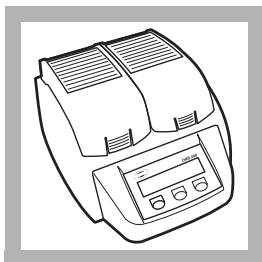
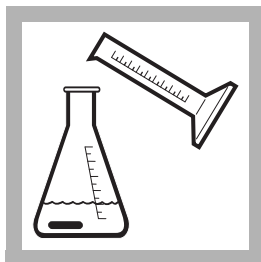


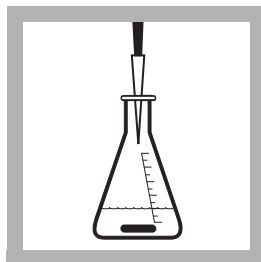
ORGANIC CARBON, TOTAL, Mid Range**Direct Method*****For wastewater and industrial waters**

1. Turn on the DRB 200 reactor. Heat to 103–105 °C.

Note: See DRB 200 user manual for selecting pre-programmed temperature applications.

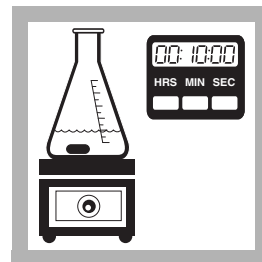


2. Use a graduated cylinder to add 10 mL of sample to a 50-mL erlenmeyer flask containing a stir bar.

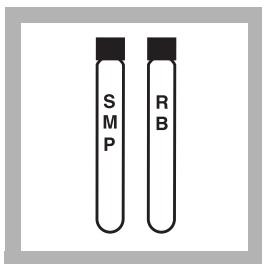


3. Add 0.4 mL of Buffer Solution, pH 2.0.

Note: Use pH paper to make sure the sample pH is 2.

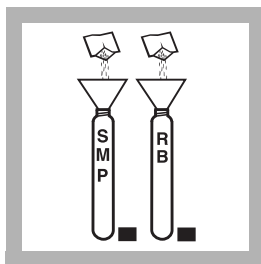


4. Place the flask on a stir plate and stir at a moderate speed for 10 minutes.

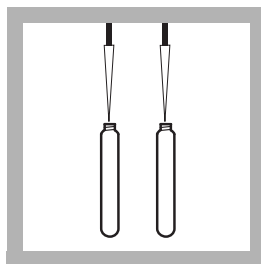


5. Label two Mid Range Acid Digestion vials: **sample** and **reagent blank**.

Note: A reagent blank is required for each series of samples.



6. Using a funnel, add the contents of one TOC Persulfate Powder Pillow to each Acid Digestion vial (colorless liquid).



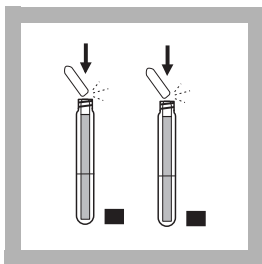
7. Use a TenSette® Pipet to add 1.0 mL of **organic-free water** to the **reagent blank** vial and 1.0 mL of **prepared sample** to the **sample** vial. Do not cap the vial; swirl gently to mix.



8. Rinse two blue Indicator Ampules with deionized water and wipe them with a soft, lint-free wipe.

Note: Do not touch the ampules on the sides after wiping. Pick them up by the top.

ORGANIC CARBON, TOTAL, Mid Range, continued

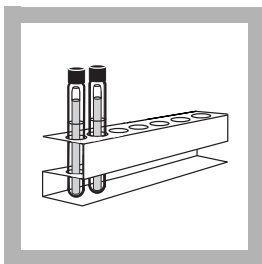


9. Lower one unopened ampule into each Acid Digestion vial. When the score mark on the ampule is level with the top of the Acid Digestion vial, snap the top off the ampule and allow it to drop into the Acid Digestion vial.

Note: Do not invert or tilt the vial after inserting the ampule to prevent the Indicator Reagent from mixing with the contents of the acid digestion vial.

