59577-88

POCKET COLORIMETER™ II
ANALYSIS SYSTEMS
INSTRUCTION MANUAL

Iron
Molybdenum
Ozone
Zinc

te/dk 9/06 2ed

Important Note

This manual is intended for use with the following Pocket Colorimeter II instruments:

Iron	Cat. No. 59530-16
Molybdenum	Cat. No. 59530-10
Ozone	Cat. No. 59530-04
Zinc	Cat. No. 59530-09

The Pocket Colorimeter II instruments listed above are not interchangeable.

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Table of Contents, continued

Safety Precautions

Please read this entire manual before unpacking, setting up, or operating this instrument. Pay particular attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

To ensure the protection provided by this equipment is not impaired, do not use or install this equipment in any manner other than that which is specified in this manual.

Laboratory Safety

As part of good laboratory practice, please familiarize yourself with the reagents used in these procedures. Read all product labels and the material safety data sheets (MSDS) before using them. It is always good practice to wear safety glasses when handling chemicals. Follow instructions carefully. Rinse thoroughly if contact occurs. If you have questions about reagents or procedures, please contact the manufacturer or distributor.

Use of Hazard Information

If multiple hazards exist, this manual will use the signal word (Danger, Caution, Note) corresponding to the greatest hazard.

Safety Precautions, continued

DANGER
Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION
Indicates a potentially hazardous situation that may result in minor or moderate injury.

NOTE
Information that requires special emphasis.

Precautionary Labels

Please pay particular attention to labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed.

⚠ This symbol, if noted on the instrument, references the instruction manual for operational and/or safety information.

Specifications

Lamp: Light emitting diode (LED)

Detector: Silicon photodiode

Photometric precision: ± 0.0015 Abs

Filter bandwidth: 15 nm

Wavelength: 600 nm

Absorbance range: 0–2.5 Abs

Dimensions: 3.2 x 6.1 x 15.2 cm (1.25 x 2.4 x 6 inches)

Weight: 0.2 kg (0.43 lb)

Sample cells: 25 mm (10 mL), AccuVac® Ampuls

Operating conditions: 0 to 50 °C (32 to 122 °F); 0 to 90% relative humidity (noncondensing)

Power supply: Four AAA alkaline batteries; approximate life is 2000 tests*

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* Backlight usage will decrease battery life.

OPERATION

DANGER

Handling chemical samples, standards, and reagents can be dangerous. Review the necessary Material Safety Data Sheets and become familiar with all safety procedures before handling any chemicals.

DANGER

La manipulation des échantillons chimiques, étalons et réactifs peut être dangereuse. Lire les Fiches de Données de Sécurité des Produits (FDSP) et se familiariser avec toutes les procédures de sécurité avant de manipuler tous les produits chimiques.

PELIGRO

La manipulación de muestras químicas, estándares y reactivos puede ser peligrosa. Revise las fichas de seguridad de materiales y familiarícese con los procedimientos de seguridad antes de manipular productos químicos.

GEFAHR

Das Arbeiten mit chemischen Proben, Standards und Reagenzien ist mit Gefahren verbunden. Es wird dem Benutzer dieser Produkte empfohlen, sich vor der Arbeit mit sicheren Verfahrensweisen und dem richtigen Gebrauch der Chemikalien vertraut zu machen und alle entsprechenden Materialsicherheitsdatenblätter aufmerksam zu lesen.

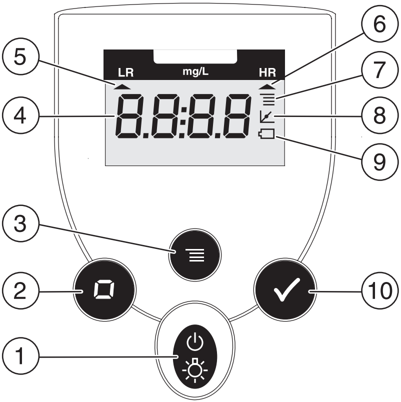
PERIGO

A manipulação de amostras, padrões e reagentes químicos pode ser perigosa. Reveja a folha dos dados de segurança do material e familiarize-se com todos os procedimentos de segurança antes de manipular quaisquer produtos químicos.

PERICOLO

La manipolazione di campioni, standard e reattivi chimici può essere pericolosa. La preghiamo di prendere conoscenza delle Schede Techniche necessarie legate alla Sicurezza dei Materiali e di abituarsi con tutte le procedure di sicurezza prima di manipolare ogni prodotto chimico.

Instrument Keys and Display



Item	Description
1	**POWER/BACKLIGHT** Key
2	**ZERO/SCROLL** Key
3	**MENU** Key
4	Numeric Display
5	Range Indicator
6	Range Indicator
7	Menu Indicator
8	Calibration Adjusted Indicator
9	Battery Low Indicator
10	**READ/ENTER** Key

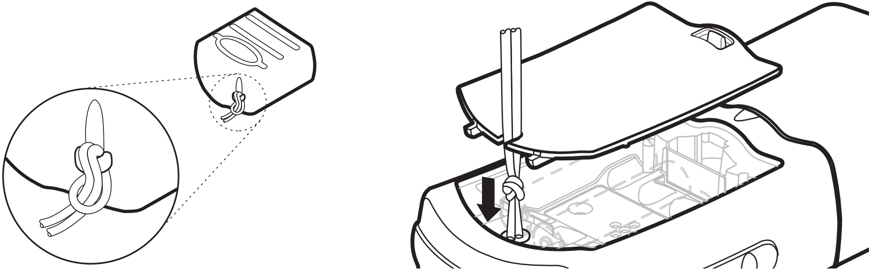
Instrument Cap Cord

The instrument cap for the Pocket Colorimeter™ II doubles as a light shield. Accurate measurements cannot be obtained unless the sample or blank is covered with the cap. Use the instrument cap cord to secure the cap to the body of the colorimeter and prevent loss of the cap. See Figure 1 on page 1—13.

1. Loop the instrument cap cord through the ring on the cap.
2. Remove the battery compartment cover. Press the knotted end of the cord into the hole indicated by the arrow.
3. Slide the cord into the slot on the battery compartment cover. Snap the cover into place.

Instrument Cap Cord, continued

Figure 1 Attaching the Instrument Cap Cord



Iron, Total (0.01 to 1.70 mg/L Fe)

Method 8112

For water, wastewater, and seawater

TPTZ Method*

Measuring Hints

- Testing generally does not require digestion, however if the sample contains particulate matter, digestion is required for total iron measurement.**
- If samples cannot be analyzed immediately, see Sampling and Storage on page 1—24.
- Wipe sample cells with a soft, dry cloth before placing in the instrument.
- After adding TPTZ reagent, a blue color will form if iron is present.

Note: *The Pocket Colorimeter™ II is designed to measure solutions contained in sample cells.* **DO NOT** *dip the meter in the sample or pour the sample directly into the cell holder.*

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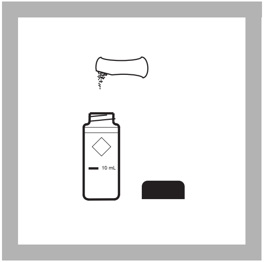
* Adapted from G. Frederic Smith Chemical Co., 1980, *The Iron Reagents*, 3rd ed.

** See the Hach *Water Analysis Handbook* for further information concerning digestions.

Using Powder Pillows

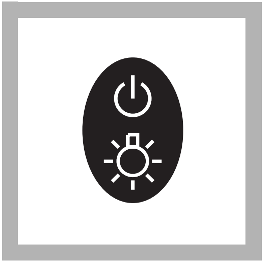
1. Fill a 10-mL cell to the 10 mL line with sample.



2. Add the contents of one Iron TPTZ Reagent Powder Pillow to the cell (the prepared sample). Cap and shake for 30 seconds.

3. Wait at least 3 minutes for full color development before completing steps 4–12.

4. Fill a second sample cell with 10 mL of sample (the blank).

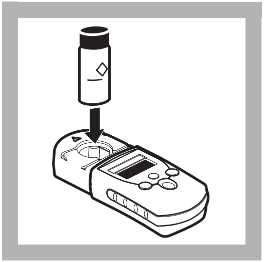


5. Press the **POWER** key to turn the meter on.

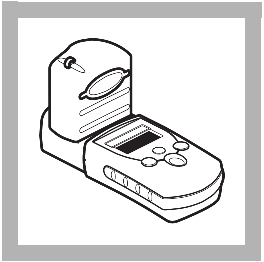
The arrow should indicate mg/L Fe.

Note: *See page 2—4 for information on selecting the correct range channel.*

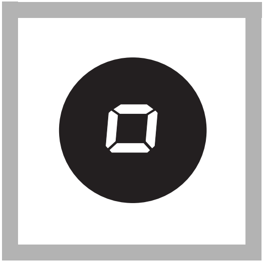
6. Wipe the sample cells free of liquid or fingerprints. Any liquid entering the sample cell compartment can cause damage to the instrument.



7. Place the blank in the cell holder.



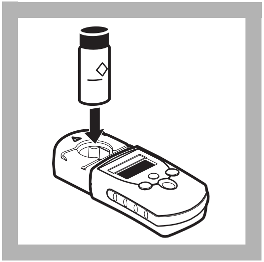
8. Cover the blank with the instrument cap.



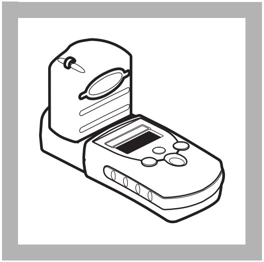
9. Press **ZERO/SCROLL**.

