

# iron, reactive

FerroVer® Method<sup>1</sup>

0.04 to 3.00 mg/L Fe

Powder Pillows

**Scope and application:** For water, wastewater and seawater.

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




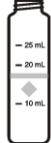
## Test preparation

### instrument specific information

Table 1 shows the sample cell and cell orientation requirements for the SUEZ instruments that can use this Analytical Procedure (AP).

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

**Table 1 Instrument-specific information**

Instrument	Sample cell orientation	Sample cell
DR 2800 DR 1900	The fill line is to the right.	L2793.0002 
DR 900	The fill lines and diamond mark are toward the display.	L1976 

Find a contact near you by visiting [www.suezwatertechnologies.com](http://www.suezwatertechnologies.com) and clicking on "Contact Us."

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## before starting

To make sure that all soluble and insoluble forms of this metal (total) are measured, digest the sample with heat and acid. Refer to the Total Iron FerroVer procedure AP876.

Clean all glassware with 6.0 N (50%) hydrochloric acid, then fully rinse with deionized water to remove contaminants.

For turbid samples, treat the blank with one 0.1-g scoop of RoVer Rust Remover. Swirl to dissolve.

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

Refer to the instrument user manual for timer operation instructions.

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.

Clean the external surface of the sample cells before insertion into the instrument cell holder. Use a damp towel and then a dry towel to remove fingerprints or other marks.

Highly buffered samples or extreme pH may exceed the buffering capacity of the reagent and require sample pre-treatment.

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

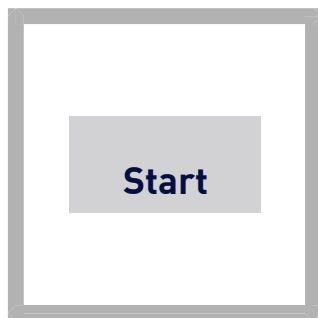
Dispose of reacted solutions according to local, state and federal regulations. Refer to the Safety Data Sheets for disposal information for unused reagents. Refer to the environmental, health and safety staff for your facility and/or local regulatory agencies for further disposal information.

Results that are not within the working range of this procedure are not valid.

## sample collection and storage

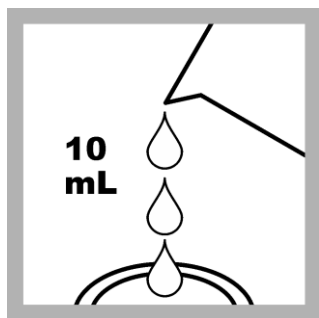
- Collect samples in clean glass or plastic bottles that have been cleaned with 6 N (50%) hydrochloric acid and rinsed with deionized water.
- To preserve samples for later analysis, adjust the sample pH to less than 2 with concentrated nitric acid (approximately 2 mL per liter). No acid addition is necessary if the sample is tested immediately.
- Keep the preserved samples at room temperature for a maximum of 6 months.
- Before analysis, adjust the pH to 3–5 with 5 N sodium hydroxide solution.
- Correct the test result for the dilution caused by the volume additions.

## procedure

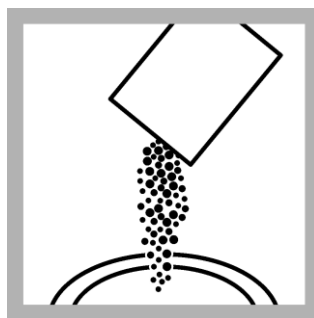


1. Start program **265 Iron, FerroVer**. For information about sample cells, adapters or light shields, refer to Instrument specific information on page 1.

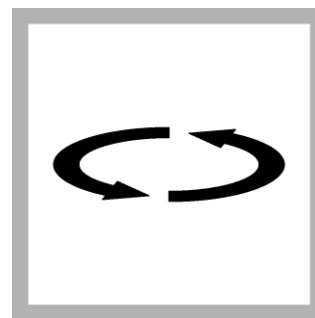
**Note:** Although the program name can be different between instruments, the program number does not change.



