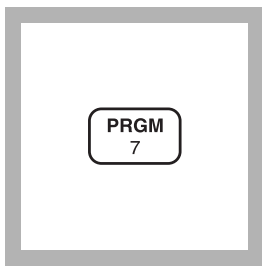


DPD Method Powder Pillows

USEPA accepted for reporting water and wastewater analyses*

Note: This product has not been evaluated to test for chlorine and chloramines in medical applications in the United States.

Using Powder Pillows



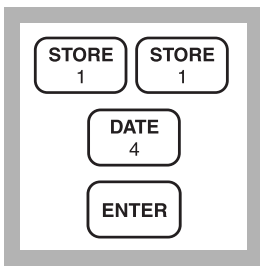
1. Enter the stored program number for total chlorine (Cl₂) powder pillows.

Press: **PRGM**

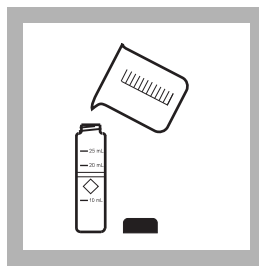
The display will show:

PRGM ?

Note: For most accurate results, perform a Reagent Blank Correction using deionized water.

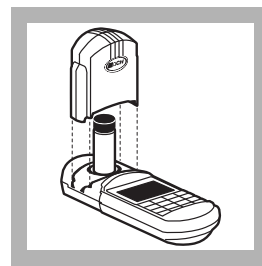


2. Press: **114 ENTER**
The display will show **mg/L, Cl₂** and the **ZERO** icon.



3. Fill a sample cell with 10 mL of sample (the blank).

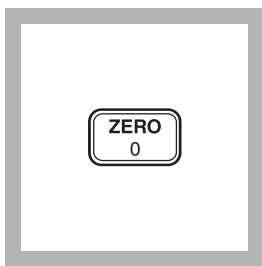
Note: Samples must be analyzed immediately and cannot be preserved for later analysis.



4. Place the blank into the cell holder. Tightly cover the sample cell with the instrument cap.

* Procedure is equivalent to USEPA method 330.5 for wastewater and Standard Method 4500-Cl G for drinking water.

CHLORINE, TOTAL, continued

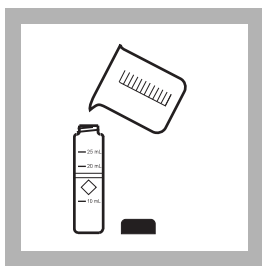


5. Press: ZERO

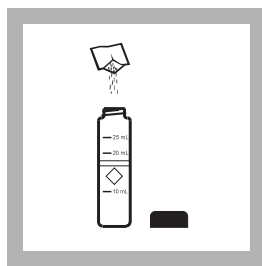
The cursor will move to the right, then the display will show:

0.00 mg/L Cl₂

Note: If Reagent Blank Correction is on, the display may flash "limit".

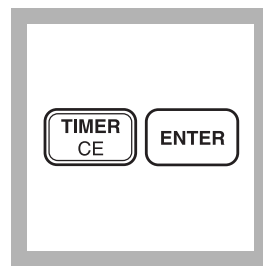


6. Fill a second cell to the 10-mL mark with sample.



7. Add the contents of one DPD Total Chlorine Powder Pillow for 25-mL samples to the sample cell (the prepared sample). Cap and swirl the sample cell vigorously to dissolve the powder.

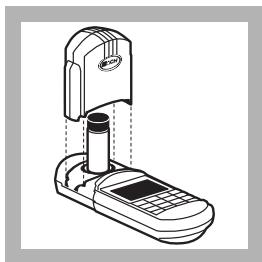
Note: It is not necessary that all the powder dissolves.



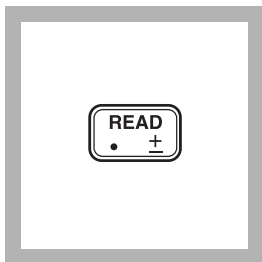
8. Press:

TIMER ENTER

A three-minute reaction period will begin. A pink color will develop if chlorine is present.



9. After the timer beeps, place the prepared sample into the cell holder. Tightly cover the sample cell with the instrument cap.



10. Press: READ

The cursor will move to the right, then the result in mg/L total chlorine will be displayed.

