

## DPD Method<sup>1</sup>

## Method 8016

0.05 to 4.50 mg/L Br<sub>2</sub>

Powder Pillows or AccuVac<sup>®</sup> Ampuls

**Scope and application:** For testing bromine residuals (including hypobromite, hypobromous acid and bromamines) used as disinfectants in process waters, treated water, estuary water and seawater.

<sup>1</sup> Adapted from Standard Methods for the Examination of Water and Wastewater.





### Test preparation

### Instrument-specific information



Table 1 shows sample cell and orientation requirements for reagent addition tests, such as powder pillow or bulk reagent tests. Table 2 shows sample cell and adapter requirements for AccuVac Ampul tests. The tables also show all of the instruments that have the program for this test.

To use the table, select an instrument, then read across to find the applicable information for this test.

**Table 1 Instrument-specific information for reagent addition**

| Instrument  | Sample cell orientation                  | Sample cell  |
|---|--|--|
| DR 6000<br>DR 3800<br>DR 2800<br>DR 2700<br>DR 1900 | The fill line is to the right.           | 2495402<br>  |
| DR 5000<br>DR 3900                                  | The fill line is toward the user.        |  |
| DR 900  | The orientation mark is toward the user. | 2401906<br> |

**Table 2 Instrument-specific information for AccuVac Ampuls**

| Instrument                    | Adapter                | Sample cell  |
|-------------------------------|------------------------|--|
| DR 6000<br>DR 5000<br>DR 900  | —                      | 2427606<br> |
| DR 3900                       | LZV846 (A)             |  |
| DR 1900                       | 9609900 or 9609800 (C) |  |
| DR 3800<br>DR 2800<br>DR 2700 | LZV584 (C)             | 2122800<br> |

## Before starting

Samples must be analyzed immediately after collection and cannot be preserved for later analysis.

Install the instrument cap on the DR 900 cell holder before ZERO or READ is pushed.

For the best results, measure the reagent blank value for each new lot of reagent. Replace the sample with deionized water in the test procedure to determine the reagent blank value. Subtract the reagent blank value from the sample results automatically with the reagent blank adjust option.

Review the Safety Data Sheets (MSDS/SDS) for the chemicals that are used. Use the recommended personal protective equipment.

Dispose of reacted solutions according to local, state and federal regulations. Refer to the Safety Data Sheets for disposal information for unused reagents. Refer to the environmental, health and safety staff for your facility and/or local regulatory agencies for further disposal information.

## Items to collect

### Powder pillows

| Description  | Quantity |
|--|----------|
| DPD Total Chlorine Reagent Powder Pillow, 10-mL  | 1        |
| Sample cells. (For information about sample cells, adapters or light shields, refer to <a href="#">Instrument-specific information</a> on page 1.) | 2        |

Refer to [Consumable and replacement items](#) on page 6 for order information.

### AccuVac Ampuls

| Description   | Quantity |
|---|----------|
| DPD Total Chlorine Reagent AccuVac <sup>®</sup> Ampul   | 1        |
| Beaker, 50-mL   | 1        |
| Sample cells (For information about sample cells, adapters or light shields, refer to <a href="#">Instrument-specific information</a> on page 1.) | 1        |
| Stopper for 18-mm tubes and AccuVac Ampuls  | 1        |

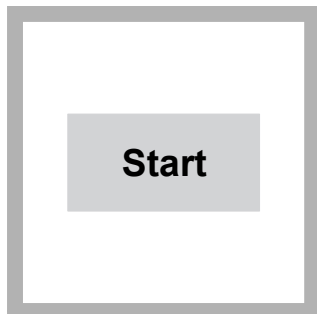
Refer to [Consumable and replacement items](#) on page 6 for order information.

## Sample collection

- Analyze samples for bromine immediately after collection.
- Bromine is a strong oxidizing agent and is unstable in natural waters. Bromine reacts quickly with various inorganic compounds and more slowly with organic compounds. Many factors, including reactant concentrations, sunlight, pH, temperature and salinity influence the decomposition of bromine in water.
- Collect samples in clean glass bottles. Do not use plastic containers because these can have a large bromine demand.
- Pretreat glass sample containers to remove bromine demand. Soak the containers in a weak bleach solution (1 mL commercial bleach to 1 liter of deionized water) for at least 1 hour. Rinse fully with deionized or distilled water. If sample containers are rinsed fully with deionized or distilled water after use, only occasional pretreatment is necessary.

