User Manual

Thermo Scientific Orion AQUAfast AQ3700

Portable Multiparameter Colorimeter

68X484003 • Revision C • March 2020

Thermo SCIENTIFIC

Important Note

Please read this user guide thoroughly before using your instrument. Any use outside of these instructions may invalidate the warranty and cause permanent damage to the instrument.

Contact Information

For assistance with Thermo Scientific™ Orion™ products, contact Technical Support by phone – within the United States call 1-800-225-1480 and outside the United States call +1-978-232-6000 or fax +1-978-232-6031 or email at wai.techservbev@thermofisher.com.

For additional product information, contact your local authorized dealer, local Thermo Scientific Orion technical sales representative or contact us using the Water and Laboratory Products (WLP) information on the page back of this manual.

Applications and Technical Resources

Visit www.thermoscientific.com/water to view Thermo Scientific Orion products and download product literature, user guides and manuals, software updates, and the latest application and technical resources.

The specifications, descriptions, drawings, ordering information and part numbers within this document are subject to change without notice.

Safety Precautions

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 reagents contain substances which are not entirely harmless environmentally. Be aware of the ingredients and take proper care when disposing of the test solution.

Caution: Read this user manual before unpacking, setting up or using the colorimeter. Read the method description completely before performing the test. Be aware of the risks of using the required reagents by reading the SDS (Safety Data Sheet). Failure could result in serious injury to the operator or damage to the instrument. SDS files are available on our website at www.thermoscientific.com/water.

Caution: The accuracy of the instrument is only valid if the instrument is used in an environment with controlled electromagnetic disturbances according to DIN 61326. Wireless devices, e.g. wireless phones, must not be used near the instrument.

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CHAPTER 1 # Colorimeter Introduction

Colorimeter Overview

Thermo Scientific™ Orion™ AQUAfast AQ3700 portable multiparameter colorimeter offers six wavelength options with wavelength auto-selection by preprogrammed method and over 90 preprogrammed methods for use with powder, tablet and liquid reagent chemistries, reaction tubes, COD digestion tubes and acid digestion tubes including nitrogen and phosphate nutrient testing. The colorimeter features a rugged, robust IP67-rated waterproof housing for on the go portability and a field carrying case to store all required testing equipment in one easy to transport package. The multi-language user interface allows customization of the meter in English, French, German, Indonesian, Italian, Polish, Portuguese and Spanish.

Packing List

Carefully inspect all items to ensure that all components are present and no visible damage has occurred during shipment. If there is any damage or something is missing, please contact Technical Support immediately.

- AQ3700 colorimeter
- 4 batteries (Type AA/LR 6)
- Round 24 mm vials with caps
- Round 16 mm vials with caps
- Adapter for 16 mm round vials
- Adapter for 13 mm round vials
- Vial cleaning brush
- Stirring rod, plastic
- User manual
- Guarantee declaration
- Certificate of compliance

Note: Colorimetric reagents must be purchased separately. Please visit www.thermoscientific.com/water to view our full offering of colorimetric reagents and colorimeter accessories.

Intended Use

Please read this reference guide thoroughly. Any use outside of these instructions may invalidate the colorimeter warranty and cause permanent damage to the colorimeter.

Important Steps for First Time Use

Before using the colorimeter, perform the following settings in the Mode Menu:

- Mode 10: Select language
- Mode 12: Set date and time
- Mode 34: Perform “Delete data”
- Mode 69: Perform “User m. init” to initialize the user polynomial system

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CHAPTER 2 # Colorimeter Setup

Installing the Batteries

Before working with the colorimeter, install the batteries. Before using the colorimeter, set the following mode menus: Mode 10: Select Language, Mode 12: Set Date and Time, Mode 34: Perform “Delete Data”, Mode 69: Perform “User M. Init” To Initialize User Polynomial System.

Important Note: The batteries are required to save data (stored results and colorimeter settings). When changing the batteries, the data in the colorimeter is saved for 2 minutes. If the change time exceeds 2 minutes, all stored data and settings are lost. It is recommended that a screwdriver and new batteries are read before beginning the battery replacement procedure.

Replacement of Batteries

1. Switch the instrument off.
2. If necessary, remove vial from the sample chamber.
3. Place the instrument upside down on a clean and even surface.
4. Unscrew the four screws (A) of the battery compartment cover (B).
5. Lift off battery compartment cover at the notch (C).
6. Remove old batteries (D).
7. Place four new batteries. **Ensure the correct polarity!**
8. Replace the battery compartment cover. Check the seal ring (E) of the notch to make sure it is tight-fitting.
9. Tighten the screws carefully.

Caution: Dispose of used batteries in accordance with all federal, state and local regulations.

Instrument (Explosion Drawing)

(A) Screws

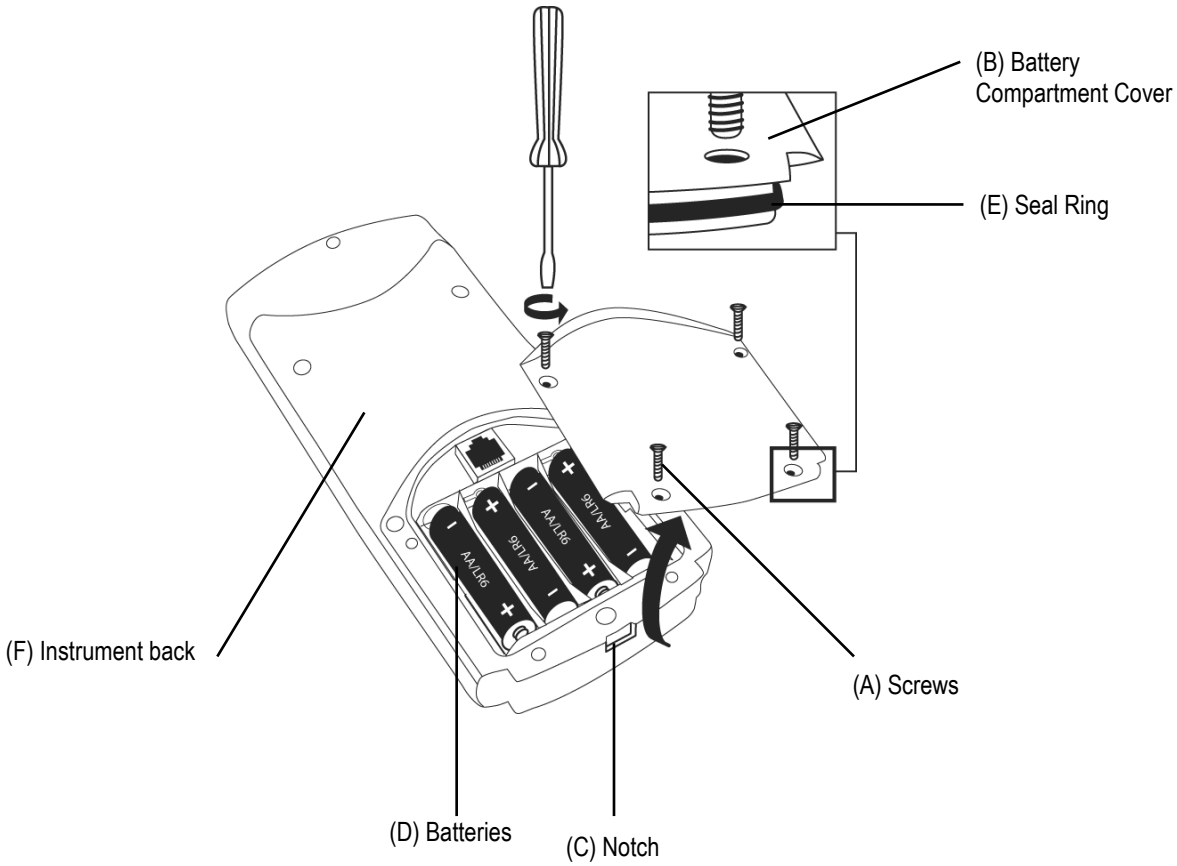
(B) Battery Compartment Cover

(C) Notch

(D) Batteries: 4 batteries (AA/LR6)

(E) Seal Ring

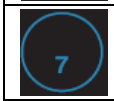
(F) Instrument back



Caution: To ensure that the instrument is water proof, the Seal Ring (E) must be in position and Battery Compartment Cover (B) must be fixed with the four screws.

Keypad Overview

To use the numeric keypad, press [Shift] key to access numeric keys 0-9 and keep [Shift] key pressed while pressing the desired numeric keys, for example, press [Shift] + [1] [1] keys to enter a value of “11”.

Key	Name	Function
	[F1]	Function key: description in onscreen text when key is active
	[F2]	Function key: description in onscreen text when key is active
	[F3]	Function key: description in onscreen text when key is active
	[Clock]	Display date and time or user countdown Enter a value of one (1) when using the numeric keypad: [Shift] + [1] keys
	[▲]	Move the cursor “>>” up Enter a value of two (2) when using the numeric keypad: [Shift] + [2] keys
	[Store]	Store the displayed test result Enter a value of three (3) when using the numeric keypad: [Shift] + [3] keys
	[Mode]	Access menu of meter settings and functions Enter a value of four (4) when using the numeric keypad: [Shift] + [4] keys
	[▼]	Move the cursor “>>” down Enter a value of five (5) when using the numeric keypad: [Shift] + [5] keys
	[Test]	Perform test procedure Enter a value of six (6) when using the numeric keypad: [Shift] + [6] keys
	[Esc]	Escape (ESC) to selection of methods or previous menu Enter a value of seven (7) when using the numeric keypad: [Shift] + [7] keys
	[↵]	Confirm action Enter a value of eight (8) when using the numeric keypad: [Shift] + [8] keys
	[Zero]	Perform zero procedure Enter a value of nine (9) when using the numeric keypad: [Shift] + [9] keys
	[Shift]	Access numeric keys 0-9, keep [Shift] key pressed while also pressing desired numeric keys, for example, press [Shift] + [1] [1] keys to enter a value of “11”
	[Decimal]	Decimal point Enter a value of zero (0) when using the numeric keypad: [Shift] + [0] keys
	[Power]	Switch the colorimeter on or off

Colorimeter Power Up and Basic Functions

1. Switch the colorimeter on by pressing [Power] key.
2. The colorimeter performs an electronic self-test.
3. The display will show:

Self test …

4. The colorimeter will proceed to the test method menu.

Important Note: The batteries are required to save data (stored results and colorimeter settings). When changing the batteries, the data in the colorimeter is saved for 2 minutes. If the change time exceeds 2 minutes, all stored data and settings are lost.

Important Steps for First Time Use: Before using the colorimeter, set the following mode menus: Mode 10: Select Language, Mode 12: Set Date and Time, Mode 34: Perform "Delete Data", Mode 69: Perform "User M. Init" To Initialize User Polynomial System.

Display Backlight

Press [Shift] + [F1] keys to turn the display backlight on or off. The backlight is switched off automatically during the measurement.

Automatic Switch Off

The colorimeter switches off automatically after 20 minutes. This is indicated 30 seconds before automatic switch off by a beeper. Press any key to avoid the colorimeter switching off. As long as the colorimeter is working (e.g. countdown or printing) the automatic switch off is inactive.

Displaying Time and Date

1. Press [Clock] key.
2. The display will show:

19:30:22 2012-06-15

3. After 15 seconds the meter reverts to the previous display automatically or press [↵] key.

User Countdown

With this function, operators are able to define their own countdown.

1. Press [Clock] key.
2. The display will show time and date:

```
19:30:22          2012-06-15
```

3. Press [Clock] key again. The display will show:

```
Countdown
mm : ss
99 : 59
```

4. Either press [↵] key to accept the last used user countdown or press [Shift] + number keys to enter a new value. The entry comprises two digits each. Enter minutes and seconds, e.g.: 2 minutes, 0 seconds = [Shift] + [0] [2] [0] [0].
5. Confirm with [↵] key. The display will show:

```
Countdown
    02:00
Start: ↵
```

6. Start countdown with [↵] key.
7. After countdown has finished the colorimeter reverts to the previous display automatically.

Colorimeter Mode Menu and Basic Settings

Before Using the Colorimeter

Before using the colorimeter, perform the following settings in the mode menu:

- Mode 10: Select language
- Mode 12: Set date and time
- Mode 34: Perform “Delete data”
- Mode 69: Perform “User m. init” to initialize the user polynomial system

Accessing the Mode Menu and Specific Modes

1. Press [Mode] key.

```
>> 10: Language
   11: Key-beep
   12: Clock
   13: Countdown
   14: Signal-beep
   20: Print
   21: Print, date
```

2. Select the desired mode number using one of the following procedures:
   a. Press arrow key [▼] or [▲] to select a mode number from the mode menu list.

```
   10: Language
>> 11: Key-beep
   12: Clock
   13: Countdown
   14: Signal-beep
   20: Print
   21: Print, date
```

   b. Press [Shift] key and numeric keys corresponding to the mode number: [1], [2], [3], [4], [5], [6], [7], [8], [9] and/or [0]. For example, press [Shift] + [1] [0] keys to enter mode number 10.

```
Mode: 10
```

3. Confirm with [↵] key.

Important Note: The batteries are required to save data (stored results and colorimeter settings). When changing the batteries, the data in the colorimeter is saved for 2 minutes. If the change time exceeds 2 minutes, all stored data and settings are lost.

Table of Mode Menu Functions

Mode Function	No.	Description
Language	10	Selecting language
Key beep	11	Switching the acoustic signal on/off to indicate key presses
Clock	12	Setting date and time
Countdown	13	Switching the countdown on/off to ensure reaction times
Signal-beep	14	Switching the acoustic signal on/off to indicate end of reading
Print	20	Printing all stored results
Print, date	21	Print only results of a selected time period
Print, code no.	22	Print only results of a selected Code No. range
Print, method	23	Print only results of one selected method
Printing parameters	29	Setting of printing options
Storage	30	Displaying all stored results
Storage, date	31	Displaying only results of a selected time period
Storage, code no.	32	Displaying only results of a selected Code No. range
Storage, method	33	Displaying only results of one selected method
Delete data	34	Deleting all stored results
Calibration	40	Special method calibration
User calibration	45	Storage of user calibration
Clear calibration	46	Deleting user calibration
Profi-Mode	50	Switching the detailed operator instructions on/off
One Time Zero	55	One Time Zero (OTZ)
Method list	60	User method list, adaption
Method list all on	61	User method list, switching on all methods
Method list all off	62	User method list, switching off all methods
User concentration	64	Entering the data necessary to run a user concentration method
User polynomials	65	Entering the data necessary to run a user polynomial
User methods clear	66	Delete all data of a user polynomial or of a concentration method
User methods print	67	Print out all data stored with mode 64 (concentration) or mode 65 (polynomial)
User methods init	69	Initialize the user method system (polynomial and concentration)
Langelier	70	Calculation of Langelier Saturation Index (Water Balance)
Temperature	71	Selection of °C or °F for Langelier Mode 70
LCD contrast	80	Setting the display contrast
LCD brightness	81	Setting the display brightness
System info	91	Information about the instrument e.g. current software version

Selecting a Language

1. Press [Mode] key.
2. Press [Shift] + [1] [0] keys.
3. Confirm with [↵] key. The display will show:

```
<Language>
    Deutsch
>> English
    Francais
    Italiano
    Espanol
```

4. Press arrow key [▼] or [▲] to select the required language from the displayed list.
5. Confirm with [↵] key.

Key Beep

1. Press [Mode] key.
2. Press [Shift] + [1] [1] keys.
3. Confirm with [↵] key. The display will show:

```
<Key-beep>
ON: 1, OFF: 0
                    ↵
```

4. Press [Shift] + [1] keys to turn on key beep or press [Shift] + [0] keys to turn off key beep.
5. Confirm with [↵] key.

Note: In the case of methods with reaction periods, an acoustic signal still sounds during the last 10 seconds of the countdown even if the key beep is switched off.

Setting Date and Time

1. Press [Mode] key.
2. Press [Shift] + [1] [2] keys.
3. Confirm with [↵] key. The display will show:

```
<Clock>
yy-mm-dd        hh:mm
_ _-_ _-_ _     _ _-_ _
```

4. The entry comprises two digits each.
5. Enter year, month and day, e.g.: 14 May 2006 = [Shift] + [0] [6] [0] [5] [1] [4].
6. Enter hours and minutes, e.g.: 3.07 p.m. = [Shift] + [1] [5] [0] [7]
7. Confirm with [↵] key.

Note: When confirming date and time with [↵] key, seconds are set to zero automatically.

Countdown (Ensuring Reaction Periods)

Some methods require a reaction period. This reaction period is incorporated in the method as standard with the countdown function. It is possible to switch the countdown off for all methods:

1. Press [Mode] key.
2. Press [Shift] + [1] [3] keys.
3. Confirm with [↵] key. The display will show:

```
<Countdown>
Actual:
    Switched on

ON: 1, OFF: 0
                    ↵
```

4. Press [Shift] + [1] key to turn on countdown or press [Shift] + [0] key to turn off countdown.
5. Confirm with [↵] key.

Note: It is possible to interrupt the working countdown by pressing the [↵] key (for example when performing serial analysis applications). The "user countdown" is also available if the countdown is switched off. If the countdown function is switched off, the operator is responsible for ensuring the necessary reaction period. **Non-compliance with reaction periods leads to incorrect test results.**

Signal Beep

Performing a zero or a measurement takes eight seconds. The colorimeter indicates the end of zeroing or measuring by a short beep.

1. Press [Mode] key.
2. Press [Shift] + [1] [4] keys.
3. Confirm with [↵] key. The display will show:

```
<Signal-beep>

ON: 1, OFF: 0

                    ↵
```

4. Press [Shift] + [1] keys to turn on the signal beep or press [Shift] + [0] keys to turn off the signal beep.
5. Confirm with [↵] key.

Note: In the case of methods with reaction periods, an acoustic signal still sounds during the last 10 seconds of the countdown even if the key beep is switched off.

Adjusting Display Contrast

1. Press [Mode] key.
2. Press [Shift] + [8] [0] keys.
3. Confirm with [↵] key. The display will show:

```
<LCD Contrast>
↑   ↓   Store   Test
+1  -1  +10     -10
                    ↵
0 …254: 185
```

4. Press arrow key [▲] to increase contrast one unit, press arrow key [▼] to decrease contrast one unit, press [Store] key to increase contrast ten units and press [Test] key to decrease contrast ten units. Repeat until the display contrast is at the preferred level.
5. Confirm with [↵] key.
6. The colorimeter will automatically return to the mode menu.

Adjusting Display Brightness

1. Press [Mode] key.
2. Press [Shift] + [8] [1] keys.
3. Confirm with [↵] key. The display will show:

```
<LCD Brightness>
↑   ↓   Store   Test
+1  -1  +10     -10
                    ↵
0 …254: 60
```

4. Press arrow key [▲] to increase brightness one unit, press arrow key [▼] to decrease brightness one unit, press [Store] key to increase brightness ten units and press [Test] key to decrease brightness ten units. Repeat until the brightness is at the preferred level.
5. Confirm with [↵] key.
6. The colorimeter will automatically return to the mode menu.

Displaying System Information

1. Press [Mode] key.
2. Press [Shift] + [9] [1] keys.
3. Confirm with [↵] key. The display will show:

```
<System Info>
Software:
V012.007.3.03.055


More: ↓ ,     Cancel: ESC
```

4. Press arrow key [▼] to display the number of performed tests and free memory capacity.
5. Press [Esc] key to return to the mode menu.

Printing Colorimeter Settings

Printing All Results

1. Press [Mode] key.
2. Press [Shift] + [2] [0] keys.
3. Confirm with [↵] key. The display will show:

```
<Print>
Print all data

Start: ↵
Cancel: ESC
```

4. Press [↵] key for printing out all stored test results.
5. The display will show, for example:

```
<Print>
Print all data

Cancel: ESC
Print
Test No.:          1
```

6. All stored data is printed out and the colorimeter returns to the mode menu automatically. It is possible to cancel the entry using [Esc] key.

Printing Results of a Selected Time Period

1. Press [Mode] key.
2. Press [Shift] + [2] [1] keys.
3. Confirm with [↵] key. The display will show:

```
<Print>
Sorted: date
From  yy-mm-dd
        _ _-_ _-_ _
```

4. Enter year, month and day for the first day of the required period, e.g.: 14 May 2006 = [Shift] + [0] [6] [0] [5] [1] [4].
5. Confirm with [↵] key. The display will show:

```
<Print>
Sorted: date
    To yy-mm-dd
        _ _-_ _-_ _
```

6. Enter year, month and day for the last day of the required period, e.g.: 19 May 2006 = [Shift] + [0] [6] [0] [5] [1] [4].
7. Confirm with [↵] key. The display will show:

```
<Print>
Sorted: date
```

```
From  2009-05-14
   To 2009-05-19
Start: ↵
Cancel: ESC
```

8. Press [↵] key and all stored results in the selected date range are printed and the colorimeter returns to the mode menu automatically. To cancel the entry, press [Esc] key.

Note: To print results of one day only, enter the same date twice to define the range.

Printing Results of a Selected Code No Range

1. Press [Mode] key.
2. Press [Shift] + [2] [2] keys.
3. Confirm with [↵] key. The display will show:

```
<Print>
Sorted: Code-No.
From _ _ _ _ _ _
```

4. Enter numeric code number (up to 6) for the first required Code No., e.g.: [Shift] + [1].
5. Confirm with [↵] key. The display will show:

```
<Print>
Sorted: Code-No.
From  1
   To _ _ _ _ _ _
```

6. Enter numeric code number (up to 6) for the last required Code No., e.g.: [Shift] + [1] [0].
7. Confirm with [↵] key. The display will show:

```
<Print>
Sorted: Code-No.
From  000001
   To 000010

Start: ↵
Cancel: ESC
```

8. Press [↵] key and all stored results in the selected code number range are printed and the colorimeter returns to the mode menu automatically. To cancel the entry, press [Esc] key.

Note: To print only results of one code number enter the same code number twice. To print all results without a code number (code number is 0) enter zero [0] twice.

Printing Results of One Selected Method

1. Press [Mode] key.
2. Press [Shift] + [2] [3] keys.
3. Confirm with [↵] key. The display will show:

```
<Print>
>> 20 Acid demand T
   35 Alkalinity-p T
   30 Alkalinity-tot T
   31 Alkal.-tot HR T
```

4. Press arrow key [▼] or [▲] to select the required method from the displayed list or enter the method number directly.
5. Confirm with [↵] key.
6. In case of differentiated methods, select the required kind of determination and confirm with [↵] key.
7. The display will show:

```
<Print>
Method
   30 Alkalinity-tot T

Start: ↵
Cancel: ESC
```

8. Press [↵] key and all stored results of the selected method are printed and the colorimeter returns to the mode menu automatically. It is possible to cancel the entry using [Esc] key.

Printing Parameter

1. Press [Mode] key.
2. Press [Shift] + [2] [9] keys.
3. Confirm with [↵] key. The display will show:

```
<Printing Parameter>

2: Baud rate

Cancel: ESC
```

4. Press [Shift] + [2] keys to select “Baud rate”. The display will show:

```
<Baud rate>
Is: 9600
Select: ▲ ▼:
Save: ↵
Cancel: ESC
```

5. Press arrow key [▲] or [▼] to select a baud rate from the list of 1200, 2400, 4800, 9600, 14400 or 19200.
6. Confirm with [↵] key and then exit with [Esc] key.

Recall / Delete Stored Results

Recall All Stored Results

1. Press [Mode] key.
2. Press [Shift] + [3] [0] keys.
3. Confirm with [↵] key. The display will show:

```
<Storage>
Display all data

Start: ↵      Cancel:   ESC
Print:  F3
Print all: F2
```

4. The stored data sets are displayed in chronological order, starting with the most recent stored test result. Press [↵] key and all stored results are displayed.
5. Press arrow key [▲] or [▼] to display the previous or following test result
6. Press [F3] key to print the displayed result or press [F2] key to print all results.
7. Exit with [Esc] key.

Recall Results of a Selected Time Period

1. Press [Mode] key.
2. Press [Shift] + [3] [1] keys.
3. Confirm with [↵] key. The display will show:

```
<Storage>
Sorted: date
From   yy-mm-dd
         _ _-_ _-_ _
```

4. Enter year, month and day for the first day of the required period, e.g.: 14 May 2006 = [Shift] + [0] [6] [0] [5] [1] [4].
5. Confirm with [↵] key. The display will show:

```
<Storage>
Sorted: date
    To yy-mm-dd
         _ _-_ _-_ _
```

6. Enter year, month and day for the last day of the required period, e.g.: 19 May 2006 = [Shift] +[0] [6] [0] [5] [1] [9].
7. Confirm with [↵] key. The display will show:

```
<Storage>
Sorted: date
From   2009-05-14
    To 2009-05-19
Start: ↵            cancel:  ESC
Print:  F3
Print all: F2
```

8. Press [↵] key and all stored results in the selected date range are displayed.

9. Press [F3] key to print the displayed result or press [F2] key to print all selected results.
10. Exit with [Esc] key.

Note: To recall only results of one day enter the same date twice to determine the time period.

Recall Results of a Selected Code No. Range

1. Press [Mode] key.
2. Press [Shift] + [3] [2] keys.
3. Confirm with [↵] key. The display will show:

```
<Storage>
Sorted: Code-No.
From  _ _ _ _ _ _
```

4. Enter numeric code number (up to 6) for the first required Code No., e.g.: [Shift] + [1].
5. Confirm with [↵] key. The display will show:

```
<Storage>
Sorted:  Code-No.
From  1 _ _ _ _ _
    To _ _ _ _ _ _
```

6. Enter numeric code number (up to 6) for the last required Code No., e.g.: [Shift] + [1] [0].
7. Confirm with [↵] key. The display will show:

```
<Storage>
Sorted:  Code-No.
From  000001
    To 000010
Start: ↵          cancel:  ESC
Print:  F3
Print all: F2
```

8. Press [↵] key and all stored results in the selected Code No. range are displayed.
9. Press [F3] key to print the displayed result or press [F2] key to print all selected results.
10. Exit with [Esc] key.

Note: To recall only results of one code number enter the same code number twice. To recall all results without code number (code number is 0) enter zero [0] twice.

Recall Results of One Selected Method

1. Press [Mode] key.
2. Press [Shift] + [3] [3] keys.
3. Confirm with [↵] key. The display will show:

```
<Storage>
>> 20 Acid demand T
   35 Alkalinity-p T
   30 Alkalinity-tot T
   31 Alkal.-tot HR T
```

4. Press arrow key [▼] or [▲] to select the required method from the displayed list or enter the method number directly.
5. Confirm with [↵] key.
6. In case of differentiated methods, select the required kind of determination and confirm with [↵] key.
7. The display will show:

```
<Storage>
Method
    30  Alkalinity-tot T

Start: ↵          cancel:  ESC
Print:  F3
Print all: F2
```

8. Press [↵] key and all stored results of the selected method are displayed.
9. Press [F3] key to print the displayed result or press [F2] key to print all selected results.
10. Exit with [Esc] key.

Delete Stored Results

1. Press [Mode] key.
2. Press [Shift] + [3] [4] keys.
3. Confirm with [↵] key. The display will show:

```
<Delete data>
Delete all data?

YES: 1,  NO: 0
```

4. Press [Shift] + [1] keys to delete stored data or press [Shift] + [0] keys to retain stored data.
5. After pressing [Shift] + [1] keys, The display will show:

```
<Delete data>
Delete data:      ↵

Do not delete:    ESC
```

6. Press [↵] key to delete all stored data or press [Esc] key to cancel without deleting data.

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CHAPTER 3 # Colorimeter Operation

Customizing the Methods List

Setting the Methods List

When the colorimeter is switched on, it displays the methods list, a list of available colorimetric test methods. The methods list can be customized to show only the test methods of interest for easier navigation through a shortened list.

1. Press [Mode] key.
2. Press [Shift] + [6] [0] keys.
3. Confirm with [↵] key. The display will show:

```
<Method list>
Selected: •
Toggle: F2
Save: ↵
Cancel: ESC
                    ↵
```

4. Press [↵] key to access the methods list. The display will show:

```
<Method list>
>> 20 • Acid demand T
   35 • Alkalinity-p T
   30 • Alkalinity-tot T
   31 • Alkal.-tot HR T
   40 • Aluminum T
   50 • Aluminum PP
```

   a. The >> icon indicates the selected line.
   b. The • icon indicates the test method will be actively shown on the methods list.

5. Press arrow key [▼] or [▲] to select the desired test method and press [F2] to toggle the test method on (• next to test) or off (• not shown next to test) the methods list.
6. Press [↵] key when finished customizing the methods list and then exit with [Esc] key.

Resetting the Methods List (Selecting All Methods)

1. Press [Mode] key.
2. Press [Shift] + [6] [1] keys.
3. Press [↵] key.
4. Press [Shift] + [1] keys.

Deselecting All Methods on the Methods List

Deselect all methods using this procedure and then customize the list by selecting a few test methods to be shown, as described in the Setting the Methods List section.

1. Press [Mode] key.
2. Press [Shift] + [6] [2] keys.
3. Press [↵] key.
4. Press [Shift] + [1] keys.

Reduced Operator Guidance: "Profi-Mode"

This function may be used for routine analyses with many samples of one method. The following information is always stored in the methods:

a. Method
b. Range
c. Date and time
d. Differentiation of results
e. Detailed operator instruction
f. Compliance with reaction periods

If the Profi-Mode is active, the colorimeter provides only a minimum of operator instructions. The criteria specified above in D, E, F are no longer included.

1. Press [Mode] key.
2. Press [Shift] + [5] [0] keys.
3. Confirm with [↵] key. The display will show:

```
<Profi-Mode>
Actual:
    Switched off

ON: 1, OFF: 0
                    ↵
```

4. Press [Shift] + [1] keys to turn on the Profi-Mode or press [Shift] + [0] keys to turn off the Profi-Mode.
5. Confirm with [↵] key.

Note: Storage of test results is possible. When results are stored the display also shows "Profi-Mode".

One Time Zero (OTZ) Function

List of Methods and OTZ Compatibility

Method	Parameter	OTZ
20	Acid Demand pH 4.3	Yes
35	Alkalinity-P	Yes
30	Alkalinity-M	Yes
31	Alkalinity-M HR	Yes
40	Aluminum	Yes
50	Aluminum	---
60	Ammonia	Yes
62	Ammonia	---
65	Ammonia LR	---
66	Ammonia HR	---
85	Boron	Yes
80	Bromine	Yes
81	Bromine	Yes
63	Chloramine (Mono)	Yes
90	Chloride	Yes
92	Chloride	Yes
100	Chlorine, F&T	Yes
101	Chlorine, F&T	Yes
110	Chlorine, F&T	Yes
103	Chlorine, F&T, HR	Yes
111	Chlorine, F&T, HR	---
105	Chlorine, T, HR (KI)	---
120	Chlorine Dioxide	Yes
122	Chlorine Dioxide	Yes
125	Chromium	---
130	COD LR	---
131	COD MR	---
132	COD HR	---
204	Color Pt-Co	---
150	Copper, F&T	Yes
151	Copper, F&T	Yes
153	Copper, Free	Yes
160	Cyanuric Acid (CyA)	Yes
157	Cyanide	Yes
165	DEHA	Yes
167	DEHA	---
170	Fluoride	Yes
210	H_2O_2	Yes
213	H_2O_2 LR	---
214	H_2O_2 HR	---
190	Hardness, Calcium	---
191	Hardness, Ca, LR	Yes
200	Hardness, Total	Yes
201	Hardness, T, HR	Yes
205	Hydrazine	Yes
206	Hydrazine	---
207	Hydrazine	---
215	Iodine	Yes
220	Iron (II & III)	Yes
222	Iron	Yes
223	Iron TPTZ	---
225	Iron LR	Yes
226	Iron LR 2	Yes
227	Iron HR	Yes
240	Manganese	Yes
242	Manganese LR	---
243	Manganese HR	Yes
245	Manganese	Yes
250	Molybdate	Yes
251	Molybdate LR	Yes
252	Molybdate HR	Yes
254	Molybdate HR	Yes
257	Nickel	Yes
260	Nitrate	Yes
265	Nitrate	---
270	Nitrite	Yes
272	Nitrite	Yes
280	Nitrogen, Total LR	---
281	Nitrogen, Total HR	---
290	Oxygen, Active	Yes
292	Oxygen, Dissolved	---
300	Ozone (DPD)	Yes
70	PHMB	Yes
320	Phosphate Orth LR	Yes
321	Phosphate Orth HR	Yes
323	Phosphate, Ortho	Yes
324	Phosphate, Ortho	---
325	Phosphate, Hydr	---
326	Phosphate, Total	---
327	Phosphate, Ortho 1	---
328	Phosphate, Ortho 2	---
334	Phosphate LR	Yes
335	Phosphate HR	Yes
316	Phosphonate	---
329	pH-Value LR	Yes
330	pH-Value	Yes
331	pH-Value	Yes
332	pH-Value HR	Yes
338	Polyacrylate	Yes
340	Potassium	Yes
350	Silica	Yes
351	Silica LR	---
352	Silica HR	Yes
353	Silica	Yes
212	Sodium Hypochl.	Yes
355	Sulfate	Yes
360	Sulfate	Yes
365	Sulfide	Yes
370	Sulfite	Yes
384	Suspended Solids	---
388	Triazole	Yes
386	Turbidity	---
390	Urea	Yes
400	Zinc	---
405	Zinc	Yes

One Time Zero function is available for all methods in which a zero procedure is performed using a 24 mm round vial with sample water. The One Time Zero function can be used for different tests, as long as the tests are performed with the same sample water and under the same test conditions. When changing the method, it is not necessary to perform a new zero procedure – the test can be carried out straight away.

When the colorimeter is first being used for an OTZ compatible method and One Time Zero is activated, the colorimeter will request a new zero procedure by displaying “Prepare OT-Zero”. Perform the zero procedure as described in the method. This zero will be stored and used for all methods with OTZ function until the colorimeter is powered off. If necessary, a new zero procedure can be performed by pressing [Zero] key at any time.

1. Press [Mode] key.
2. Press [Shift] + [5] [5] keys.
3. Confirm with [↵] key. The display will show:

```
<One Time Zero>
Actual:
    Switched off

ON: 1, OFF: 0
                    ↵
```

4. Press [Shift] + [1] keys to turn on the OTZ or press [Shift] + [0] keys to turn off the OTZ.
5. Confirm with [↵] key.

Note: The specified accuracy is valid for all test results when the zero procedure is performed for each test (One Time Zero function is switched off).

Using the Methods List

Accessing the Methods List

When the colorimeter is switched on, it displays the methods list. When a different operation is being displayed, press [Esc] key until the colorimeter displays the methods list.

```
>> 20 Acid demand T
   35 Alkalinity-p T
   30 Alkalinity-tot T
   31 Alkal.-tot HR T
   40 Aluminum T
   50 Aluminum PP
   60 Ammonium PP
```

1. Press arrow key [▼] or [▲] to select a test method from the methods list.
2. Press [F1] key to switch between the list and detailed info on the selected test method.

```
100 Chlorine T
0.01-6 mg/l Cl2
Tablet
24 mm
DPD No 1
DPD No 3
```

Line 1: Method Number, Method Name
Line 2: Range
Line 3: Reagent Type
Line 4: Vial Size
Line 5-7: Reagents Used, tube = reagent vial used in tube test

3. Press [F2] key to switch between the methods list and detailed list of available chemical species and corresponding ranges for the selected test method. To change the chemical species, refer to the Changing Chemical Species section.

```
320 Phosphate LR T
0.05-4 mg/l PO4
0.02-1.3 mg/l P
0.04-3 mg/l P2O5
```

Line 1: Method Number, Method Name
Line 2: Range with Chemical Species 1
Line 3: Range with Chemical Species 2
Line 4: Range with Chemical Species 3

Running a Test from the Methods List

1. When viewing the methods list, there are two ways to run a test method:
   a. Enter method number directly, e.g.: [Shift] + [8] [0] to select bromine.
   b. Press arrow key [▼] or [▲] to select the required method from the displayed list.
2. Confirm with [↵] key.
3. Refer to the Methods section for detailed instructions for each test method.

Differentiation in Methods

Differentiation is possible for some tests. Select the determination type before running the test.

1. When viewing the methods list, press [Shift] + [1] [0] [0] keys.
2. Confirm with [↵] key. The display will show:

```
Chlorine T
>> Diff
   Free
   Total
                    ▲ ▼ ↵
```

3. Press arrow key [▼] or [▲] to select the required determination.
4. Confirm with [↵] key.

Performing Zero in Methods

1. The display will show:

```
Prepare Zero
Press ZERO
```

2. Prepare a clean vial as described in the individual method instructions and place the vial into the sample chamber, making sure that the Δ marks are aligned.
3. Press [Zero] key.
4. The display will show:

```
Zero accepted
Prepare Test
Press TEST
```

Performing Test in Methods

1. When zero calibration is complete, remove the vial from the sample chamber and perform the test procedure as described in the individual method instructions.
2. When the results have been displayed:
    a. With some methods, you can change between different chemical species.
    b. Store and/or print the results.
    c. Perform further analysis with the same zero.
    d. Select a new method.

Reaction Periods (Countdown) in Methods

To ensure compliance with reaction periods, a time delay (the countdown) is incorporated into required test procedures. There are two kinds of countdowns:

```
Countdown
   2:00
Start: ↵
```

- Press [↵] key.
  Prepare water sample, start countdown with [↵] key and proceed as described in the individual method instructions. The vial must not be placed in the sample chamber.
- Press [Test] key.
  Prepare the water sample as described in the individual method instructions and Place the vial into the sample chamber. The display will show the countdown by pressing [Test] key and the countdown is started automatically. After the reaction period is finished the measurement starts automatically.

```
Countdown
    1:59
```

Notes:

- It is possible to end the working countdown by pressing the [↵] key and the reading will start immediately. In this case, the operator is responsible for ensuring the necessary reaction period. **Non-compliance with reaction periods leads to incorrect test results.**
- The time remaining is displayed continuously. The beeper indicates the last 10 seconds.

Changing Chemical Species in Methods

For some methods, there is a possibility to change the chemical species of the test result. When the test result is displayed, press arrow key [▼] or [▲]. For example:

320 Phosphate LR T 0.05-4 mg/l PO_4	[▼] →	320 Phosphate LR T 0.02-1.3 mg/l P	← [▼]	320 Phosphate LR T 0.04-3 mg/l P_2O_5
1.00 mg/l PO_4	← [▲]	0.33 mg/l P	[▲] →	0.75 mg/l P_2O_5

If the species of a test result is changed, the displayed range is adjusted automatically. For an already stored result, it is not possible to change the chemical species. The last displayed chemical species is saved and will be displayed if this method is used the next time. The arrows indicate the available chemical species and are included with the method instructions.

Storing Results in Methods

1. Press [Store] key while the test result is displayed.
2. The display will show:

```
Code-No.:
_ _ _ _ _ _
```

3. Enter a numeric code up to 6 places. The Code Number can contain references to the operator or the sampling location. After entering, confirm with [↵] key.
   a. If a code number is not necessary, confirm by pressing [↵] directly. The assignment for the Code No. is then 0 automatically.
4. The entire data set is stored with date, time, code number, method and test result.
5. The display will show:

Stored!

6. The test result is then shown again.

Notes:

- The display will show the number of free data sets.

Storage: 900
Free records left

- If there are, less than 30 data sets free, The display will show:

Storage: only 29
Free records left

Clear the memory as soon as possible, see the Deleting Stored Results section. If memory capacity is used up, it is impossible to save additional test results.

Printing Results (Infra-Red Interface Module – Optional)

If the IRIM module is switched on and printer is connected, it is possible to print out the test results without saving beforehand. Refer to the Data Transfer section for additional information.

1. Press [F3] key.
2. The entire data set is printed with date, time, code number, method and test result.
3. The test number is an internal number that is set automatically if a test result is stored. It appears only on the print out.

Performing Additional Measurements

1. Press [Test] key to perform additional tests using the same method. The display will show:

Zero accepted
Prepare Test
Press TEST

2. Confirm with the [Test] key or press [Zero] key to perform a new zero calibration.
3. If performing a new zero calibration is selected, The display will show:

Prepare Zero
Press ZERO

Selecting a New Method

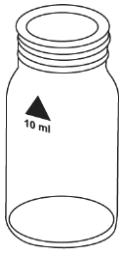
1. Press [Esc] key to return to the methods list.
2. Enter method number directly, e.g.: [Shift] + [8] [0] to select Bromine, or press arrow key [▼] or [▲] to select the required method from the displayed list.
3. Confirm with [↵] key.

4

CHAPTER 4 Methods

Thermo Scientific Orion AQUAfast AQ3700 colorimeters contain over 100 test methods for use with Thermo Scientific Orion AQUAfast colorimetric reagents and additional common reagent chemistries. Test methods automatically load test parameter settings required to run specific reagent chemistries on the colorimeter, including wavelength, vial path length, concentration equation, measurement units and reaction times.

Test methods use a specific vial size (path length) in the concentration equations and the vial size specified in these instructions must be used for accurate analysis. The majority of AQUAfast reagent methods use a 24mm round vial, Cat. No. AC2V24 or 16mm round vial, Cat. No. AC2V16. Other vial sizes are noted in the individual reagent chemistry instructions.



Example 24 mm Round Vial

Example 16 mm Round Vial

Table of Methods

The following table lists the available test methods as shown in the colorimeter's methods list. LR = low range; MR = middle range; HR = high range. Wavelength (λ) values are shown in nm. Refer to the Customizing the Methods List section for instructions on modifying the methods list.

