using pipette and mix.

6. Fill the cell with the coloured test solution.

7. Replace the cell in the sample chamber and close the photometer lid.

8. Press [↵] key.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l lead.

11. Methods

Notes

This method is adapted from Merck:

1. Please find further information as working protection, waste management and general information in the information sheet in each test box.

2. The test measures only Pb^{2+}-ions. Samples must be pretreated or decomposed by digestion before colloidal, undissolved, and complex-bound lead can be measured.

* Spectroquant® is a registered trade-mark of MerckKGaA.

11. Methods

652 **Vial Test Lead**
0.1 - 5 mg/l Pb **16 mm ø**
Reagents:
MERCK Spectroquant® Lead Cell Test*
Order Code: 1.14833.0001 (Note 1)

Determination of Pb^{2+}-ions (Note 4)

Pb (A) = 1
Pb (B) = 2

The display shows:

1

Press key [1] to select the determination of lead in soft to medium hard waters with a Ca2+ content lower than 100 mg/l (approx. 14°d = 17.5°e)

2

Press key [2] to select the determination of lead in hard to very hard waters with a Ca2+ content between 100 mg/l and 500 mg/l (approx. 14°d and 70°d = 17.5°e and 87.5°e)

PREPARE ZERO
PRESS ZERO

The display shows:

11. Methods

Determination A

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Perform zero calibration with the supplied blank (note 2, 3).
   After zeroing the display shows:

2. After zeroing remove blank from the sample chamber.

   Caution! The reaction vial contain potassium cyanide !. Adhere to the specified dosage sequence! (Note 1)

3. Add 5 drops reagent Pb-1K directly into vial, close vial tightly and mix.

4. Add 5 ml water sample using pipette, immediately close vial tightly and mix.

5. Place the vial in the sample chamber and carefully close the photometer lid as far as possible. (note 2)

6. Press [↵] key.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l lead.

11. Methods

Determination B

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Perform zero calibration with the supplied blank (note 2, 3).
   After zeroing the display shows:

2. After zeroing remove blank from the sample chamber.

   Caution! The reaction vial contain potassium cyanide ! First add reagent Pb-1, than the sample! (Note 1)

3. Add 5 drops reagent Pb-1K directly into vial, close vial tightly and mix.

4. Add 5 ml water sample using pipette, immediately close vial tightly and mix.

5. Place the vial in the sample chamber and carefully close the photometer lid as far as possible. (Note 2).

6. Press [↵] key.

T1 OK
PREPARE T2
PRESS ↵

   The display shows:

7. Remove the vial from the sample chamber and carefully open.

8. Add 1 level microspoon reagent Pb-2K.

9. Close vial tightly and shake until the reagent is completely dissolved.

10. Place the vial in the sample chamber and carefully close the photometer lid as far as possible. (Note 2).

11. Press [↵] key.

MEASURING

   The display shows:

RESULT

   The result is shown in the display in mg/l lead.

11. Methods

Notes

This method is adapted from Merck:

1. Please find further information as working protection, waste management and general information in the information sheet in each test box.

2. As Merck cell tests use longer tubes it is not possible to close the photometer lid completely.

3. To get reproduceable results, perform zero and measurement under the environmental same light conditions.

4. The test measures only Pb^{2+}-ions. Samples must be pretreated or decomposed by digestion before colloidal, undissolved, and complex-bound Lead can be measured.

* Spectroquant® is a registered trade-mark of MerckKGaA.

11. Methods

670 pH (Phenolred)
6.5 - 8.4 24 mm ∅

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (Ø 24 mm) with 10 ml of the water sample, replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber.

3. Test procedure:
   Add one PHENOLRED PHOTOMETER tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.

4. Replace the cap tightly and invert the vial gently several times to mix the contents.

5. Replace the vial in the sample chamber and close the photometer lid.

6. Press [↵] key.

MEASURING

The display shows:

RESULT

The result is shown in the display as pH value.

11. Methods

Notes

For photometric determination of pH values, only use PHENOLRED-tablets in black printed foil pack and marked PHOTOMETER.

pH values below 6.5 and above 8.4 can produce results inside the measuring range.

A plausibility test (pH meter) is recommended.

Water samples with low values of alkalinity-m may give wrong pH readings.

