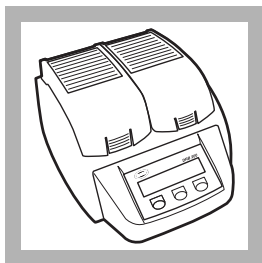
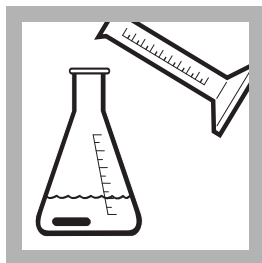


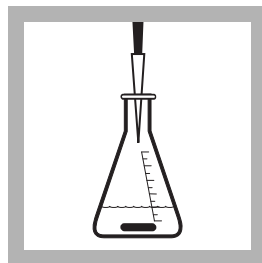
ORGANIC CARBON, TOTAL, High Range (20–700 mg/L C)**Direct Method*****For wastewater and industrial waters**

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

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

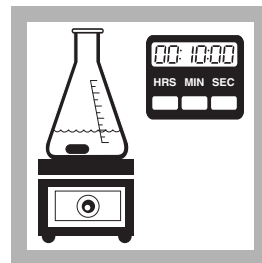


2. Use a graduated cylinder to add 10 mL of sample to a 50-mL erlenmeyer flask containing a stir bar.

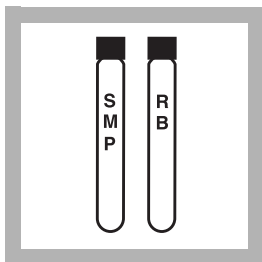


3. Add 0.4 mL of Buffer Solution, pH 2.0.

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

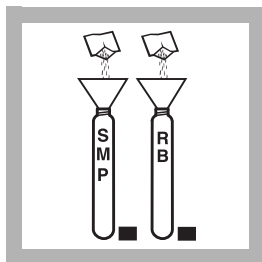


4. Place the flask on a stir plate and stir at a moderate speed for 10 minutes.

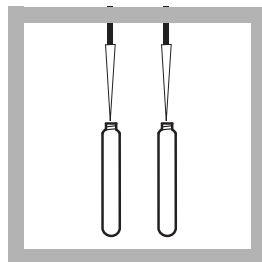


5. Label two High Range Acid Digestion vials: **sample** and **reagent blank**.

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).



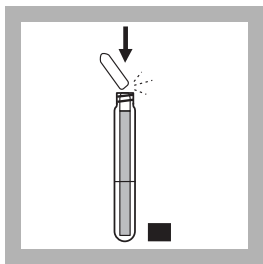
7. Use a TenSette[®] Pipet to add 0.3 mL of **organic-free water** to the **reagent blank** vial and 0.3 mL of **prepared sample** to the **sample** vial. Swirl to mix.



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, High Range, continued

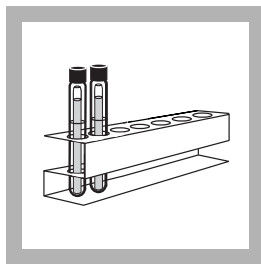


9. Lower one unopened ampule into each Acid Digestion vial. When the score mark on the ampule is level with the top of the Acid Digestion vial, snap the top off the ampule and allow it to drop into the Acid Digestion vial.

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.

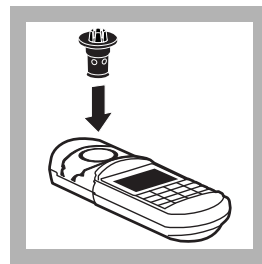


10. Cap the vial assemblies tightly and place them in the reactor for 2 hours at 103–105 °C.



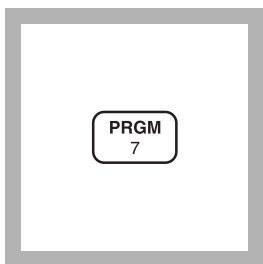
11. Carefully remove the vial assemblies from the reactor. Place them in a test tube rack.

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.

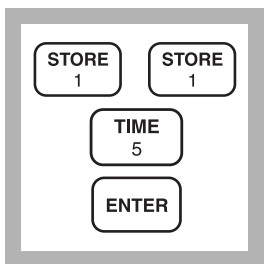
Note: For increased performance, a diffuser band covers the light path holes on the adapter. Do not remove the diffuser band.



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

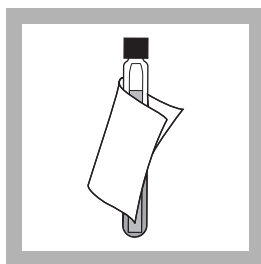
Press: **PRGM**

The display will show:
PRGM?



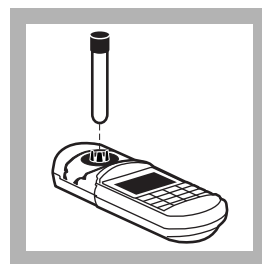
14. Press: **115 ENTER**

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.

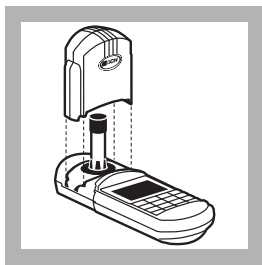
Note: The liquid in the reagent blank vial should be dark blue.



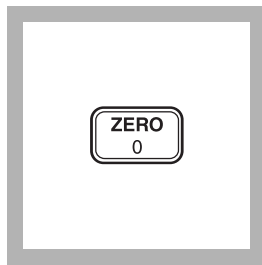
16. Place the **reagent blank** vial assembly in the adapter.