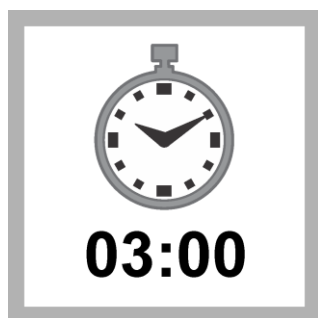
2. **Prepare the sample:** Fill a sample cell with 10 mL of sample.



3. Add the contents of one FerroVer Iron Reagent Powder Pillow to the sample cell.

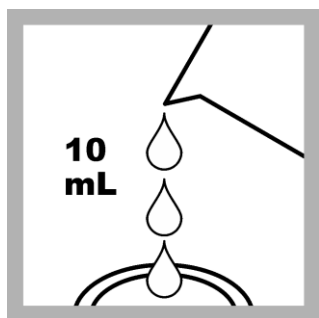


4. Swirl the sample cell to mix. Undissolved powder will not affect accuracy.

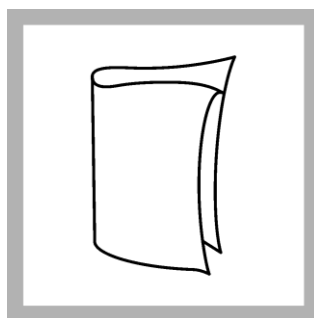


5. Start the instrument timer. A 3-minute reaction time starts.

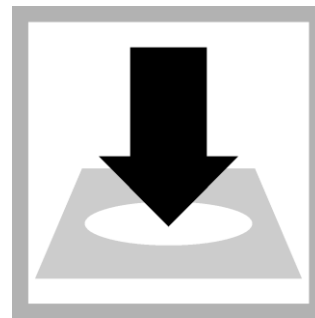
An orange color will show if iron is present. Let samples that contain rust react for 5 minutes or more.



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

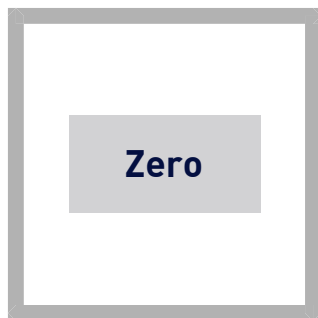


7. Clean the blank sample cell.

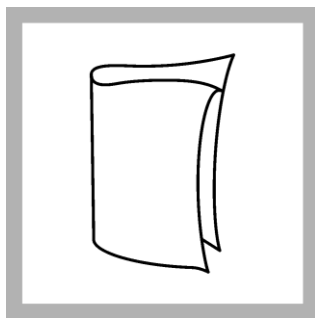


8. When the timer expires, insert the blank into the cell holder.

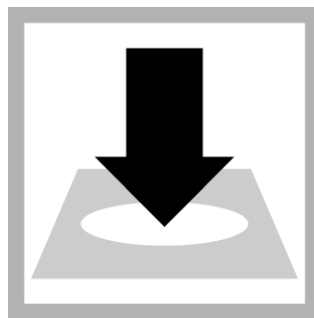




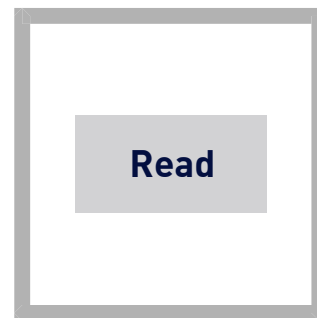
9. Push **ZERO**. The display shows 0.00 mg/L Fe.