Accuracy of the Method

The accuracy of the colorimetric determination of the pH value is dependent on various boundary conditions (buffer capacity of the sample, salt content etc.).

Salt Error

Correction of test results (average values) for samples with a salt content of :

Indicator	**Salt Content**		
	1 Molar	2 Molar	3 Molar
Phenolred	-0.21	-0.26	-0.29

The values of Parsons and Douglas (1926) are based on the use of Clark and Lubs buffers.
(1 Molar NaCl = 58.4 g/l = 5.8%)

11. Methods

680 Phenols[1)]
0.1 - 5 mg/l C_6H_5OH 24 mm ∅

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (Ø 24 mm) with 10 ml of the water sample, replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber.

3. Test procedure:
   Add one PHENOLE No.1 tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.

4. Add one PHENOLE No.2 tablet straight from the foil to the same sample and mix to dissolve using a clean stirring rod.

5. Replace the cap tightly and invert the vial gently several times to mix the contents.

6. Replace the vial in the sample chamber and close the photometer lid.

7. Press [↵] key.

REACTION TIME
5 min
5:00

Wait for a colour reaction time of 5 minutes. The time remaining is displayed continuously starting from 5 minutes. The beeper indicates the last 10 seconds.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l C_6H_5OH.

Notes

1. This method determines ortho- and meta- substituted phenols but not para- substituted phenols.*
   Because water samples can contain different types of phenolic compounds, the results are displayed as the equivalent concentration of Phenol (C_6H_5OH).

2. The test sample should have a pH of between 3 and 11.

3. Interference can be caused in the presence of reducing agents, oxidising reagents, sulphides or suspended solids. Distillation of the sample is necessary then.*

4. Wastewater and seawater samples may also require a distillation.

   * see: “Standard Methods for the Examination of Water and Wastewater, 20th Edition, 4-40 f.”

11. Methods

701 Phosphate LR
0.05 - 4 mg/l PO_4 24 mm ∅

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (Ø 24 mm) with 10 ml of the water sample, replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber.

3. Test procedure:
   Add one PHOSPHATE LR No.1 tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.

4. Add one PHOSPHATE LR No.2 tablet straight from the foil to the same sample, and mix to dissolve using a clean stirring rod.

5. Replace the cap tightly and invert the vial gently several times to mix the contents.

6. Replace the vial in the sample chamber and close the photometer lid.

7. Press [↵] key.

REACTION TIME
10 min
10:00

Wait for a colour reaction time of 10 minutes. The time remaining is displayed continuously starting from 10 minutes. The beeper indicates the last 10 seconds.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l PO_4.

8. Conversion
   mg/l P_2O_5 = mg/l PO_4 x 0.75
   mg/l P = mg/l PO_4 x 0.33

11. Methods

Notes

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

2. The test sample should have a pH of between 6 and 7.
   Only ortho-phosphate ions react.

3. Interferences

   Higher concentrations of Cu, Ni, Cr (III) and V (V) can interfere due to their colour. Silicates do not interfere (masked by citric acid in the tablets).

4. Before using clean the vials with 10% hydrochloric acid-liquid and after this rinse with deionized water.

11. Methods

702 Vial test ortho-Phosphate (VM)
3 - 60 mg/l PO_4

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Perform zero calibration with the blank (red labelled vial).
   After zeroing the display shows:

2. After zeroing remove the blank from the sample chamber.

3. Test procedure:
   Open a vial and add 4 ml water sample.

4. Replace the cap tightly.
   Press [↵] (count-down starts).
   Invert the vial gently several times to mix the contents.

5. Place the vial in the sample chamber and close the photometer lid.

REACTION TIME
3 min
3:00

Wait for a colour development time of 3 minutes. The time remaining is displayed continuously starting from 3 minutes.
The beeper indicates the last 10 seconds.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l PO_4.

6. Conversion:
   mg/l P = mg/l PO_4 x 0.33
   mg/l P_2O_5 = mg/l PO_4 x 0.75

11. Methods

703 Vial test
Total Phosphate low range (LR) / PMB
0.07 - 3 mg/l P

Digestion:

1. Open a vial and add 5 ml of the prepared water sample.
2. Add 1 scoop No. 4 (grey colour) Phosphat 103 (Close reagent bottle immediately).
3. Replace the cap tightly. Invert the vial gently several times to mix the contents and heat the vial for 30 minutes in the reactor at a temperature of 100 °C.
4. After 30 minutes remove the vial from the reactor and cool the vials to room temperature (Note 2).
5. Use this pretreated sample for the test procedure.