The display will show "- - - -" then "0.00".

Remove the blank from the cell holder.



10. Place the prepared sample in the cell holder.



11. Cover the sample cell with the instrument cap.

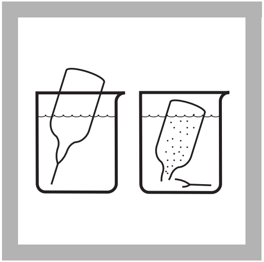
12. Press **READ/ENTER**.

The display will show "- - - -" then "0.00", followed by results in mg/L Iron.

Iron, Total, continued

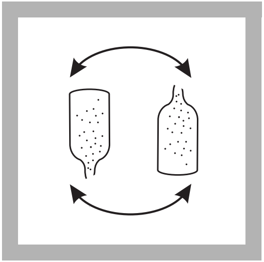
Using AccuVac® Ampuls

1. Fill a 10-mL cell to the 10 mL line with sample. Cap. Collect at least 40 mL of sample in a 50-mL beaker.



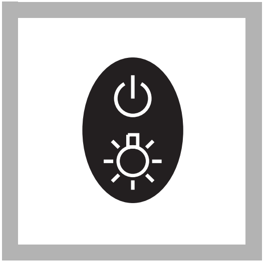
2. Fill an Iron TPTZ Reagent AccuVac Ampul with sample.

Note: *Keep the tip of the ampule immersed until the ampule fills completely.*



3. Invert the ampule several times to mix. Wipe off any liquid or fingerprints.

4. Wait at least 3 minutes for full color development before completing steps 5–12.



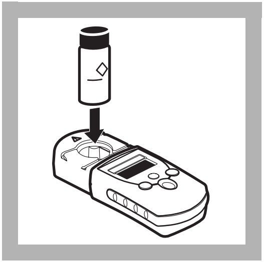
5. Press the **POWER** key to turn the meter on.

The arrow should indicate mg/L Fe.

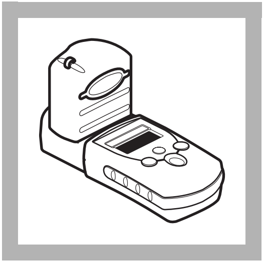
Note: *See page 2—4 for information on selecting the correct range channel.*

6. Wipe the sample cells free of liquid or fingerprints. Any liquid entering the sample cell compartment can cause damage to the instrument.

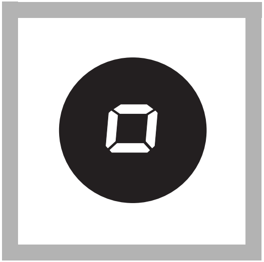
Iron, Total, continued



7. Place the blank in the cell holder.



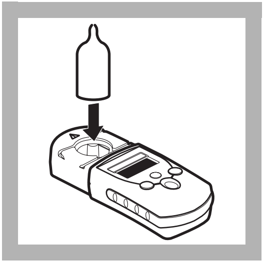
8. Cover the blank with the instrument cap.



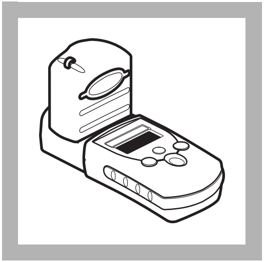
9. Press **ZERO/SCROLL**.

The display will show
“- - - -” then “0.00”.

Remove the blank from the cell holder.



10. Place the prepared sample in the cell holder.



11. Cover the sample cell with the instrument cap.

12. Press **READ/ENTER**.

The display will show "- - - -" then "0.00", followed by results in mg/L Iron.

Sampling and Storage

Collect samples in acid-washed glass or plastic bottles. Adjust the sample pH to 2 or less with Nitric Acid (about 2 mL per L). Store samples preserved in this manner up to 6 months at room temperature. If reporting only dissolved iron, filter the sample immediately after collection and before addition of nitric acid.

Before testing, adjust the pH of the stored sample to between 3 and 4 with 5.0 N Sodium Hydroxide Standard Solution. Do not exceed pH 5 as iron may precipitate.

Accuracy Check

Standard Additions Method

1. Using a graduated cylinder, measure 25.0 mL of sample into each of three 50-mL beakers.
2. Snap the neck off an Iron Standard Solution Voluette™ Ampule, 25 mg/L Fe.
3. Use a TenSette® Pipet to add 0.1, 0.2, and 0.3 mL of standard, respectively, to the three 50-mL beakers. Swirl to mix.
4. Analyze each standard addition sample as described in the procedure. The iron concentration should increase by 0.1 mg/L for each 0.1 mL of standard added.

Note: *For analysis with powder pillows, transfer only 10 mL of solution to 10-mL sample cells.*

Standard Solutions Method

Use a 1.00 mg/L Iron Standard Solution in place of the sample. Perform the Total Iron procedure. Multiparameter standards that simulate typical drinking water concentrations without dilution are available to confirm tests. See Optional Reagents on page 1—29.

Standard Calibration Adjust Method

To perform a standard calibration adjustment using the 1.0 mg/L iron standard or using an alternate concentration, see Standard Calibration Adjust on page 2—13.

Method Performance

Typical Precision (95% Confidence Interval):

1.00 ± 0.02 mg/L Fe

Estimated Detection Limit:

EDL = 0.01 mg/L Fe

Interferences

A sample pH of less than 3 or greater than 4 after the addition of reagent may inhibit color formation, cause the developed color to fade quickly or result in turbidity. Before the addition of reagent, use a pH meter or pH paper to measure the pH in the sample. Adjust the sample pH to between 3 and 8 by dropwise addition of an appropriate amount of iron-free acid or base such as 1.0 N Sulfuric Acid Standard Solution or 1.0 N Sodium Hydroxide Standard Solution. Make a volume correction if significant volumes of acid or base are used.

Interference tests were performed using an iron concentration of 0.5 mg/L. When interferences occurred, the color formation was inhibited or a precipitate formed.

The following do not interfere with the test when present up to the levels listed:

Element	Interference level	Element	Interference level
Cadmium	4.0 mg/L	Manganese	50.0 mg/L
Chromium $^{(3+)}$	0.25 mg/L	Mercury	0.4 mg/L
Chromium $^{(6+)}$	1.2 mg/L	Molybdenum	4.0 mg/L
Cobalt	0.05 mg/L	Nickel	1.0 mg/L
Copper	0.6 mg/L	Nitrite Ion	0.8 mg/L
Cyanide	2.8 mg/L		

Summary of Method

The TPTZ Iron Reagent forms a deep blue-purple color with ferrous iron. The indicator is combined with a reducing agent which converts precipitated or suspended iron, such as rust, to the ferrous state. The amount of ferric iron present can be determined as the difference between the results of a ferrous iron test and the concentration of total iron.

Reagents and Apparatus

Required Reagents (Using Powder Pillows)

Description	Quantity Per Test	Unit	Cat. No.
TPTZ Iron Reagent Powder Pillows, 10 mL size	2 pillows	100/pkg	26087-99

Required Reagents (Using AccuVac® Ampuls)

Description	Quantity Per Test	Unit	Cat. No.
TPTZ Low Range Iron Reagent AccuVac® Ampuls	1 ampul	25/pkg	25100-25

Required Apparatus (Using AccuVac® Ampuls)

Description	Quantity Per Test	Unit	Cat. No.
Beaker, 50 mL	1	each	500-41H

Optional Reagents

Description	Unit	Cat. No.
Hydrochloric Acid Solution, 1:1 6.0 N	500 mL	884-49
Iron Standard Solution, 1 mg/L Fe	500 mL	139-49
Iron Standard Solution Voluette™ Ampules, 25 mg/L Fe, 10 mL	16/pkg	14253-10
Nitric Acid, ACS	500 mL	152-49
Nitric Acid Solution, 1:1	500 mL	2540-49
Sodium Hydroxide Standard Solution, 1.0 N	100 mL MDB	1045-32
Sodium Hydroxide Standard Solution, 5.0 N	100 mL MDB	2450-32
Drinking Water Quality Control Standard, mixed parameter (copper, iron, and manganese	500 mL	28337-49
Sulfuric Acid Standard Solution, 1.000 N	100 mL MDB	1270-32
Water, deionized	4 L	272-56

Optional Apparatus

Description	Unit	Cat. No.
AccuVac® Snapper	each	24052-00
Beaker, 50 mL	each	500-41H
Cylinder, graduated 25 mL	each	1081-40
Dropper, graduated, 0.5 and 1.0 mL marks	10/pkg	21247-20
pH Indicator Paper, 1 to 11 pH	5 rolls/pkg	391-33
sension™1 Basic Portable pH Meter, with electrode	each	51700-10
Pipet Filler, safety bulb	each	14651-00
Pipet, serological, 2 mL	each	532-36
Pipet TenSette®, 0.1 to 1.0 mL	each	19700-01
Pipet Tips, for 19700-01 TenSette® Pipet	50/pkg	21856-96

Replacement Parts

Description	Unit	Cat. No.
Batteries, alkaline	4/pkg	46743-00
Instrument Cap/light shield	each	59548-00
Instruction Manual	each	59577-88
Sample Cells, 10-mL, with caps	6/pkg	24276-06

Molybdenum, Molybdate, LR (0.02 to 3.00 mg/L Mo)

Method 8169

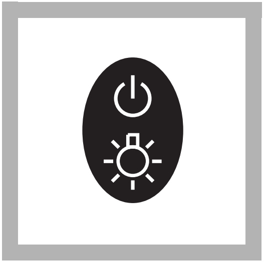
For boiler and cooling tower waters

Ternary Complex Method

Measuring Hints

- The results can be expressed as mg/L molybdate (MoO_4^{2-}) or mg/L sodium molybdate ($NaMoO_4$) by multiplying the mg/L molybdenum (Mo^{6+}) result by 1.67 or 2.15, respectively.
- Wipe sample cells with a soft, dry cloth before placing in the instrument.
- After adding reagent, a green color will develop if molybdenum is present in the sample.

