UV/VIS
Spectrophotometer

User's Manual

7-2000-UV-MN

11.08.19

LaMotte®

WARNING! This set contains chemicals that may be harmful if misused. Read cautions on individual containers carefully. Not to be used by children except under adult supervision.

CONTENTS

OPERATION

■ General Precautions

The apparatus described in this manual is designed to be used by properly trained personnel in a suitable equipped laboratory. For the correct and safe use of this apparatus it is essential that laboratory personnel follow generally accepted safe procedures in addition to the safety precautions called for in this manual. Read the instruction manual before attempting to set up or operate this instrument. Failure to do so could result in personal injury or damage to the equipment.

The covers on this instrument may be removed for servicing. However, the inside of the power supply unit is a hazardous area and its cover should not be removed under any circumstances. There are no serviceable components inside this power supply unit. Avoid touching the high voltage power supply at all times.

The spectrophotometer should not be stored or used in a wet or corrosive environment. Care should be taken to prevent water or reagent chemicals from wet tubes or cuvettes from entering the Spectrophotometer chamber.

Never put wet tubes in the spectrophotometer.

■ Safety Precautions

***WARNING:** Reagents marked with an * are considered to be potential health hazards. To view or print a Safety Data Sheet (SDS) for these reagents go to www.lamotte.com. Search for the four digit reagent code number listed on the reagent label, in the contents list or in the test procedures. Omit any letter that follows or precedes the four digit code number. For example, if the code is 4450WT-H, search 4450. To obtain a printed copy, contact LaMotte by email, phone or fax.

Keep equipment and reagent chemicals out of the reach of young children.

■ Power Supply

Electrical

The power supply is auto-ranging (100-230V). Two power cords are supplied. The power cord shall be inserted in a socket provided with a protective earth contact. The protective action must not be negated by the use of an extension cord without a protective conductor.

Warning

Any interruption of the protective conductor inside or outside the apparatus or disconnection of the protective earth terminal is likely to make the apparatus dangerous. Intentional interruption is prohibited.

Whenever it is likely that the protection has been impaired, the apparatus shall be made inoperative and be secured against any unintended operation. NEVER touch or handle the power supply due to the high voltage.

The protection is likely to be impaired if, for example, the apparatus

- Shows visible damage
- Fails to perform the intended measurements
- Has been subjected to prolonged storage under unfavorable conditions.
- Has been subjected to severe transport stresses

Radio Interference

For compliance with the EMC standards referred to in the EC Declaration of Conformity, it is necessary that only shielded cables are used when connecting the instrument to computers and accessories.

■ Components

Spectrophotometer Tubes

Spectrophotometer tubes which have been scratched through excessive use should be discarded and replaced with new ones. Dirty tubes should be cleaned on both the inside and outside. Fingerprints on the exterior of the tubes can cause excessive light scattering and result in errors. Handle the tubes carefully, making sure the bottom half of the tube is not handled.

LaMotte Company makes every effort to provide high quality spectrophotometer tubes. However, wall thicknesses and diameter of tubes may still vary slightly. This may lead to slight variations in results (e.g. if a tube is turned while in the sample chamber, the reading will likely change slightly). To eliminate this error put the tubes into the sample chamber with the same orientation every time. The tubes that are included with the spectrophotometer have an index mark to facilitate this. If possible, use the same tube to scan the blank and scan the sample.

The glass spectrophotometer tubes can only be used above 260 nm.

Cuvettes

One quartz cuvette is included. Quart cuvettes may be used in the visible and ultraviolet ranges but must be used below 260 nm. Glass cuvettes are only suitable for the visible region above 260 nm. For the most accurate results, use the same cuvette for the blank and the test sample.

Sample Holders

The spectrophotometer is supplied with two removable sample holders. Each holder is secured to the chamber with screws. The square sample holder will hold 10 mm square cuvettes. The square sample holder should be positioned so that the row of screws on the top is on the right hand side. The universal sample holder will hold round tubes of varying diameters. The universal sample holder should be positioned with the V-channel toward the right side of the chamber and the white roller toward the left side of the chamber. To use the universal sample holder, place the tube between the white roller on the spring loaded arm and the V-channel on the right side of the adapter. Press the tube down on the white roller to retract the arm.

General Operating Procedures

Contents

Qty	Description
1	Spectrophotometer
1	Power Cord
1	Cuvette, Quartz
6	Tubes, Glass, 10 mL
1	Universal Sample Holder
1	Square Sample Holder
1	Dust Cover
1	Manual
1	Quick Start Guide

Replacements and Accessories

Description	Code
Tungsten Halogen Lamp	27290-UVH
Deuterium Lamp	27290-UVD
Cuvette, Quartz (1)	0292-Q
Tubes, Glass, 10 mL (6)	0290-6
K3 Analyst Software, with cable	7-2000-UV-CD

Installation

1. After carefully unpacking the contents, check the materials with the packing list to ensure that everything has been received in good condition.
2. Place the instrument in a suitable location away from direct sunlight. In order to have the best performance from the instrument, keep it as far as possible from any strong magnetic or electrical fields or any electrical device that may generate high-frequency fields. Set the unit up in an area that is free of dust, corrosive gases and strong vibrations.
3. Remove any obstructions or materials that could hinder the flow of air under and around the instrument.
4. Turn on the instrument and allow it to warm up for 15 minutes before taking any readings.

The Keypad

Description of Key Functions

CLEAR/DEL	Clear or delete
SET λ	Set wavelength
LOAD	Load saved curve
0A/100%T	Blank (Set 0A and 100%T) or establish baseline
SAVE	Save data
MODE	Select type of measurement
ESC	Escape or back to previous screen
ENTER	Confirm
^	Scroll up
v	Scroll down
1-9	Numeric keys
PRINT	Print test data
-/.	Minus/Dot

The Display and the Menus

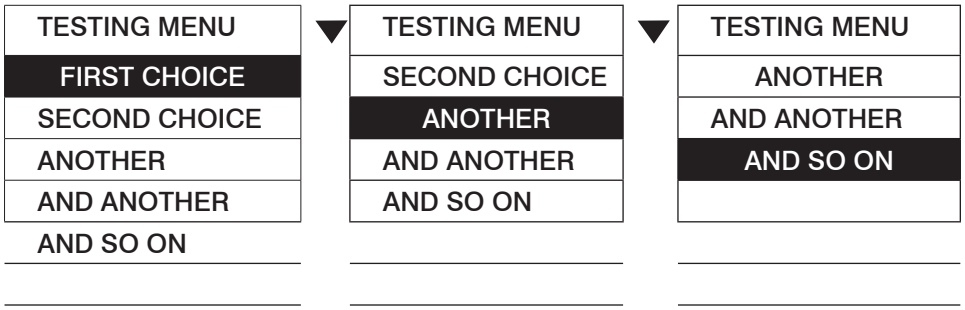
The display allows menu selections to be viewed and chosen. These choices instruct the spectrophotometer to perform specific tasks. The menus are viewed in the display using a general format which is followed from one menu to the next. Each menu is a list of choices or selections.

There are five lines in the display. The top line in each menu is a title or pertinent instruction. The top line does not change unless a new menu is selected. The second line is used in two ways. One way is to display additional information if the top line is insufficient. The second line is also used to display menu choices. The three additional lines are also used for menu choices.

DISPLAY

TESTING MENU	Title or Instruction
FIRST CHOICE	
SECOND CHOICE	Menu Choice Window
THIRD CHOICE	
AND ANOTHER	
AND SO ON	

Think of the menu choices as a vertical list in the display which moves up or down each time an arrow button is pressed. This list or menu is viewed through a window, the menu choice window, in the display. Pushing the arrow buttons brings another portion of the menu into menu choice window. This is referred to as scrolling through the menu.



The highlighted line will have a reverse font – blue figures on a white background. As the menu is scrolled through, different choices will be highlighted. Pressing the **ENTER** button, or other buttons as directed, will select the menu choice that is highlighted

The **ESC** button allows an exit or escape from the current menu and a return to the previous menu. This allows a rapid exit from an inner menu to the main menu by repeatedly pressing the **ESC** button. The spectrophotometer may be turned off at any moment.

Initialization & System Calibration

■ Initialization

1. Turn on the spectrophotometer by pressing the Power Switch (IO) on the back of the instrument. The instrument will automatically run a self-initialization check. The display will show the status of the checking procedure.	Initializing Booting System: Check clock..... LAMOTTE SMART SPECTRO

2.	Initializing Booting System: Check clock..... √ Locating lamp... LAMOTTE SMART SPECTRO

3.	Initializing Booting System: Locating lamp... √ Locating filter... LAMOTTE SMART SPECTRO

4. Press **EXIT** to skip the 15 minutes warm up. Not recommended.	Initializing 15 : 00 Booting System: Locating filter..... √ Warm up 15 min... Press ESC to skip...

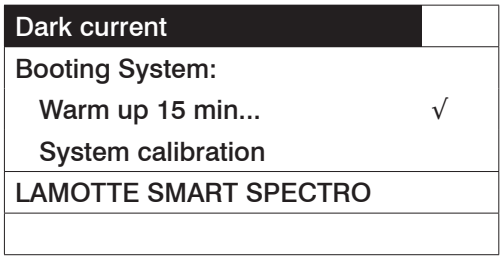
5. Press **ENTER** to select **NO** and skip the system calibration and go to the Main menu. Or Press ^ to go to **YES**. Press **ENTER** to select **YES** and begin the System calibration. Press **EXIT** to skip the 15 minutes warm up. Not recommended.	Initializing 15 : 00 Booting System: Warm up 15 min... √ System calibration... Please select : NO

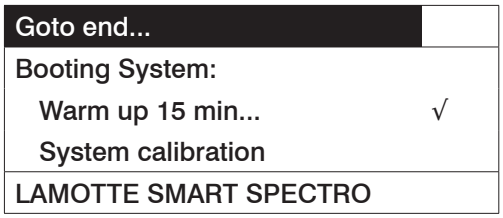
System Calibration

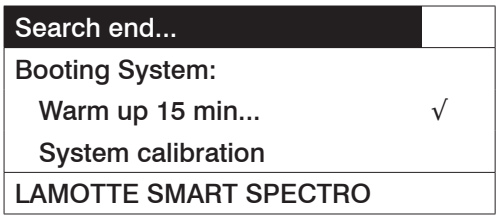
After the 15 minute warm up, choose to run a full System Calibration or not. The system calibration mode is used to establish or re-establish the accuracy of the wavelength selection process. Normally, the System Calibration procedure should be run after the spectrophotometer is turned on and allowed to warm up for 15 minutes or if operating conditions (temperature, humidity, etc.) change significantly. If previously saved data is lost the instrument will automatically run the system calibration.

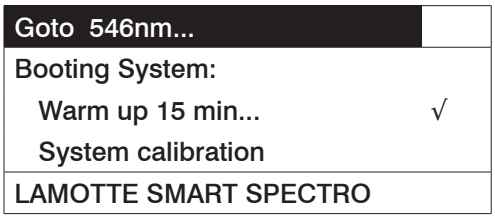
If NO is chosen, the instrument will use the previously saved calibration data and the display will move to the main menu and will be ready to use.

If YES is selected, the instrument will go through the system calibration. The display will show the system calibration process.









The system calibration is complete and the instrument is ready for use and will go to the main menu.

12:30	05/03/14
1 Programmed Tests	
2 User Defined Tests	
3 %T/Abs	
4 DNA/Protein	

GENERAL TESTING PROCEDURES

■ Programmed Tests

Introduction

The Programmed Tests mode is used to run all LaMotte Programmed Tests with LaMotte test reagent systems. This is also where Test Sequences are set up and edited.

1. Press the power switch on the back of the instrument to turn the instrument on. The **Initializing** screen will appear.	**Initializing** **Booting System:** **Locating filter...** √ **System calibration...** **Please select : NO**
2. Press **ENTER** to select **No**. The main menu screen will appear.	**12 : 00** **05/03/14** **1 Programmed Tests** **2 User Defined Tests** **3 %T/Abs** **4 DNA/Protein**
3. Scroll to Programmed Tests.	**12 : 00** **05/03/14** **1 Programmed Tests** **2 User Defined Tests** **3 %T/Abs** **4 DNA/Protein**

4. Press **ENTER** to select Programmed Tests. In the Programmed Tests menu there are three alterable sequences and one All Tests fixed sequence.	Programmed 1 Sequence 1 2 Sequence 2 3 Sequence 3 4 All Tests

Testing With LaMotte Programmed Tests

The following is a step by step example of how to run a test from the Programmed Tests/All Tests menu. These test procedures are designed to be used with LaMotte Spectrophotometer reagent systems.

1.	Initializing 15 : 00 Booting System: Locating filter ... Warmup 15 min... LAMOTTE SMART SPECTRO

2. Turn spectrophotometer **ON**. Allow instrument to warm up for 15 minutes. Or press **ESC** to skip warm up.	Initializing Booting System: Warm up 15 min... √ System calibration... Please select : NO

3. Press **ENTER** to select **No** and skip the system calibration. Or press ^ and press **ENTER** to select **YES** and begin the system calibration.	12 : 00 05/03/14 1 Programmed Tests 2 User Defined Tests 3 %T/Abs 4 DNA/Protein

4. Press **ENTER** to select Programmed Tests.	Programmed 1 Sequence 1 2 Sequence 2 3 Sequence 3 4 All Tests

5. Scroll to and press **ENTER** to select All Tests.	**All Tests** **1 Alkalinity-UDV** **2 Aluminum** **3 Ammonia-N LF** **Press "Enter" to Run**

6. Scroll to the desired test. The spectrophotometer is ready to scan the blank. The proper wavelength has been selected.	**All Tests** **13 Ca & Mg Hard-UDV** **14 Carbohydrazide** **15 Chlorine** **Press "Enter" to Run**

7. Insert the blank. Press **ENTER** to scan the blank. Wait for the instrument to blank. The blank has been stored.	**Chlorine**		**515nm**
	0.000A		**99.9%T**
	No.	**Abs**	**ppm**

8. Insert the reacted sample. Press **ENTER** to scan the sample. The result will be displayed.	**Chlorine**		**515nm**
	0.209		
	No.	**Abs**	**ppm**
	***01**	**0.212**	**0.309**

9. Press **PRINT** to print the result when connected to a printer. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.	

Quick Start

1. Press the power switch on the back of the instrument to turn the instrument on. The **Initializing** screen will appear.	Initializing 15 : 00 Booting System: Locating filter ... Warmup 15 min... LAMOTTE SMART SPECTRO

2. Press **ENTER** to select Programmed Tests.	Programmed 1 Sequence 1 2 Sequence 2 3 Sequence 3 4 All Tests

3. Scroll to and press **ENTER** to select All Tests.	All Tests 1 Alkalinity-UDV 2 Aluminum 3 Ammonia-N LF Press “Enter” to Run

4. Scroll to the desired test. The spectrophotometer is ready to scan the blank. The proper wavelength has been selected.	All Tests 13 Ca & Mg Hard-UDV 14 Carbohydrazide 15 Chlorine Press “Enter” to Run

5. Insert the blank. Press **ENTER** to scan the blank. Wait for the instrument to blank. The blank has been stored.	Chlorine		515nm
	0.000A		99.9%T
	No.	Abs	ppm

6. Insert the reacted sample. Press **ENTER** to scan the sample. The result will be displayed.	**Chlorine**		**515nm**
	0.209		
	No.	**Abs**	**ppm**
	***01**	**0.212**	**0.309**

7. Press **PRINT** to print. Insert another sample and press **ENTER**. Press **ESCAPE** to exit. Or turn spectrophotometer **OFF**.	

Sequences of Tests

All Tests is a fixed sequence containing the LaMotte Programmed Tests.

Any of the lamotte programmed tests may be placed in these sequences in whatever testing order that is preferred. Some examples of typical sequences are given below.

Modification of the alterable sequence is accomplished with the **LOAD** and **CLEAR/DEL** buttons. Pressing **EXIT** while in a sequence menu will escape back to the **Programmed Tests** menu. Pressing the power button at any time will turn the spectrophotometer off.