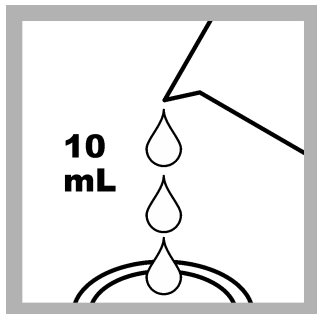
- Make sure to get a representative sample. If the sample is taken from a spigot or faucet, let the water flow for at least 5 minutes. Let the container overflow with the sample several times and then put the cap on the sample container so that there is no headspace (air) above the sample.

## Powder pillow procedure

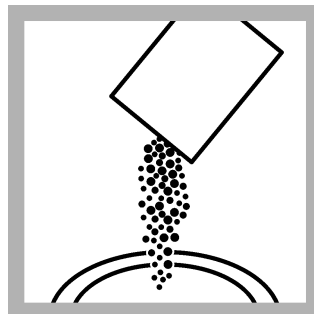


**1. Start program 50 Bromine.** For information about sample cells, adapters or light shields, refer to [Instrument-specific information](#) on page 1.

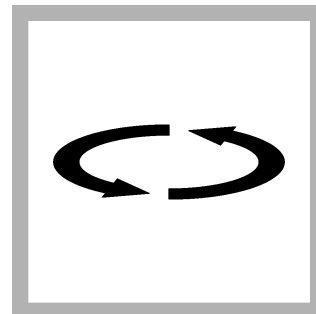
**Note:** Although the program name can be different between instruments, the program number does not change.



**2. Fill a sample cell with 10 mL of sample.**



**3. Prepare the sample:** Add the contents of one powder pillow to the sample cell.

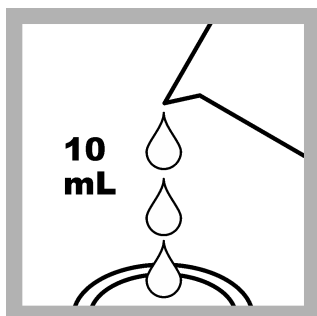


**4. Swirl the sample cell for to mix.** A pink color shows if bromine is in the sample.

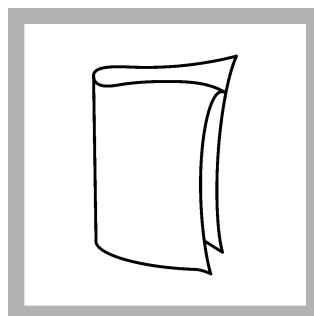


**5. Start the instrument timer.** A 3-minute reaction time starts.

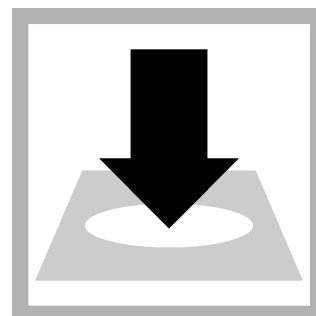
The instrument can be set to zero with the blank during the reaction timer.



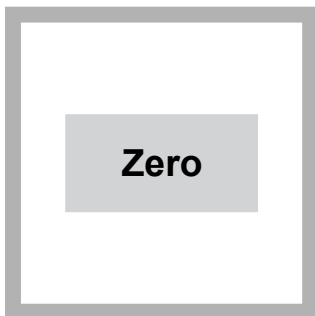
**6. Prepare the blank:** Fill a second sample cell with 10 mL of sample.



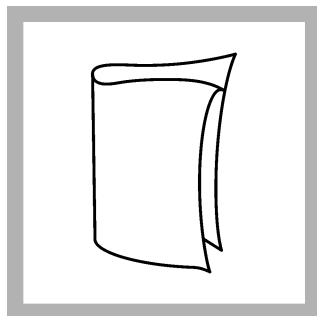
**7. Clean the blank sample cell.**



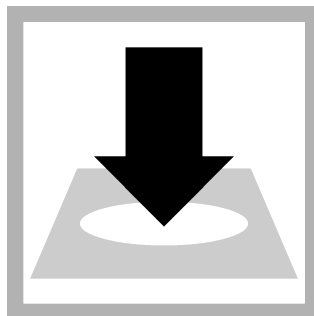
**8. Insert the blank into the cell holder.**



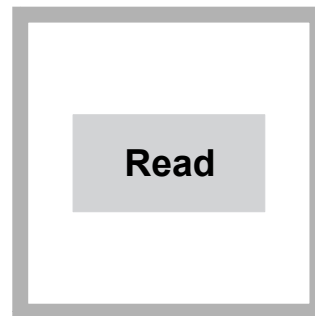
9. Push **ZERO**. The display shows 0.00 mg/L Br<sub>2</sub>.