#	Parameter	Range	Units	Reagent	Vial	Method	λ	Reagent P/N
20	Acid Demand to pH 4.3	0.1-4	mmol/l	Tablet	24 mm	Acid / Indicator [1,2,5]	610	AC2002
35	Alkalinity-P	5-300	mg/l $CaCO_3$	Tablet	24 mm	Acid / Indicator [1,2,5]	560	AC3002P
30	Alkalinity-M (Total)	5-200	mg/l $CaCO_3$	Tablet	24 mm	Acid / Indicator [1,2,5]	610	AC2002
31	Alkalinity-M (Total) HR	5-500	mg/l $CaCO_3$	Tablet	24 mm	Acid / Indicator [1,2,5]	610	---
40	Aluminum	0.01-0.3	mg/l Al	Tablet	24 mm	Eriochrome Cyanine R [2]	530	AC2027
50	Aluminum	0.01-0.25	mg/l Al	Powder & Liquid	24 mm	Eriochrome Cyanine R [2]	530	AC4P27
60	Ammonia	0.02-1	mg/l N	Tablet	24 mm	Indophenol blue [2,3]	610	AC2012
62	Ammonia	0.01-0.8	mg/l N	Powder	24 mm	Salicylate [2]	660	AC4P12
65	Ammonia LR	0.02-2.5	mg/l N	Tube Test	16 mm	Salicylate [2]	660	ACR012
66	Ammonia HR	1-50	mg/l N	Tube Test	16 mm	Salicylate [2]	660	ACR011
85	Boron	0.1-2	mg/l B	Tablet	24 mm	Azomethine [3]	430	AC3089
80	Bromine	0.05-13	mg/l Br_2	Tablet	24 mm	DPD [5]	530	AC2035
81	Bromine	0.05-4.5	mg/l Br_2	Powder	24 mm	DPD [5]	530	AC4P71
63	Chloramine (Mono)	0.04-4.5	mg/l Cl_2	Powder & Liquid	24 mm	Indophenol	660	---
90	Chloride	0.5-25	mg/l Cl^-	Tablet	24 mm	Silver Nitrate / Turbidity	530	AC2017
92	Chloride	0.5-20	mg/l Cl^-	Liquid	24 mm	Mercurythiocyanate/Iron Nitrate	430	---
100	Chlorine, Free & Total	0.01-6	mg/l Cl_2	Tablet	24 mm	DPD [1,2,3]	530	AC2070 / 71 / 72
101	Chlorine, Free & Total	0.02-4	mg/l Cl_2	Liquid	24 mm	DPD [1,2,3]	530	---
110	Chlorine, Free & Total	0.02-2	mg/l Cl_2	Powder	24 mm	DPD [1,2]	530	AC4P71 / 72
103	Chlorine, Free & Total, HR	0.1-10	mg/l Cl_2	Tablet	24 mm	DPD [1,2,3]	530	---
111	Chlorine, Free & Total, HR	0.1-8	mg/l Cl_2	Powder	10 mm	DPD [1,2]	530	AC4P71 / 72
105	Chlorine, Total, HR (KI)	5-200	mg/l Cl_2	Tablet	16 mm	KI / Acid [5]	530	AC3072
120	Chlorine Dioxide	0.02-11	mg/l ClO_2	Tablet	24 mm	DPD, Glycine [1,2]	530	AC2099, AC3048
122	Chlorine Dioxide	0.04-3.8	mg/l ClO_2	Powder	24 mm	DPD [1,2]	530	AC4P71
125	Chromium	0.02-2	mg/l Cr	Powder	16 mm	1,5-Diphenylcarbohydrazide[1,2]	530	---
130	COD LR	0-150	mg/l O_2	Tube Test	16 mm	Dichromate / H_2SO_4 [1,2]	430	CODL00
131	COD MR	0-1500	mg/l O_2	Tube Test	16 mm	Dichromate / H_2SO_4 [1,2]	610	CODH00
132	COD HR	0-15	g/l O_2	Tube Test	16 mm	Dichromate / H_2SO_4 [1,2]	610	CODHP0
204	Color Pt-Co	0-500	Pt-Co units	Direct	24 mm	Pt-Co-Scale [1,2] (APHA)	430	Direct Reading
150	Copper, Free & Total	0.05-5	mg/l Cu	Tablet	24 mm	Biquinoline [4]	560	AC2029
151	Copper, Free & Total	0.05-4	mg/l Cu	Powder & Liquid	24 mm	Bicinchoninate	560	---
153	Copper, Free	0.05-5	mg/l Cu	Powder	24 mm	Bicinchoninate	560	AC4P29
160	Cyanuric Acid (CyA)	0-160	mg/l CyA	Tablet	24 mm	Melamine	530	AC2098

#	Parameter	Range	Units	Reagent	Vial	Method	λ	Reagent P/N
157	Cyanide	0.01-0.5	mg/l CN	Powder & Liquid	24 mm	Pyridine-barbituric acid [1]	580	AC4P06
165	DEHA	20-500	µg/l DEHA	Tablet & Liquid	24 mm	PPST [3]	560	AC3088
167	DEHA	20-500	µg/l DEHA	Powder & Liquid	24 mm	PPST [3]	560	AC4P88
170	Fluoride	0.05-2	mg/l F	Liquid	24 mm	SPADNS [2]	580	AC2009
210	Hydrogen Peroxide	0.03-3	mg/l H_2O_2	Tablet	24 mm	DPD / catalyst [5]	530	AC3069
213	Hydrogen Peroxide LR	1-50	mg/l H_2O_2	Liquid	16 mm	Titanium tetrachloride / acid	430	---
214	Hydrogen Peroxide HR	40-500	mg/l H_2O_2	Liquid	16 mm	Titanium tetrachloride / acid	560	---
190	Hardness, Calcium	50-900	mg/l $CaCO_3$	Tablet	24 mm	Murexide [4]	560	AC3032C
191	Hardness, Calcium, LR	0-500	mg/l $CaCO_3$	Tablet	24 mm	Murexide [4]	560	AC3032C2
200	Hardness, Total	2-50	mg/l $CaCO_3$	Tablet	24 mm	Metallphthalein [3]	560	AC3032T
201	Hardness, Total, HR	20-500	mg/l $CaCO_3$	Tablet	24 mm	Metallphthalein [3]	560	AC3032T
205	Hydrazine	0.05-0.5	mg/l N_2H_4	Powder	24 mm	4-(Dimethyl- amino)- benzaldehyde [3]	430	AC2030
206	Hydrazine	0.005-0.6	mg/l N_2H_4	Liquid	24 mm	4-(Dimethyl-amino)-benzaldehyde [3]	430	AC3030LQ
207	Hydrazine	0.01-0.7	mg/l N_2H_4	Ampoule	13 mm	PDMAB	430	---
215	Iodine	0.05-3.6	mg/l I	Tablet	24 mm	DPD [5]	530	AC2071
220	Iron (II & III)	0.02-1	mg/l Fe	Tablet	24 mm	PPST [3]	560	AC2078
222	Iron	0.02-3	mg/l Fe	Powder	24 mm	1,10-Phenantroline [3]	530	AC4P78
223	Iron TPTZ	0.02-1.8	mg/l Fe	Powder	24 mm	TPTZ	580	AC4P79
225	Iron LR	0.03-2	mg/l Fe	Liquid	24 mm	Ferrozine / Thioglycolate	580	---
226	Iron LR 2	0.03-2	mg/l Fe	Liquid	24 mm	Ferrozine / Thioglycolate	560	---
227	Iron HR	0.1-10	mg/l Fe	Liquid	24 mm	Thioglycolate	530	---
240	Manganese	0.2-4	mg/l Mn	Tablet	24 mm	Formaldoxime	530	AC2055
242	Manganese LR	0.01-0.7	mg/l Mn	Powder & Liquid	24 mm	PAN	560	AC4P54
243	Manganese HR	0.1-18	mg/l Mn	Powder	24 mm	Periodate oxidation [2]	530	AC4P55
245	Manganese	0.5-5	mg/l Mn	Liquid	24 mm	Formaldoxime	430	---
250	Molybdate	1-50	mg/l MoO_4	Tablet	24 mm	Thioglycolate [4]	430	---
251	Molybdate LR	0.05-5	mg/l MoO_4	Powder	24 mm	Mercaptoacetic acid	610	---
252	Molybdate HR	0.5-66	mg/l MoO_4	Powder	24 mm	Mercaptoacetic acid	430	AC4P42
254	Molybdate HR	1-100	mg/l MoO_4	Liquid	24 mm	Thioglycolate [4]	430	---
257	Nickel	0.1-10	mg/l Ni	Tablet	24 mm	Nioxime	560	---
260	Nitrate	0.08-1	mg/l N	Tablet & Powder	24 mm	Zinc reduction / NED	530	---
265	Nitrate	1-30	mg/l N	Tube Test	16 mm	Chromotropic acid	430	ACR007
270	Nitrite	0.01-0.5	mg/l N	Tablet	24 mm	N-(1-Naphthyl)- ethylendiamine [2,3]	560	AC2046
272	Nitrite	0.01-0.3	mg/l N	Powder	24 mm	Diazotization	530	AC4P46
280	Nitrogen, Total LR	0.5-25	mg/l N	Tube Test	16 mm	Persulfate digestion	430	ACD004
281	Nitrogen, Total HR	5-150	mg/l N	Tube Test	16 mm	Persulfate digestion	430	ACD007
290	Oxygen, Active	0.1-10	mg/l O_2	Tablet	24 mm	DPD	530	AC2072
292	Oxygen, Dissolved	10-800	µg/l O_2	Ampoule	13 mm	Rhodazine D	530	---

#	Parameter	Range	Units	Reagent	Vial	Method	λ	Reagent P/N
300	Ozone (DPD)	0.02-2	mg/l O_3	Tablet	24 mm	DPD / Glycine [5]	530	AC3048
70	PHMB	2-60	mg/l PHMB	Tablet	24 mm	Buffer / Indicator	560	---
320	Phosphate, Ortho, LR	0.05-4	mg/l PO_4	Tablet	24 mm	Ammonium-molybdate [2,3]	660	AC2095-WA
321	Phosphate, Ortho, HR	1-80	mg/l PO_4	Tablet	24 mm	Vanando-molybdate [2]	430	AC2096
323	Phosphate, Ortho	0.06-2.5	mg/l PO_4	Powder	24 mm	Molybdate / Ascorbic Acid [2]	660	AC4P95
324	Phosphate, Ortho	0.06-5	mg/l PO_4	Tube Test	16 mm	Molybdate / Ascorbic acid [2]	660	ACR095
325	Phosphate, Hydrolysable	0.02-1.6	mg/l P	Tube Test	16 mm	Acid Digestion, Ascorbic Acid [2]	660	ACD095AH
326	Phosphate, Total	0.02-1.1	mg/l P	Tube Test	16 mm	Acid Persulfate Digestion, Ascorbic Acid [2]	660	ACD095
327	Phosphate, Ortho 1	5-40	mg/l PO_4	Ampoule	13 mm	Vanado-molybdate [2]	430	---
328	Phosphate, Ortho 2	0.05-5	mg/l PO_4	Ampoule	13 mm	Stannous chloride [2]	660	---
334	Phosphate LR	0.1-10	mg/l PO_4	Powder & Liquid	24 mm	Phosphomolybdic Acid, Ascorbic Acid	660	---
335	Phosphate HR	5-80	mg/l PO_4	Liquid	24 mm	Vanadomolybdate	430	---
316	Phosphonate	0-125	mg/l PO_4	Powder	24 mm	Persulfate UV-Oxidation	660	---
329	pH-Value LR	5.2-6.8	pH	Tablet	24 mm	Bromocresol Purple [5]	560	AC3001BP
330	pH-Value	6.5-8.4	pH	Tablet	24 mm	Phenol Red [5]	560	AC2001
331	pH-Value	6.5-8.4	pH	Liquid	24 mm	Phenol Red [5]	560	AC3001
332	pH-Value HR	8.0-9.6	pH	Tablet	24 mm	Thymol Blue [5]	560	AC3001TB
338	Polyacrylate	1-30	mg/l Polyacryl	Liquid	24 mm	Turbidity	660	---
340	Potassium	0.7-12	mg/l K	Tablet	24 mm	Tetraphenylborate-Turbidity [4]	430	AC3019
350	Silica	0.05-4	mg/l SiO_2	Tablet	24 mm	Silicomolybdate [2,3]	660	AC2060, AC2061
351	Silica LR	0.1-1.6	mg/l SiO_2	Powder & Liquid	24 mm	Heteropolyblue [2]	660	---
352	Silica HR	1-90	mg/l SiO_2	Powder	24 mm	Silicomolybdate [2]	430	AC4P60
353	Silica	0.1-8	mg/l SiO_2	Powder & Liquid	24 mm	Heteropolyblue [2]	660	---
212	Sodium Hypochlorite	0.2-16	% NaOCl	Tablet	24 mm	Potassium Iodide [5]	530	AC3072
355	Sulfate	5-100	mg/l SO_4	Tablet	24 mm	Bariumsulfate-Turbidity	610	AC2082
360	Sulfate	5-100	mg/l SO_4	Powder	24 mm	Bariumsulfate-Turbidity[2]	530	AC4P82
365	Sulfide	0.04-0.5	mg/l S	Tablet	24 mm	DPD / Catalyst [3,4]	660	AC2016
370	Sulfite	0.1-5	mg/l SO_3	Tablet	24 mm	DTNB	430	---
384	Suspended Solids	0-750	mg/l TSS	Direct	24 mm	Photometric	660	Direct Reading
388	Triazole	1-16	mg/l Benzo	Powder	24 mm	Catalyzed UV Photolysis	430	---
386	Turbidity	0-1000	FAU	Direct	24 mm	Attenuated Radiation Method	530	Direct Reading
390	Urea	0.1-2.5	mg/l Urea	Tablet & Liquid	24 mm	Indophenol / Urease	610	---
400	Zinc	0.02-1	mg/l Zn	Tablet	24 mm	Zincon [3]	610	AC2065
405	Zinc	0.1-2.5	mg/l Zn	Powder & Liquid	24 mm	Zicon / EDTA	610	---

Literature References

The reagent formulations are based on internationally recognized test methods. Some are described in national and/or international guidelines.

1. Deutsche Einheitsverfahren zur Wasser-, Abwasser- und Schlammuntersuchung
2. Standard Methods for the Examination of Water and Wastewater; 18th Edition, 1992
3. Photometrische Analysenverfahren, Schwedt, Wissenschaftliche Verlagsgesellschaft mbH, Stuttgart 1989
4. Photometrische Analyse, Lange / Vejdelek, Verlag Chemie 1980
5. Colorimetric Chemical Analytical Methods, 9th Edition, London

Equivalent Terms for Searching Methods

Active oxygen	=	Oxygen, activ
Alkalinity-m	=	Alkalinity, total
Biguanide	=	PHMB
Calcium hardness	=	Hardness, calcium
Cyanuric acid	=	CyA-TEST
H_2O_2	=	Hydrogen peroxide
Monochloramine	=	Chloramine, mono
m-Value	=	Alkalinity, total
p-Value	=	Alkalinity-p
Silicon dioxide	=	Silica
Total alkalinity	=	Alkalinity, total
Total Hardness	=	Hardness, total
Langelier Saturation Index (Water Balance)	=	Mode function 70

Reagent Test Method Instructions

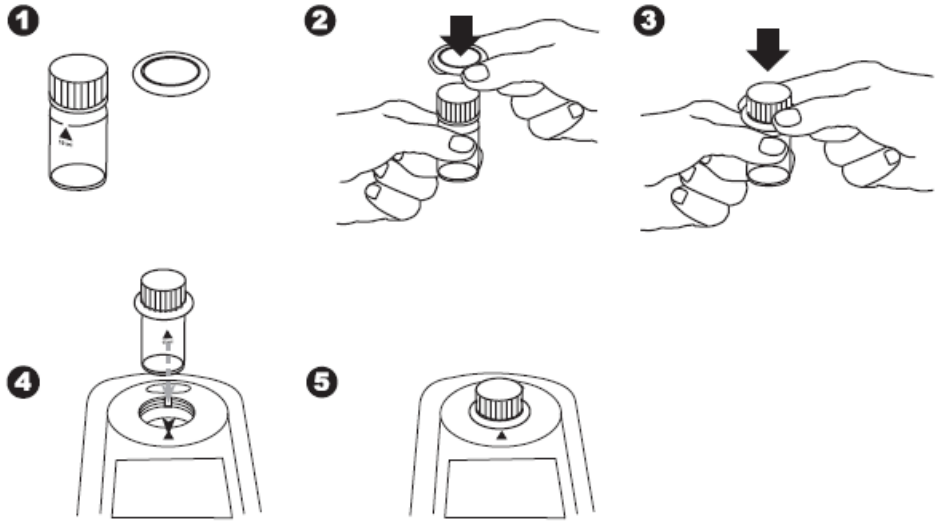
The measurement ranges specified in the following test procedures are based on standard solutions measured under ideal conditions. These ranges may vary due to the type of sample being measured, since various interferences can have a major influence on the accuracy of the method. Due to the fact that each sample is different, the only way to check the tolerance (precision) is the Standard Additions Method. According to this method, first the original sample is tested. Then further samples (2 to 4) are taken and small amounts of a standard solution are added and further results are obtained. The amounts added range from approximately half, up to double the amount present in the sample itself. These supplementary results make it possible to estimate the actual concentration of the original sample by comparison.

Test methods and ranges are subject to change without notice. For a list of the most up-to-date test methods, visit www.thermoscientific.com/water.

Recommendations for Avoiding Measurement Errors

- Thoroughly clean vials, caps and stir rods after each analysis in order to prevent carryover errors. Even minute reagent residues lead to incorrect measurements.
- Ensure that the outer walls of the vials are dry and clean before performing the analysis. Fingerprints or water droplets on the light entry surfaces of the vials lead to incorrect measurements.
- Blank and measurement procedures should be performed using the same vial whenever possible, since different vials can possess slightly different tolerances.
- Always take all readings with capped vials.
- The vials must be positioned in the sample chamber for zeroing and testing with the Δ marks on the vial aligned with the Δ mark on the instrument.
- Bubbles on the inside walls of the vial can lead to incorrect measurements. To prevent this, cap the vial and remove the bubbles by swirling the vial before performing the test.
- Always add the reagent to the sample straight from the foil. The reagent should never touch fingers or hands.
- Major temperature differentials between the colorimeter and environment can lead to incorrect measurements, for example due to the formation of condensate in the area of the lens or on the vial. Specified tolerances at T = 20 °C.
- For the best results, use a pipette to measure and add samples to vials or beakers.
- Avoid spillage of water in the sample chamber. If water should leak into the instrument housing, it can destroy electronic components and cause corrosion.
- Contamination of the lens in the sample chamber can result in errors. Check at regular intervals and, if necessary, clean the light entry surfaces of the sample chamber using a moist cloth.

- To avoid errors caused by stray light, do not use the instrument in bright sunlight.
- The vial sealing ring is not required in most operating conditions. Correct position of the vial with sealing ring is as follows:



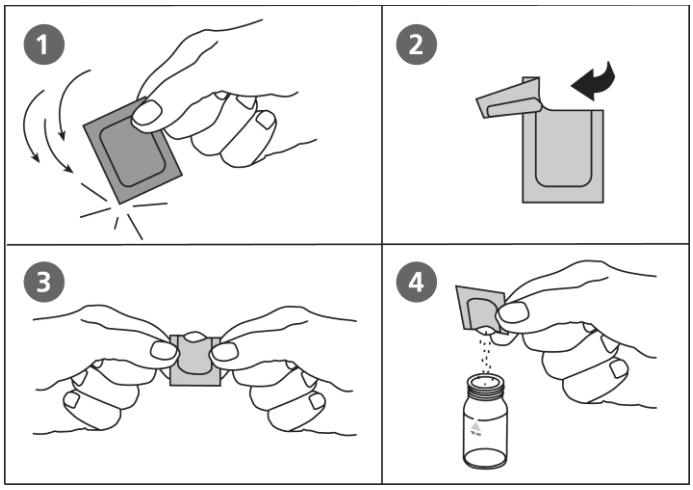
Correct Use of Reagents

The reagents must be added in the correct sequence.

Tablet Reagents: The tablet reagents should be added to the sample straight from the foil without touching the tablets with your fingers.

Liquid Reagents: Add drops of the same size to the sample by holding the bottle vertically and squeezing slowly. After use, replace the bottle caps securely noting the color coding. Note any recommendations for storage, for example a cool and dry area.

Powder Packs:

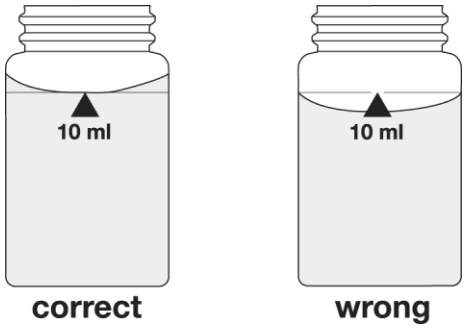


Cleaning Of Vials and Accessories for Analysis

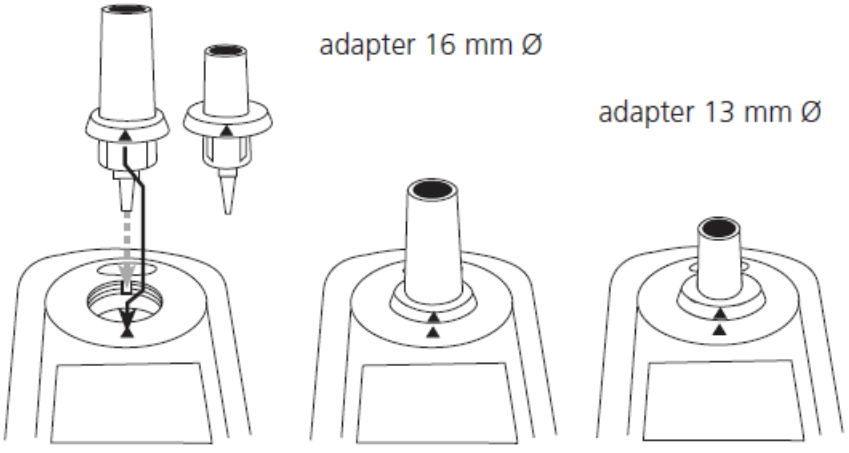
Vials, caps and stirring rods should be cleaned thoroughly after each analysis to prevent interferences. Clean vials and accessories after each analysis as soon as possible.

1. Clean vials and accessories with laboratory detergent. (e.g. Extran® MA 02 (neutral, phosphatic), Extran® MA 03 (alkaline, phosphate-free) from Merck KGaA).
2. Rinse vials and accessories thoroughly with deionized water.
3. As indicated in the Notes section of individual tests, perform special cleaning as required, e.g.: rinse with diluted hydrochloric acid solution.
4. Rinse vials and accessories thoroughly with deionized water.

Correct Filling of the Vial:



Insertion of the Adapter:



Sample Dilution Techniques:

Proceed as follows for accurate dilutions: Pipette the sample into a 100 ml volumetric flask and fill up to 100 ml mark with deionized water. Swirl to mix the contents. Pipette the required volume of the diluted sample into the vial and proceed as described in the test methods.

Water Sample [ml]	Multiplication factor
1	100
2	50
5	20
10	10
25	4
50	2

Caution: Dilution decreases accuracy. Do not dilute water samples for measurement of pH-values. This will lead to incorrect test results.

Correcting For Volume Additions

If a larger volume of acid or base is used to pre-adjust the pH-value, a volume correction of the displayed result is necessary.

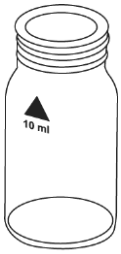
Example: For adjusting the pH-value of a 100 ml water sample 5 ml of acid had to be added. The corresponding displayed result is 10 mg/l.

Total volume = 100 ml + 5 ml = 105 ml

Correction factor = 105 ml / 100 ml = 1.05

Corrected result = 10 mg/l x 1.05 = 10.5 mg/l

Method 20



Acid Demand to pH 4.3 with Tablet Reagent, AC2002

AQUAfast AC2002 Alkalinity-M Tablets

Range: 0.1 to 4 mmol/l

1. Access the methods list, press [Shift] + [2] [0] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **one ALKA-M tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
7. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
8. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
9. Press [**Test**] key and wait for the measurement to be taken.
10. The result will be shown as acid demand to pH 4.3 in mmol/l.

Notes:

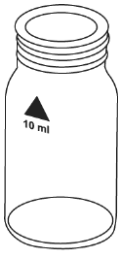
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- The terms Total Alkalinity, Alkalinity-m, m-Value and Acid Demand to pH 4.3 are identical.
- For accurate results, exactly 10 ml of water sample must be used for the test.

Alkalinity-P with Tablet Reagent, AC3002P

AQUAfast AC3002P Alkalinity-P Tablets

Range: 5 to 300 mg/l $CaCO_3$

Method 35



1. Access the methods list, press [Shift] + [3] [5] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **one ALKA-P tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
7. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
8. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
9. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 5 minutes** will be displayed.
10. The result will be shown as mg/l alkalinity-p.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to $CaCO_3$, °dH, °eH, °fH or °aH.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- The terms Alkalinity-p, p-Value and Alkalinity to pH 8.2 are identical.
- For accurate results, exactly 10 ml of water sample must be used for the test.
- This method was developed from a volumetric procedure for determination of alkalinity-p. Due to undefined conditions, the deviations from the standardized method may be greater.
- Conversion table:

	mg/l $CaCO_3$	°dH	°fH	°eH
1 mg/l $CaCO_3$	----	0.056	0.10	0.07
1 °dH	17.8	----	1.78	1.25
1 °fH	10.0	0.56	----	0.70
1 °eH	14.3	0.80	1.43	----

- By determining alkalinity-p and alkalinity-m, 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

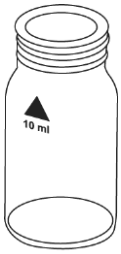
    b. Hydroxide and hydrogen are not present in the same water sample

Alkalinity-M (Total Alkalinity) with Tablet Reagent, AC2002

AQUAfast AC2002 Alkalinity-M Tablets

Range: 5 to 200 mg/l $CaCO_3$

Method 30



1. Access the methods list, press [Shift] + [3] [0] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **one ALKA-M tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
7. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
8. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
9. Press [**Test**] key and wait for the measurement to be taken.
10. The result will be shown as mg/l total alkalinity.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to $CaCO_3$, °dH, °eH, °fH or °aH.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- The terms Total Alkalinity, Alkalinity-m, m-Value and Acid Demand to pH 4.3 are identical.
- For accurate results, exactly 10 ml of water sample must be used for the test.
- Conversion table:

	Acid demand to pH 4.3 DIN 38 409 ($K_{S4.3}$)	German °dH*	English °eH*	French °fH*
1 mg/l $CaCO_3$	0.02	0.056	0.07	0.1

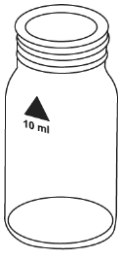
* Carbonate hardness (reference = hydrogen carbonate anions)

Example:

10 mg/l $CaCO_3$ = 10 mg/l x 0.056 = 0.56 mg/l °dH

10 mg/l $CaCO_3$ = 10 mg/l x 0.02 = 0.2 mmol/l

Method 31



Alkalinity-M (Total Alkalinity) High Range with Tablet Reagent

Refer to Reagent Manufacturer Instructions for Specific Procedure

Range: 5 to 500 mg/l $CaCO_3$

1. Access the methods list, press [Shift] + [3] [1] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **one ALKA-M-HR tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
7. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
8. Press [↵] key.
    a. A countdown for the **reaction period of 1 minute** will be displayed.
9. **Remix the solution.**
10. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
11. Press [**Test**] key and wait for the measurement to be taken.
12. The result will be shown as mg/l total alkalinity.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to $CaCO_3$, °dH, °eH, °fH or °aH.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This method is adapted from one originated by an alternative reagent manufacturer. Always review original instructions and Safety Data Sheet (SDS) before starting the test.
- For verification of the result, look carefully at the bottom of the vial. If a thin yellow layer forms, mix the vial again – this ensures that the reaction is complete and then re-measure the sample.
- Conversion table:

	Acid demand to pH 4.3 DIN 38 409 ($K_{S4.3}$)	German °dH*	English °eH*	French °fH*
1 mg/l $CaCO_3$	0.02	0.056	0.07	0.1

* Carbonate hardness (reference = hydrogen carbonate anions)

Example:

10 mg/l $CaCO_3$ = 10 mg/l x 0.056 = 0.56 mg/l °dH

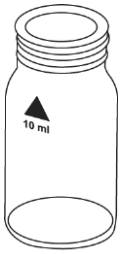
10 mg/l $CaCO_3$ = 10 mg/l x 0.02 = 0.2 mmol/l

Aluminum with Tablet Reagent, AC2027

AQUAfast AC2027 Aluminum Tablets

Range: 0.01 to 0.3 mg/l Al

Method 40



1. Access the methods list, press [Shift] + [4] [0] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **one Aluminum No. 1 tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
7. Add **one Aluminum No. 2 tablet** straight from the foil into the same vial and crush the tablet using a clean stir rod.
8. Tightly secure the vial cap and swirl several times until the tablets are dissolved.
9. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
10. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 5 minutes** will be displayed.
11. The result will be shown as mg/l aluminum.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to Al or Al_2O_3.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Before use, clean the vials and the measuring beaker with hydrochloric acid (approximately 20%) and then rinse thoroughly with deionized water.
- To get accurate results, the sample temperature must be between 20°C and 25°C.
- A low test result may occur in the presence of fluorides and polyphosphates. The error is generally insignificant unless the water has fluoride added artificially. In this case, the following table should be used.

Fluoride [mg/l F]	Displayed value: Aluminum [mg/l Al]					
	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	---

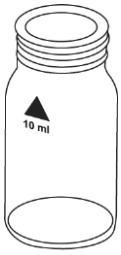
Example: If the result of aluminum determination is 0.15 mg/l aluminum and the fluoride concentration is known to be 0.4 mg/l fluoride, the true concentration of aluminum is 0.17 mg/l.

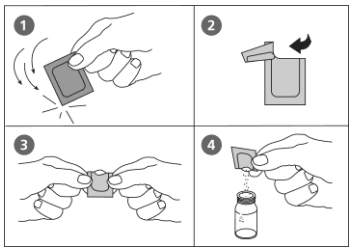
Aluminum with Powder Pack & Liquid Reagents, AC4P27

AQUAfast AC4P27 Aluminum Powder Packs & Liquid Reagent

Range: 0.01 to 0.25 mg/l Al

Method 50





1. Access the methods list, press [Shift] + [5] [0] keys and press [↵] key.
2. Use two clean 24 mm round vials and mark one as the blank vial.
3. Add **20 ml of water sample** into a 100 ml beaker.
4. Add the contents of **one Aluminum ECR F20 powder pack** straight from the foil into the beaker and dissolve the powder using a clean stir rod.
5. Press [↵] key.
    a. A countdown for the **reaction period of 30 seconds** will be displayed.
6. After the reaction period is done, add the contents of **one Hexamine F20 powder pack** straight from the foil into the same beaker and dissolve the powder using a clean stir rod.
7. Add **one drop Aluminum ECR Masking Reagent solution** in the vial marked as the blank.
8. Add 10 ml of the prepared sample to the vial marked as the blank.
9. Add the remaining 10 ml of the prepared sample to the second vial (this is the sample vial).
10. Tightly secure the vial caps and swirl several times to mix the contents.
11. Press [↵] key.
    a. A countdown for the **reaction period of 5 minutes** will be displayed.
12. After the reaction period is done, place the blank vial in the sample chamber, making sure that the Δ marks are aligned.
13. Press [**Zero**] key and wait for the zero to be accepted.
14. Remove the vial from the sample chamber.
15. Place the sample vial in the sample chamber, making sure that the Δ marks are aligned.
16. Press [**Test**] key and wait for the measurement to be taken.
17. The result will be shown as mg/l aluminum.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to Al or Al_2O_3.

Notes:

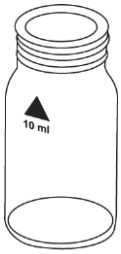
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Before use, clean the vials and the measuring beaker with hydrochloric acid (approximately 20%) and then rinse thoroughly with deionized water.
- To get accurate results, the sample temperature must be between 20°C and 25°C.
- A low test result may occur in the presence of fluorides and polyphosphates. The error is generally insignificant unless the water has fluoride added artificially. In this case, the table shown in Method 40 should be used.

Ammonia with Tablet Reagent, AC2012

AQUAfast AC2012 Ammonia Tablets

Range: 0.02 to 1 mg/l N

Method 60



1. Access the methods list, press [Shift] + [6] [0] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **one Ammonia No. 1 tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
7. Add **one Ammonia No. 2 tablet** straight from the foil into the same vial and crush the tablet using a clean stir rod.
8. Tightly secure the vial cap and swirl several times until the tablets are dissolved.
9. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
10. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 10 minutes** will be displayed.
11. The result will be shown as mg/l ammonia as nitrogen (N).
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to N, NH_4 or NH_3.

Notes:

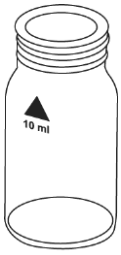
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- The tablets must be added in the correct sequence.
- The Ammonia No. 1 tablet will only dissolve completely after the Ammonia No. 2 tablet has been added.
- The temperature of the sample is important for full color development. At a temperature below 20°C, the reaction period is 15 minutes.
- Conversion:
    - mg/l NH_4 = mg/l N x 1.29
    - mg/l NH_3 = mg/l N x 1.22

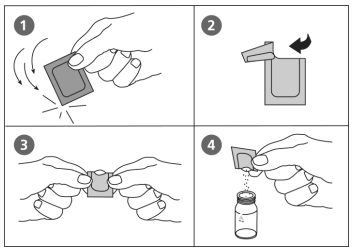
Ammonia with Powder Pack Reagent, AC4P12

AQUAfast AC4P12 Ammonia Powder Packs

Range: 0.01 to 0.8 mg/l N

Method 62





1. Access the methods list, press [Shift] + [6] [2] keys and press [↵] key.
2. Use two clean 24 mm round vials and mark one as the blank vial.
3. Fill one 24 mm round vial with **10 ml of deionized water** (this is the blank vial).
4. Fill the second 24 mm round vial with **10 ml of water sample** (this is the sample vial).
5. Add the contents of **one Ammonia Salicylate F10 powder pack** straight from the foil into each vial.
6. Tightly secure the vial caps and shake to mix the contents.
7. Press [↵] key.
    a. A countdown for the **reaction period of 3 minutes** will be displayed.
8. After the reaction period is done, add the contents of **one Ammonia Cyanurate F10 powder pack** straight from the foil into each vial.
9. Tightly secure the vial caps and shake to mix the vial contents.
10. Press [↵] key.
    a. A countdown for the **reaction period of 15 minutes** will be displayed.
11. After the reaction period is done, place the blank vial in the sample chamber, making sure that the Δ marks are aligned.
12. Press [**Zero**] key and wait for the zero to be accepted.
13. Remove the vial from the sample chamber.
14. Place the sample vial in the sample chamber, making sure that the Δ marks are aligned.
15. Press [**Test**] key and wait for the measurement to be taken.
16. The result will be shown as mg/l ammonia as nitrogen (N).
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to N, NH_4 or NH_3.

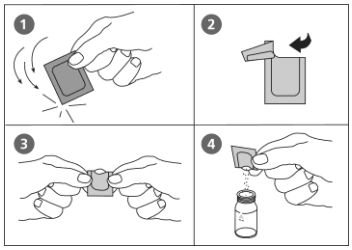
Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Extremely basic or acidic water samples should be adjusted to pH 7 with 0.5 mol/l (1 N) sulfuric acid solution or 1 mol/l (1 N) sodium hydroxide solution.
- Interferences:

Interference	Levels and Treatments
Calcium	Greater than 1000 mg/l $CaCO_3$
Iron	Interferes at all levels. To correct, determine the concentration of iron present in the sample by performing a total iron test and then add the same iron concentration as determined to the deionized water (blank vial). The interference will be blanked out.
Magnesium	Greater than 6000 mg/l $CaCO_3$

Interference	Levels and Treatments
Nitrate	Greater than 100 mg/l NO_3-N
Nitrite	Greater than 12 mg/l NO_2-N
Phosphate	Greater than 100 mg/l PO_4-P
Sulfate	Greater than 300 mg/l SO_4
Sulfide	Intensifies the color
Glycine, Hydrazine	Less common, will cause intensified color in prepared samples
Color, Turbidity	Give erroneous high values, distill samples with severe interferences

Method 65



Ammonia Low Range with Reaction Tube, ACR012

AQUAfast ACR012 Ammonia LR Reaction Tubes

Range: 0.02 to 2.5 mg/l N

1. Insert the adapter for 16 mm round vials into the sample chamber.
2. Access the methods list, press [Shift] + [6] [5] keys and press [↵] key.
3. Open one reaction tube and add **2 ml deionized water** (this is the blank vial).
4. Open a second reaction tube and add **2 ml of water sample** (this is the sample vial).
5. Add the contents of **one Ammonia Salicylate F5 powder pack** straight from the foil into each vial.
6. Add the contents of **one Ammonia Cyanurate F5 powder pack** straight from the foil into each vial.
7. Tightly secure the vial caps and swirl several times to dissolve the powder.
8. Press [↵] key.
    a. A countdown for the **reaction period of 20 minutes** will be displayed.
9. After the reaction period is done, place the blank vial in the sample chamber, making sure that the Δ marks are aligned.
10. Press [**Zero**] key and wait for the zero to be accepted.
11. Remove the vial from the sample chamber.
12. Place the sample vial in the sample chamber making sure that the Δ marks are aligned.
13. Press [**Test**] key and wait for the measurement to be taken.
14. The result will be shown as mg/l ammonia as nitrogen (N).
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to N, NH_4 or NH_3.

Notes:

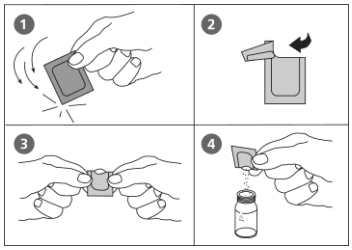
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Strong alkaline or acidic water samples must be adjusted to approximately pH 7 before analysis (use 1 mol/l hydrochloric acid or 1 mol/l sodium hydroxide).
- Iron interferes with the test. To eliminate the interferences, determine the amount of total iron present in the water sample and then add an iron standard solution with the same iron concentration to the blank vial instead of deionized water.
- Conversion:
    - mg/l NH_4 = mg/l N x 1.29
    - mg/l NH_3 = mg/l N x 1.22

Ammonia High Range with Reaction Tube, ACR011

AQUAfast ACR011 Ammonia HR Reaction Tubes

Range: 1 to 50 mg/l N

Method 66

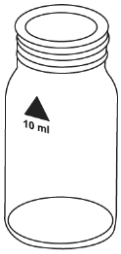


1. Insert the adapter for 16 mm round vials into the sample chamber.
2. Access the methods list, press [Shift] + [6] [6] keys and press [↵] key.
3. Open one reaction tube and add **0.1 ml deionized water** (this is the blank vial).
4. Open a second reaction tube and add **0.1 ml of water sample** (this is the sample vial).
5. Add the contents of **one Ammonia Salicylate F5 powder pack** straight from the foil into each vial.
6. Add the contents of **one Ammonia Cyanurate F5 powder pack** straight from the foil into each vial.
7. Tightly secure the vial caps and swirl several times to dissolve the powder.
8. Press [↵] key.
    a. A countdown for the **reaction period of 20 minutes** will be displayed.
9. After the reaction period is done, place the blank vial in the sample chamber, making sure that the Δ marks are aligned.
10. Press [**Zero**] key and wait for the zero to be accepted.
11. Remove the vial from the sample chamber.
12. Place the sample vial in the sample chamber making sure that the Δ marks are aligned.
13. Press [**Test**] key and wait for the measurement to be taken.
14. The result will be shown as mg/l ammonia as nitrogen (N).
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to N, NH_4 or NH_3.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Strong alkaline or acidic water samples must be adjusted to approximately pH 7 before analysis (use 1 mol/l hydrochloric acid or 1 mol/l sodium hydroxide).
- If chlorine is known to be present, add one drop of 0.1 mol/l sodium thiosulfate for each 0.3 mg/l Cl_2 in a one liter water sample.
- Iron interferes with the test. To eliminate the interferences, determine the amount of total iron present in the water sample and then add an iron standard solution with the same iron concentration to the blank vial instead of deionized water.
- Conversion:
    - mg/l NH_4 = mg/l N x 1.29
    - mg/l NH_3 = mg/l N x 1.22

Method 85



Boron with Tablet Reagent, AC3089

AQUAfast AC3089 Boron Tablets

Range: 0.1 to 2 mg/l B

1. Access the methods list, press [Shift] + [8] [5] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **one Boron No. 1 tablet** straight from the foil into the vial, crush the tablet using a clean stir rod and dissolved the tablet.
7. Add **one Boron No. 2 tablet** straight from the foil into the same vial and crush the tablet using a clean stir rod.
8. Tightly secure the vial cap and swirl several times until the tablets are dissolved.
9. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
10. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 20 minutes** will be displayed.
11. The result will be shown as mg/l boron.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to B or H_3BO_3.

Notes:

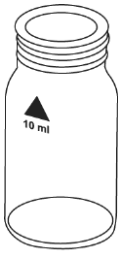
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- The tablets must be added in the correct sequence.
- The sample solution should have a pH value between 6 and 7.
- Interferences are prevented by the presence of EDTA in the tablets.
- The rate of color development depends on the temperature. The temperature of the sample must be 20°C ± 1°C.