SEQUENCE 1
60 Molybdenum LR
79 Phosphate
9 Bromine LR
76 pH TB
15 Chlorine
86 Silica HI
45 Hydrazine
32 Copper DDC
51 Iron Bipyr

SEQUENCE 2
1 Aluminum
35 Cyanide
41 Fluoride
53 Iron Phen
55 Manganese L
64 Nitrate N LR
26 COD Low
77 Phenols
78 Phosphate L
90 Sulfide LR

SEQUENCE 3
3 Ammonia-N L F
32 Copper DDC
64 Nitrate-N LR
67 Nitrite-N LR
74 pH CPR
78 Phosphate L
85 Silica Lo

Setup and Edit Sequences

The three test sequences (**Sequence 1, Sequence 2**, and **Sequence 3**) can be edited. This allows a sequence or test that is used frequently to be set up for easy access. The order of the sequence can be arranged to suit the needs of the user. Any combination, and order of tests from **All Tests** may be placed into these sequences. **User Defined Tests** cannot be added to these sequences but are saved in a separate **Favorite Tests** sequence

1. Scroll to and select **Programmed Tests**.	Programmed 1 Sequence 1 2 Sequence 2 3 Sequence 3 4 All Tests

2. Scroll to and select **All Tests**.	All Tests **1 Alkalinity-UDV** 2 Aluminum 3 Ammonia-N LF Press “Enter” to Run

3. Scroll to the desired test.	All Tests 2 Aluminum **3 Ammonia-N LF** 3 Ammonia-N LS Press “Enter” to Run

4. Press **LOAD**.	Programmed **1 Sequence 1** 2 Sequence 2 3 Sequence 3 Press “ENTER” to Run

5. Scroll to the sequence where the test will be loaded (**Sequence 1**, **Sequence 2**, or **Sequence 3**). Press **ENTER**.	Programmed 1 Sequence 1 2 Sequence 2 3 Sequence 3 Press “Enter” to Load

6. Press **ENTER**. The test will be loaded to the test sequence. The **All Tests** menu will be diplayed.	All Tests **1 Alkalinity-UDV** 2 Aluminum 3 Ammonia-N LF Press “Enter” to Run

7. To remove a test from a sequence, highlight the test and press **CLEAR/DEL**. Scroll to **YES**.	**Sequence 1** 4 Ammonia-N LS **2 Aluminum** 1 Alkalinity-UDV Are you sure : **YES**

8. Press **ENTER** to confirm. The test will be removed from the sequence.	**Sequence 1** 4 Ammonia-N LS 1 Alkalinity-UDV Press “Enter” to Run

■ User Defined Tests

A curve for an undefined test method must be defined and established before quantitative tests can be run. The instrument has an open platform that allows custom curves to be established. The established curves will be saved as defined tests in the User Defined Test list.

Quantitative
1 Create New Curve
2 Edit Curve
3 Delete Curve
4 Load Curve

This instrument allows the user to:

- Create new curves by standard solution or coefficient
- Edit predefined and saved curves
- Delete predefined and saved curves
- Load predefined and saved curves
- Add predefined and saved curves to the favorite test folder for easy and fast access

A standard curve can be established by using known Standards solution or using a known coefficient.

Create a New Curve – By Standard Solution

1. Press the power switch on the back of the instrument to turn the instrument on. The **Initializing** screen will appear.	Initializing 15 : 00 Booting System: Locating filter ... Warmup 15 min... LAMOTTE SMART SPECTRO

2. Press **ENTER** to select **No**.	Initializing Booting System: Locating filter... System calibration... Please select : NO

3. The main menu screen will appear.	12 : 00 05/03/14 1 Programmed Tests 2 User Defined Tests 3 %T/Abs 4 DNA/Protein

4. Scroll to **User Defined Tests**.	12 : 00 05/03/14 1 Programmed Tests 2 User Defined Tests 3 %T/Abs 4 DNA/Protein

5. Press **ENTER** to select User Defined Tests. The Quantitative menu will be displayed.	Quantitative 1 Create New Curve 2 Edit Curve 3 Delete Curve 4 Load Curve

6. Press **ENTER** to select **(1)**. Create New Curve.	Create Curve **1 By Standards** 2 By Coefficient

7. Use ^ and v to select **(1) By Standards**. Press **ENTER** to confirm the selection.	Standard **1 Unit** 2 WL 3 Curve Select Unit : **ppm**

8. **Select the Units** 1 Unit is highlighted. Use ^ and v to scroll through the unit list (ppm, ppb, ng/ul, ng/ml, g/l, mg/l, %). Press **ENTER** to confirm the unit selection.	Standard 1 Unit ppm **2 WL** 3 Curve Enter WL : 515_

9. **Select the Wavelength** Use **(0)** to **(9)** numerical keys to enter the desired wavelength (i.e. 500 nm). Press **ENTER** to confirm the wavelength selection.	Standard 1 Unit ppm 2 WL **3 Curve** Curve Mode : **Linear**

10. **Select the Curve Type** There are two kinds of curves; Linear or Linear through zero. Press ^ and v to choose, Press **ENTER** to confirm the curve selection.	Standard 2 WL 500nm 2 Curve Linear **4 No of Stds** Enter number (2-8) : 2_

11. **Select the Number of Standards** Enter how many standards will be used to establish the curve. A minimum of two standards is required. Up to a maximum of eight standards can be used. Use the numerical keys to enter the number of standards. Press **ENTER** to confirm the selection.	Standard 3 Curve Linear 4 No of Stds 2 5 Repeat Times Enter number (1-3) : 3_

12. **Select the Number of Repetitions** Up to 3 standard solutions of the same concentration standard can be measured. The average will be used for the final calculation. Use the numerical key to enter the desired repeat times of measurement for each standard concentration. Insert the blank reference first before pressing **ENTER**. Press **ENTER**.	Goto 500nm 546nm

13. **Scan the Reference Blank** Insert the blank reference. Press **ENTER** to blank.	Blanking... 546nm

14. **Measure the Standards** After the parameters are set up and the reference is blanked the instrument will automatically proceed to measure the standards. In this example: 1) Two standards 2) Three repetitions for each standard concentration.	Std#1 500nm Input Conc. 1=

Follow the step by step instruction on the display to measure the standard samples.

• Enter the concentration value of the first sample solution of the first standard.(i.e. 0.05). Press **ENTER** to confirm. The concentration value will be displayed on the screen.	**Std#1** **500nm** **Input Conc. 1=0.05**

• Insert the first sample of the first standard into the cuvette holder in the optical path.	**Std#1** **500nm** **1 0.050** **Insert 1-1 Enter**

• Press **ENTER** to measure it. The measured absorbance value will be displayed. • Enter the concentration value of the second sample of the first standard. Insert that solution into the cuvette holder in the optical path. Press **ENTER** to measure it.	**Std#1** **500nm** **1 0.050** **0.918** **2 0.050** **Insert 1-2 Enter**

• Repeat the same procedures for the third sample of the first standard.	**Std#1** **500nm** **1 0.050** **0.918** **2 0.050** **0.680** **3 0.050** **Insert 1-3 Enter**

	Std#1 **500nm** **1 0.050** **0.918** **2 0.050** **0.680** **3 0.050** **0.495** **Confirm?** **Y**

After the last sample of the first standard is measured the display will show **Confirm? Y** with Y highlighted. Review and press **ENTER** to confirm the measurements.

Follow the instructions on the display to measure the rest of the standards.

Note: To measure the first standard again if an error occurs, use ^ and v to switch to Confirm? N. Press **ENTER** to repeat the measurements.

Std#2	500nm
Input Conc. 2=0.052	

Std#2	500nm
1 0.052	
Insert 2-1 Enter	

Std#2	500nm
1 0.052	0.918
2 0.052	
Insert 2-2 Enter	

Std#2	500nm
1 0.052	0.918
2 0.052	0.680
3 0.052	
Insert 2-3 Enter	

After the last standard sample solution has been measured the display will show **Confirm? Y**. To continue to processing the data. Select **Y**.

Std#2	500nm
1 0.052	0.918
2 0.052	0.680
3 0.052	0.495
Confirm to Continue?	Yes

15. **Save the Curve** The display will show **Confirm to Save? Yes**. Press **ENTER** to save the curve in the memory for future use.	Std#2	500nm
	1 0.052	0.918
	2 0.052	0.680
	3 0.052	0.495
	Confirm to Save?	Yes

If **Confirm to Save? No** is selected and confirmed,the curve will not be saved and the curve will be displayed on the screen. Use to switch the display between the curve and the equation. Press **ENTER** to start the sample test. (The curve will be used for one-time test only.)

The newly established curve can be saved:

1) In sequence in the first available slot after the last saved curve on the list

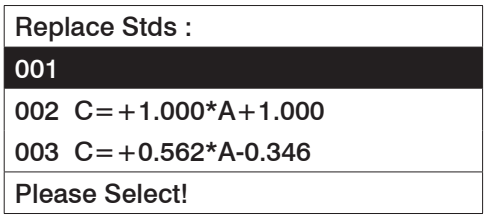
2) to replace a standard curve

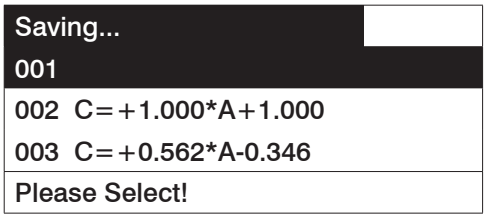
3) to the previously deleted curve slot that is open

The established curve is saved by default to the next available slot in the numerical sequence unless another slot is chosen.

16. When **Yes** is selected the slot after the last saved curve will be highlighted. Press **ENTER** to save in that slot. (Take note of the sequence number of the saved curve). To save the curve in any other open slot or to replace an existing saved curve, use ^ and v to highlight the open slot or saved curve. Press **ENTER** to save.	Saving	500nm
	1 0.052	0.918
	2 0.052	0.680
	3 0.052	0.495

Up to 200 curves can be saved. The 201 curve will replace the 001 curve and be saved in the 001 slot. To choose a slot other than 001 for the new curve, use ^ and v to choose another slot.



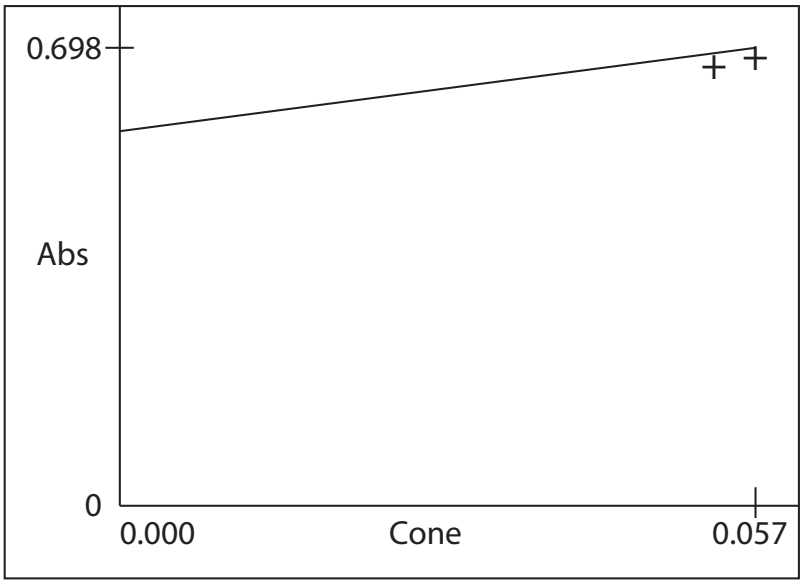


17. **Replace a Previously Saved Curve**

To save the new curve in another open slot or to replace an existing previously saved curve, use the ^ and v to highlight the open slot or saved curve, press **ENTER** to save.

18. **Display the Curve and Equation**

The standard curve will be displayed regardless of the choice to save or not save the curve. Use ^ and v to switch the display between the curve and the equation. If the curve has not been saved before, it can be saved now by pressing the **SAVE** button.



001	500nm
Conc=K*Abs+B	
K=+0.562	
B+=-0.341	
r=0.990	

19. Press **ENTER** to start to test unknown samples.

(Go to page 38)

Create a New Curve – By Coefficient

1. Press the power switch on the back of the instrument to turn the instrument on. The **Initializing** screen will appear.	Initializing 15 : 00 Booting System: Locating filter ... Warmup 15 min... LAMOTTE SMART SPECTRO

2. Press **ENTER** to select **No**.	Initializing Booting System: Locating filter... System calibration... Please select : NO

3. The main menu screen will appear.	12 : 00 05/03/14 1 Programmed Tests 2 User Defined Tests 3 %T/Abs 4 DNA/Protein

4. Scroll to **User Defined Tests**.	12 : 00 05/03/14 1 Programmed Tests 2 User Defined Tests 3 %T/Abs 4 DNA/Protein

5. Press **ENTER** to select User Defined Tests. The Quantitative menu will be displayed.	Quantitative 1 Create New Curve 2 Edit Curve 3 Delete Curve 4 Load Curve

6. Press **ENTER** to select **(1)**. Create New Curve.	Create Curve 1 By Standards **2 By Coefficient**

7. Use ^ and v to highlight **2 By Coefficient**. Press **ENTER** to confirm the selection.	Coefficient **1 Unit** 2 WL 3 Coef. K= Select Unit : **ppm**

8. **Select the Units** Use ^ and v to scroll through the unit list (ppm, ppb, ng/ul, ng/ml, g/l, mg/l, %). Press **ENTER** to confirm the unit selection.	Coefficient 1 Unit **2 WL** 3 Coef. K= Input WL : 546

9. **Select the Wavelength** Use (0)~(9)numerical keys to enter the desired wavelength (i.e. 500 nm). Press **ENTER** to confirm the wavelength selection.	Coefficient 1 Unit 2 WL **3 Coef. K=** Input K : 0.000

10. **Enter the Slope K Value of the Standard Curve**	Coefficient 1 Unit ppm 2 WL 500nm **3 Coef. K=** Input K= 0.05_

Press **ENTER**.

11. **Enter the Intercept B Value**	Coefficient
	2 WL 500nm
	3 Coef. K=0.050
	3 Coef. B=
	Input B= 0.1_

Press **ENTER**.

12. **Save the Curve** The display will show **Confirm to Save? Yes**. Press **ENTER** to save the curve in the memory for future use.	Coefficient
	2 WL
	3 Coef. K=0.050
	3 Coef. B=0.100
	Confirm to Save : YES

13. When **Yes** is selected the slot after the last saved curve will be highlighted. Press **ENTER** to save in that slot. (Take note of the sequence number of the saved curve). To save the curve in any other open slot or to replace an existing saved curve, use ^ and v to highlight the open slot or saved curve. Press **ENTER** to save.	Saving 500nm
	1 0.052 0.918
	2 0.052 0.680
	3 0.052 0.495

Up to 200 curves can be saved. The 201 curve will replace the 001 curve and be saved in the 001 slot. To choose a slot other than 001 for the new curve, use ^ and v to choose another slot.

Replace Stds :
001
002 C=+1.000*A+1.000
003 C=+0.562*A-0.346
Please Select!

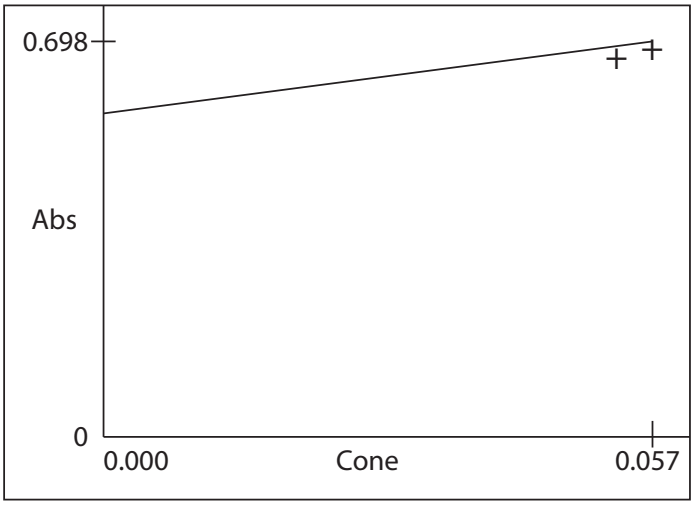
Saving...
001
002 C=+1.000*A+1.000
003 C=+0.562*A-0.346
Please Select!

14. **Replace a Previously Saved Curve**

To save the new curve in another open slot or to replace an existing previously saved curve, use the ^ and v to highlight the open slot or saved curve, press **ENTER** to save.

15. **Display the Curve and Equation**

The standard curve will be displayed regardless of the choice to save or not save the curve. Use ^ and v to switch the display between the curve and the equation. If the curve has not been saved before, it can be saved now by pressing the **SAVE** button.