10. Clean the prepared sample cell.



11. Insert the prepared sample into the cell holder.



12. Push **READ**. Results show in mg/L Fe.

## interferences

Interfering substance	Interference level
Calcium, Ca <sup>2+</sup>	No effect at less than 10,000 mg/L as CaCO <sub>3</sub> .
Chloride, Cl <sup>-</sup>	No effect at less than 185,000 mg/L.
Copper, Cu <sup>2+</sup>	No effect. Masking agent is contained in FerroVer Reagent.
High iron levels	Inhibit color development. Dilute sample and re-test to verify results.
Magnesium	No effect at 100,000 mg/L as CaCO <sub>3</sub> .
Molybdate	Causes positive interference. Refer to AP878.
High sulfide levels, S <sup>2-</sup>	Pretreat the sample in a fume hood or in an area with sufficient airflow before analysis: <ol style="list-style-type: none"> <li>1. Add 5 mL of 6.0 N (50%) hydrochloric acid solution to 100 mL of sample in a 250-mL Erlenmeyer flask.</li> <li>2. Boil for 20 minutes.</li> <li>3. Let the solution cool to room temperature.</li> <li>4. Adjust the pH to 3–5 with 5 N sodium hydroxide solution.</li> <li>5. Add deionized water until the volume is 100 mL.</li> <li>6. Use the treated sample in the test procedure.</li> </ol>
Turbidity	Pre-treat the sample before analysis: <ol style="list-style-type: none"> <li>1. Add one 0.1-g scoop of RoVer® Rust Remover to the blank. Swirl to mix.</li> <li>2. If the sample remains turbid, add three 0.2-g scoops of RoVer Rust Remover to 75 mL of sample. Let stand 5 minutes.</li> <li>3. Filter through a 0.45-micron membrane filter and filter holder.</li> <li>4. Use the treated sample in the test procedure.</li> </ol>
Highly buffered samples or extreme	Can prevent the correct pH adjustment of the sample by the reagents. Sample pre-treatment may be necessary. Adjust the pH to 3–5.

## accuracy check

### standard solution method

1. Prepare a 2.00-mg/L iron standard solution as follows:
  - a. Use a pipet to add 2 mL of a 50-mg/L iron standard solution into a 50-mL volumetric flask. Adjust the pH to 2.5–5.
  - 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. The result should be 2.0 mg/L Fe.

## 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
265	2.00 mg/L Fe	1.99–2.01 mg/L Fe	0.021 mg/L Fe

## summary of method

FerroVer Iron Reagent converts all soluble iron and most insoluble forms of iron in the sample to soluble ferrous iron. The ferrous iron reacts with the 1-10 phenanthroline indicator in the reagent to form an orange color in proportion to the iron concentration. The measurement wavelength is 510 nm for spectrophotometers or 520 nm for colorimeters.

## lab supply code numbers

### Required reagents\*

Description	Quantity/Test	Unit	Code
FerroVer® Iron Reagent Powder Pillow <sup>1</sup> , 10-mL	1	100/pkg	L2031

<sup>1</sup> FerroVer is a registered trademark of Hach Company

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

### Spectrophotometers and colorimeters (select one)

Description	Quantity/Test	Unit	Code
DR 1900 Spectrophotometer with accessories	1	each	L1901
Sample cells, 10-mL square, matched pair	2	2/pkg	L2793.0002
DR 900 Colorimeter with accessories	1	each	L901
Sample cells, 10-20-25-mL, with cap	2	6/pkg	L1976

### Optional reagents and apparatus

Description	Unit	Code
Pipetter, adjustable volume, 1.00–10.00 mL	each	L1089
Tips for L1089 Pipetter, 10-mL	200/pkg	L20002
Pipetter, Socorex Calibra 822.1000, 100–1000 µL (EMEA only)	each	L8034
Pipetter, Socorex Calibra 832.10, 1.0–10.0 mL (EMEA only)	each	L8035
Tips for L8035 Pipetter, Socorex 312.10, 10-mL (EMEA only)	100/pkg	L8036
Tips for L8034 Pipetter, Socorex 319.1000B, 1000-µL (EMEA only)	250/pkg	L8037
Filter membrane filter holder, 47-mm	each	L571
Filter membrane, 0.45-micron, 47-mm	100/pkg	L733
Hydrochloric Acid Solution, 6.0 N (50%)	60 mL	L247.0060
Iron Standard Solution, 50-mg/L as Fe	500 mL	L523.0500
RoVer Rust Remover	30 g	L2058
Safety bulb, rubber	each	L1575
Sodium Hydroxide Solution, 5 N	100 mL	L2003.0120
Syringe, plastic 50-mL	each	L775
Water, deionized	4000 mL	L243.4000