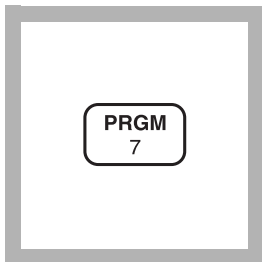


Indophenol Method*

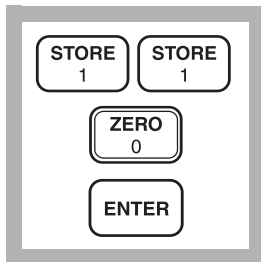
For chlorinated drinking water and chlorinated wastewater



1. Enter the user program number for monochloramine.

Press: **PRGM**

The display will show:
PRGM?



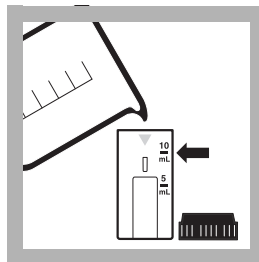
2. Press:
110 ENTER

The display will show

mg/L Cl₂

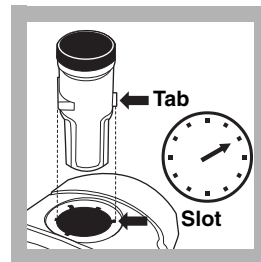
then: **ZERO**

Note: For alternate forms, press the **CONC** key.



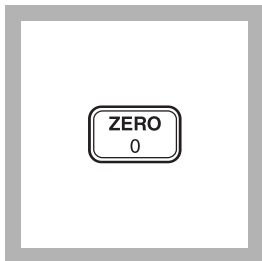
3. Fill the 10-mL/1-cm cell to the 10-mL line with sample.

Note: For the most accurate results, determine a reagent blank for each new lot of reagent by running the test using deionized water instead of sample.



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

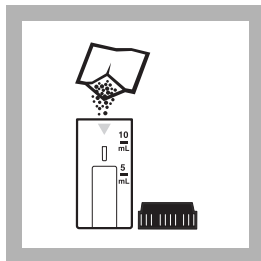
Note: Place the cell into the cell holder as illustrated. The cell's tab should be at the 2 o'clock position. Make sure the sample cell tab is completely seated in the cell holder slot.



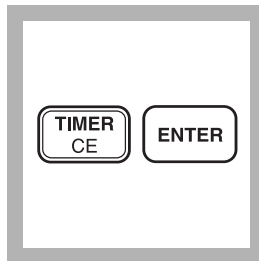
5. Press: **ZERO**

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

0.00 mg/L Cl₂



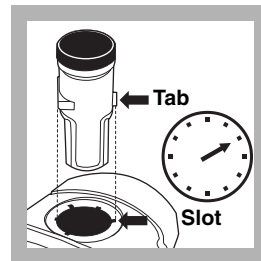
6. Remove the cell from the cell holder and add the contents of one pillow of Monochlor-F to the sample. Cap and shake the cell about 20 seconds to dissolve.



7. Press:
TIMER ENTER

A 5-minute reaction period will begin.

Note: The color development time depends on the sample temperature. Refer to Table 3 for the actual time required.

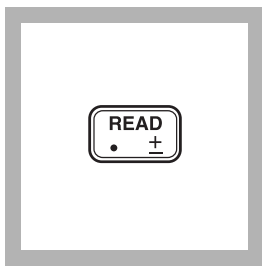


8. After the timer beeps, place the cell into the instrument. Tightly cover the sample cell with the instrument cap.

Note: Place the cell into the cell holder as illustrated. The cell's tab should be at the 2-o'clock position. Make sure the sample cell tab is completely seated in the cell holder slot.

* Patent pending

CHLORAMINE, MONO, Low Range, continued



9. Press: **READ**

The cursor will move to the right, then the result in mg/L monochloramine (as Cl₂ or chosen units) will be displayed.

Sampling and Storage

Analyze samples for monochloramine immediately after collection. If sampling with the sample cell, rinse the sample cell several times with the sample, then carefully fill to the 10-mL mark. If sampling from a tap, let the water flow for at least 5 minutes. Let the container overflow with the sample several times, then cap the container so there is no headspace (air) above the sample.

Accuracy Check

1. Prepare the following monochloramine standard fresh before use.
2. Add the contents of one Buffer Powder Pillow, pH 8.3 to about 50-mL of organic-free water in a clean 100-mL Class A volumetric flask. Swirl to dissolve the powder.
3. Using a Class A volumetric pipet, transfer 2.00 mL of Nitrogen, Ammonia Standard Solution, 100 mg/L as NH₃-N into the flask.
4. Dilute to volume with organic-free water, cap and mix thoroughly. This is a 2.00 mg/L buffered ammonia standard.
5. Pipet 50.00 mL of the buffered ammonia standard into a clean 100-mL beaker. Add a stir bar.

CHLORAMINE, MONO, Low Range, continued

6. Obtain a recent lot of Chlorine Solution Ampules, 50–70 mg/L, and note the actual free chlorine concentration for this lot.
7. Calculate the amount of Chlorine Solution to be added to the ammonia standard using the following equation:

$$\text{mL chlorine solution required} = \frac{455}{\text{free chlorine concentration}}$$

8. Open an ampule and, using a glass Mohr pipet, add the calculated amount of Chlorine Solution slowly to the ammonia standard, while mixing at medium speed on a stir-plate.
9. Allow the monochloramine solution to mix for 1 minute after all Chlorine Solution is added.
10. Quantitatively transfer the monochloramine solution to a clean 100-mL Class A volumetric flask. Dilute to the mark with organic-free water, cap, and mix thoroughly. This is a nominal 4.5 mg/L (as Cl₂) monochloramine standard.