Bromine with Tablet Reagent, AC2035

AQUAfast AC2035 Bromine Tablets

Range: 0.05 to 13 mg/l Br_2

Method 80

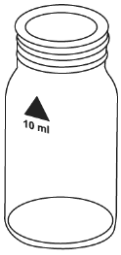


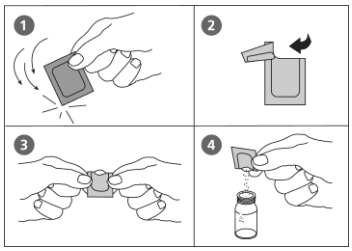
1. Access the methods list, press [Shift] + [8] [0] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber and **empty the vial leaving only a few drops remaining** in the vial.
6. Add **one DPD No. 1 tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
7. Add the water sample to the 10 ml mark.
8. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
9. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
10. Press [**Test**] key and wait for the measurement to be taken.
11. The result will be shown as mg/l bromine.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Vial cleaning: As many household cleaners (e.g. dishwasher detergent) contain reducing substances, the subsequent determination of bromine may show lower results. To avoid measurement errors, only use glassware free of chlorine demand.
    - Preparation: Put all applicable glassware into a sodium hypochlorite solution (0.1 g/l) for one hour and then rinse all glassware thoroughly with deionized water.
- 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 color development is carried out at a pH value of 6.2 to 6.5. The reagent tablet therefore contains a buffer for the pH adjustment. Strong alkaline or acidic water samples must be adjusted between pH 6 and pH 7 before the reagent is added (use 0.5 mol/l sulfuric acid or 1 mol/l sodium hydroxide).
- Exceeding the measuring range: Concentrations above 22 mg/l bromine can lead to results showing 0 mg/l. In this event, the water sample must be diluted with bromine-free water and then 10 ml of the diluted sample should be mixed with the reagent and the measurement repeated.
- Oxidizing agents (i.e. chlorine, ozone) interfere as they react in the same way as bromine.

Method 81





Bromine with Powder Pack Reagent, AC4P71

AQUAfast AC4P71 Powder Packs

Range: 0.05 to 4.5 mg/l Br_2

1. Access the methods list, press [Shift] + [8] [1] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add the contents of **one Chlorine Total DPD F10 powder pack** straight from the foil into the vial.
7. Tightly secure the vial cap and swirl several times (about 20 seconds) to mix the contents.
8. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
9. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 3 minutes** will be displayed.
10. The result will be shown as mg/l bromine.

Notes:

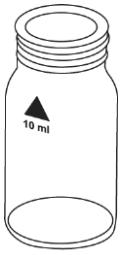
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Vial cleaning: As many household cleaners (e.g. dishwasher detergent) contain reducing substances, the subsequent determination of bromine may show lower results. To avoid measurement errors, only use glassware free of chlorine demand.
    - Preparation: Put all applicable glassware into a sodium hypochlorite solution (0.1 g/l) for one hour and then rinse all glassware thoroughly with deionized water.
- 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 color development is carried out at a pH value of 6.2 to 6.5. The reagent therefore contains a buffer for the pH adjustment. Strong alkaline or acidic water samples must be adjusted between pH 6 and pH 7 before the reagent is added (use 0.5 mol/l sulfuric acid or 1 mol/l sodium hydroxide).
- Exceeding the measuring range: Concentrations above 4.5 mg/l bromine can lead to results showing 0 mg/l. In this event, the water sample must be diluted with bromine-free water and then 10 ml of the diluted sample should be mixed with the reagent and the measurement repeated.
- Oxidizing agents (i.e. chlorine, ozone) interfere as they react in the same way as bromine.

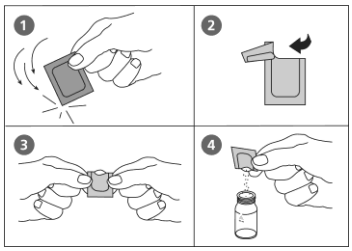
Chloramine (Mono) with Powder Pack & Liquid Reagents

Refer to Reagent Manufacturer Instructions for Specific Procedure

Range: 0.04 to 4.5 mg/l Cl_2

Method 63





Determination of Monochloramine

1. Access the methods list, press [Shift] + [6] [3] keys and press [↵] key.
2. Press arrow key [▼] or [▲] to select the determination of monochloramine (>> without NH4) and press [↵] key.
3. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
4. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
5. Press [**Zero**] key and wait for the zero to be accepted.
6. Remove the vial from the sample chamber.
7. Add the contents of **one Monochlor F RGT powder pack** straight from the foil into the vial.
8. Tightly secure the vial cap and swirl several times (about 20 seconds) to mix the contents.
9. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
10. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 5 minutes** will be displayed.
11. The result will be shown as mg/l monochloramine.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to Cl_2, NH_2Cl or N.

Determination of Monochloramine and Free Ammonia (0.01 to 0.5 mg/L N)

1. Access the methods list, press [Shift] + [6] [3] keys and press [↵] key.
2. Press arrow key [▼] or [▲] to select the determination of monochloramine with ammonia (>> with NH4) and press [↵] key.
3. Use two clean 24 mm round vials, mark one vial as the monochloramine vial and mark the other vial as the ammonia vial.
4. Place the monochloramine vial into the sample chamber, making sure that the Δ marks are aligned.
5. Press [**Zero**] key and wait for the zero to be accepted.
6. Remove the vial from the sample chamber.
7. Add the contents of **one Monochlor F RGT powder pack** straight from the foil into the monochloramine vial.
8. Tightly secure the vial cap and swirl several times (about 20 seconds) to mix the contents.
9. Add **one drop Free Ammonia Reagent solution** into the ammonia vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
10. Tightly secure the vial cap and invert several times to mix the contents.
11. Place the monochloramine vial into the sample chamber, making sure that the Δ marks are aligned.
12. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 5 minutes** will be displayed.
13. Remove the vial from the sample chamber.

14. Add the contents of **one Monochlor F RGT powder pack** straight from the foil into the ammonia vial.
15. Tightly secure the vial cap and swirl several times (about 20 seconds) to mix the contents.
16. Place the ammonia vial into the sample chamber, making sure that the Δ marks are aligned.
17. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 5 minutes** will be displayed.
18. The results will be shown as mg/l monochloramine and mg/l free ammonia as nitrogen (N).
    a. Press arrow key [▼] or [▲] to change the chemical species of the monochloramine test result to Cl_2, NH_2Cl or N.
    b. Conversion for the free ammonia as nitrogen (N) test result is:
       mg/l NH_4 = mg/l N x 1.29
       mg/l NH_3 = mg/l N x 1.22

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This method is adapted from one originated by an alternative reagent manufacturer. Always review original instructions and Safety Data Sheet (SDS) before starting the test.
- Full color development and temperature: The reaction periods indicated in these instructions refer to a sample temperature between 18 °C and 20 °C. Due to the fact that the reaction period is strongly influenced by sample temperature, both reaction periods must be adjusted according to the following table.

Sample Temperature (°C)	Reaction Period (Minutes)
5	10
10	8
16	6
20	5
23	2.5
25	2

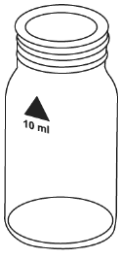
- To determine the free ammonia concentration, the difference between the chloramine (T1) and the sum of chloramine and ammonia (T2) is calculated. If T2 exceeds the range limit the following message is displayed: NH2Cl + NH4 > 0.5 mg/l. In this case the sample has to be diluted and the measurement repeated.

Chloride with Tablet Reagent, AC2017

AQUAfast AC2017 Chloride Tablets

Range: 0.5 to 25 mg/l Cl^-

Method 90



1. Access the methods list, press [Shift] + [9] [0] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **one Chloride T1 tablet** straight from the foil into the vial, crush the tablet using a clean stir rod and dissolved the tablet.
7. Add **one Chloride T2 tablet** straight from the foil into the same vial and crush the tablet using a clean stir rod.
8. Tightly secure the vial cap and swirl gently several times until the tablets are dissolved.

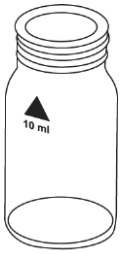
Note: Ensure that all particles of the tablet are dissolved, as chloride causes an extremely fine distributed turbidity with a milky appearance. **Heavy shaking leads to bigger sized particles, which can cause false readings.**

9. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
10. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 2 minutes** will be displayed.
11. The result will be shown as mg/l chloride.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to Cl^- or NaCl.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Ensure that all particles of the tablet are dissolved as chloride causes an extremely fine distributed turbidity with a milky appearance. **Heavy shaking leads to bigger sized particles which can cause false readings.**
- High concentrations of electrolytes and organic compounds have different effects on the precipitation reaction.
- Ions that also form deposits with silver nitrate in acidic media, such as bromides, iodides and thiocyanates, interfere with the analysis.
- Highly alkaline water should, if necessary, be neutralized using nitric acid before analysis.
- Conversion:
    - Mg/l NaCl = mg/l Cl- x 1.65

Method 92



Chloride with Liquid Reagent

Refer to Reagent Manufacturer Instructions for Specific Procedure

Range: 0.5 to 20 mg/l Cl^-

1. Access the methods list, press [Shift] + [9] [2] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **20 drops KS251 solution (Chloride Reagent A)** into the vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
7. Tightly secure the vial cap and invert several times to mix the contents.
8. Add **20 drops KS253 solution (Chloride Reagent B)** into the same vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
9. Tightly secure the vial cap and invert several times to mix the contents.
10. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
11. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 5 minutes** will be displayed.
12. The result will be shown as mg/l chloride.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to Cl^- or NaCl.

Notes:

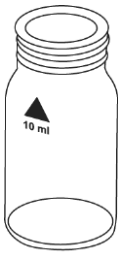
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This method is adapted from one originated by an alternative reagent manufacturer. Always review original instructions and Safety Data Sheet (SDS) before starting the test.
- Conversion:
    - Mg/l NaCl = mg/l Cl- x 1.65

Chlorine with Tablet Reagent, AC2070, AC2071 and AC2072

AQUAfast AC2070 Free and Total Chlorine Tablets, AQUAfast AC2071 Free Chlorine Tablets and AQUAfast AC2072 Total Chlorine Tablets

Range: 0.01 to 6 mg/l Cl_2

Method 100



Determination of Free Chlorine, AC2070 and AC2071

1. Access the methods list, press [Shift] + [1] [0] [0] keys and press [↵] key.
2. Press arrow key [▼] or [▲] to select the determination of free chlorine (>> free) and press [↵] key.
3. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
4. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
5. Press [**Zero**] key and wait for the zero to be accepted.
6. Remove the vial from the sample chamber and **empty the vial leaving only a few drops remaining** in the vial.
7. Add **one DPD No. 1 tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
8. Add the water sample to the 10 ml mark.
9. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
10. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
11. Press [**Test**] key and wait for the measurement to be taken.
12. The result will be shown as mg/l free chlorine.

Determination of Total Chlorine, AC2070 and AC2072

1. Access the methods list, press [Shift] + [1] [0] [0] keys and press [↵] key.
2. Press arrow key [▼] or [▲] to select the determination of total chlorine (>> total) and press [↵] key.
3. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
4. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
5. Press [**Zero**] key and wait for the zero to be accepted.
6. Remove the vial from the sample chamber and **empty the vial leaving only a few drops remaining** in the vial.
7. Add tablet or tablets straight from the foil into the vial and crush using a clean stir rod.
    a. If using AQUAfast AC2070 free and total chlorine tablets, add **one DPD No. 1 tablet** and **one DPD No. 3 tablet** straight from the foil into the vial and crush the tablets using a clean stir rod.
    b. If using AQUAfast AC2072 total chlorine tablets, add **one DPD No. 4 tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
8. Add the water sample to the 10 ml mark.
9. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
10. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
11. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 2 minutes** will be displayed.
12. The result will be shown as mg/l total chlorine.

Determination of Free and Total Chlorine (Differentiated), AC2070

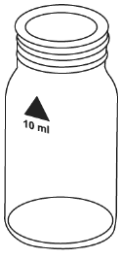
1. Access the methods list, press [Shift] + [1] [0] [0] keys and press [↵] key.
2. Press arrow key [▼] or [▲] to select the determination of differentiated chlorine (>> diff) and press [↵] key.
3. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
4. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
5. Press [**Zero**] key and wait for the zero to be accepted.
6. Remove the vial from the sample chamber and **empty the vial leaving only a few drops remaining** in the vial.
7. Add **one DPD No. 1 tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
8. Add the water sample to the 10 ml mark.
9. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
10. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
11. Press [**Test**] key and wait for the measurement to be taken.
12. Remove the vial from the sample chamber.
13. Add **one DPD No. 3 tablet** straight from the foil into the same vial and crush the tablet using a clean stir rod.
14. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
15. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
16. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 2 minutes** will be displayed.
17. The results will be shown as mg/l free chlorine, combined chlorine and total chlorine.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Vial cleaning: As many household cleaners (e.g. dishwasher detergent) contain reducing substances, the subsequent determination of chlorine may show lower results. To avoid any measurement errors, only use glassware free of chlorine demand. Preparation: Put all applicable glassware into sodium hypochlorite solution (0.1 g/l) for one hour and 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).
- Preparing the sample: When preparing the sample, avoid the escape of chlorine gases (e.g. by pipetting or shaking). Perform the analysis immediately after taking the sample.
- The DPD color development is carried out at a pH value of 6.2 to 6.5. The reagents therefore contain a buffer for the pH adjustment. Strong alkaline or acidic water samples must be adjusted between pH 6 and pH 7 before the reagent is added (use 0.5 mol/l sulfuric acid or 1 mol/l sodium hydroxide).

- Exceeding the Measuring Range: Concentrations above 10 mg/l chlorine can lead to results showing 0 mg/l. In this event, the sample must be diluted with chlorine-free water. 10 ml of the diluted sample should be mixed with reagent and the measurement repeated.
- Turbidity Errors: The use of the DPD No. 1 tablet in samples with high calcium ion contents and/or high conductivity can lead to turbidity of the sample and therefore incorrect measurements. It is not possible to give exact interference values, because the development of turbidity depends on the nature of the sample.
- If ??? is displayed in differentiated chlorine test results, see the Troubleshooting section.
- Oxidizing agents (i.e. bromine, ozone) interfere as they react in the same way as chlorine.

Method 101



Chlorine with Liquid Reagent

Refer to Reagent Manufacturer Instructions for Specific Procedure

Range: 0.02 to 4 mg/l Cl_2

Determination of Free Chlorine

1. Access the methods list, press [Shift] + [1] [0] [1] keys and press [↵] key.
2. Press arrow key [▼] or [▲] to select the determination of free chlorine (>> free) and press [↵] key.
3. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
4. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
5. Press [**Zero**] key and wait for the zero to be accepted.
6. Remove the vial from the sample chamber and **empty the vial**.
7. Add **6 drops DPD 1 Buffer solution** and **2 drops DPD 1 Reagent solution** into the vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
8. Add the water sample to the 10 ml mark.
9. Tightly secure the vial cap and swirl several times to mix the contents.
10. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
11. Press [**Test**] key and wait for the measurement to be taken.
12. The result will be shown as mg/l free chlorine.

Determination of Total Chlorine

1. Access the methods list, press [Shift] + [1] [0] [1] keys and press [↵] key.
2. Press arrow key [▼] or [▲] to select the determination of total chlorine (>> total) and press [↵] key.
3. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
4. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
5. Press [**Zero**] key and wait for the zero to be accepted.
6. Remove the vial from the sample chamber and **empty the vial**.
7. Add **6 drops DPD 1 Buffer solution**, **2 drops DPD 1 Reagent solution** and **3 drops DPD 3 solution** into the vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
8. Add the water sample to the 10 ml mark.
9. Tightly secure the vial cap and swirl several times to mix the contents.
10. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
11. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 2 minutes** will be displayed.
12. The result will be shown as mg/l total chlorine.

Determination of Free and Total Chlorine (Differentiated)

1. Access the methods list, press [Shift] + [1] [0] [1] keys and press [↵] key.
2. Press arrow key [▼] or [▲] to select the determination of differentiated chlorine (>> diff) and press [↵] key.
3. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
4. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
5. Press [**Zero**] key and wait for the zero to be accepted.

6. Remove the vial from the sample chamber and **empty the vial**.
7. Add **6 drops DPD 1 Buffer solution** and **2 drops DPD 1 Reagent solution** into the vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
8. Add the water sample to the 10 ml mark.
9. Tightly secure the vial cap and swirl several times to mix the contents.
10. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
11. Press [**Test**] key and wait for the measurement to be taken.
12. Remove the vial from the sample chamber.
13. Add **3 drops DPD 3 solution** into the same vial.
14. Tightly secure the vial cap and swirl several times to mix the contents.
15. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
16. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 2 minutes** will be displayed.
17. The results will be shown as mg/l free chlorine, combined chlorine and total chlorine.

Notes:

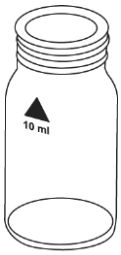
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This method is adapted from one originated by an alternative reagent manufacturer. Always review original instructions and Safety Data Sheet (SDS) before starting the test.
- After use, replace the bottle caps securely noting the color coding. **Store the reagent bottles in a cool, dry place ideally between 6°C and 10°C.**
- Vial cleaning: As many household cleaners (e.g. dishwasher detergent) contain reducing substances, the subsequent determination of chlorine may show lower results. To avoid any measurement errors, only use glassware free of chlorine demand. Preparation: Put all applicable glassware into sodium hypochlorite solution (0.1 g/l) for one hour and 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).
- Preparing the sample: When preparing the sample, avoid the escape of chlorine gases (e.g. by pipetting or shaking). Perform the analysis immediately after taking the sample.
- The DPD color development is carried out at a pH value of 6.2 to 6.5. The reagents therefore contain a buffer for the pH adjustment. Strong alkaline or acidic water samples must be adjusted between pH 6 and pH 7 before the reagent is added (use 0.5 mol/l sulfuric acid or 1 mol/l sodium hydroxide).
- Exceeding the Measuring Range: Concentrations above 4 mg/l chlorine can lead to results showing 0 mg/l. In this event, the sample must be diluted with chlorine-free water. 10 ml of the diluted sample should be mixed with reagent and the measurement repeated.
- If ??? is displayed in differentiated chlorine test results, see the Troubleshooting section.
- Oxidizing agents (i.e. bromine, ozone) interfere as they react in the same way as chlorine.

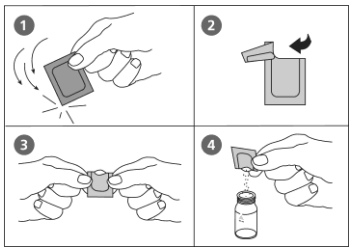
Chlorine with Powder Pack Reagent, AC4P71 and AC4P72

AQUAfast AC4P71 Free Chlorine Powder Packs and AQUAfast AC4P72 Total Chlorine Powder Packs

Range: 0.02 to 2 mg/l Cl_2

Method 110





Determination of Free Chlorine, AC4P71

1. Access the methods list, press [Shift] + [1] [1] [0] keys and press [↵] key.
2. Press arrow key [▼] or [▲] to select the determination of free chlorine (>> free) and press [↵] key.
3. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
4. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
5. Press [**Zero**] key and wait for the zero to be accepted.
6. Remove the vial from the sample chamber.
7. Add the contents of **one Chlorine Free DPD F10 powder pack** straight from the foil into the vial.
8. Tightly secure the vial cap and swirl several times (about 20 seconds) to mix the contents.
9. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
10. Press [**Test**] key and wait for the measurement to be taken.
11. The result will be shown as mg/l free chlorine.

Determination of Total Chlorine, AC4P72

1. Access the methods list, press [Shift] + [1] [1] [0] keys and press [↵] key.
2. Press arrow key [▼] or [▲] to select the determination of total chlorine (>> total) and press [↵] key.
3. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
4. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
5. Press [**Zero**] key and wait for the zero to be accepted.
6. Remove the vial from the sample chamber.
7. Add the contents of **one Chlorine Total DPD F10 powder pack** straight from the foil into the vial.
8. Tightly secure the vial cap and swirl several times (about 20 seconds) to mix the contents.
9. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
10. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 3 minutes** will be displayed.
11. The result will be shown as mg/l total chlorine.

Determination of Free and Total Chlorine (Differentiated), AC4P71 + AC4P72

1. Access the methods list, press [Shift] + [1] [1] [0] keys and press [↵] key.
2. Press arrow key [▼] or [▲] to select the determination of differentiated chlorine (>> diff) and press [↵] key.
3. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
4. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
5. Press [**Zero**] key and wait for the zero to be accepted.
6. Remove the vial from the sample chamber.

7. Add the contents of **one Chlorine Free DPD F10 powder pack** straight from the foil into the vial.
8. Tightly secure the vial cap and swirl several times (about 20 seconds) to mix the contents.
9. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
10. Press [**Test**] key and wait for the measurement to be taken.
11. Remove the vial from the sample chamber, empty the vial, rinse the vial and cap several times and then fill the vial with **10 ml of water sample**.
12. Add the contents of **one Chlorine Total DPD F10 powder pack** straight from the foil into the vial.
13. Tightly secure the vial cap and swirl several times (about 20 seconds) to mix the contents.
14. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
15. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 3 minutes** will be displayed.
16. The results will be shown as mg/l free chlorine, combined chlorine and total chlorine.

Notes:

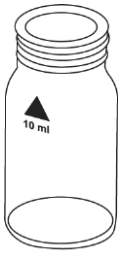
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Vial cleaning: As many household cleaners (e.g. dishwasher detergent) contain reducing substances, the subsequent determination of chlorine may show lower results. To avoid any measurement errors, only use glassware free of chlorine demand.
    - Preparation: Put all applicable glassware into sodium hypochlorite solution (0.1 g/l) for one hour and 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).
- Preparing the sample: When preparing the sample, avoid the escape of chlorine gases (e.g. by pipetting or shaking). Perform the analysis immediately after taking the sample.
- The DPD color development is carried out at a pH value of 6.2 to 6.5. The reagents therefore contain a buffer for the pH adjustment. Strong alkaline or acidic water samples must be adjusted between pH 6 and pH 7 before the reagent is added (use 0.5 mol/l sulfuric acid or 1 mol/l sodium hydroxide).
- Exceeding the Measuring Range: Concentrations above 2 mg/l chlorine can lead to results showing 0 mg/l. In this event, the sample must be diluted with chlorine-free water. 10 ml of the diluted sample should be mixed with reagent and the measurement repeated.
- If ??? is displayed in differentiated chlorine test results, see the Troubleshooting section.
- Oxidizing agents (i.e. bromine, ozone) interfere as they react in the same way as chlorine.

Method 103

Chlorine High Range with Tablet Reagent

Refer to Reagent Manufacturer Instructions for Specific Procedure

Range: 0.1 to 10 mg/l Cl_2



Determination of Free Chlorine

1. Access the methods list, press [Shift] + [1] [0] [3] keys and press [↵] key.
2. Press arrow key [▼] or [▲] to select the determination of free chlorine (>> free) and press [↵] key.
3. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
4. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
5. Press [**Zero**] key and wait for the zero to be accepted.
6. Remove the vial from the sample chamber and **empty the vial leaving only a few drops remaining** in the vial.
7. Add **one DPD No. 1 HR tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
8. Add the water sample to the 10 ml mark.
9. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
10. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
11. Press [**Test**] key and wait for the measurement to be taken.
12. The result will be shown as mg/l free chlorine.

Determination of Total Chlorine

1. Access the methods list, press [Shift] + [1] [0] [3] keys and press [↵] key.
2. Press arrow key [▼] or [▲] to select the determination of total chlorine (>> total) and press [↵] key.
3. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
4. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
5. Press [**Zero**] key and wait for the zero to be accepted.
6. Remove the vial from the sample chamber and **empty the vial leaving only a few drops remaining** in the vial.
7. Add **one DPD No. 1 HR tablet** and **one DPD No. 3 HR tablet** straight from the foil into the vial and crush the tablets using a clean stir rod.
8. Add the water sample to the 10 ml mark.
9. Tightly secure the vial cap and swirl several times until the tablets are dissolved.
10. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
11. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 2 minutes** will be displayed.
12. The result will be shown as mg/l total chlorine.

Determination of Free and Total Chlorine (Differentiated)

1. Access the methods list, press [Shift] + [1] [0] [3] keys and press [↵] key.
2. Press arrow key [▼] or [▲] to select the determination of differentiated chlorine (>> diff) and press [↵] key.
3. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.

4. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
5. Press [**Zero**] key and wait for the zero to be accepted.
6. Remove the vial from the sample chamber and **empty the vial leaving only a few drops remaining** in the vial.
7. Add **one DPD No. 1 HR tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
8. Add the water sample to the 10 ml mark.
9. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
10. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
11. Press [**Test**] key and wait for the measurement to be taken.
12. Remove the vial from the sample chamber.
13. Add **one DPD No. 3 HR tablet** straight from the foil into the same vial and crush the tablet using a clean stir rod.
14. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
15. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
16. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 2 minutes** will be displayed.
17. The results will be shown as mg/l free chlorine, combined chlorine and total chlorine.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This method is adapted from one originated by an alternative reagent manufacturer. Always review original instructions and Safety Data Sheet (SDS) before starting the test.
- Vial cleaning: As many household cleaners (e.g. dishwasher detergent) contain reducing substances, the subsequent determination of chlorine may show lower results. To avoid any measurement errors, only use glassware free of chlorine demand. Preparation: Put all applicable glassware into sodium hypochlorite solution (0.1 g/l) for one hour and 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).
- Preparing the sample: When preparing the sample, avoid the escape of chlorine gases (e.g. by pipetting or shaking). Perform the analysis immediately after taking the sample.
- The DPD color development is carried out at a pH value of 6.2 to 6.5. The reagents therefore contain a buffer for the pH adjustment. Strong alkaline or acidic water samples must be adjusted between pH 6 and pH 7 before the reagent is added (use 0.5 mol/l sulfuric acid or 1 mol/l sodium hydroxide).
- If ??? is displayed in differentiated chlorine test results, see the Troubleshooting section.
- Oxidizing agents (i.e. bromine, ozone) interfere as they react in the same way as chlorine.

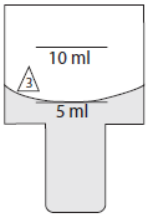
Chlorine High Range with Powder Pack Reagent and 10 mm Vial

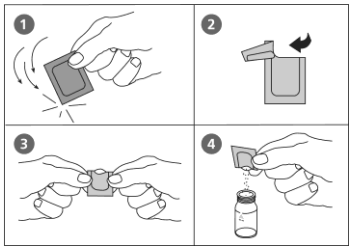
AQUAfast AC4P71 Free Chlorine Powder Packs and AQUAfast AC4P72 Total Chlorine Powder Packs

10 mm Round Plastic Vial (Type 3)

Range: 0.1 to 8 mg/l Cl_2

Method 111





Determination of Free Chlorine, AC4P71

1. Access the methods list, press [Shift] + [1] [1] [1] keys and press [↵] key.
2. Press arrow key [▼] or [▲] to select the determination of free chlorine (>> free) and press [↵] key.
3. Fill a clean 10 mm round vial with **5 ml of water sample** and tightly secure the vial cap.
4. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
5. Press [**Zero**] key and wait for the zero to be accepted.
6. Remove the vial from the sample chamber.
7. Add the contents of **two Chlorine Free DPD F10 powder packs** straight from the foil into the vial.
8. Tightly secure the vial cap and invert several times (about 20 seconds) to mix the contents.
9. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
10. Press [**Test**] key and wait for the measurement to be taken.
11. The result will be shown as mg/l free chlorine.

Determination of Total Chlorine, AC4P72

1. Access the methods list, press [Shift] + [1] [1] [1] keys and press [↵] key.
2. Press arrow key [▼] or [▲] to select the determination of total chlorine (>> total) and press [↵] key.
3. Fill a clean 10 mm round vial with **5 ml of water sample** and tightly secure the vial cap.
4. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
5. Press [**Zero**] key and wait for the zero to be accepted.
6. Remove the vial from the sample chamber.
7. Add the contents of **two Chlorine Total DPD F10 powder pack** straight from the foil into the vial.
8. Tightly secure the vial cap and invert several times (about 20 seconds) to mix the contents.
9. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
10. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 3 minutes** will be displayed.
11. The result will be shown as mg/l total chlorine.

Determination of Free and Total Chlorine (Differentiated), AC4P71 + AC4P72

1. Access the methods list, press [Shift] + [1] [1] [1] keys and press [↵] key.
2. Press arrow key [▼] or [▲] to select the determination of differentiated chlorine (>> diff) and press [↵] key.
3. Fill a clean 10 mm round vial with **5 ml of water sample** and tightly secure the vial cap.
4. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
5. Press [**Zero**] key and wait for the zero to be accepted.

6. Remove the vial from the sample chamber.
7. Add the contents of **two Chlorine Free DPD F10 powder pack** straight from the foil into the vial.
8. Tightly secure the vial cap and invert several times (about 20 seconds) to mix the contents.
9. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
10. Press [**Test**] key and wait for the measurement to be taken.
11. Remove the vial from the sample chamber, empty the vial, rinse the vial and cap several times and then fill the vial with **5 ml of water sample**.
12. Add the contents of **two Chlorine Total DPD F10 powder pack** straight from the foil into the vial.
13. Tightly secure the vial cap and invert several times (about 20 seconds) to mix the contents.
14. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
15. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 3 minutes** will be displayed.
16. The results will be shown as mg/l free chlorine, combined chlorine and total chlorine.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Vial cleaning: As many household cleaners (e.g. dishwasher detergent) contain reducing substances, the subsequent determination of chlorine may show lower results. To avoid any measurement errors, only use glassware free of chlorine demand. Preparation: Put all applicable glassware into sodium hypochlorite solution (0.1 g/l) for one hour and 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).
- Preparing the sample: When preparing the sample, avoid the escape of chlorine gases (e.g. by pipetting or shaking). Perform the analysis immediately after taking the sample.
- The DPD color development is carried out at a pH value of 6.2 to 6.5. The reagents therefore contain a buffer for the pH adjustment. Strong alkaline or acidic water samples must be adjusted between pH 6 and pH 7 before the reagent is added (use 0.5 mol/l sulfuric acid or 1 mol/l sodium hydroxide).
- Exceeding the Measuring Range: Concentrations above 8 mg/l chlorine can lead to results showing 0 mg/l. In this event, the sample must be diluted with chlorine-free water. 10 ml of the diluted sample should be mixed with reagent and the measurement repeated.
- If ??? is displayed in differentiated chlorine test results, see the Troubleshooting section.
- Oxidizing agents (i.e. bromine, ozone) interfere as they react in the same way as chlorine.

Chlorine High Range (KI) with Tablet Reagent, AC3072

AQUAfast AC3072 Total Chlorine HR (KI) Tablets

Range: 5 to 200 mg/l Cl^-

Method 105

1. Insert the adapter for 16 mm round vials into the sample chamber.
2. Access the methods list, press [Shift] + [1] [0] [5] keys and press [↵] key.
3. Fill a clean 16 mm round vial with **8 ml of water sample** and tightly secure the vial cap.
4. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
5. Press [**Zero**] key and wait for the zero to be accepted.
6. Remove the vial from the sample chamber.
7. Add **one Chlorine HR (KI) tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
8. Add **one Acidifying GP tablet** straight from the foil into the same vial and crush the tablet using a clean stir rod.
9. Tightly secure the vial cap and swirl several times until the tablets are dissolved.
10. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
11. Press [**Test**] key and wait for the measurement to be taken.
12. The result will be shown as mg/l chlorine.

Notes:

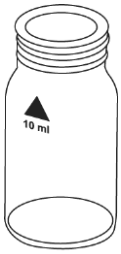
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Oxidizing agents (i.e. bromine, ozone) interfere as they react in the same way as chlorine.

Chlorine Dioxide with Tablet Reagent, AC2099 or AC3048

AQUAfast AC2099 Chlorine Dioxide Tablets or AQUAfast AC3048 Tablets

Range: 0.02 to 11 mg/l ClO_2

Method 120



Determination of Chlorine Dioxide in Absence of Chlorine, AC2099

1. Access the methods list, press [Shift] + [1] [2] [0] keys and press [↵] key.
2. Press arrow key [▼] or [▲] to select the determination of chlorine dioxide in absence of chlorine (>> without Cl) and press [↵] key.
3. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
4. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
5. Press [**Zero**] key and wait for the zero to be accepted.
6. Remove the vial from the sample chamber and **empty the vial leaving only a few drops remaining** in the vial.
7. Add **one DPD No. 1 tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
8. Add the water sample to the 10 ml mark.
9. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
10. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
11. Press [**Test**] key and wait for the measurement to be taken.
12. The result will be shown as mg/l chlorine dioxide.

Determination of Chlorine Dioxide in Presence of Chlorine, AC3048

1. Access the methods list, press [Shift] + [1] [2] [0] keys and press [↵] key.
2. Press arrow key [▼] or [▲] to select the determination of chlorine dioxide in presence of chlorine (>> with Cl) and press [↵] key.
3. Fill a clean 24 mm round vial with **10 ml of water sample**.
4. Add **one Glycine tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
5. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
6. Fill a second clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
7. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
8. Press [**Zero**] key and wait for the zero to be accepted.
9. Remove the vial from the sample chamber and **empty the vial**.
10. Add **one DPD No. 1 tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
11. **Transfer the contents of the vial containing the glycine solution into the vial with DPD No. 1 tablet**.
12. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
13. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
14. Press [**Test**] key and wait for the measurement to be taken.
15. Remove the vial from the sample chamber, empty the vial, rinse the vial and cap several times and then fill the vial with **a few drops of water sample**.

16. Add **one DPD No. 1 tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
17. Add the water sample to the 10 ml mark.
18. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
19. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
20. Press [**Test**] key and wait for the measurement to be taken.
21. Remove the vial from the sample chamber.
22. Add **one DPD No. 3 tablet** straight from the foil into the same vial and crush the tablet using a clean stir rod.
23. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
24. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
25. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 2 minutes** will be displayed.
26. The results will be shown as mg/l chlorine dioxide, free chlorine, combined chlorine and total chlorine.

Note: The conversion factor for chlorine dioxide as chlorine to chlorine dioxide as ClO_2 is 0.38 and mg/l ClO_2 = mg/l ClO_2 [Cl] x 0.38. Chlorine dioxide as chlorine (ClO_2 [Cl]) has its origin in swimming pool water treatment according to DIN 19643. The total chlorine result includes the contribution of the chlorine dioxide as chlorine result. For the true total chlorine value, subtract the chlorine dioxide as chlorine result from the total chlorine reading.

Notes:

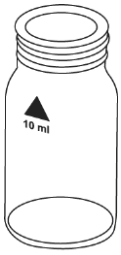
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Vial cleaning: As many household cleaners (e.g. dishwasher detergent) contain reducing substances, the subsequent determination of chlorine dioxide may show lower results. To avoid any measurement errors, only use glassware free of chlorine demand. Preparation: Put all applicable glassware into sodium hypochlorite solution (0.1 g/l) for one hour and then rinse all glassware thoroughly with deionized water.
- Preparing the sample: When preparing the sample, avoid the escape of chlorine dioxide (e.g. by pipetting or shaking). Perform the analysis immediately after taking the sample.
- The DPD color development is carried out at a pH value of 6.2 to 6.5. The reagents therefore contain a buffer for the pH adjustment. Strong alkaline or acidic water samples must be adjusted between pH 6 and pH 7 before the reagent is added (use 0.5 mol/l sulfuric acid or 1 mol/l sodium hydroxide).
- Exceeding the Measuring Range: Concentrations above 19 mg/l chlorine dioxide can lead to results showing 0 mg/l. In this event, the sample must be diluted with chlorine dioxide-free water. Prepare 10 ml of the diluted sample with reagent and repeat the measurement.
- Oxidizing agents (i.e. chlorine, ozone) interfere as they react in the same way as chlorine.

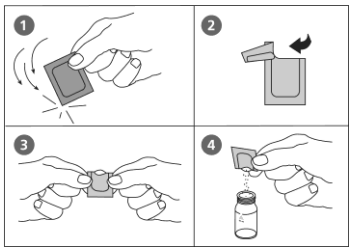
Chlorine Dioxide with Powder Pack Reagent, AC4P71

AQUAfast AC4P71 Powder Packs

Range: 0.04 to 3.8 mg/l Cl_2

Method 122





Determination of Chlorine Dioxide in Absence of Chlorine

1. Access the methods list, press [Shift] + [1] [2] [2] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add the contents of **one Chlorine Free DPD F10 powder pack** straight from the foil into the vial.
7. Tightly secure the vial cap and swirl several times (about 20 seconds) to mix the contents.
8. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
9. Press [**Test**] key and wait for the measurement to be taken.
10. The result will be shown as mg/l chlorine dioxide.

Determination of Chlorine Dioxide in Presence of Chlorine

Note: Glycine tablets can be purchased from various reagent manufacturers or by ordering the AQUAfast ozone tablets, Catalog Number AC3048, which contain 100 glycine tablets.

1. Access the methods list, press [Shift] + [1] [2] [2] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **one Gylcine tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
7. Tightly secure the vial cap and swirl gently several times until the tablet is dissolved.
8. Add the contents of **one Chlorine Free DPD F10 powder pack** straight from the foil into the same vial.
9. Tightly secure the vial cap and swirl several times (about 20 seconds) to mix the contents.
10. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
11. Press [**Test**] key and wait for the measurement to be taken.
12. The result will be shown as mg/l chlorine dioxide.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Vial cleaning: As many household cleaners (e.g. dishwasher detergent) contain reducing substances, the subsequent determination of chlorine dioxide may show lower results. To avoid any measurement errors, only use glassware free of chlorine demand. Preparation:

Put all applicable glassware into sodium hypochlorite solution (0.1 g/l) for one hour and then rinse all glassware thoroughly with deionized water.

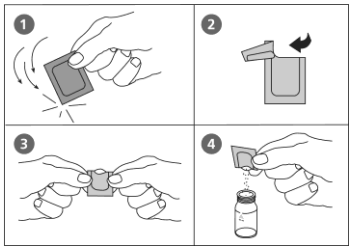
- Preparing the sample: When preparing the sample, avoid the escape of chlorine dioxide (e.g. by pipetting or shaking). Perform the analysis immediately after taking the sample.
- The DPD color development is carried out at a pH value of 6.2 to 6.5. The reagents therefore contain a buffer for the pH adjustment. Strong alkaline or acidic water samples must be adjusted between pH 6 and pH 7 before the reagent is added (use 0.5 mol/l sulfuric acid or 1 mol/l sodium hydroxide).
- Exceeding the Measuring Range: Concentrations above 3.8 mg/l chlorine dioxide can lead to results showing 0 mg/l. In this event, the sample must be diluted with water free of chlorine dioxide. 10 ml of the diluted sample should be mixed with reagent and the measurement repeated.
- Oxidizing agents (i.e. chlorine, ozone) interfere as they react in the same way as chlorine.

Chromium with Powder Pack Reagent

Refer to Reagent Manufacturer Instructions for Specific Procedure

Range: 0.02 to 2 mg/l Cr

Method 125



Determination of Differentiated Chromium (VI)

1. Fill a clean 16 mm round vial with **10 ml of water sample**.
2. Add the contents of **one Pursulf Rgt CR powder pack** straight from the foil into the vial.
3. Tightly secure the vial cap and swirl several times to mix the contents.
4. Heat the vial for **120 minutes** in a preheated thermoreactor at a temperature of 100°C.
5. **Caution: Vial will be hot!** Remove the vial from the thermoreactor. Invert the vial to mix contents and then allow the vial to cool to room temperature.
6. Insert the adapter for 16 mm round vials into the sample chamber.
7. Access the methods list, press [Shift] + [1] [2] [5] keys and press [↵] key.
8. Press arrow key [▼] or [▲] to select the determination of differentiated chromium VI (>> diff) and press [↵] key.
9. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
10. Press [**Zero**] key and wait for the zero to be accepted.
11. Remove the vial from the sample chamber.
12. Add the contents of **one Chromium Hexavalent powder pack** straight from the foil into the vial.
13. Tightly secure the vial cap and swirl several times to mix the contents.
14. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
15. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 5 minutes** will be displayed.
16. Fill a second clean 16 mm round vial with **10 ml of water sample**.
17. Add the contents of **one Chromium Hexavalent powder pack** straight from the foil into the vial.
18. Tightly secure the vial cap and swirl several times to mix the contents.
19. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
20. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 5 minutes** will be displayed.
21. The results will be shown as mg/l chromium (VI), chromium (III) and total chromium.

Determination of Chromium (VI)

1. Insert the adapter for 16 mm round vials into the sample chamber.
2. Access the methods list, press [Shift] + [1] [2] [5] keys and press [↵] key.
3. Press arrow key [▼] or [▲] to select the determination of chromium VI (>> VI) and press [↵] key.
4. Fill a clean 16 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
5. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
6. Press [**Zero**] key and wait for the zero to be accepted.
7. Remove the vial from the sample chamber.

8. Add the contents of **one Chromium Hexavalent powder pack** straight from the foil into the vial.
9. Tightly secure the vial cap and swirl several times to mix the contents.
10. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
11. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 5 minutes** will be displayed.
12. The result will be shown as mg/l chromium (VI).

Determination of Total Chromium, Sum of Cr (III) + Cr (VI)

1. Fill a clean 16 mm round vial with **10 ml of water sample**.
2. Add the contents of **one Pursulf Rgt CR powder pack** straight from the foil into the vial.
3. Tightly secure the vial cap and swirl several times to mix the contents.
4. Heat the vial for **120 minutes** in a preheated thermoreactor at a temperature of 100°C.
5. **Caution: Vial will be hot!** Remove the vial from the thermoreactor. Invert the vial to mix contents and then allow the vial to cool to room temperature.
6. Insert the adapter for 16 mm round vials into the sample chamber.
7. Access the methods list, press [Shift] + [1] [2] [5] keys and press [↵] key.
8. Press arrow key [▼] or [▲] to select the determination of total chromium (>> VI + III) and press [↵] key.
9. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
10. Press [**Zero**] key and wait for the zero to be accepted.
11. Remove the vial from the sample chamber.
12. Add the contents of **one Chromium Hexavalent powder pack** straight from the foil into the vial.
13. Tightly secure the vial cap and swirl several times to mix the contents.
14. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
15. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 5 minutes** will be displayed.
16. The results will be shown as mg/l total chromium.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This method is adapted from one originated by an alternative reagent manufacturer. Always review original instructions and Safety Data Sheet (SDS) before starting the test.
- For the differentiated chromium test, steps 1-15 determine the total chromium, steps 16-20 determine the chromium (VI) and chromium (III) results out of the difference.
- The pH value of the water sample should be between 3 and 9.
- For information on metal and reductive/oxidic interferences in wastewater and chemical wastewater, see DIN 38405-D24 and Standard Methods of Water and Wastewater.