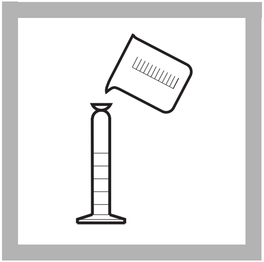
Note: *The Pocket Colorimeter™ II is designed to measure solutions contained in sample cells.* **DO NOT** *dip the meter in the sample or pour the sample directly into the cell holder.*



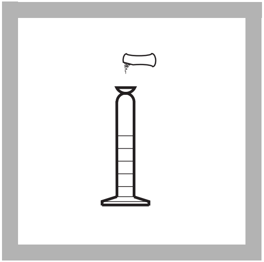
1. Press the **POWER** key to turn the meter on.

The arrow should indicate the low range channel (LR).

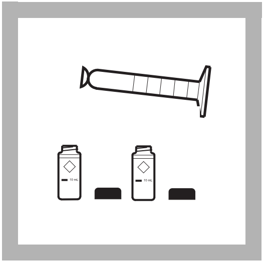
Note: *See page 2—4 for information on selecting the correct range channel.*



2. Fill a 25-mL mixing graduated cylinder to the 20-mL mark with sample.



3. Add the contents of one Molybdenum 1 Reagent Powder Pillow to the cylinder. Stopper the cylinder and invert or gently shake until all particles are dissolved.

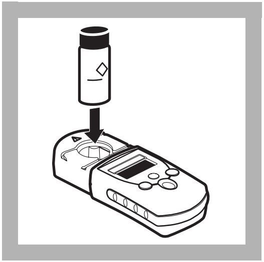


4. Split the sample by filling two 10-mL sample cells to the 10-mL mark. Cap one of the cells, this is the blank.

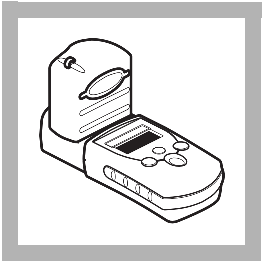
Note: *Exactly 10 mL is not critical for the blank. Make sure the other cell contains 10 mL.*

5. Using the calibrated dropper, add 0.5 mL of Molybdenum 2 to the sample in the uncapped 10-mL cell. Cap the cell and swirl to mix. Wait two minutes for full color development.

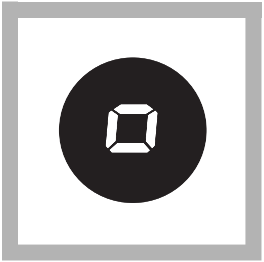
6. Wipe the sample cells free of liquid. Any liquid entering the sample cell compartment can cause damage to the instrument.



7. Place the blank in the cell holder.



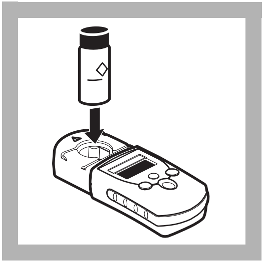
8. Cover the blank with the instrument cap.



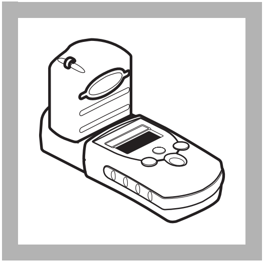
9. Press **ZERO/SCROLL**.

The display will show "- - - -" then "0.00".

Remove the blank from the cell holder.



10. Place the prepared sample in the cell holder.



11. Cover the sample cell with the instrument cap.

12. Press **READ/ENTER**.

The display will show "- - - -" then "0.00", followed by results in mg/L Molybdenum.

Sampling and Storage

See Sampling and Storage on page 1—42.

Accuracy Check

See Accuracy Check on page 1—42.

Interferences

See Interferences on page 1—44.

Summary of Method

See Summary of Method on page 1—47.

Replacement Parts

Replacement Parts on page 1—49

Molybdenum, Molybdate, HR (0.1 to 12.0 mg/L Mo)

Method 8169

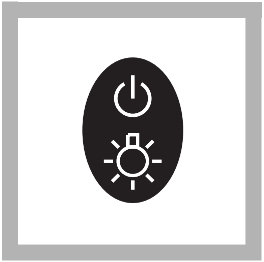
For boiler and cooling tower waters

Ternary Complex Method

Measuring Hints

- The results can be expressed as mg/L molybdate (MoO_4^{2-}) or mg/L sodium molybdate ($NaMoO_4$) by multiplying the mg/L molybdenum (Mo^{6+}) result by 1.67 or 2.15, respectively.
- Wipe sample cells with a soft, dry cloth before placing in the instrument.
- After adding reagent, a green color will develop if molybdenum is present in the sample.

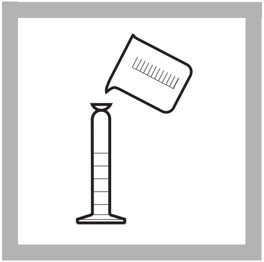
Note: *The Pocket Colorimeter™ II is designed to measure solutions contained in sample cells.* **DO NOT** *dip the meter in the sample or pour the sample directly into the cell holder.*



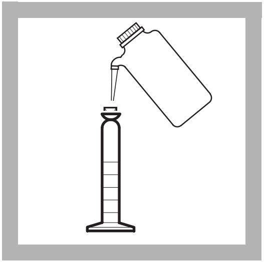
1. Press the **POWER** key to turn the meter on.

The arrow should indicate the high range channel (HR).

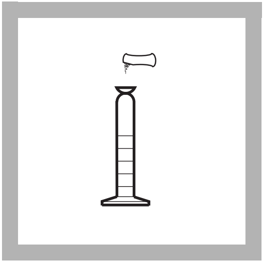
Note: *See page 2—4 for information on selecting the correct range channel.*



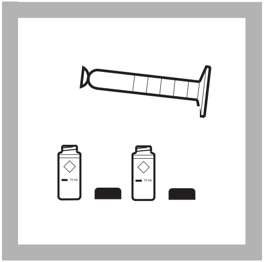
2. Fill a 25-mL mixing graduated cylinder to the 5-mL mark with sample.



3. Dilute to the 20-mL mark with deionized water.



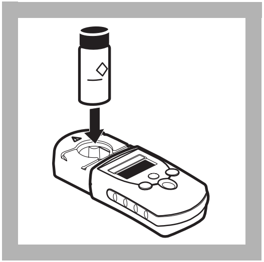
4. Add the contents of one Molybdenum 1 Reagent Powder Pillow to the cylinder. Stopper the cylinder and invert or gently shake until all particles are dissolved.



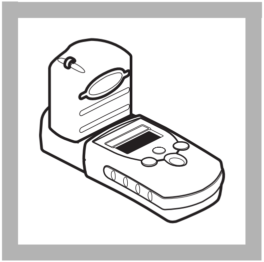
5. Split the sample by filling two 10-mL sample cells to the 10-mL mark. Cap one of the cells, this is the blank.

6. Using the calibrated dropper, add 0.5 mL of Molybdenum 2 to the sample in the uncapped 10-mL cell. Cap the cell and swirl to mix. Wait two minutes for full color development.

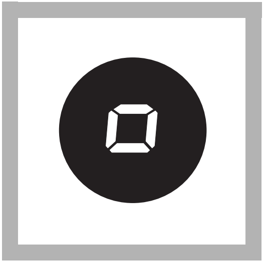
7. Wipe the sample cells free of liquid. Any liquid entering the sample cell compartment can cause damage to the instrument.



8. Place the blank in the cell holder.



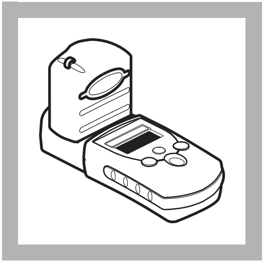
9. Cover the blank with the instrument cap.



10. Press **ZERO/SCROLL**.

The display will show "- - -" then "0.0".

Remove the blank from the cell holder.



11. Place the prepared sample in the cell holder. Cover the sample cell with the instrument cap.

12. Press **READ/ENTER**.

The display will show "- - - -" then "0.00", followed by results in mg/L Molybdenum.

Sampling and Storage

Collect samples in glass or plastic bottles.

Accuracy Check

Standard Additions Method

1. Snap the neck off a Molybdenum Standard Solution as Mo 75 mg/L Voluette® ampule.
2. Use a TenSette® Pipet to add 0.1 mL, 0.2 mL, and 0.3 mL of standard, respectively, to three 20-mL samples. Mix each thoroughly.
3. Analyze each sample as described above. The molybdenum concentration should increase approximately 0.38 mg/L for the low range and 1.6 mg/L for the high range for each 0.1 mL of standard added.

Standard Solutions Method

For the Low Range, use Class A glassware to prepare a 2.00-mg/L molybdenum standard solution by pipetting 10.00 mL of Molybdenum Standard Solution, 10.00-mg/L, into a 50-mL volumetric flask. Dilute to the mark with deionized water. For the High Range, use the 10.0 mg/L standard directly. Dilute to the mark with deionized water. Prepare this solution daily. Perform the molybdenum procedure.

