

# **New Technologies for Lab and Field Analysis**

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# What are the new technologies?

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## Combination of:

- **Instrumentation**
- **Digestion equipment**
- **Chemistry /methods**

# Universal platforms

- pH
- Ultra pH
- conductivity
- ORP
- Ammonia
- Fluoride



- Nitrate
- BOD
- Chloride
- Sulfate



# Ion-Sensitive Field-Effect Transistor ISFET pH Technology

- No glass bulb
- Stores dry
- Rugged
- 3 point calibration

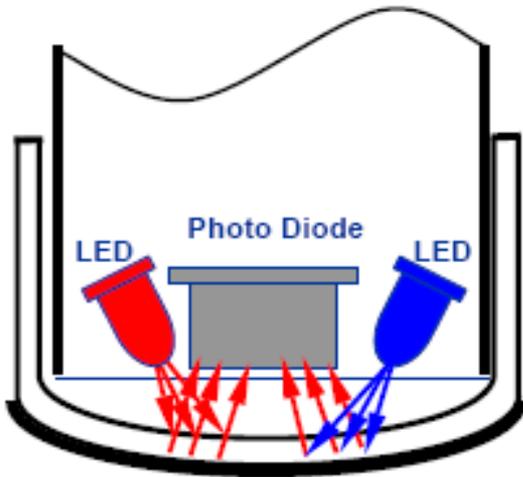


# Membrane style DO/BOD probes



© Fondriest Environmental, Inc.

# Luminescent Dissolved Oxygen



# Optical advantages

- No membrane to replace/worrying about air bubbles
- No electrolyte to foul or poison
- No polarization time (no electrodes)
- No more punctured membranes
- No anode or cathode electrode cleaning or coating
- Speed -it is up and running in 30 seconds
- Replacement parts - sensor cap and stirrer bar
- Internal barometer – \*no more elevation

# Luminescent probes for field or lab



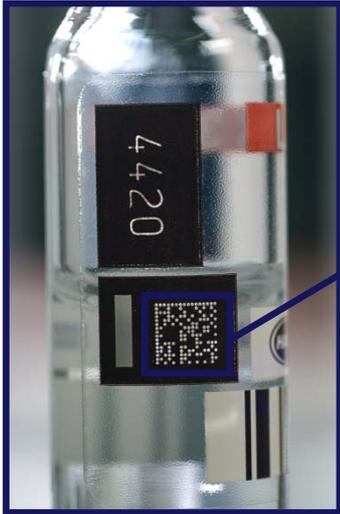
# Advancements in Spectrophotometry



# Barcode II – Easy Update

## Test Recognition

via



Information

- Test #
- Lot #
- Factors
- Expiration date
- CoA

Touchless  
Factory Update\*

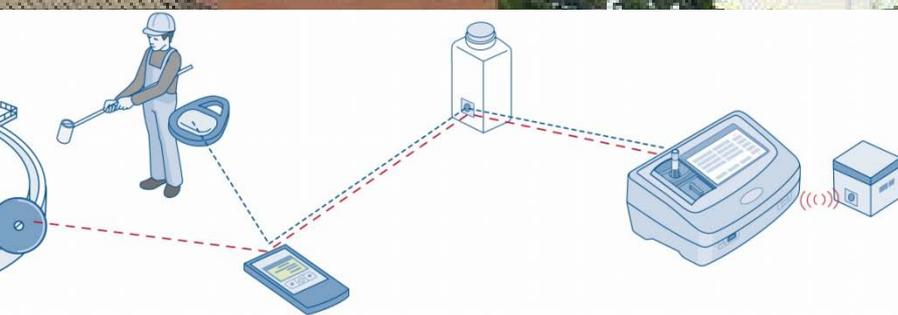
via RFID

\*only if required



# Sample ID

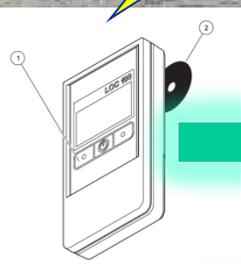
- Parameter
- Result
- Location
- Operator
- Date
- Time