COD Low Range with Digestion Tube, CODL00

AQUAfast CODL00 COD LR Digestion Tubes

Range: 0 to 150 mg/l O_2

Method 130

1. Open a white capped reaction tube and add **2 ml deionized water** (this is the blank vial).
2. Open a second white capped reaction tube and add **2 ml of water sample** (this is the sample vial).
3. Tightly secure the vial caps and gently invert the vial several times to mix the contents. **Caution: Vials will become hot while mixing!**
4. Heat the vials for **120 minutes** in a preheated thermoreactor at a temperature of 150°C.
5. **Caution: Vials will be hot!** Remove the vials from the thermoreactor and allow the vials to cool to 60°C or below. While the vials are still warm, carefully invert the vials several times to mix contents and then allow the vials to cool to room temperature.
6. Insert the adapter for 16 mm round vials into the sample chamber.
7. Access the methods list, press [Shift] + [1] [3] [0] keys and press [↵] key.
8. Place the blank vial in the sample chamber, making sure that the Δ marks are aligned.
9. Press [**Zero**] key and wait for the zero to be accepted.
10. Remove the vial from the sample chamber.
11. Place the sample vial in the sample chamber making sure that the Δ marks are aligned.
12. Press [**Test**] key and wait for the measurement to be taken.
13. The result will be shown as mg/l COD (O_2).

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- 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.
- Do not place the hot vials in the sample chamber. Cool the vials to room temperature for final measurements.
- 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 precipitate at the bottom of the sample should be not suspended.
- Samples can be measured when the chloride content does not exceed 1000 mg/l.
- In exceptional cases, compounds contained in the water cannot be oxidized adequately, so results may be lower than reference methods.

COD Mid Range with Digestion Tube, CODH00

AQUAfast CODH00 COD MR Digestion Tubes

Range: 0 to 1500 mg/l O_2

Method 131

1. Open a white capped reaction tube and add **2 ml deionized water** (this is the blank vial).
2. Open a second white capped reaction tube and add **2 ml of water sample** (this is the sample vial).
3. Tightly secure the vial caps and gently invert the vial several times to mix the contents. **Caution: Vials will become hot while mixing!**
4. Heat the vials for **120 minutes** in a preheated thermoreactor at a temperature of 150°C.
5. **Caution: Vials will be hot!** Remove the vials from the thermoreactor and allow the vials to cool to 60°C or below. While the vials are still warm, carefully invert the vials several times to mix contents and then allow the vials to cool to room temperature.
6. Insert the adapter for 16 mm round vials into the sample chamber.
7. Access the methods list, press [Shift] + [1] [3] [1] keys and press [↵] key.
8. Place the blank vial in the sample chamber, making sure that the Δ marks are aligned.
9. Press [**Zero**] key and wait for the zero to be accepted.
10. Remove the vial from the sample chamber.
11. Place the sample vial in the sample chamber making sure that the Δ marks are aligned.
12. Press [**Test**] key and wait for the measurement to be taken.
13. The result will be shown as mg/l COD (O_2).

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- 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.
- Do not place the hot vials in the sample chamber. Cool the vials to room temperature for final measurements.
- 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 precipitate at the bottom of the sample should be not suspended.
- Samples can be measured when the chloride content does not exceed 1000 mg/l.
- In exceptional cases, compounds contained in the water cannot be oxidized adequately, so results may be lower than reference methods.
- For samples under 100 mg/l COD (O_2), it is recommended to repeat the test with the AQUAfast COD LR digestion tube, Catalog Number CODL00.

COD High Range with Digestion Tube, CODHP0

AQUAfast CODHP0 COD HR Digestion Tubes

Range: 0 to 15 g/l O_2 (0 to 15000 mg/l O_2)

Method 132

1. Open a white capped reaction tube and add **0.2 ml deionized water** (this is the blank vial).
2. Open a second white capped reaction tube and add **0.2 ml of water sample** (this is the sample vial).
3. Tightly secure the vial caps and gently invert the vial several times to mix the contents. **Caution: Vials will become hot while mixing!**
4. Heat the vials for **120 minutes** in a preheated thermoreactor at a temperature of 150°C.
5. **Caution: Vials will be hot!** Remove the vials from the thermoreactor and allow the vials to cool to 60°C or below. While the vials are still warm, carefully invert the vials several times to mix contents and then allow the vials to cool to room temperature.
6. Insert the adapter for 16 mm round vials into the sample chamber.
7. Access the methods list, press [Shift] + [1] [3] [2] keys and press [↵] key.
8. Place the blank vial in the sample chamber, making sure that the Δ marks are aligned.
9. Press [**Zero**] key and wait for the zero to be accepted.
10. Remove the vial from the sample chamber.
11. Place the sample vial in the sample chamber making sure that the Δ marks are aligned.
12. Press [**Test**] key and wait for the measurement to be taken.
13. The result will be shown as **g/l** COD (O_2).

Notes:

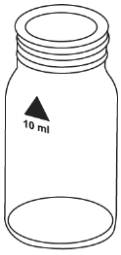
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Run samples and blanks with the same batch of vials. The blank is stable when stored in the dark and can be used for further measurements with vials of the same batch.
- Do not place the hot vials in the sample chamber. Cool the vials to room temperature for final measurements.
- 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 precipitate at the bottom of the sample should be not suspended.
- Samples can be measured when the chloride content does not exceed 1000 mg/l.
- In exceptional cases, compounds contained in the water cannot be oxidized adequately, so results may be lower than reference methods.
- For samples below 1 g/l COD (O_2), it is recommended to repeat the test with the AQUAfast COD MR digestion tube, Catalog Number CODH00 and for samples below 0.1 g/l COD (O_2), it is recommended to repeat the test with the AQUAfast COD LR digestion tube, Catalog Number CODL00.

Color, True and Apparent, APHA Platinum-Cobalt

APHA Platinum-Cobalt Standard Method

Range: 0 to 500 Pt-Co Units

Method 204



Step A: Filter approximately 50 ml of deionized water through a membrane filter with a pore width of 0.45 µm. Discard the filtrate. Filter another 50 ml of deionized water and keep it for the zero procedure.

Step B: Filter approximately 50 ml of water sample using the same filter. Keep this filter for sample measurement.

1. Access the methods list, press [Shift] + [2] [0] [4] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of the filtered deionized water** (from Step A) and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber and empty it completely.
6. Rinse the vial with the filtered water sample, fill the vial with **10 ml of the filtered water sample** (from Step B) and tightly secure the vial cap.
7. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
8. Press [**Test**] key and wait for the measurement to be taken.
9. The result will be shown as Pt-Co units.

Notes:

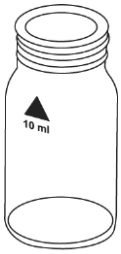
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This color scale was originally developed by A. Hazen as a visual comparison scale. It is necessary to determine if the extinction maximum of the water sample is in the range of 420 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. The estimated detection limit is 15 mg/L Pt. This method is calibrated based on standards specified by Standard Methods for the Examination of Water and Wastewater (EN ISO 7887: 1994) 1 Pt-Co unit = 1 mg/L platinum as chloroplatinate ion
- This procedure describes the determination of true color by filtration of the water sample. The apparent color is defined as the color of a solution due to dissolved substances and suspended particles in the sample – measure non-filtered deionized water and samples.
- Sample collection, preservation and storage: Pour the water sample into clean glass or plastic containers and analyze 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.

Copper with Tablet Reagent, AC2029

AQUAfast AC2029 Free and Total Copper Tablets

Range: 0.05 to 5 mg/l Cu

Method 150



Determination of Free and Total Copper (Differentiated)

1. Access the methods list, press [Shift] + [1] [5] [0] keys and press [↵] key.
2. Press arrow key [▼] or [▲] to select the determination of differentiated copper (>> diff) and press [↵] key.
3. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
4. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
5. Press [**Zero**] key and wait for the zero to be accepted.
6. Remove the vial from the sample chamber.
7. Add **one Copper No. 1 tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
8. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
9. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
10. Press [**Test**] key and wait for the measurement to be taken.
11. Remove the vial from the sample chamber.
12. Add **one Copper No. 2 tablet** straight from the foil into the same vial and crush the tablet using a clean stir rod.
13. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
14. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
15. Press [**Test**] key and wait for the measurement to be taken.
16. The results will be shown as mg/l free copper, combined copper and total copper.

Determination of Free Copper

1. Access the methods list, press [Shift] + [1] [5] [0] keys and press [↵] key.
2. Press arrow key [▼] or [▲] to select the determination of free copper (>> free) and press [↵] key.
3. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
4. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
5. Press [**Zero**] key and wait for the zero to be accepted.
6. Remove the vial from the sample chamber.
7. Add **one Copper No. 1 tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
8. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
9. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
10. Press [**Test**] key and wait for the measurement to be taken.
11. The result will be shown as mg/l free copper.

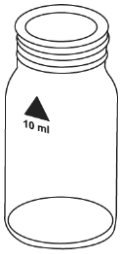
Determination of Total Copper

1. Access the methods list, press [Shift] + [1] [5] [0] keys and press [↵] key.
2. Press arrow key [▼] or [▲] to select the determination of total copper (>> total) and press [↵] key.
3. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
4. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
5. Press [**Zero**] key and wait for the zero to be accepted.
6. Remove the vial from the sample chamber.
7. Add **one Copper No. 1 tablet** and **one Copper No. 2 tablet** straight from the foil into the vial and crush the tablets using a clean stir rod.
8. Tightly secure the vial cap and swirl several times until the tablets are dissolved.
9. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
10. Press [**Test**] key and wait for the measurement to be taken.
11. The result will be shown as mg/l total copper.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- If ??? is displayed in differentiated copper test results, see the Troubleshooting section.

Method 151



Copper with Powder and Liquid Reagents

Refer to Reagent Manufacturer Instructions for Specific Procedure

Range: 0.05 to 4 mg/l Cu

Determination of Free and Total Copper (Differentiated)

1. Access the methods list, press [Shift] + [1] [5] [1] keys and press [↵] key.
2. Press arrow key [▼] or [▲] to select the determination of differentiated copper (>> diff) and press [↵] key.
3. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
4. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
5. Press [**Zero**] key and wait for the zero to be accepted.
6. Remove the vial from the sample chamber.
7. Add **10 drops KS240 solution (Coppercol Reagent 1)** into the vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
8. Tightly secure the vial cap and swirl several times to mix the contents.
9. Add **10 drops KS241 solution (Coppercol Reagent 2)** into the same vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
10. Tightly secure the vial cap and swirl several times to mix the contents.
11. Add **one level spoon of reagent KP242 powder (Coppercol Reagent 3)** into the same vial. For correct dosage, the spoon supplied with the reagent must be used.
12. Tightly secure the vial cap and swirl several times to dissolve the powder.
13. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
14. Press [**Test**] key and wait for the measurement to be taken.
15. Remove the vial from the sample chamber.
16. Add **one Copper No. 2 tablet** straight from the foil into the same vial and crush the tablet using a clean stir rod.
17. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
18. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
19. Press [**Test**] key and wait for the measurement to be taken.
20. The results will be shown as mg/l free copper, combined copper and total copper.

Determination of Free Copper

1. Access the methods list, press [Shift] + [1] [5] [1] keys and press [↵] key.
2. Press arrow key [▼] or [▲] to select the determination of free copper (>> free) and press [↵] key.
3. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
4. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
5. Press [**Zero**] key and wait for the zero to be accepted.
6. Remove the vial from the sample chamber.
7. Add **10 drops KS240 solution (Coppercol Reagent 1)** into the vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
8. Tightly secure the vial cap and swirl several times to mix the contents.

9. Add **10 drops KS241 solution (Coppercol Reagent 2)** into the same vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
10. Tightly secure the vial cap and swirl several times to mix the contents.
11. Add **one level spoon of reagent KP242 powder (Coppercol Reagent 3)** into the same vial. For correct dosage, the spoon supplied with the reagent must be used.
12. Tightly secure the vial cap and swirl several times to dissolve the powder.
13. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
14. Press [**Test**] key and wait for the measurement to be taken.
15. The result will be shown as mg/l free copper.

Determination of Total Copper

1. Access the methods list, press [Shift] + [1] [5] [1] keys and press [↵] key.
2. Press arrow key [▼] or [▲] to select the determination of total copper (>> total) and press [↵] key.
3. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
4. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
5. Press [**Zero**] key and wait for the zero to be accepted.
6. Remove the vial from the sample chamber.
7. Add **10 drops KS240 solution (Coppercol Reagent 1)** into the vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
8. Tightly secure the vial cap and swirl several times to mix the contents.
9. Add **10 drops KS241 solution (Coppercol Reagent 2)** into the same vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
10. Tightly secure the vial cap and swirl several times to mix the contents.
11. Add **one level spoon of reagent KP242 powder (Coppercol Reagent 3)** into the same vial. For correct dosage, the spoon supplied with the reagent must be used.
12. Tightly secure the vial cap and swirl several times to dissolve the powder.
13. Add **one Copper No. 2 tablet** straight from the foil into the same vial and crush the tablet using a clean stir rod.
14. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
15. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
16. Press [**Test**] key and wait for the measurement to be taken.
17. The result will be shown as mg/l total copper.

Notes:

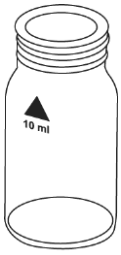
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This method is adapted from one originated by an alternative reagent manufacturer. Always review original instructions and Safety Data Sheet (SDS) before starting the test.
- For correct dosage, the spoon supplied with the reagent must be used.
- If ??? is displayed in differentiated chlorine test results, see the Troubleshooting section.

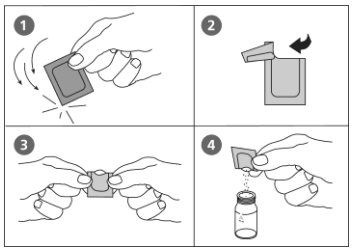
Copper with Powder Pack Reagent, AC4P29

AQUAfast AC4P29 Copper Powder Packs

Range: 0.05 to 5 mg/l Cu

Method 153





1. Access the methods list, press [Shift] + [1] [5] [3] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial in the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add the contents of **one Cu 1 F10 powder pack** straight from the foil into the vial.
7. Tightly secure the vial cap and swirl several times to mix the contents.
8. Place the vial in the sample chamber, making sure that the Δ marks are aligned.
9. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 2 minutes** will be displayed.
10. The result will be shown as mg/l copper.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- For determination of total copper, digestion is required.
- Extremely acid water samples (pH 2 or less) must be adjusted between pH 4 and pH 6 with 8 mol/l potassium hydroxide solution (KOH) before the reagent is added.
- Accuracy is not affected by undissolved powder.
- Interferences:

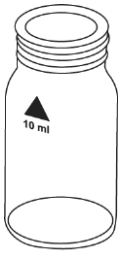
Interference	Treatment
Cyanide, CN-	Cyanide prevents full color development. Add 0.2 ml formaldehyde to 10 ml water sample, wait for a reaction time of 4 minutes (cyanide is masked) and then perform the test as described. Multiply the result by 1.02 to correct the sample dilution by formaldehyde.
Silver, Ag+	If turbidity remains and turns black, silver interference is likely. Add 10 drops of saturated potassium chloride solution to 75 ml of water sample. Filtrate through a fine filter. Use 10 ml of the filtered water sample to perform the test as described.

Cyanuric Acid (CyA) with Tablet Reagent, AC2098

AQUAfast AC2098 Cyanuric Acid Tablets

Range: 0 to 160 mg/l CyA

Method 160



1. Access the methods list, press [Shift] + [1] [6] [0] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **5 ml of water sample** and **5 ml of deionized water** (use deionized water or tap water free of cyanuric acid) and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **one CyA-Test tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
7. Tightly secure the vial cap and swirl several times until the tablet is dissolved.

Note: If cyanuric acid is present, a cloudy solution will occur. Small single particles are not necessarily caused by cyanuric acid. Dissolve the tablet completely by swirling the vial for approximately one minute. Undissolved tablet particles can cause results that are too high.

8. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
9. Press [**Test**] key and wait for the measurement to be taken.
10. The results will be shown as mg/l cyanuric acid.

Notes:

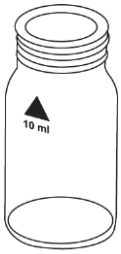
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- In Step 2, use deionized water or tap water free of cyanuric acid.
- In Step 7, if cyanuric acid is present, a cloudy solution will occur. Small single particles are not necessarily caused by cyanuric acid. Dissolve the tablet completely by swirling the vial for approximately 1 minute. Undissolved tablet particles can cause results that are too high.

Cyanide with Powder & Liquid Reagents, AC4P06

AQUAfast AC4P06 Cyanide Powder and Liquid Set

Range: 0.01 to 0.5 mg/l CN

Method 157



1. Access the methods list, press [Shift] + [1] [5] [7] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **2 ml of water sample** and **8 ml of deionized water** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **2 level spoons of Cyanide-11 powder** into the vial. For correct dosage, the No. 4 Spoon supplied with the reagent must be used.
7. Tightly secure the vial cap and invert several times to mix the contents.
8. Add **2 level spoons of Cyanide-12 powder** into the same vial. For correct dosage, the No. 4 Spoon supplied with the reagent must be used.
9. Tightly secure the vial cap and invert several times to mix the contents.
10. Add **3 drops Cyanide-13 solution** into the same vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
11. Tightly secure the vial cap and invert several times to mix the contents.
12. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
13. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 10 minutes** will be displayed.
14. The result will be shown as mg/l cyanide.

Notes:

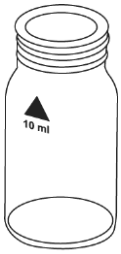
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Only free cyanide and cyanides that can be destroyed by chlorine are determined by this test.
- In the present of thiocyanate, heavy metal complexes, colorants or aromatic amines, the cyanide must be separated out by distillation before analysis is performed.
- **Store the reagents in closed containers at a temperature of +15°C to +25°C.**

DEHA with Tablet & Liquid Reagents, AC3088

AQUAfast AC3088 DEHA (N,N-Diethylhydroxylamine) Tablet and Liquid Set

Range: 20 to 500 µg/l DEHA, 0.02 to 0.5 mg/l DEHA

Method 165



1. Access the methods list, press [Shift] + [1] [6] [5] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **6 drops (0.25 ml) DEHA solution** into the vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
7. Tightly secure the vial cap and swirl several times to mix the contents.
8. Add **one DEHA tablet** straight from the foil into the same vial and crush the tablet using a clean stir rod.
9. Tightly secure the vial cap and swirl several times to mix the contents.
10. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
11. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 10 minutes** will be displayed.
    b. Keep the sample in the dark during the color development time.
12. The result will be shown as mg/l DEHA.
    a. Press arrow key [▼] or [▲] to change the test result units to mg/l or µg/l.

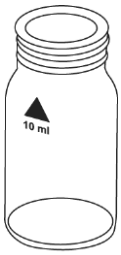
Notes:

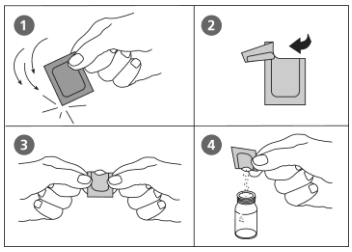
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Application: Testing of residual corrosion inhibitors (oxygen scavengers) in boiler feed water or condensate.
- Before using, clean the vials with hydrochloric acid (approximately 20%) and then rinse thoroughly with deionized water.
- Keep the sample in the dark during the color development time. UV-light (sunlight) causes high measurement results.
- Ideal temperature for full color development is 20°C ±2°C.
- Interferences:
    - Iron (II) interferes at all concentrations: Repeat the test procedure but without adding the DEHA solution. If the displayed result is above 20 µg/l, subtract this value from the DEHA test result.
    - Substances that reduce iron (III) interfere. Substances that complex iron strongly may also interfere.
    - Substances that may interfere when present in concentrations at:

- Borate (as $Na_2B_4O_7$): 500 mg/l
- Cobalt: 0.025 mg/l
- Copper: 8.0 mg/l
- Hardness (as $CaCO_3$): 1000 mg/l
- Lignosulfonates: 0.05 mg/l
- Manganese: 0.8 mg/l
- Molybdenum: 80 mg/l
- Nickel: 0.8 mg/l
- Phosphate: 10 mg/l
- Phosphonates: 10 mg/l
- Sulfate: 1000 mg/l
- Zinc: 50 mg/l

- There is an option to change the unit from mg/l to µg/l. The mg/l unit is rounded, e.g. 25 µg/l = 0.025 mg/l, but will be displayed as 0.03 mg/l.

Method 167





DEHA with Powder Pack & Liquid Reagents, AC4P88

AQUAfast AC4P88 DEHA (N,N-Diethylhydroxylamine) Powder Pack and Liquid Set

Range: 20 to 500 µg/l DEHA, 0.02 to 0.5 mg/l DEHA

1. Access the methods list, press [Shift] + [1] [6] [7] keys and press [↵] key.
2. Use two clean 24 mm round vials and mark one as the blank vial.
3. Fill one 24 mm round vial with **10 ml of deionized water** (this is the blank vial).
4. Fill the second 24 mm round vial with **10 ml of water sample** (this is the sample vial).
5. Add the contents of **one Oxyscav 1 Rgt powder pack** straight from the foil into each vial.
6. Tightly secure the vial caps and swirl several times to mix the contents.
7. Using a suitable Class A pipette, add 0.2 ml DEHA 2 Rgt solution to each vial.
8. Tightly secure the vial caps and swirl several times to mix the contents.
9. Press [↵] key.
    a. A countdown for the **reaction period of 10 minutes** will be displayed.
    b. Keep the sample in the dark during the color development time.
10. After the reaction period is done, place the blank vial in the sample chamber, making sure that the Δ marks are aligned.
11. Press [**Zero**] key and wait for the zero to be accepted.
12. Remove the vial from the sample chamber.
13. Place the sample vial in the sample chamber, making sure that the Δ marks are aligned.
14. Press [**Test**] key and wait for the measurement to be taken.
15. The result will be shown as mg/l DEHA.
    a. Press arrow key [▼] or [▲] to change the test result units to mg/l or µg/l.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Application: Testing of residual corrosion inhibitors (oxygen scavengers) in boiler feed water or condensate.
- Before using, clean the vials with hydrochloric acid (approximately 20%) and then rinse thoroughly with deionized water.
- Ideal temperature for full color development is 25°C ±3°C.
- For Step 7, the volume should always be measured using a suitable pipette (class A).
- For Step 9, keep the sample in the dark during color development time. UV-light (sunlight) causes high measurement results.

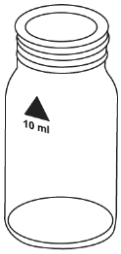
- Interferences:
    - Iron (II) interferes at all concentrations: Repeat the test procedure but without adding the DEHA solution. If the displayed result is above 20 µg/l, subtract this value from the DEHA test result.
    - Substances that reduce iron (III) interfere. Substances that complex iron strongly may also interfere.
    - Substances that may interfere when present in concentrations at:
        - Borate (as $Na_2B_4O_7$): 500 mg/l
        - Cobalt: 0.025 mg/l
        - Copper: 8.0 mg/l
        - Hardness (as $CaCO_3$): 1000 mg/l
        - Lignosulfonates: 0.05 mg/l
        - Manganese: 0.8 mg/l
        - Molybdenum: 80 mg/l
        - Nickel: 0.8 mg/l
        - Phosphate: 10 mg/l
        - Phosphonates: 10 mg/l
        - Sulfate: 1000 mg/l
        - Zinc: 50 mg/l
- There is an option to change the unit from mg/l to µg/l. The mg/l unit is rounded, e.g. 25 µg/l = 0.025 mg/l, but will be displayed as 0.03 mg/l.

Fluoride with Liquid Reagent, AC2009

AQUAfast AC2009 Fluoride Liquid Reagent

Range: 0.05 to 2 mg/l F

Method 170



Caution: Review notes before performing test procedure.

1. Access the methods list, press [Shift] + [1] [7] [0] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **exactly 10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **exactly 2 ml SPADNS Reagent solution** into the vial. **Caution: Vial will be filled up to the top!**
7. Tightly secure the vial cap and swirl several times to mix the contents.
8. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
9. Press [**Test**] key and wait for the measurement to be taken.
10. The result will be shown as mg/l fluoride.

Notes:

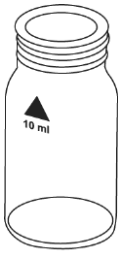
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- The same batch of SPADNS reagent solution must be used for adjustment and test. The adjustment process needs to be performed for each new batch of SPADNS reagent solution (see Standard Methods 20th, 1998, APHA, AWWA, WEF 4500 F D., S. 4-82). The procedure is described in the Calibration – Fluoride Method 170 section.
- During adjustment and test, the same vial should be used for zeroing and test, as different vials may exhibit minor tolerances.
- The calibration solution and the water samples to be tested should have the same temperature (± 1°C).
- The test result is highly dependent on exact sample and reagent volumes, so the sample and reagent volumes must always be measured using 10 ml and 2 ml volumetric pipettes (class A).
- The accuracy of the test method decreases above a level of 1.2 mg/l fluoride. Although the results are sufficiently accurate for most applications, even more exact results can be achieved by 1:1 dilution of the sample prior to use and subsequent multiplication of the result by 2.
- SPADNS reagent solution contains arsenite. Chlorine concentrations up to 5 mg/l do not interfere.
- Seawater and wastewater samples must be distilled.

Hydrogen Peroxide (H_2O_2) with Tablet Reagent, AC3069

AQUAfast AC3069 Hydrogen Peroxide Tablets

Range: 0.03 to 3 mg/l H_2O_2

Method 210



1. Access the methods list, press [Shift] + [2] [1] [0] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber and **empty the vial leaving only a few drops remaining** in the vial.
6. Add **one Hydrogen Peroxide LR tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
7. Add the water sample to the 10 ml mark.
8. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
9. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
10. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 2 minutes** will be displayed.
11. The result will be shown as mg/l hydrogen peroxide.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Vial cleaning: As many household cleaners (e.g. dishwasher detergent) contain reducing substances, the subsequent determination of hydrogen peroxide may show lower results. To avoid measurement errors, only use glassware free of chlorine demand. Preparation: Put all applicable glassware into a sodium hypochlorite solution (0.1 g/l) for one hour and then rinse all glassware thoroughly with deionized water.
- Preparing the sample: When preparing the sample, the loss of hydrogen peroxide (e.g. by pipetting or shaking) must be avoided. The analysis must take place immediately after taking the sample.
- The DPD color development is carried out at a pH value of 6.2 to 6.5. The reagent tablet therefore contains a buffer for the pH adjustment. Strong alkaline or acidic water samples must be adjusted between pH 6 and pH 7 before the reagent is added (use 0.5 mol/l sulfuric acid or 1 mol/l sodium hydroxide).
- Exceeding the measuring range: Concentrations above 5 mg/l hydrogen peroxide can lead to results showing 0 mg/l. In this event, the water sample must be diluted with hydrogen peroxide-free water and then 10 ml of the diluted sample should be mixed with the reagent and the measurement repeated.
- Oxidizing agents (i.e. chlorine, ozone) interfere as they react in the same way as hydrogen peroxide.

Method 213

Hydrogen Peroxide (H_2O_2) Low Range with Liquid Reagent

Refer to Reagent Manufacturer Instructions for Specific Procedure

Range: 1 to 50 mg/l H_2O_2

1. Insert the adapter for 16 mm round vials into the sample chamber.
2. Access the methods list, press [Shift] + [2] [1] [3] keys and press [↵] key.
3. Fill a clean 16 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
4. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
5. Press [**Zero**] key and wait for the zero to be accepted.
6. Remove the vial from the sample chamber.
7. Add **6 drops H2O2 Reagent solution** into the vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
8. Tightly secure the vial cap and invert several times to mix the contents.
9. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
10. Press [**Test**] key and wait for the measurement to be taken.
11. The result will be shown as mg/l hydrogen peroxide.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This method is adapted from one originated by an alternative reagent manufacturer. Always review original instructions and Safety Data Sheet (SDS) before starting the test. It is recommended to wear appropriate protective clothing (protective goggles and gloves).
- The hydrogen peroxide is determined in the form of yellow/orange colored peroxotitanic acids in strongly acidic media. In connection with neutral to weakly alkaline (~pH 10) samples, the acid in the reagent is sufficient in order to produce a medium suitable for measurement. In the case of strongly alkaline samples (pH > 10), the samples must be acidified before measurement otherwise the results may be deficient. This is achieved by diluting the sample with a 5% sulfuric acid solution, for example, at a ratio of 1:1. In contrast to many other color reactions, in connection with the presence of hydrogen peroxide, discoloration with long-term stability is achieved that can still be measured after 24 hours. Particles in the sample solution or turbidity distort the analysis and must be eliminated by centrifuging or simply filtering the sample solution prior to performing the measurement. Falsification of the measurement results should also be expected in connection with colored solutions.
- Oxidizing agents such as chlorine, bromine, chlorine dioxide and ozone do not distort the analysis. However, water discoloration does distort the analysis. In this case, proceed as described in the following: Fill a clean 16 mm round vial with 10 ml of the water sample and perform the zero procedure. Measure the sample solution without the addition of drops of H2O2 reagent (result B). Then add the H2O2 reagent to the same sample solution and measure with the addition of the H2O2 reagent (result A). Calculate mg/l hydrogen peroxide = result A - result B

Hydrogen Peroxide (H_2O_2) High Range with Liquid Reagent

Refer to Reagent Manufacturer Instructions for Specific Procedure

Range: 40 to 500 mg/l H_2O_2

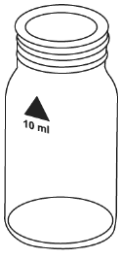
Method 214

1. Insert the adapter for 16 mm round vials into the sample chamber.
2. Access the methods list, press [Shift] + [2] [1] [4] keys and press [↵] key.
3. Fill a clean 16 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
4. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
5. Press [**Zero**] key and wait for the zero to be accepted.
6. Remove the vial from the sample chamber.
7. Add **6 drops H2O2 Reagent solution** into the vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
8. Tightly secure the vial cap and invert several times to mix the contents.
9. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
10. Press [**Test**] key and wait for the measurement to be taken.
11. The result will be shown as mg/l hydrogen peroxide.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This method is adapted from one originated by an alternative reagent manufacturer. Always review original instructions and Safety Data Sheet (SDS) before starting the test. It is recommended to wear appropriate protective clothing (protective goggles and gloves).
- The hydrogen peroxide is determined in the form of yellow/orange colored peroxotitanic acids in strongly acidic media. In connection with neutral to weakly alkaline (~pH 10) samples, the acid in the reagent is sufficient in order to produce a medium suitable for measurement. In the case of strongly alkaline samples (pH > 10), the samples must be acidified before measurement otherwise the results may be deficient. This is achieved by diluting the sample with a 5% sulfuric acid solution, for example, at a ratio of 1:1. In contrast to many other color reactions, in connection with the presence of hydrogen peroxide, discoloration with long-term stability is achieved that can still be measured after 24 hours. Particles in the sample solution or turbidity distort the analysis and must be eliminated by centrifuging or simply filtering the sample solution prior to performing the measurement. Falsification of the measurement results should also be expected in connection with colored solutions.
- Oxidizing agents such as chlorine, bromine, chlorine dioxide and ozone do not distort the analysis. However, water discoloration does distort the analysis. In this case, proceed as described in the following: Fill a clean 16 mm round vial with 10 ml of the water sample and perform the zero procedure. Measure the sample solution without the addition of drops of H2O2 reagent (result B). Then add the H2O2 reagent to the same sample solution and measure with the addition of the H2O2 reagent (result A). Calculate mg/l hydrogen peroxide = result A - result B

Method 190



Hardness, Calcium with Tablet Reagent, AC3032C

AQUAfast AC3032C Hardness, Calcium Tablets

Range: 50 to 900 mg/l $CaCO_3$

1. Access the methods list, press [Shift] + [1] [9] [0] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample**.
3. Add **one Cal Check tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
4. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
5. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
6. Press [**Zero**] key and wait for the zero to be accepted.
    a. A countdown for the **reaction period of 2 minutes** will be displayed.
7. Remove the vial from the sample chamber.
8. Add **2 ml of water sample** to the same vial. **Caution: Vial will be filled up to the top!**
9. Tightly secure the vial cap and swirl several times (about 5 times) to mix the contents.
10. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
11. Press [**Test**] key and wait for the measurement to be taken.
12. The result will be shown as mg/l calcium hardness as $CaCO_3$.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to $CaCO_3$, °dH, °eH, °fH or °aH.

Notes:

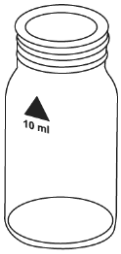
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Strong alkaline or acidic water samples must be adjusted between pH 4 and pH 10 before the tablet is added (use 1 mol/l hydrochloric acid or 1 mol/l sodium hydroxide).
- The tolerance of the method increases with higher concentrations. When diluting samples, this should be taken into account by always measuring in the lower third of the range.
- This method was developed from a volumetric procedure for the determination of calcium. Due to undefined conditions, the deviations from the standardized method may be greater.

Hardness, Calcium Low Range with Tablet Reagent, AC3032C2

AQUAfast AC3032C2 Hardness, Calcium LR Tablets

Range: 0 to 500 mg/l $CaCO_3$

Method 191

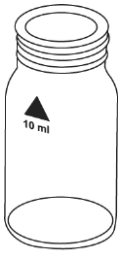


1. Access the methods list, press [Shift] + [1] [9] [1] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **one Calcio H No. 1 tablet** straight from the foil into the vial, crush the tablet using a clean stir rod and dissolve the tablet completely.
7. Add **one Calcio H No. 2 tablet** straight from the foil into the same vial and crush the tablet using a clean stir rod.
8. Tightly secure the vial cap and swirl gently several times until the tablet is completely dissolved.
9. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
10. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 2 minutes** will be displayed.
11. The result will be shown as mg/l calcium hardness as $CaCO_3$.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to $CaCO_3$, °dH, °eH, °fH or °aH.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- To optimize the results, an optional batch related calibration can be performed using the Mode 40 function.
- Strong alkaline or acidic water samples must be adjusted between pH 4 and pH 10 before the tablet is added (use 1 mol/l hydrochloric acid or 1 mol/l sodium hydroxide).
- For accurate test results, exactly 10 ml of water sample must be taken for the test.
- This method was developed from a volumetric procedure for the determination of calcium. Due to undefined conditions, the deviations from the standardized method may be greater.
- The tolerance of the method increases with higher concentrations. When diluting samples, this should be taken into account by always measuring in the lower third of the range.
- Interferences:
    - Magnesium hardness up to 200 mg/l $CaCO_3$ does not interfere
    - Iron concentration above 10 mg/l may cause low results
    - Zinc concentration above 5 mg/l may cause high results

Method 200



Hardness, Total with Tablet Reagent, AC3032T

AQUAfast AC3032T Hardness, Total Tablets

Range: 2 to 50 mg/l $CaCO_3$

1. Access the methods list, press [Shift] + [2] [0] [0] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **one Hard Check P tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
7. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
8. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
9. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 5 minutes** will be displayed.
10. The result will be shown as mg/l total hardness as $CaCO_3$.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to $CaCO_3$, °dH, °eH, °fH or °aH.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Strong alkaline or acidic water samples must be adjusted between pH 4 and pH 10 before the tablet is added (use 1 mol/l hydrochloric acid or 1 mol/l sodium hydroxide).
- Conversion table:

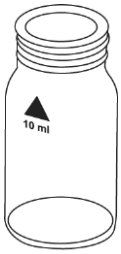
	mg/l $CaCO_3$	°dH	°fH	°eH
1 mg/l $CaCO_3$	----	0.056	0.10	0.07
1 °dH	17.8	----	1.78	1.25
1 °fH	10.0	0.56	----	0.70
1 °eH	14.3	0.80	1.43	----

Hardness, Total High Range with Tablet Reagent, AC3032T

AQUAfast AC3032T Hardness, Total Tablets

Range: 20 to 500 mg/l $CaCO_3$

Method 201



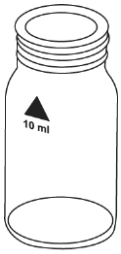
1. Access the methods list, press [Shift] + [2] [0] [1] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **1 ml of water sample** and **9 ml of deionized water** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **one Hard Check P tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
7. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
8. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
9. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 5 minutes** will be displayed.
10. The result will be shown as mg/l total hardness as $CaCO_3$.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to $CaCO_3$, °dH, °eH, °fH or °aH.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Strong alkaline or acidic water samples must be adjusted between pH 4 and pH 10 before the tablet is added (use 1 mol/l hydrochloric acid or 1 mol/l sodium hydroxide).
- Conversion table:

	mg/l $CaCO_3$	°dH	°fH	°eH
1 mg/l $CaCO_3$	----	0.056	0.10	0.07
1 °dH	17.8	----	1.78	1.25
1 °fH	10.0	0.56	----	0.70
1 °eH	14.3	0.80	1.43	----

Method 205



Hydrazine with Powder Reagent, AC2030

AQUAfast AC2030 Hydrazine Powder Set

Range: 0.05 to 0.5 mg/l N_2H_4, 50 to 500 µg/l N_2H_4

1. Access the methods list, press [Shift] + [2] [0] [5] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **one gram Hydrazine Test powder** (using the included spoon, one gram is equivalent to one spoon) into the vial.
7. Press [↵] key.
    a. A countdown for the **reaction period of 10 minutes** will be displayed.
8. After the reaction period is done, the slight turbidity that occurs when the reagent is added must be removed by filtration (qualitative folded filter papers for medium precipitates are recommended) and then tightly secure the vial cap.
9. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
10. Press [**Test**] key and wait for the measurement to be taken.
11. The result will be shown as mg/l hydrazine.
    a. Press arrow key [▼] or [▲] to change the test result units to mg/l or µg/l.

Notes:

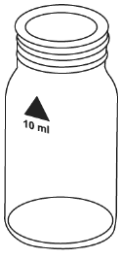
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- If the sample is cloudy, the sample must be filtered before performing the zero procedure.
- The temperature of the water sample should not exceed 21°C.
- When using the hydrazine spoon, one gram is equivalent to one level spoon.
- For Step 8, qualitative folded filter papers for medium precipitates are recommended.
- In order to check whether the reagent has aged (if it has been stored for a lengthy period), perform the test as described above using tap water. If the result is above the detection limit of 0.05 mg/l, only use the reagent with reservations, as there may be a major deviation in results.
- There is an option to change the unit from mg/l to µg/l.
- There is an option to change the unit from mg/l to µg/l. The mg/l unit is rounded, e.g. 25 µg/l = 0.025 mg/l, but will be displayed as 0.03 mg/l.

Method 206

Hydrazine with Liquid Reagent, AC3030LQ

AQUAfast AC3030LQ Hydrazine liquid Reagent

Range: 0.005 to 0.6 mg/l N_2H_4, 5 to 600 µg/l N_2H_4

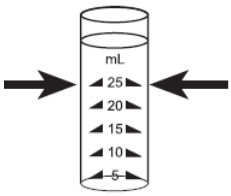


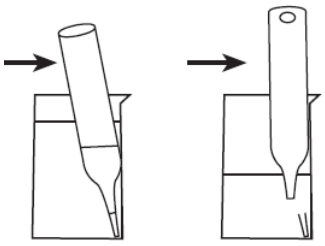
1. Access the methods list, press [Shift] + [2] [0] [6] keys and press [↵] key.
2. Use two clean 24 mm round vials and mark one as the blank vial.
3. Fill one 24 mm round vial with **10 ml of deionized water** (this is the blank vial).
4. Add **1 ml Hydra 2 Rgt solution** into the blank vial.
5. Tightly secure the vial cap and swirl several times to mix the contents.
6. Place the blank vial in the sample chamber, making sure that the Δ marks are aligned.
7. Press [**Zero**] key and wait for the zero to be accepted.
8. Remove the vial from the sample chamber.
9. Fill the second 24 mm round vial with **10 ml of water sample** (this is the sample vial).
10. Add **1 ml Hydra 2 Rgt solution** into the sample vial.
11. Tightly secure the vial cap and swirl several times to mix the contents.
12. Place the sample vial in the sample chamber, making sure that the Δ marks are aligned.
13. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 12 minutes** will be displayed.
14. The result will be shown as mg/l hydrazine.
    a. Press arrow key [▼] or [▲] to change the test result units to mg/l or µg/l.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Samples cannot be preserved and must be analyzed immediately.
- Sample temperature should be 21°C ±4°C.
- The blank may develop a faint yellow color due to the reagent.
- Interferences:
    - Ammonia causes no interferences up to 10 mg/l. At a concentration of 20 mg/l, it is possible that the test result increases by 20%.
    - Morpholine does not interfere up to 10 mg/l.
    - Highly colored or turbid samples: Mix 1 part deionized water with 1 part household bleach. Add 1 drop of this mixture into 25 ml water sample and mix. Use 10 ml prepared sample in place of deionized water for the blank. Use the unprepared sample for the water sample. Principle: Hydrazine is oxidized by household bleach and color interference will be eliminated by the zero procedure.
- There is an option to change the unit from mg/l to µg/l. The mg/l unit is rounded, e.g. 25 µg/l = 0.025 mg/l, but will be displayed as 0.03 mg/l.