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

6. Perform zero calibration with the blank (red labelled vial).
   After zeroing the display shows:
7. After zeroing remove the vial from the sample chamber.

11. Methods

Test procedure:

8. Open the prepared vial (point 5) and add 2 drops (0.1 ml) Phosphat 101.

9. Replace the cap tightly and invert several times to mix the contents.

10. Add one scoop No. 4 (gray colour) Phosphat 102.

11. Replace the cap tightly.
Press [↵] (count-down starts).
Dissolve reagent by shaking.

12. Place the vial in the sample chamber (Note 2) and close the cover on the sample chamber.

REACTION TIME
10 min
10:00

Wait for a colour development time of 10 minutes. The time remaining is displayed continuously starting from 10 minutes.
The beeper indicates the last 10 seconds.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l P.

13. Conversion:
mg/l PO_4 = mg/l P x 3.07
mg/l P_2O_5 = mg/l P x 4.58

Notes

1. If the method is performanced without digestion (point 1-5), only ortho-phosphate is determined.

2. Clean the outside of the vials with a towel. Finger-prints or other marks will be removed.

11. Methods

704 Vial test
Total Phosphate high range (HR) / PMB
1.5 - 20 mg/l P

Digestion:

1. Open a vial and add 1 ml of the prepared water sample.
2. Add 1 scoop No. 4 (grey colour) Phosphat 103 (Close reagent bottle immediately).
3. Replace the cap tightly. Invert the vial gently several times to mix the contents and heat the vial for 30 minutes in the reactor at a temperature of 100 °C.
4. After 30 minutes remove the vial from the reactor and cool the vials to room temperature (Note 2).
5. Use this pretreated sample for the test procedure.

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

6. Perform zero calibration with the blank (red labelled vial).
   After zeroing the display shows:
7. After zeroing remove the vial from the sample chamber.

11. Methods

Test procedure:

8. Open the prepared vial (point 5) and add 2 drops (0.1 ml) Phosphat 101.

9. Replace the cap tightly and invert several times to mix the contents.

10. Add one scoop No. 4 (gray colour) Phosphat 102.

11. Replace the cap tightly.
Press [↵] (count-down starts).
Dissolve reagent by shaking.

12. Place the vial in the sample chamber (Note 2) and close the cover on the sample chamber.

REACTION TIME
10 min
10:00

Wait for a colour development time of 10 minutes. The time remaining is displayed continuously starting from 10 minutes.
The beeper indicates the last 10 seconds.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l P.

13. Conversion:
mg/l PO_4 = mg/l P x 3.07
mg/l P_2O_5 = mg/l P x 4.58

Notes

1. If the method is performanced without digestion (point 1-5), only ortho-phosphate is determined.

2. Clean the outside of the vials with a towel. Finger-prints or other marks will be removed.

11. Methods

710 Sulphide
0.05 - 0.5 mg/l S 24 mm ∅

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (Ø 24 mm) with 10 ml of the water sample, replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber.

3. Test procedure:
   Add one SULFIDE No.1 tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.

4. Add one SULFIDE No.2 tablet straight from the foil to the same water sample and mix to dissolve using a clean stirring rod.

5. Replace the cap tightly and invert the vial gently several times to mix the contents.

6. Replace the vial in the sample chamber and close the photometer lid.

7. Press [↵] key.

REACTION TIME
10 min
10:00

Wait for a colour reaction time of 10 minutes.
The time remaining is displayed continuously starting from 10 minutes.
The beeper indicates the last 10 seconds.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l S.

8. Conversion
   mg/l H_2S = mg/l S x 1.06

Notes

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

2. Chlorine and other oxidizing agents which react with DPD do not interfere in the test.

3. To avoid loss of sulphide collect the sample carefully with a minimum of aeration. It is essential to test the sample immediately after collection.

4. The temperature of test performance should be 20 °C. Difference to this temperature can lead to higher or lower results.