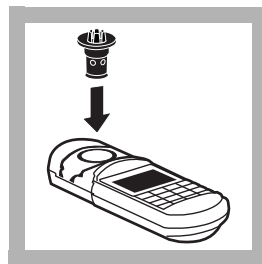


10. Cap the vial assemblies tightly and place them in the reactor for 2 hours at 103–105 °C.



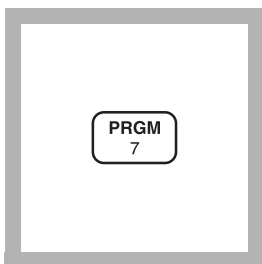
11. Carefully remove the vial assemblies from the reactor. Place them in a test tube rack.

Allow the vials to cool for **one hour** for accurate results.



12. Insert the COD/TNT Adapter into the cell holder by rotating the adapter until it drops into place. Then push down to fully insert it.

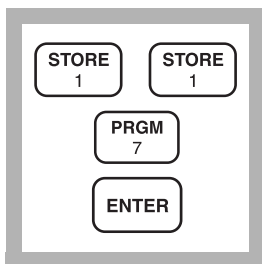
Note: For increased performance, a diffuser band covers the light path holes on the adapter. Do not remove the diffuser band.



13. Enter the stored program number for Mid Range TOC.

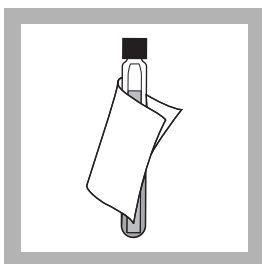
Press: **PRGM**

The display will show:
PRGM?



14. Press: **117 ENTER**

The display will show **mg/L** and the **ZERO** icon.



15. Wipe the reagent blank vial assembly with a damp towel, followed by a dry one, to remove fingerprints or other marks.

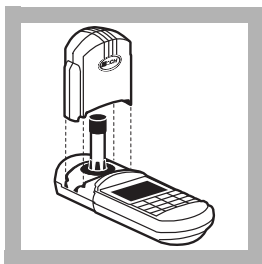
Note: The liquid in the reagent blank vial should be dark blue.



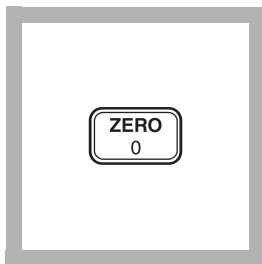
16. Place the **reagent blank** vial assembly in the adapter.

Push straight down on the top of the vial until it seats solidly in the adapter.

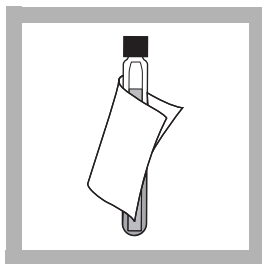
ORGANIC CARBON, TOTAL, Mid Range, continued



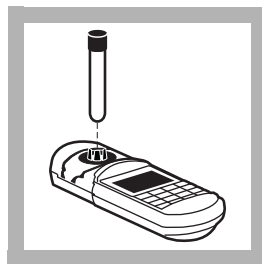
17. Tightly cover the vial assembly with the instrument cap.



18. Press: **ZERO**
The cursor will move to the right, then the display will show:
0 mg/L C

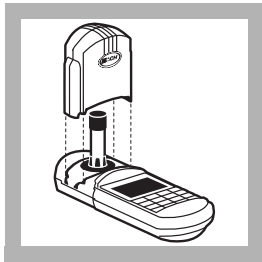


19. Wipe the sample vial assembly with a damp towel, followed by a dry one, to remove fingerprints or other marks.

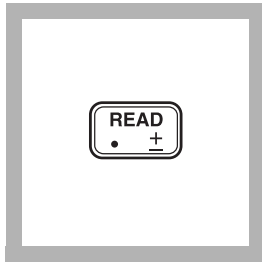


20. Place the **sample** vial assembly in the adapter.

Push straight down on the top of the vial assembly until it seats solidly in the adapter.