Method 207





Hydrazine with Ampoule Reagent

Refer to Reagent Manufacturer Instructions for Specific Procedure

Range: 0.01 to 0.7 mg/l N_2H_4, 10 to 700 µg/l N_2H_4

1. Insert the adapter for 13 mm round vials into the sample chamber.
2. Access the methods list, press [Shift] + [2] [0] [7] keys and press [↵] key.
3. Place the blank ampoule in the sample chamber. The blank ampoule should be part of the reagent manufacturer's test kit.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the ampoule from the sample chamber.
6. Fill the sample container to the **25 ml mark with water sample**.
7. Place one ampoule into the sample container. Snap the tip by pressing the ampoule against the side of the sample container. The ampoule breaks at the neck and fills automatically. A small volume of inert gas remains in the ampoule.
8. Mix the contents of the ampoule by inverting it several times, allowing the bubble to move from one end to the other. Dry the outside of the ampoule.
9. Place the sample ampoule in the sample chamber.
10. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 10 minutes** will be displayed.
11. The result will be shown as mg/l hydrazine.
    a. Press arrow key [▼] or [▲] to change the test result units to mg/l or µg/l.

Notes:

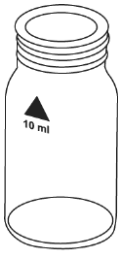
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This method is adapted from one originated by an alternative reagent manufacturer. Always review original instructions and Safety Data Sheet (SDS) before starting the test.
- There is an option to change the unit from mg/l to µg/l. The mg/l unit is rounded, e.g. 25 µg/l = 0.025 mg/l, but will be displayed as 0.03 mg/l.

Iodine with Tablet Reagent, AC2071

AQUAfast AC2071 Tablets

Range: 0.05 to 3.6 mg/l I

Method 215

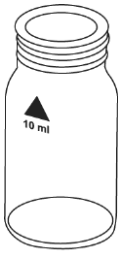


1. Access the methods list, press [Shift] + [2] [1] [5] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber and **empty the vial leaving only a few drops remaining** in the vial.
6. Add **one DPD No. 1 tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
7. Add the water sample to the 10 ml mark.
8. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
9. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
10. Press [**Test**] key and wait for the measurement to be taken.
11. The result will be shown as mg/l iodine.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Vial cleaning: As many household cleaners (e.g. dishwasher detergent) contain reducing substances, the subsequent determination of iodine may show lower results. To avoid measurement errors, only use glassware free of chlorine demand.
    - Preparation: Put all applicable glassware into a sodium hypochlorite solution (0.1 g/l) for one hour and then rinse all glassware thoroughly with deionized water.
- Oxidizing agents (i.e. chlorine, bromine) interfere as they react in the same way as iodine.

Method 220



Iron (II & III) with Tablet Reagent, AC2078

AQUAfast AC2078 Iron Tablets

Range: 0.02 to 1 mg/l Fe

This test procedure is suitable for determining total dissolved iron (Fe^{2+} and Fe^{3+}).

1. Access the methods list, press [Shift] + [2] [2] [0] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **one Iron LR tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
7. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
8. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
9. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 5 minutes** will be displayed.
10. The result will be shown as mg/l iron (Fe^{2+} + Fe^{3+}).

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This method determines the total dissolved iron as Fe^{2+} and Fe^{3+}.
- For the determination of total dissolved and undissolved iron, a digestion is required. An example is described as follows:
    - Add 1 ml of concentrated sulfuric acid to 100 ml water sample. Heat and boil for 10 minutes or until all particles are dissolved. After cooling down, the sample is set to a pH-value of 3 to 6 by using ammonia solution. Refill with deionized water to the previous volume of 100 ml and mix well. 10 ml of this pre-treated solution is used for the following analysis. Perform as described by the selected test method.
    - Water that has been treated with organic compounds like corrosion inhibitors must be oxidized where necessary to break down the iron. Therefore add 1 ml concentrated sulfuric acid and 1 ml concentrated nitric acid to 100 ml water sample and boil to approximately half volume. After cooling down, proceed as described above.

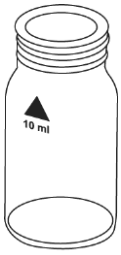
Iron with Powder Pack Reagent, AC4P78

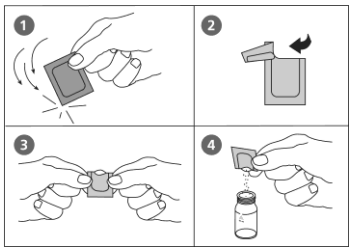
AQUAfast AC4P78 Iron (Ferro) Powder Packs

Range: 0.02 to 3 mg/l Fe

Method 222

This test procedure is suitable for determining all dissolved iron and most undissolved forms of iron.



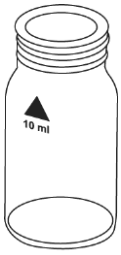


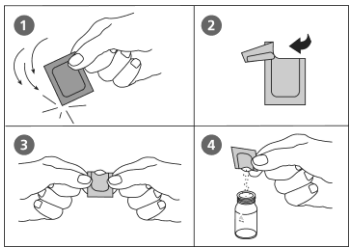
1. Access the methods list, press [Shift] + [2] [2] [2] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add the contents of **one Ferro F10 powder pack** straight from the foil into the vial.
7. Tightly secure the vial cap and swirl several times to mix the contents.
    a. Accuracy is not affected by undissolved powder.
8. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
9. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 3 minutes** will be displayed.
    b. Water samples containing visible rust should react for at least 5 minutes.
10. The result will be shown as mg/l iron.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- The reagent reacts with all soluble iron and most insoluble forms of iron in the sample.
- Iron oxide requires prior digestion: use mild, vigorous or acid digestion. For the determination of total dissolved and undissolved iron, a digestion is required. An example is described as follows:
    - Add 1 ml of concentrated sulfuric acid to 100 ml water sample. Heat and boil for 10 minutes or until all particles are dissolved. After cooling down, the sample is set to a pH-value of 3 to 6 by using ammonia solution. Refill with deionized water to the previous volume of 100 ml and mix well. 10 ml of this pre-treated solution is used for the following analysis. Perform as described by the selected test method.
    - Water that has been treated with organic compounds like corrosion inhibitors must be oxidized where necessary to break down the iron. Therefore add 1 ml concentrated sulfuric acid and 1 ml concentrated nitric acid to 100 ml water sample and boil to approximately half volume. After cooling down, proceed as described above.
- Very strong alkaline or acidic water samples must be adjusted to a pH value between 3 and 5 before analysis.

Method 223





Iron (Total) with Powder Pack Reagent, AC4P79

AQUAfast AC4P79 Iron (Total) Powder Packs

Range: 0.02 to 1.8 mg/l Fe

This test procedure is suitable for determining all dissolved iron and most undissolved forms of iron; most undissolved iron oxides are recovered by the reagent.

1. Access the methods list, press [Shift] + [2] [2] [3] keys and press [↵] key.
2. Use two clean 24 mm round vials and mark one as the blank vial.
3. Fill one 24 mm round vial with **10 ml of deionized water** (this is the blank vial).
4. Fill the second 24 mm round vial with **10 ml of water sample** (this is the sample vial).
5. Add the contents of **one Iron TPTZ F10 powder pack** straight from the foil into each vial.
6. Tightly secure the vial caps and swirl several times to mix the contents.
7. Press [↵] key.
    a. A countdown for the **reaction period of 3 minutes** will be displayed.
8. After the reaction period is done, place the blank vial in the sample chamber, making sure that the Δ marks are aligned.
9. Press [**Zero**] key and wait for the zero to be accepted.
10. Remove the vial from the sample chamber.
11. Place the sample vial in the sample chamber, making sure that the Δ marks are aligned.
12. Press [**Test**] key and wait for the measurement to be taken.
13. The result will be shown as mg/l iron.

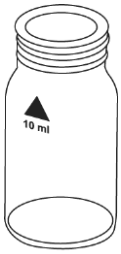
Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- For determination of total iron digestion is required. An example is described as follows:
    - Add 1 ml of concentrated sulfuric acid to 100 ml water sample. Heat and boil for 10 minutes or until all particles are dissolved. After cooling down, the sample is set to a pH-value of 3 to 6 by using ammonia solution. Refill with deionized water to the previous volume of 100 ml and mix well. 10 ml of this pre-treated solution is used for the following analysis. Perform as described by the selected test method.
    - Water that has been treated with organic compounds like corrosion inhibitors must be oxidized where necessary to break down the iron. Therefore add 1 ml concentrated sulfuric acid and 1 ml concentrated nitric acid to 100 ml water sample and boil to approximately half volume. After cooling down, proceed as described above.
- TPTZ reagent recovers most insoluble iron oxides without digestion.
- Rinse all glassware with 1:1 hydrochloric acid solution first and then rinse with deionized water to remove iron deposits that can cause slightly high results.

- Strong alkaline or acidic water samples must be adjusted between pH 3 and pH 8 before the reagent is added (use 0.5 mol/l sulfuric acid or 1 mol/l sodium hydroxide).
- Interferences: When interferences occur, color development is inhibited or a precipitate is formed. The values below refer to a standard with an iron concentration of 0.5 mg/l. The following substances do not interfere when present up to the levels given:

Substance	No Interference To
Cadmium	4.0 mg/l
Chromium ($^{3+}$)	0.25 mg/l
Chromium ($^{6+}$)	1.2 mg/l
Cobalt	0.05 mg/l
Copper	0.6 mg/l
Cyanide	2.8 mg/l
Manganese	50 mg/l
Mercury	0.4 mg/l
Molybdenum	4.0 mg/l
Nickel	1.0 mg/l
Nitrite Ion	0.8 mg/l

Method 225



Iron Low Range with Liquid Reagent

Refer to Reagent Manufacturer Instructions for Specific Procedure

Range: 0.03 to 2 mg/l Fe

This test procedure is suitable for determining total soluble iron. The sample should be pre-filtered using a 0.45 µm membrane if total dissolved iron is required. Particulate or suspended iron will otherwise add to the result.

1. Access the methods list, press [Shift] + [2] [2] [5] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **10 drops KS61 solution (Ferrozine/Thioglycolate)** into the vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
7. Tightly secure the vial cap and swirl several times to mix the contents.
8. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
9. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 5 minutes** will be displayed.
10. The result will be shown as mg/l iron.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This method is adapted from one originated by an alternative reagent manufacturer. Always review original instructions and Safety Data Sheet (SDS) before starting the test.
- Complexed iron may be measured by increasing the development period until no further color development is seen. Very strongly complexed iron may not be included in the measured iron. In this case, the complexing agent must be destroyed by oxidation with acid/persulfate followed by neutralization to pH 6-9 and then follow the procedure in the Determination of Total Iron (Low Range) Test Procedure section.
- For total iron (suspended and dissolved), boil sample with acid/persulfate. Neutralize back to pH 6-9, use deionized water to reach original volume and follow the procedure in the Determination of Total Iron (Low Range) Test Procedure section.
- When using the KS61 solution, high levels of molybdate will produce an intense yellow color and a reagent blank is required. Use two clean 24 mm round vials and mark one as the blank vial. Fill the blank vial with 10 ml of the water sample, add 10 drops KS63 solution, tightly secure the vial cap and swirl gently several times to mix. Place the vial into the sample chamber, making sure that the Δ marks are aligned. Press [Zero] key, wait for the zero to be accepted and remove the vial from the sample chamber. Fill the second vial with 10 ml water sample and follow the standard procedure, beginning with Step 6.

Determination of Total Iron (Low Range) Test Procedure

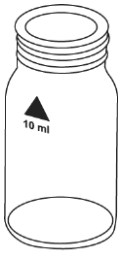
This digestion test procedure is for the determination of total iron (soluble, complexed and suspended). Do not filter the sample, but ensure the sample is homogeneous by vigorously shaking immediately prior to testing. For total soluble iron, including all complexed iron, filtration is necessary. This procedure may require equipment not included in the standard test kit.

1. Fill a clean 100 ml Erlenmeyer flask with **50 ml homogenized sample**.
2. Add **5 ml 1:1 hydrochloric acid** and **one spoon KP962 powder (Ammonium Persulfate**) to the flask.
3. Boil for **20 minutes**, maintaining the sample volume above 25 ml with deionized water.
4. Cool the sample to room temperature.
5. Add **one drop KS135 solution (Phenolphthalein Indicator)** into the flask. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
6. Add drops of **KS144 solution (Calcium Hardness Buffer)**, one drop at a time with mixing, until a pink/red color just appears.
7. Fill the flask up to 50 ml with deionized water.
8. Access the methods list, press [Shift] + [2] [2] [5] keys and press [↵] key.
9. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
10. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
11. Press [**Zero**] key and wait for the zero to be accepted.
12. Remove the vial from the sample chamber and empty the vial.
13. Add **10 ml of prepared water sample to the same vial.**
14. Add **10 drops KS61 solution (Ferrozine/Thioglycolate)** into the vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
15. Tightly secure the vial cap and swirl several times to mix the contents.
16. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
17. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 5 minutes** will be displayed.
18. The result will be shown as mg/l total iron, or if sample was filtered, mg/l total soluble iron.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This method is adapted from one originated by an alternative reagent manufacturer. Always review original instructions and Safety Data Sheet (SDS) before starting the test.
- Complexed iron may be measured by increasing the development period until no further color development is seen. Very strongly complexed iron may not be included in the measured iron. In this case, the complexing agent must be destroyed by oxidation with acid/persulfate followed by neutralization to pH 6-9 and then follow the above procedure.
- For total iron (suspended and dissolved), boil sample with acid/persulfate. Neutralize back to pH 6-9, use deionized water to reach original volume and follow the above procedure.

Method 226



Iron Low Range 2 with Liquid Reagent

Refer to Reagent Manufacturer Instructions for Specific Procedure

Range: 0.03 to 2 mg/l Fe

This test procedure is suitable for determining total soluble iron and differentiating between the ferrous and ferric state. The sample should be pre-filtered using a 0.45 µm membrane if total dissolved iron is required. Particulate or suspended iron will otherwise add to the result.

1. Access the methods list, press [Shift] + [2] [2] [6] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **10 drops KS60 solution (Acetate Buffer)** into the vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
7. Tightly secure the vial cap and swirl several times to mix the contents.
8. Add **10 drops KS63 solution (Thioglycolate)** into the same vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
    a. For soluble iron Fe^{2+}, omit this step.
9. Tightly secure the vial cap and swirl several times to mix the contents.
10. Add **10 drops KS65 solution (Ferrozine)** into the same vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
11. Tightly secure the vial cap and swirl several times to mix the contents.
12. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
13. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 5 minutes** will be displayed.
14. The result will be shown as mg/l $Fe^{2+/3+}$, or if Step 8 was omitted, as mg/l Fe^{2+}.
    a. $Fe^{3+} = Fe^{2+/3+} - Fe^{2+}$

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This method is adapted from one originated by an alternative reagent manufacturer. Always review original instructions and Safety Data Sheet (SDS) before starting the test.
- Complexed iron may be measured by increasing the development period until no further color development is seen. Very strongly complexed iron may not be included in the measured iron. In this case, the complexing agent must be destroyed by oxidation with acid/persulfate followed by neutralization to pH 6-9 and then follow the procedure in the Determination of Total Iron 2 Test Procedure section.

- For total iron (suspended and dissolved), boil sample with acid/persulfate. Neutralize back to pH 6-9, use deionized water to reach original volume and follow the procedure in the Determination of Total Iron 2 Test Procedure section.
- When using the KS63 solution, high levels of molybdate will produce an intense yellow color and a reagent blank is required. Use two clean 24 mm round vials and mark one as the blank vial. Fill the blank vial with 10 ml of the water sample, add 10 drops KS63 solution, tightly secure the vial cap and swirl gently several times to mix. Place the vial into the sample chamber, making sure that the Δ marks are aligned. Press [Zero] key, wait for the zero to be accepted and remove the vial from the sample chamber. Fill the second vial with 10 ml water sample and follow the standard procedure, beginning with Step 6.

Determination of Total Iron 2 Test Procedure

This digestion test procedure is for the determination of total iron (soluble, complexed and suspended). Do not filter the sample, but ensure the sample is homogeneous by vigorously shaking immediately prior to testing. For total soluble iron, including all complexed iron, filtration is necessary. This procedure may require equipment not included in the standard test kit.

1. Fill a clean 100 ml Erlenmeyer flask with **50 ml homogenized sample**.
2. Add **5 ml 1:1 hydrochloric acid** and **one spoon KP962 powder (Ammonium Persulfate**) to the flask.
3. Boil for **20 minutes**, maintaining the sample volume above 25 ml with deionized water.
4. Cool the sample to room temperature.
5. Add **one drop KS135 solution (Phenolphthalein Indicator)** into the flask. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
6. Add drops of **KS144 solution (Calcium Hardness Buffer)**, one drop at a time with mixing, until a pink/red color just appears.
7. Fill the flask up to 50 ml with deionized water.
8. Access the methods list, press [Shift] + [2] [2] [6] keys and press [↵] key.
9. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
10. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
11. Press [**Zero**] key and wait for the zero to be accepted.
12. Remove the vial from the sample chamber and empty the vial.
13. Add **10 ml of prepared water sample to the same vial.**
14. Add **10 drops KS60 solution (Acetate Buffer)** into the vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
15. Tightly secure the vial cap and swirl several times to mix the contents.
16. Add **10 drops KS63 solution (Thioglycolate)** into the same vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
17. Tightly secure the vial cap and swirl several times to mix the contents.
18. Add **10 drops KS65 solution (Ferrozine)** into the same vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
19. Tightly secure the vial cap and swirl several times to mix the contents.

20. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
21. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 5 minutes** will be displayed.
22. The result will be shown as mg/l total iron, or if sample was filtered, mg/l total soluble iron.

Notes:

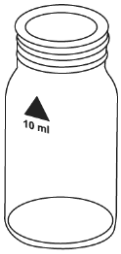
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This method is adapted from one originated by an alternative reagent manufacturer. Always review original instructions and Safety Data Sheet (SDS) before starting the test.
- Complexed iron may be measured by increasing the development period until no further color development is seen. Very strongly complexed iron may not be included in the measured iron. In this case, the complexing agent must be destroyed by oxidation with acid/persulfate followed by neutralization to pH 6-9 and then follow the above procedure.
- For total iron (suspended and dissolved), boil sample with acid/persulfate. Neutralize back to pH 6-9, use deionized water to reach original volume and follow the above procedure.

Iron High Range with Liquid Reagent

Refer to Reagent Manufacturer Instructions for Specific Procedure

Range: 0.1 to 10 mg/l Fe

Method 227



This test procedure is suitable for determining total soluble iron. The sample should be pre-filtered using a 0.45 µm membrane if total dissolved iron is required. Particulate or suspended iron will otherwise add to the result.

1. Access the methods list, press [Shift] + [2] [2] [7] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **10 drops KS63 solution (Thioglycolate)** into the vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
7. Tightly secure the vial cap and swirl several times to mix the contents. Wait until the purple color goes before continuing.
8. Add **10 drops KS160 solution (Total Hardness Buffer)** into the same vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
9. Tightly secure the vial cap and swirl several times to mix the contents.
10. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
11. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 15 minutes** will be displayed.
12. The result will be shown as mg/l iron.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This method is adapted from one originated by an alternative reagent manufacturer. Always review original instructions and Safety Data Sheet (SDS) before starting the test.
- Complexed iron may be measured by increasing the development period until no further color development is seen. Very strongly complexed iron may not be included in the measured iron. In this case, the complexing agent must be destroyed by oxidation with acid/persulfate followed by neutralization to pH 6-9 and then follow the procedure in the Determination of Total Iron (High Range) Test Procedure section.
- For total iron (suspended and dissolved), boil sample with acid/persulfate. Neutralize back to pH 6-9, use deionized water to reach original volume and follow the procedure in the Determination of Total Iron (High Range) Test Procedure section.

Determination of Total Iron (High Range) Test Procedure

This digestion test procedure is for the determination of total iron (soluble, complexed and suspended). Do not filter the sample, but ensure the sample is homogeneous by vigorously

shaking immediately prior to testing. For total soluble iron, including all complexed iron, filtration is necessary. This procedure may require equipment not included in the standard test kit.

1. Fill a clean 100 ml Erlenmeyer flask with **50 ml homogenized sample**.
2. Add **5 ml 1:1 hydrochloric acid** and **one spoon KP962 powder (Ammonium Persulfate**) to the flask.
3. Boil for **20 minutes**, maintaining the sample volume above 25 ml with deionized water.
4. Cool the sample to room temperature.
5. Add drops of **KS144 solution (Calcium Hardness Buffer)**, two drops at a time with mixing, until a neutral or slightly alkaline solution is obtained. Test periodically with a pH meter or pH test paper, taking care not to add excess buffer.
6. Fill the flask up to 50 ml with deionized water.
7. Access the methods list, press [Shift] + [2] [2] [7] keys and press [↵] key.
8. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
9. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
10. Press [**Zero**] key and wait for the zero to be accepted.
11. Remove the vial from the sample chamber and empty the vial.
12. Add **10 ml of prepared water sample to the same vial.**
13. Add **10 drops KS63 solution (Thioglycolate)** into the vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
14. Tightly secure the vial cap and swirl several times to mix the contents.
15. Add **10 drops KS160 solution (Total hardness Buffer)** into the same vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
16. Tightly secure the vial cap and swirl several times to mix the contents.
17. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
18. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 15 minutes** will be displayed.
19. The result will be shown as mg/l total iron, or if sample was filtered, mg/l total soluble iron.

Notes:

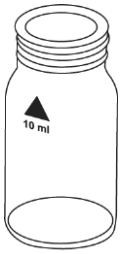
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This method is adapted from one originated by an alternative reagent manufacturer. Always review original instructions and Safety Data Sheet (SDS) before starting the test.
- Complexed iron may be measured by increasing the development period until no further color development is seen. Very strongly complexed iron may not be included in the measured iron. In this case, the complexing agent must be destroyed by oxidation with acid/persulfate followed by neutralization to pH 6-9 and then follow the above procedure.
- For total iron (suspended and dissolved), boil sample with acid/persulfate. Neutralize back to pH 6-9, use deionized water to reach original volume and follow the above procedure.

Manganese with Tablet Reagent, AC2055

AQUAfast AC2055 Manganese Tablets

Range: 0.2 to 4 mg/l Mn

Method 240



1. Access the methods list, press [Shift] + [2] [4] [0] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **one Manganese LR 1 tablet** straight from the foil into the vial, crush the tablet using a clean stir rod and dissolved the tablet.
7. Add **one Manganese LR 2 tablet** straight from the foil into the same vial and crush the tablet using a clean stir rod.
8. Tightly secure the vial cap and swirl gently several times until the tablets are dissolved.
9. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
10. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 5 minutes** will be displayed.
11. The result will be shown as mg/l manganese.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to Mn, MnO_4 or $KMnO_4$.

Notes:

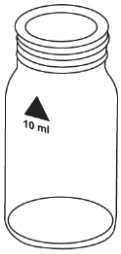
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.

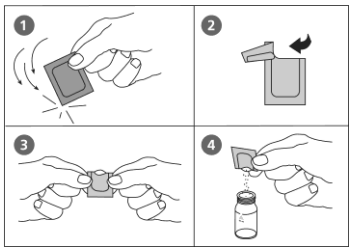
Manganese Low Range with Powder Pack & Liquid Reagents, AC4P54

AQUAfast AC4P54 Manganese LR Powder Packs & Liquid Reagent

Range: 0.01 to 0.7 mg/l Mn

Method 242





1. Access the methods list, press [Shift] + [2] [4] [2] keys and press [↵] key.
2. Use two clean 24 mm round vials and mark one as the blank vial.
3. Fill one 24 mm round vial with **10 ml of deionized water** (this is the blank vial).
4. Fill the second 24 mm round vial with **10 ml of water sample** (this is the sample vial).
5. Add the contents of **one Ascorbic Acid powder pack** straight from the foil into each vial.
6. Tightly secure the vial caps and swirl several times to mix the contents.
7. Add **15 drops Alkaline Cyanide Reagent solution** into each vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
8. Tightly secure the vial caps and swirl several times to mix the contents.
9. Add **21 drops PAN Indicator solution** into each vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
10. Tightly secure the vial caps and swirl several times to mix the contents.
11. Press [↵] key.
    a. A countdown for the **reaction period of 2 minutes** will be displayed.
    b. Samples containing over 5 mg/l iron should react for at least 10 minutes.
12. After the reaction period is done, place the blank vial in the sample chamber, making sure that the Δ marks are aligned.
13. Press [**Zero**] key and wait for the zero to be accepted.
14. Remove the vial from the sample chamber.
15. Place the sample vial in the sample chamber, making sure that the Δ marks are aligned.
16. Press [**Test**] key and wait for the measurement to be taken.
17. The result will be shown as mg/l manganese.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to Mn, MnO_4 or $KMnO_4$.

Notes:

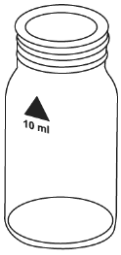
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Rinse all glassware with 1:1 nitric acid solution first and then rinse with deionized water.
- Water samples that contain more than 300 mg/l $CaCO_3$ hardness: after adding the ascorbic acid powder pack, add additionally 10 drops of Rochelle Salt Solution (source from alternative reagent manufacturer).
- After addition of the alkaline-cyanide reagent solution, a cloudy or turbid solution may form in some water samples. The turbidity should disappear after adding PAN Indicator solution.
- Conversion: mg/l MnO_4 = mg/l Mn x 2.17

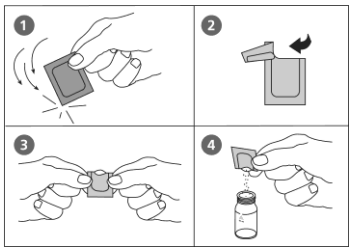
Manganese High Range with Powder Pack Reagents, AC4P55

AQUAfast AC4P55 Manganese HR Powder Packs

Range: 0.1 to 18 mg/l Mn

Method 243





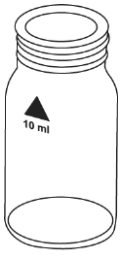
1. Access the methods list, press [Shift] + [2] [4] [3] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add the contents of **one Manganese Citrate Buffer F10 powder pack** straight from the foil into the vial.
7. Tightly secure the vial cap and swirl several times to mix the contents.
8. Add the contents of **one Sodium Periodate F10 powder pack** straight from the foil into the same vial.
9. Tightly secure the vial cap and swirl several times to mix the contents.
10. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
11. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 2 minutes** will be displayed.
12. The result will be shown as mg/l manganese.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to Mn, MnO_4 or $KMnO_4$.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This test is applicable for the determination of soluble manganese in water and wastewater.
- Highly buffered water samples or extreme pH values may exceed the buffering capacity of the reagents and requires sample pre-treatment. If samples were acidified for storing, adjust the pH between 4 and 5 with 5 mol/l (5 N) sodium hydroxide before testing. Do not exceed pH 5, as manganese may precipitate.
- Interferences

Interfering Substance	Interference Level
Calcium	greater than 700 mg/l
Chloride	greater than 70000 mg/l
Iron	greater than 5 mg/l
Magnesium	greater than 100000 mg/l

Method 245



Manganese with Liquid Reagent

Refer to Reagent Manufacturer Instructions for Specific Procedure

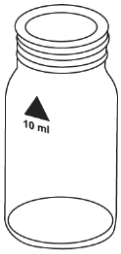
Range: 0.5 to 5 mg/l Mn

1. Access the methods list, press [Shift] + [2] [4] [5] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **10 drops KS265 solution (Manganese Reagent A)** into the vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
7. Tightly secure the vial cap and swirl several times to mix the contents.
8. Add **10 drops KS266 solution (Manganese Reagent B)** into the same vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
9. Tightly secure the vial cap and swirl several times to mix the contents.
10. Add **10 drops KS304 solution (Manganese Reagent C)** into the same vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
11. Tightly secure the vial cap and swirl several times to mix the contents.
12. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
13. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 3 minutes** will be displayed.
14. The result will be shown as mg/l manganese.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This method is adapted from one originated by an alternative reagent manufacturer. Always review original instructions and Safety Data Sheet (SDS) before starting the test.
- The following substances interfere with this test:
    - Calcium > 500mg/l
    - Sodium > 500mg/l
    - Nickel > 0.5 mg/l
    - Iron > 5 mg/l
    - Chromium > 5 mg/l

Method 250



Molybdate with Tablet Reagent

Refer to Reagent Manufacturer Instructions for Specific Procedure

Range: 1 to 50 mg/l MoO_4, 0.6 to 30 mg/l Mo

1. Access the methods list, press [Shift] + [2] [5] [0] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber and **empty the vial**.
6. Add **20 ml of water sample** into a 100 ml beaker.
7. Add **one Molybdate HR No. 1 tablet** straight from the foil into the beaker and crush the tablet using a clean stir rod.
8. Add **one Molybdate HR No. 2 tablet** straight from the foil into the same beaker and crush the tablet using a clean stir rod.
9. Dissolve the tablets using a clean stir rod.
10. Rinse the vial with the prepared water sample and then fill the vial to the 10 ml mark.
11. Tightly secure the vial cap.
12. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
13. Press [**Test**] key and wait for the measurement to be taken.
14. The result will be shown as mg/l molybdate / molybdenum.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to MoO_4, Mo or Na_2MoO_4.

Notes:

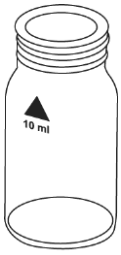
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.\
- This method is adapted from one originated by an alternative reagent manufacturer. Always review original instructions and Safety Data Sheet (SDS) before starting the test.
- The tablets must be added in the correct sequence.
- Under test conditions (pH 3.8 – 3.9), iron does not interfere nor do other metals at levels likely to be found in industrial water systems.
- Conversions:
    - mg/l Mo = mg/l MoO_4 x 0.6
    - mg/l Na_2MoO_4 = mg/l MoO_4 x 1.3

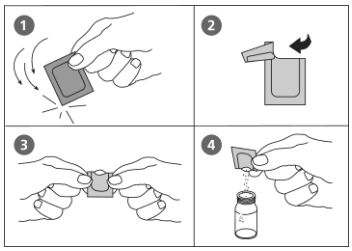
Molybdate/Molybdenum Low Range with Powder Pack Reagents

Refer to Reagent Manufacturer Instructions for Specific Procedure

Range: 0.05 to 5 mg/l MoO_4, 0.03 to 3 mg/l Mo

Method 251





1. Access the methods list, press [Shift] + [2] [5] [1] keys and press [↵] key.
2. Fill a clean 25 ml mixing cylinder with **20 ml of water sample**.
3. Add the contents of **one Molybdenum 1 LR F20 powder pack** straight from the foil into the mixing cylinder.
4. Tightly secure the mixing cylinder stopper and swirl several times to mix the contents.
5. Use two clean 24 mm round vials and mark one as the blank vial.
6. Fill both 24 mm round vials with **10 ml of prepared water sample.**
7. Tightly secure the vial cap on the blank vial.
8. Add **0.5 ml Molybdenum 2 LR solution to the sample vial.**
9. Tightly secure the vial cap on the sample vial and invert several times to mix the contents.
10. Press [↵] key.
    a. A countdown for the **reaction period of 2 minutes** will be displayed.
11. After the reaction period is done, place the blank vial into the sample chamber, making sure that the Δ marks are aligned.
12. Press [**Zero**] key and wait for the zero to be accepted.
13. Remove the vial from the sample chamber.
14. Place the sample vial into the sample chamber, making sure that the Δ marks are aligned.
15. Press [**Test**] key and wait for the measurement to be taken.
16. The result will be shown as mg/l molybdate / molybdenum.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to MoO_4, Mo or Na_2MoO_4.

Notes:

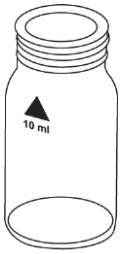
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This method is adapted from one originated by an alternative reagent manufacturer. Always review original instructions and Safety Data Sheet (SDS) before starting the test.
- Strong alkaline or acidic water samples must be adjusted to between pH 3 and pH 5 before the reagents are added (use 0.5 mol/l sulfuric acid or 1 mol/l sodium hydroxide).
- Clean the vials with 20% hydrochloric acid and rinse thoroughly with deionized water before using the vials.

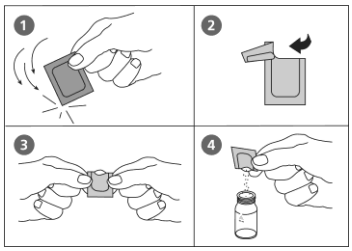
Molybdate/Molybdenum High Range with Powder Pack Reagents, AC4P42

AQUAfast AC4P54 Molybdate/Molybdenum HR Powder Packs

Range: 0.5 to 66 mg/l MoO_4, 0.3 to 40 mg/l Mo

Method 252





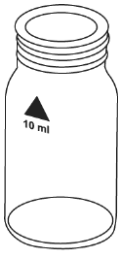
1. Access the methods list, press [Shift] + [2] [5] [2] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add the contents of **one Molybdenum HR 1 F10 powder pack** straight from the foil into the vial.
7. Tightly secure the vial cap and swirl several times to mix the contents.
8. Add the contents of **one Molybdenum HR 2 F10 powder pack** straight from the foil into the same vial.
9. Tightly secure the vial cap and swirl several times to mix the contents.
10. Add the contents of **one Molybdenum HR 3 F10 powder pack** straight from the foil into the same vial.
11. Tightly secure the vial cap and swirl several times to mix the contents.
12. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
13. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 5 minutes** will be displayed.
14. The result will be shown as mg/l molybdate / molybdenum.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to MoO_4, Mo or Na_2MoO_4.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Filter turbid water samples using filter paper and funnel before analysis.
- Highly buffered water samples or extreme pH values should be adjusted to a pH of nearly 7 with 1 mol/l nitric acid or 1 mol/l sodium hydroxide.
- Concentrations above 10 mg/l copper cause too high test values if the reaction time of 5 minutes is increased, so it is very important to perform the test procedure as described.
- Substances which may interfere when present in concentrations at:

Aluminum	50 mg/l
Chromium	1000 mg/l
Iron	50 mg/l
Nickel	50 mg/l
Nitrite	all levels

Method 254



Molybdate/Molybdenum High Range with Liquid Reagents

Refer to Reagent Manufacturer Instructions for Specific Procedure

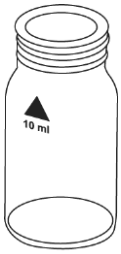
Range: 1 to 100 mg/l MoO_4, 0.6 to 60 mg/l Mo

1. Access the methods list, press [Shift] + [2] [5] [4] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **10 drops KS63 solution (Thioglycolate)** into the vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
7. Tightly secure the vial cap and swirl several times to mix the contents.
8. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
9. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 5 minutes** will be displayed.
10. The result will be shown as mg/l molybdate / molybdenum.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to MoO_4, Mo or Na_2MoO_4.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This method is adapted from one originated by an alternative reagent manufacturer. Always review original instructions and Safety Data Sheet (SDS) before starting the test.
- Perform tests on water samples taken directly from the system. Molybdate will be absorbed onto the walls of sample containers and give low results.

Method 257



Nickel with Tablet Reagent

Refer to Reagent Manufacturer Instructions for Specific Procedure

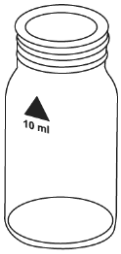
Range: 0.1 to 10 mg/l Ni

1. Access the methods list, press [Shift] + [2] [5] [7] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **one Nickel No. 1 tablet** straight from the foil into the vial, crush the tablet using a clean stir rod and dissolved the tablet completely.
7. Add **one Nickel No. 2 tablet** straight from the foil into the same vial and crush the tablet using a clean stir rod.
8. Tightly secure the vial cap and swirl gently several times until the tablet is dissolved.
9. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
10. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 2 minutes** will be displayed.
11. The result will be shown as mg/l nickel.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This method is adapted from one originated by an alternative reagent manufacturer. Always review original instructions and Safety Data Sheet (SDS) before starting the test.
- If iron is present in the sample, add one level spoonful of Nickel PT powder to the sample (after adding Nickel No. 1) and mix.
- The presence of cobalt at 0.5 mg/l gives a positive response in the test.
- The presence of higher levels of EDTA (at least 25 mg/l) complexes nickel and reduces response in the test. Complexing agents used in water treatment, such as polyphosphates, do not affect the results.

Method 260



Nitrate with Tablet and Powder Reagent

Refer to Reagent Manufacturer Instructions for Specific Procedure

Range: 0.08 to 1 mg/l N

1. Access the methods list, press [Shift] + [2] [6] [0] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber and empty the vial.
6. Fill the nitrate tube with **20 ml of water sample.**
7. Add **one level spoon of Nitrate Test powder** to the tube.
8. Tightly secure the tube cap and swirl vigorously for one minute to mix the contents.
9. Add **one Nitrate Test tablet** straight from the foil into the tube.
10. Tightly secure the tube cap and swirl vigorously for one minute to mix the contents.
11. Stand the tube upright and after the reducing agent has settled to the bottom, gently invert it three to four times to complete the flocculation of the reducing agent. Then let the tube stand for a further 2 minutes. Open the tube and wipe around the top of the tube with a clean tissue to remove any residuals of the reducing agent.
12. Carefully decant 10 ml of the treated solution into the 24 mm round vial used for the zero procedure, ensuring that no reducing agent is carried over.
13. Add **one Nitrite LR tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
14. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
15. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
16. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 10 minutes** will be displayed.
17. The result will be shown as mg/l nitrate as nitrogen (NO_3-N).

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This method is adapted from one originated by an alternative reagent manufacturer. Always review original instructions and Safety Data Sheet (SDS) before starting the test.
- If the sample contains nitrite as well as nitrate, it will react with the Nitrite LR tablet, leading to a high result. For correction, carry out a nitrite determination using method 270 in NO2-N and subtract the result from the nitrate reading in NO3-N to give the corrected result.
- Concentration of nitrate (NO3-N) above 1 mg/l (e.g. 50 mg/l) lead to an apricot color instead of the reddish pink solution after the reaction time of 10 minutes. This color cannot be correctly measured by the colorimeter. The displayed result does not show the concentration of NO3-N. The range of the test can be extended by first diluting the water

sample with deionized water. One method is to dilute 1.0 ml of sample up to 100 ml (dilution factor of 100). The test result must then be multiplied by the dilution factor.

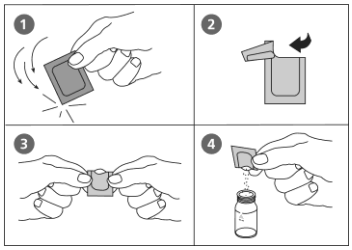
- The following ions can produce interference, as under the reaction conditions they can cause precipitation: antimony (III), iron (III), lead, mercury (I), silver, chloroplatinate, metavanadate and bismuth. Copper (II) ions may give a low result, as they accelerate the decomposition of diazonium salt. It is improbable in practice that these interfering ions will occur in such high concentrations that they cause significant errors.

Nitrate with Reaction Tube, ACR007

AQUAfast ACR007 Nitrate Reaction Tubes

Range: 1 to 30 mg/l N

Method 265



1. Insert the adapter for 16 mm round vials into the sample chamber.
2. Access the methods list, press [Shift] + [2] [6] [5] keys and press [↵] key.
3. Open one reaction tube (Reagent A), add **1 ml of the water sample** and tightly secure the vial cap.
4. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
5. Press [**Zero**] key and wait for the zero to be accepted.
6. Remove the vial from the sample chamber.
7. Add the contents of **one Nitrate Chromotropic powder pack** straight from the foil into the vial.
8. Tightly secure the vial cap and invert gently at least ten times to mix the contents. Note that some solids may not dissolve.
9. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
10. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 5 minutes** will be displayed.
11. The result will be shown as mg/l nitrate as nitrogen (NO_3-N).
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to N or NO_3.

Notes:

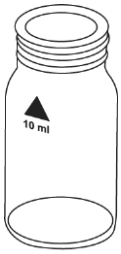
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Some solids may not dissolve in Step 8.
- To optimize the readings, an optional batch related calibration can be performed. Follow the procedure using 1 ml deionized water in place of the sample and subtract the reagent blank value from the final result.
- Conversion: mg/l NO_3 = mg/l N x 4.43

Nitrite with Tablet Reagent, AC2046

AQUAfast AC2046 Nitrite Tablets

Range: 0.01 to 0.5 mg/l N

Method 270



1. Access the methods list, press [Shift] + [2] [7] [0] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **one Nitrite LR tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
7. Tightly secure the vial cap and swirl gently several times until the tablet is dissolved.
8. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
9. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 10 minutes** will be displayed.
10. The result will be shown as mg/l nitrite as nitrogen (NO_2-N).
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to N or NO_2.

