Boron

DOC316.53.01313

Carmine Method

Method 10252

2 to 50 mg/L B

Powder Pillows

Scope and application: For oil and gas field waters

Test preparation

Instrument-specific information

Table 1 shows all of the instruments that have the program for this test. The table also shows adapter and light shield requirements for the instruments that use them.

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

Table 1 Instrument-specific information for test tubes

Instrument	Adapters	Light shield
DR 6000, DR 5000	—	—
DR 3900	—	LZV849
DR 3800, DR 2800, DR 2700	—	LZV646
DR 1900	9609900 (D[1])	—
DR 900	4846400	Cover supplied with the instrument

[1] The D adapter is not available with all instrument versions.

Before starting

Install the instrument cap on the DR 900 cell holder before ZERO or READ is pushed.
DR 3900, DR 3800, DR 2800 and DR 2700: Install the light shield in Cell Compartment #2 before this test is started.
The reagent that is used in this test is corrosive. Use protection for eyes and skin and be prepared to flush any spills with running water.
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

Description	Quantity
BoroVer 3 Reagent Powder Pillow	1
Sufuric Acid, Concentrated	75 mL
Water, deionized	2 mL
Tubes, glass, 16 mm x 100 mm	2
Caps, white Teflon	2
Flask, poly, screw-on cap, 250-mL	1
Cylinder, graduated, poly, 100-mL	1

Items to collect (continued)

Description	Quantity
Light shield or adapter (For information about sample cells, adapters or light shields, refer to Instrument-specific information on page 1.)	1
Select:	
Pipet, 0.2 - 1.0 mL , BBP078	1
Pipet Tip, for BBP078	2
Pipet, 1.0 - 1.0 mL, BBP065	1
Pipet Tip for BBP065	2
OR	
Pipet, TenSette, 0.1- to 1.0-mL	1
Pipet tips for 0.1- to 1.0-mL TenSette	2
Pipet, TenSette, 1.0- to 10.0-mL	1
Pipet tips for 1.0- to 10.0-mL TenSette	2

Refer to Consumables and replacement items on page 5 for order information.

Sample collection

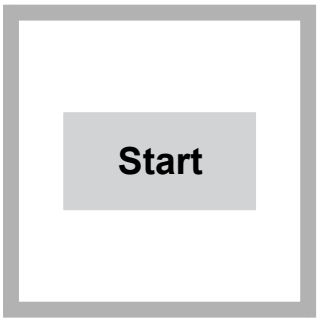
Collect samples in clean polyethylene or polypropylene bottles.

Prepare the glass tubes for first use

New glass tubes can contain residual amounts of reactive boron from the glass manufacturing process. For best results, precondition the tubes before the first use. Previously used tubes do not need to be preconditioned.

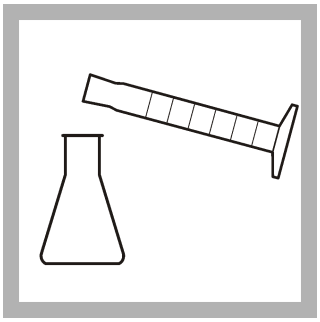
1. Prepare the BoroVer 3/Sulfuric Acid Solution.
2. Add 3 to 4 mL of the prepared BoroVer 3/Sulfuric Acid Solution into the tubes.
3. After 30 minutes, discard the solution.
4. Rinse and dry the tubes before use.

Powder pillow procedure

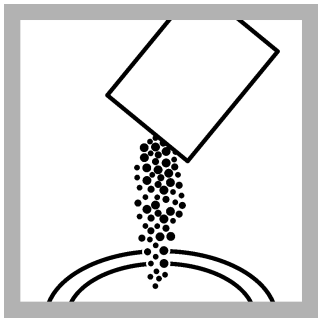


1. Start program **41 Boron HR**. For information about sample cells, adapters or light shields, refer to Instrument-specific information on page 1.