Method Performance

Typical Precision (95% Confidence Interval):

2.00 ± 0.02 mg/L Mo (LR)

10.0 ± 0.1mg/L Mo (HR)

Estimated Detection Limit:

EDL = 0.02 mg/L Mo LR

EDL = 0.1 mg/L Mo HR

Standard Calibration Adjust Method

To perform a standard calibration adjustment using the 2.00 and 10.0 molybdenum standard or using an alternate concentration, see Standard Calibration Adjust on page 2—13.

Interferences

Interference studies were conducted by preparing a molybdenum standard solution (2 mg/L Mo^{6+}) as well as a solution of the potential interfering ion. When the standard solution concentration changed by ± 5% with a given ion concentration, the ion was considered an interference.

Large interferences are caused by some biocides common to cooling water tower samples. Hach recommends testing the procedure on molybdenum standards in the presence of the specific biocides in use to determine the feasibility of the ternary complex chemistry.

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Negative Interference:

Ion	Interferes at (mg/L):	Ion	Interferes at (mg/L):
Acrylates	790	Diethanoldithiocarba-mate	32
Alum	7	EDTA	1500
Aluminum	2	Ethylene Glycol	2% (by volume)

Negative Interference: (Continued)

Ion	Interferes at (mg/L):
AMP (Phosphonate)	15
Bicarbonate	5650
Bisulfite	3300
Borate	5250
Chloride	1400
Chromium (Cr^{6+})	4.51
Copper	98
Iron	200
Lignin Sulfonate	105
Nitrite	350[1]
Orthophosphate	4500
Phosphonohydroxyacetic acid	32
Sulfite	6500

[1] Read the molybdenum concentration immediately after the 2-minute reaction period has ended.

Positive Interference:

Ion	Highest Concentration Tested (mg/L):
Benzotriazole	210
Carbonate	1325
Silica	600

No Interference:

Ion	Highest Concentration Tested (mg/L):	Ion	Highest Concentration Tested (mg/L):
Bisulfate	9600	Nickel	250
Calcium	720	PBTC (phosphonate)	500
Chlorine	7.5	Sulfate	12800
Magnesium	8000	Zinc	400
Manganese	1600		

The presence of the phosphonate HEDP at concentrations up to 30 mg/L will increase the apparent molybdenum concentration reading by approximately 10%

(positive interference). For these samples, multiply the value obtained in the final step of the procedure by 0.9 to obtain the actual molybdenum concentration. As the concentration of HEDP increases above 30 mg/L, a decrease in the molybdenum concentration reading occurs (negative interference).

Highly buffered samples or extreme sample pH may exceed the buffering capacity of the reagent and require sample pretreatment. Adjust the sample pH to between 3 and 5 by using a pH meter or pH paper and add, drop-wise, an appropriate amount of acid or base such as 1.0 N Sulfuric Acid Standard Solution or 1.0 N Sodium Hydroxide Solution. If significant volumes of acid or base are used, a volume correction should be made. Divide the total volume (sample + acid + base) by the original volume and multiply the test result by this factor.

After several samples have been analyzed, the sample cells may exhibit a slightly blue buildup. Eliminate buildup with a rinse of Hydrochloric Acid Solution, 1:1.

Summary of Method

Molybdate is determined with the ternary complex method by the reaction of molybdate molybdenum with an indicator and a sensitizing agent yielding a stable blue complex. While molybdate (MoO_4^{2-}) is the actual chemical species involved in the chemistry, the instrument displays the result as molybdenum, Mo.

Required Reagents

Description	Unit	Cat. No.
Molybdenum, Molybdate Reagent Set, 20-mL sample	100 tests	24494-00

Includes:

Molybdenum 1 Reagent Powder Pillow, 100/pkg

Molybdenum 2 Reagent Solution, 50 mL

Optional Reagents

Description	Unit	Cat. No.
Hydrochloric Acid Solution, 1:1, 6.0 N	500 mL	884-49
Molybdenum Standard Solution, 10 mg/L as Mo	100 mL	14187-42
Sodium Hydroxide Standard Solution, 1.000 N	100 mL MDB	1045-32

Optional Reagents, continued

Description	Unit	Cat. No.
Sulfuric Acid Standard Solution, 1.000 N	100 mL MDB	1270-32
Water, deionized	4 L	272-56

Optional Apparatus

Cylinder, mixing, 25-mL	each	20886-40
Funnel, poly, 65-mm	each	1083-67
Filter paper, folded, 12.5-cm	pkg/100	1894-57
Flask, volumetric, 50-mL	each	14574-41
Pipet, TenSette®, 0.1 to 1.0-mL	each	19700-01
Pipet, volumetric, 10-mL, Class A	each	14515-38
Pipet Filler, safety bulb	each	14651-00
Pipet Tips, TenSette® (for 19700-01)	pkg/50	21856-96

Replacement Parts

Batteries, alkaline, AAA	pkg/4	46743-00
Instrument Cap/light shield	each	59548-00
Instruction Manual	each	59577-88
Sample Cells, 10-mL, with caps	pkg/6	24276-06

Ozone (0.01 to 0.25 mg/L O_3—LR and 0.01 to 0.75 mg/L O_3—MR)

For water **Method 8311**

Indigo Method (Using AccuVac® Ampuls)*

Measuring Hints

- Ozone sample cannot be stored, they must be analyzed immediately to avoid ozone loss.
- For best results, clean collection containers after each use.
- If the ozone concentration exceeds the upper limit of the test, the color will not develop properly. The display will show "overrange" (flashing) when the concentration is exceeded.
- If the reading is over 0.25 mg/L using the low range, repeat the test using mid-range ampules and the mid-range of the instrument. If the concentration is over 0.75 mg/L, dilute the sample with high quality water that is ozone-free and repeat the test. Multiply the result by the appropriate dilution factor. Some loss of ozone may occur during dilution.

Note: *The Pocket Colorimeter™ II is designed to measure solutions contained in sample cells.* ***DO NOT*** *dip the meter in the sample or pour the sample directly into the cell holder.*

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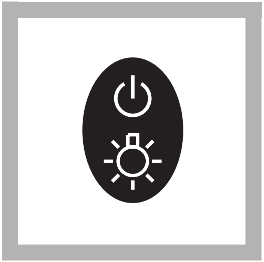
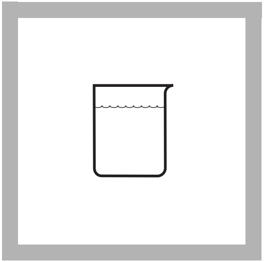
* Adapted from *Standard Methods for the Examination of Water and Wastewater*.



1. Press the **POWER** key to turn the meter on.

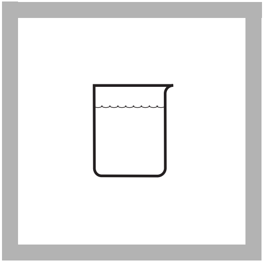
The arrow should indicate LR when using the Low Range ampules or should indicate MR when using the mid-range ampules.

Note: *See page 2—4 for information on selecting the correct range channel.*



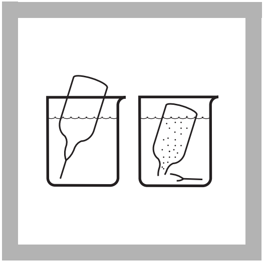
2. Gently collect at least 40 mL of sample in a 50-mL beaker.

Note: *Samples must be analyzed immediately and cannot be preserved for later analysis.*



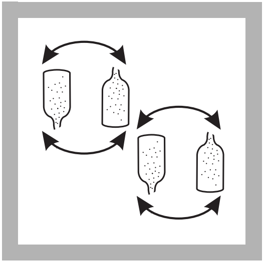
3. Collect at least 40 mL of ozone-free water (blank) in another 50-mL beaker.

Note: *Ozone-free water used for the blank may be deionized or tap water if samples do not contain significant color or turbidity.*



4. Fill one Indigo Ozone Reagent AccuVac Ampul of the appropriate range with the sample and another ampule with the blank.

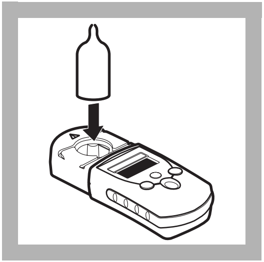
Keep the tip immersed while the ampule fills completely.



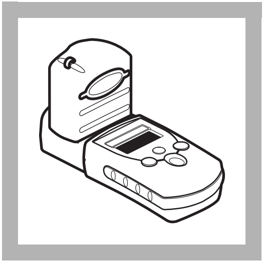
5. Gently but quickly invert both ampules several times to mix. Wipe off any liquid or fingerprints.

Note: *Do not shake the ampules. Shaking will result in a loss of ozone.*

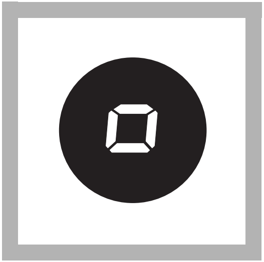
Note: *Part of the blue color will be bleached if ozone is present.*



6. Place the blank in the cell holder.



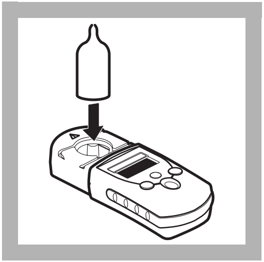
7. Cover the blank with the instrument cap.



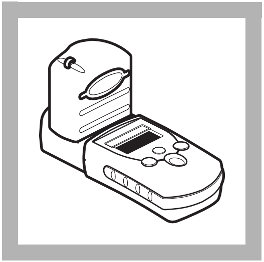
8. Press **ZERO/SCROLL**.