11. Methods

720 Spectral Absorption Coefficient (S Abs)
0-50 m^{-1} 50 mm ❑

721 Spectral Absorption Coefficient at 436 nm (S Abs 1)

722 Spectral Absorption Coefficient at 525 nm (S Abs 2)

723 Spectral Absorption Coefficient at 620 nm (S Abs 3)

Methods 721, 722, and 723 are called up one after the other and the water sample analysed using the tests as described below:

1. Preparation of sample:
   Filter the water sample through a membrane filter with a pore width of 0.45 µm.
   (At least 100 ml of the water sample should be filtrated)
2. Fill a 50 mm rectangular vial with deionized water (Note 1).
3. Perform zero calibration.

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

4. After zero calibration, the following appears in the display:
5. Following zero calibration, remove the vial from the test compartment and empty completely.
6. Use some of the filtered water sample to rinse out the vial, then pour the sample into the vial.
7. Immediately place the vial in the test compartment and close the photometer cover.

8. Press the [↵] key.

MEASURING

The following appears in the display:

RESULT

The result is then shown in [m^{-1}].

Notes

1. Filter the deionized water for zero calibration through a membrane filter with a pore width of 0.45 µm.

2. The test complies with standard EN ISO 7887:1994, main section 3.

3. As colorations depend on pH and temperature, these should be determined together with optical measurement and specified along with the result.

4. The spectral absorption coefficient is a variable used to describe the true coloration of a water sample. The ”true coloration” of a water sample is the coloration caused solely by dissolved substances in the sample. This is why the water sample has to be filtered prior to measurement.
   Measurement at the 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 nm to 780 nm using the spectrum function (no. 985).

11. Methods

730 Silica
0.05 - 3 mg/l SiO_2 24 mm ∅

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (Ø 24 mm) with the water sample, replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber.

3. Test procedure:
   Add one SILICA No.1 tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.

4. Wait for a colour development time of 5 minutes.

5. Add one SILICA No.2 tablet and one SILICA PR tablet straight from the foil to the same water sample and mix to dissolve using a clean stirring rod.

6. Replace the cap tightly and invert the vial gently several times to mix the contents.

7. Replace the vial in the sample chamber and close the photometer lid.

8. Press [↵] key.

REACTION TIME
1 min
1:00

Wait for a colour reaction time of 1 minute.
The time remaining is displayed continuously starting from 1 minute.
The beeper indicates the last 10 seconds.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l SiO_2.

Notes

Phosphate does not interfere under the given reaction conditions.

11. Methods

741 Sulphite
0.1 - 10 mg/l SO_3 10 mm ❑

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean 10 mm cell with the water sample.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber.

3. Test procedure:
   Fill a clean beaker with 10 ml water sample.
   Add one SULFITE LR tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.
   Dissolve the tablet completely.

4. Fill the cell with the solution.

5. Replace the vial in the sample chamber and close the photometer lid.

6. Press [↵] key.

REACTION TIME
5 min
5:00

Wait for a colour reaction time of 5 minutes.
The time remaining is displayed continuously starting from 5 minutes.
The beeper indicates the last 10 seconds.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l SO_3.

11. Methods

742 Sulphite
0.05 - 4 mg/l SO_3 24 mm ∅

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (Ø 24 mm) with 10 ml of the water sample, replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber.

3. Test procedure:
   Add one SULFITE LR tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.

4. Replace the cap tightly and invert the vial gently several times to mix the contents.

5. Replace the vial in the sample chamber and close the photometer lid.

6. Press [↵] key.

REACTION TIME
5 min
5:00

Wait for a colour reaction time of 5 minutes.
The time remaining is displayed continuously starting from 5 minutes.
The beeper indicates the last 10 seconds.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l SO_3.

11. Methods

750 Sulphate
2 - 100 mg/l SO_4 24 mm ∅

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a clean vial (Ø 24 mm) with 10 ml of the water sample, replace the cap tightly.
   Perform zero calibration.
   After zeroing the display shows:

2. After zeroing remove the vial from the sample chamber.

3. Test procedure:
   Add one VARIO Sulpha 4 reagent straight from the foil to the water sample.

4. Replace the cap tightly and invert the vial gently several times to mix the contents.

5. Replace the vial in the sample chamber and close the photometer lid.

6. Press [↵] key.

REACTION TIME
5 min
5:00

7. Wait for a colour reaction time of 5 minutes. The time remaining is displayed continuously starting from 5 minutes. The beeper indicates the last 10 seconds.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l SO_4.