Notes:

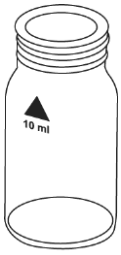
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- The following ions can produce interferences since under the reaction conditions they cause precipitation. It is unlikely in practice that these interfering ions will occur in such high concentrations that they cause significant reading errors.
    - Antimony (III), iron (III), lead, mercury (I), silver, chloroplatinate, metavanadate and bismuth.
    - Copper (II) ions may cause lower test results as they accelerate the decomposition of the diazonium salt.
- Conversion: mg/l NO_2 = mg/l N x 3.29

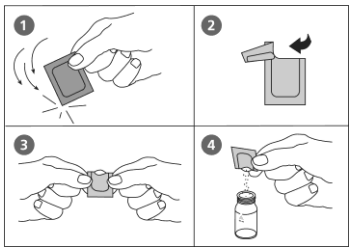
Nitrite Low Range with Powder Pack Reagents, AC4P46

AQUAfast AC4P46 Nitrite Powder Packs

Range: 0.01 to 0.3 mg/l N

Method 272





1. Access the methods list, press [Shift] + [2] [7] [2] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add the contents of **one Nitri 3 powder pack** straight from the foil into the vial.
7. Tightly secure the vial cap and swirl several times to mix the contents.
8. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
9. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 20 minutes** will be displayed.
10. The result will be shown as mg/l nitrite as nitrogen (NO_2-N).
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to N or NO_2.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Interferences:
    - Strong oxidizing and reducing substances interfere.
    - Cupric and ferrous ions cause low results.
    - Antimonous, auric, bismuth, chloroplatinate, ferric, lead, mercurous, metavanadate, silver ions interfere by causing precipitation.
    - In samples with very high concentrations of nitrate (> 100 mg/L N) a small amount of nitrite will be found. Such high levels of nitrate appear to undergo a slight amount of reduction to nitrite, either spontaneously or during test reaction time.
- Conversion: mg/l NO_2 = mg/l N x 3.29

Nitrogen, Total Low Range with Digestion Tube, ACD004

AQUAfast ACR004 Nitrogen Total Low Range Digestion Tubes

Range: 0.5 to 25 mg/l N

Method 280

1. Open **two TN Hydroxide LR digestion vials** and add the contents of **one TN Persulfate Rgt. powder pack** to each vial. Use a funnel to add the powder to the vial and wipe off any powder that may get on the lid or the vial threads.
2. Add **2 ml deionized water** to the first prepared digestion vial (this is the blank).
3. Add **2 ml of water sample** to the second prepared digestion vial (this is the sample).
4. Tightly secure the vial caps and shake the vials several times, for at least 30 seconds, to mix the contents. Note that the powder may not dissolve completely.
5. Heat the vials for **30 minutes** in a preheated thermoreactor at a temperature of 100°C. Note that it is very important to remove the vials from the reactor after exactly 30 minutes.
6. **Caution: Vials will be hot!** After 30 minutes, remove the vials from the reactor and allow the vials to cool to room temperature.
7. Insert the adapter for 16 mm round vials into the sample chamber.
8. Access the methods list, press [Shift] + [2] [8] [0] keys and press [↵] key.
9. Open the cooled vials and add the contents of **one TN Reagent A powder pack** to each vial. Use a funnel to add the powder to the vial.
10. Tightly secure the vial caps and shake the vials several times, for at least 15 seconds, to mix the contents.
11. Press [↵] key.
    a. A countdown for the **reaction period of 3 minutes** will be displayed.
12. After the reaction period is done, open the vials and add the contents of **one TN Reagent B powder pack** to each vial. Use a funnel to add the powder to the vial.
13. Tightly secure the vial caps and shake the vials several times, for at least 15 seconds, to mix the contents. Note that the powder will not dissolve completely.
14. Press [↵] key.
    a. A countdown for the **reaction period of 2 minutes** will be displayed.
15. After the reaction period is done, open **two TN Acid LR/HR (Reagent C) vials**.
16. Add **2 ml of the digested, treated blank** to the first TN Acid LR/HR vial (this is the blank vial).
17. Add **2 ml of the digested, treated water sample** to the second TN Acid LR/HR vial (this is the sample vial).
18. Tightly secure the vial caps and gently invert the vials at least 10 times to mix the contents. **Caution: Vials will warm up during mixing!**
    a. Hold the vial in a vertical position with the cap pointing up. Turn the vial upside-down and wait for all of the solution to flow down to the cap. Return the vial to the upright position and wait for all the solution to flow down to the bottom of the vial. This process is one inversion; 10 inversions = approximately 30 seconds.
19. Place the blank vial in the sample chamber, making sure that the Δ marks are aligned.
20. Press [**Zero**] key and wait for the zero to be accepted.
    a. A countdown for the **reaction period of 5 minutes** will be displayed.

21. Remove the vial from the sample chamber.
22. Place the sample vial in the sample chamber making sure that the Δ marks are aligned.
23. Press [**Test**] key and wait for the measurement to be taken.
24. The result will be shown as mg/l nitrogen.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to N, NH_4 or NH_3.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Appropriate safety precautions and good lab technique should be used during the entire test procedure.
- Use a funnel to add the reagent.
- Volumes for the blank and samples should always be measured using 2 ml volumetric pipettes (class A) for the nitrogen total low range procedure.
- One blank is sufficient for each set of samples. After zero calibration with the blank it is possible to measure several samples. The zero (stored in the dark) can be used for seven days, if the measured samples were prepared with the same batch of reagent.
- It is very important to remove the vials from the reactor after exactly 30 minutes.
- Large quantities of nitrogen free, organic compounds that are included in some water samples may reduce the effectiveness of the digestion by reacting with the persulfate reagent. Samples that are well known to contain large quantities of organic compounds must be diluted, and digestion and measurement must be repeated for checking the effectiveness of the digestion.
- Application: for water, wastewater and seawater.
- Interfering substances that resulted in a concentration change of 10%:
    - Bromide more than 60 mg/l and chloride more than 1000 mg/l produce positive interferences.
- TN = Total Nitrogen.

Nitrogen, Total High Range with Digestion Tube, ACD007

AQUAfast ACR007 Nitrogen Total High Range Digestion Tubes

Range: 5 to 150 mg/l N

Method 281

1. Open **two TN Hydroxide HR digestion vials** and add the contents of **one TN Persulfate Rgt. powder pack** to each vial. Use a funnel to add the powder to the vial and wipe off any powder that may get on the lid or the vial threads.
2. Add **0.5 ml deionized water** to the first prepared digestion vial (this is the blank).
3. Add **0.5 ml of water sample** to the second prepared digestion vial (this is the sample).
4. Tightly secure the vial caps and shake the vials several times, for at least 30 seconds, to mix the contents. Note that the powder may not dissolve completely.
5. Heat the vials for **30 minutes** in a preheated thermoreactor at a temperature of 100°C. Note that it is very important to remove the vials from the reactor after exactly 30 minutes.
6. **Caution: Vials will be hot!** After 30 minutes, remove the vials from the reactor and allow the vials to cool to room temperature.
7. Insert the adapter for 16 mm round vials into the sample chamber.
8. Access the methods list, press [Shift] + [2] [8] [1] keys and press [↵] key.
9. Open the cooled vials and add the contents of **one TN Reagent A powder pack** to each vial. Use a funnel to add the powder to the vial.
10. Tightly secure the vial caps and shake the vials several times, for at least 15 seconds, to mix the contents.
11. Press [↵] key.
    a. A countdown for the **reaction period of 3 minutes** will be displayed.
12. After the reaction period is done, open the vials and add the contents of **one TN Reagent B powder pack** to each vial. Use a funnel to add the powder to the vial.
13. Tightly secure the vial caps and shake the vials several times, for at least 15 seconds, to mix the contents. Note that the powder will not dissolve completely.
14. Press [↵] key.
    a. A countdown for the **reaction period of 2 minutes** will be displayed.
15. After the reaction period is done, open **two TN Acid LR/HR (Reagent C) vials**.
16. Add **2 ml of the digested, treated blank** to the first TN Acid LR/HR vial (this is the blank vial).
17. Add **2 ml of the digested, treated water sample** to the second TN Acid LR/HR vial (this is the sample vial).
18. Tightly secure the vial caps and gently invert the vials at least 10 times to mix the contents. **Caution: Vials will warm up during mixing!**
    a. Hold the vial in a vertical position with the cap pointing up. Turn the vial upside-down and wait for all of the solution to flow down to the cap. Return the vial to the upright position and wait for all the solution to flow down to the bottom of the vial. This process is one inversion; 10 inversions = approximately 30 seconds.
19. Place the blank vial in the sample chamber, making sure that the Δ marks are aligned.
20. Press [**Zero**] key and wait for the zero to be accepted.
    a. A countdown for the **reaction period of 5 minutes** will be displayed.

21. Remove the vial from the sample chamber.
22. Place the sample vial in the sample chamber making sure that the Δ marks are aligned.
23. Press [**Test**] key and wait for the measurement to be taken.
24. The result will be shown as mg/l nitrogen.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to N, NH_4 or NH_3.

Notes:

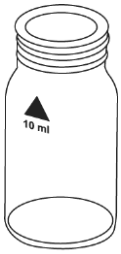
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Appropriate safety precautions and good lab technique should be used during the entire test procedure.
- Use a funnel to add the reagent.
- Volumes for the blank and samples should always be measured using suitable volumetric pipettes (class A) for the nitrogen total high range procedure.
- One blank is sufficient for each set of samples. After zero calibration with the blank it is possible to measure several samples. The zero (stored in the dark) can be used for seven days, if the measured samples were prepared with the same batch of reagent.
- It is very important to remove the vials from the reactor after exactly 30 minutes.
- Large quantities of nitrogen free, organic compounds that are included in some water samples may reduce the effectiveness of the digestion by reacting with the persulfate reagent. Samples that are well known to contain large quantities of organic compounds must be diluted, and digestion and measurement must be repeated for checking the effectiveness of the digestion.
- Application: for water, wastewater and seawater.
- Interfering substances that resulted in a concentration change of 10%:
    - Bromide more than 60 mg/l and chloride more than 1000 mg/l produce positive interferences.
- TN = Total Nitrogen.

Oxygen, Active with Tablet Reagent, AC2072

AQUAfast AC2072 DPD Tablets

Range: 0.1 to 10 mg/l O_2

Method 290

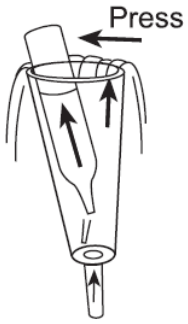


1. Access the methods list, press [Shift] + [2] [9] [0] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **one DPD No. 4 tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
7. Tightly secure the vial cap and swirl gently several times until the tablet is dissolved.
8. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
9. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 2 minutes** will be displayed.
10. The result will be shown as mg/l active oxygen.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Active oxygen is a synonym for a common disinfectant (based on oxygen) in swimming pool treatment.
- When preparing the sample, the escape of oxygen gases, for example by pipetting or shaking, must be avoided.
- The analysis must take place immediately after taking the sample.

Method 292



Oxygen, Dissolved with Ampoule Reagent

Refer to Reagent Manufacturer Instructions for Specific Procedure

Range: 10 to 800 µg/l O_2

1. Insert the adapter for 13 mm round vials into the sample chamber.
2. Access the methods list, press [Shift] + [2] [9] [2] keys and press [↵] key.
3. Place the blank ampoule in the sample chamber. The blank ampoule should be part of the reagent manufacturer's test kit.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the ampoule from the sample chamber.
6. Water should flow through the special sample container for several minutes to remove any air bubbles sticking at the surface. The water must flow from the bottom to the top.
7. When the sample container is bubble-free, press one ampoule into the lower edge of the sample container. The ampoule will snap at the neck and fill automatically. A small volume of inert gas will remain in the ampoule.
8. Remove the ampoule, pointing downwards, from the sample container immediately. As the contents of the ampoule have a higher density than water, it is important to remove the ampoule from the sample container within five seconds to prevent any loss of reagent.
9. Use a gloved finger to close the ampoule to prevent the entry of air. Invert the ampoule several times. Dry the outside of the ampoule with a lint-free tissue.
10. Place the ampoule in the sample chamber.
11. Press [**Test**] key and wait for the measurement to be taken.
12. The result will be shown as µg/l oxygen.

Notes:

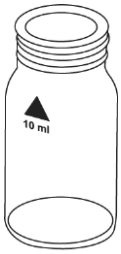
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This method is adapted from one originated by an alternative reagent manufacturer. Always review original instructions and Safety Data Sheet (SDS) before starting the test.
- Ampoules should be stored in the dark and at room temperature

Ozone with Tablet Reagent, AC3048

AQUAfast AC3048 Ozone Tablets

Range: 0.02 to 2 mg/l O_3

Method 300



Determination of Ozone in Absence of Chlorine

1. Access the methods list, press [Shift] + [3] [0] [0] keys and press [↵] key.
2. Press arrow key [▼] or [▲] to select the determination of ozone in absence of chlorine (>> without Cl) and press [↵] key.
3. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
4. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
5. Press [**Zero**] key and wait for the zero to be accepted.
6. Remove the vial from the sample chamber and **empty the vial leaving only a few drops remaining** in the vial.
7. Add **one DPD No. 1 tablet** and **one DPD No. 3 tablet** straight from the foil into the vial and crush the tablets using a clean stir rod.
8. Add the water sample to the 10 ml mark.
9. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
10. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
11. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 2 minutes** will be displayed.
12. The result will be shown as mg/l ozone.

Determination of Ozone in Presence of Chlorine

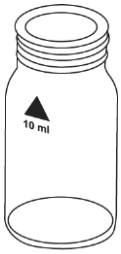
1. Access the methods list, press [Shift] + [3] [0] [0] keys and press [↵] key.
2. Press arrow key [▼] or [▲] to select the determination of ozone in presence of chlorine (>> with Cl) and press [↵] key.
3. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
4. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
5. Press [**Zero**] key and wait for the zero to be accepted.
6. Remove the vial from the sample chamber and **empty the vial leaving only a few drops remaining** in the vial.
7. Add **one DPD No. 1 tablet** and **one DPD No. 3 tablet** straight from the foil into the vial and crush the tablets using a clean stir rod.
8. Add the water sample to the 10 ml mark.
9. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
10. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
11. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 2 minutes** will be displayed.
12. Remove the vial from the sample chamber, empty the vial, rinse the vial and cap several times.
13. **Fill a second clean 24 mm round vial with 10 ml of water sample.**
14. Add **one Glycine tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.

15. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
16. Add **one DPD No. 1 tablet** and **one DPD No. 3 tablet** straight from the foil into the first cleaned vial and crush the tablets using a clean stir rod.
17. Transfer the contents of the second vial containing the glycine solution into the prepared vial.
18. Tightly secure the vial cap and swirl several times until the tablets are dissolved.
19. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
20. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 2 minutes** will be displayed.
21. The results will be shown as mg/l ozone and mg/l total chlorine.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Vial cleaning: As many household cleaners (e.g. dishwasher detergent) contain reducing substances, the subsequent determination of ozone may show lower results. To avoid any measurement errors, only use glassware free of chlorine demand. Preparation: Put all applicable glassware into sodium hypochlorite solution (0.1 g/l) for one hour and then rinse all glassware thoroughly with deionized water.
- Preparing the sample: When preparing the sample, avoid the escape of ozone (e.g. by pipetting or shaking). Perform the analysis immediately after taking the sample.
- The DPD color development is carried out at a pH value of 6.2 to 6.5. The reagent therefore contains a buffer for the pH adjustment. Strong alkaline or acidic water samples must be adjusted between pH 6 and pH 7 before the reagent is added (use 0.5 mol/l sulfuric acid or 1 mol/l sodium hydroxide).
- Exceeding the Measuring Range: Concentrations above 6 mg/l ozone can lead to results showing 0 mg/l. In this event, the sample must be diluted with chlorine dioxide-free water. Prepare 10 ml of the diluted sample with reagent and repeat the measurement.
- Oxidizing agents (i.e. chlorine, bromine) interfere as they react in the same way as ozone.

Method 70



PHMB (Biquanide) with Tablet Reagent

Refer to Reagent Manufacturer Instructions for Specific Procedure

Range: 2 to 60 mg/l PHMB

1. Access the methods list, press [Shift] + [7] [0] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber and **empty the vial leaving only a few drops remaining** in the vial.
6. Add **one PHMB tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
7. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
8. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
9. Press [**Test**] key and wait for the measurement to be taken.
10. The result will be shown as mg/l PHMB.

Notes:

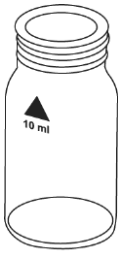
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Clean vials with the brush immediately after analysis.
- Vials and stirring rods may turn blue after prolonged use. In this case, clean vials and stirring rods with a laboratory detergent. Rinse vials and caps thoroughly with tap water and then with deionized water.
- The test result is influenced by hardness and total alkalinity. The calibration of this method was done using water with the following concentration:
    - Calcium-Hardness: 200 mg/l $CaCO_3$
    - Total alkalinity: 120 mg/l $CaCO_3$

Phosphate, Ortho, Low Range with Tablet Reagent, AC2095-WA

AQUAfast AC2095-WA Phosphate (Ortho) Low Range Tablets

Range: 0.05 to 4 mg/l PO_4

Method 320



1. Access the methods list, press [Shift] + [3] [2] [0] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **one Phosphate No. 1 LR tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
7. Add **one Phosphate No. 2 LR tablet** straight from the foil into the same vial and crush the tablet using a clean stir rod.
8. Tightly secure the vial cap and swirl gently several times until the tablets are dissolved.
9. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
10. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 10 minutes** will be displayed.
11. The result will be shown as mg/l orthophosphate.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to PO_4, P or P_2O_5.

Notes:

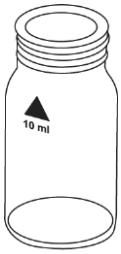
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This procedure is for the determination of orthophosphate ions and only orthophosphate ions react. Orthophosphate ions react with the reagent to form an intense blue color.
- The tablets must be added in the correct sequence. The test sample should have a pH-value between 6 and 7.
- Interferences: Higher concentrations of Cu, Ni, Cr (III), V (V) and W (VI) interfere due to their color. Silicates do not interfere (masked by citric acid in the tablets).
- Conversion:
  - mg/l P = mg/l PO_4 x 0.33
  - mg/l P_2O_5= mg/l PO_4 x 0.75
- Phosphate in organic and condensed inorganic forms (meta-, pyro- and polyphosphates) must be converted to orthophosphate ions before analysis. Pretreatment of the sample with acid and heat provides the conditions for hydrolysis of the condensed inorganic forms. Organically combined phosphates are converted to orthophosphate ions by heating with acid and persulfate. The amount of organically combined phosphates can be calculated: mg/l phosphate, organic = mg/l phosphate, total – mg/l phosphate, acid hydrolysable
- Phosphate, ortho = Phosphorus, reactive

Phosphate, Ortho, High Range with Tablet Reagent, AC2096

AQUAfast AC2096 Phosphate (Ortho) High Range Tablets

Range: 1 to 80 mg/l PO_4

Method 321



1. Access the methods list, press [Shift] + [3] [2] [1] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **one Phosphate HR P1 tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
7. Add **one Phosphate HR P2 tablet** straight from the foil into the same vial and crush the tablet using a clean stir rod.
8. Tightly secure the vial cap and swirl gently several times until the tablets are dissolved.
9. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
10. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 10 minutes** will be displayed.
11. The result will be shown as mg/l orthophosphate.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to PO_4, P or P_2O_5.

Notes:

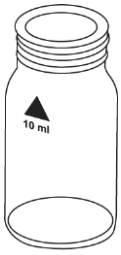
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- For samples under 5 mg/l PO_4, it is recommended to analyze the water sample using method 320 for phosphate, ortho, low range with tablet.
- This procedure is for the determination of orthophosphate ions and only orthophosphate ions react. The orthophosphate ions react with the vanadate-molybdate reagent under acid conditions to form a yellow colored product.
- Conversion:
  - mg/l P = mg/l PO_4 x 0.33
  - mg/l P_2O_5= mg/l PO_4 x 0.75
- Phosphate in organic and condensed inorganic forms (meta-, pyro- and polyphosphates) must be converted to orthophosphate ions before analysis. Pretreatment of the sample with acid and heat provides the conditions for hydrolysis of the condensed inorganic forms. Organically combined phosphates are converted to orthophosphate ions by heating with acid and persulfate. The amount of organically combined phosphates can be calculated: mg/l phosphate, organic = mg/l phosphate, total – mg/l phosphate, acid hydrolysable
- Phosphate, ortho = Phosphorus, reactive

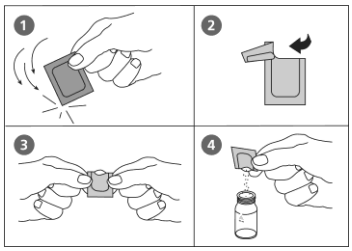
Phosphate, Ortho, with Powder Pack Reagents, AC4P95

AQUAfast AC4P95 P Phosphate (Ortho) Powder Packs

Range: 0.06 to 2.5 mg/l PO_4

Method 323





1. Access the methods list, press [Shift] + [3] [2] [3] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add the contents of **one Phosphate Rgt. F10 powder pack** straight from the foil into the vial.
7. Tightly secure the vial cap and swirl several times, approximately 10-15 seconds, to mix the contents. Note that the reagent will not dissolve completely.
8. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
9. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 2 minutes** will be displayed.
10. The result will be shown as mg/l orthophosphate.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to PO_4, P or P_2O_5.

Notes:

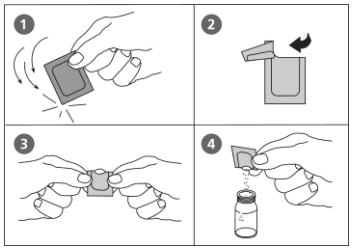
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This procedure is for the determination of orthophosphate ions and only orthophosphate ions react. Orthophosphate ions react with the reagent to form an intense blue color.
- Conversion:
    - mg/l P = mg/l PO_4 x 0.33
    - mg/l P_2O_5= mg/l PO_4 x 0.75
- Phosphate in organic and condensed inorganic forms (meta-, pyro- and polyphosphates) must be converted to orthophosphate ions before analysis. Pretreatment of the sample with acid and heat provides the conditions for hydrolysis of the condensed inorganic forms. Organically combined phosphates are converted to orthophosphate ions by heating with acid and persulfate. The amount of organically combined phosphates can be calculated: mg/l phosphate, organic = mg/l phosphate, total – mg/l phosphate, acid hydrolysable
- Phosphate, ortho = Phosphorus, reactive

Phosphate, Ortho, with Reaction Tube, ACR095

AQUAfast ACR095 Phosphate (Ortho) Reaction Tubes

Range: 0.06 to 5 mg/l PO_4

Method 324



1. Insert the adapter for 16 mm round vials into the sample chamber.
2. Access the methods list, press [Shift] + [3] [2] [4] keys and press [↵] key.
3. Open **one PO4-P Dilution vial**, add **5 ml of the water sample** and tightly secure the vial cap.
4. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
5. Press [**Zero**] key and wait for the zero to be accepted.
6. Remove the vial from the sample chamber.
7. Add the contents of **one Phosphate Rgt. F10 powder pack** straight from the foil into the vial. Use a funnel to add the powder to the vial.
8. Tightly secure the vial cap and swirl several times, at least 10-15 seconds, to mix the contents. Note that the reagent will not dissolve completely.
9. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
10. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 2 minutes** will be displayed.
11. The result will be shown as mg/l orthophosphate.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to PO_4, P or P_2O_5.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This procedure is for the determination of orthophosphate ions and only orthophosphate ions react. Orthophosphate ions react with the reagent to form an intense blue color.
- Conversion:
  - mg/l P = mg/l PO_4 x 0.33
  - mg/l P_2O_5= mg/l PO_4 x 0.75
- Phosphate in organic and condensed inorganic forms (meta-, pyro- and polyphosphates) must be converted to orthophosphate ions before analysis. Pretreatment of the sample with acid and heat provides the conditions for hydrolysis of the condensed inorganic forms. Organically combined phosphates are converted to orthophosphate ions by heating with acid and persulfate. The amount of organically combined phosphates can be calculated: mg/l phosphate, organic = mg/l phosphate, total – mg/l phosphate, acid hydrolysable
- Application: for water, wastewater and seawater.
- Highly buffered samples or samples with extreme pH values should be adjusted between pH 2 and 10 before analysis (with 1 mol/l hydrochloric acid or 1 mol/l sodium hydroxide).
- Interferences: Large amounts of turbidity may cause inconsistent results.

- Interferences:

Interfering substance	**Interfering Level**
Aluminum	greater than 200 mg/l
Arsenate	at any level
Chromium	greater than 100 mg/l
Copper	greater than 10 mg/l
Iron	greater than 100 mg/l
Nickel	greater than 300 mg/l
Silica (silicium dioxide)	greater than 50 mg/l
Silicate	greater than 10 mg/l
Sulfide	at any level
Zinc	greater than 80 mg/l

- Phosphate, ortho = Phosphorus, reactive

Phosphate, Acid Hydrolysable, with Digestion Tube, ACD095AH

AQUAfast ACD095AH Phosphate (Acid Hydrolysable) Digestion Tubes

Range: 0.02 to 1.6 mg/l P

Method 325

1. Open **one PO4-P Acid Reagent digestion vial**, add **5 ml of the water sample** and tightly secure the vial cap.
2. Tightly secure the vial cap and gently invert the vial several times to mix the contents.
3. Heat the vial for **30 minutes** in a preheated thermoreactor at a temperature of 100°C.
4. **Caution: Vial will be hot!** After 30 minutes, remove the vial from the reactor and allow the vial to cool to room temperature.
5. Insert the adapter for 16 mm round vials into the sample chamber.
6. Access the methods list, press [Shift] + [3] [2] [5] keys and press [↵] key.
7. Open the cooled vial and add **2 ml 1.00 N Sodium Hydroxide solution** to the vial.
8. Tightly secure the vial cap and gently invert the vial several times to mix the contents.
9. Place the vial in the sample chamber, making sure that the Δ marks are aligned.
10. Press [**Zero**] key and wait for the zero to be accepted.
11. Remove the vial from the sample chamber.
12. Add the contents of **one Phosphate Rgt. F10 powder pack** straight from the foil into the vial. Use a funnel to add the powder to the vial.
13. Tightly secure the vial cap and swirl several times, at least 10-15 seconds, to mix the contents. Note that the reagent will not dissolve completely.
14. Place the vial in the sample chamber making sure that the Δ marks are aligned.
15. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 2 minutes** will be displayed.
16. The result will be shown as mg/l acid hydrolysable phosphate as phosphorous.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to PO_4, P or P_2O_5.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Appropriate safety precautions and good lab technique should be used during the entire test procedure.
- This procedure is for the determination of orthophosphate ions plus condensed, inorganic phosphates. Orthophosphate ions react with the reagent to form an intense blue color.
- Conversion:
  - mg/l PO_4 = mg/l P x 3.07
  - mg/l P_2O_5= mg/l P x 2.29
- Phosphate in organic and condensed inorganic forms (meta-, pyro- and polyphosphates) must be converted to orthophosphate ions before analysis. Pretreatment of the sample with

acid and heat provides the conditions for hydrolysis of the condensed inorganic forms. Organically combined phosphates are converted to orthophosphate ions by heating with acid and persulfate. The amount of organically combined phosphates can be calculated: mg/l phosphate, organic = mg/l phosphate, total – mg/l phosphate, acid hydrolysable

- Application: for water, wastewater and seawater.
- Highly buffered samples or samples with extreme pH values should be adjusted between pH 2 and 10 before analysis (with 1 mol/l hydrochloric acid or 1 mol/l sodium hydroxide).
- Interferences: Large amounts of turbidity may cause inconsistent results.
- Interferences:

Interfering substance	**Interfering Level**
Aluminum	greater than 200 mg/l
Arsenate	at any level
Chromium	greater than 100 mg/l
Copper	greater than 10 mg/l
Iron	greater than 100 mg/l
Nickel	greater than 300 mg/l
Silica (silicium dioxide)	greater than 50 mg/l
Silicate	greater than 10 mg/l
Sulfide	at any level
Zinc	greater than 80 mg/l

- Phosphate, ortho = Phosphorus, reactive

Phosphate, Total, with Digestion Tube, ACD095

AQUAfast ACD095 Phosphate (Total) Digestion Tubes

Range: 0.02 to 1.1 mg/l P (0.06 to 3.5 mg/l PO_4)

Method 326

1. Open **one PO4-P Acid Reagent digestion vial** and add **5 ml of the water sample.**
2. Add the contents of **one Potassium Persulfate F10 powder pack** straight from the foil into the vial. Use a funnel to add the powder to the vial.
3. Tightly secure the vial cap and invert the vial several times to mix the contents.
4. Heat the vial for **30 minutes** in a preheated thermoreactor at a temperature of 100°C.
5. **Caution: Vial will be hot!** After 30 minutes, remove the vial from the reactor and allow the vial to cool to room temperature.
6. Insert the adapter for 16 mm round vials into the sample chamber.
7. Access the methods list, press [Shift] + [3] [2] [6] keys and press [↵] key.
8. Open the cooled vial and add **2 ml 1.54 N Sodium Hydroxide solution** to the vial.
9. Tightly secure the vial cap and gently invert the vial several times to mix the contents.
10. Place the vial in the sample chamber, making sure that the Δ marks are aligned.
11. Press [**Zero**] key and wait for the zero to be accepted.
12. Remove the vial from the sample chamber.
13. Add the contents of **one Phosphate Rgt. F10 powder pack** straight from the foil into the vial. Use a funnel to add the powder to the vial.
14. Tightly secure the vial cap and swirl several times, at least 10-15 seconds, to mix the contents. Note that the reagent will not dissolve completely.
15. Place the vial in the sample chamber making sure that the Δ marks are aligned.
16. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 2 minutes** will be displayed.
17. The result will be shown as mg/l total phosphate as phosphorous.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to PO_4, P or P_2O_5.

Notes:

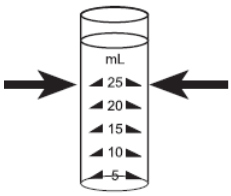
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Appropriate safety precautions and good lab technique should be used during the entire test procedure.
- This procedure is for the determination of orthophosphate ions plus condensed, inorganic phosphates plus organically combined phosphates. Orthophosphate ions react with the reagent to form an intense blue color.
- Conversion:
  - mg/l PO_4 = mg/l P x 3.07
  - mg/l P_2O_5= mg/l P x 2.29

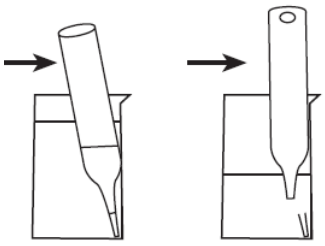
- Phosphate in organic and condensed inorganic forms (meta-, pyro- and polyphosphates) must be converted to orthophosphate ions before analysis. Pretreatment of the sample with acid and heat provides the conditions for hydrolysis of the condensed inorganic forms. Organically combined phosphates are converted to orthophosphate ions by heating with acid and persulfate. The amount of organically combined phosphates can be calculated: mg/l phosphate, organic = mg/l phosphate, total – mg/l phosphate, acid hydrolysable
- Application: for water, wastewater and seawater.
- Highly buffered samples or samples with extreme pH values should be adjusted between pH 2 and 10 before analysis (with 1 mol/l hydrochloric acid or 1 mol/l sodium hydroxide).
- Interferences: Large amounts of turbidity may cause inconsistent results.
- Interferences:

Interfering substance	**Interfering Level**
Aluminum	greater than 200 mg/l
Arsenate	at any level
Chromium	greater than 100 mg/l
Copper	greater than 10 mg/l
Iron	greater than 100 mg/l
Nickel	greater than 300 mg/l
Silica (silicium dioxide)	greater than 50 mg/l
Silicate	greater than 10 mg/l
Sulfide	at any level
Zinc	greater than 80 mg/l

- Phosphate, ortho = Phosphorus, reactive

Method 327





Phosphate 1, Ortho, with Ampoule Reagent

Refer to Reagent Manufacturer Instructions for Specific Procedure

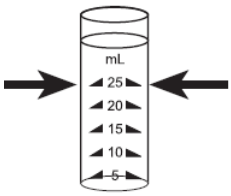
Range: 5 to 40 mg/l PO_4

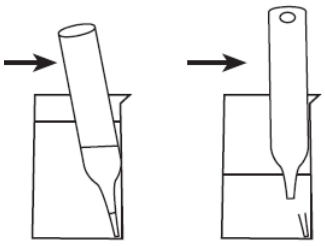
1. Insert the adapter for 13 mm round vials into the sample chamber.
2. Access the methods list, press [Shift] + [3] [2] [7] keys and press [↵] key.
3. Place the blank ampoule in the sample chamber. The blank ampoule should be part of the reagent manufacturer's test kit.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the ampoule from the sample chamber.
6. Fill the sample container to the **25 ml mark with water sample**.
7. Place one ampoule into the sample container. Snap the tip by pressing the ampoule against the side of the sample container. The ampoule breaks at the neck and fills automatically. A small volume of inert gas remains in the ampoule.
8. Mix the contents of the ampoule by inverting it several times, allowing the bubble to move from one end to the other. Dry the outside of the ampoule.
9. Place the sample ampoule in the sample chamber.
10. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 5 minutes** will be displayed.
11. The result will be shown as mg/l orthophosphate.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to PO_4, P or P_2O_5.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This method is adapted from one originated by an alternative reagent manufacturer. Always review original instructions and Safety Data Sheet (SDS) before starting the test.
- This procedure is for the determination of orthophosphate ions and only orthophosphate ions react.
- Sulfide, thiosulfate and thiocyanate cause low test results.

Method 328





Phosphate 2, Ortho, with Ampoule Reagent

Refer to Reagent Manufacturer Instructions for Specific Procedure

Range: 0.05 to 5 mg/l PO_4

1. Insert the adapter for 13 mm round vials into the sample chamber.
2. Access the methods list, press [Shift] + [3] [2] [8] keys and press [↵] key.
3. Place the blank ampoule in the sample chamber. The blank ampoule should be part of the reagent manufacturer's test kit.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the ampoule from the sample chamber.
6. Fill the sample container to the **25 ml mark with water sample**.
7. Add **2 drops A-8500 Activator solution** into the sample container. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
8. Tightly secure the sample container cap and swirl several times to mix the contents.
9. Place one ampoule into the sample container. Snap the tip by pressing the ampoule against the side of the sample container. The ampoule breaks at the neck and fills automatically. A small volume of inert gas remains in the ampoule.
10. Mix the contents of the ampoule by inverting it several times, allowing the bubble to move from one end to the other. Dry the outside of the ampoule.
11. Place the sample ampoule in the sample chamber.
12. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 3 minutes** will be displayed.
13. The result will be shown as mg/l orthophosphate.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to PO_4, P or P_2O_5.

Notes:

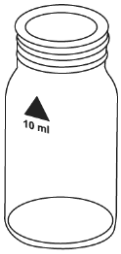
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This method is adapted from one originated by an alternative reagent manufacturer. Always review original instructions and Safety Data Sheet (SDS) before starting the test.
- This procedure is for the determination of orthophosphate ions and only orthophosphate ions react.
- Sulfide, thiosulfate and thiocyanate cause low test results.

Phosphate Low Range with Powder & Liquid Reagents

Refer to Reagent Manufacturer Instructions for Specific Procedure

Range: 0.1 to 10 mg/l PO_4

Method 334



Determination of Orthophosphate Low Range

This test is suitable for determining orthophosphate in boiler waters and potable water supplies. Samples should be filtered prior to analysis to remove any suspended insoluble phosphate. A GF/C filter is suitable.

Unscrew the two halves of the filter holder and place one GF/C filter circle onto the base section. Screw the two parts together again; ensuring the O ring is correctly located.

1. Access the methods list, press [Shift] + [3] [3] [4] keys and press [↵] key.
2. Fill a clean 20 ml syringe with approximately 14 ml water sample.
3. Connect the syringe to the filtration assembly and discharge the syringe to waste, down to the 10 ml mark.
4. Fill a clean 24 mm round vial with **10 ml of water sample from the prepared syringe** and tightly secure the vial cap.
5. Place the vial in the sample chamber, making sure that the Δ marks are aligned.
6. Press [**Zero**] key and wait for the zero to be accepted.
7. Remove the vial from the sample chamber.
8. Add **50 drops KS80 (CRP) solution** into the vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
9. Tightly secure the vial cap and invert several times to mix the contents.
10. Add **one level spoonful of Reagent KP119 (Ascorbic Acid) powder** to the same vial. Note that for correct dosage, the spoon supplied with the reagent must be used.
11. Tightly secure the vial cap and swirl several times to dissolve the powder.
12. Place the vial in the sample chamber, making sure that the Δ marks are aligned.
13. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 10 minutes** will be displayed.
14. The result will be shown as mg/l phosphate.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to PO_4, P or P_2O_5.

Determination of Polyphosphate Low Range (Total Inorganic Phosphate)

This test will give total inorganic phosphate. Polyphosphate is determined by the difference of total inorganic phosphate and orthophosphate.

1. Access the methods list, press [Shift] + [3] [3] [4] keys and press [↵] key.
2. Fill a clean 100 ml Erlenmeyer flask with **50 ml homogenized sample**.
3. Add **15 drops KS278 (50% Sulfuric Acid) solution** into the Erlenmeyer flask. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
4. Boil for 20 minutes, maintaining the sample volume above 25 ml using deionized water.
5. Swirl gently several times to mix the contents and allow the Erlenmeyer flask to cool to room temperature.

6. Add **2 drops KS135 (Phenolphthalein Indicator) solution** into the Erlenmeyer flask. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
7. Add drops of **KS144 (Calcium Hardness Buffer) solution** into the Erlenmeyer flask, one at a time **with mixing**, until a pale pink color just appears.
8. Fill the sample up to 50ml with deionized water.
9. Fill a clean 24 mm round vial with **10 ml of prepared water sample** and tightly secure the vial cap.
10. Place the vial in the sample chamber, making sure that the Δ marks are aligned.
11. Press [**Zero**] key and wait for the zero to be accepted.
12. Remove the vial from the sample chamber.
13. Add **50 drops KS80 (CRP) solution** into the vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
14. Tightly secure the vial cap and invert several times to mix the contents.
15. Add **one level spoonful of Reagent KP119 (Ascorbic Acid)** to the same vial. Note that for correct dosage, the spoon supplied with the reagent must be used.
16. Tightly secure the vial cap and swirl several times to dissolve the powder.
17. Place the vial in the sample chamber, making sure that the Δ marks are aligned.
18. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 10 minutes** will be displayed.
19. The result will be shown as mg/l phosphate.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to PO_4, P or P_2O_5.

Determination of Total Phosphate Low Range

This test will measure all phosphorous containing compounds present in the sample, including orthophosphate, polyphosphate and organic phosphorous compounds.

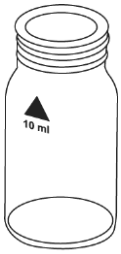
1. Access the methods list, press [Shift] + [3] [3] [4] keys and press [↵] key.
2. Fill a clean 100 ml Erlenmeyer flask with **50 ml homogenized sample**.
3. Add **one level spoonful KP962 (Ammonia Persulfate) powder** to the Erlenmeyer flask. Note that for correct dosage, the spoon supplied with the reagent must be used.
4. Add **15 drops KS278 (50% Sulfuric Acid) solution** into the same Erlenmeyer flask. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
5. Boil for 20 minutes, maintaining the sample volume above 25 ml using deionized water.
6. Swirl gently several times to mix the contents and allow the Erlenmeyer flask to cool to room temperature.
7. Add **2 drops KS135 (Phenolphthalein Indicator) solution** into the Erlenmeyer flask. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
8. Add drops of **KS144 (Calcium Hardness Buffer) solution** into the Erlenmeyer flask, one at a time **with mixing**, until a pale pink color just appears.
9. Fill the sample up to 50ml with deionized water.
10. Fill a clean 24 mm round vial with **10 ml of prepared water sample** and tightly secure the vial cap.
11. Place the vial in the sample chamber, making sure that the Δ marks are aligned.

12. Press [**Zero**] key and wait for the zero to be accepted.
13. Remove the vial from the sample chamber.
14. Add **50 drops KS80 (CRP) solution** into the vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
15. Tightly secure the vial cap and invert several times to mix the contents.
16. Add **one level spoonful of Reagent KP119 (Ascorbic Acid)** to the same vial. Note that for correct dosage, the spoon supplied with the reagent must be used.
17. Tightly secure the vial cap and swirl several times to dissolve the powder.
18. Place the vial in the sample chamber, making sure that the Δ marks are aligned.
19. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 10 minutes** will be displayed.
20. The result will be shown as mg/l phosphate.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to PO_4, P or P_2O_5.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This method is adapted from one originated by an alternative reagent manufacturer. Always review original instructions and Safety Data Sheet (SDS) before starting the test.
- Sample temperature should be between 15 and 30°C.
- For the analysis of polyphosphate and total phosphate, digestion is required.
- Conversion:
  - mg/l P = mg/l PO_4 x 0.33
  - mg/l P_2O_5= mg/l PO_4 x 0.75

Method 335



Phosphate High Range with Liquid Reagent

Refer to Reagent Manufacturer Instructions for Specific Procedure

Range: 5 to 80 mg/l PO_4

Determination of Orthophosphate High Range

This test is suitable for determining orthophosphate in boiler waters and potable water supplies. Samples should be filtered prior to analysis to remove any suspended insoluble phosphate. A GF/C filter is suitable.

Unscrew the two halves of the filter holder and place one GF/C filter circle onto the base section. Screw the two parts together again; ensuring the O ring is correctly located.

1. Access the methods list, press [Shift] + [3] [3] [5] keys and press [↵] key.
2. Fill a clean 20 ml syringe with approximately 14 ml water sample.
3. Connect the syringe to the filtration assembly and discharge the syringe to waste, down to the 10 ml mark.
4. Fill a clean 24 mm round vial with **10 ml of water sample from the prepared syringe** and tightly secure the vial cap.
5. Place the vial in the sample chamber, making sure that the Δ marks are aligned.
6. Press [**Zero**] key and wait for the zero to be accepted.
7. Remove the vial from the sample chamber.
8. Add **25 drops KS228 (Ammonia Molybdate) solution** into the vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
9. Tightly secure the vial cap and invert several times to mix the contents.
10. Add **25 drops KS229 (Ammonium Metavanadate) solution** into the same vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
11. Tightly secure the vial cap and invert several times to mix the contents.
12. Place the vial in the sample chamber, making sure that the Δ marks are aligned.
13. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 10 minutes** will be displayed.
14. The result will be shown as mg/l phosphate.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to PO_4, P or P_2O_5.

Determination of Polyphosphate High Range (Total Inorganic Phosphate)

This test will give total inorganic phosphate. Polyphosphate is determined by the difference of total inorganic phosphate and orthophosphate.

1. Access the methods list, press [Shift] + [3] [3] [5] keys and press [↵] key.
2. Fill a clean 100 ml Erlenmeyer flask with **50 ml homogenized sample**.
3. Add **15 drops KS278 (50% Sulfuric Acid) solution** into the Erlenmeyer flask. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
4. Boil for 20 minutes, maintaining the sample volume above 25 ml using deionized water.
5. Swirl gently several times to mix the contents and allow the Erlenmeyer flask to cool to room temperature.