The display will show "- - - -" then "0.00".

Remove the blank from the cell holder.



9. Place the prepared sample into the cell holder.



10. Cover the sample cell with the instrument cap.

11. Press **READ/ENTER**.

The display will show "- - - -" then "0.00", followed by results in mg/L Ozone (O_3).

Sampling and Storage

The main consideration when collecting a sample is preventing the escape of ozone from the sample. The sample should be collected gently and analyzed immediately. Warming the sample or disturbing the sample by stirring or shaking will result in ozone loss. After collecting the sample, do not transfer it from one container to another unless absolutely necessary.

Stability of Indigo Reagent

Indigo is light-sensitive. Therefore, the AccuVac Ampuls should be kept in the dark at all times. However, the indigo solution decomposes slowly under room light after filling with sample. The blank ampule can be used for multiple measurements during the same day.

Accuracy Check

Standard solutions for ozone are difficult and time-consuming to prepare. Errors can occur if proper attention to details is not taken while preparing the standards. The manufacturer prepares the calibration curve under rigorous analytical laboratory conditions and recommends using the factory calibration.

A user calibration or a user-prepared ozone standard may be required by a regulatory official or agency. Two options are available on the Pocket Colorimeter II to meet this requirement.

An ozone standard may be prepared and used to validate the calibration curve using the Standard Calibration Adjust feature (see Standard Calibration Adjust on page 2—13). The concentration of the prepared standard must be determined with an alternate instrument such as a spectrophotometer, colorimeter, amperometric titration or by an alternate method. The concentration of the ozone standard for the Low Range procedure must be between 0.10 and 0.20 mg/L ozone and between 0.30 and 0.70 mg/L ozone for the mid-range procedure.

In addition, a user-generated calibration curve can be made and programmed into the Pocket Colorimeter II. See User-Entered Calibration on page 2—15.

Spec√™ Secondary Standards for Instrument Verification

(Mid-range Only)

Note: *Due to improvements in the optical system of the Pocket Colorimeter™ II, the tolerance ranges and values on the Certificate of Analysis of previously purchased Spec√ standards may no longer be valid. Obtain a new set of standards, or use the Pocket Colorimeter II to assign new values to existing standards.*

Spec√ Secondary Standards are available to quickly check the repeatability of the Pocket Colorimeter II instrument. After initial measurements for the Spec√ standards are collected, the standards can be re-checked as often as desired to ensure the instrument is working consistently.

The standards do not ensure reagent quality nor do they ensure the accuracy of the test results. Analysis of real standard solutions using the kit reagents is required to verify the accuracy of the entire Pocket Colorimeter system. The Spec√ Standards should *NEVER* be used to calibrate the instrument. The certificate of analysis lists the expected value and tolerance for each Spec√ Standard.

Note: *Before proceeding, make sure the instrument is in the mid-range (MR). See Switching Ranges on page 2—4.*

Using the Spec√ Standards

1. Place STD 1 into the cell holder with the alignment mark facing the keypad. Tightly cover the cell with the instrument cap.
2. Press **ZERO**. The display will show “0.00”.
3. Place the blank cell into the cell holder. Tightly cover the cell with the instrument cap.
4. Press **READ/ENTER**. Record the concentration measurement.

5. Repeat steps 1– 4 with cells labeled STD 2 and STD 3.
6. Compare these measurements with previous measurements to verify the instrument is performing consistently. (If these are the first measurements, record them for comparison with later measurements.)

Note: *If the instrument is user-calibrated, initial standard measurements of the Spec√ Standards will need to be performed again for the user calibration.*

Summary of Method

The reagent formulation adjusts the sample pH to 2.5 after the ampule has filled. The indigo reagent reacts immediately and quantitatively with ozone.

The blue color of indigo is bleached in proportion to the amount of ozone present in the sample. Other reagents in the formulation prevent chlorine interference. No transfer of sample is necessary in the procedure. Therefore, ozone loss due to sampling is eliminated.

Reagents and Apparatus

Required Reagents

Select one or both based on sample range:

Description	Unit	Cat. No.
Low Range Ozone AccuVac® Ampuls, 0 to 0.25 mg/L	25/pkg	25160-25
Mid-Range Ozone AccuVac® Ampuls, 0 to 0.75 mg/L	25/pkg	25170-25

Required Apparatus (Using AccuVac® Ampuls)

Description	Unit	Cat. No.
Beaker, 50 mL	each	500-41H

Optional Reagents

Description	Unit	Cat. No.
Spec√ Secondary Standards, Ozone, mid-range		27080-00

Replacement Parts

Description	Unit	Cat. No.
Batteries, alkaline	4/pkg	46743-00
Instrument Cap/light shield	each	46704-00
Instruction Manual	each	59577-88

Zinc (0.02 to 3.00 mg/L Zn)

For water and wastewater **Method 8009**

Zincon Method* USEPA Approved for wastewater (digestion required)**

Measuring Hints

Caution! The reagent used in step 3 contains cyanide and is very poisonous if taken internally or if the vapors are inhaled. Do not add to a sample with a pH of less than 4. See Sampling and Storage for pH adjustment.

- Testing for non-reporting purposes generally does not require sample digestion. However, if the sample contains particulate matter, digestion is required for total zinc measurement.
- Use only glass stoppered cylinders in the procedure.
- Wipe sample cells with a soft, dry cloth before placing in the instrument.

Note: *The Pocket Colorimeter™ II is designed to measure solutions contained in sample cells.* **DO NOT** *dip the meter in the sample or pour the sample directly into the cell holder.*

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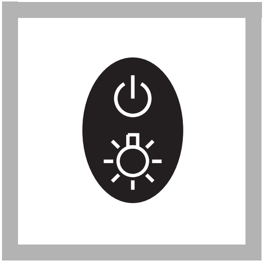
* Adapted from *Standard Methods for the Examination of Water and Wastewater*, 15th ed. 244 (1980).

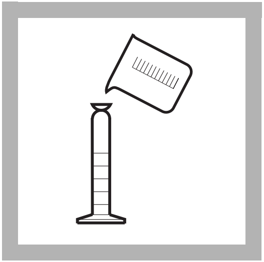
** *Federal Register*, 45(105) 36166 (May 29, 1980). See the Hach *Water Analysis Handbook* for further information concerning digestions.



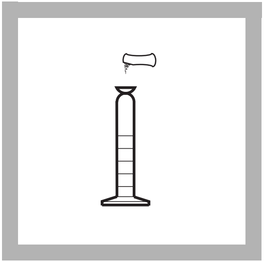
1. Press the **POWER** key to turn the meter on.

The arrow should indicate mg/L Zn.

Note: *See page 2—4 for information on selecting the correct channel.*

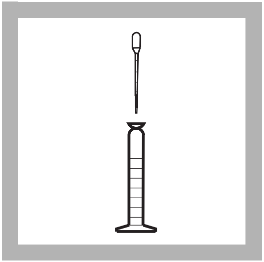


2. Fill a 25-mL mixing graduated cylinder to the 20-mL mark with sample.



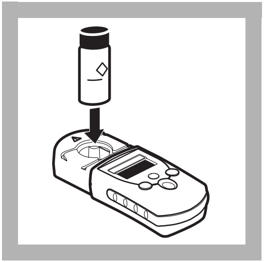
3. Add the contents of one ZincoVer® 5 Reagent Powder Pillow to the cylinder. Stopper the cylinder and invert or gently shake until all particles are dissolved.

4. Measure 10 mL of the solution into a 10-mL sample cell (the blank) leaving exactly 10 mL in the mixing cylinder.

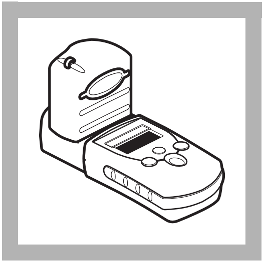


5. Use the calibrated dropper to add 0.5 mL of cyclohexanone to the sample remaining in the mixing cylinder. Stopper and shake for 30 seconds. Wait three minutes but no longer than 15 minutes for full color development before performing step 6.

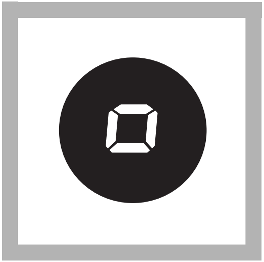
6. Fill a clean 10-mL sample cell to the 10-mL mark with the solution in the mixing cylinder. This is the prepared sample.



7. Place the blank in the cell holder.



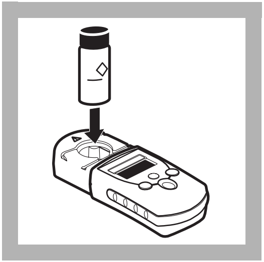
8. Cover the blank with the instrument cap.



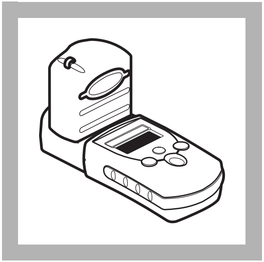
9. Press **ZERO/SCROLL**.

The display will show "- - - -" then "0.00".

Remove the blank from the cell holder.



10. Place the prepared sample in the cell holder.



11. Cover the sample cell with the instrument cap.

12. Press **READ/ENTER**.

The display will show “- - - -” then “0.00”, followed by the results in mg/L Zn.

Sampling and Storage

Collect sample in acid-washed plastic or glass bottles. For storage, adjust the pH to 2 or less with nitric acid (about 2 mL per liter). The preserved samples can be stored for up to six months at room temperature. Adjust the pH to between 4 to 5 with 5.0 N Sodium Hydroxide before analysis. Never add the reagent to samples with pH less than 4. Do not exceed pH 5, as zinc may be lost as a precipitate.