1. LOC 100 (RFID Read/Write)

5. Transfer Sample ID(s) to Spectrophotometer by moving bottle close to internal reader

RFID tag on bottle



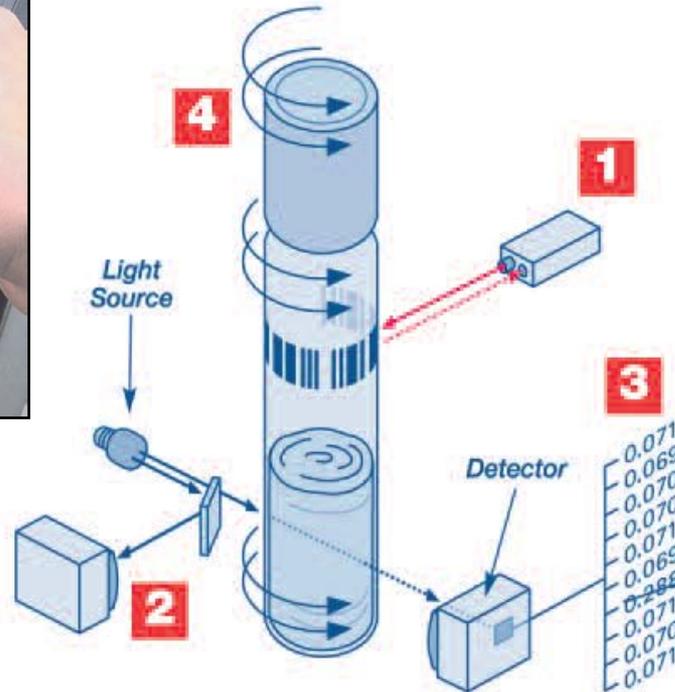
1. Read Location ID Tag
2. Read Operator ID Key Tag (optional)
3. Write Sample ID to Bottle Tag
4. Transfer Bottle to Lab
5. Read Sample ID From Bottle
6. Perform measurement On Photometer
7. Assign Sample ID to Result



# Step by step guided procedures



# Test N Tube Plus (TNT+) Chemistries



## How TNTplus Works

### 1 Barcode Recognition

Simply drop in the vial and get results immediately with automatic method detection.

### 2 Reference Detector

Monitors and compensates for optical fluctuations.

### 3 10X Measurement and Outlier Elimination

Dirty, scratched, or flawed glassware, including fingerprints, is no longer an issue—instrument averages 10 readings and rejects outliers.

### 4 Self-Contained Packaging— Reagents Inside Sealed Cap

Reduces exposure to chemicals—no need to open pillows or clean glassware.

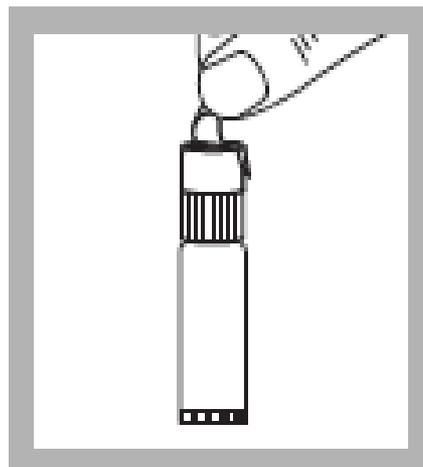
See our TNTplus video at: [www.hach.com/tntplus](http://www.hach.com/tntplus)

# Test N Tube Plus (TNT+) Chemistries

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- No blanks required
- No calibrations
- Reduces user interference
- Easy to use

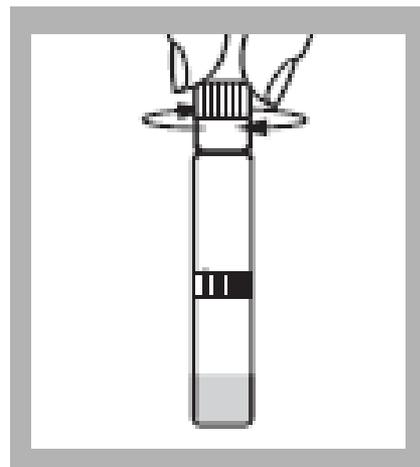
Ammonia for example...



