

Phosphorus, Reactive (Orthophosphate)

DOC316.53.01120

Molybdovanadate Method**Method 10214****5.0 to 90.0 mg/L PO₄³⁻ or 1.6 to 30 mg/L PO₄-P****TNTplus™ 846****Scope and application:** For wastewater, drinking water, boiler water, surface water and process water.

Test preparation

Instrument-specific information

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

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

Table 1 Instrument-specific information for TNTplus vials

Instrument	Adapters	Light shield
DR 6000, DR 5000	—	—
DR 3900	—	LZV849
DR 3800, DR 2800	—	LZV646
DR 1900	9609900 or 9609800 (A)	—

Before starting

DR 3900, DR 3800, DR 2800: Install the light shield in Cell Compartment #2 before this test is started.

Review the safety information and the expiration date on the package.

The recommended sample pH is 3–10.

The sample temperature must be 15–25 °C (59–77 °F) for accurate results.

The recommended temperature for reagent storage is 15–25 °C (59–77 °F).

DR 1900: Go to All Programs>LCK or TNTplus Methods>Options to select the TNTplus number for the test. Other instruments automatically select the method from the barcode on the vial.

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

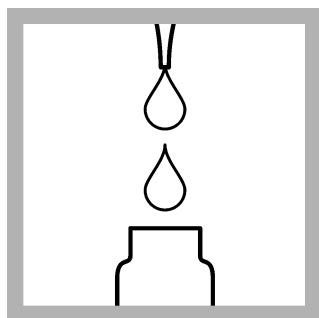
Description	Quantity
Phosphorus, Reactive TNTplus Reagent Set	1
Pipet, adjustable volume, 1.0–5.0 mL	1
Pipet tips, for 1.0–5.0 mL pipet	1

Refer to [Consumables and replacement items](#) on page 4 for order information.

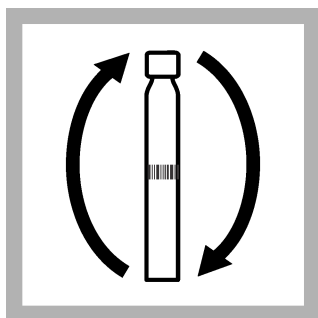
Sample collection and storage

- Collect samples in clean glass or plastic bottles that have been cleaned with 6 N (1:1) hydrochloric acid and rinsed with deionized water.
- Do not use a detergent that contains phosphate to clean the sample bottles. The phosphate in the detergent will contaminate the sample.
- Analyze the samples as soon as possible for best results.
- If immediate analysis is not possible, immediately filter and keep the samples at or below 6 °C (43 °F) for a maximum of 48 hours.
- Let the sample temperature increase to room temperature before analysis.

Test procedure



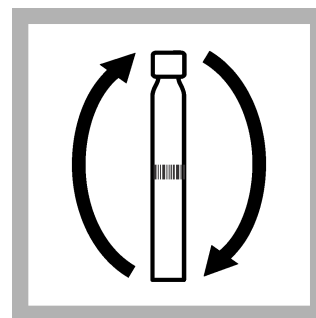
1. Use a pipet to add 5.0 mL of sample to the test vial.



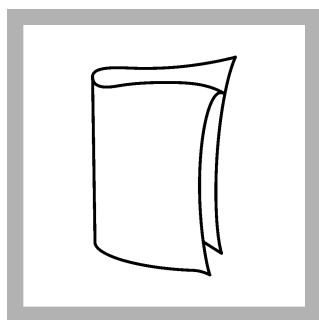
2. Tighten the cap on the vial and invert the vial 2–3 times.



3. Start the reaction time of 10 minutes.



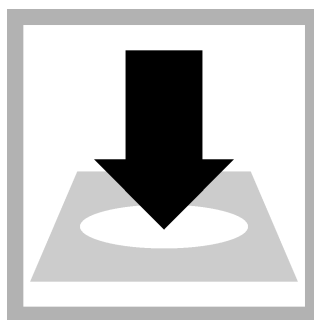
4. When the timer expires, invert the vial 2–3 times.