Accuracy Check

Standard Additions Method

1. Snap the neck off a Zinc Standard Solution Voluette® Ampule, 25 mg/L.
2. Use a TenSette® Pipet to add 0.1 mL, 0.2 mL and 0.3 mL of standard, respectively, to three 25-mL samples. Mix each thoroughly.
3. Analyze 20 mL of each sample as described above. The zinc concentration should increase 0.1 mg/L for each 0.1 mL of standard added.

Standard Solution Method

Prepare a 2.00 mg/L zinc standard by diluting 2.00 mL of Zinc Standard Solution, 100 mg/L as Zinc, to 100 mL. Use volumetric pipets and flasks. Perform the procedure as described above.

Method Performance

Typical Precision (95% Confidence Interval):

2.00 ± 0.08 mg/L Zn

Estimated Detection Limit:

EDL = 0.02 mg/L Zn

Standard Calibration Adjust Method

To perform a standard calibration adjustment using the 2.00 mg/L zinc standard, or to use an alternative concentration, see Standard Calibration Adjust on page 2—13.

Interferences

The following may interfere when present in concentrations exceeding those listed:

Aluminum	6 mg/L	Iron (ferric)	7 mg/L
Cadmium	0.5 mg/L	Manganese	5 mg/L
Copper	5 mg/L	Nickel	5 mg/L

Large amounts of organic material may interfere. Digest the sample to eliminate this interference. Highly buffered samples or extreme sample pH may exceed the buffering capacity of the reagents and require sample pretreatment.

Waste Management

ZincoVer 5 reagent contains potassium cyanide. Cyanide solutions are regulated as hazardous wastes by the Federal RCRA. Cyanide should be collected for disposal as a reactive (D003) waste. Be sure that cyanide solutions are stored in a caustic solution with pH >11 to prevent release of hydrogen cyanide gas.

Summary of Method

Zinc and other metals in the sample are complexed with cyanide. The addition of cyclohexanone causes a selective release of zinc. The zinc then reacts with 2-carboxy-2'-hydroxy-5'-sulfoformazyl benzene (Zincon) indicator to form a blue-colored species. The blue color is masked by the brown color from the excess indicator. The intensity of the blue color is proportional to the amount of zinc present.

Reagents and Apparatus

Required Reagents

Description	Cat. No.
Zinc Reagent Set (100 tests)	24293-00
Includes:	
(1) Cyclohexanone, 100 mL MDB	
(1) ZincoVer® 5 Reagent Powder Pillows, 100/pkg	

Required Apparatus

Description	Unit	Cat. No.
Cylinder, graduated mixing, 25-mL	each	20886-40

Optional Reagents

Description		Cat. No.
Hydrochloric Acid, 6.0 N	500 mL	884-49
Nitric Acid, 1:1	500 mL	2540-49
Sodium Hydroxide Standard Solution, 5.0 N	59 mL SCDB	2450-26
Water, deionized	4 L	272-56
Zinc Standard Solution, 100 mg/L	100 mL	2378-42
pH Indicator paper, 1-11 pH	5 rolls/pkg	391-33
Zinc Standard Solution Voluette® Ampules, 25 mg/L as Zn, 10-mL	16/pkg	14246-10

Optional Apparatus

Flask, volumetric, 100-mL	each	14574-42
Pipet, volumetric, 2.00 mL	each	14515-36
Pipet Filler, safety bulb	each	14651-00

Replacement Parts

Batteries, alkaline	4/pkg	46743-00
Instrument Cap/light shield	each	59548-00
Instruction Manual	each	59577-88
Sample Cells, 10-mL, with caps	6/pkg	24276-06

Section 2
Instrument Manual

Instrument Operation

Key Functions

Key	Description	Function
⏻ ☼	**POWER**	On/Off/Backlight To turn on the backlight, turn on the instrument, then press and hold the power key until the backlight turns on. Press and hold again to turn off the backlight. This key functions the same in all instrument modes and ranges.
0	**ZERO/SCROLL**	In measurement mode, sets the instrument to zero. In menu mode, scrolls through menu options. Also scrolls numbers when entering or editing a value.
✓	**READ/ENTER**	In measurement mode, initiates sample measurement. In menu mode, selects a menu option. When entering numbers, moves one space to the right and executes the function when the entry is complete.

Key	Description	Function
☰	**MENU**	Enter/Exit the menu mode Press and hold for approximately 5 seconds to enter user-entered method mode.

Menu Selections

Press the **MENU** key to access the menu selections.

Switching Ranges

1. Press the **MENU** key. The display will show “SEL”. A flashing arrow indicates the current range.
2. Press the **READ/ENTER** key to toggle between ranges.
3. Press **MENU** again to accept and exit back to the measurement screen.

Setting the Time

1. Press the **MENU** key, then press the **ZERO/SCROLL** key until the display shows a time in the “00:00” format.

2. Press **READ/ENTER**. The digit to be edited will flash.
3. Use the **ZERO/SCROLL** key to change the entry, then press **READ/ENTER** to accept and advance to the next digit. The time is entered in 24-hour format.

Recalling Stored Measurements

1. Press the **MENU** key, then press the **ZERO/SCROLL** key until the display shows RCL. The instrument automatically stores the last 10 measurements.
2. In RCL, press **READ/ENTER** to recall the stored measurements, beginning with the most recent measurement taken. The meter stores the measurement number as 01 (most recent) through 10 (oldest), the time the measurement was taken, and the measurement value. The **ZERO/SCROLL** key allows for selection of a specific measurement by number. The **READ/ENTER** key scrolls through all stored data points.

Battery Installation

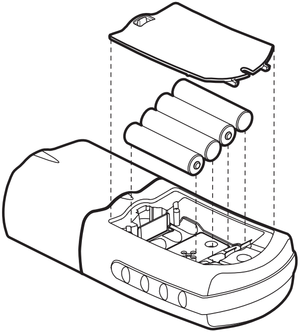
Figure 1 on page 2—7 provides an exploded view of battery installation.

1. Unhook the latch and remove the battery compartment cover. The polarities are shown on the battery holder.
2. Place the four batteries provided with the instrument in the holder as indicated and replace the battery compartment cover. The display will show the software version number (e.g., “P 1.6”) after correct battery installation.

When replacing discharged batteries, always replace the complete set of four alkaline batteries. Rechargeable batteries are not recommended and cannot be recharged in the instrument.

Note: *The Low Battery icon will appear on the display when the batteries have 10% battery life remaining. The battery icon will flash when the batteries are too low to complete measurements. See Instrument Keys and Display on page 1—11.*

Figure 1 Battery Installation



Error Codes

When the instrument cannot perform the function initiated by the operator, an error message will appear in the display. Refer to the appropriate message information below to determine what the problem is and how it can be corrected. Resolve error messages in the order that they appear on the display. Service Centers are listed in page 2—37.

Error Messages

1. E-0 No Zero (User mode)

   Error occurs when trying to read a standard in the user calibration mode before setting the meter to zero.

   - Zero the instrument on an appropriate blank.

2. E-1 Ambient Light Error

   There is too much light present to take a valid measurement.

   - Verify instrument cap is correctly seated.
   - If the problem persists, contact a Service Center (page 2—37).

3. E-2 LED Error

   The LED (light source) is out of regulation.

   - Replace batteries.
   - Verify LED lights up (inside the cell holder) when the **READ/ENTER** or **ZERO/SCROLL** key is pressed.
   - If the problem persists, contact a Service Center (page 2—37).

Note: When an E-1 or E-2 error occurs on a measurement, the display will show “_.__”. (The decimal place is determined by the chemistry.) If the E-1 or E-2 error occurs while zeroing the meter, the meter will require the user to re-zero.

4. E-3 Standard Adjust Error

   The value obtained on the prepared standard exceeds the adjustment limits allowed for the standard concentration, or the concentration of the standard is outside the concentration range allowed for standard calibration adjust.

   - Prepare the standard and rerun according to the procedure.
   - Prepare a standard at or near the recommended concentrations given in the procedure.
   - Verify that the concentration of the standard has been entered correctly.

- If the problem persists, contact a Service Center (page 2—37).

5. E-6 Abs Error (User mode)

   Indicates that the absorbance value is invalid, or indicates an attempt to make a curve with less than two points.

   - Enter or measure the absorbance value again.
   - If the problem persists, contact a Service Center (page 2—37).

6. E-7 Standard Value Error (User mode)

   Standard concentration is equal to another standard concentration that is already entered.

   - Enter the correct standard concentration.
   - If the problem persists, contact a Service Center (page 2—37).

7. E-9 Flash Error

   The meter is unable to save data.

   - If the problem persists, contact a Service Center (page 2—37).

8. Underrange—flashing number below stated test range
   - Verify instrument cap is correctly seated.
   - Check zero by measuring a blank. If error recurs, re-zero the instrument.
   - If the problem persists, contact a Service Center (page 2—37).

   Note: See Maximum/Minimum Displayed Value on page 2—26 for more information.

9. Overrange—flashing number above stated test range

   Note: Flashing value will be 10% over the upper test limit.

   - Check for light blockage.
   - Dilute and retest sample.

   Note: See Maximum/Minimum Displayed Value on page 2—26 for more information.

Standard Calibration Adjust

The Pocket Colorimeter™ II instrument is factory-calibrated and ready for use without user calibration. Use of the factory calibration is recommended unless the user is required to generate a calibration. The Standard Calibration Adjust can be used to meet regulatory requirements.