11. Methods

760 **Vial test TOC**
50-800 mg/l TOC **16 mm ∅**
Reagents:
MERCK Spectroquant® TOC-vial test*
Order code: 1.14879.0001 (Note 1)
Zubehör:
Alukappen (6 Stück)
Order code: 1.73500.0001 (Note 1)

Sample preparation :

1. Pipette 1 ml water sample into a suitable glass-beaker.
2. Add 9 ml deionized water and mix.
3. Add 2 drops reagent TOC-1K and mix.
4. pH value of the solution must be below 2.5.
   If necessary adjust the pH with sulphuric acid.
5. Stir for 10 minutes at medium speed (magnetic stirrer, stirring staff).

Test procedure:

6. Pipette 3ml prepared sample into vial.
7. Add 1 level microspoon reagent TOC-2K.
8. Immediately close the vial with an aluminium cap tightly.
9. Heat vials, standing on its head, at 120°C in the preheated reactor for 2 hours.
10. Place vials standing on its head in a cell rack.
11. **Wait for 1 hour before proceeding.**
    Do not cool down with water!

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

12. Perform zero calibration with the supplied blank (note 2, 3).
    After zeroing the display shows:
13. After zeroing remove the vial from the sample chamber.
14. Place the vial in the sample chamber and carefully close the photometer lid as far as possible. (note 2).

15. Press [↵] key.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l TOC.

11. Methods

Notes

This method is a adapted from Merck:

1. Please find further information as working protection, waste management and general information in the information sheet in each test box.

2. As Merck cell tests use longer vials it is not possible to close the photometer lid completely.

3. To get reproduceable results, perform zero and measurement under the environmental same light conditions.

4. TOC = **T**otal **O**rganic **C**arbon

* Spectroquant® is a registered trade-mark of MerckKGaA.

11. Methods

770 Turbidity
5 - 500 FAU **50 mm ❑**

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Fill a 50 mm rectangular vial with deionised water. Perform zero calibration.
   After zero calibration, the following appears in the display:

2. After zeroing remove the vial from the sample chamber and empty completely.

3. Fill the cell with the water sample.

4. Replace the cell in the sample chamber and close the photometer lid.

5. Press [↵] key.

MEASURING

The display shows:

RESULT

The result is shown in the display in FAU.

Notes

1. This test uses an attenuated radiation method for the reading of FAU (Formazin Attenuation Units). The results can not be used for USEPA reporting purposes, but it may be used for routine measurements. This attenuated radiation method is different from the Nephelometric method.

2. Colour interference is minimized through measurement at 860 nm. Interferences depend on light absorption at 860 nm and gas bubbles.

3. Collect water samples in clean glass bottles and analyse the water sample as soon as possible. It is possible to store the sample at 4°C for 48 hours. Before measurement warm up the sample to temperature at collection time.

11. Methoden

790 Zinc
0.02 - 1 mg/l Zn **24 mm ∅**

PREPARE ZERO
PRESS ZERO

1. Test procedure:
   Fill a clean vial (ø 24 mm) with 10 ml of the water sample.
2. Add one COPPER/ZINC LR tablet straight from the foil to the water sample and mix to dissolve using a clean stirring rod.
3. Replace the cap tightly and invert the vial gently several times to mix the contents.
4. Wait for a colour development time of 5 minutes.

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

5. Perform zero calibration.
   After zeroing the display shows:
6. After zeroing remove the vial from the sample chamber.
7. Add one EDTA tablet to the same water sample and mix to dissolve using a clean stirring rod.
8. Replace the cap tightly and invert the vial gently several times to mix the contents.
9. Replace the vial in the sample chamber and close the photometer lid.

10. Press [↵] key.

MEASURING

The display shows:

RESULT

The result is shown in the display in mg/l Zn.

11. Methods

Notes

b) Some bleaching of the colours may be observed in this test, due to :

i) high levels of zinc or

ii) high levels of residual chlorine.

If i) is suspected, dilute the sample with zinc free (e.g.deionized) water and repeat the test, multiplying the result by the dilution factor.

If ii) is the case, repeat the test on a water sample after dechlorination. To dechlorinate the sample, after zero calibration, first add a dechlor tablet, crush and mix to dissolve. Then add the COPPER / ZINC LR-tablet and continue with zero calibration after 5 minutes colour development time.