Note: It the sample temporarily turns yellow after sample addition, or the display flashes "limit", it is due to high chlorine levels. Dilute a fresh sample and repeat the test. A slight loss of chlorine may occur during dilution. Multiply the result by the dilution factor. Or use the High Range Total Chlorine test, program #8.

Note: Standard Adjust may be performed using a prepared standard.

CHLORINE, TOTAL, continued

Sampling and Storage

Analyze samples for chlorine **immediately** after collection. Chlorine is a strong oxidizing agent, and it is unstable in natural waters. It reacts rapidly with various inorganic compounds and more slowly oxidizes organic compounds. Many factors, including reactant concentrations, sunlight, pH, temperature and salinity influence decomposition of chlorine in water.

Avoid plastic containers since these may have a large chlorine demand. **Pretreat glass** sample containers to remove any chlorine demand by soaking in a dilute bleach solution (1 mL commercial bleach to 1 liter of deionized water) for at least 1 hour. Rinse thoroughly with deionized or distilled water. If sample containers are rinsed thoroughly with deionized or distilled water after use, only occasional pre-treatment is necessary.

Do not use the same sample cells for free and total chlorine. If trace iodide from the total chlorine reagent is carried over into the free chlorine determination, monochloramine will interfere. It is best to use separate, dedicated sample cells for free and total chlorine determinations.

A common error in testing for chlorine is introduced when a representative sample is not obtained. If sampling from a tap, let the water flow for at least 5 minutes to ensure a representative sample. Let the container overflow with the sample several times, then cap the sample containers so there is no headspace (air) above the sample. If sampling with a sample cell, rinse the cell several times with the sample, then carefully fill to the 10-mL mark. Perform the chlorine analysis immediately.

Accuracy Check

Standard Additions Method (using powder pillows)

- a) Snap the top off a LR Chlorine PourRite Ampule Standard Solution.
- b) Use a TenSette Pipet to add 0.1 mL of the standard to the reacted sample (this is the spiked sample). Swirl to mix.
- c) Re-zero the instrument using the original sample (the blank).
- d) Place the spiked sample into the cell holder and press **READ**. Record the results.

CHLORINE, TOTAL, continued

- e) Calculate the concentration of mg/L chlorine added to the sample:

$$\text{mg/L Chlorine added} = \frac{0.1(\text{vol. standard added}) \times \text{Label value (mg/L Cl}_2\text{)}}{10.1(\text{sample} + \text{standard volume})}$$

- f) The spiked sample result (step d) should reflect the analyzed sample result + the calculated mg/L Cl₂ added (step e).

Method Performance

In a single laboratory, using a standard solution of 1.50 mg/L chlorine and two lots of reagents with the instrument, a single operator obtained standard deviations of ± 0.02 mg/L chlorine.

Interferences

Interfering Substance	Interference Level and Treatment
Acidity	Greater than 150 mg/L CaCO ₃ . May not develop full color or color may fade instantly. Neutralize to pH 6-7 with 1 N sodium hydroxide. Determine amount to be added on separate sample aliquot, then add the same amount to the sample being tested. Correct for volume addition.
Alkalinity	Greater than 250 mg/L CaCO ₃ . May not develop full color or color may fade instantly. Neutralize to pH 6-7 with 1 N sulfuric acid. Determine amount to be added on separate sample aliquot, then add the same amount to the sample being tested. Correct for volume addition.
Bromine	Interferes at all levels
Chlorine Dioxide	Interferes at all levels
Chloramines, organic	May interfere
Hardness	No effect at less than 1,000 mg/L as CaCO ₃
Iodine	Interferes at all levels
Manganese, Oxidized (Mn ⁴⁺ , Mn ⁷⁺) or Chromium, Oxidized (Cr ⁶⁺)	<ol style="list-style-type: none">1. Adjust sample pH to 6-7.2. Add 3 drops potassium iodide (30 g/L) to a 25-mL sample.3. Mix and wait one minute.4. Add 3 drops sodium arsenite (5 g/L) and mix.5. Analyze 10 mL of the treated sample as described in the procedure.6. Subtract the result from this test from the original analysis to obtain the correct chlorine concentration.
Ozone	Interferes at all levels
Peroxides	May interfere
Extreme sample pH and highly buffered samples	Adjust to pH 6-7.