5. Clean the vial.



6. DR 1900 only: Select program 846. Refer to [Before starting](#) on page 1.



7. Insert the vial into the cell holder. DR 1900 only: Push **READ**. Results show in mg/L PO_4^{3-} .

Reagent blank correction

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. Measure the reagent blank value when a new lot of reagent is used.

1. Use deionized water as the sample in the test procedure to measure the reagent blank value.
2. Set the reagent blank function to on. The measured reagent blank value is shown.
3. Accept the blank value. The reagent blank value is then subtracted from all results until the reagent blank function is set to off or a different method is selected.

Note: As an alternative, record or enter the reagent blank value at a different time. Push the highlighted reagent blank box and use the keypad to enter the value.

Sample blanks

Samples with color or turbidity can cause high test results. Use an optional sample blank vial to do this procedure. To adjust for color or turbidity, use the steps that follow to find the sample blank.

1. Put the prepared sample blank vial into the instrument.
2. The correct method starts.
3. The display shows the uncorrected sample result.
4. Remove the sample vial.
5. Fill a vial with 5.0 mL of sample and 1.0 mL of deionized water.
6. Put the red stopper on the vial.
7. Put the sample blank vial with the untreated sample into the instrument. If applicable, the instrument reads the barcode and knows this is the sample blank. If the sample blank is in the permitted range, this value will automatically correct the result.
8. The instrument subtracts the sample blank from the uncorrected result.

Note: Alternately, record or enter the reagent blank at a different time. Push the highlighted reagent blank box and use the keypad to enter the value.

Note: Verify the measurement results with sample dilutions or standard additions.

Interferences

Table 2 shows that the ions were individually examined to the given concentrations and do not cause interference. No cumulative effects or influences of other ions were found. Verify the measurement results with sample dilutions or standard additions.

Table 2 Interfering substances

Interfering substance	Interference level
SO ₄ ²⁻ , Cl ⁻	1000 mg/L
K ⁺ , Na ⁺ , Ca ²⁺	500 mg/L
CO ₃ ²⁻ , Fe ²⁺ , Fe ³⁺ , NO ₃ ⁻ , Zn ²⁺ , Cu ²⁺ , Ni ²⁺ , Cr ³⁺	50 mg/L
Pb ²⁺	5 mg/L

Accuracy check

Standard solution method

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

Items to collect:

- Phosphate Standard Solution, 50-mg/L PO₄³⁻ or Wastewater Influent Standard Solution, Mixed Parameter (contains 10-mg/L PO₄³⁻)

1. Use the test procedure to measure the concentration of the standard solution.
2. 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.

Summary of Method

Phosphate ions react with vanadate-molybdate reagent to form a yellow dye. The measurement wavelength is 435 nm.

Consumables and replacement items

Required reagents

Description	Quantity/Test	Unit	Item no.
Phosphorus, Reactive TNTplus Reagent Set	1	25/pkg	TNT846

Required apparatus

Description	Quantity/test	Unit	Item no.
Pipet, adjustable volume, 1.0–5.0 mL	1	each	BBP065
Pipet tips, for 1.0–5.0 mL pipet	1	75/pkg	BBP068
Light shield, DR 3800, DR 2800, DR 2700	1	each	LZV646
Light shield, DR 3900	1	each	LZV849

Recommended standards

Description	Unit	Item no.
Phosphate Standard Solution, 50-mg/L as PO_4^{3-}	500 mL	17149
Wastewater Influent Standard Solution, Mixed Parameter, for $\text{NH}_3\text{-N}$, $\text{NO}_3\text{-N}$, PO_4 , COD, SO_4 , TOC	500 mL	2833149

Optional reagents and apparatus

Description	Unit	Item no.
Filter membrane, 0.45-micron, 25-mm	100/pkg	2514101
Hydrochloric Acid Solution, 6.0 N (1:1)	500 mL	88449
Sample blank vials for TNTplus methods	5/pkg	TNT919
Sampling bottle with cap, low density polyethylene, 500-mL	12/pkg	2087079
Sodium Hydroxide Standard Solution, 5.0 N	100 mL MDB	245032
Sulfuric Acid, concentrated, ACS	500 mL	97949
Test tube rack, polyethylene, for 13-mm OD vials, 90 holes	each	2497900



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