10. Clean the prepared sample cell.

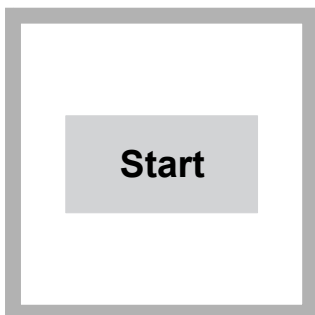


11. Within 3 minutes after the timer expires, insert the prepared sample into the cell holder.



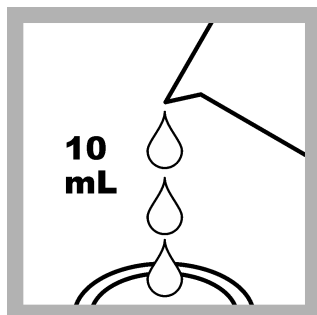
12. Push **READ**. Results show in mg/L Br<sub>2</sub>.

### AccuVac Ampul procedure

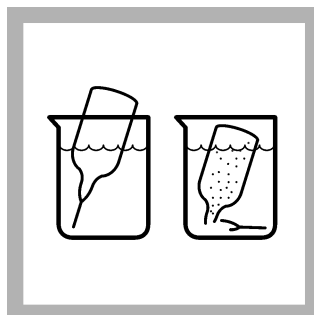


1. Start program **55 Bromine AV**. For information about sample cells, adapters or light shields, refer to [Instrument-specific information](#) on page 1.

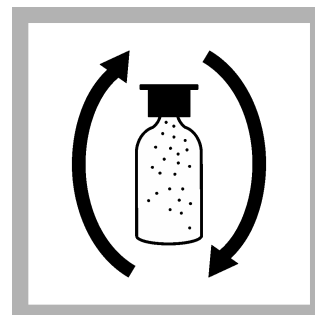
**Note:** Although the program name can be different between instruments, the program number does not change.



2. **Prepare the blank:** Fill the sample cell with 10 mL of sample.



3. **Prepare the sample:** Collect at least 40 mL of sample in a 50-mL beaker. Fill the AccuVac Ampul with sample. Keep the tip immersed while the AccuVac Ampul fills completely.

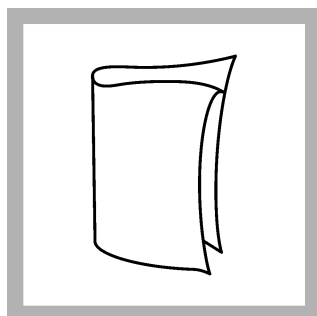


4. Quickly invert the AccuVac Ampul several times to mix. A pink color shows if bromine is in the sample.

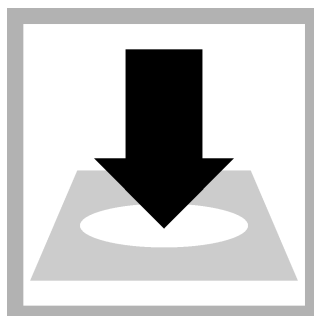


5. Start the instrument timer. A 3-minute reaction time starts.

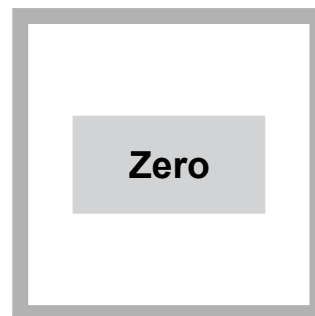
The instrument can be set to zero with the blank during the reaction timer.