CHLORINE, TOTAL, continued

Summary of Method

Chlorine can be present in water as free available chlorine and as combined available chlorine. Both forms can exist in the same water and be determined together as the total available chlorine. Free chlorine is present as hypochlorous acid and/or hypochlorite ion. Combined chlorine exists as monochloramine, dichloramine, nitrogen trichloride and other chloro derivatives.

The combined chlorine oxidizes iodide in the reagent to iodine. The iodine reacts with DPD (N, N-diethyl-p-phenylenediamine) along with free chlorine present in the sample to form a pink color which is proportional to the total chlorine concentration. To determine the concentration of combined chlorine, run free chlorine and total chlorine tests. Subtract the results of the free chlorine test from the results of the total chlorine test to obtain combined chlorine.

Pollution Prevention and Waste Management

Samples treated with sodium arsenite for manganese or chromium interferences will be hazardous wastes as regulated by Federal RCRA for arsenic (D004). Refer to the appropriate Material Safety Data Sheet (MSDS) for more information on proper disposal of these materials.

Instrument Setup

The following procedure will add program 114 to a DR/820, DR/850 or DR/890 instrument.

1. Turn on the instrument by pressing the **ON** key.
2. Press the **SETUP** key.
3. Press the **DOWN** arrow key until the prompt line shows **USER**.
4. Press the **ENTER** key.
5. Enter "8138", followed by **ENTER**.
6. Refer to the following table and enter the number from the "Enter" column that corresponds to line number 1 on the display. Press **ENTER**. Repeat for lines 2–56 on the display.

Note: The arrow keys can be used to scroll and review or change numbers at any time.

CHLORINE, TOTAL, continued

Line Number	Enter	Line Number	Enter
1	114	29	0
2	24	30	0
3	74	31	0
4	0	32	0
5	0	33	0
6	0	34	0
7	0	35	0
8	0	36	0
9	0	37	0
10	0	38	0
11	0	39	0
12	63	40	0
13	219	41	0
14	34	42	0
15	200	43	1
16	0	44	164
17	0	45	0
18	0	46	4
19	0	47	10
20	67	48	0
21	108	49	180
22	50	50	0
23	0	51	0
24	0	52	0
25	0	53	0
26	0	54	223
27	0	55	0
28	0	56	255

CHLORINE, TOTAL, continued

REQUIRED REAGENTS & APPARATUS (Using Powder Pillows)

Description	Qty/Test	Unit	Cat. No.
DPD Total Chlorine Powder Pillows, 25 mL.....	1 pillow.....	100/pkg	1406499
Sample Cell, 10-20-25 mL, w/caps	2	6/pkg	2401906

OPTIONAL REAGENTS

Description		Unit	Cat. No.
Chlorine Standard Solution, PourRite ampule, 25-30 mg/L Cl ₂		20/pkg	26300-20
Potassium Iodide Solution, 30 g/L	100 mL*	MDB	343-32
Sodium Arsenite, 5 g/L	100 mL*	MDB	1047-32
Sodium Hydroxide Standard Solution, 1 N.....	100 mL*	MDB	1045-32
Sulfuric Acid Standard Solution, 1 N.....	100 mL*	MDB	1270-32
Water, deionized		4 L	272-56

OPTIONAL APPARATUS

Description		Unit	Cat. No.
PourRite Ampule Breaker		each.....	24846-00
Cylinder, graduated, 25 mL.....		each.....	508-40
pH Indicator Paper, 1 to 11 pH units.....	5 rolls/pkg.....		391-33
pH Meter, HQ30d, single-input, multi-parameter		each... HQ30D53000000	
pH probe, standard gel, 1-m cable.....		each.....	PHC10101
Pipet, TenSette, 0.1 to 1.0 mL		each.....	19700-01
Pipet Tips, for 19700-01 TenSette Pipet	50/pkg.....		21856-96
Pipet Tips, for 19700-01 TenSette Pipet	1000/pkg.....		21856-28

For Technical Assistance, Price and Ordering

In the U.S.A.—Call 800-227-4224

Outside the U.S.A.—Contact the Hach office or distributor serving you.

* Marked Dropper Bottle - contact Hach for larger sizes.

CHLORINE, TOTAL, continued



FOR TECHNICAL ASSISTANCE, PRICE INFORMATION AND ORDERING:

In the U.S.A. – Call toll-free 800-227-4224

Outside the U.S.A. – Contact the HACH office or distributor serving you.

On the Worldwide Web – www.hach.com; E-mail – techhelp@hach.com

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