6. Add **2 drops KS135 (Phenolphthalein Indicator) solution** into the Erlenmeyer flask. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
7. Add drops of **KS144 (Calcium Hardness Buffer) solution** into the Erlenmeyer flask, one at a time **with mixing**, until a pale pink color just appears.
8. Fill the sample up to 50ml with deionized water.
9. Fill a clean 24 mm round vial with **10 ml of prepared water sample** and tightly secure the vial cap.
10. Place the vial in the sample chamber, making sure that the Δ marks are aligned.
11. Press [**Zero**] key and wait for the zero to be accepted.
12. Remove the vial from the sample chamber.
13. Add **25 drops KS228 (Ammonia Molybdate) solution** into the vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
14. Tightly secure the vial cap and invert several times to mix the contents.
15. Add **25 drops KS229 (Ammonium Metavanadate) solution** into the same vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
16. Tightly secure the vial cap and invert several times to mix the contents.
17. Place the vial in the sample chamber, making sure that the Δ marks are aligned.
18. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 10 minutes** will be displayed.
19. The result will be shown as mg/l phosphate.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to PO_4, P or P_2O_5.

Determination of Total Phosphate High Range

This test will measure all phosphorous containing compounds present in the sample, including orthophosphate, polyphosphate and organic phosphorous compounds.

1. Access the methods list, press [Shift] + [3] [3] [5] keys and press [↵] key.
2. Fill a clean 100 ml Erlenmeyer flask with **50 ml homogenized sample**.
3. Add **one level spoonful KP962 (Ammonia Persulfate) powder** to the Erlenmeyer flask. Note that for correct dosage, the spoon supplied with the reagent must be used.
4. Add **15 drops KS278 (50% Sulfuric Acid) solution** into the same Erlenmeyer flask. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
5. Boil for 20 minutes, maintaining the sample volume above 25 ml using deionized water.
6. Swirl gently several times to mix the contents and allow the Erlenmeyer flask to cool to room temperature.
7. Add **2 drops KS135 (Phenolphthalein Indicator) solution** into the Erlenmeyer flask. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
8. Add drops of **KS144 (Calcium Hardness Buffer) solution** into the Erlenmeyer flask, one at a time **with mixing**, until a pale pink color just appears.
9. Fill the sample up to 50ml with deionized water.
10. Fill a clean 24 mm round vial with **10 ml of prepared water sample** and tightly secure the vial cap.
11. Place the vial in the sample chamber, making sure that the Δ marks are aligned.

12. Press [**Zero**] key and wait for the zero to be accepted.
13. Remove the vial from the sample chamber.
14. Add **25 drops KS228 (Ammonia Molybdate) solution** into the vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
15. Tightly secure the vial cap and invert several times to mix the contents.
16. Add **25 drops KS229 (Ammonium Metavanadate) solution** into the same vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
17. Tightly secure the vial cap and invert several times to mix the contents.
18. Place the vial in the sample chamber, making sure that the Δ marks are aligned.
19. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 10 minutes** will be displayed.
20. The result will be shown as mg/l phosphate.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to PO_4, P or P_2O_5.

Notes:

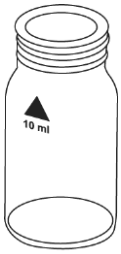
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This method is adapted from one originated by an alternative reagent manufacturer. Always review original instructions and Safety Data Sheet (SDS) before starting the test.
- For the analysis of polyphosphate and total phosphate, digestion is required.
- Conversion:
  - mg/l P = mg/l PO_4 x 0.33
  - mg/l P_2O_5= mg/l PO_4 x 0.75

Phosphonates Persulfate UV Oxidation Method with Powder Pack Reagent

Refer to Reagent Manufacturer Instructions for Specific Procedure

Range: 0 to 125 mg/l PO_4^{3-} (See Table)

Method 316



Choose the Appropriate Sample Volume From the Following Table:

Expected Range (mg/l Phosphonate)	Sample Volume (ml)	Factor
0 – 2.5	50	0.1
0 – 5.0	25	0.2
0 – 12.5	10	0.5
0 – 25	5	1.0
0 – 125	1	5.0

1. Access the methods list, press [Shift] + [3] [1] [6] keys and press [↵] key.
2. Pipette the chosen sample volume into a clean 50 ml graduated cylinder. If necessary, fill the graduated cylinder with deionized water to the 50 ml mark and mix well.
3. Fill a clean 24 mm round vial with **10 ml of prepared water sample** and tightly secure the vial cap (this is the blank vial).
4. Transfer **25 ml of prepared water sample** into the digestion vial.
5. Add the contents of **one Potassium Persulfate F10 powder pack** straight from the foil into the digestion vial.
6. Tightly secure the digestion vial cap and swirl until the reagent is dissolved.
7. **Caution: Wear UV safety goggles!** Insert the UV lamp into the digestion vial. Note that while the UV lamp is on UV safety goggles must be worn. For handling of the UV lamp, see manufacturer instructions. Do not touch the surface of the UV lamp. Fingerprints will etch the glass. Wipe the UV lamp with a soft and clean tissue between measurements.
8. Switch the UV lamp on. Press [↵] key.
    a. A countdown for the **reaction period of 10 minutes** will be displayed.
9. After the reaction period is done, switch the UV lamp off and remove the lamp from the vial.
10. Fill a second clean 24 mm round vial with **10 ml of digested water sample** and tightly secure the vial cap (this is the sample vial).
11. Add the contents of **one Phosphate Rgt. F10 powder pack** straight from the foil into the blank and sample vials.
12. Tightly secure the vial caps and gently swirl several times, at least 30 seconds, to mix the contents. The reagent will not dissolve completely.
13. Place the blank vial in the sample chamber, making sure that the Δ marks are aligned.
14. Press [**Zero**] key and wait for the zero to be accepted.
    a. A countdown for the **reaction period of 2 minutes** will be displayed.
    b. Note that the given reaction time of 2 minutes refers to a water sample temperature of more than 15 °C. At a sample temperature of lower than 15 °C, a reaction time of 4 minutes is required.

15. Remove the vial from the sample chamber.
16. Place the sample vial in the sample chamber, making sure that the Δ marks are aligned.
17. Press [**Test**] key and wait for the measurement to be taken.
18. The result will be shown as mg/l phosphonates.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This method is adapted from one originated by an alternative reagent manufacturer. Always review original instructions and Safety Data Sheet (SDS) before starting the test.
- Rinse all glassware with 1:1 hydrochloric acid first and then rinse with deionized water.
- During UV digestion, phosphonates are converted to orthophosphates. This step is normally completed in 10 minutes. High organic loaded samples or a weak lamp can cause incomplete phosphate conversion.
- While the UV lamp is on UV safety goggles must be worn.
- For handling of the UV lamp, see manufacturer's instructions. Do not touch the surface of the UV lamp. Fingerprints will etch the glass. Wipe the UV lamp with a soft and clean tissue between measurements.
- The given reaction time of 2 minutes refers to a water sample temperature of more than 15 °C. At a sample temperature of lower than 15 °C a reaction time of 4 minutes is required.
- Conversion factors for active phosphonates:

Phosphonate Type	Conversion Factor for Active Phosphonate
PBTC	2.840
NTP	1.050
HEDPA	1.085
EDTMPA	1.148
HMDTMPA	1.295
DETPMPA	1.207
HPA	1.490

- Interference levels decrease with increasing sample volume. Example: Iron interferes above 200 mg/L if a sample volume of 5 ml is used. At a sample volume of 10 ml the interference level decreases to 100 mg/L.

Interfering Substances	Interference Level Using 5 ml Sample
Aluminum	100 mg/l
Arsenate	interferes at all concentrations

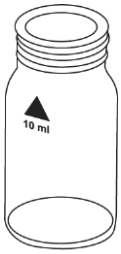
Interfering Substances	Interference Level Using 5 ml Sample
Benzotriazole	10 mg/l
Bicarbonate	1000 mg/l
Bromide	100 mg/l
Calcium	5000 mg/l
CDTA	100 mg/l
Chloride	5000 mg/l
Chromate	100 mg/l
Copper	100 mg/l
Cyanide	100 mg/l; increase the UV digestion to 30 minutes
Diethanoldithiocarbamate	50 mg/l
EDTA	100 mg/l
Iron	200 mg/l
Nitrate	200 mg/l
NTA	250 mg/l
Orthophosphate	15 mg/l
Phosphite and organophosphorus compounds	reacts quantitatively; Meta- and polyphosphates do not interfere
Silica	500 mg/l
Silicate	100 mg/l
Sulfate	2000 mg/l
Sulfide	interferes at all concentrations
Sulfite	100 mg/l
Thiourea	10mg/l
Highly buffered samples or extreme sample pH	may exceed the buffering capacity of the reagents and require sample pretreatment

pH-Value Low Range with Tablet Reagent, AC3001BP

AQUAfast AC3001BP pH-Value LR Tablets

Range: 5.2 to 6.8 pH

Method 329



1. Access the methods list, press [Shift] + [3] [2] [9] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **one Bromocresol Purple tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
7. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
8. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
9. Press [**Test**] key and wait for the measurement to be taken.
10. The result will be shown as pH-value.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- For photometric determination of pH values, only use Bromocresol Purple tablets in printed foil pack marked with Photometer.
- pH values below 5.2 and above 6.8 can produce results inside the measuring range. A plausibility test (pH meter) is recommended.
- The accuracy of the colorimetric determination of pH values depends on various boundary conditions (buffer capacity of the sample, salt contents etc.).
- Salt error, correction of test results (average values) for samples with salt contents of:

Indicator	Salt Content		
Bromcresol Purple	1 molar – 0.26	2 molar – 0.33	3 molar – 0.31

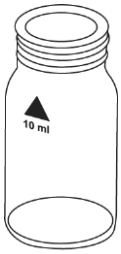
- The values of Parson and Douglas (1926) are based on the use of Clark and Lubs buffers.
- 1 Mol NaCl = 58.4 g/l = 5.8 %

pH-Value with Tablet Reagent, AC2001

AQUAfast AC2001 pH-Value Tablets

Range: 6.5 to 8.4 pH

Method 330



1. Access the methods list, press [Shift] + [3] [3] [0] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **one Phenol Red tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
7. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
8. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
9. Press [**Test**] key and wait for the measurement to be taken.
10. The result will be shown as pH-value.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Water samples with low values of alkalinity-m (below 35 mg/l $CaCO_3$) may give wrong pH readings.
- For photometric determination of pH values, only use Phenol Red tablets in printed foil pack marked with Photometer.
- pH values below 6.5 and above 8.4 can produce results inside the measuring range. A plausibility test (pH meter) is recommended.
- The accuracy of the colorimetric determination of pH values depends on various boundary conditions (buffer capacity of the sample, salt contents etc.).
- Salt error, correction of test results (average values) for samples with salt contents of:

Indicator	Salt Content		
Phenol Red	1 molar – 0.21	2 molar – 0.26	3 molar – 0.29

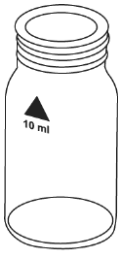
- The values of Parson and Douglas (1926) are based on the use of Clark and Lubs buffers.
- 1 Mol NaCl = 58.4 g/l = 5.8 %

pH-Value with Liquid Reagent, AC3001

AQUAfast AC3001 pH-Value Liquid Reagent

Range: 6.5 to 8.4 pH

Method 331



1. Access the methods list, press [Shift] + [3] [3] [1] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **6 drops Phenol Red solution** into the vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
7. Tightly secure the vial cap and swirl several times to mix the contents.
8. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
9. Press [**Test**] key and wait for the measurement to be taken.
10. The result will be shown as pH-value.

Notes:

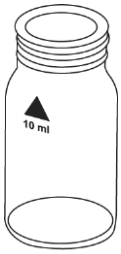
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- When testing chlorinated water, the residual chlorine contents can influence the color reaction of the liquid reagent. This can be avoided (without interfering with the pH measurement) by adding a small crystal of sodium thiosulfate ($Na_2S_2O_3 \cdot 5\ H_2O$) to the sample before adding the Phenol Red solution. Phenol Red tablets contain thiosulfate.
- Due to varying drop sizes, results can show a discrepancy in accuracy by comparison with tablets. This can be minimized using a pipette (0.18 ml Phenol Red solution is equivalent to 6 drops).
- After use, replace the bottle cap securely on the Phenol Red solution.
- Store the reagent in a cool, dry place ideally at between 6°C and 10°C.

pH-Value High Range with Tablet Reagent, AC3001TB

AQUAfast AC3001TB pH-Value HR Tablets

Range: 8.0 to 9.6 pH

Method 332



1. Access the methods list, press [Shift] + [3] [3] [2] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **one Thymol Blue tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
7. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
8. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
9. Press [**Test**] key and wait for the measurement to be taken.
10. The result will be shown as pH-value.

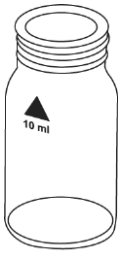
Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- For photometric determination of pH values, only use Thymol Blue tablets in printed foil pack marked with Photometer.
- pH values below 8.0 and above 9.6 can produce results inside the measuring range. A plausibility test (pH meter) is recommended.
- The accuracy of the colorimetric determination of pH values depends on various boundary conditions (buffer capacity of the sample, salt contents etc.).
- Salt error, correction of test results (average values) for samples with salt contents of:

Indicator	Salt Content		
Thymol Blue	1 molar – 0.22	2 molar – 0.29	3 molar – 0.34

- The values of Parson and Douglas (1926) are based on the use of Clark and Lubs buffers.
- 1 Mol NaCl = 58.4 g/l = 5.8 %

Method 338



Polyacrylate with Liquid Reagent

Refer to Reagent Manufacturer Instructions for Specific Procedure

Range: 1 to 30 mg/l Polyacrylic Acid 2'100 Sodium Salt

1. Access the methods list, press [Shift] + [3] [3] [8] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **25 drops (1 ml) KS255 (Polyacrylate Reagent 1) solution** into the vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
7. Tightly secure the vial cap and gently swirl several times to mix the contents.
8. Add **25 drops (1 ml) KS256 (Polyacrylate Reagent 2) solution** into the same vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
9. Tightly secure the vial cap and gently swirl several times to mix the contents.
10. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
11. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 10 minutes** will be displayed.
12. The result will be shown as mg/l polyacrylic acid 2'100 sodium salt.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This method is adapted from one originated by an alternative reagent manufacturer. Always review original instructions and Safety Data Sheet (SDS) before starting the test.
- If little or no turbidity is present at correct dose concentrations, the sample will need a pre-concentration step in order to detect this level of polyacrylate/polymer. Carry out this procedure as directed then test the pre-concentrated sample as described in the standard test procedure.
- Anomalous results occur when interferences are present as part of the product blend or from sample contaminants. In these instances follow the interference removal steps detailed in the following sections and test this treated sample as described in the standard test procedure.
- This test has been calibrated using polyacrylic acid 2'100 sodium salt in the range 1 to 30 mg/l. Other polyacrylates/polymers will give differing responses and therefore the test range will vary.

Pre-Concentration:

Pre-concentration uses exactly the same procedure as interference removal, except a greater volume of sample is used in step 1, instead of deionized water. For calculation of the original sample concentration, a concentration factor should be considered:

- If a 50 ml sample is used the concentration factor is 20/50 = 0.4
- If a 100 ml sample is used the concentration factor is 20/100 = 0.2

This can be extended as required to concentrate the polyacrylate sufficiently for analysis.

Example: If the reading is 20 mg/l and 50 ml are taken for pre-concentration the original concentration should be calculated as 20 * 0.4 = 8 mg/l.

Note: Samples exceeding 10,000 TDS should be diluted prior to loading onto the cartridge. Take this dilution into consideration when working out the overall concentration factor.

Cartridge Preparation:

1. Remove the plunger of the 20 ml syringe from the barrel and attach the C18 cartridge.
2. Add 5 ml of KS336 (Propan-2-ol) to the syringe barrel, attach the plunger and pass drop-wise through the cartridge. Discard the eluent to waste.
3. Remove plunger and fill the syringe barrel with 20 ml of deionized water. Attach the plunger and pass drop-wise through the cartridge. Discard the eluent to waste. The cartridge is now ready to be used/reused.

Interference Removal:

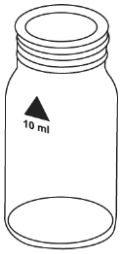
1. Transfer exactly 20 ml of sample water to a 100 ml sample bottle and dilute to approximately 50 to 60 ml with deionized water.
2. Add drops of KS173 (2, 4 Dinitrophenol) until a pale yellow color is observed in the sample.
3. Add drops of KS183 (Nitric Acid) until the yellow color JUST disappears.
4. Remove the plunger from the barrel of the 60 ml plastic syringe and firmly attach the prepared C18 cartridge to the end of the barrel.
5. Transfer the 50 to 60 ml of sample from the bottle to the syringe barrel and attach the plunger. Depress the plunger and allow the sample to flow drop-wise from the cartridge. Do not use excessive force to elute the sample quickly. LEAVE THE C18 CARTRIDGE ATTACHED and remove the plunger. Discard all of eluted sample to waste.
6. Using the 20 ml syringe, add exactly 20 ml of deionized to the 60 ml syringe barrel attached to the cartridge followed by 25 drops (1 ml) of KS255 (Polyacrylate Reagent 1). Gently swirl the syringe to mix.
7. Attach the plunger and depress. Collect the eluted sample in a clean vessel. Allow the sample to flow drop-wise from the cartridge. Do not use excessive force to elute the sample quickly.
8. Add 10 ml of the eluted water sample into a clean 24 mm round vial.
9. Using this vial, perform the measurement of polyacrylate as described in the standard test procedure.

Potassium with Tablet Reagent, AC3019

AQUAfast AC3019 Potassium Tablets

Range: 0.7 to 12 mg/l K

Method 340



1. Access the methods list, press [Shift] + [3] [4] [0] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **one Potassium T tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
7. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
8. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
9. Press [**Test**] key and wait for the measurement to be taken.
10. The result will be shown as mg/l potassium.

Notes:

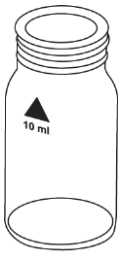
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- If potassium is present, a cloudy solution will appear. Single particles are not necessarily caused by potassium.

Silica/Silicon Dioxide with Tablet Reagent, AC2060 & AC2061

AQUAfast AC2060 Silica Tablets and AQUAfast AC2061 Phosphate Removal Tablets

Range: 0.05 to 4 mg/l SiO_2

Method 350

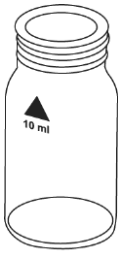


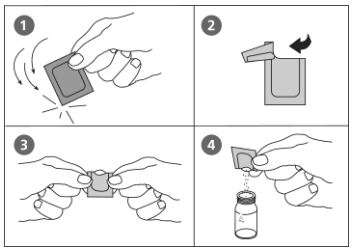
1. Access the methods list, press [Shift] + [3] [5] [0] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **one Silica No. 1 tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
7. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
8. Press [↵] key.
    a. A countdown for the **reaction period of 5 minutes** will be displayed.
9. After the reaction period is done, add **one Silica PR tablet** straight from the foil into the same vial and crush the tablet using a clean stir rod.
10. Add **one Silica No. 2 tablet** straight from the foil into the same vial and crush the tablet using a clean stir rod.
11. Tightly secure the vial cap and swirl several times until the tablets are dissolved.
12. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
13. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 2 minutes** will be displayed.
14. The result will be shown as mg/l silica.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to SiO_2 or Si.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- The tablets must be added in the correct sequence.
- Phosphate ions do not interfere under the given reaction conditions.
- If Phosphate is known to be absent, the addition of the Silica PR tablet may be omitted.
- Conversion: mg/l Si = mg/l SiO_2 x 0.47

Method 351





Silica/Silicon Dioxide Low Range with Powder Pack & Liquid Reagents

Refer to Reagent Manufacturer Instructions for Specific Procedure

Range: 0.1 to 1.6 mg/l SiO_2

1. Access the methods list, press [Shift] + [3] [5] [1] keys and press [↵] key.
2. Use two clean 24 mm round vials and mark one as the blank vial.
3. Add **10 ml of water sample** to each vial.
4. Add **0.5 ml Molybdate 3 Reagent solution** to each vial.
5. Tightly secure the vial caps and swirl several times to mix the contents. Close the vials with the caps immediately after adding the Molybdate 3 Reagent solution, otherwise low readings may result.
6. Press [↵] key.
    a. A countdown for the **reaction period of 4 minutes** will be displayed.
    b. The given reaction time of 4 minutes refers to a water sample temperature of 20°C. At 30 °C a reaction time of 2 minutes is required and at 10 °C a reaction time of 8 minutes is required.
7. After the reaction period is done, add the contents of **one Silica Citric Acid F10 powder pack** straight from the foil into each vial.
8. Tightly secure the vial caps and swirl several times to mix the contents.
9. Press [↵] key.
    a. A countdown for the **reaction period of 1 minute** will be displayed.
    b. The given reaction time of 1 minute refers to a water sample temperature of 20°C. At 30 °C a reaction time of 30 seconds is required and at 10 °C a reaction time of 2 minutes is required.
10. After the reaction period is done, place the blank vial in the sample chamber, making sure that the Δ marks are aligned.
11. Add the contents of **one LR Silica Amino Acid F F10 powder pack** straight from the foil into the sample vial and then tightly secure the vial cap and swirl several times to mix the contents.
12. Press [**Zero**] key and wait for the zero to be accepted.
    a. A countdown for the **reaction period of 2 minutes** will be displayed.
13. After the reaction period is done, remove the vial from the sample chamber.
14. Place the sample vial in the sample chamber, making sure that the Δ marks are aligned.
15. Press [**Test**] key and wait for the measurement to be taken.
16. The result will be shown as mg/l silica.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to SiO_2 or Si.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.

- This method is adapted from one originated by an alternative reagent manufacturer. Always review original instructions and Safety Data Sheet (SDS) before starting the test.
- Close the vials with the cap immediately after adding the Molybdate 3 Reagent solution, otherwise low readings may result.
- Interferences:

Substance	Interference
Iron	large amounts interfere
Phosphate	does not interfere at concentrations less than 50 mg/l PO_4 at 60 mg/l PO_4 the interference is approximately -2% at 75 mg/l PO_4 the interference is approximately -11%
Sulfide	interferes at all levels

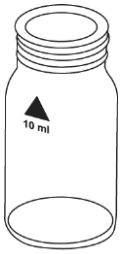
- Occasionally water samples contain forms of silica that react very slowly with molybdate. The nature of these forms is not known. A pre-treatment with sodium hydrogen carbonate and then with sulfuric acid will make these forms reactive to molybdate.

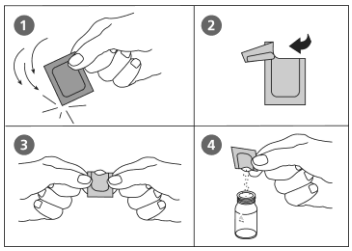
Silica/Silicon Dioxide High Range with Powder Pack Reagent, AC4P60

AQUAfast AC4P60 Silica Powder Packs

Range: 1 to 90 mg/l SiO_2

Method 352





1. Access the methods list, press [Shift] + [3] [5] [2] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap. Note that the temperature of the sample should be 15 to 25°C.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add the contents of **one Silica HR Molybdate F10 powder pack** straight from the foil into the vial.
7. Tightly secure the vial cap and swirl several times to mix the contents.
8. Add the contents of **one Silica HR Acid Rgt. F10 powder pack** straight from the foil into the same vial. Note that if silica or phosphate is present, a yellow color will develop.
9. Tightly secure the vial cap and swirl several times to mix the contents.
10. Press [↵] key.
    a. A countdown for the **reaction period of 10 minutes** will be displayed.
11. After the reaction period is done, add the contents of **one Silica Citric Acid F10 powder pack** straight from the foil into the same vial. Note that in this step, any yellow color due to phosphate is removed.
12. Tightly secure the vial cap and swirl several times to mix the contents.
13. Place the vial in the sample chamber, making sure that the Δ marks are aligned.
14. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 2 minutes** will be displayed.
15. The result will be shown as mg/l silica.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to SiO_2 or Si.

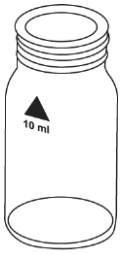
Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Interferences:

Substance	Interference
Iron	large amounts interfere
Phosphate	does not interfere at concentrations less than 50 mg/l PO_4 at 60 mg/l PO_4 the interference is approximately -2% at 75 mg/l PO_4 the interference is approximately -11%
Sulfide	interferes at all levels

- Occasionally water samples contain forms of silica that react very slowly with molybdate. The nature of these forms is not known. A pre-treatment with sodium hydrogen carbonate and then with sulfuric acid will make these forms reactive to molybdate.

Method 353



Silica/Silicon Dioxide with Powder & Liquid Reagents

Refer to Reagent Manufacturer Instructions for Specific Procedure

Range: 0.1 to 8 mg/l SiO_2

1. Access the methods list, press [Shift] + [3] [5] [3] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **20 drops KS104 (Silica Reagent 1) solution** into the vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
7. Tightly secure the vial cap and gently swirl several times to mix the contents.
8. Press [↵] key.
    a. A countdown for the **reaction period of 5 minutes** will be displayed.
9. After the reaction period is done, add **20 drops KS105 (Silica Reagent 2) solution** into the same vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
10. Tightly secure the vial cap and swirl several times to mix the contents.
11. Add **one level spoon of KP106 (Silica Reagent 2)** into the same vial. Note that for the correct dosage, the spoon supplied with the reagent must be used.
12. Tightly secure the vial cap and swirl several times to dissolve the powder.
13. Place the vial in the sample chamber, making sure that the Δ marks are aligned.
14. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 10 minutes** will be displayed.
15. The result will be shown as mg/l silica.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to SiO_2 or Si.

Notes:

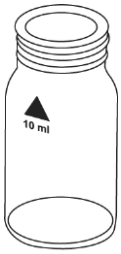
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This method is adapted from one originated by an alternative reagent manufacturer. Always review original instructions and Safety Data Sheet (SDS) before starting the test.
- For accurate results, ensure that the water being tested is between 20 °C and 30 °C.
- At temperatures under 20°C the reaction does not proceed to completion and low results are obtained.

Sodium Hypochlorite with Tablet Reagent, AC3072

AQUAfast AC3072 Tablets

Range: 0.2 to 16 % NaOCl

Method 212



Sample Preparation:

1. Fill a 5 ml plastic syringe with the test solution, ensuring that all air bubbles are expelled. Transfer the 5 ml test solution slowly into a 100 ml beaker and dilute to the 100 ml mark with chlorine-free water. Mix the solution thoroughly.
2. Fill a 5 ml plastic syringe with the diluted test solution (step 1) to the 1 ml mark, ensuring that all air bubbles are expelled. Transfer the 1 ml test solution slowly into a 100 ml beaker and dilute to the 100 ml mark with chlorine-free water. Mix thoroughly.

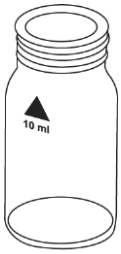
Test Procedure:

1. Access the methods list, press [Shift] + [2] [1] [2] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of prepared water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **one Chlorine HR (KI) tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
7. Add **one Acidifying GP tablet** straight from the foil into the same vial and crush the tablet using a clean stir rod.
8. Tightly secure the vial cap and swirl several times until the tablets are dissolved.
9. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
10. Press [**Test**] key and wait for the measurement to be taken.
11. The result will be shown as % w/w as available chlorine present in the original sample of sodium hypochlorite.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- Please pay attention when handling sodium hypochlorite. The material has a very strong alkalinity and can cause corrosion. Contact with eyes, skin and clothes must be avoided. Refer to the detailed information supplied with the product.
- The tablets must be added in the correct sequence.
- This method provides a fast and simple test. The test can be performed onsite, but the result will not be as precise as a laboratory method.
- By strictly following the test procedure, an accuracy of +/- 1 weight % can be achieved.

Method 355



Sulfate with Tablet Reagent, AC2082

AQUAfast AC2082 Sulfate Tablets

Range: 5 to 100 mg/l SO_4

1. Access the methods list, press [Shift] + [3] [5] [5] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **one Sulfate T tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
7. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
8. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
9. Press [**Test**] key and wait for the measurement to be taken.
10. The result will be shown as mg/l sulfate.

Notes:

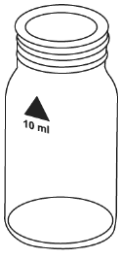
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- If sulfate ions are present a cloudy solution will appear.

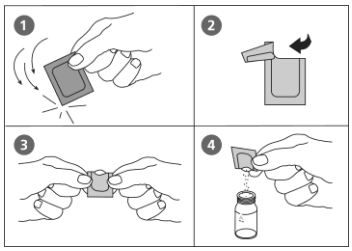
Sulfate with Powder Pack Reagent, AC4P82

AQUAfast AC4P82 Sulfate Powder Packs

Range: 5 to 100 mg/l SO_4

Method 360





1. Access the methods list, press [Shift] + [3] [6] [0] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add the contents of **one Sulfa 4 / F10 powder pack** straight from the foil into the vial.
7. Tightly secure the vial cap and swirl several times to mix the contents.
8. Place the vial in the sample chamber, making sure that the Δ marks are aligned.
9. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 5 minutes** will be displayed.
10. The result will be shown as mg/l sulfate.

Notes:

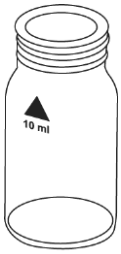
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- If sulfate ions are present a cloudy solution will appear.

Sulfide with Tablet Reagent, AC2016

AQUAfast AC2016 Sulfide Tablets

Range: 0.04 to 0.5 mg/l S

Method 365

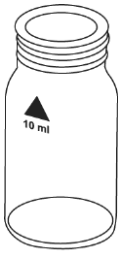


1. Access the methods list, press [Shift] + [3] [6] [5] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **one Sulfide No. 1 tablet** straight from the foil into the vial, crush the tablet using a clean stir rod and dissolve the tablet.
7. Add **one Sulfide No. 2 tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
8. Tightly secure the vial cap and swirl several times until the tablets are dissolved.
9. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
10. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 10 minutes** will be displayed.
11. The result will be shown as mg/l sulfide.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to S or H_2S.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- The tablets must be added in the correct sequence.
- Chlorine and other oxidizing agents that react with DPD do not interfere with the test.
- To avoid loss of sulfide, collect the sample carefully with a minimum of aeration. It is essential to test the sample immediately after collection.
- The sample temperature should be 20°C. A different temperature can lead to higher or lower results.
- Conversion: H_2S = mg/l S x 1.06

Method 370



Sulfite with Tablet Reagent

Refer to Reagent Manufacturer Instructions for Specific Procedure

Range: 0.1 to 5 mg/l SO_3

1. Access the methods list, press [Shift] + [3] [7] [0] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **one Sulfite LR tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
7. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
8. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
9. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 5 minutes** will be displayed.
10. The result will be shown as mg/l sulfite.
    a. Press arrow key [▼] or [▲] to change the chemical species of the test result to SO_3 or Na_2SO_3.

Notes:

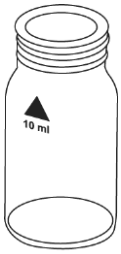
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This method is adapted from one originated by an alternative reagent manufacturer. Always review original instructions and Safety Data Sheet (SDS) before starting the test.

Suspended Solids, Total

Photometric Determination Method (Direct Reading)

Range: 0 to 750 mg/l TSS

Method 384



1. **Sample Preparation**: Blend approximately 500 ml of the water sample in a clean blender at high speed for 2 minutes.
2. Access the methods list, press [Shift] + [3] [8] [4] keys and press [↵] key.
3. Fill a clean 24 mm round vial with **10 ml of deionized water** and tightly secure the vial cap.
4. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
5. Press [**Zero**] key and wait for the zero to be accepted.
6. Remove the vial from the sample chamber and empty it completely.
7. Stir the blended water sample. Immediately rinse the vial with the water sample and then fill the vial with **10 ml of the water sample** and tightly secure the vial cap.
8. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
9. Press [**Test**] key and wait for the measurement to be taken.
10. The result will be shown as mg/l TSS (Total Suspended Solids).

Notes:

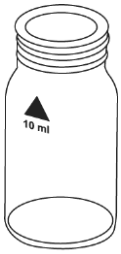
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- The photometric determination of Total Suspended Solids is based on a gravimetric method. In a lab, this is usually done by evaporation of the filter residue of a filtered water sample in an over at 103°C to 105°C and weighing of the dried residue.
- When higher accuracy is required, perform a gravimetric determination of a water sample. The result can be used to calibrate the colorimeter with the same water sample.
- The estimated detection limit is 20 mg/L TSS.
- Collect water samples in clean plastic or glass bottles and analyze the water sample as soon as possible. It is possible to store the sample at 4°C for up to 7 days. Before measurement, warm up the sample to the temperature at collection time.
- Interferences:
    - Air bubbles interfere and can be removed by swirling the vial gently.
    - Color interferes if light is absorbed at 660 nm.

Method 388

Triazole, Benzotriazole / Tolyltriazole with Powder Pack Reagent

Refer to Reagent Manufacturer Instructions for Specific Procedure

Range: 1 to 16 mg/l $C_6H_5N_3$ / 1.1 to 17.8 mg/l $C_7H_7N_3$



1. Access the methods list, press [Shift] + [3] [8] [8] keys and press [↵] key.
2. Transfer **25 ml of water sample** into the digestion vial.
3. Add the contents of **one Triazole Rgt. F25 powder pack** straight from the foil into the digestion vial.
4. Tightly secure the digestion vial cap and swirl until the reagent is completely dissolved.
5. **Caution: Wear UV safety goggles!** Insert the UV lamp into the digestion vial. Note that while the UV lamp is on UV safety goggles must be worn. For handling of the UV lamp, see manufacturer instructions. Do not touch the surface of the UV lamp. Fingerprints will etch the glass. Wipe the UV lamp with a soft and clean tissue between measurements.
6. Switch the UV lamp on. Press [↵] key.
    a. A countdown for the **reaction period of 5 minutes** will be displayed.
7. After the reaction period is done, switch the UV lamp off and remove the lamp from the vial. Note that a yellow color will form if triazole is present. Low results will occur if photolysis (UV lamp on) takes place for more than or less than five minutes.
8. Tightly secure the vial cap and invert several times to mix the contents.
9. Fill a clean 24 mm round vial with **10 ml of deionized water** and tightly secure the vial cap.
10. Place the vial in the sample chamber, making sure that the Δ marks are aligned.
11. Press [**Zero**] key and wait for the zero to be accepted.
12. Remove the vial from the sample chamber and empty the vial.
13. Add the **prepared digested water sample to the 10 ml mark** of the same vial and tightly secure the vial cap.
14. Place the vial in the sample chamber, making sure that the Δ marks are aligned.
15. Press [**Test**] key and wait for the measurement to be taken.
16. The result will be shown as mg/l benzotriazole or tolyltriazole.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This method is adapted from one originated by an alternative reagent manufacturer. Always review original instructions and Safety Data Sheet (SDS) before starting the test.
- While the UV lamp is on UV safety goggles must be worn.
- For handling of the UV lamp, see manufacturer's instructions. Do not touch the surface of the UV lamp. Fingerprints will etch the glass. Wipe the UV lamp with a soft and clean tissue between measurements.
- The test will not distinguish between benzotriazole and tolyltriazole.
- The analysis should take place immediately after taking the sample.

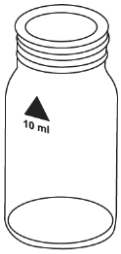
- Strong oxidizing or reducing agents in the vial will lead to incorrect measurements.
- To obtain accurate results, the sample temperature must be between 20°C and 25°C.
- If the sample contains nitrite or borax (sodium borate), adjust the pH between 4 and 6 with 1 N sulfuric acid.
- If the sample contains more than 500 mg/l $CaCO_3$ hardness, add 10 drops of Rochelle Salt Solution.
- Low results will occur if photolysis (lamp on) takes place for more than or less than five minutes.

Turbidity

Attenuated Radiation Method (Direct Reading)

Range: 0 to 1000 FAU

Method 386



1. Access the methods list, press [Shift] + [3] [8] [6] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of deionized water** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber and empty it completely.
6. Stir the water sample. Immediately rinse the vial with the water sample and then fill the vial with **10 ml of the water sample.**
7. Tightly secure the vial cap and gently swirl several times.
8. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
9. Press [**Test**] key and wait for the measurement to be taken.
10. The result will be shown as FAU (Formazin Attenuation Units).

Notes:

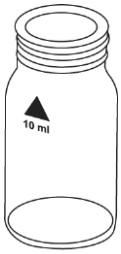
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This test uses an attenuated radiation method for the reading of FAU (Formazin Attenuation Units). The results cannot be used for US-EPA reporting purposes, but may be used for routine measurements. The attenuated radiation method is different from the Nephelometric method.
- The estimated detection limit is 20 FAU.
- Collect water samples in clean plastic or glass bottles and analyze 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 the temperature at collection time. Temperature differences between measurement and sample collection can affect the turbidity of the sample.
- Color interferes if light is absorbed at 530 nm. For strong colored water samples, a filtrated portion of the sample can be used for zeroing instead of the deionized water.
- Air bubbles interfere and can be removed using an ultrasonic bath.

Urea with Tablet & Liquid Reagents

Refer to Reagent Manufacturer Instructions for Specific Procedure

Range: 0.1 to 2.5 mg/l Urea

Method 390



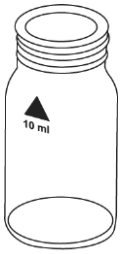
1. Access the methods list, press [Shift] + [3] [9] [0] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. In the presence of free chlorine (HOCl), add **one Urea Pretreat tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
7. Tightly secure the vial cap and swirl several times to mix the contents.
8. Add **2 drops Urea Reagent 1 solution** into the same vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
9. Tightly secure the vial cap and swirl several times to mix the contents.
10. Add **1 drop Urea Reagent 2 solution** into the same vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
11. Tightly secure the vial cap and swirl several times to mix the contents.
12. Press [↵] key.
    a. A countdown for the **reaction period of 5 minutes** will be displayed.
13. After the reaction period is done, add **one ammonia No. 1 tablet** straight from the foil into the same vial, crush the tablet using a clean stir rod and mix to dissolve the tablet.
14. Add **one ammonia No. 2 tablet** straight from the foil into the same vial, crush the tablet using a clean stir rod and mix to dissolve the tablet.
15. Tightly secure the vial cap and swirl several times until the tablets are dissolved.
16. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
17. Press [**Test**] key and wait for the measurement to be taken.
    a. A countdown for the **reaction period of 10 minutes** will be displayed.
    b. Keep the sample in the dark during the color development time.
18. The result will be shown as mg/l urea.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This method is adapted from one originated by an alternative reagent manufacturer. Always review original instructions and Safety Data Sheet (SDS) before starting the test.
- The sample temperature should be between 20 °C and 30 °C.
- Perform the test at least one hour after collecting the sample.
- Concentrations above 2 mg/l urea can produce results inside the measuring range. In this case, the water sample should be diluted with urea-free water and re-measured.

- The tablets must be added in the correct sequence.
- The Ammonia No. 1 tablet will only dissolve completely after the Ammonia No. 2 tablet has been added.
- **Do not store Reagent 1 (Urease) below 10°C; granulation is possible. Store Reagent 2 (Urease) in the refrigerator at a temperature of 4°C to 8°C.**
- Ammonia and chloramines are also measured during urea measurement.
- Before analyzing seawater samples, a measuring spoon of Ammonia Conditioning Powder must be added to the sample and swirled to dissolve before the Ammonia No. 1 tablet is added.
- One Urea Pretreat tablet compensates for the interference of free chlorine up to 2 mg/l (two tablets up to 4 mg/l, three tablets up to 6 mg/l).

Method 400



Zinc with Tablet Reagent, AC2065

AQUAfast AC2065 Zinc Tablets

Range: 0.02 to 1 mg/l Zn

1. Access the methods list, press [Shift] + [4] [0] [0] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample.**
3. Add **one Copper / Zinc LR tablet** straight from the foil into the vial and crush the tablet using a clean stir rod.
4. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
5. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
6. Press [**Zero**] key and wait for the zero to be accepted.
    a. A countdown for the **reaction period of 5 minutes** will be displayed.
7. After the reaction period in done, remove the vial from the sample chamber.
8. Add **one EDTA tablet** straight from the foil into the same vial and crush the tablet using a clean stir rod.
9. Tightly secure the vial cap and swirl several times until the tablet is dissolved.
10. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
11. Press [**Test**] key and wait for the measurement to be taken.
12. The result will be shown as mg/l zinc.

Notes:

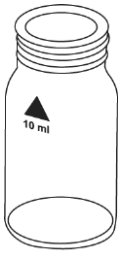
- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- The tablets must be added in the correct sequence.
- In the case of high levels of residual chlorine, perform the analysis with a dechlorinated water sample.

Method 405

Zinc with Powder & Liquid Reagents

Refer to Reagent Manufacturer Instructions for Specific Procedure

Range: 0.1 to 2.5 mg/l Zn



1. Access the methods list, press [Shift] + [4] [0] [5] keys and press [↵] key.
2. Fill a clean 24 mm round vial with **10 ml of water sample** and tightly secure the vial cap.
3. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
4. Press [**Zero**] key and wait for the zero to be accepted.
5. Remove the vial from the sample chamber.
6. Add **20 drops KS243 (Zinc Reagent 1) solution** into the vial. Ensure drops are the same size by holding the bottle vertically and squeezing slowly.
7. Tightly secure the vial cap and gently swirl several times to mix the contents.
8. Add **one level spoon of KP244 (Zinc Reagent 2) powder** into the same vial. Note that for the correct dosage, the spoon supplied with the reagent must be used.
9. Tightly secure the vial cap and swirl several times to dissolve the powder.
10. Place the vial in the sample chamber, making sure that the Δ marks are aligned.
11. Press [**Test**] key and wait for the measurement to be taken.
12. The result will be shown as mg/l zinc.