Use this standard within 1 hour of preparation.

Method Performance

Precision

In a single laboratory, using a monochloramine standard solution of 2.10 mg/L Cl₂ and representative lots of reagent, a single operator obtained a standard deviation of ±0.12 mg/L Cl₂.

Estimated Detection Limit

The estimated detection limit for Method 10171 is 0.05 mg/L Cl₂. For more information on the estimated detection limit, see *Section 1* of the *Procedure Manual*.

Interferences

The following have been tested for interference and found *not* to interfere up to the indicated levels:

Table 9 Non-interfering Substances

Substance	Maximum Level Tested
Alanine	1 mg/L N
Aluminum	10 mg/L
Bromide	100 mg/L Br ⁻

CHLORAMINE, MONO, Low Range, continued

Table 9 Non-interfering Substances (Continued)

Substance	Maximum Level Tested
Bromine	15 mg/L Br ₂
Calcium	1000 mg/L CaCO ₃
Chloride	18,000 mg/L
Chlorine Dioxide	5 mg/L ClO ₂
Chromium (III)	5 mg/L
Copper	10 mg/L
Cyanide	10 mg/L CN ⁻
Free chlorine	10 mg/L Cl ₂
Glycine	1 mg/L N
Iron (II)	10 mg/L
Iron (III)	10 mg/L
Lead	10 mg/L
Nitrate	100 mg/L as N
Nitrite	50 mg/L N
Phosphate	100 mg/L PO ₄ ³⁻
Silica	100 mg/L SiO ₂
Silver	10 mg/L
Sulfate	2600 mg/L
Sulfite	50 mg/L SO ₃ ²⁻
Tyrosine	1 mg/L N
Urea	10 mg/L N
Zinc	5 mg/L

Table 10 Interfering Substances

Interfering Substance and its effect		Interference Level	Recommended Treatment
Magnesium	+	Above 400 mg/L CaCO ₃	Add 5 drops Rochelle Salt Solution prior to testing.
Manganese (+7)	-	Above 3 mg/L	
Ozone	-	Above 1 mg/L	Usually doesn't coexist with monochloramine.
Sulfide	+	Turns a "rust" color if present.	Usually doesn't coexist with monochloramine.
Thiocyanate	-	Above 0.5 mg/L	

CHLORAMINE, MONO, Low Range, continued

Summary of Method

In the presence of a cyanoferrate catalyst, monochloramine in the sample reacts with a substituted phenol to form an intermediate monoimine compound. The intermediate couples with excess substituted phenol to form a green-colored indophenol, which is proportional to the amount of monochloramine present in the sample.

Sample Temperature		Minutes
° C	° F	
5	40	10
7	42	9
9	48	8
10	50	8
12	54	7
14	58	7
16	61	6
18	68	4
20	73	3
23	75	2.5
25	77	2
>25	>77	2

Instrument Setup

This procedure will add the current method as a new Hach program to your DR/850 or DR/890.

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. Enter each of the numbers in the right column, each followed by **ENTER**. The line numbers in the left column relate to the line number on the display. At any time, you may use the arrow keys to scroll back to review or change a number already entered.

CHLORAMINE, MONO, Low Range, continued

Line Number	Entry	Line Number	Entry
1	110	29	108
2	42	30	78
3	74	31	0
4	0	32	0
5	0	33	0
6	0	34	0
7	0	35	63
8	0	36	57
9	0	37	199
10	0	38	104
11	0	39	62
12	64	40	74
13	176	41	61
14	120	42	45
15	106	43	1
16	0	44	204
17	0	45	0
18	0	46	5
19	0	47	10
20	67	48	1
21	108	49	44
22	50	50	0
23	0	51	0
24	0	52	0
25	78	53	0
26	72	54	3
27	50	55	0
28	67	56	255

CHLORAMINE, MONO, Low Range, continued

REQUIRED REAGENTS

Description	Quantity Required Per Test	Unit	Cat. No.
Monochlor F Reagent Pillows.....	1.....	50/pkg.....	28022-46

REQUIRED APPARATUS

Sample Cell, 10-mL/1-cm.....	1.....	2/pkg.....	48643-02
Clippers, shears	1.....	each.....	23694-00

OPTIONAL REAGENTS

Rochelle Salt Solution	29-mL DB	1725-33
Organic-Free Water	500-mL.....	26415-49
Buffer Powder Pillows, pH 8.3	25/pkg.....	898-68
Nitrogen, Ammonia Standard Solution, 100 mg/L as NH ₃ -N	500-mL.....	24065-49
Chlorine Solution Voluette Ampule, 50–75 mg/L	16/pkg.....	14268-10

OPTIONAL APPARATUS

Beaker, 100-mL.....	each.....	500-42H
Flask, Volumetric, Class A, 100-mL	each.....	14574-42
Pipet, Mohr, Glass, 10-mL	each.....	20934-38
Pipet, Volumetric, Class A, 2.00 mL.....	each.....	14515-36
Pipet, Volumetric, Class A, 50.00 mL.....	each.....	14515-41
Stir Bar, Octagonal	each.....	20953-52
Stirrer, Magnetic, 110 V, 4" x 4"	each.....	28812-00