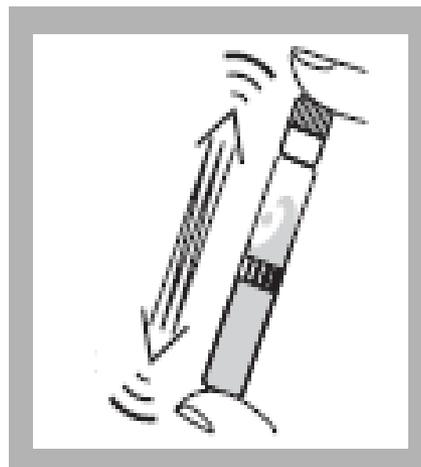
1. Carefully remove the protective foil lid from the DosiCap™ Zip. Unscrew the cap from the vial.



2. Carefully pipet 5.0 mL of sample into the vial. Immediately proceed to step 3.



3. Flip the DosiCap Zip over so that the reagent side faces the vial. Screw the cap tightly onto the vial.



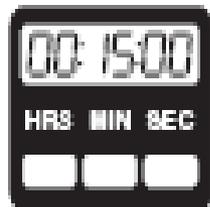
4. Shake the capped vial 2–3 times to dissolve the reagent in the cap.

Verify that the reagent has dissolved by looking down through the open end of the DosiCap Zip.

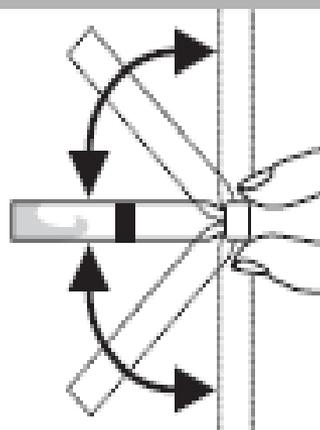
Nitrogen, Ammonia

## Nitrogen, Ammonia ULR (0.015 to 2.000 mg/L NH<sub>3</sub>-N)

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5. Wait 15 minutes.



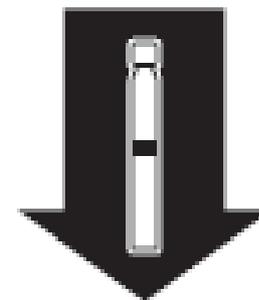
6. After 15 minutes, invert the sample an additional 2–3 times to mix.

The color remains constant for an additional 15 minutes after the timer expires.



7. Thoroughly clean the outside of the vial.

Install the Light Shield in Cell Compartment #2.



8. Insert the prepared vial into the cell holder.

The instrument reads the barcode, then selects and performs the correct test. Results are in mg/L NH<sub>3</sub>-N.

No instrument Zero is required.

# Salicylate disadvantages compared to ISE

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- Range specific reagent sets 0.1-2.0; 1-12; 2-47 vs. wide range
- Possible interferences (but not typical in most muni WWTP) vs. very few interferences
- Waste disposal vs. no waste

# Salicylate advantages compared to ISE

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- 15 minute test with no calibration curve vs. time intensive calibration procedure
- Very simple test vs. skill needed
- Good low level performance vs. slow response at levels less than 0.5 mg/L

# Test N Tube Plus (TNT +) Parameters



- NH3--EPA Equivalent
- T-Phosphorous --EPA Equivalent
- Nitrate--EPA Approved
- Nitrite--EPA Equivalent
- COD--EPA Equivalent
- s-TKN –stay tuned...
- Total Alkalinity
- Etc...
- **Always check with your state regulator when switching methods**

# Traditional vs. Simplified digestion equipment

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- **Total Phosphorous**
- COD
- Total Nitrogen
- s-TKN
- Metals

# Traditional Total P digestion



# Traditional phosphate digestion

- Add acid to sample
- Boil gently for 30 minutes. Do not boil dry!
- Concentrate sample to less than 20 mL for best recovery
- Maintain volume by adding small amounts of DI water.
- Do not exceed 20 mL
- Cool and neutralize

# New digestion equipment

- Program time and temperature.
- Insert tubes and walk away “set it and forget it!”