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

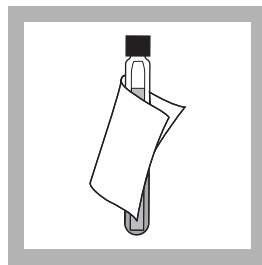
ORGANIC CARBON, TOTAL, High Range, continued



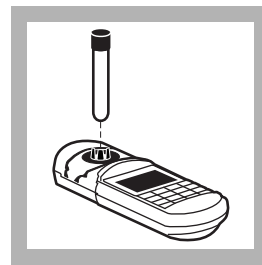
17. Tightly cover the vial assembly with the instrument cap.



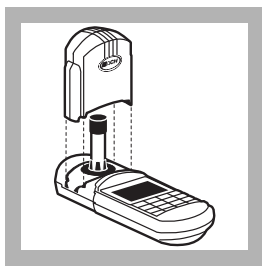
18. Press: **ZERO**
The cursor will move to the right, then the display will show:
0 mg/L C



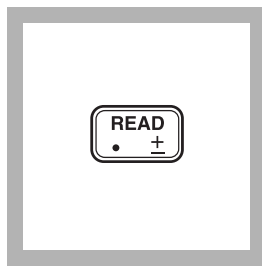
19. Wipe the sample vial assembly with a damp towel, followed by a dry one, to remove fingerprints or other marks.



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.

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 300 mg/L C standard by transferring 15.00 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 18.00 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 0.3 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 100 mg/L for each 0.1 mL increment.

Method Performance

Precision

In a single laboratory, using a standard solution of 360 mg/L C and one lot of reagents, a single operator obtained a standard deviation of ± 8 mg/L C.

Estimated Detection Limit

Use Method Number 10129 to test TOC levels below 20 mg/L C.

Sensitivity

At mid-range, the sensitivity, expressed as the concentration change per 0.010 absorbance change, is 6 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 | 5000 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 |
| Monochloramine | 14 mg/L NH ₂ Cl as Cl ₂ |
| Nitrite | 500 mg/L NO ₂ ⁻ |
| Ozone | 2 mg/L O ₃ |
| Phosphate | 3390 mg/L PO ₄ ³⁻ |

ORGANIC CARBON, TOTAL, High Range, continued

Table 1 Non-interfering Substances (Continued)

| Substance | Maximum Level Tested |
|-----------|---|
| 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 |

If the sample contains greater than 600 mg/L CaCO₃ alkalinity, lower the sample pH to less than 7 before testing by adding sulfuric acid solution.

Most sample turbidity is either dissolved during the digestion stage or settled during the cooling period. Sample turbidities up to 900 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.

REQUIRED REAGENTS

Total Organic Carbon Direct Method High Range

Test 'N Tube Reagent Set..... 50 vials..... 27604-45

Includes:

| Description | Qty/Test | Unit | Cat. No. |
|---|--------------|--------------|----------------|
| Acid Digestion Solution Vials, High Range TOC | 1 | 50/pkg | * |
| Buffer Solution, Sulfate | 0.4 mL | 25 mL..... | 452-33 |
| Funnel, micro | 1 | each..... | 25843-35 |
| Indicator Ampules, High Range TOC | 1 | 10/pkg..... | * |
| TOC Persulfate Powder Pillows | 1 | 50/pkg..... | * |
| Water, organic-free** | 0.3 mL | 500 mL..... | 26415-49 |

* These items are not sold separately.

ORGANIC CARBON, TOTAL, High Range, continued

REQUIRED APPARATUS

| | | | |
|---|----------|-----------------|----------|
| Cylinder, graduated, 10-mL | 1..... | each | 508-38 |
| 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 | |
| Flask, Erlenmeyer, 50-mL..... | 1..... | each | 505-41 |
| Magnetic Stirrer, 115 V, 4" x 4" | 1..... | each | 28812-00 |
| Safety Shield, laboratory bench | 1..... | each | 50030-00 |
| Test Tube Rack..... | 1-3..... | each | 18641-00 |
| Pipet, TenSette [®] , 0.1 to 1.0 mL..... | 1..... | each | 19700-01 |
| Pipet, TenSette [®] , 1.0 to 10.0 mL..... | 1..... | each | 19700-10 |
| Pipet Tips, for 19700-01 TenSette [®] Pipet..... | 2..... | 50/pkg | 21856-96 |
| Pipet Tips, for 19700-10 TenSette [®] Pipet..... | 2..... | 50/pkg | 21997-96 |
| Stir Bar, Magnetic | 1..... | each | 45315-00 |
| Wipes, Disposable, Kimwipes..... | 1..... | 280/pkg | 20970-00 |

OPTIONAL REAGENTS

| | | | |
|---|------------------|----------|--|
| Oxygen Demand Standard (BOD, COD, TOC), 10-mL Ampules..... | 16/pkg | 28335-10 | |
| Potassium Acid Phthalate..... | 500 g | 315-34 | |
| Sulfuric Acid Reagent Solution, 5.25 N..... | 100 mL MDB | 2449-32 | |
| TOC Standard Solution Ampules (KHP Standard, 1000 mg/L C)..... | 5/pkg | 27915-05 | |
| Wastewater Influent Standard, Inorganic (NH ₃ -N, NO ₃ -N, PO ₄ , COD, SO ₄ , TOC) | 500 mL | 28331-49 | |

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, 1000-mL | | each | 14574-53 |
| 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 |

** This item must be purchased separately.