This feature allows the factory default calibration curve to be adjusted with a known standard. Use the standard described in the procedure.

1. Place a blank in the meter (in measurement mode). Press **ZERO/SCROLL**.
2. Place the reacted standard in the meter. Press **READ/ENTER**.
3. Press **MENU**, then press **ZERO/SCROLL** until the display shows “SCA”.
4. Press **READ/ENTER** to display the standard calibration adjust value.
5. Press **READ/ENTER** to adjust the curve to the displayed value. The meter will return to the measurement mode and the Calibration Adjusted icon will appear in the display window.

If an alternate concentration is used, or if a standard concentration is not given:

6. Repeat steps 1–4.

7. Press **ZERO/SCROLL** to access the Edit function, then press **READ/ENTER** to begin editing. The digit to be edited will flash. Use the **ZERO/SCROLL** key to change the entry, then press **READ/ENTER** to accept and advance to the next digit.

   When the last digit is entered, press **READ/ENTER** and the meter will adjust the curve to the value entered. The meter will return to measurement mode and the Calibration Adjusted icon will appear in the display window.

To turn off Standard Calibration Adjust (SCA):

1. Press **MENU**.
2. Press **ZERO/SCROLL** until “SCA” appears in the display.
3. Press **READ/ENTER**, then press **ZERO/SCROLL** until “Off” appears in the display.
4. Press **READ/ENTER** to turn off SCA.

   Note: Perform another standard calibration adjust to turn SCA on again.

   Note: For meters with factory-calibrated ranges or methods, Standard Calibration Adjust (SCA) will be disabled when a user-entered method is programmed into the meter. To turn SCA back on, restore the meter to factory default calibration. See Retrieving the Factory Calibration on page 2—25.

User-Entered Calibration

Overview

The Pocket Colorimeter™ II will accept a user-prepared calibration curve. The curve can extend from 0 to 2.5 absorbance. A user-prepared calibration curve may be entered into any channel that does not contain a factory-programmed curve. These channels are labeled “abs” on instruments having a single factory calibration or are labeled “1” and “2” on the uncalibrated single wavelength instruments. Any chemistry that can be run at the instrument wavelength may be user-entered in these channels.

Using prepared standard solutions that cover the range of interest, the meter generates a calibration curve by calculating the straight-line segments between each standard entered. A calibration curve may be entered using the keypad. Factory-entered calibration curves may also be recalculated or adjusted using the same procedure.

To enter the user-entered calibration mode, press the **MENU** key and hold it down until the display shows “USER” (about 5 seconds), followed by “CAL”. Press **ZERO/SCROLL** to scroll through the options.

User-Entered Calibration, continued

- CAL—Used to enter and edit standard values and measure absorbance values, or review the existing calibration.
- Edit—Used to enter and edit standard values and absorbance values with the keypad or review the existing calibration. Used to enter a predetermined calibration curve.
- dFL—Used to return the instrument back to the default factory calibration. User-entered calibrations are stored upon exit from the calibration or edit modes.

Note: To return to factory settings, following the instructions in Retrieving the Factory Calibration on page 2—25.

If the instrument is shut off or loses power during data entry, all edits will be lost. Automatic shut-off in user-entered calibration entry mode is 60 minutes.

CAL and Edit Submenus

In CAL mode, standard values are entered and absorbance values are measured. In Edit mode, standard and absorbance values are entered.

- To select CAL from the User menu, press **READ/ENTER**.
- To select Edit from the User menu, press **ZERO/SCROLL** and **READ/ENTER.**

- Once in the CAL or Edit option, press the **READ/ENTER** key to navigate through each option.

  Note: Press **ZERO/SCROLL** *to quickly scroll through each option.*

Calibration Procedure Using Prepared Standards

Note: *Deionized water or a reagent blank can be used to zero during the calibration procedure. Calibrations generated with deionized water as the zero will give less accurate results if the reagent blank is significantly more turbid or colored than deionized water. Use the deionized water or the reagent blank as the zero concentration point (S0) in the following calibration procedure.*

1. Turn on the instrument and select the range to be calibrated. An arrow at the top of the display will point to the selected range. To change ranges, press the **MENU** key, then use the **READ/ENTER** key to toggle between ranges 1 and 2. Press **MENU** again to return to measurement mode.
2. Follow the procedure for the chemical method to be calibrated. Prepare a reagent blank (if needed) and a standard solution. Allow the color to develop fully.

3. Insert the reagent blank or deionized water into the meter and cover with the cap. Press the **ZERO/SCROLL** key. The meter will display "- - - -", followed by "0.000". This initializes (zeroes) the meter.
4. Press the **MENU** key and hold it down until the display shows "USER", followed by "CAL". Press **READ/ENTER** to enter the calibration mode.
5. In factory-calibrated meters, S0 will appear in the display.

Note: When recalibrating a factory-calibrated meter or range, RES (resolution) cannot be changed.

6. In uncalibrated meters or meters with ranges labeled Abs, "RES" will appear. Press **ZERO/SCROLL** to review the current resolution (decimal placement). Press **ZERO/SCROLL** again to accept the current resolution. To change the resolution, press **READ/ENTER,** then **ZERO/SCROLL** to change the resolution. Press **READ/ENTER** to accept the new resolution. "S0" will appear on the display.
7. Press the **READ/ENTER** key again, then enter the blank value.

Note: Press the **READ/ENTER** *key to move from digit to digit. Use the* **ZERO/SCROLL** *key to change the number.*

8. After completing entry of the blank value, press the **READ/ENTER** key. The display will show "A0".

9. Insert the reagent blank or deionized water into the cell holder. Cover the blank with the instrument cap.
10. Press the **READ/ENTER** key. The meter will measure and display the absorbance value for “S0”.
11. Remove the sample blank. Press the **ZERO/SCROLL** key. “S1” will appear. Press the **READ/ENTER** key, then enter the first standard value.

    Note: Press the **READ/ENTER** *key to move from digit to digit. Use the* **ZERO/SCROLL** *key to change the number.*

12. After completing entry of the first standard value, press the **READ/ENTER** key. The display will show “A1”.
13. Insert the first reacted standard solution into the cell holder. Cover the prepared standard with the instrument cap.
14. Press the **READ/ENTER** key. The meter will measure and display the absorbance value for S1.
15. The calibration is complete with two points. If additional standards are required, press **ZERO/SCROLL** until “Add” appears on the display. Repeat steps 11–14 to enter additional standards.

16. Press the **MENU** key twice to exit and accept the changes. The instrument will use this calibration to determine the displayed concentration of future sample measurements.

Entering a Predetermined Calibration Curve

Note: Entering a predetermined calibration curve requires at least two data pairs. Each data pair requires a concentration value and the absorbance value for the given concentration. Up to 10 data pairs may be entered. This procedure uses the Edit mode.

1. Turn on the instrument and select the range to be calibrated. An arrow at the top of the display will point to the selected range. To change ranges, press the **MENU** key, then use the **READ/ENTER** key to toggle between ranges 1 and 2. Press **MENU** again to return to measurement mode.
2. Press the **MENU** key and hold it down until the display shows “USER”, followed by “CAL”. Press **ZERO/SCROLL** to scroll to EDIT. Press **READ/ENTER.**
3. In uncalibrated meters or in Abs range, “RES” will appear. Press **ZERO/SCROLL**. To change the resolution (decimal placement), press **READ/ENTER**. Press **ZERO/SCROLL** to select the new resolution, then press **READ/ENTER** to accept. “S0” will appear on the display.

4. Enter the concentration value and absorbance value of the first data pair (S0, A0).
5. To enter the S0 value, press **READ/ENTER**. Use the **ZERO/SCROLL** key to select the numerical value, then press the **READ/ENTER** key to accept the entry and advance to the next decimal place. Repeat this sequence until the S0 concentration value is entered.
6. After editing the S0 value, press **READ/ENTER** to accept. “A0” will appear on the display.
7. To enter the absorbance value for S0, press the **READ/ENTER** key to go to entry mode. Use the **ZERO/SCROLL** key to select the numerical value, then press the **READ/ENTER** key to accept the entry and advance to the next decimal place. Repeat this sequence until the absorbance value for S0 is entered.
8. After entering A0, press **READ/ENTER** to accept. “S1” will appear on the display.
9. Repeat steps 5 through 8 for each standard value and absorbance value pair in the calibration curve

Note: After A1 is entered, Add will appear in the display. If additional data pairs are to be entered, press **READ/ENTER** *and continue with step 9.*

10. When all the calibration data has been entered, press **MENU** twice to return to the measurement mode.

Editing a User-entered or Factory Calibration Curve

1. Press the **MENU** key and hold it down until the display shows “USER”, followed by “CAL”. Press **ZERO/SCROLL** until EDIT appears.
2. Press the **READ/ENTER** key to enter Edit mode. In factory-calibrated meters, “S0” will appear in the display.

Note: When editing a factory-calibrated meter or range, RES (resolution) cannot be changed.

Note: When RES or S0 appears in the display, press **ZERO/SCROLL** *to quickly scroll to the data to be edited.*

3. In uncalibrated meters or in Abs range, “RES” will appear. Press **ZERO/SCROLL** to review the current resolution. Press **ZERO/SCROLL** again to accept the displayed resolution. To change the resolution (decimal placement), press **READ/ENTER**. Press **ZERO/SCROLL** to select the new resolution, then press **READ/ENTER** to accept. “S0” will appear on the display.
4. Press **READ/ENTER**. The current concentration value for S0 will appear on the display.