001	500nm
Conc=K*Abs+B	
K=+0.562	
B+=-0.341	
r=0.990	

16. Press **ENTER** to start to test unknown samples.

(Go to page 38).

Edit Curve

At the Quantitative menu...	Quantitative
	1 Create New Curve
	2 Edit Curve
	3 Delete Curve
	4 Load Curve

1. Use ^ and v to highlight **2 Edit Curve**. Press **ENTER** to confirm the selection.	Edit Curve
	001 C=+0.562*A-0.341
	002 C=+0.050*A+0.100
	Please Select!

1. Use ^ and v to highlight **2 Edit Curve**. Press **ENTER** to confirm Press **ENTER** and **Edit Unit**, Wavelength and any other parameter setting. Then run the standards measurement with the new standards solutions to re-establish the curve. The newly established curve will replace the previously saved curve.	

Note: Press **ESC** to cancel editing before measuring the new standards.

Delete Curve

At the Quantitative menu...	**Quantitative** **1 Create New Curve** **2 Edit Curve** **3 Delete Curve** **4 Load Curve**

1. Use ^ and v to highlight **3 Delete Curve**. Press **ENTER** to confirm the selection.	**Delete Curve** **001 C=+0.562*A-0.341** **002 C=+0.050*A+0.100** **Please Select!**

2. Use ^ and v to highlight the curve to be deleted. Press **ENTER** to confirm your selection.	**Delete Curve** **001 C=+0.562*A-0.341** **002 C=+0.050*A+0.100** **Please Select!**

3. The default setting to confirm the selection is No. Use ^ and v to switch to Yes and press **ENTER** to confirm to continue the deleting process. Press **ESC** to cancel delete and return to the previous screen.	**Delete Curve** **001 C=+0.562*A-0.341** **002 C=+0.050*A+0.100** **Deleting Curve?? NO**

Note: Press **ESC** to cancel editing before measuring the new standards.

4. To avoid possible an accidental deletion, **Are you sure: NO** is displayed. Press **ESC** to stop the deleting process.	**Delete Curve** **001 C=+0.562*A-0.341** **002 C=+0.050*A+0.100** **Are you sure : NO**

5. To delete the curve, switch to Yes using ^ and v button. Press **ENTER** to permanently remove the curve from the memory.	**Delete Curve** **001 C=+0.562*A-0.341** **002 C=+0.050*A+0.100**

Now the sequence slot is open.	**Delete Curve** **001** **002 C=+0.050*A+0.100** **Please Select!**

Load Curve to Run

At the Quantitative menu...	Quantitative **1 Create New Curve** 2 Edit Curve 3 Delete Curve 4 Load Curve

1. Use ^ and v to highlight **4 Load Curve**. Press **ENTER** to go to the Load Curve screen.	Load Curve **001 C=+0.562*A-0.341** 002 C=+0.050*A+0.100 Press “Enter” to Run

2. Press **ENTER** to load the highlighted curve and run the test.	Loading... **001 C=+0.562*A-0.341** 002 C=+0.050*A+0.100 Press “Enter” to Run

Load Curve to Favorite Tests

Favorite Tests is designed for easy access to the most frequently used curves.

At the Quantitative menu...	Quantitative **1 Create New Curve** 2 Edit Curve 3 Delete Curve 4 Load Curve

1. Use ^ and v to highlight **4 Load Curve**. Press **ENTER** to get into the Load Curve screen.	Load Curve **001 C=+0.562*A-0.341** 002 C=+0.050*A+0.100 Press “Enter” to Run

2. Use ^ and v to highlight the curve. Press **LOAD** to load the curve to **Favorite Tests**.	Loaded!! 001 C=+0.562*A-0.341 002 C=+0.050*A+0.100 Press “Enter” to Run

Note: The curve will also be kept in the general saved curve list.

Favorite Tests

Favorite Tests is alterable sequence that allows a series of User Defined Tests that are run frequently to be set up. The curves may be placed in the sequence in whatever testing order is preferred. Programmed Tests cannot be added to this sequence but are saved in separate sequences (Sequence 1, Sequence 2, and Sequence 3) in the Programmed Tests menu.

1. Press the power switch on the back of the instrument to turn the instrument on. The **Initializing** screen will appear.	**Initializing** 15 : 00 **Booting System:** **Locating filter ...** **Warmup 15 min...** **LAMOTTE SMART SPECTRO**
2. Press **ENTER** to select **No**.	**Initializing** **Booting System:** **Locating filter...** **System calibration...** **Please select : NO**
3. The main menu screen will appear.	**12 : 00** 05/03/14 **1 Programmed Tests** **2 User Defined Tests** **3 %T/Abs** **4 DNA/Protein**
4. Scroll to **User Defined Tests**.	**12 : 00** 05/03/14 **1 Programmed Tests** **2 User Defined Tests** **3 %T/Abs** **4 DNA/Protein**
5. At the Quantitative menu ,use ^ and v to highlight **5 Favorite Tests**.	**Quantitative** **2 Edit Curve** **3 Delete Curve** **4 Load Curve** **5 Favorite Tests**

6. Press ENTER to confirm the selection.	Favorite Tests 001 C=+0.562*A-0.341 002 C=+0.050*A+0.100 Press “Enter” to Run
7. Select the desired curve in the favorite tests list and press **ENTER** to run test.	
8. To remove a curve from the Favorite Tests folder highlight the curve and press **CLEAR/DEL**. Then reconfirm the selection to remove the curve.	Favorite Tests 001 C=+0.562*A-0.341 002 C=+0.050*A+0.100 Are you sure : NO
	Removing... 001 C=+0.562*A-0.341 002 C=+0.050*A+0.100
	Favorite Tests 002 C=+0.050*A+0.100 Press “Enter” to Run

■ Run a Test Using a Standard Curve

Follow the instruction described in the previous section in this manual to load the standard curve.

1. Place a blank reference in the optical path. Press 0A/100%T to blank.

+0.562*A-0.341		500nm
Blanking...		
No.	ABS	ppm

2. Place a sample in the optical path and press ENTER to measure. The Absorbance and Transmittance value of the current sample will be displayed. The concentration value and the Absorbance value of the sample will be logged into the table.

+0.562*A-0.341		500nm
0.*19A 12.0%T		
No.	ABS	ppm
* 01	0.919	0.175

3. Repeat the above procedure to measure the other samples.

+0.562*A-0.341		500nm
0.*680 20.8%T		
No.	ABS	ppm
01	0.919	0.175
*02	0.680	0.041

4. To delete a test result in the table, move ***** to highlight the test result and press **CLEAR/DEL** to delete it.
5. Press **PRINT** to print the test results.

■ %T/Absorbance

1. Press the power switch on the back of the instrument to turn the instrument on. The **Initializing** screen will appear.	**Initializing** 15 : 00 **Booting System:** **Locating filter ...** **Warmup 15 min...** LAMOTTE SMART SPECTRO

2. Press **ENTER** to select **No**.	**Initializing** **Booting System:** **Locating filter...** **System calibration...** **Please select : NO**

3. The main menu screen will appear.	**12 : 00** **05/03/14** **1 Programmed Tests** **2 User Defined Tests** **3 %T/Abs** **4 DNA/Protein**

4. Scroll to **%T/Abs**.	**12 : 00** **05/03/14** **1 Programmed Tests** **2 User defined tests** **3 %T/Abs** **4 DNA/Protein**

5. Press ENTER to select **%T/Abs**. The display will show the current wavelength setting.	%T/Abs 546nm *0.000A* *100.0%T*

6. Press **SET** λ to reset the wavelength. Enter the desired wavelength.	**%T/Abs** **546nm** *0.000A* *100.0%T* **Enter WL : 500_**

7. Press **ENTER** to confirm the wavelength. The instrument will go from the previous wavelength (546 nm) to the desired wavelength (500 nm).	**%T/Abs** **500nm** *0.000A* *100.0%T*

Note: At this point, the instrument must be blanked before measuring a sample.

8. Fill a clean cuvette or tube with distilled or deionized water or other specified solvent. This is the Blank. Wipe the cuvette with a lint-free wipe to remove fingerprints and droplets of liquid.

9. Place the Blank in chamber. Close the lid.

10. Press **0A/100%T** to set 0.000A or 100%T. The instrument will set the blank. Note: If “Energy low!” is displayed the reference may be too dark or the light beam energy from the lamp is too weak.	**%T/Abs** **500nm** *Blanking*

11. Remove the Blank.

12. Rinse a cuvette or tube with a small amount of sample solution. Fill the cuvette or tube with the sample. Wipe to remove fingerprints or moisture.

13. Put the Sample in the chamber. Close the lid.

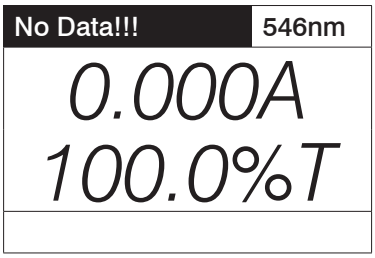
14. The Sample test result will be displayed.

%T/Abs	500nm
0.183A	
65.6%T	

15. Press **ENTER** to confirm and log the result. Up to 20 test results can be logged. When the 21st test result is confirmed the first test result will be automatically removed from the list.

%T/Abs	500nm
0.000A	
100.0%T	
01 : 0.418	**02 : 0.436**

Note: Press **CLEAR/DEL** to delete the test result displayed on the right. If no test result is logged on the bottom line, the display will show that **No Data!!!** is available to be deleted.



To print the result press **PRINT**.

■ DNA/Protein

There are three methods to choose for DNA Ratio, RNA ratio and concentrations of RNA, dsDNA, ssDNA and olig. Follow step by step instructions on the display to run the tests.

SYSTEM SETUP

■ Clock Setup

1. At the main menu select “System Setup”. Choose “Clock Setup” and press **ENTER** to confirm.	System Setup 546nm **1 Clock Setup** 2 Dark Current 3 Lamp Service 4 WL Calibration

Set Time

1. Highlight **Set Time**.	Clock Setup 546nm **1 Set Time 12 : 31 : 21** 2 Set Date 31-03-11

2. Enter the time in the order of hour, minute and second. For example 19:30:00 stands for 7:30 pm.	Clock Setup 546nm **1 Set Time 12 : 31 : 21** 2 Set Date 31-03-11 HH. MM. SS :

Set Date

1. Enter the date in the order of day (DD), month (MM) and year (YY). For example, 31-03-17 stands for March 31, 2014.	Clock Setup 546nm 1 Set Time 12 : 31 : 21 **2 Set Date 31-03-17** DD. MM. YY :

■ Dark Current

1. At System Setup select Dark Current to check and refresh the system dark current. The circled value is the live dark current value at 0-gain which should not be zero or negative.	**Dark current** **546nm** **00023 00047 00091** **00180 00362 00720** **01460 02913 00023** **"Enter" to Refresh!**

2. Press **ENTER** to refresh the dark current: Press **PRINT** to view the energy counts at different gain-setting (from 0 to 7).	**Energy** **546nm** **10268** **Set ADM M=0...7**

■ Lamp Service

1. At **System Setup** choose **Lamp Service** to switch the deuterium lamp off when it is not being used to prolong the life of the lamp. Choose **Switch Point** to select the wavelength where the instrument will switch between the Tungsten Halogen lamp and the deuterium lamp.	**Lamp Service** **500nm** **1 Switch D2 : ON** **2 Switch Point**

■ WL Calibration

1. At System Setup select WL Calibration to recalibrate the system and the wavelength.	**Calibration** λ **546nm** **Calibration** λ **...???** **Are you sure :** **Yes**

Press **ESC** to return to System Setup without recalibrating the wavelength.

2. Press **ENTER** to select Yes and recalibrate the wavelength. a) Recheck Dark Current	**Dark current** **546nm** **Calibration λ ....**

b) Move back to initial position.	**Goto end ...** **546nm** **Calibration λ ....**

c) Search the “0” order light for re-positioning.	**WL...** **546nm** **Calibration λ ....**

d) Finish wavelength calibration and move to 546nm.	**Goto 546nm** **546nm** **Calibration λ ....**

■ WL Correction

The wavelength is pre-calibrated and can be recalibrated using the Wavelength Calibration function. If for any reason the wavelength accuracy is off, it can be adjusted by resetting it using the wavelength correction function in the system setup.

1. Choose WL Correction in the System Setup menu. Use ^ and v to select the correction value. Press **ENTER** to confirm the adjustment. The correction range is +8 nm to -7 nm.	Correction λ	546nm
	Adjust value :	+2nm

■ Firmware Version

1. The firmware version can be confirmed from the System Setup.	**LaMotte** **Model : UV2150** **Software : KL.5.1.12** **Hdwe : U926.42.02.10A**

■ Wavelength Calibration

Under normal conditions the LaMotte UV/VIS Spectrophotometer will retain the wavelength calibration indefinitely. However if the instrument receives a severe shock or is abused, use the following methods to check the wavelength calibration. The procedure requires a didymium wavelength calibration standard, or a holmium oxide wavelength calibration standard.

A didymium wavelength calibration standard has two distinct absorbance peaks at 529 nm and 807 nm. A holmium oxide wavelength calibration standard has a distinct peak at 361 nm. When the instrument is calibrated properly the minimum Transmittance (or maximum Absorbance) should be +2 nm from the target peak values. Note that the specific Transmittance values are not important - only the wavelength where the minimum transmittance (maximum Absorbance) occurs.

Holmium Oxide Wavelength Calibration Standard Method

1. Turn the instrument on and allow it to warm up for 15 minutes.
2. Select %T/Abs.
3. Set the wavelength to 350 nm.
4. Make sure the cuvette holder in the sample compartment is empty. Close the sample compartment lid.
5. Set the Absorbance to zero by pressing 0A/100%T. The reading should be 0.000A. If not, press 0A/100%T again.

6. Place the holmium oxide wavelength calibration standard in the sample compartment and close the lid.
7. Record the Absorbance reading from the display.
8. Advance the wavelength setting by 1 nm and repeat steps 2 to 5.
9. Repeat step 8 until the wavelength setting reaches 370nm.
10. The maximum absorbance reading should be between 359 nm and 363nm.

Didymium Wavelength Calibration Standard Method

1. Turn the instrument on and allow it to warm up for 15 minutes.
2. Select %T/Abs.
3. Set the Wavelength to 800 nm.
4. Make sure the cuvette holder in the sample compartment is empty. Close the sample compartment lid.
5. Set the Absorbance to zero by pressing 0A/100%T. The reading should be 0.000A. If not, press 0A/100%T again.
6. Place the didymium wavelength calibration standard in the sample compartment and close the lid.
7. Record the Absorbance reading from the display.
8. Advance the wavelength setting by 1nm and repeat steps 2 to 5.
9. Repeat step 8 until the wavelength setting reaches 815 nm.
10. The maximum absorbance reading should be between 805 nm and 809 nm.
11. To check a wavelength in the middle range of the instrument, set the wavelength to 522 nm.
12. Make sure the cuvette holder in the sample compartment is empty. Close the sample compartment lid.
13. Set the Absorbance to zero by pressing 0A/100%T. The reading should be 0.000A. If not, press 0A/100%T again.
14. Place the didymium wavelength calibration standard in the sample compartment and close the lid.
15. Record the absorbance reading from the display.
16. Advance the wavelength setting by 1nm and repeat steps 10 to 13.
17. Repeat step 14 until the wavelength setting reaches 536 nm. The maximum absorbance reading should be between 527 nm and 531 nm.

Absorbance Accuracy Checks

Specification: +0.004A at 0.5A

The absorbance accuracy should be checked against a set of neutral density filters accurately calibrated to the NIST standards.

An alternative method using potassium dichromate is described below. Due to the many factors that might affect the results (i.e. temperature, band pass, weighing and diluting errors), this method is less accurate and should only be used as a guide.

Reference: Johnson E
Potassium Dichromate as an absorbance standard
PSG Bulletin 1967, No. 17, page 505

1. Use N/100 sulfuric acid as the solvent and then prepare a solution containing 120 +0.5 mg/L of potassium dichromate.
2. Wash out a square cuvette with solvent, and fill with solvent.
3. Put the cuvette into the sample compartment and close the lid.
4. Select %T/Abs. Set the wavelength to 350 nm.
5. Press OA/100%T to set the reading to 0.000A.
6. Empty the cuvette. Rinse the cuvette with the dichromate solution. Fill the cuvette with the dichromate solution.
7. Put the cuvette into the sample compartment and close the lid.
8. Read the absorbance of the standard from the display. The value should be Calibrated Value + 0.004A. Refer to the notes above when interpreting the result.