# Traditional Kjeldahl Nitrogen Method

- Digest sample for several hours at high temperature with sulfuric acid and metal(Hg) catalyst.
- Sample is then distilled and analyzed for ammonia



# Modified/Simplified TKN

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- **Total Nitrogen = Organic N + NO<sub>3</sub> + NO<sub>2</sub> + NH<sub>3</sub>**
- **TKN = Organic N + NH<sub>3</sub>**
- **Simplified TKN = Total N – (NO<sub>3</sub> + NO<sub>2</sub>)**

**Phosphorus, Reactive (Orthophosphate) and Total LR (0.15–4.50 mg/L PO<sub>4</sub><sup>3-</sup> or 0.05–1.50 mg/L PO<sub>4</sub>-P)**

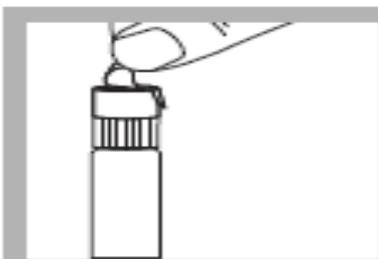
**TNTplus—Phosphorus, Total**

**Method 10210**

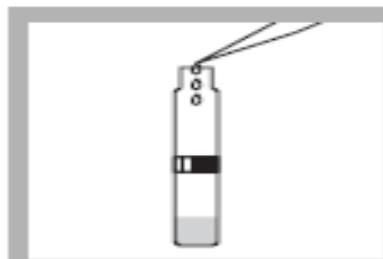


1. Turn on the DRB200 Reactor. Heat to 100 °C.

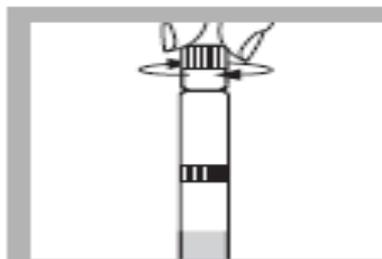
*Note: For DRB200 Reactors with 16-mm wells, insert a 16-mm to 13-mm adapter sleeve into each well before turning on the reactor.*



2. Carefully remove the protective foil lid from the DosiCap™ Zip. Unscrew the cap from the vial.



3. Carefully pipet 2.0 mL of sample into the vial.



4. Flip the DosiCap Zip over so the reagent side faces the vial. Screw the cap tightly onto the vial.

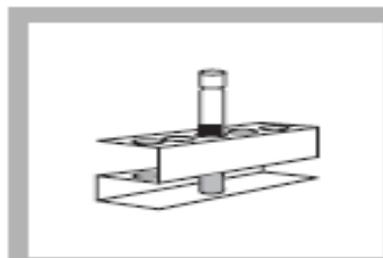


5. Shake the capped vial with 2–3 times to dissolve the reagent in the cap.

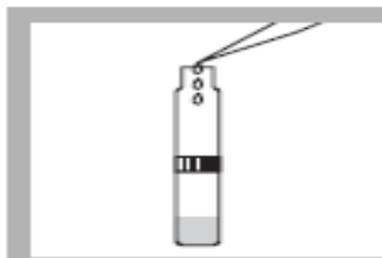
Verify that the reagent has dissolved by looking down through the open end of the DosiCap Zip.



6. Insert the vial in the DRB200 Reactor. Close the protective cover. Heat for 1 hour at 100 °C.

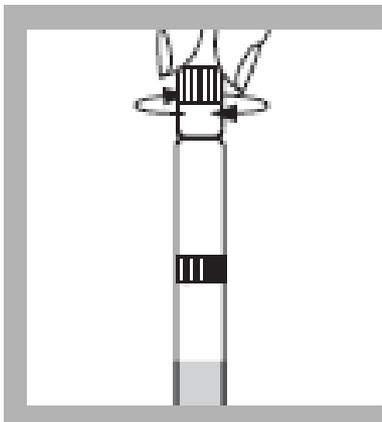


7. After the timer expires, carefully remove the hot vial from the reactor. Insert them in a test tube rack and allow to cool to room temperature (15–25 °C).