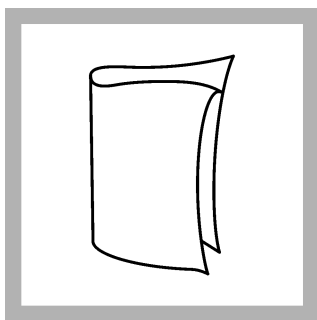
6. Clean the blank sample cell.



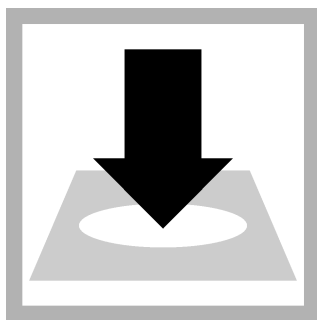
7. Insert the blank into the cell holder.



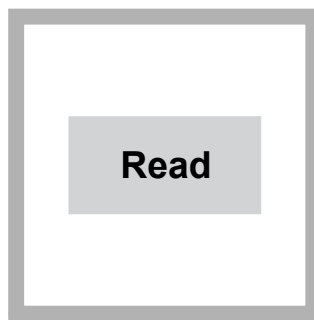
8. Push **ZERO**. The display shows 0.00 mg/L Br<sub>2</sub>.



9. Clean the AccuVac Ampul.



10. Within 3 minutes after the timer expires, insert the prepared sample AccuVac Ampul into the cell holder.



11. Push **READ**. Results show in mg/L Br<sub>2</sub>.

## Interferences

| Interfering substance  | Interference level   |
|--|--|
| Acidity  | More than 150 mg/L CaCO <sub>3</sub> . The full color may not develop or the color may fade instantly. Neutralize to pH 6–7 with 1 N Sodium Hydroxide. Measure the amount to be added on a separate sample aliquot, then add the same amount to the sample that is tested. Correct the test result for the dilution caused by the volume addition.   |
| Alkalinity   | More than 250 mg/L CaCO <sub>3</sub> . The full color may not develop or the color may fade immediately. Neutralize to pH 6–7 with 1 N Sulfuric Acid. Measure the amount to add on a separate sample aliquot, then add the same amount to the sample that is tested. Correct the test result for the dilution caused by the volume addition.   |
| Chlorine   | Causes positive interference   |
| Chlorine Dioxide   | Causes positive interference   |
| Chloramines, organic   | May cause positive interference  |
| Hardness   | No effect at less than 1000 mg/L as CaCO <sub>3</sub>  |
| Iodine   | Causes positive interference   |
| Manganese, Oxidized (Mn <sup>4+</sup> , Mn <sup>7+</sup> ) or Chromium, Oxidized (Cr <sup>6+</sup> ) | Pre-treat the sample as follows: <ol style="list-style-type: none"> <li>1. Adjust the sample pH to 6–7.</li> <li>2. Add 3 drops of Potassium Iodide (30-g/L) to 25 mL of sample.</li> <li>3. Mix and wait 1 minute.</li> <li>4. Add 3 drops of Sodium Arsenite<sup>1</sup> (5-g/L) and mix.</li> <li>5. Use the test procedure to measure the concentration of 10 mL of the treated sample.</li> <li>6. Subtract this result from the result without the treatment to obtain the correct bromine concentration.</li> </ol> |
| Monochloramine   | Causes positive interference   |
| Ozone  | Causes positive interference   |
| Peroxides  | May cause positive interference  |
| Highly buffered samples or extreme sample pH   | Can prevent the correct pH adjustment of the sample by the reagents. Sample pre-treatment may be necessary. Adjust to pH 6–7 with acid (Sulfuric Acid, 1 N) or base (Sodium Hydroxide, 1 N). Correct the test result for the dilution caused by the volume additions.  |

<sup>1</sup> Samples that are treated with sodium arsenite will contain arsenic and may require special disposal consideration. Refer to the current MSDS/SDS for safe handling and disposal instructions.