Note: It is recommended that the Dark Current be refreshed before performing the check.

Stray Light Check

Specification: Less than 0.3%T at 340nm by ASTM E 387

A good indication as to whether the stray light level is within specification may be obtained as follows:

1. Set the wavelength to 340nm.
2. Select %T/Abs with the sample compartment empty, close the lid and press the 0A/100%T key to set the display to 100.0%.
3. Prepare a solution containing 50 gm/L of sodium nitrite ($NaNO_2$) in distilled water and fill a square cuvette with this solution.
4. Place the cuvette in the sample compartment. Close the lid. The display should read $<$0.3%T.

Note: It is recommended that you refresh the Dark Current before performing the check.

■ Connect to K3 Analyst

The optional Software (Code 7-2000-UV-CD) performs the following methods for analysis:

- Absorbance/%Transmittance/Concentration at single or multi wavelengths: measure the Absorbance, %Transmittance, Concentration/Standard, or Concentration/Factor at a single wavelength or multi wavelengths within the range of 200~1000 nm
- Standard Curve: create a calibration curve with up to 8 standard solutions at a single wavelength to determine concentrations of unknown samples.
- Kinetics (Absorbance vs. Time Kinetics): measure a sample's absorbance change over a selected period of time, store the test results in data table, and display the results graphically.
- Scanning (Absorbance/Transmittance vs. Wavelength): permit the operator to scan at any wavelength range featuring zoom and peak/valley pick.

Requirements: Win XP or Win 7 operating system, 1GB RAM (1 GHz Pentium processer or better), 500 MB of free space on memory, monitor, mouse, and keyboard

Troubleshooting

■ Trouble Shooting Guide

Problem	Possible	Solution
Instrument inoperative	Power cord not connected to outlet	Plug instrument in.
	Dead power outlet	Change to a different outlet
	Internal fuse blown or defective electronic component	Contact LaMotte technical service or a LaMotte distributor.
	Improper power input	Check the power supply (100V-230V)
Instrument cannot set 100%T (0.000A)	Light beam blocked	Check sample holder. See if holder is properly positioned and nothing is blocking light path.
	Lamp is misaligned	Check to see if light is focused properly on entrance slit of the monochromator. Contact LaMotte Technical Service or a LaMotte distributor.
	Lamp light is weak or lamp is defective	Replace the lamp.
	Defective electronic component	Contact LaMotte technical service or a LaMotte distributor.
Incorrect T% to Absorbance correlation	Bubbles or particles in solution	Check sample preparation and analytical procedure.
	Defective electronic component	Contact LaMotte technical service or a LaMotte distributor.

Display does not change regardless of sample concentration	Concentration reading "frozen"	Sample solution too dark, dilute solution and repeat the measurement.
	Wrong wavelength setting	Check sample procedure and wavelength setting.
	Insufficient sample volume	Fill cuvette with more sample solution.
	Stray sample preparation vapors	Prepare the sample away from the instrument. Use proper ventilation.
	Bubbles or particles in solution	Check sample preparation and analytical procedure.
	Defective electronic component or loose wiring	Contact LaMotte technical service or a LaMotte distributor.
Instrument drift and noise	Lamp not adjusted properly (misalignment)	Check lamp for proper installation. Be sure lamp has not moved during transit.
	Lamp old or defective	Replace with a new lamp.
	Defective or dirty detector or defective electronic component.	Contact LaMotte technical service or a LaMotte distributor.
Incorrect readings obtained	Insufficient sample volume	Fill cuvette with more sample solution.
	Wrong wavelength setting	Check analytical procedure and wavelength setting. Check wavelength accuracy according to procedure in this manual.
	Stray sample preparation vapors	Prepare sample away from instrument. Use proper ventilation.
	Bubbles or particles in solution	Check sample preparation and analytical procedure.
	Instrument out of electronic calibration	Contact LaMotte technical service or a LaMotte distributor.

■ Error Messages

Error messages will be displayed in the instrument detects an error. Each error message represents an error that has occured during the self calibration or during operation.

Error Message	Description	Solution
Locating lamp...X	Instrument unable to locate the lamp change-over switch	Contact LaMotte technical service or a LaMotte distributor.
Locating filter…X	Instrument unable to initialize and/or locate the secondary filter	Contact LaMotte technical service or a LaMotte distributor.
WL Zero-order!		1. Light beam alignment is off or is blocked. 2. Tungsten Halogen lamp is off or dead. 3. Filter wheel is malfunctioning and incorrect filter is brought into the optical path.
Sys energy low!	Pass system calibration and WL calibration but detects light beam energy low	Energy to the detector is low. The 0-order energy count is less than 35000. 1. Light beam alignment is off. 2. Filter wheel is malfunctioning and incorrect filter is brought into the optical path.
WL Sensor 1...X	Unable to locate the WL calibration starting point	If " WL sensor 1 …X" is shown after humming (jamming): Wavelength bar starting sensor is malfunctioning or dead and the bar may be jammed at the bar-front end. Contact LaMotte technical service or a LaMotte distributor.
	Unable to locate the WL calibration starting point	if " WL sensor 1 …X" is shown without humming and wavelength-driving motor does not work, contact LaMotte technical service or a LaMotte distributor. If wavelength-driving motor works, 1) Light beam is misaligned or blocked 2) Lamp is off/dead. Contact LaMotte technical service or a LaMotte distributor.

WL Sensor 2...X	Wavelength bar reaches the back end and triggers the back-end protection sensor	Contact LaMotte technical service or a LaMotte distributor.
System calibration...X	Unable to complete system calibration	If Wavelength-driving motor does not work, contact LaMotte technical service or a LaMotte distributor. If wavelength-driving motor works, 1) Light beam is misaligned or blocked failing to reach the detector. 2) Lamp is off/dead. Contact LaMotte technical service or a LaMotte distributor.
Energy low!!		Lamp not on or dead. 1) Light is on but light beam fails to reach detector. 2) Light may be blocked. 3) Reference is too dark. 4) Light optical path misaligned: not focused on entrance slit; or internal optics off aligned to cause light beam not out from the exit slit to sample compartment. 5) Secondary filter positioning is malfunctioning. Detector PCB malfunctioning (dark current too small or negative or the board is defective). Contact LaMotte technical service or a LaMotte distributor
Energy high!!		1. Secondary filter positioning is malfunctioning. 2. Detector PCB malfunctioning (dark current either too high or the board is defective). Contact LaMotte technical service or a LaMotte distributor.

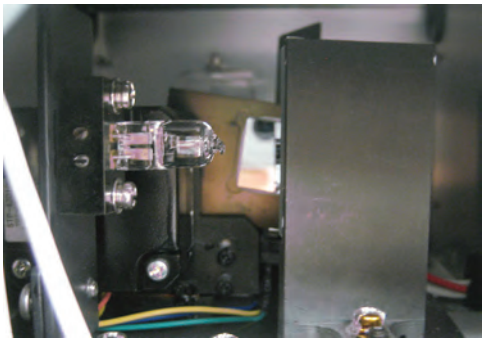
■ Performance

To ensure that the instrument is working within its specification, especially when making measurements of an important nature, carry out performance checks with particular reference to wavelength and absorbance accuracy. Performance checks are detailed in this manual.

■ Tungsten Halogen Lamp Replacement

1. Use a screwdriver to loosen the screws and remove the cover on the back of the instrument.

2. Loosen the 2 lamp-securing screws. Pull the bulb out and replace with a new lamp (12V 20W) of the same type. The filament type must be identical. Secure the new lamp with the locking screw. Tighten the screw firmly but do not over-tighten to avoid damaging or breaking the lamp.



■ Maintenance

Cleaning

Clean with a damp, lint-free cloth.

DO NOT ALLOW WATER TO ENTER THE SPECTROPHOTOMETER CHAMBER OR ANY OTHER PARTS OF THE METER.

Meter Disposal

Waste Electrical and Electronic Equipment (WEEE)

Natural resources were used in the production of this equipment. This equipment may contain materials that are hazardous to health and the environment. To avoid harm to the environment and natural resources, the use of appropriate take-back systems is recommended. The crossed out wheeled bin symbol on the meter encourages you to use these systems when disposing of this equipment.

Take-back systems will allow the materials to be reused or recycled in a way that will not harm the environment. For more information on approved collection, reuse, and recycling systems contact your local or regional waste administration or recycling service.

■ PACKAGING & DELIVERY

Experienced packaging personnel at LaMotte Company assure adequate protection against normal hazards encountered in transportation of shipments. After the product leaves the manufacturer, all responsibility for its safe delivery is assured by the transportation company. Damage claims must be filed immediately with the transportation company to receive compensation for damaged goods.

Should it be necessary to return the instrument for repair or servicing, pack instrument carefully in suitable container with adequate packing material. A return authorization number must be obtained from LaMotte Company by calling 1-800-344-3100. Attach a letter with the authorization number to the shipping carton which describes the kind of trouble experienced. This valuable information will enable the service department to make the required repairs more efficiently.

■ LIMITS OF LIABILITY

Under no circumstances shall LaMotte Company be liable for loss of life, property, profits, or other damages incurred through the use or misuse of their products.

■ WARRANTY

LaMotte Company warrants this instrument to be free of defects in parts and workmanship for 1 year from the date of shipment. If it should become necessary to return the instrument for service during or beyond the warranty period, contact our Technical Service Department at 1-800-344-3100 or tech@lamotte.com for a return authorization number or visit www.lamotte.com for troubleshooting help. The sender is responsible for shipping charges, freight, insurance and proper packaging to prevent damage in transit. This warranty does not apply to defects resulting from action of the user such as misuse, improper wiring, operation outside of specification, improper maintenance or repair, or unauthorized modification. LaMotte Company specifically disclaims any implied warranties or merchantability or fitness for a specific purpose and will not be liable for any direct, indirect, incidental or consequential damages. LaMotte Company's total liability is limited to repair or replacement of the product. The warranty set forth above is inclusive and no other warranty, whether written or oral, is expressed or implied.

To register your meter with the LaMotte Service Department, go to www.lamotte.com and choose SUPPORT on the top navigation bar.

■ STATISTICAL AND TECHNICAL DEFINITIONS RELATED TO PRODUCT SPECIFICATIONS

Method Detection Limit (MDL): "The method detection limit (MDL) is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte."[1] Note that, "As Dr. William Horwitz once stated, 'In almost all cases when dealing with a limit of detection or limit of determination, the primary purpose of determining that limit is to stay away from it.'"[2]

1.CFR 40, part 136, appendix B

2.Statistics in Analytical Chemistry: Part 7 – A Review, D. Coleman and L Vanatta, American Laboratory, Sept 2003, P. 31.

Precision: Precision is the numerical agreement between two or more measurements.[3] The precision can be reported as a range for a measurement (difference between the min and max). It can also be reported as the standard deviation or the relative standard deviation. It is a measure of how close together the measurements are, not how close they are to the correct or true value. The precision can be very good and the accuracy very bad. This is a useful measure of the performance of a test method.

3.Skoog, D.A., West, D. M., Fundamental of Analytical Chemistry, 2nd ed., Holt Rinehart and Winston, Inc, 1969, p. 26.

Accuracy: Accuracy is the nearness of a measurement to the accepted or true value.[4] The accuracy can be expressed as a range, about the true value, in which a measurement occurs (i.e. ±0.5 ppm). It can also be expressed as the % recovery of a know amount of analyte in a determination of the analyte (i.e. 103.5 %). This

is a useful measure and what most customers are interested in when they want to know about the performance of a test method.

4.Skoog D.A., West D. M., Fundamental of Analytical Chemistry, 2nd ed., Holt Rinehart and Winston, Inc, 1969, p. 26.

Resolution: Resolution is the smallest discernible difference between any two measurements that can be made.5 For meters this is usually how many decimal places are displayed. (i.e. 0.01). For titrations and various comparators it is the smallest interval the device is calibrated or marked to (i.e. 1 drop = 10 ppm, 0.2 ppm for a DRT, or ±half a unit difference for an octaslide or color chart). Note that the resolution many change with concentration or range. In some cases the resolution may be less than the smallest interval, if it is possible to make a reading that falls between calibration marks. This is often done with various comparators. One caveat is, that resolution has very little relationship to accuracy or precision. The resolution will always be less than the accuracy or precision but it is not a statistical measure of how well a method of analysis works. The resolution can be very very good and the accuracy and precision can be very, very bad! This is not a useful measure of the performance of a test method.

5.Statistics in Analytical Chemistry: Part 7 – A Review, D. Coleman and L Vanatta, American Laboratory, Sept 2003, P. 34.

Sensitivity: Sensitivity is the resolution based on how this term is used in LaMotte catalogs. This term is not listed in any of the references. Sometimes it is used for detection limit. It is a confusing term and should be avoided.

Repeatability: Repeatability is the within-run precision.6 A run is a single data set, from set up to clean up. Generally, one run occurs on one day. However, for meter calibrations, a single calibration is considered a single run or data set, even though it may take 2 or 3 days.

6.Jeffery G. H., Basset J., Mendham J., Denney R. C., Vogel's Textbook of Quantitative Chemical Analysis, 5th ed., Longman Scientific & Technical, 1989, p. 130.

Reproducibility: Reproducibility is the between-run precision.7

7.Jeffery G. H., Basset J., Mendham J., Denney R. C., Vogel's Textbook of Quantitative Chemical Analysis, 5th ed., Longman Scientific & Technical, 1989, p. 130.

■ SPECIFICATIONS

INSTRUMENT TYPE: Single beam spectrophotometer

Wavelength Range	190-1100 nm
Spectral Bandpass	4 nm
Wavelength Accuracy	+2 nm
Wavelength Repeatability	+1nm
Stray Radiant Energy	<0.3 @ 220 and 340 nm
Photometric Range	0 to 125%T 0.3 to 2.5 Abs -9999 to 9999
Photometric Accuracy	+ 0.004 @ 0.5A
Display	LCD Graphic 128 x 64
Control and Data Entry	Touch Button Keypad
Data output	For RS232 printer
Power Requirements	90-240Vac, 50-60 Hz
Dimensions	550 W x 400 D x 270 H (mm)
Light Source	Tungsten Halogen/Deuterium
Weight	46 lb/21kg

■ EPA COMPLIANCE

The UV/VIS Spectrophotometer is an EPA-Accepted instrument. EPA-Accepted means that the instrument meets the requirements for instrumentation as found in test procedures that are approved for the National Primary Drinking Water Regulations (NPDWR) or National Pollutant Discharge Elimination System (NPDES) compliance monitoring programs. EPA-Accepted instruments may be used with approved test procedures without additional approval.

■ CE COMPLIANCE

The UV/VIS Spectrophotometer has been independently tested and has earned the European CE Mark of Compliance for electromagnetic compatibility and safety. To view the Declaration of Conformity go to www.lamotte.com.

■ OVERVIEW

The LaMotte UV/VIS Spectrophotometer is a single beam, general purpose instrument designed to meet the needs of the conventional laboratory, It is ideal for various applications, such as: Clinical Chemistry, Biochemistry, Petro-chemistry, Environmental Protection, Food and Beverage Labs, Water and Waste Water Labs and other fields of quality control and research.

The LaMotte UV/VIS Spectrophotometer features a digital display of the photometric result, easy operation and wavelength range of 190 nm to 1100 nm. The LaMotte UV/VIS Spectrophotometer is ideal for measurements in the ultraviolet and visible wavelength regions of the electromagnetic spectrum.

The spectrophotometer consists of five parts:

1) Tungsten Halogen and deuterium lamp to supply the light

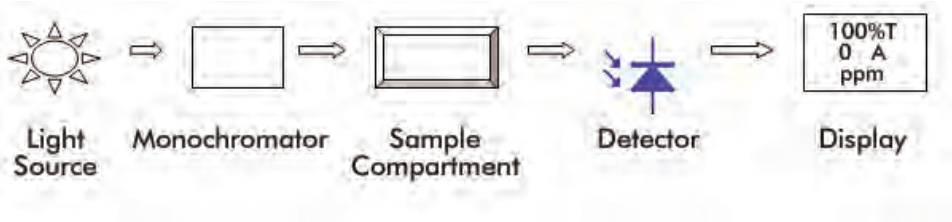
2) A monochromator to isolate the wavelength of interest and eliminate the unwanted second order radiation

3) A sample compartment to accommodate the sample solution

4) A detector to receive the transmitted light and convert it to an electrical signal

5) A digital display to indicate absorbance, transmittance, or test unit.