11. Methods

950 Fluoride
0.02-1.5 mg/l F^- 24 mm ∅

Measuring mode: When in the start display of the method, press the [↵] key.

ZERO ACCEPTED
PREPARE TEST
PRESS ↵

1. Pour 10 ml of the sample (Note 2) into a 24 mm special vial. Perform zero calibration.
   After zero calibration, the following appears in the display:
2. Remove the vial from the test compartment following zero calibration.
3. Add 2 ml of SPADNS reagent.
4. Seal the vial with the vial lid and swirl to mix the contents.
5. Immediately place the vial in the test compartment and close the photometer cover.
6. Press the [↵] key.

MEASURING

The following appears in the display:

RESULT

The display then shows the result in mg/l F^-.

Important:
The same batch of SPADNS reagent must be used for adjustment and sample measurement (Note 1). If a new batch of SPADNS reagent is used, a new adjustment routine must also be performed using this batch (see below).

11. Methods

Adjustment mode: when in the start display of the method, press the DEL key.

DEL

The following appears:

DELETE METHOD ?

Press DEL to confirm "Yes".

DEL

This deletes the old adjustment and starts the adjustment mode.

PREPARE ZERO
PRESS ZERO

1. Pour 10 ml of deionized water into a 24 mm special vial. Perform zero calibration.
   After zero calibration, the following appears in the display:

PREPARE
STANDARD NO.1
PRESS ↵

2. Remove the vial from the test compartment following zero calibration.
3. Add 2 ml of SPADNS reagent.
4. Seal the vial with the vial lid and swirl to mix the contents.
5. Immediately place the vial in the test compartment and close the photometer cover.

↵

6. Press the [↵] key.

MEASURING

The following appears in the display:

7. Remove the vial from the test compartment, empty completely, and dry well.

PREPARE
STANDARD NO.2
PRESS ↵

8. Pour 10 ml of the 1 mg/l Fluoride standard into the vial.
9. Add 2 ml of SPADNS reagent.
10. Seal the vial with the vial lid and swirl to mix the contents.

↵

11. Press the [↵] key.

Y = A + Bx

The display shows the result of adjustment:

↵

12. Press the [↵] key.

The start picture of the method appears in the display. Press the [↵] key to start the measuring mode (see above).

11. Methods

Notes

1. The adjustment process needs to be performed for each new batch of SPADNS reagent (see Standard Methods 20th, 1998, APHA, AWWA, WEF 4500 F^-D. S. 4.82). The procedure is described under "Adjustment mode".

2. The special vials are not graduated, as the test result is highly dependent on exact sample and reagent volumes. The sample and reagent volumes should always be metered using a 10 or 2 ml full pipette. The calibration solution and the water samples to be tested should have the same temperature (± 1°C).

3. During adjustment and measurement, the same vial should be used for zero calibration and test, as different vials may exhibit minor tolerances.

4. The accuracy of the method decreases above a level of 1.2 mg/l of fluoride. Although the results are sufficiently accurate for most applications, even more exact results can be achieved by 1:1 dilution of the sample prior to use and subsequent multiplication of the result by 2.

5. SPADNS reagent contains arsenite.
   Chlorine concentrations up to 5 mg/l do not interfere with the measurement process.

6. Seawater and waste water samples must be distilled.

7. Results cannot be stored.

12. Declaration of CE-Conformity

Declaration of CE-Conformity

The manufacturer: **Tintometer GmbH**

Schleefstraße 8 a
44287 Dortmund
Deutschland

declares that this product

Product name: **PC SPECTRO**

The product above mentioned is in compliance with:

European Union Council Directive of may, 3rd, 1989 regarding the reconciliation of union members legislations relative to Electromagnetic Compatibility (89/336/CEE) (JOCE 23.05.89 L 139/19-26).

Low voltage directive regarding people, animals and goods security during the use of electrical materials which should be employed within certain voltage limits (73/23/CEE).

This conformity is presumed according to the following specifications:

- **EN 50082-1 Standard - 1992 Edition - Immunity Generic Standard**
- **EN 55022 Standard B Class - 1994 Edition - Emission Generic Standard**
- **EN 5081-1 Standard - 1992 Edition - Emission Generic Standard**

Dortmund, 28. Mai 2001

Cay-Peter Voss, Managing Director

Technische Änderungen vorbehalten.
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We reserve the right to alter or amend
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without prior notice.

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