21. Tightly cover the vial assembly with the instrument cap.



22. Press: **READ**
The cursor will move to the right, then the result in mg/L C will be displayed.

ORGANIC CARBON, TOTAL, Mid Range, continued

Sampling and Storage

Collect samples in clean glass bottles. Rinse the sample bottle several times with the sample to be collected. Fill the bottle with minimum headspace before capping. Test samples as soon as possible. Acid preservation is not recommended. Homogenize samples containing solids to assure representative samples.

Accuracy Check

Standard Solutions Method

- a. Prepare a 1000 mg/L organic carbon stock standard by dissolving 2.1254 g dry primary standard Potassium Acid Phthalate in Organic-Free Reagent Water and dilute to 1000 mL. This stock standard is stable for about 1 month at room temperature. Alternatively, open one ampule of TOC Standard Solution (Cat. No. 27915-05).
- b. Prepare a 100 mg/L C standard by transferring 5.00 mL of the stock standard to a 50-mL Class A volumetric flask. Dilute to volume using Organic-Free Reagent Water. Stopper and mix thoroughly. Prepare this standard fresh weekly.

Standard Additions Method

- a. Prepare a 300 mg/L C standard by transferring 15.00 mL of 1000 mg/L C stock solution to a 50-mL Class A volumetric flask. Dilute to volume with Organic-Free Water. Mix.
- b. Use the TenSette Pipet to add 0.1, 0.2, and 0.3 mL of the 300 mg/L C standard to each of three Acid Digestion vials.
- c. Add the contents of one TOC Persulfate powder pillow to each vial.
- d. Add 1.0 mL of sample to each vial. Swirl to mix.
- e. Proceed with the procedure starting at *step 8*.
- f. The mg/L C concentration should increase by 30 mg/L for each 0.1 mL increment.

ORGANIC CARBON, TOTAL, Mid Range, continued

Method Performance

Precision

mg/L C	95% Confidence Limits
15	± 5 mg/L C
50	± 6 mg/L
75	± 7 mg/L
115	± 4 mg/L
150	± 6 mg/L

Estimated Detection Limit

Use Method Number 10173 to test TOC levels below 15 mg/L C.

Sensitivity

At mid-range, the sensitivity, expressed as the concentration change per 0.010 absorbance change, is 1.9 mg/L C.

Interferences

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

Table 1 Non-interfering Substances

Substance	Maximum Level Tested
Aluminum	10 mg/L
Ammonia Nitrogen	1000 mg/L as N
ASTM Wastewater	No effect
Bromide	500 mg/L Br
Bromine	25 mg/L Br ₂
Calcium	2000 mg/L as CaCO ₃
Chloride	1500 mg/L
Chlorine	10 mg/L Cl ₂
Chlorine Dioxide	6 mg/L ClO ₂
Copper	10 mg/L
Cyanide	10 mg/L CN
Iodide	50 mg/L
Iron (II)	10 mg/L
Iron (III)	10 mg/L
Magnesium	2000 mg/L as CaCO ₃
Manganese (VII)	1 mg/L

ORGANIC CARBON, TOTAL, Mid Range, continued

Table 1 Non-interfering Substances (Continued)

Substance	Maximum Level Tested
Monochloramine	14 mg/L NH_2Cl as Cl_2
Nitrite	500 mg/L NO_2^-
Ozone	2 mg/L O_3
Phosphate	3390 mg/L PO_4^{3-}
Silica	100 mg/L SiO_2
Sulfate	5000 mg/L SO_4^{2-}
Sulfide	20 mg/L S^{2-}
Sulfite	50 mg/L SO_3^{2-}
Zinc	5 mg/L

Note: If the sample contains greater than 1000 mg/L CaCO_3 alkalinity, lower the sample pH to less than 7 before testing by adding sulfuric acid solution.

Note: Most sample turbidity is either dissolved during the digestion stage or settled during the cooling period. Sample turbidities up to 50 NTU have been tested without interference.