The block diagram below illustrates the relationship between these parts.



Light from the lamp is focused on the entrance slit of the monochromator where the collimating mirror directs the beam onto the grating. The grating disperses the light beam to produce the spectrum, a portion of which is focused on the exit slit of the monochromator by a collimating mirror. From here the beam is passed to a sample compartment through one of the filters, which helps to eliminate unwanted second order radiation from the diffraction grating. Upon leaving the sample compartment, the beam is passed to the silicon photodiode detector and causes the detector to produce an electrical signal that is displayed on the digital display.

■ WATER SAMPLING FOR CHEMICAL ANALYSIS

Taking Representative Samples

The underlying factor to be considered for any type of water sampling is whether or not the sample is truly representative of the source. To properly collect a representative sample:

- Sample as frequently as possible.
- Collect a large sample or at least enough to conduct whatever tests are necessary.
- Make a composite sample for the same sampling area.
- Handle the sample in such a way as to prevent deterioration or contamination before the analysis is performed.
- Perform analysis for dissolved gases such as dissolved oxygen, carbon dioxide, and hydrogen sulfide immediately at the site of sampling. These factors, as well as samples for pH testing, cannot be stored for later examination.
- Make a list of conditions or observations which may affect the sample. Other considerations for taking representative samples are dependent upon the source of the sample. Taking samples from surface waters involves different considerations than taking samples from impounded and sub-surface waters.

Sampling of Open Water Systems

Surface waters, such as those found in streams and rivers, are usually well mixed. The sample should be taken downstream from any tributary, industrial or sewage pollution source. For comparison purposes samples may be taken upstream and at the source of the pollution.

In ponds, lakes, and reservoirs with restricted flow, it is necessary to collect a number of samples in a cross section of the body of water, and where possible composite samples should be made to ensure representative samples.

To collect samples from surface waters, select a suitable plastic container with a tight fitting screw cap. Rinse the container several times with the sample to be tested, then immerse the container below the surface until it is filled to overflowing and replace the cap. If the sample is not to be tested immediately, pour a small part of the sample out and reseal. This will allow for any expansion. Any condition which might affect the sample should be listed.

Sub-surface sampling is required to obtain a vertical profile of streams, lakes, ponds, and reservoirs at specific depths. This type of sampling requires more sophisticated sampling equipment.

For dissolved oxygen studies, or for tests requiring small sample sizes, a Water Sampler (LaMotte Code 1060) will serve as a sub-surface or in-depth sampler. This weighted device is lowered to the sampling depth and allowed to rest at this depth for a few minutes. The water percolates into the sample chamber displacing

the air which bubbles to the surface. When the bubbles cease to rise, the device has flushed itself approximately five times and it may be raised to the surface for examination. The inner chamber of the sampling device is lifted out and portions of the water sample are carefully dispensed for subsequent chemical analysis.

A Snap-Plunger Water Sampler (LaMotte Code 1077) is another "in-depth" sampling device which is designed to collect large samples which can be used for a multitude of tests. Basically, this collection apparatus is a hollow cylinder with a spring loaded plunger attached to each end. The device is cocked above the surface of the water and lowered to the desired depth. A weighted messenger is sent down the calibrated line to trip the closing mechanism and the plungers seal the sample from mixing with intermediate layers as it is brought to the surface. A special drain outlet is provided to draw off samples for chemical analysis.

Sampling of Closed System

To obtain representative samples from confined water systems, such as pipe lines, tanks, vats, filters, water softeners, evaporators and condensers, different considerations are required because of chemical changes which occur between the inlet and outlet water. One must have a basic understanding of the type of chemical changes which occur for the type of equipment used. Also, consideration should be given to the rate of passage and retaining time for the process water.

Temperature changes play an important part in deciding exactly what test should be performed. Process water should be allowed to come to room temperature, 20–25°C, before conducting any tests.

When drawing off samples from an outlet pipe such as a tap, allow sample to run for several minutes, rinsing the container several times before taking the final sample. Avoid splashing and introduction of any contaminating material.

■ FILTRATION

When testing natural waters that contain significant turbidity due to suspended solids and algae, filtration is an option. Reagent systems, whether EPA, Standard Methods, LaMotte or any others, will generally only determine dissolved constituents. Both EPA and Standard Methods suggest filtration through a 0.45 micron filter membrane, to remove turbidity, for the determination of dissolved constituents.** To test for total constituents, organically bound and suspended or colloidal materials, a rigorous high temperature acid digestion is necessary.

**LaMotte offers a filtering apparatus: syringe assembly (Code 1050) and membrane filters, 0.45 micron, (Code 1103).

■ AN INTRODUCTION TO COLORIMETRIC ANALYSIS & SPECTROSCOPY

Most test substances in water are colorless and undetectable to the human eye. To test for their presence we must find a way to "see" them. The LaMotte UV/VIS Spectrophotometer can be used to measure any test substance that is itself colored or can be reacted to produce a color. In fact a simple definition

of colorimetry is “the measurement of color” and a colorimetric method is “any technique used to evaluate an unknown color in reference to known colors”. In a colorimetric chemical test the intensity of the color from the reaction must be proportional to the concentration of the substance being tested. Some reactions have limitations or variances inherent to them that may give misleading results. Many such interferences are discussed with each particular test instruction. In the most basic colorimetric method the reacted test sample is visually compared to a known color standard. However, accurate and reproducible results are limited by the eyesight of the analyst, inconsistencies in the light sources, and the fading of color standards.

To avoid these sources of error, a colorimeter or spectrophotometer can be used to photoelectrically measure the amount of colored light absorbed by a colored sample in reference to a colorless sample (blank).

White light is made up of many different colors or wavelengths of light. A colored sample typically absorbs only one color or one band of wavelengths from the white light. Only a small difference would be measured between white light before it passes through a colored sample versus after it passes through a colored sample. The reason for this is that the one color absorbed by the sample is only a small portion of the total amount of light passing through the sample. However, if we could select only that one color or band of wavelengths of light to which the test sample is most sensitive, we would see a large difference between the light before it passes through the sample and after it passes through the sample.

The difference in the amount of monochromatic light transmitted through a colorless sample (blank) and the amount of monochromatic light transmitted through a test sample is a measurement of the amount of monochromatic light absorbed by the sample. In most colorimetric tests the amount of monochromatic light absorbed is directly proportional to the concentration of the test factor producing the color and the path length through the sample. However, for a few tests the relationship is reversed and the amount of monochromatic light absorbed is inversely proportional to the concentration of the test factor.

The choice of the correct wavelength for testing is important. It is interesting to note that the wavelength that gives the most sensitivity (lower detection limit) for a test factor is the complementary color of the test sample. For example the Nitrate-Nitrogen test produces a pink color proportional to the nitrate concentration in the sample (the greater the nitrate concentration, the darker the pink color). A wavelength in the green region should be selected to analyze this sample since a pinkish-red solution absorbs mostly green light.

■ REAGENT BLANK

Some tests will provide greater accuracy if a reagent blank is determined to compensate for any color or turbidity resulting from the reagents themselves. A reagent blank is performed by running the test procedure on 10 mL of demineralized or deionized water. Use sample water to scan the blank. Insert the reacted reagent blank in the colorimeter chamber and scan the sample. Note the result of reagent blank. Perform the tests on the sample water as described.

Subtract results of reagent blank from all subsequent test results.

NOTE: Some tests require a reagent blank to be used as the scanned blank..

■ SELECTING AN APPROPRIATE WAVELENGTH

The most appropriate wavelength to use when creating a calibration curve is usually the one which gives the greatest change from the lowest reacted standard concentration to the highest reacted standard concentration. However, the absorbance of the highest reacted standard concentration should never be greater than 2.0 absorbance units. Scan the lowest and highest reacted standards at different wavelengths using the %T/ABS mode to find the wavelength which gives the greatest change in absorbance without exceeding 2.0 absorbance units. Use this wavelength to create a calibration curve.

Below is a list of suggested wavelength ranges for the color of the reacted samples. Use these as a starting point.

Sample Color	Wavelength Range, nm
Yellow	350-450
Yellow-Orange	450-490
Orange	490-510
Pink	510-570
Red	570-600
Green and Blue	600-750

■ CALIBRATION CURVES

The UV/VIS Spectrophotometer contains precalibrated tests for the LaMotte reagent systems. The first step in using a non-LaMotte reagent system with the UV/VIS Spectrophotometer is to create a calibration curve for the reagent system. To create a calibration curve, prepare standard solutions of the test factor and use the reagent system to test the standard solutions with the UV/VIS Spectrophotometer.

The results are plotted to create a calibration curve. The calibration curve may then be used to identify the concentration of an unknown sample .

PROCEDURE

1. Prepare 2 or 8 standard solutions of the factor being tested. The concentration of these standards should be evenly distributed throughout the range of the reagent system, and should include a 0 ppm standard (distilled water, in most cases). For instance, the solutions could measure 0, 10%, 30%, 50%, 70%, and 90% of the system's maximum range.

2. Select the appropriate %T/ABS wavelength. Be sure to select the appropriate wavelength for the color produced by the reagent system.
3. Use the unreacted 0 ppm standard to standardize the spectrophotometer by using it to scan blank.
4. Following the individual reagent system instructions, react each standard solution including 0 ppm.

■ PREPARING DILUTE STANDARD SOLUTIONS

Standard solutions should be prepared to create a calibration curve. Standard solutions can be prepared by diluting a known concentrated standard by specified amounts. A chart or computer spreadsheet can be created to determine the proper dilutions. Use volumetric flasks and volumetric pipets for all dilutions.

1. In Column A – Record the maximum concentration of test as determined by the range and path length.
2. In Column B – Record the percent of the maximum concentration the standard solution will be.
3. In Column C – Calculate the final concentration of the diluted standard solutions by multiplying the maximum concentration (In Column A) by the % of maximum concentration divided by 100. (C = A x).
4. In Column D – Record the final volume of the diluted sample (i.e. volume of volumetric flask).
5. In Column E – Record the concentration of the original standard.
6. In Column F – Calculate the milliliters of original standard required (C x D/E = F).

A sample chart appears below:

A	B	C=A x B/100	D	E	F=C x D/E
Maximum concentration of test	% of Maximum concentration	Final concentration of Diluted Standard	Volume of Standard	Concentration of Original Standard	mL of Original Standard Required
10.0 ppm	90	9.0 ppm	100 mL	1000 ppm	0.90 mL
10.0 ppm	70	7.0 ppm	100 mL	1000 ppm	0.70 mL
10.0 ppm	50	5.0 ppm	100 mL	1000 ppm	0.50 mL
10.0 ppm	30	3.0 ppm	100 mL	1000 ppm	0.30 mL
10.0 ppm	10	1.0 ppm	100 mL	1000 ppm	0.10 mL
10.0 ppm	0	0 ppm	100 mL	1000 ppm	0 mL

■ STANDARD ADDITIONS

A common method to check the accuracy and precision of a test is by standard additions. In this method a sample is tested to determine the concentration of the test substance. A second sample is then "spiked" by the addition of a known quantity of the test substance. The second sample is then tested. The determined concentration of the spiked sample should equal the concentration of the first plus the amount added with the spike. The procedure can be repeated with larger and larger "spikes." If the determined concentrations do not equal the concentration of the sample plus that added with the "spike", then an interference may exist.

For example, a 10.0 mL water sample was determined to contain 0.3 ppm iron. To a second 10.0 mL sample, 0.1 mL of 50 ppm iron standard was added. The concentration of iron due to the "spike" was (0.10 mL x 50 ppm)/10.0 mL = 0.50 ppm. The concentration of iron determined in the spiked sample should be 0.3 + 0.5 = 0.8 ppm iron.

(Note: any error due to the increased volume from the "spike" is negligible).

LaMotte offers a line of calibration standards which can be used to generate calibration curves and perform standard additions.

■ SAMPLE DILUTION TECHNIQUES & VOLUMETRIC MEASUREMENTS

If a test result gives an **OUT OF RANGE** message then the sample concentration could be over range or under range. If it is over range, the sample must be diluted. Then the test should be repeated on the diluted sample to obtain a reading which is in the concentration range for the test. (Note: This is not true for colorimetric determination of pH.)

Example: Measure 5 mL of the water sample into a graduated cylinder. Add demineralized water until the cylinder is filled to the 10 mL line. The sample has been diluted by one-half, and the dilution factor is therefore 2. Perform the test procedure, then multiply the resulting concentration by 2 to obtain the test result.

The following table gives quick reference guidelines on dilutions of various proportions. All dilutions are based on a 10 mL volume, so several dilutions will require small volumes of the water sample. Graduated pipets should be used for all dilutions.

Size of Sample	Deionized Water to Bring Volume to 10 mL	Multiplication Factor
10 mL	0 mL	1
5 mL	5 mL	2
2.5 mL	7.5 mL	4
1 mL	9 mL	10
0.5 mL	0.5 mL	20

If the above glassware is not available, dilutions can be made with the spectrophotometer tube. Fill the tube to the 10 mL line with the sample then transfer it to another container. Add 10 mL volumes of demineralized water to the container and mix. Transfer back 10 mL of the diluted sample to the tube and follow the test procedure. Continue diluting and testing until a reading, which is in the concentration range for the test, is obtained. Be sure to multiply the concentration found by the dilution factor (the number of total 10 mL volumes used).

Example:

10 mL of sample is diluted with three 10 mL volumes of demineralized water; the dilution factor is four.

■ INTERFERENCES

LaMotte reagent systems are designed to minimize most common interferences. Each individual test instruction discusses interferences unique to that test. Be aware of possible interferences in the water being tested.

The reagent systems also contain buffers to adjust the water sample to the ideal pH for the reaction. It is possible that the buffer capacity of the water sample may exceed the buffer capacity of the reagent system and the ideal pH will not be obtained. If this is suspected, measure the pH of a reacted distilled water reagent blank using a pH meter. This is the ideal pH for the test. Measure the pH of a reacted water sample using the pH meter. If the pH is significantly different from the ideal value, the pH of the sample should be adjusted before testing.

Chlorine interferences can be removed with the use of glycine. Very high levels of chloramines may interfere if the test result is not read immediately. Oxidized manganese interferes but can be removed with arsenite. Bromine and iodine interferes but can be removed with a thioacetamide blank correction.

Interferences due to high concentration of the substance being tested, can be overcome by sample dilution.

■ STRAY LIGHT INTERFERENCE

Normal indoor lighting causes no interference with the UV/VIS Spectrophotometer. Always be sure the sample chamber lid is closed when scanning blanks or samples.

UV/VIS
Spectrophotometer

Test Procedures

7-2000-UV-MN

11.08.19

LaMotte®

WARNING! This set contains chemicals that may be harmful if misued. Read cautions on individual containers carefully. Not to be used by children except under adult supervision.

UV/VIS SPECTROPHOTOMETER REAGENT SYSTEMS LIST

Call LaMotte Technical Services at 1-800-344-3100 (410-778-3100 outside the USA) or email at tech@lamotte.com for a current list of available calibrations..