5. To edit the S0 value, press **READ/ENTER**. Use the **ZERO/SCROLL** key to select the numerical value, then press the **READ/ENTER** key to accept the entry and advance to the next decimal place. Repeat this sequence until the S0 concentration value is entered.
6. After editing the S0 value, press **READ/ENTER** to accept. “A0” will appear on the display.
7. To edit the absorbance value for S0, press the **READ/ENTER** key to go to entry mode. Use the **ZERO/SCROLL** key to select the numerical value, then press the **READ/ENTER** key to accept the entry and advance to the next decimal place. Repeat this sequence until the absorbance value for S0 is entered.
8. After editing A0, press **READ/ENTER** to accept. “S1” will appear on the display.
9. Repeat steps 4 through 8 for each standard value and absorbance value pair in the calibration curve.
10. When all calibration data has been reviewed or edited, “ADD” will appear in the display.
11. Press **READ/ENTER** to add more calibration points, or press **MENU** twice to return to the measurement mode.

Note: When a factory calibration curve has been edited, the "calibration adjust" icon will appear in the display.

Exiting the Calibration Routine

Exit the calibration routine by pressing the **MENU** key to return to measurement mode. The instrument uses the last completed user-entered calibration or the factory calibration if no user-entered calibration has been completed.

Deleting Calibration Points

1. Select the range containing user-entered calibration points. See Switching Ranges on page 2—4.
2. Press and hold the **MENU** key until "USER", then "CAL" appears. Press **READ/ENTER.**

   Note: Calibration points can also be deleted in Edit mode.

3. Press **ZERO/SCROLL** to select the point to delete (e.g., S0 or S1 or S2). Press **READ/ENTER.**
4. The left digit will flash. Press **ZERO/SCROLL** until "dEL" appears. ("dEL" will appear after the numeral 9.)

5. Press **READ/ENTER** to delete. Repeat for all points to be deleted.

   Note: The minimum number of valid points is two. For example, if five points have been entered, three can be deleted using this feature.

6. Press **MENU** to return to the measurement mode.

Retrieving the Factory Calibration

1. Select the range to restore factory default calibration. See Switching Ranges on page 2—4.
2. Press and hold the **MENU** key until “USER”, then “CAL” appears.
3. Press the **ZERO/SCROLL** key to find dFL.
4. Press the **READ/ENTER** key to select dFL and restore the instrument to the factory default calibration.

   Note: For meters with factory-calibrated ranges or methods, Standard Calibration Adjust (SCA) will be disabled when a user-entered method is programmed into the meter. To turn SCA back on, restore the meter to factory default calibration.

Maximum/Minimum Displayed Value

In meters with absorbance (Abs) ranges, the maximum displayed value and minimum displayed value is related to the value of the standards entered in a user calibration.

Measurements that exceed the minimum or maximum standards entered in the user calibration will return a flashing number indicating “underrange” or “overrange”. See *Error Codes* (page 2—12) for more information.

Example 1

For a calibration with the following standards:

S0=0.000
S1=1.000

Maximum Displayed Value	1.000
Minimum Displayed Value	0.000

Example 2

For a calibration with the following standards:

S0=1.00
S1=2.00
S2=4.00

Maximum Displayed Value	4.00
Minimum Displayed Value	1.00

For Hach-calibrated programs, the maximum and minimum displayed values always equal the factory-calibrated values and cannot be changed.

Certification

Hach Company certifies this instrument was tested thoroughly, inspected, and found to meet its published specifications when it was shipped from the factory.

The Pocket Colorimeter™ II instrument has been tested and is certified as indicated to the following instrumentation standards:

EMC Immunity:

Per 89/ 336/ EEC EMC: EN 61326: 1998 (Electrical Equipment for measurement, control and laboratory use—EMC requirements). Supporting test records by Hach Company, certified compliance by Hach Company.

Standard(s) include:

IEC 1000-4-2: 1995 (EN 61000-4-2: 1995) Electro-Static Discharge Immunity (Criteria B)

IEC 1000- 4- 3: 1995 (EN 61000- 4- 3: 1996) Radiated RF Electro- Magnetic Field Immunity (Criteria A)

Additional Immunity Standard(s) include:

ENV 50204: 1996 Radiated Electromagnetic Field from Digital Telephones

(Criteria A) Radio Frequency Emissions:

Per 89/ 336/ EEC EMC: EN 61326: 1998 (Electrical Equipment for measurement, control and laboratory use—EMC requirements) "Class B" emission limits. Supporting test records from Hach EMC Test Facility, certified compliance by Hach Company.

Additional Radio Frequency Emissions Standard(s) include:

EN 55022 (CISPR 22), Class B emissions limits.

Canadian Interference-causing Equipment Regulation, IECS-003, Class A: Supporting test records from Hach EMC Test Facility, certified compliance by Hach Company.

This Class A digital apparatus meets all requirements of the Canadian Interference-causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

FCC Part 15, Class "A" Limits: Supporting test records from Hach EMC Test Facility, certified compliance by Hach Company.

Certification, continued

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation. Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense. The following techniques of reducing the interference problems are applied easily.

1. Remove power from the Pocket Colorimeter instrument by removing one of its batteries to verify that it is or is not the source of the interference.
2. Move the Pocket Colorimeter instrument away from the device receiving the interference.
3. Reposition the receiving antenna for the device receiving the interference.
4. Try combinations of the above.

GENERAL INFORMATION

At Hach Company, customer service is an important part of every product we make.

With that in mind, we have compiled the following information for your convenience.

How to Order

By Telephone:

6:30 a.m. to 5:00 p.m. MST
Monday through Friday
(800) 227-HACH (800-227-4224)

By Mail:

Hach Company
P.O. Box 389
Loveland, Colorado 80539-0389 U.S.A.

By FAX:

(970) 669-2932 (Hach Loveland)

For order information by E-mail:

orders@www.hach.com

Information Required:

- Hach account number (if available)
- Billing address
- Shipping address
- Your name and phone number
- Purchase order number
- Catalog number
- Brief description or model number
- Quantity

Technical and Customer Service (USA only)

Hach Technical and Customer Service Department personnel are eager to answer questions about our products and their use and to take your orders. Specialists in analytical methods, they are happy to put their talents to work for you.
Call 1-800-227-4224 or E-mail techhelp@hach.com.

International Customers

Hach maintains a worldwide network of dealers and distributors. To locate the representative nearest you, send E-mail to intl@hach. com or call (970) 669-3050.

In Canada

Hach Instrument Service Centre, Winnipeg, Manitoba, Canada

Telephone: (204) 632-5598; (800) 665-7635

FAX: (204) 694-5134

Repair Service

Authorization must be obtained from Hach Company before sending any items for repair. Please contact the Hach Service Center serving your location.

In the United States:

Hach Company
100 Dayton Avenue
Ames, Iowa 50010
(800) 227-4224 (USA only)
FAX: (515) 232-3835

Canada:

Hach Sales & Service Canada Ltd.
1313 Border Street, Unit 34
Winnipeg, Manitoba R3H 0X4
(800) 665-7635 (Canada only)
Telephone: (204) 632-5598
FAX: (204) 694-5134
E-mail: canada@hach.com

Latin America, Caribbean, Africa, Far East, Indian Subcontinent:

Hach Company World Headquarters
P.O. Box 389
Loveland, Colorado 80539-0389 U.S.A.
Telephone: (970) 669-3050
FAX: (970) 669-2932
E-mail: intl@hach. com.

Europe, the Middle East, or Mediterranean Africa:

HACH Company, c/o
Dr. Bruno Lange GmbH & CO. KG
Willstätterstr. 11
40549 Düsseldorf, Germany
Telephone: +49/(0)211/52 88-0
FAX: +49/(0)211/52 88-134

Warranty

Hach Company warrants this product to the original purchaser against any defects that are due to faulty material or workmanship for a period of two years from date of shipment.

In the event that a defect is discovered during the warranty period, Hach Company agrees that, at its option, it will repair or replace the defective product or refund the purchase price, excluding original shipping and handling charges. Any product repaired or replaced under this warranty will be warranted only for the remainder of the original product warranty period.

This warranty does not apply to consumable products such as chemical reagents; or consumable components of a product, such as, but not limited to, lamps and tubing.

Contact Hach Company or your distributor to initiate warranty support. Products may not be returned without authorization from Hach Company.

Limitations

This warranty does not cover:

- damage caused by acts of God, natural disaster, labor unrest, acts of war (declared or undeclared), terrorism, civil strife or acts of any governmental jurisdiction
- damage caused by misuse, neglect, accident or improper application or installation
- damage caused by any repair or attempted repair not authorized by Hach Company
- any product not used in accordance with the instructions furnished by Hach Company
- freight charges to return merchandise to Hach Company
- freight charges on expedited or express shipment of warranted parts or product
- travel fees associated with on-site warranty repair

This warranty contains the sole express warranty made by Hach Company in connection with its products. All implied warranties, including without limitation, the warranties of merchantability and fitness for a particular purpose, are expressly disclaimed.

Some states within the United States do not allow the disclaimer of implied warranties and if this is true in your state the above limitation may not apply to you. This warranty gives you specific rights, and you may also have other rights that vary from state to state.

This warranty constitutes the final, complete, and exclusive statement of warranty terms and no person is authorized to make any other warranties or representations on behalf of Hach Company.

Limitation of Remedies

The remedies of repair, replacement or refund of purchase price as stated above are the exclusive remedies for the breach of this warranty. On the basis of strict liability or under any other legal theory, in no event shall Hach Company be liable for any incidental or consequential damages of any kind for breach of warranty or negligence.