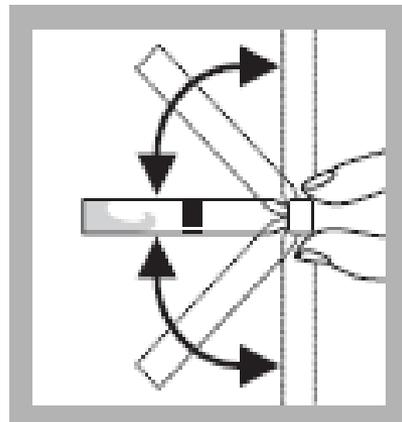


8. Pipet 0.2 mL (200 µL) of Reagent B into the cooled vial.

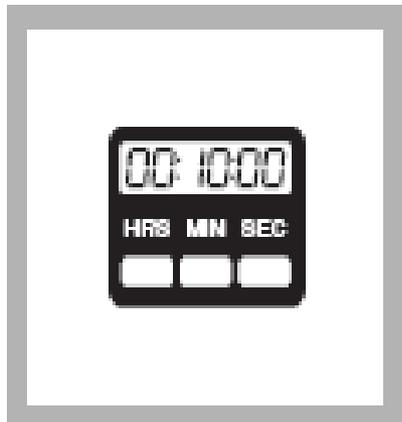
Immediately close the Reagent B container.



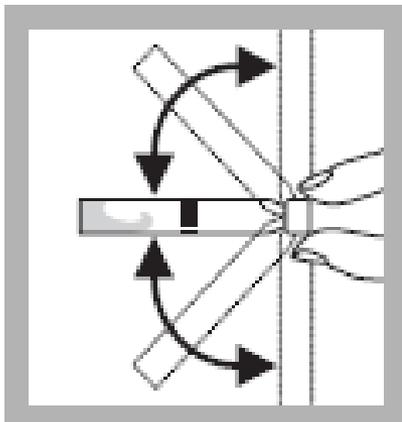
9. Screw a grey DosiCap C onto the vial.



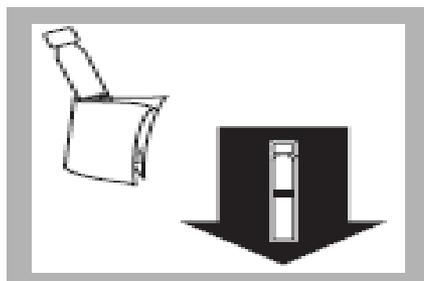
10. Invert the capped vial 2–3 times to dissolve the reagent in the DosiCap.



11. Wait 10 minutes. Install the Light Shield in Cell Compartment #2.



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



13. Clean the outside of the vial and insert it into the cell holder. The instrument reads the barcode, then selects and performs the correct test.

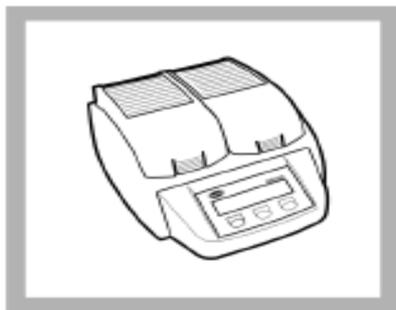
Results are in mg/L  $\text{PO}_4$ .

No instrument Zero is required.

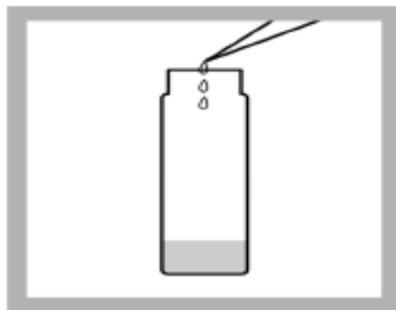
# Finally a new easier Total Kjeldahl Nitrogen method!



## s-TKN TNTplus method

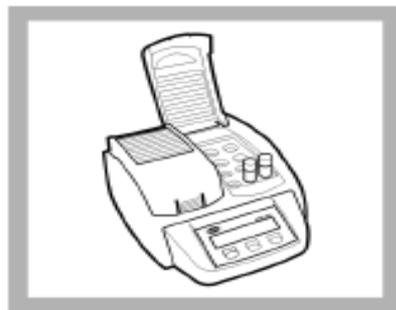


1. Turn on the DRB 200 Reactor and heat to 100 °C.



2. Add 1.3 mL of sample, 1.3 mL of **Solution A** and 1 Reagent B tablet in quick succession to a dry 20-mm reaction tube.