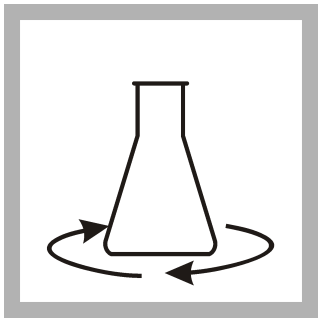
Note: *Although the program name can be different between instruments, the program number does not change.*



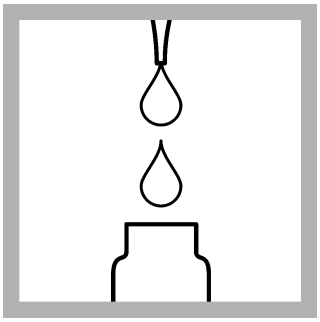
2. Use a 100-mL graduated cylinder to measure 75 mL of concentrated sulfuric acid. Pour the acid into a plastic 250-mL Erlenmeyer flask.



3. In a well-ventilated area or fume hood, add the contents of one BoroVer 3 Reagent Powder Pillow to the flask.

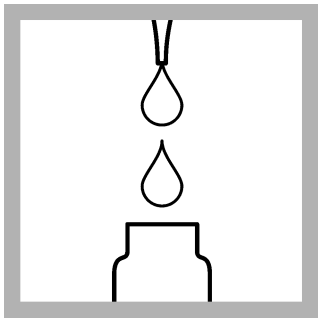


4. Swirl the flask immediately to mix. Swirl for up to 5 minutes to dissolve the powder completely.



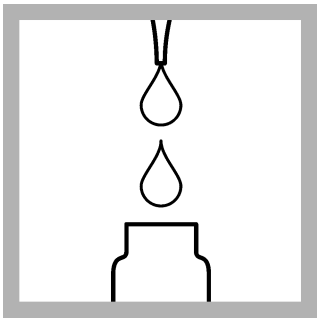
5. Prepare the blank: Remove the cap from a clean 16-mm tube. Add 0.2 mL of deionized water. Refer to Prepare the glass tubes for first use on page 2 and Clean the glass tubes after use on page 4.

Note: *If a 3.5-mL pipet is not available, 0.4 mL of DI water can be used.*



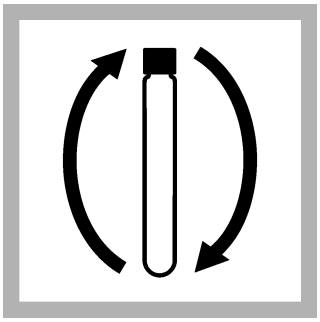
6. Prepare the sample: Remove the cap from a clean 16-mm tube. Add 0.2 mL of sample.

Note: *If a 3.5-mL pipet is not available, 0.4 mL of sample can be used.*

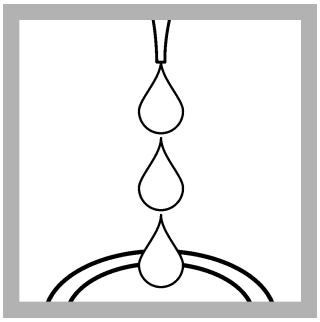


7. Add 3.5 mL of the BoroVer 3 Solution from step 4 to the **prepared** sample tube.

Note: *If a 3.5-mL pipet is not available, 7.0 mL of BoroVer 3 Solution can be used with 0.4 mL of sample.*

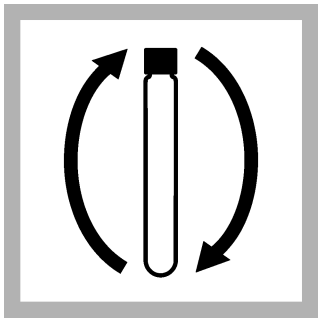


8. Put the cap on the prepared sample and invert to mix.
The solution in the tube will get warm.



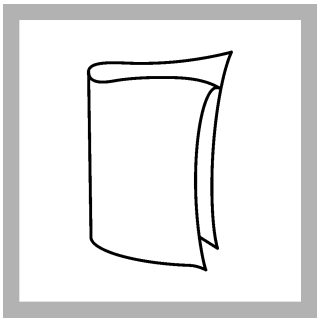
9. Add 3.5 mL of the BoroVer 3 Solution from step 4 to the **blank** sample tube.