Test Factor (Test #)	Range (ppm)	MDL	Test Method (# of Reagents)	# of Tests
Alkalinity-UDV (1)	0–200	15	Unit Dose Vials (1)	100
Aluminum (2)	0.00–0.30	0.01	Eriochrome Cyanine R (4)	50
Ammonia Nitrogen-Low Range, Fresh Water (3)	0.00–1.00	0.02	Salicylate (3)	25
Ammonia Nitrogen-Low Range, Salt Water (4)	0.00–1.00	0.10	Salicylate (3)	25
Ammonia Nitrogen-High Range (5)	0.00–4.00	0.05	Nesslerization (2)	50
Biguanide (7)	0–70	5	Colorimetric	50
Boron (8)	0.00-0.80	0.05	Azomethine-H (2)	25
Bromine-Low Range (9)	0.00–9.00	0.04	DPD (3)	100
Bromine-UDV (11)	0.0–20.0	0.3	DPD (1)	100
Cadmium (12)	0.00–1.00	0.02	PAN (4)	50
Carbohydrazide (14) *See Oxygen Scavengers*	0.000–0.900	0.005	Iron Reduction (3)	100
Calcium & Magnesium (Total), Hardness-UDV (13)	10-500	10	Unit Dose Vial (1)	100
Chloride-TesTab (21)	0.0–50.0	0.5	Argentometric (1)	50
Chlorine-Tablet DPD (15)	0.00–4.00	0.02	DPD (3)	100
Chlorine-Free-UDV (16)	0.00–10.00	0.10	DPD (1)	100
Chlorine-Total-UDV (18)	0.00–10.00	0.10	DPD (1)	100
Chlorine-Liquid DPD (17)	0.00–4.00	0.025	DPD (3)	144
Chlorine Dioxide (20)	0.00–7.00	0.04	DPD (2)	100
Chromium, Hexavalent (22)	0.00–1.00	0.01	Diphenylcarbohydrazide	50
Chromium, Hex, Tri, Total (22)	0.00–1.00	0.01	Diphenylcarbohydrazide	50
Chromium-TesTab (23)	0.00-1.00	0.01	Diphenylcarbohydrazide	50
Cobalt (24)	0.00–2.00	0.02	PAN (3)	50
COD-Low Range (25)	0–150	5	Digestion (1)	25
COD-Standard Range (26)	0-1500	20	Digestion (1)	25
COD-High Range (27)	0–15,000	500	Digestion (1)	25
Color (28)	0–1,000	15	Platinum Cobalt (0)	–

Copper-BCA-Low Range (29)	0.00–3.50	0.05	Bicinchoninic Acid (1)	50
Copper-Cuprizone (31)	0.00–2.00	0.01	Cuprizone (2)	50
Copper-DDC (32)	0.00–6.00	0.05	Diethyldithiocarbamate (1)	50
Copper-UDV (33)	0.00–4.00	0.20	Bicinchoninic Acid (1)	100
Cyanide (35)	0.00-0.50	0.50	Pyridine-Barbituric Acid	100
Cyanuric Acid (36)	0–200	16	Melamine (1)	40
Cyanuric Acid-UDV (37)	0–150	5	Melamine (1)	100
DEHA (38) *See Oxygen Scavengers*	0.000–0.700	0.005	Iron Reduction (3)	100
Dissolved Oxygen (39)	0.0–12.0	0.25	Winkler Colorimetric (3)	100
Erythorbic Acid (40) *See Oxygen Scavengers*	0.00–3.00	0.02	Iron Reduction (3)	100
Fluoride (41)	0.00–2.00	0.05	SPADNS (2)	50
Hydrazine (45)	0.000–0.750	0.010	P-dimethyl-aminobenzaldehyde (2)	50
Hydrogen Peroxide-Low Range (46)	0.00–1.50	0.02	DPD (2)	100
Hydrogen Peroxide-High Range (47)	0–60	1	DPD (2)	50
Hydrogen Peroxide-Shock (48)	0–225	4	DPD (2)	100
Hydroquinone (49) *See Oxygen Scavengers*	0.00–1.80	0.01	Iron Reduction (3)	100
Iodine (50)	0.00–14.00	0.08	DPD (2)	100
Iron-Bipyridyl (51)	0.00–6.00	0.06	Bipyridyl (2)	50
Iron-Phenanthroline (53)	0.00–4.50	0.04	1,10 Phenanthroline (2)	50
Iron-UDV (52)	0.00–10.00	0.07	Bipyridyl (1)	100
Lead (54)	0.00–5.00	0.10	PAR (5)	50
Manganese-Low Range (55)	0.00–0.50	0.02	PAN (3)	50
Manganese-High Range (56)	0.0–15.0	0.3	Periodate (2)	50
Methylethylketoxime (58) *See Oxygen Scavengers*	0.00–3.00	0.02	Iron Reduction (3)	100
Molybdenum-High Range (61)	0.0–30.0	0.2	Thioglycolate (3)	50
Nickel (63)	0.00–8.00	0.06	Dimethylglyoxime (6)	50
Nitrate-TesTab (66)	0-60	2.5	Zinc Reucion (1)	50
Nitrate Nitrogen-Low Range (64)	0.00–3.00	0.05	Cadmium Reduction (2)	20
Nitrite-TesTab (69)	0.00-1.25	0.025	Zinc Reduction (1)	50
Nitrite Nitrogen-Low Range (67)	0.00–0.80	0.02	Diazotization (2)	20

Nitrogen, Total (62)	0-25 mg/L	2 mg/L	Chromotropic Acid/ Digestion (6)	25
Oxygen Scanvengers	various	various	DEHA (3)	50
Ozone-Low Range (71)	0.00–0.40	0.02	Indigo Trisulfonate (3)	100
Ozone-High Range (72)	0.00–1.50	0.05	Indigo Trisulfonate (3)	20
pH-Chlorophenol Red (74)	5.0-7.0	–	Chlorophenol Red (1)	100
pH-Phenol Red (75)	6.6–8.4	–	Phenol Red (1)	100
pH-Thymol Blue (76)	8.0–9.5	–	Thymol Blue (1)	100
Phenol (77)	0.00-6.00	0.05	Aminoantipyrine (3)	50
Phosphate-Low Range (78)	0.00–3.00	0.04	Ascorbic Acid Reduction (2)	50
Phosphate-High Range (79)	0.0–70.0	1.0	Vanodomolybd-phosphoric Acid (1)	50
Phosphorus, Total, Low Range (82)	0.00–3.00 mg/L	0.07	Ascorbic Acid/Digestion	25
Phosphorus, Total, High-Range (83)	0.0–70.0 mg/L	5.0 mg/L	Molybdovanadate/ Digestion (5)	25
Potassium (81)	0.0-10.0	0.5	Tetraphenolboron (2)	100
Silica-Low Range (85)	0.00–2.50	0.03	Heteropoly Blue (4)	50
Silica-High Range (86)	0–50	1	Silicomolybdate (3)	50
Sulfate-High Range (89)	5–100	5	Barium Chloride (1)	100
Sulfide-Low Range (90)	0.00–1.00	0.02	Methylene Blue (3)	50
Surfactants (94)	0.00-8.00	0.5	Bromphenol Blue (3)	50
Tannin (96)	0.0–10.0	0.2	Tungsto-molybdophosphoric Acid (2)	50
Turbidity (98)	2-400 FTU	2 FTU	Absorption (0)	–
Zinc-Low Range (99)	0.00–3.00	0.025	Zincon (6)	50

ALKALINITY, UDV

UNIT DOSE VIAL METHOD • CODE 4318-J

QUANTITY	CONTENTS	CODE
1	*Alkalinity Unit Dose Vials, 20 pouches	*4318-J

Equipment needed but not supplied:

STANDARD ACCESSORY PACKAGE • CODE 1961

1	Package of 3 Vials (empty)	0156
1	Syringe, 6 mL, plastic	1184
1	Foil Storage Bag	9467

Or:

ADVANCED ACCESSORY PACKAGE • CODE 1962

1	Pipettor	30528
1	Pipet Tip (0-5 mL)	30695
1	Cuvette Rack	31695
1	Package of 3 Vials (empty)	0156
1	Foil Storage Bag	9467

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Emergency information for all LaMotte reagents is available from Chem-Tel: (US, 1-800-255-3924) (International, call collect, 813-248-0585)

Alkalinity is a measure of the acid-neutralizing capacity of water that enables it to resist abrupt changes in pH. It is the sum of all titratable bases. Alkalinity is significant in maintaining proper pH levels in natural water; water used for irrigation, swimming pools, industrial processes and wastewater treatment processes.

The presence of buffering materials in natural waters helps to neutralize acids as they are added to, or created in, the water ecosystem. A Total Alkalinity of 100 to 200 ppm will stabilize the pH level in a stream. In swimming pools, total alkalinity is commonly known as a pH stabilizer because, when the alkalinity is at a proper level, a consistent pH level can be maintained while treatment chemicals or fresh make-up water is added. In industrial situations, alkalinity is an important factor in preventing fluctuating pH levels that can damage equipment and corrode pipes.

APPLICATION:	Drinking and surface water and swimming pool water
RANGE:	0–200 ppm as $CaCO_3$
MDL:	15 ppm
METHOD:	The sample is added to a buffered indicator reagent. The color that develops, ranging from yellow to blue, will indicate the amount of alkalinity in the sample.
SAMPLE HANDLING & PRESERVATION:	Samples should be analyzed as soon as possible after collection. Sample may be refrigerated for 24 hours.
INTERFERENCES:	Quats and poly quats at high concentrations will interfere.

PROCEDURE

Use Square Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **1 Alkalinity-UDV**).
6. Scroll to **1 Alkalinity-UDV**.
7. Rinse a clean vial (0156) with sample water.
8. Use the syringe (1184) to add 3 mL of sample to the vial.
9. Insert the vial into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
10. Remove vial from spectrophotometer.
11. Use the syringe (1184) to add 3 mL of sample to a *Alk UDV vial (4318).
12. Wait 2 minutes.
13. Invert vial 3 times to mix.
    NOTE: If powder residue remains in the bottom of the vial after inverting or air bubbles form, invert once more and tap bottom of vial sharply once or twice to dislodge powder and bubbles. Mix.
14. Insert vial into chamber. Close lid. Press **ENTER** to scan sample.
15. Turn the spectrophotometer **OFF**. Or insert another sample into chamber. Close lid. Press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTES: For best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents is obtained.

UDVs from opened pouches should be used promptly. Store unused vials from opened pouches in the Foil Storage Bag (9467) to extend the shelf life of the reagent. Generally, UDVs stored in the bag should be used within 10 days if the humidity is less than 50% and within 5 days if humidity is greater than 50%. The Foil Storage Bag contains a dessicant pack with indicator. When the indicator in the window turns from blue to pink, the bag should be replaced.

ALUMINUM

ERIOCHROME CYANINE R METHOD
CODE 364I-01-SC

QUANTITY	CONTENTS	CODE
5 g	Aluminum Inhibitor Reagent	7865-C
2 x 120 mL	*Aluminum Buffer Reagent	*7866-J
120 mL	Aluminum Indicator Reagent	7867-J
15 mL	Aluminum Complexing Reagent	7868-E
1	Spoon, 0.1 g, plastic	0699
1	Spoon, 0.05 g, plastic	0696
2	Pipets, 1.0 mL, plastic	0354
1	Test Tube, glass, 5 mL w/cap	0230

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Aluminum is the third most common element in the earth's crust, which accounts for its wide appearance in many water supplies. Aluminum exists in water as soluble salts, colloidal compounds, and insoluble compounds. In wastewater that has been treated by alum coagulation it will appear in one or more of the above forms. Properly treated drinking water should have an aluminum concentration below 0.05 mg/L.

APPLICATION:	Drinking, surface, and saline waters; domestic and industrial wastewater.
RANGE:	0.00–0.30 ppm Aluminum
MDL:	0.01 ppm
METHOD:	Aluminum ions buffered to a pH of 6.0 react with Eriochrome Cyanine R dye to produce a pink to red complex in proportion to the concentration.
SAMPLE HANDLING & PRESERVATION:	Collect sample in acid washed glass or plastic bottle. Analyze as soon as possible.
INTERFERENCES:	Fluoride and polyphosphate will interfere. Interference from iron and manganese is eliminated by the addition of an inhibitor.

PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select All Tests (or another sequence containing **2 Aluminum**).
6. Scroll to **2 Aluminum**.
7. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
8. Insert the tube into chamber. Close lid. Select **ENTER** to scan blank. Wait for the instrument to blank.
9. Rinse a clean test tube (0230) with sample water. Fill to the 5 mL line with sample.
10. Remove tube from spectrophotometer. Empty sample from spectrophotometer tube (0290).
11. Add 5 mL sample from test tube (0230) to empty spectrophotometer tube (0290).
12. Use the 0.05 g spoon (0696) to add one measure of Aluminum Inhibitor Reagent (7865). Cap and mix to dissolve powder.
13. Use a 1.0 mL pipet (0354) to add 2 mL of *Aluminum Buffer Reagent (7866). Cap and mix.
14. Use a second 1.0 mL pipet (0354) to add 1 mL of Aluminum Indicator Reagent (7867). Cap and mix contents. Wait 5 minutes for maximum color development.
15. At end of 5 minute waiting period, mix. Insert tube into chamber. Close lid. Press **ENTER** to scan sample. Record result.
16. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTE: For the best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Add 5 drops of Aluminum Complexing Reagent (7868). Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents is obtained.

AMMONIA-NITROGEN, LOW RANGE

SALICYLATE METHOD • CODE 3659-01-SC

QUANTITY	CONTENTS	CODE
60 mL	*Salicylate Ammonia #1	*3978-H
10 g	*Salicylate #2	*7457-D
2 x 5 g	*Salicylate #3 Reagent Powder	*7458-C
1	Spoon, 0.1 g, plastic	0699
1	Spoon, 0.15 g, plastic	0727
1	Pipet, 1.0 mL, plastic	0354

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Ammonia nitrogen is present in various concentrations in many surface and ground water supplies. Any sudden change in the concentration of ammonia nitrogen in a water supply is cause for suspicion. A product of microbiological activity, ammonia nitrogen is sometimes accepted as chemical evidence of pollution when encountered in natural waters.

Ammonia is rapidly oxidized in natural water systems by special bacterial groups that produce nitrite and nitrate. This oxidation requires that dissolved oxygen be available in the water. Ammonia is an additional source of nitrogen as a nutrient which may contribute to the expanded growth of undesirable algae and other forms of plant growth that overload the natural system and cause pollution.

APPLICATION:	Low concentrations of ammonia in fresh, brackish and salt water; fresh and salt water aquariums.
RANGE:	0.00–1.00 ppm Ammonia-Nitrogen
MDL:	0.02 ppm Fresh Waer 0.10 ppm Salt Water
METHOD:	Salicylate and ammonia react at high pH in the presence of a chlorine donor and an iron catalyst to form a blue indophenol dye, the concentration of which is proportional to the ammonia concentration in the sample.
SAMPLE HANDLE & PRESERVATION:	Ammonia solutions tend to be unstable and should be analyzed immediately. Samples may be stored for 24 hours at 4°C or 28 days at –20°C.
INTERFERENCES:	There are few interferences in most natural waters. High concentrations of reducing agents, such as hydrazine, react with the chlorine donor and can result in negative interferences. Color and turbidity can also interfere.

PROCEDURE–FRESH WATER

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **3 Ammonia-N L F**).
6. Scroll to **3 Ammonia-N L F**.
7. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
8. Insert the tube into chamber. Close lid. Select **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove tube from Spectrophotometer. Use the 1.0 mL plastic pipet (0354) to add 2.0 mL of *Salicylate Ammonia #1 (3978). Cap and mix.
10. Use the 0.15 g spoon (0727) to add two measures of *Salicylate #2 Reagent (7457). Cap and mix until dissolved. Wait 1 minute.
11. At end of 1 minute waiting period use 0.1 g spoon (0699) to add two measures of *Salicylate #3 Reagent Powder (7458). Cap and shake vigorously for at least 30 seconds and all solid has dissolved. Wait 12 minutes for maximum color development.
12. At the end of 12 minute waiting period, mix. Insert tube into chamber. Close lid. Press **ENTER** to scan sample. Record result.
13. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

CALCULATIONS:

To express results as Ammonia (NH_3):

ppm Ammonia (NH_3) =

ppm Ammonia-Nitrogen (NH_3–N) x 1.2

To express results as Ammonium (NH_4):

ppm Ammonium (NH_4^+) =

ppm Ammonia-Nitrogen (NH_3–N) x 1.3

NOTES: For the best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents is obtained.

To determine the percentage of Ammonia-Nitrogen that is unionized and ionized, consult the Appendix.

PROCEDURE–SALT WATER

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **4 Ammonia-N L S**).
6. Scroll to **4 Ammonia-N L S**.
7. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
8. Insert the tube into chamber. Close lid. Select **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove tube from Spectrophotometer. Use the 1.0 mL plastic pipet (0354) to add 2.0 mL of *Salicylate Ammonia #1 (3978). Cap and mix.
10. Use the 0.15 g spoon (0727) to add two measures of *Salicylate #2 Reagent (7457). Cap and mix until dissolved. Wait 1 minute.
11. At end of 1 minute waiting period use 0.1 g spoon (0699) to add two measures of *Salicylate #3 Reagent Powder (7458). Cap and shake vigorously for at least 30 seconds and all solid has dissolved. Wait 20 minutes for maximum color development.
12. At the end of 20 minute waiting period, mix. Insert tube into chamber. Close lid. Press **ENTER** to scan sample. Record result.
13. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

CALCULATIONS:

To express results as Ammonia (NH_3):

$$\text{ppm Ammonia } (NH_3) = \text{ppm Ammonia-Nitrogen } (NH_3\text{–N}) \times 1.2$$

To express results as Ammonium (NH_4):

$$\text{ppm Ammonium } (NH_4^+) = \text{ppm Ammonia-Nitrogen } (NH_3\text{–N}) \times 1.3$$

NOTES: For the best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents is obtained.