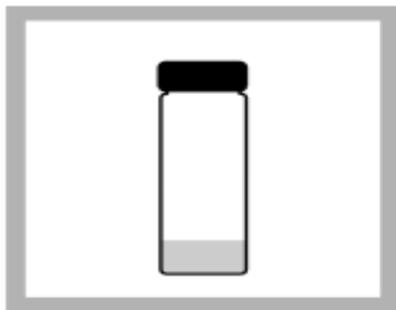
Close the reaction tube immediately. Do not invert.



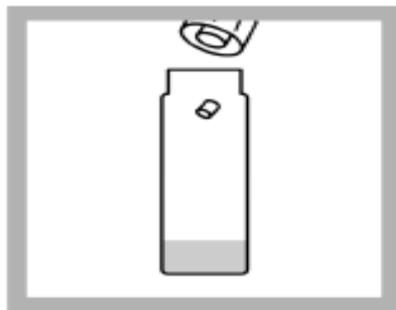
3. Insert the reaction tube in the reactor and close the lid.



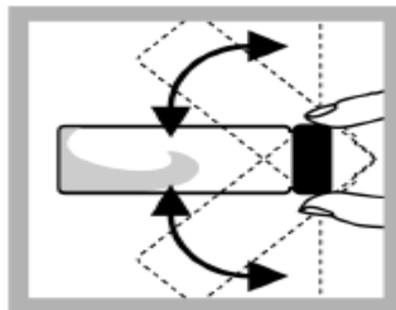
4. Heat for one hour.



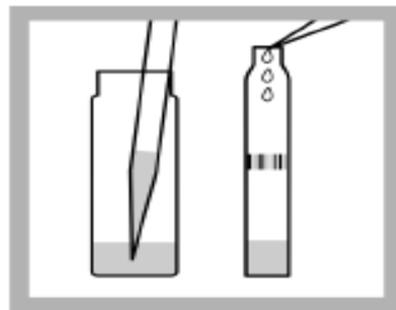
5. Remove the hot reaction tube from the reactor. Cool the reaction tube to room temperature (15–20 °C).



6. After the reaction tube has cooled, remove the cap and add 1 Micro Cap C to the tube.



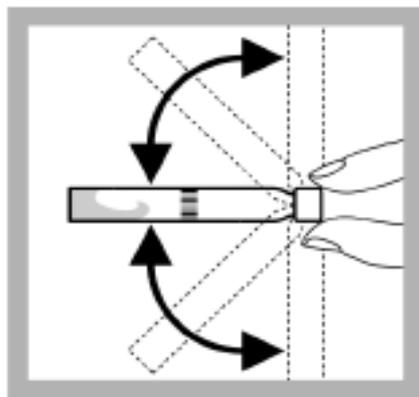
7. Cap and invert the reaction tube 2–3 times until no more streaks can be seen in the reaction tube solution.



8. Pipet 0.5 mL (500 µL) of the digested sample from the reaction tube into a Test Vial 1 (red label).

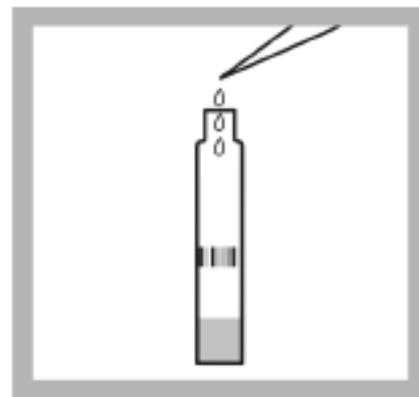


9. Pipet 0.2 mL (200  $\mu$ L) of **Solution D** into the test vial.



10. Quickly cap and invert the test vial 2–3 times until no more streaks can be seen in the vial solution.

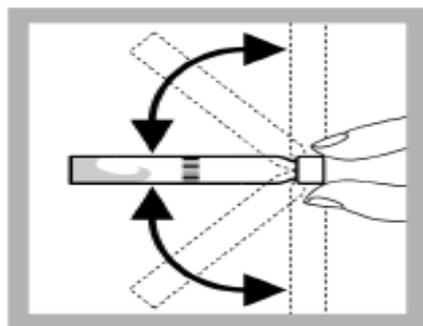
Proceed immediately to step 11.