Notes:

- Review information in the Recommendations for Avoiding Measurement Errors section. Always wipe the exterior of the vial with a lint-free tissue to remove fingerprints or water droplets before inserting the vial into the sample chamber.
- This method is adapted from one originated by an alternative reagent manufacturer. Always review original instructions and Safety Data Sheet (SDS) before starting the test.
- For correct dosage the spoon supplied with the reagents must be used.
- This test is suitable for determining free soluble zinc. Zinc bound with strong complexing agents will not be measured.
- Cationics such as quaternary ammonium compounds will cause the color to change from rose red to purple, depending upon the level of copper present. In this event, add drops of KS89 (cationic suppressor) one at a time, mixing between additions until the orange/blue color is obtained.

5

CHAPTER 5

Absorbance, Calibration and Special Functions

Absorbance Measurements

AQUAfast Verification Standard Kit, AC3VSK

Use the absorbance tests with the Thermo Scientific Orion AQUAfast verification standard kit (catalog number AC3VSK) to verify the accuracy of the colorimeter's wavelength dependent absorbance measurements. The measurement range is -2600 mAbs to +2600 mAbs.

Method Number	Test Method
900	mAbs 430 nm
910	mAbs 530 nm
920	mAbs 560 nm
930	mAbs 580 nm
940	mAbs 610 nm
950	mAbs 660 nm

1. Select the desired wavelength from the method list or by entering the corresponding method number directly. For example: access the methods list, press [Shift] + [9] [0] [0] keys and press [↵] key. The display will show:

900 mAbs 430 nm
-2600 – 2600 mAbs

Prepare Zero
Press ZERO

2. Perform the zero procedure using the zero standard included in the verification standard kit. Always perform zero procedure using a filled vial (for example with deionized water).
    a. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
    b. Press [Zero] key.
3. The display will show:

```
900 mAbs          430 nm
-2600 – 2600 mAbs

Zero accepted
Prepare Test
Press TEST
```

4. Perform the test procedure using the corresponding standard included in the verification standard kit.
    a. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
    b. Press [Test] key.
5. The display will show:

```
900 mAbs          430 nm
-2600 – 2600 mAbs
    1324 mAbs
```

6. Refer to the verification standard kit for expected test values and tolerances.

Tip: To ensure complete reaction times, the user countdown may be helpful.

Calibration Functions

Calcium Hardness Method 191 – Calibration of Method Blank

1. Press [Mode] key.
2. Press [Shift] + [4] [0] keys.
3. Confirm with [↵] key. The display will show:

```
<Calibration>
1:  M191 Ca-Hardness 2
2:  M191 Reset 0 Cali.
3: M170 Fluoride L
```

4. Press [Shift] + [1] keys. The display will show:

```
<Calibration>
191 Ca-Hardness 2 T
Prepare Zero
Press ZERO
```

5. Fill a clean 24 mm round vial with exactly **10 ml of deionized water** and tightly secure the vial cap.
6. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
7. Press [**Zero**] key and wait for the zero to be accepted.
8. Remove the vial from the sample chamber and empty the vial.
9. Pipette 100 ml of calcium-free water into an appropriate beaker. Note that deionized or tap water can be used. If no calcium-free water is available, the calcium ions can be masked using EDTA. Preparation: Add 50 mg EDTA to 100 ml water and dissolve.
10. Add **10 Calcio H No. 1 tablets** straight from the foil into the 100 ml calcium-free water, crush the tablets using a clean stir rod and dissolve the tablets completely.
11. Add **10 Calcio H No. 2 tablets** straight from the foil into the same water, crush the tablets using a clean stir rod and dissolve the tablets completely.
12. Press [↵] key.
    a. A countdown for the **reaction period of 2 minutes** will be displayed.
13. After the reaction period is done, rinse the 24 mm round vial with the prepared, colored water from the beaker and then fill the vial with 10 ml of the prepared, colored water.
14. Tightly secure the vial cap.
15. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
16. Press [**Test**] key and wait for the measurement to be taken.
17. The batch-related method blank will be saved.
18. Press [↵] key to return to the mode menu.

Notes:

- If a new batch of tablets is used, a calibration of the method blank must be performed to optimize the results.
- To achieve the most accurate method blank, it is important to adhere exactly to the sample volume of 100 ml.

Calcium Hardness Method 191 – Reset Method Blank to Factory Calibration

1. Press [Mode] key.
2. Press [Shift] + [4] [0] keys.
3. Confirm with [↵] key. The display will show:

```
<Calibration>
1:  M191 Ca-Hardness 2
2:  M191 Reset 0 Cali.
3: M170 Fluoride L
```

4. Press [Shift] + [2] keys. The display will show:

```
<Calibration>
191 Ca-Hardness 2 T
Reset ?
Yes: 1 , No:0
```

5. Press [Shift] + [0] key to retain the method blank or press [Shift] + [1] key to erase the method blank and set the value back to the factory calibration setting.
6. The colorimeter will return to the mode menu automatically.

Fluoride Method 170 – Calibration

1. Press [Mode] key.
2. Press [Shift] + [4] [0] keys.
3. Confirm with [↵] key. The display will show:

```
<Calibration>
1:  M191 Ca-Hardness 2
2:  M191 Reset 0 Cali.
3: M170 Fluoride L
```

4. Press [Shift] + [3] key. The display will show:

```
<Calibration>
170 Fluoride L
Zero: Deionized water
Press ZERO
```

5. Fill a clean 24 mm round vial with exactly **10 ml of deionized water** and tightly secure the vial cap.
6. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
7. Press [**Zero**] key and wait for the zero to be accepted.
8. Remove the vial from the sample chamber.
9. Add **exactly 2 ml SPADNS Reagent solution** into the vial. **Caution: Vial will be filled up to the top!**
10. Tightly secure the vial cap and gently swirl several times to mix the contents.
11. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
12. Press [**Test**] key and wait for the measurement to be taken.
13. Remove the vial from the sample chamber, empty the vial, rinse the vial and cap several times and then fill the vial with exactly 10 ml fluoride standard (concentration 1 mg/l F).
14. Add **exactly 2 ml SPADNS Reagent solution** into the vial. **Caution: Vial will be filled up to the top!**
15. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
16. Press [**Test**] key and wait for the measurement to be taken.
17. The display will show that the calibration has been accepted. Confirm with [↵] key.
    a. If an error message is given, repeat the procedure.
18. Press [Esc] key to return to the mode menu.

Note:

- The same batch of SPADNS reagent solution must be used for the adjustment and test procedure. The adjustment process needs to be performed for each new batch of SPADNS reagent solution (see Standard Methods 20th, 1998, APHA, AWWA, WEF 4500 F D, S.4-82).
- As the test result is highly dependent on exact sample and reagent volumes, the sample and reagent volumes should always be metered by using a 10 ml volumetric pipette (class A) and 2 ml volumetric pipette (class A).

User Calibration Function

The user calibration function can be performed each time a new batch of reagents are used to account for variations in batch-to-batch reagent composition and other factors that affect the accuracy of a method with a fixed factor or equation. If a user calibration is performed on a test method, the test method name will be highlighted on the display as inverse (white) text.

General Procedure

1. Prepare a standard of known concentration and use this standard instead of the sample according to the test procedure.
2. It is recommend to use a well known standard that is formulated according to DIN EN, ASTM or other international norms or to use a certified standard that is commercially available.
3. After measuring the standard solution, update the displayed results to match the required standard concentration value.
4. If a method uses a mathematic equation for the calculation of the result, it is only possible to calibrate the basic test, since additional tests use the same polynomial. The same applies for some test procedures that use a polynomial from another test procedure.

Storing a User Calibration

1. Perform the required method as described in the reagent instructions using a standard of known concentration instead of the water sample.
2. At the end of the test procedure, when the test result is displayed, press [Mode], [Shift] + [4] [5] keys and confirm with [↵] key.
3. For example, the display will show:

```
<User Calibration>
100 Chlorine T
0.02-6 mg/l Cl2
0.90 mg/l free Cl2
Up: ↑,  Down: ↓
```

4. Press up arrow key [▲] to increase the displayed result or press down arrow key [▼] to decrease the displayed result. Repeat until the displayed result matches the concentration value of the standard.
5. Confirm with [↵] key to store the new calibration factor.
6. For example, the display will show:

```
100 Chlorine T
0.02-6 mg/l Cl2
0.90 mg/l free Cl2
```

7. The test method name will be highlighted on the display as inverse (white) text and the test result will be calculated with the new calibration factor.

Note: Fluoride Method 170 cannot be calibrated with using Mode 45, since the test requires a calibration related to the batch of the liquid reagent (SPADNS).

Note: To return to the default factory calibration, delete the user calibration and the factory calibration will be automatically activated.

Recommended Concentration Range for User Calibrations:

Test #	Method	Recommended Range For User Calibration
20	Acid Demand	1-3 mmol/l
35	Alkalinity-P	100-300 mg/l $CaCO_3$
30	Alkalinity-M (Total)	50-150 mg/l $CaCO_3$
31	Alkalinity-M (Total) HR	50-300 mg/l $CaCO_3$
40	Aluminum	0.1-0.2 mg/l Al
50	Aluminum	0.1-0.2 mg/l Al
60	Ammonia	0.3-0.5 mg/l N
62	Ammonia	0.3-0.5 mg/l N
65	Ammonia LR	1 mg/l N
66	Ammonia HR	20 mg/l N
85	Boron	1 mg/l B
80	Bromine	Calibration with basic Test # 100 Chlorine, Free
81	Bromine	Calibration with basic Test # 110 Chlorine, Free
63	Chloramine (Mono)	3-4 mg/l Cl_2
90	Chloride	10-20 mg/l Cl-
92	Chloride	10-15 mg/l Cl-
100	Chlorine, Free & Total	0.5-1.5 mg/l Cl_2
101	Chlorine, Free & Total	Calibration with basic Test # 100 Chlorine, Free
110	Chlorine, Free & Total	0.5-1 mg/l Cl_2
103	Chlorine, Free & Total, HR	0.5-6 mg/l Cl_2
111	Chlorine, Free & Total, HR	4-5 mg/l Cl_2
105	Chlorine, Total, HR (KI)	70-150 mg/l Cl_2
120	Chlorine Dioxide	Calibration with basic Test # 100 Chlorine, Free
122	Chlorine Dioxide	Calibration with basic Test # 110 Chlorine, Free
125	Chromium	1 mg/l Cr
130	COD LR	100 mg/l O_2
131	COD MR	500 mg/l O_2
132	COD HR	5 g/l O_2 = 5000 mg/l O_2
204	Color Pt-Co	Operating range
150	Copper, Free & Total	0.5-1.5 mg/l Cu
151	Copper, Free & Total	2-3 mg/l Cu
153	Copper, Free	0.5-1.5 mg/l Cu
160	Cyanuric Acid (CyA)	30-60 mg/l CyA

Test #	Method	Recommended Range For User Calibration
157	Cyanide	0.1-0.3 mg/l CN
165	DEHA	200-400 µg/l DEHA
167	DEHA	200 µg/l DEHA
170	Fluoride	Calibration with 0 and 1 mg/l F through Mode 40
210	Hydrogen Peroxide	Calibration with basic Test # 100 Chlorine, Free
213	Hydrogen Peroxide LR	20-30 mg/l H_2O_2
214	Hydrogen Peroxide HR	200-300 mg/l H_2O_2
190	Hardness, Calcium	100-200 mg/l $CaCO_3$
191	Hardness, Calcium, LR	100-200 mg/l $CaCO_3$
200	Hardness, Total	15-25 mg/l $CaCO_3$
201	Hardness, Total, HR	Calibration with basic Test # 200 Hardness, Total
205	Hydrazine	0.2-0.4 mg/l N_2H_4
206	Hydrazine	0.2-0.4 mg/l N_2H_4
207	Hydrazine	0.2-0.4 mg/l N_2H_4
215	Iodine	Calibration with basic Test # 100 Chlorine, Free
220	Iron (II & III)	0.3-0.7 mg/l Fe
222	Iron	0.1-2 mg/l Fe
223	Iron (TPTZ)	0.3-0.7 mg/l Fe
225	Iron LR	0.5-1.5 mg/l Fe
226	Iron LR 2	1-15 mg/l Fe
227	Iron HR	6-8 mg/l Fe
240	Manganese	1-2 mg/l Mn
242	Manganese LR	0.1-0.4 mg/l Mn
243	Manganese HR	4-6 mg/l Mn
245	Manganese	2-3 mg/l Mn
250	Molybdate	5-15 mg/l Mo
251	Molybdate LR	1.5-2.5 mg/l Mo
252	Molybdate HR	10-30 mg/l Mo
254	Molybdate HR	50-70 mg/l Mo
257	Nickel	6-8 mg/l Ni
260	Nitrate	0.5-0.7 mg/l N
265	Nitrate	10 mg/l N
270	Nitrite	0.2-0.3 mg/l N
272	Nitrite	0.1-0.2 mg/l N
280	Nitrogen, Total, LR	10 mg/l N
281	Nitrogen, Total, HR	50-100 mg/l N
290	Oxygen, Active	Calibration with basic Test # 100 Chlorine, Free
292	Oxygen, Dissolved	Possible against meter for dissolved oxygen

Test #	Method	Recommended Range For User Calibration
300	Ozone (DPD)	Calibration with basic Test # 100 Chlorine, Free
70	PHMB	15-30 mg/l
320	Phosphate, Ortho, LR	1-3 mg/l PO_4
321	Phosphate, Ortho, HR	30-50 mg/l PO_4
323	Phosphate, Ortho	0.1-2 mg/l PO_4
324	Phosphate, Ortho	3 mg/l PO_4
325	Phosphate, Hydrolysable	0.3-6 mg/l P
326	Phosphate, Total	0.3-0.6 mg/L P
327	Phosphate, Ortho 1	20-30 mg/l PO_4
328	Phosphate, Ortho 2	1-3 mg/l PO_4
334	Phosphate LR	5-7 mg/l PO_4
335	Phosphate HR	30-50 mg/l PO_4
316	Phosphonate	1-2 mg/l PO_4
329	pH-Value LR	6.0-6.6 pH
330	pH-Value	7.6-8.0 pH
331	pH-Value	7.6-8.0 pH
332	pH-Value HR	8.6-9.0 pH
338	Polyacrylate	15-20 mg/l polyacrylic acid 2’100 sodium salt
340	Potassium	3 mg/l K
350	Silica	0.5-1.5 mg/l SiO_2
351	Silica LR	1 mg/l SiO_2
352	Silica HR	50 mg/l SiO_2
353	Silica LR	4-6 mg/l SiO_2
212	Sodium Hypochlorite	8 %
355	Sulfate	50 mg/l SO_4
360	Sulfate	50 mg/l SO_4
365	Sulfide	0.2-0.4 mg/l S
370	Sulfite	3-4 mg/l SO_3
384	Suspended Solids	Operating range
388	Triazole	6 mg/l benzotriazole
386	Turbidity	Operating range
390	Urea	1-2 mg/l CH_4N_2O
400	Zinc	0.2-0.4 mg/l Zn
405	Zinc	1-1.5 mg/l Zn

Deleting a User Calibration

To return to the default factory calibration, delete the user calibration and the factory calibration will be automatically activated.

1. Access the methods list and enter the required method number, for example press [Shift] + [1] [0] [0] keys and press [↵] key.
2. Instead of performing the test procedure, press [Mode], [Shift] + [4] [6] keys and confirm with [↵] key.
3. For example, the display will show:

```
<User Calibration>
100 Chlorine T
0.02-6 mg/l Cl2
Clear user
Calibration?
Yes: 1,   No: 0
```

4. Press [Shift] + [1] keys to delete user calibration or press [Shift] + [0] keys to keep the existing user calibration.
5. The colorimeter will return to the zero procedure step of the selected method automatically.

User Concentration Methods

It is possible to enter and store up to 10 user concentration methods.

Needed are 2 to 14 standards of known concentration and one blank (deionized water or reagent blank value). The standards should be measured with increasing concentrations and from the brightest to the darkest coloration.

The measuring range for “Underrange” is defined as -2600 mAbs and “Overrange” is defined as +2600 mAbs with 1000 mAbs = 1 Abs = 1 E (displayed). After selection of a method, the concentration of the lowest and highest used standard is displayed as measuring range. The operation range should be within this range to achieve best results.

Entering a User Concentration

1. Press [Mode] key.
2. Press [Shift] + [6] [4] keys.
3. Confirm with [↵] key. The display will show:

```
<User Concentration>

Choose no.: _ _ _
(850-859)
```

4. Enter a method number in the range of 850 to 859, for example press [Shift] + [8] [5] [0] keys to enter method number 850.
5. Confirm with [↵] key.
    a. If the entered method number has already been used to save a concentration method, the display will prompt to overwrite the concentration method. Press [Shift] + [0] keys to return to the method number entry screen or press [Shift] + [1] keys to overwrite the existing concentration method.
6. The display will show:

```
< User Concentration >
Choose wavelength
    1: 530 nm     4: 430 nm
    2: 560 nm     5: 580 nm
    3: 610 nm     6: 660 nm
```

7. Select the required wavelength, for example press [Shift] + [2] keys to select 560 nm as the wavelength.
8. The display will show:

```
< User Concentration >
Choose unit
>>
    mg/l
    g/l
    mmol/l
    mAbs
    µg/l
    E
```

A
%

9. Press arrow key [▼] or [▲] to select the required unit as mg/l, g/l, mmol/l, mAbs, µg/l, E, A, % or blank and press [↵] key to confirm.
10. The display will show:

< User Concentration >
Choose resolution
1: 1
2: 0.1
3: 0.01
4: 0.001

11. Select the required resolution, for example press [Shift] + [3] keys to select 0.01 resolution.
    a. Note that the desired measurement range will directly influence the selected maximum resolution.
        i. Range: 0.000 to 9.999, Maximum Resolution: 0.001
        ii. Range: 10.00 to 99.99, Maximum Resolution: 0.01
        iii. Range: 100.0 to 999.9, Maximum Resolution: 0.1
        iv. Range: 1000 to 9999, Maximum Resolution: 1
12. Using deionized water or a reagent blank, prepare the zero in a clean round vial and tightly secure the vial cap.
13. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
14. Press [**Zero**] key and wait for the zero to be accepted.
15. Remove the vial from the sample chamber.
16. Enter the concentration value of the first standard, for example press [Shift] + [0] keys, press [.] key and press [Shift] + [0] [5] keys to enter a concentration of 0.05.
    a. If needed, press [F1] key to reset the concentration value.
17. Confirm with [↵] key.
18. Using the first standard, prepare the sample in the vial and tightly secure the vial cap.
19. Place the vial into the sample chamber, making sure that the Δ marks are aligned.
20. Press [**Test**] key and wait for the sample value to be accepted.
21. Remove the vial from the sample chamber.
22. The display will show the entered concentration value and the corresponding measured absorption value. Confirm with [↵] key.
23. Repeat steps 18-22 for each additional standard, from 2 to 14 standards (S1 to S14).
24. Once all required standards have been measured, press [Store] key.
25. The concentration method will be stored in the colorimeter and can be recalled by entering the method number or selecting it from the displayed method list.

Note: Save all concentration data in a written form in case of loss of power to the colorimeter (e.g. dead batteries). If power loss exceeds 2 minutes, all stored data including the concentration data will be lost and must be entered again.

Entering a User Polynomial

It is possible to enter and store up to 25 user polynomials. The program allows the user to apply a polynomial up to the 5th degree: $\mathbf{y = A + Bx + Cx^2 + Dx^3 + Ex^4 + Fx^5}$

If a polynomial of a lower degree is necessary, the other coefficients are specified as zero (0), e.g.: for a second degree polynomial, D, E, F = 0.

The values of the coefficients A, B, C, D, E, F must be entered in an academic notation with maximal 6 decimal places, e.g.: 121,35673 = 1,213567E+02

1. Press [Mode] key.
2. Press [Shift] + [6] [5] keys.
3. Confirm with [↵] key. The display will show:

<User Polynomial>

Choose no.: _ _ _
(800-824)

4. Enter a method number in the range of 800 to 824, for example press [Shift] + [8] [0] [0] keys to enter method number 800.
5. Confirm with [↵] key.
    a. If the entered method number has already been used to save a polynomial, the display will prompt to overwrite the polynomial. Press [Shift] + [0] keys to return to the polynomial number entry screen or press [Shift] + [1] keys to overwrite the existing polynomial.
6. The display will show:

< User Polynomial>
Choose wavelength
1: 530 nm 4: 430 nm
2: 560 nm 5: 580 nm
3: 610 nm 6: 660 nm

7. Select the required wavelength, for example press [Shift] + [2] keys to select 560 nm as the wavelength.
8. Enter the value of coefficient A, including the decimal point, for example press [Shift] + [1] keys, press [.] key and press [Shift] + [3] [2] keys to enter a value of 1.32.
    a. Press arrow key [▼] or [▲] to set the value as positive or negative.
    b. If needed, press [F1] key to reset the value.
9. Confirm with [↵] key.
10. Enter the value of coefficient A, including the decimal point, for example press [Shift] + [1] keys, press [.] key and press [Shift] + [3] [2] keys to enter a value of 1.32.
11. Enter the exponent of coefficient A, for example press [Shift] + [3] keys to enter an exponent of E+03.
    a. Press arrow key [▼] or [▲] to set the value as positive or negative.
12. Confirm with [↵] key.

13. Repeat steps 8-12 for coefficients B, C, D E and F. If zero [0] is entered for the value of the coefficient, the exponent entry steps are omitted automatically. Make sure to confirm every entry with [↵] key.
14. Enter the minimum and maximum measurement range from -2600 mAbs to +2600 mAbs. For example, press arrow key [▼] and press [Shift] + [2] [6] [0] [0] keys to enter a minimum absorbance value of -2600, press [↵] key to confirm, press [Shift] + [2] [6] [0] [0] keys to enter a maximum absorbance value of +2600 and press [↵] key to confirm.
15. The display will show:

```
< User Polynomial>
Choose unit
>>
    mg/l
    g/l
    mmol/l
    mAbs
    µg/l
    E
    A
    %
```

16. Press arrow key [▼] or [▲] to select the required unit as mg/l, g/l, mmol/l, mAbs, µg/l, E, A, % or blank and press [↵] key to confirm.
17. The display will show:

```
< User Polynomial>
Choose resolution
1:  1
2:  0.1
3:  0.01
4:  0.001
```

18. Select the required resolution, for example press [Shift] + [3] keys to select 0.01 resolution.
    a. Note that the desired measurement range will directly influence the selected maximum resolution.
        i. Range: 0.000 to 9.999, Maximum Resolution: 0.001
        ii. Range: 10.00 to 99.99, Maximum Resolution: 0.01
        iii. Range: 100.0 to 999.9, Maximum Resolution: 0.1
        iv. Range: 1000 to 9999, Maximum Resolution: 1
19. The display will show “Stored!” and then automatically return to the mode menu.
20. The polynomial method will be stored in the colorimeter and can be recalled by entering the method number or selecting it from the displayed method list.

Note: Save all polynomial data in a written form in case of loss of power to the colorimeter (e.g. dead batteries). If power loss exceeds 2 minutes, all stored data including the polynomial data will be lost and must be entered again.

Delete User Methods (Polynomial or Concentration)

In principle, a valid user method can be overwritten. An existing user method (polynomial or concentration) can be completely deleted as well and will be removed out of the method selection list.

1. Press [Mode] key.
2. Press [Shift] + [6] [6] keys.
3. Confirm with [↵] key. The display will show:

```
<User M. Clear>
Choose no.: _ _ _
(800-824), (850-859)
```

4. Enter a method number in the range of 800 to 824 or 850 to 859, for example press [Shift] + [8] [0] [0] keys to enter method number 800.
5. Confirm with [↵] key.
6. Press [Shift] + [1] keys to delete the selected user method or press [Shift] + [0] keys to keep the selected user method.
7. The colorimeter will automatically return to the mode menu.

Print Data of User Methods (Polynomials & Concentration)

With Mode 67, all data (e.g. wavelength, unit, etc) of stored user polynomials and concentration methods can be printed or transferred with HyperTerminal to a computer.

1. Press [Mode] key.
2. Press [Shift] + [6] [7] keys.
3. Confirm with [↵] key. The display will show:

```
<User M. Print>
Start:    ↵
```

4. Press [↵] key to print the data of all stored user methods.
5. After transferring the data, the colorimeter will automatically return to the mode menu.

Initialize User Method System (Polynomials & Concentration)

Power loss will cause incoherent data. The user method system must be initialized with Mode 69 to set it to a predefined state.

Attention: All stored user methods (polynomial & concentration) are deleted with initialization.

1. Press [Mode] key.
2. Press [Shift] + [6] [9] keys.
3. Confirm with [↵] key. The display will show:

<User M. Init.>
Start: ↵

4. Confirm with [↵] key.
5. Press [Shift] + [1] keys to start the initialization or press [Shift] + [0] keys to cancel without performing the initialization.
6. The colorimeter will automatically return to the mode menu.

Special Functions

Langelier Saturation Index (Water Balance)

For calculation of Langelier Saturation Index, the following tests are required. Run each test separately and note the results. Set the temperature units and use mode 70 for calculation.

1. pH-value
2. Temperature
3. Calcium hardness
4. Total Alkalinity
5. TDS (Total Dissolved Solids)

Selection of Temperature Unit for Langelier Saturation Index

1. Press [Mode] key.
2. Press [Shift] + [7] [1] keys.
3. Confirm with [↵] key. The display will show:

```
<Temperature>
1: °C      2: °F
```

4. Press [Shift] + [1] keys to select degrees Celsius or press [Shift] + [2] keys to select degrees Fahrenheit.
5. The colorimeter will automatically return to the mode menu.

Calculating the Langelier Saturation Index

1. Press [Mode] key.
2. Press [Shift] + [7] [0] keys.
3. Confirm with [↵] key. The display will show:

```
<Langelier>
Temperature °C:
3°C <= T <= 53°C
+ _ _ _ _
```

4. Enter the temperature value (T) in the range of 3 to 53°C.
    a. If °F is selected, enter the temperature value in the range of 37 to 128 °F.
5. Confirm with [↵] key. The display will show:

```
<Langelier>
Calcium hardness
50 <= CH <= 1000
+ _ _ _ _
```

6. Enter the calcium harness value in the range of 50 to 1000 mg/l $CaCO_3$.
7. Confirm with [↵] key. The display will show:

```
<Langelier>
Tot. Alkalinity
5 <= TA <= 800
+ _ _ _ _
```

8. Enter the total alkalinity (TA) value in the range of 5 to 800 mg/l $CaCO_3$.
9. Confirm with [↵] key. The display will show:

```
<Langelier>
Total Dissol. Solids
0 <= TDS <= 6000
+ _ _ _ _
```

10. Enter the total dissolved solids (TDS) value in the range of 0 to 6000 mg/l.
11. Confirm with [↵] key. The display will show:

```
<Langelier>
pH Value
0 <= pH <= 12
+ _ _ _ _
```

12. Enter the pH-value in the range of 0 to 12 pH and confirm with [↵] key.
13. The display will show the calculated Langelier Saturation Index
14. Press [↵] key to start a new calculation or press [Esc] key to return to the mode menu.

Operating Error: If values are outside of defined range, the colorimeter will show the entered value that is too high and/or the entered value that is too low. Confirm the display message with [↵] key and enter a new value within the defined range.

Data Transfer

To print data or transmit to computer, the optional IRIM (Infra-Red Interface Module) is required.

Data Printing

In addition to the IRIM module, the following printer is required to print data directly using the USB interface of the IRIM module: HP Deskjet 6940.

Data Transfer to a Computer

In addition to the IRIM module, a transfer program is required to transmit test results. Refer to the IRIM user manual for detailed information.

Internet Updates

To connect the colorimeter to the serial interface of a computer, the optional connection cable with integrated electronic system is required. It is possible to update new software applications and additional languages via the internet.

Note: To prevent loss of stored test results, record or print them out before performing an update. If the update procedure is interrupted (e.g. interruption of connection, low battery, etc), the colorimeter will not be able to function (no display). The colorimeter will only function again after completing the data transfer.

6

CHAPTER 6 Customer Services

Technical Support

For any questions or if you require assistance, contact our Technical Support Specialists:

- Email wai.techservbev@thermofisher.com
- Within the United States, call 1-800-225-1480
- Outside the United States, call +1-978-232-6000 or fax +1-978-232-6031

For additional product information, contact your local authorized dealer, Thermo Scientific Orion technical sales representative or contact us using the Water and Laboratory Products (WLP) information on the page back of this user manual.

Visit www.thermoscientific.com/water to view Thermo Scientific Orion products and download product literature, user manuals and manuals, software updates and additional application and technical resources.

For the most current warranty information, refer to the Thermo Scientific Orion warranty card included with the colorimeter and available online at www.thermoscientific.com/water.

Instrument Specifications

Display	Graphic display
Serial Interface	IR interface for data transfer; RJ45 connector for internet updates
Light Source	Light Emitting Diode (LED) – photo sensor – pair arrangement in a transparent measurement chamber
Wavelength Ranges	λ1 = 530 nm interference filter Δλ = 5 nm λ2 = 530 nm interference filter Δλ = 5 nm λ3 = 530 nm interference filter Δλ = 6 nm λ4 = 530 nm interference filter Δλ = 5 nm λ5 = 530 nm interference filter Δλ = 5 nm λ6 = 530 nm interference filter Δλ = 5 nm
Wavelength Accuracy	± 1 nm
Photometric Accuracy (with standard solutions)	2% full scale (Temperature 20°C to 25°C)
Photometric Resolution	0.005 A
Absorbance Measurement Range	-2600 to 2600 mAbs
Protection	Conforming to IP 68 (1 h, 0.1 m)
Operation	Acid and solvent resistant touch-sensitive keypad with integral beeper as acoustic indicator
Power Supply	4 batteries (Type AA/LR 6)
Average Battery Lifetime	Approximately 26 hours continuous use or 3500 tests
Automatic Shutoff	20 minutes after last function, 30 second acoustical signal before shutoff
Dimensions	Colorimeter: approximately 210 x 95 x 45 mm Case: approximately 395 x 295 x 106 mm
Weight	Colorimeter: approximately 450 g
Working Condition	5 to 40°C at maximum 30 – 90% relative humidity (without condensation)
Language Options	English, German, French, Spanish, Italian, Portuguese, Polish
Storage Capacity	1000 data sets

All specifications are subject to technical modification. To ensure maximum accuracy of test results, always use the reagent systems supplied by the instrument manufacturer.

Abbreviations

° C	Degree Celsius (Centigrade)
° F	Degree Fahrenheit, °F = (°C x 1.8) + 32
° dH	Degree German Hardness
° fH	Degree French Hardness
° eH	Degree English Hardness
° aH	Degree American Hardness
Abs	Absorption Unit (=^ Extinction E) 1000 mAbs = 1 Abs =^ 1 A =^ 1 E
µg/l	Microgram per Liter (= ppb)
mg/l	Milligram per Liter (= ppm)
g/l	Gram per Liter (= ppth)
KI	Potassium Iodide
K S 4.3	Acid Demand to pH 4.3, method similar to total alkalinity but converted into mmol/l units per German DIN 38409
TDS	Total Dissolved Solids
LR	Low Range
MR	Medium Range
HR	High Range
C	Ampoule Reagents
L	Liquid Reagent
P	Powder (Reagent)
PP	Powder Pack Reagent
T	Tablet Reagent
TT	Tube Test Reagent
DEHA	N,N-Diethylhydroxylamine
DPD	Diethyl-p-phenylendiamine
DTNB	Ellmans reagent
PAN	1-(2-Pyridylazo)-2-napthol
PDMAB	Paradimethylaminobenzaldehyde
PPST	3-(2-Pyridyl)-5,6-bis(4-phenylsulfonic acid)1,2,4-triazine
TPTZ	2,4,6-Tri-(2-Pyridyl)-1,3,5-triazine

Troubleshooting

Operating Messages in the Display

Display	Possible Causes	Suggested Resolutions
Overrange	Reading is exceeding the range Water sample is too cloudy Too much light on photo cell	Dilute sample or use other measuring range Filtrate water sample Check if seal on the cap, repeat measurement with seal on the cap of the vial
Underrange	Result is under the detection limit	Indicate result with lower x mg/l where x = low end of measuring range; if necessary use other analytical method
Storage system error use Mode 34	Main power fails or is not connected	Insert or change battery Delete data with Mode 34
	Battery warning: signals every 3 minutes	Capacity of the battery is too low Change the batteries
	Battery warning: signals every 12 seconds	
	Battery warning: signals and the instrument switches itself off	
Jus Overrange E4 Jus Underrange E4	The user calibration is out of the accepted range	Check the standard, reaction time and other possible faults. Repeat the user calibration.
Overrange E1 Underrange E1	The concentration of the standard is too high/too low, so that during user calibration the limit of the range was exceeded	Perform the test with a standard of higher/lower concentration
E40 user calibration not possible	If the display shows Overrange/ Underrange for a test result, a user calibration is not possible	Perform the test with a standard of higher/lower concentration
Zero not accepted	Light absorption is too great or too low	Verify the zero procedure, clean sample chamber and repeat zero procedure
???	The calculation of a value (e.g. combined chlorine) is not possible	Check that test procedure is correct, if not – repeat test
Example 1: **0.60 mg/l free Cl** **??? comb Cl** **0.59 mg/l total Cl**	Readings for free and total chlorine are different, but considering the tolerances of each reading they are the same	The combined chlorine value is most likely zero
Example 2: **Underrange** **??? comb Cl** **1.59 mg/l total Cl**	The reading for free chlorine is under the detection limit and the instrument is not able to calculate the combined chlorine	The combined chlorine is most likely the same as the total chlorine
Example 3: **0,60 mg/l free Cl** **??? comb Cl** **Overrange**	The reading for total chlorine is exceeding the range and instrument is not able to calculate the combined chlorine	The test should be repeated with a diluted sample
Error absorbance e.g.: T2 > T1	Fluoride calibration was not correct	Repeat calibration

General Issues

Issue	Possible Causes	Suggested Resolutions
Test result deviates from expected	Chemical species not as required	Press arrow keys to select the required chemical species
No differentiation: e.g. for the chlorine test there is no selection between differentiated, free or total	Profi-Mode is switched on	Switch Profi-Mode off with Mode 50
The pre-programmed countdown is not displayed	Countdown is not activated and/or the Profi-Mode is activated	Switch the countdown on with Mode 13 and/or switch the Profi-Mode off with Mode 50
It seems that a method is not available	Method is not activated in the user method list	Activate the required method in the user method list with Mode 60

Declaration of Conformity

Manufacturer: Thermo Fisher Scientific Inc
Address: Ayer Rajah Crescent
Blk 55 #04-16/24
Singapore 139949
Singapore

Hereby declares that the following products:

Thermo Scientific Orion AQUAfast AQ3700 Colorimeter

Conforms with the following directives and standards:

EMC

Emission:	EN61326:1997 + A1:1998 + A2:2001 + A3:2003 Devices for class B
Immunity:	EN 61326:1997 + A1:1998 + A2:2001 + A3:2003 Requirements according to table A1, industrial environment
Applicable Standards:	61000-4-3:1996 + A1:2002

This product conforms to the regulations of the directive 2004/108/EG of the European Parliament and the Council of 2004, December the 15th.

Cheow Kwang Chan
QA/Regulatory Manager

Place and Date of Issue:
16 October 2015
Singapore

Ordering Information

Cat. No.	Description
AQ3700	AQ3700 meter with 4 AA batteries, 24 mm vials, 16 mm vials, 16 mm vial adapter, 13 mm vial adapter, field case, user guide with test methods, tablet tampering stir rod and vial cleaning brush
AC3VSK	Verification standard kit for AQ3700 colorimeter, set of 6
AQ37IRIM	IRIM data transfer device for AQ3700 colorimeter
AC2V24	24 mm round vials, 12 pack
AC3SR24	Sealing rings for 24 mm vials, 12 pack
AC2V16	16 mm round vials, 10 pack
AC3CBR	Vial cleaning brush, 5 pack
COD165	Thermoreactor for digestion methods, 100 / 120 / 150 / 160 / 165°C temperature control
CODS01	1000 ppm COD standard, 475 mL
CODS10	10000 ppm COD standard, 475 mL
AC2002	Alkalinity-M, acid / indicator method, tablet reagent, 100 tests
AC3002P	Alkalinity-P, acid / indicator method, tablet reagent, 100 tests
AC2027	Aluminum, eriochrome cyanine R method, tablet reagent, 50 tests
AC4P27	Aluminum, eriochrome cyanine R method, powder reagent, 100 tests
AC2012	Ammonia as nitrogen, indophenol blue method, tablet reagent, 50 tests
AC4P12	Ammonia as nitrogen, salicylate method, powder reagent, 100 tests
ACR011	Ammonia as nitrogen, high range, salicylate method, 50 reaction tubes
ACR012	Ammonia as nitrogen, low range, salicylate method, 50 reaction tubes
AC3089	Boron, azomethine method, tablet reagent, 100 tests
AC2035	Bromine, DPD method, tablet reagent, 100 tests
AC2017	Chloride, silver nitrate / turbidity method, tablet reagent, 50 tests
AC2070	Chlorine, free & total, DPD method, tablet reagent, 50 tests each
AC2071	Chlorine, free, DPD method, tablet reagent, 100 tests
AC2072	Chlorine, total, DPD method, tablet reagent, 100 tests
AC3072	Chlorine, total, high range, KI / acid method, tablet reagent, 100 tests
AC4P71	Chlorine, free, DPD method, powder reagent, 100 tests
AC4P72	Chlorine, total, DPD method, powder reagent, 100 tests
AC2099	Chlorine dioxide, DPD method, tablet reagent, 100 tests
CODL00	COD, low range, dichromate reactor digestion method, 25 digestion tubes
CODH00	COD, mid range, dichromate reactor digestion method, 25 digestion tubes
CODHP0	COD, high range, dichromate reactor digestion method, 25 digestion tubes
AC2029	Copper, free & total, biquinoline method, tablet reagent, 50 tests

Cat. No.	Description
AC4P29	Copper, free, bicinchoninate method, powder reagent, 100 tests
AC4P06	Cyanide, pyridinebarbituric acid method, powder & liquid reagent, 100 tests
AC2098	Cyanuric acid, melamine method, tablet reagent, 100 tests
AC3088	DEHA, PPST method, tablet & liquid reagents, 100 tests
AC4P88	DEHA, PPST method, powder & liquid reagents, 100 tests
AC2009	Fluoride, SPADNS method, liquid reagent, 50 tests
AC3032C	Hardness, calcium, high range, murexide method, tablet reagent, 100 tests
AC3032C2	Hardness, calcium, low range, murexide method, tablet reagent, 100 tests
AC3032T	Hardness, total, metallphthalein method, tablet reagent, 100 tests
AC3030LQ	Hydrazine, 4-(dimethyl-amino)-benzaldehyde method, liquid reagent, 50 tests
AC2030	Hydrazine, 4-(dimethyl-amino)-benzaldehyde method, powder reagent, 30 tests
AC3069	Hydrogen peroxide, DPD/catalyst method, tablet reagent, 100 tests
AC2078	Iron, II & III, PPST method, tablet reagent, 100 tests
AC4P78	Iron, ferro, 1,10-phenanthroline method, powder reagent, 100 tests
AC4P79	Iron, total, TPTZ method, powder reagent, 100 tests
AC2055	Manganese, formaldoxime method, tablet reagent, 50 tests
AC4P54	Manganese, low range, PAN method, powder reagent, 100 tests
AC4P55	Manganese, high range, periodate oxidation method, powder reagent, 100 tests
AC4P42	Molybdate / molybdenum, mercaptoacetic acid method, powder reagent, 100 tests
ACR007	Nitrate as nitrogen, chromotropic acid method, 50 reaction tubes
AC2046	Nitrite as nitrogen, n-(1-naphthyl)-ethylenediamine method, tablet reagent, 100 tests
AC4P46	Nitrite as nitrogen, low range, diazotization (azo) method, powder reagent, 100 tests
ACD004	Nitrogen, total, low range, persulfate digestion method, 50 digestion tubes
ACD007	Nitrogen, total, high range, persulfate digestion method, 50 digestion tubes
AC3048	Ozone, DPD / glycine method, tablet reagent, 100 tests
AC2001	pH, phenol red method, tablet reagent, 100 tests
AC3001	pH, phenol red method, liquid reagent, 30 tests
AC3001BP	pH, bromocresol purple method, tablet reagent, 100 tests
AC3001TB	pH, thymol blue method, tablet reagent, 100 tests
AC2095-WA	Phosphate, ortho, low range, phosphomolybdic acid / ascorbic acid, tablet reagent, 50 tests
AC2096	Phosphate, ortho, high range, vanadomolybdate method, tablet reagent, 50 tests
AC4P95	Phosphate, ortho, phosphomolybdenum / ascorbic acid method, powder reagent, 100 tests
ACD095	Phosphate as P, total, persulfate digestion / ascorbic acid method, 50 digestion tubes
ACD095AH	Phosphate as P, 211ydrolysable, phosphomolybdenum / ascorbic acid, 50 digestion tubes
ACR095	Phosphate, ortho, phosphomolybdenum / ascorbic acid method, 50 reaction tubes

Cat. No.	Description
AC3019	Potassium, tetraphenylborate-turbidity method, tablet reagent, 100 tests
AC2060	Silica, silicomolybdate method, tablet reagent, 50 tests
AC2061	Silica, phosphate removal reagent, 100 tablets
AC4P60	Silica, high range, silicomolybdate method, powder reagent, 100 tests
AC3072	Sodium hypochlorite, potassium iodide method, tablet reagent, 100 tests
AC2082	Sulfate, barium sulfate-turbidity method, tablet reagent, 100 tests
AC4P82	Sulfate, barium sulfate-turbidity method, powder reagent, 100 tests
AC2016	Sulfide, DPD / catalyst method, tablet reagent, 50 tests
AC2065	Zinc, zincon method, tablet reagent, 50 tests

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