To determine the percentage of Ammonia-Nitrogen that is unionized and ionized, consult the Appendix.

AMMONIA-NITROGEN, HIGH RANGE

NESSLERIZATION METHOD • CODE 3642-SC

QUANTITY	CONTENTS	CODE
30 mL	Ammonia Nitrogen Reagent #1	V-4797-G
2 x 30 mL	*Ammonia Nitrogen Reagent #2	*V-4798-G
1	Pipet, 1 mL, plastic	0354

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Ammonia nitrogen is present in various concentrations in many surface and ground water supplies. Any sudden change in the concentration of ammonia nitrogen in a water supply is cause for suspicion. A product of microbiological activity, ammonia nitrogen is sometimes accepted as chemical evidence of pollution when encountered in natural waters.

Ammonia is rapidly oxidized in natural water systems by special bacterial groups that produce nitrite and nitrate. This oxidation requires that dissolved oxygen be available in the water. Ammonia is an additional source of nitrogen as a nutrient which may contribute to the expanded growth of undesirable algae and other forms of plant growth that overload the natural system and cause pollution.

APPLICATION:	Drinking, surface, and saline waters; domestic and industrial wastes.
RANGE:	0.00–4.00 ppm Ammonia Nitrogen
MDL:	0.05 ppm
METHOD:	Ammonia forms a colored complex with Nessler's Reagent in proportion to the amount of ammonia present in the sample. Rochelle salt is added to prevent precipitation of calcium or magnesium in undistilled samples.
SAMPLE HANDLING & PRESERVATION:	Ammonia solutions tend to be unstable and should be analyzed immediately. Sample may be stored for 24 hours at 4°C or 28 days at –20°C.
INTERFERENCES:	Sample turbidity and color may interfere. Turbidity may be removed by a filtration procedure. Color interference may be eliminated by blanking the instrument with a sample blank.

PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **5 Ammonia-N H**).
6. Scroll to **5 Ammonia-N H**.
7. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
8. Insert the tube into chamber. Close lid. Select **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove tube from Spectrophotometer. Add 8 drops of Ammonia Nitrogen Reagent #1 (V-4797). Cap and mix. Wait 1 minute.
10. Use the 1.0 mL pipet (0354) to add 1.0 mL of *Ammonia Nitrogen Reagent #2 (V-4798). Cap and mix. Allow 5 minutes for maximum color development.
11. At end of 5 minute waiting period, mix. Insert tube into chamber. Close lid. Press **ENTER** to scan sample. Record result.
12. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

CALCULATIONS:

To express results as Ammonia (NH_3):

$$\text{ppm Ammonia } (NH_3) = \text{ppm Ammonia-Nitrogen } (NH_3\text{–N}) \times 1.2$$

To express results as Ammonium (NH_4):

$$\text{ppm Ammonium } (NH_4^+) = \text{ppm Ammonia-Nitrogen } (NH_3\text{–N}) \times 1.3$$

NOTES: For the best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents is obtained.

To determine the percentage of Ammonia-Nitrogen that is unionized and ionized, consult the Appendix.

BIGUANIDE

COLORIMETRIC METHOD • CODE 4044

QUANTITY	CONTENTS	CODE
2 X 60 mL	Biguanide Indicator	3994-H
1	Pipet, plastic, 1.0 mL	0354

Biguanide is a non-chlorine, non-bromine chemical sanitizer. It is more stable than chlorine or bromine and has little chemical odor. Biquanide is an effective bacteriacide but, unlike chlorine and bromine, it does not destroy organic contaminants. Therefore, hydrogen peroxide is added to biguanide pools on a regular basis to eliminate organic contaminants. The optimum recommended level of biguanide is 30 to 50 ppm.

APPLICATION:	Swimming pools
RANGE:	0-70 ppm
MDL:	5 ppm
METHOD:	Biguanide complexes with the proprietary indicator to produce a colored solution. The color ranges from yellow through green to blue depending on the biguanide concentration.
SAMPLE HANDLING & PRESERVATION:	Samples should be analyzed as soon as possible.
INTERFERENCES:	The only interfering substances that are likely to be encountered in pool water are oxidized manganese and oxidizing agents, such as chlorine, bromine and ozone.

PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **7 Biguanide**).
6. Scroll to **7 Biguanide**.
7. Rinse a tube (0290) with sample water. Fill to 10 mL with sample.
8. Insert the vial/tube into chamber. Close lid. Select **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove the tube from spectrophotometer.
10. Use the 1.0 mL pipet (0354) to add 2.0 mL of Biguanide Indicator (3994). Cap and invert three times to mix.
11. Wait 1 minute.
12. Insert the tube into chamber. Close lid. Press **ENTER** to scan sample. Record result in ppm Biguanide
13. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTE: For best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents is obtained.

BORON

AZOMETHINE-H METHOD • CODE 4868-01

QUANTITY	CONTENTS	CODE
120 mL	*Boron Buffer	*4869-J
10 g	*Boron Indicator Powder	*4870-D
1	Pipet, plastic, 1.0 mL	0354
1	Spoon, 0.15 g	0727
1	Dark Storage Chamber, brown	0108

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Small amounts of boron are necessary for plant growth but large amounts can be toxic. In humans, boron aids in the uptake of calcium and the production of strong bones. An excess of boron can affect the central nervous system resulting in a syndrome known as borism. Some natural waters may contain small amounts of boron. Large concentrations may be due to industrial effluent entering waterways. Boron compounds are used in cleaning compounds, paper and paints, fertilizers, glass and ceramics, fire retardants and the production of alloys. In the atomic energy field, boron is a component of neutron shields and nuclear reactors. Some swimming pools use boron buffering systems.

APPLICATION:	Surface and saline waters, hydroponic solutions, industrial waste, swimming pools.
RANGE:	0.00–0.80 ppm Boron
MDL:	0.05 ppm
METHOD:	Azomethine-H and borate form a yellow complex at pH 6 in proportion to the concentration of boron present.
SAMPLE HANDLING & PRESERVATION:	Store samples in polyethylene bottles. Do not use borate detergents or glassware.
INTERFERENCES:	Interferences in drinking water are unlikely. Manganese, zirconium, chromium, titanium, copper, vanadium, aluminum, beryllium and iron may cause high results.

PROCEDURE

Use universal sample holder

1. This test requires a Reagent Blank. Rinse a tube (0290) with clear, colorless, boron free water. Fill to 10 mL line with clear, colorless, boron free water.
2. Use the 1.0 mL pipet (0354) to add 2 mL of *Boron Buffer (4869). Cap and mix.
3. Use the 0.15 g spoon (0727) to add one level measure of *Boron Indicator Powder (4870). Press full spoon against side of jar to compress powder. Scrape off excess powder on inside neck of bottle. Tap excess off spoon handle.
4. Cap and shake vigorously for 30 seconds.
5. Insert the tube into meter chamber. Close lid.
6. Start a timer set for 30 minutes. Do not open the lid during the waiting time. The reaction is photosensitive.
7. Rinse a clean tube (0290) with Sample Water. Fill to the 10 mL line with sample water. Repeat steps 2-4.
8. Insert the tube into the Dark Storage Chamber (29849). Close top.
9. Start a second timer set for 30 minutes. Do not open the chamber during the waiting time. The reaction is photosensitive.
10. Turn spectrophotometer **ON**.
11. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
12. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
13. Press **ENTER** to select **Programmed Tests**.
14. Scroll to and press ENTER to select **All Tests** (or another sequence containing **8 Boron**).
15. Scroll to **8 Boron**.
16. At the end of the Reagent Blank 30 minute waiting period, remove Reagent Blank tube from meter chamber. Invert several times to mix.
17. Insert the tube into chamber. Close lid. Select **ENTER** to scan blank. Wait for the instrument to blank.
18. Remove the tube from spectrophotometer.
19. At the end of the Sample Water 30 minute waiting period, remove Sample Water tube from Dark Storage Chamber. Invert several times to mix.
20. Insert tube into meter chamber. Close lid. Press **ENTER** to scan sample. Record result in ppm boron.
21. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

BROMINE-LR

DPD METHOD • CODE 3643-SC

QUANTITY	CONTENTS	CODE
100	DPD #1 IG Tablets	6903A-J
100	DPD #3 IG Tablets	6197A-J
15 mL	Glycine Solution	6811-E
1	Tablet Crusher	0175

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(US, 1-800-255-3924) (International, call collect, 813-248-0585)

Like chlorine, bromine is an effective germicidal agent employed in drinking water treatment, pool and spa water sanitation, food service sanitation, and other public health applications.

APPLICATION:	Drinking, surface, and saline waters; swimming pool water; domestic and industrial waters and wastes.
RANGE:	0.00–9.00 ppm Bromine
MDL:	0.04 ppm
METHOD:	In buffered sample bromine reacts with diethyl-p-phenylene diamine (DPD) to produce a pink-red color in proportion to the concentration of bromine present.
SAMPLE HANDLING & PRESERVATION:	Bromine in aqueous solutions is not stable, and the bromine content of samples or solutions, particularly weak solutions, will rapidly decrease. Exposure to sunlight or agitation will accelerate the reduction of bromine present in such solutions. For best results start analysis immediately after sampling. Samples to be analyzed for bromine cannot be preserved or stored.
INTERFERENCE:	The only interfering substance likely to be encountered in water is oxidized manganese. The extent of this interference can be determined by treating a sample with sodium arsenite to destroy the bromine present so that the degree of interference can be estimated. Iodine and chlorine can also interfere, but these are not normally present unless they have been added as sanitizers.

PROCEDURE A: BROMINE (NO CHLORINE)

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **9 Bromine-LR**).
6. Scroll to **9 Bromine-LR**.
7. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
8. Insert the tube into chamber. Close lid. Select **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove tube from Spectrophotometer. Add one DPD #1 IG Tablet (6903A). Cap tube and shake for 10 seconds. Invert slowly 5 times. Solution will turn pink if bromine is present. Wait 15 seconds. Mix.
10. Immediately insert tube into chamber. Close lid. Press **ENTER** to scan sample.
11. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

PROCEDURE B: BROMINE IN THE PRESENCE OF CHLORINE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **9 Bromine-LR**).
6. Scroll to **9 Bromine-LR**.
7. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.

8. Insert the tube into chamber. Close lid. Select **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove blank from Spectrophotometer. Add 5 drops of Glycine Solution (6811). Cap and mix.
10. Add one DPD #1 IG Tablet (6903A). Cap tube ad shake for 10 seconds. Invert slowly 5 times. Solution will turn pink if bromine is present. Wait 15 seconds. Mix.
11. Insert tube into chamber. Close lid. Press **ENTER** to scan sample.
12. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

PROCEDURE C: FREE AVAILABLE, TOTAL AVAILABLE & COMBINED CHLORINE IN THE PRESENCE OF BROMINE

1. Perform the test for free and combined chlorine as previously described.
2. Perform the test for bromine in the presence of chlorine.
3. Calculations:

Residual Bromine (ppm) = Reading BR

Free Chlorine in the Presence of Bromine = Free Chlorine – 0.45 (Reading BR)

Total Chlorine in the Presence of Bromine = Total Chlorine – 0.45 (Reading BR)

Combined Chlorine in the Presence of Bromine = Total Chlorine – Free Chlorine

NOTE: Combined chlorine is not affected by the presence of bromine, so the calculation is the same as when only chlorine is present.

BROMINE, UDV

DPD UNIT DOSE VIAL METHOD • CODE 4311-J

QUANTITY	CONTENTS	CODE
1	Free Chlorine Unit Dose Vials, 20 pouches	4311-J

Equipment needed but not supplied:

STANDARD ACCESSORY PACKAGE • CODE 1961		
1	Package of 3 Vials (empty)	0156
1	Syringe, 3 mL, plastic	1184
1	Foil Storage Bag	9467

Or:

ADVANCED ACCESSORY PACKAGE • CODE 1962		
1	Pipettor, 3 mL	30528
1	Pipet Tip (0-5 mL)	30695
1	Cuvette Rack	31695
1	Package of 3 Vials (empty)	0156
1	Foil Storage Bag	9467

***WARNING:** Reagents marked with an * are considered to be potential health hazards. To view or print a Safety Data Sheet (SDS) for these reagents go to www.lamotte.com. Search for the four digit reagent code number listed on the reagent label, in the contents list or in the test procedures. Omit any letter that follows or precedes the four digit code number. For example, if the code is 4450WT-H, search 4450. To obtain a printed copy, contact LaMotte by email, phone or fax.

Emergency information for all LaMotte reagents is available from Chem-Tel:
(US, 1-800-255-3924) (International, call collect, 813-248-0585)

Like chlorine, bromine is an effective germicidal agent employed in drinking water treatment, pool and spa water sanitation, food service sanitation, and other public health applications.

APPLICATION:	Drinking, surface, and saline waters; domestic and industrial waters and wastes.
RANGE:	0.0 – 22.0 ppm Bromine
MDL:	0.3 ppm
METHOD:	In buffered sample bromine reacts with diethyl-p-phenylene diamine (DPD) to produce a pink-red color in proportion to the concentration of bromine present.
SAMPLE HANDLING & PRESERVATION:	Bromine in aqueous solutions is not stable, and the bromine content of samples or solutions, particularly weak solutions, will rapidly decrease. Exposure to sunlight or agitation will accelerate the reduction of bromine present in such solutions. For best results start analysis immediately after sampling. Samples to be analyzed for bromine cannot be preserved or stored.
INTERFERENCES:	The only interfering substance likely to be encountered in water is oxidized manganese. The extent of this interference can be determined by treating a sample with sodium arsenite to destroy the bromine present so that the degree of interference can be estimated. Iodine and chlorine can also interfere, but these are not normally present unless they have been added as sanitizers.

PROCEDURE

Use Square Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **11 Bromine-UDV**).
6. Scroll to **11 Bromine-UDV**.
7. Rinse a clean vial (0156) with sample water.
8. Use the syringe (1184) to add 3mL of sample to the vial.
9. Insert the vial into chamber. Close lid. Select **ENTER** to scan blank. Wait for the instrument to blank.
10. Remove the vial from the Spectrophotometer.
11. Use the syringe (1184) to add 3mL of sample to a Free Chlorine UDV (4311).
12. Shake vigorously until powder dissolves completely.
    NOTE: If powder residue remains in the bottom of the vial after inverting or air bubbles form, invert once more and tap bottom of vial sharply once or twice to dislodge powder and bubbles. Mix.
13. Immediately insert tube into chamber. Close lid. Press **ENTER** to scan sample. Record result in ppm bromine.
14. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTE: For best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents is obtained.

NOTE: UDVs from opened pouches should be used promptly. Store unused vials from opened pouches in the Foil Storage Bag (9467) to extend the shelf life of the reagent. Generally, UDVs stored in the bag should be used within 10 days if the humidity is less than 50% and within 5 days if humidity is greater than 50%. The Foil Storage Bag contains a desiccant pack with indicator. When the indicator in the window turns from blue to pink, the bag should be replaced.

CADMIUM

PAN METHOD • CODE 4017-01

QUANTITY	CONTENTS	CODE
60 mL	*Buffered Ammonia Reagent	*4020-H
15 mL	Sodium Citrate, 10%	6253-E
30 mL	*PAN Indicator	*4021-G
30 mL	Stabilizing Reagent	4022-G
1	Pipet, 1.0 mL, plastic	0354
2	Pipet, 0.5 mL, plastic	0369

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Cadmium is used in batteries, paint pigments, electroplating processes, and with other metals in the preparation of alloys. The solubility of cadmium in natural water is proportional to the hardness or alkalinity of the water. Cadmium is not an essential nutrient for plants and animals. It is extremely toxic and can accumulate in the kidneys and liver.