Summary of Method

The total organic carbon (TOC) is determined by first sparging the sample under slightly acidic conditions to remove the inorganic carbon. In the outside vial, organic carbon in the sample is digested by persulfate and acid to form carbon dioxide. During digestion, the carbon dioxide diffuses into a pH indicator reagent in the inner ampule. The adsorption of carbon dioxide into the indicator forms carbonic acid. Carbonic acid changes the pH of the indicator solution which, in turn, changes the color. The amount of color change is related to the original amount of carbon present in the sample.

ORGANIC CARBON, TOTAL, Mid Range, continued

Instrument Setup

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

1. Turn the instrument on 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, 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.

Line Number	Entry	Line Number	Entry
1	117	29	0
2	42	30	0
3	72	31	0
4	0	32	0
5	0	33	0
6	0	34	0
7	0	35	0
8	66	36	0
9	36	37	0
10	92	38	0
11	40	39	0
12	195	40	0
13	89	41	0
14	74	42	0
15	61	43	0
16	0	44	165
17	0	45	128
18	0	46	0
19	0	47	10
20	67	48	0
21	0	49	0
22	0	50	0
23	0	51	0
24	0	52	0
25	0	53	0
26	0	54	25
27	0	55	0
28	0	56	255

ORGANIC CARBON, TOTAL, Mid Range, continued

REQUIRED REAGENTS

Total Organic Carbon Direct Method Mid Range

Test 'N Tube Reagent Set 50 vials..... 28159-45

Includes:

Description	Quantity Required		Cat. No.
	Per Test	Unit	
Acid Digestion Solution Vials, Mid Range TOC	1	50/pkg	*
Buffer Solution, Sulfate	0.4 mL	25 mL	452-33
Funnel, micro	1	each	25843-35
Indicator Ampules, Mid/High Range TOC.....	1	50/pkg	*
TOC Persulfate Powder Pillows	1	50/pkg	*
Water, organic-free**	1.0 mL	500 mL	26415-49

REQUIRED APPARATUS

DRB 200 Reactor, 110 V, 15 x 16 mm tubes			LTV082.53.40001
DRB 200 Reactor, 220 V, 15 x 16 mm tubes			LTV082.52.40001
Cylinder, graduated, 10-mL.....	1	each	508-38
Flask, Erlenmeyer, 50-mL	1	each	505-41
Magnetic Stirrer, 115 V, 4" x 4"	1	each	28812-00
Test Tube Rack	1-3	each	18641-00
Pipet, TenSette®, 0.1 to 1.0 mL	1	each	19700-01
Pipet Tips, for 19700-01 TenSette® Pipet.....	2	50/pkg	21856-96
Stir Bar, Magnetic	1	each	45315-00
Wipes, Disposable, Kimwipes	1	280/pkg	20970-00

OPTIONAL REAGENTS

Description	Per Test	Unit	Cat. No.
TOC Standard Solution (KHP Standard, 1000 mg/L C).....		5/pkg	27915-05
Potassium Acid Phthalate		500 g	315-34
Sulfuric Acid Reagent Solution, 5.25 N		100 mL MDB	2449-32

OPTIONAL APPARATUS

Analytical Balance		each	28014-01
DRB 200 Reactor, 110 V, 21 x 16 mm and 4 x 20 mm			LTV082.53.42001
DRB 200 Reactor, 220 V, 21 x 16 mm and 4 x 20 mm			LTV082.52.42001
DRB 200 Reactor, 110 V, 9 x 16 mm and 2 x 20 mm			LTV082.53.30001
DRB 200 Reactor, 220 V, 9 x 16 mm and 2 x 20 mm			LTV082.52.30001
Flask, volumetric, 100-mL.....		each	14574-42
Pipet, Class A, 10.00-mL.....		each	14515-38
Pipet, Class A, 15.00-mL.....		each	14515-39
Pipet Tips, for 19700-01 TenSette Pipet		1000/pkg	21856-28

* These items are not sold separately.

** This item must be purchased separately.