## Method performance

The method performance data that follows was derived from laboratory tests that were measured on a spectrophotometer during ideal test conditions. Users can get different results under different test conditions.

| Program | Standard                  | Precision (95% Confidence Interval) | Sensitivity<br>Concentration change per 0.010 Abs change |
|---------|---------------------------|-------------------------------------|--|
| 50      | 2.80 mg/L Br <sub>2</sub> | 2.75–2.85 mg/L Br <sub>2</sub>      | 0.05 mg/L Br <sub>2</sub>                                |
| 55      | 2.80 mg/L Br <sub>2</sub> | 2.71–2.89 mg/L Br <sub>2</sub>      | 0.05 mg/L Br <sub>2</sub>                                |

## Summary of method

Bromine residuals reacts with DPD (N,N-diethyl-p-phenylenediamine) to form a pink color which is proportional to the total bromine concentration. The measurement wavelength is 530 nm for spectrophotometers or 520 nm for colorimeters.

## Consumable and replacement items

### Required reagents

| Description   | Quantity/Test | Unit    | Item no. |
|---|---------------|---------|----------|
| DPD Total Chlorine Reagent Powder Pillow, 10-mL       | 1             | 100/pkg | 2105669  |
| OR  |               |         |          |
| DPD Total Chlorine Reagent AccuVac <sup>®</sup> Ampul | 1             | 25/pkg  | 2503025  |

### Required apparatus

| Description                                 | Quantity/Test | Unit  | Item no. |
|---|---------------|-------|----------|
| AccuVac Snapper                             | 1             | each  | 2405200  |
| Beaker, 50-mL                               | 1             | each  | 50041H   |
| Stoppers for 18-mm tubes and AccuVac Ampuls | 2             | 6/pkg | 173106   |

### Optional reagents and apparatus

| Description  | Unit      | Item no. |
|--|-----------|----------|
| AccuVac <sup>®</sup> Ampul vials for sample blanks                             | 25/pkg    | 2677925  |
| Ampule Breaker, 2-mL PourRite <sup>®</sup> Ampules                             | each      | 2484600  |
| Ampule Breaker, 10-mL Voluette <sup>®</sup> Ampules                            | each      | 2196800  |
| Mixing cylinder, graduated, 25-mL  | each      | 2088640  |
| Mixing cylinder, graduated, 50-mL  | each      | 189641   |
| Chlorine Standard Solution, 2-mL PourRite <sup>®</sup> Ampules, 50–75 mg/L     | 20/pkg    | 1426820  |
| Chlorine Standard Solution, 10-mL Voluette <sup>®</sup> Ampule, 50–75 mg/L     | 16/pkg    | 1426810  |
| Chlorine Standard Solution, 2-mL PourRite <sup>®</sup> Ampules, 25–30 mg/L     | 20/pkg    | 2630020  |
| DPD Total Chlorine Reagent Powder Pillows, 10-mL                               | 1000/pkg  | 2105628  |
| DPD Total Chlorine Reagent Powder Pillows, 10-mL                               | 300/pkg   | 2105603  |
| DPD Total Chlorine Reagent, 10-mL, SwifTest <sup>™</sup> Dispenser refill vial | 250 tests | 2105660  |
| Paper, pH, 0–14 pH range   | 100/pkg   | 2601300  |
| Pipet, TenSette <sup>®</sup> , 0.1–1.0 mL                                      | each      | 1970001  |
| Pipet tips for TenSette <sup>®</sup> Pipet, 0.1–1.0 mL                         | 50/pkg    | 2185696  |

**Optional reagents and apparatus (continued)**

| <b>Description</b>  | <b>Unit</b> | <b>Item no.</b> |
|---|-------------|-----------------|
| Pipet tips for TenSette <sup>®</sup> Pipet, 0.1–1.0 mL                      | 1000/pkg    | 2185628         |
| Potassium Iodide, 30-g/L  | 100 mL      | 34332           |
| Sodium Arsenite, 5-g/L  | 100 mL      | 104732          |
| Sodium Hydroxide Standard Solution, 1.0 N                                   | 100 mL MDB  | 104532          |
| SpecCheck <sup>™</sup> Secondary Standard Kit, Chlorine DPD, 0–2.0 mg/L Set | each        | 2635300         |
| Sulfuric Acid Standard Solution, 1 N  | 100 mL MDB  | 127032          |
| Water, Chlorine-demand Free   | 500 mL      | 2641549         |
| Water, deionized  | 4 L         | 27256           |



**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](http://www.hach.com); E-mail – [techhelp@hach.com](mailto:techhelp@hach.com)

**HACH COMPANY**  
WORLD HEADQUARTERS  
Telephone: (970) 669-3050  
FAX: (970) 669-2932