11. Pipet 1.0 mL (1000  $\mu$ L) of **undigested sample** into a Test Vial 2 (green label).



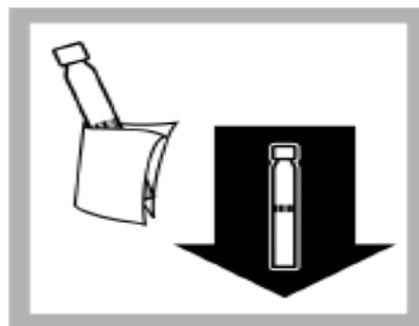
12. Pipet 0.2 mL (200  $\mu$ L) of **Solution D** into the test vial.



13. Quickly cap and invert the test vial 2–3 times until no more streaks can be seen in the vial solution.

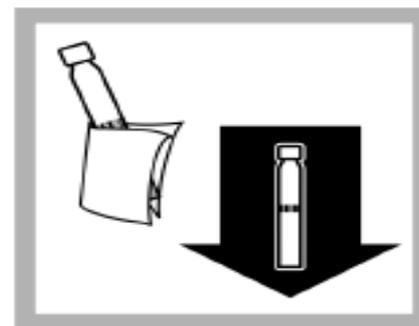


14. Wait 15 minutes.



15. After the timer expires wipe the Test Vial 1 (red label) and insert the prepared vial into the cell holder.

The instrument reads the barcode and displays E1. Proceed immediately to step 16.



16. Wipe the Test Vial 2 (green label) and insert the prepared vial into the cell holder.

The instrument reads the barcode.

Results are in mg/L Total N, mg/L  $\text{NO}_3\text{-N} + \text{NO}_2\text{-N}$ , and mg/L TKN.

# Simplified TKN(s-TKN)

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- Eliminates the use of hazardous mercury
- Reduces operating expenses with costs under \$4 per test-this
- Minimizes training and equipment requirements
- Takes ~ 1 hour total analysis time with minimal hands-on time

# CEL/890 Hydraulic Fracturing Water Analysis Kit

## Applications

- Oil & Gas
- Field Use



***Get real-time results in the field in minutes.***

*Offering on-site results in an easy-to-use, rugged, portable lab, Hach's Hydraulic Fracturing Water Analysis Kit covers parameters critical to water analysis in oil and gas applications, including source water, fracturing fluid, produced water, flowback water, water treatment, drilling fluids, and enhanced oil recovery.*

# Hydraulic Fracturing Field Test Kit

Each kit includes:

- DR890 Colorimeter
- HQ40d multimeter
- Digital titrator
- Reagents for 12 parameters
- Water analysis handbook



# Parameters

## Parameter/Range information

Parameter	Range	# of tests
Alkalinity (Phenolphthalein and Total) as CaCO <sub>3</sub>	10 - 4000 mg/L	100
Bacteria: Iron Related, Sulfate Reducing, Slime Forming	Presence/Absence; population estimation	9
Barium	0-8,000 mg/L	100
Chloride as Cl <sup>-</sup>	100-200,000 mg/L	100
Conductivity	0.01 uS/cm - 200 mS/cm	Unlimited
Hardness, Total as CaCO <sub>3</sub>	100-200,000 mg/L	100 each range
Hardness, Calcium as CaCO <sub>3</sub>	100-200,000 mg/L	100 each range
Iron, Total as Fe	0-300 mg/L	100
pH	2 – 14 units	Unlimited
Sulfate as SO <sub>4</sub>	0 -7,000 mg/L	100

- Boron can be added to the kit as well



DOC022.53.80225

# Hydraulic Fracturing Water Analysis Handbook

For use with DR/820, DR/850 or DR/890 Colorimeters

September 2011, Edition 1



# Questions

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