Note: *If a 3.5-mL pipet is not available, 7.0 mL of BoroVer 3 Solution can be used with 0.4 mL of deionized water.*

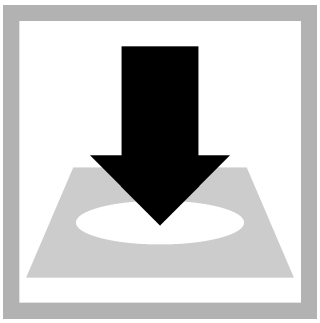


10. Put the cap on the blank. Iinvert to mix.
The solution in the tube will get warm.

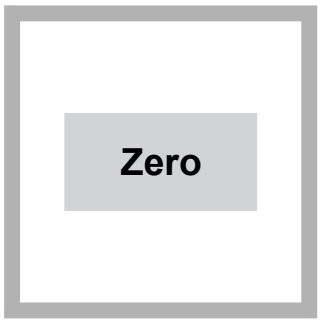
11. Start the instrument timer. A 30-minute reaction time starts.



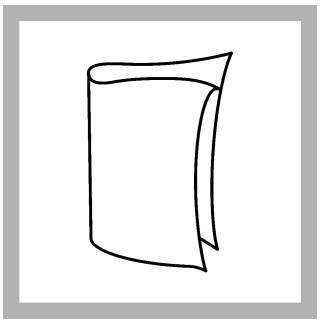
12. When the timer expires, clean the blank sample cell.



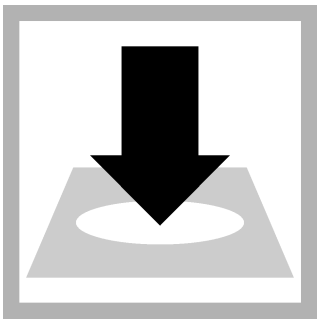
13. Insert the blank into the cell holder.



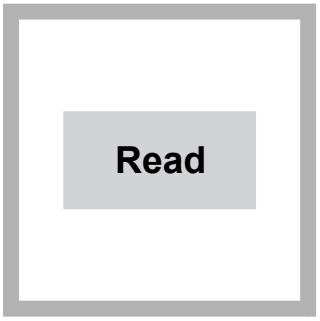
14. Push **ZERO**. The display shows 0.0 mg/L B HR.



15. Clean the prepared sample cell.



16. Insert the prepared sample into the cell holder.



17. Push **READ**. Results show in mg/L B.

Reagent preparation

More than 75 mL of the BoroVer 3/Sulfuric Acid Solution can be prepared for use in multiple analyses.

Preparation notes

- Gaseous hydrochloric acid (HCl) forms when the powder pillow is added to sulfuric acid. Always mix under a fume hood.
- The solution is stable for a maximum of 48 hours when kept in plastic containers.
- To prevent boron contamination from the glassware, do not keep the solution in borosilicate glassware (Pyrex® or Kimax®) for more than 1 hour.
- The BoroVer 3/Sulfuric Acid Solution is highly acidic. Refer to the current MSDS/SDS for safe handling and disposal instructions.

1. Determine the amount of sulfuric acid and powder pillows that are necessary for the number of samples to be analyzed. Use 75 mL of sulfuric acid for each analysis. Use one BoroVer 3 Reagent Powder Pillow for each 75 mL of sulfuric acid.
2. Under a fume hood, measure the concentrated sulfuric acid with a graduated cylinder.
3. Pour the acid into a Erlenmeyer flask.
4. Stir the acid and add the contents of one BoroVer 3 Reagent Powder Pillow to the flask. Swirl to mix. Wait for the powder to completely dissolve. Continue to add one powder pillow at a time. Stir to dissolve after each powder pillow is added.
5. Pour this solution into plastic containers and use within 48 hours.

Clean the glass tubes after use

NOTICE

The BoroVer 3/Sulfuric Acid solution is highly acidic. Neutralize the solution to pH 6–9 before disposal. Refer to a current SDS (Safety Data Sheet) for safe handling and disposal instructions of reacted boron.

Glass tubes and caps can be reused.

1. Thoroughly drain the boron solution.
2. Rinse the vials several times with deionized water.
3. Let the vials dry completely before the next use.

Accuracy check

Standard solution method

Use the standard solution method to validate the test procedure, the reagents and the instrument.

Items to collect:

- 1000 mg/L Boron Standard Solution
- 100-mL volumetric flask, Class A
- 3-mL volumetric pipet, Class A and pipet filler
- Deionized water

1. Prepare a 30.0 mg/L boron standard solution as follows:
   a. Use a pipet to add 3.0 mL of 1000 mg/L boron standard solution into the volumetric flask.
   b. Dilute to the mark with deionized water. Mix well. Prepare this solution daily.
2. Use the test procedure to measure the concentration of the prepared standard solution.
3. Compare the expected result to the actual result.

   Note: *The factory calibration can be adjusted slightly with the standard adjust option so that the instrument shows the expected value of the standard solution. The adjusted calibration is then used for all test results. This adjustment can increase the test accuracy when there are slight variations in the reagents or instruments.*

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 Concentration change per 0.010 Abs change
41	25 mg/L B	24.2–25.8 mg/L B	2.2 mg/L B

Summary of method

Boron is determined by its reaction with carminic acid in the presence of sulfuric acid to produce a reddish to bluish color. The amount of color is directly proportional to the boron concentration. The measurement wavelength is 605 nm for spectrophotometers or 610 nm for colorimeters.

Consumables and replacement items

Required reagents

Description	Quantity/test	Unit	Item no.
BoroVer® 3 Boron Reagent Powder Pillow	1 pillow/1 tests	100/pkg	1417099
Sulfuric Acid, concentrated, ACS	varies	500 mL	97949
Water, deionized	varies	100 mL	27242

Required apparatus

Description	Quantity/test	Unit	Item no.
Tubes, glass, 16-mm x 100-mm	1	6/pkg	2275806
Caps, white, Teflon lining, for 16-mm vials	2	6/pkg	2241106
Cylinder, graduated, polypropylene, 100-mL	1	each	108142
Flask, Polymethylpentene, screw cap, 250-mL, 125-mL	1	each	2089846
Pipet, adjustable volume, 0.2–1.0 mL	1	each	BBP078
Pipet tips, for 0.2–1.0 mL pipet	2	100/pkg	BBP079
Pipet, adjustable volume, 1.0–5.0 mL	1	each	BBP065

Required apparatus (continued)

Description	Quantity/test	Unit	Item no.
Pipet tips, for 1.0–5.0 mL pipet	1	75/pkg	BBP068
OR			
Pipet, TenSette®, 0.1–1.0 mL	1	each	1970001
Pipet Tips, for TenSette® Pipet, 0.1–1.0 mL	2	50/pkg	2185696
Pipet, TenSette® 1.0–10.0 mL	1	each	1970010
Pipet Tips, for TenSette® Pipet, 1.0–10.0 mL	varies	50/pkg	2199796
Tubes, glass, 16-mm x 100-mm	1	6/pkg	2275806

Optional reagents

Description	Unit	Item no.
Boron Standard Solution, 1000-mg/L as B	100 mL	191442

Optional apparatus

Description	Unit	Item no.
Gloves, chemical resistant, size 10	pair	2410105
Goggles, safety, standard	each	2927902
Pipet tips for TenSette® Pipet, 0.1–1.0 mL	1000/pkg	2185628
Pipet tips for TenSette® Pipet, 1.0–10.0 mL	250/pkg	2199725
Test tube rack, stainless steel	each	1864100
Pipets, adjustable volume, includes one 0.2–1.0 mL and one 1.0–5.0 mL pipet plus tips	each	LZP320

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**

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

01/2014, Edition 10