APPLICATION:	Drinking and surface waters; domestic and industrial wastewater.
RANGE:	0.00–1.00 Cadmium
MDL:	0.02 ppm
METHOD:	PAN (1-(2-Pyridylazo)-2-Naphthol) forms a red complex with Cadmium (Cd+2) at a pH of 10.
SAMPLE HANDLING & PRESERVATION:	Analyze sample as soon as possible. If sample must be stored, acidify with nitric acid to a pH below 2.
INTERFERENCES:	Ag^{+2}, Co^{+2}, Cu^{+2}, Mn^{+2}, Ni^{+2}, Zn^{+2}, Y^{+3}, In^{+3}

PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **12 Cadmium**).
6. Scroll to **12 Cadmium**.
7. Rinse a tube (0290) with sample water. Fill to the 10 mL line with sample.
8. Insert the tube into chamber. Close lid. Select **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove tube from Spectrophotometer. Use the 1.0 mL pipet (0354) to add 1.0 mL of *Buffered Ammonia Reagent (4020). Swirl to mix.
10. Add two drops of Sodium Citrate, 10% (6253). Swirl to mix.
11. Use a 0.5 mL pipet (0369) to add 0.5 mL of PAN Indicator (4021). Swirl to mix.
12. Use a 0.5 mL pipet (0369) to add 0.5 mL Stabilizing Reagent (4022). Cap and mix.
13. Immediately insert tube into chamber. Close lid. Press **ENTER** to scan sample. Record result.
14. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTE: For best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents is obtained.

CALCIUM & MAGNESIUM (TOTAL) HARDNESS, UDV

UNIT DOSE VIAL METHOD • CODE 4309-J

QUANTITY	CONTENTS	CODE
1	*Calcium Hardness Unit Dose Vials, 20 pouches	*4309-J

Equipment needed but not supplied:

STANDARD ACCESSORY PACKAGE • CODE 1961		
1	Package of 3 Vials (empty)	0156
1	Syringe, 3 mL, plastic	1184
1	Foil Storage Bag	9467

Or:

ADVANCED ACCESSORY PACKAGE • CODE 1962		
1	Pipettor, 3 mL	30528
1	Pipet Tips (0-5 mL)	30695
1	Cuvette Rack	31695
1	Package of 3 Vials (empty)	0156
1	Foil Storage Bag	9467

***WARNING:** Reagents marked with an * are considered to be potential health hazards. To read complete safety information, go to page 3 in the User Manual.

APPLICATION:	Drinking and surface waters; swimming pool water.
RANGE:	10–500 as $CaCO_3$ Total Hardness
MDL:	10 ppm
METHOD:	Calcium and magnesium react in a strongly buffered medium with an indicator to develop a pale purple color in proportion to the concentration.
SAMPLE HANDLING & PRESERVATION:	Samples should be analyzed as soon as possible after collection. If storage is necessary, add 0.5 mL of 20 % hydrochloric acid per 100 mL of sample. However, the added acid will have to be neutralized with NaOH before testing.
INTERFERENCES:	Heavy metals will interfere.

PROCEDURE

Use Square Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **13 Ca&Mg Hard-UDV**).
6. Scroll to **13 Ca&Mg Hard-UDV**.
7. Rinse a clean vial (0156) with sample water.
8. Use the syringe (1184) to add 3mL of sample to the vial.
9. Insert the vial into chamber. Close lid. Select **ENTER** to scan blank. Wait for the instrument to blank.
10. Remove vial from spectrophotometer.
11. Use the syringe (1184) to add 3mL of sample to a *Calcium Hardness UDV vial (4309).
12. Shake vigorously for 10 seconds.
    NOTE: If powder residue remains in the bottom of the vial after shaking, or if air bubbles form, invert vial once more and tap bottom of vial sharply once or twice to dislodge powder or bubbles. Mix.
13. Insert tube into chamber. Close lid. Press **ENTER** to scan sample. Record result.
14. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTES: For best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents is obtained.

UDVs from opened pouches should be used promptly. Store unused vials from opened pouches in the Foil Storage Bag (9467) to extend the shelf life of the reagent. Generally, UDVs stored in the bag should be used within 10 days if the humidity is less than 50% and within 5 days if humidity is greater than 50%. The Foil Storage Bag contains a desiccant pack with indicator. When the indicator in the window turns from blue to pink, the bag should be replaced.

CHLORIDE, TESTAB

ARGENTOMETRIC TESTAB METHOD • CODE 3693-SC

QUANTITY	CONTENTS	CODE
50	*Chloride IG Tablets	*3885A-H
1	Tablet Crusher	0175

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Emergency information for all LaMotte reagents is available from Chem-Tel: (US, 1-800-255-3924) (International, call collect, 813-248-0585)

Chloride is one of the major anions found in water and sewage. The presence of chlorides in large amounts may be due to the natural process of water passing through salt formations in the earth, or it may be evidence of the intrusion of seawater or pollution from industrial processes or domestic wastes. The salt content of water affects the distribution of plant and animal life in an aquatic system, based on the amount of salt they can tolerate.

APPLICATION:	Drinking, surface, and saline waters; domestic and industrial wastewaters.
RANGE:	0.0–30.0 ppm Chloride
MDL:	0.5 ppm
METHOD:	Silver nitrate reacts with chloride to form turbid silver chloride in proportion to the amount of chloride in the sample.
SAMPLE HANDLING & PRESERVATION:	Collect samples in clean, chemically-resistant glass or plastic containers. No preservative is needed if sample is to be stored.
INTERFERENCES:	Substances in amounts normally found in drinking water will not interfere. Bromide, iodide, cyanide, sulfide, thiosulfate, sulfide and orthophosphate will interfere.

PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **21 Chloride-TesTab**).
6. Scroll to **21 Chloride-TesTab**.
7. Rinse a tube (0290) with sample water. Fill to 10 mL with sample.
8. Insert the tube into chamber. Close lid. Select **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove the tube from spectrophotometer.
10. Add one *Chloride IG Tablet (3885A).
11. Use Tablet Crusher (0175) to crush tablet.
12. Cap tube.
13. Invert 2 times.
14. Wait 3 minutes. Do NOT mix.
15. Insert tube into chamber. Close lid. Press **ENTER** to scan sample. Record result in ppm chloride.
16. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTE: For best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples.

The reagent system is temperature sensitive. The calibration is for 25°C. If sample is at 30°C, multiply resulting ppm by 1.1. If the sample is at 20°C, multiply resulting ppm by 0.9.

CHLORINE

DPD METHOD • CODE 3643-SC

QUANTITY	CONTENTS	CODE
100	DPD #1 IG Tablets	6903A-J
100	DPD #3 IG Tablets	*6197A-J
15 mL	Glycine Solution	6811-E
1	Tablet Crusher	0175

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Emergency information for all LaMotte reagents is available from Chem-Tel: (US, 1-800-255-3924) (International, call collect, 813-248-0585)

All water for cities and communities must be sanitized; even waters that come from clean sources, protected watersheds, reservoirs, and deep wells, are commonly sanitized to assure safety. Chlorine is the most commonly used sanitizer for several reasons: it is effective against a wide range of microorganisms, the cost is low, and the methods of applying it have been well developed. If an adequate concentration of chlorine is present in the water for a few minutes, disease producing bacteria will be destroyed. A number of conditions affect the sanitizing action of chlorine. In municipal systems these can be controlled so that if chlorine is detectable, it can be assumed that bacteria have been killed. The factors that influence the rate of kill are temperature, pH, presence of other materials that react with chlorine, time, and the concentrations of the various chlorine combinations that are formed in the water with ammonia and other substances that react with chlorine.

The fact that chlorine can be easily detected and measured makes chlorine a favorite water sanitizer of those concerned with the public safety of water supplies. Chlorine concentrations in the range of 0.1 to 0.4 parts per million are usually maintained in municipal supplies.

Chlorine can be added in the form of chlorine gas, liquid sodium hypochlorite (bleach), granular calcium hypochlorite or as organic chlorine compounds. Chlorine is not present in natural water supplies; if it is present it is the result of chlorination of a water supply or of chlorinated compounds being discharged as waste from industrial operations. The presence of chlorine in concentrations above 0.5 parts per million should be considered evidence of pollution from chlorine treated effluents or from a process in which high concentrations of chlorine are used.

APPLICATION:	Drinking, surface, and saline waters; swimming pool water; domestic and industrial wastes.
RANGE:	0.00–4.00 ppm Chlorine
MDL:	0.02 ppm
METHOD:	In the absence of iodide, free available chlorine reacts instantly with DPD to produce a red color. Subsequent addition of potassium iodide evokes a rapid color response from the combined forms of chlorine (chloramines).
SAMPLE HANDLING & PRESERVATION:	Chlorine in aqueous solutions is not stable, and the chlorine content of samples or solutions, particularly weak solutions, will rapidly decrease. Exposure to sunlight or agitation will accelerate the reduction of chlorine present in such solutions. For best results, start analysis immediately after sampling. Samples to be analyzed for chlorine cannot be preserved or stored.
INTERFERENCE:	The only interfering substance likely to be encountered in water is oxidized manganese. The extent of this interference can be determined by treating a sample with sodium arsenite to destroy the chlorine present so that the degree of interference can be measured. Iodine and bromine can give a positive interference, but these are not normally present unless they have been added as sanitizers.

PROCEDURE–FREE CHLORINE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **15 Chlorine**).
6. Scroll to **15 Chlorine**.
7. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
8. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove tube from Spectrophotometer. Add one DPD #1 IG Tablet (6903A). Cap tube and shake for 10 seconds. Invert slowly 5 times. Solution will turn pink if free chlorine is present. Wait 15 seconds, but no longer than 30 seconds. Mix.
10. Immediately insert tube into chamber. Close lid. Press **ENTER** to scan sample.

PROCEDURE–COMBINED CHLORINE

Use universal sample holder.

11. Remove tube from Spectrophotometer. Add one DPD #3 IG Tablet (6197A) to sample from Step 9 above. Cap tube and shake for 10 seconds. Invert slowly 5 times An increase in color represents combined chlorine.
    NOTE: For wastewater samples, Standard Methods for the Examination of Water and Wastewater recommends waiting 2 minutes for full color development.
12. Insert sample into chamber. Close lid. Press **ENTER** to scan sample. Record result as Total Chlorine.
13. Subtract free chlorine reading from total chlorine reading to obtain concentration of combined chlorine.
14. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

CHLORINE-FREE, UDV

DPD UNIT DOSE VIAL METHOD • CODE 4311-J

QUANTITY	CONTENTS	CODE
1	Free Chlorine Unit Dose Vials, 20 pouches	4311-J

Equipment needed but not supplied:

STANDARD ACCESSORY PACKAGE • CODE 1961		
1	Package of 3 Vials (empty)	0156
1	Syringe, 3 mL, plastic	1184
1	Foil Storage Bag	9467

Or:

ADVANCED ACCESSORY PACKAGE • CODE 1962		
1	Pipettor	30528
1	Pipet Tips (0-5 mL)	30695
1	Cuvette Rack	31695
1	Package of 3 Vials (empty)	0156
1	Foil Storage Bag	9467

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All water for cities and communities must be sanitized; even waters that come from clean sources, protected watersheds, reservoirs, and deep wells, are commonly sanitized to assure safety. Chlorine is the most commonly used sanitizer for several reasons: it is effective against a wide range of microorganisms, the cost is low, and the methods of applying it have been well developed. If an adequate concentration of chlorine is present in the water for a few minutes, disease producing bacteria will be destroyed. A number of conditions affect the sanitizing action of chlorine. In municipal systems these can be controlled so that if chlorine is detectable, it can be assumed that bacteria have been killed. The factors that influence the rate of kill are temperature, pH, presence of other materials that react with chlorine, time, and the concentrations of the various chlorine combinations that are formed in the water with ammonia and other substances that react with chlorine.

The fact that chlorine can be easily detected and measured makes chlorine a favorite water sanitizer of those concerned with the public safety of water supplies. Chlorine concentrations in the range of 0.1 to 0.4 parts per million are usually maintained in municipal supplies.

Chlorine can be added in the form of chlorine gas, liquid sodium hypochlorite

(bleach), granular calcium hypochlorite or as organic chlorine compounds. Chlorine is not present in natural water supplies; if it is present it is the result of chlorination of a water supply or of chlorinated compounds being discharged as waste from industrial operations. The presence of chlorine in concentrations above 0.5 parts per million should be considered evidence of pollution from chlorine treated effluents or from a process in which high concentrations of chlorine are used.

APPLICATION:	Drinking, surface, and saline waters; domestic and industrial wastes.
RANGE:	0.00–10.00 ppm
MDL:	0.10 ppm
METHOD:	In the absence of iodide, free available chlorine reacts instantly with DPD to produce a red color. Subsequent addition of potassium iodide evokes a rapid color response from the combined forms of chlorine (chloramines).
SAMPLE HANDLING & PRESERVATION:	Chlorine in aqueous solutions is not stable, and the chlorine content of samples or solutions, particularly weak solutions, will rapidly decrease. Exposure to sunlight or agitation will accelerate the reduction of chlorine present in such solutions. For best results, start analysis immediately after sampling. Samples to be analyzed for chlorine cannot be preserved or stored.
INTERFERENCES:	The only interfering substance likely to be encountered in water is oxidized manganese. The extent of this interference can be determined by treating a sample with sodium arsenite to destroy the chlorine present so that the degree of interference can be measured. Iodine and bromine can give a positive interference, but these are not normally present unless they have been added as sanitizers.

PROCEDURE

Use Square Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **16 Cl Free-UDV**).
6. Scroll to **16 Cl Free-UDV**.
7. Rinse a clean vial (0156) with sample water.
8. Use the syringe (1184) to add 3mL of sample to the vial.
9. Insert the vial into chamber. Close lid. Select **ENTER** to scan blank. Wait for the instrument to blank.
10. Remove the vial from the Spectrophotometer.
11. Use the syringe (1184) to add 3mL of sample to a Free Chlorine UDV (4311).
12. Shake vigorously until powder dissolves completely.
    NOTE: If powder residue remains in the bottom of the vial after inverting or air bubbles form, invert once more and tap bottom of vial sharply once or twice to dislodge powder and bubbles. Mix.
13. Immediately insert tube into chamber. Close lid. Press **ENTER** to scan sample. Record result in ppm free chlorine.
14. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTES: For best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents is obtained.

UDVs from opened pouches should be used promptly. Store unused vials from opened pouches in the Foil Storage Bag (9467) to extend the shelf life of the reagent. Generally, UDVs stored in the bag should be used within 10 days if the humidity is less than 50% and within 5 days if humidity is greater than 50%. The Foil Storage Bag contains a desiccant pack with indicator. When the indicator in the window turns from blue to pink, the bag should be replaced.

CHLORINE

LIQUID DPD METHOD • CODE 4859

QUANTITY	CONTENTS	CODE
30 mL	DPD 1A Free Chlorine Reagent	P-6740-G
30 mL	*DPD 1B Free Chlorine Reagent	*P-6741-G
30 mL	DPD 3 Total Chlorine Reagent	P-6743-G

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All water for cities and communities must be sanitized; even waters that come from clean sources, protected watersheds, reservoirs, and deep wells, are commonly sanitized to assure safety. Chlorine is the most commonly used sanitizer for several reasons: it is effective against a wide range of microorganisms, the cost is low, and the methods of applying it have been well developed. If an adequate concentration of chlorine is present in the water for a few minutes, disease producing bacteria will be destroyed. A number of conditions affect the sanitizing action of chlorine. In municipal systems these can be controlled so that if chlorine is detectable, it can be assumed that bacteria have been killed. The factors that influence the rate of kill are temperature, pH, presence of other materials that react with chlorine, time, and the concentrations of the various chlorine combinations that are formed in the water with ammonia and other substances that react with chlorine.

The fact that chlorine can be easily detected and measured makes chlorine a favorite water sanitizer of those concerned with the public safety of water supplies. Chlorine concentrations in the range of 0.1 to 0.4 parts per million are usually maintained in municipal supplies.

Chlorine can be added in the form of chlorine gas, liquid sodium hypochlorite (bleach), granular calcium hypochlorite or as organic chlorine compounds. Chlorine is not present in natural water supplies; if it is present it is the result of chlorination of a water supply or of chlorinated compounds being discharged as waste from industrial operations. The presence of chlorine in concentrations above 0.5 parts per million should be considered evidence of pollution from chlorine treated effluents or from a process in which high concentrations of chlorine are used.

APPLICATION:	Drinking, surface, and saline waters; swimming pool water; domestic and industrial wastes.
RANGE:	0.00–4.00 ppm Chlorine
MDL:	0.025 ppm
METHOD:	In the absence of iodide, free available chlorine reacts instantly with DPD to produce a red color. Subsequent addition of potassium iodide evokes a rapid color response from the combined forms of chlorine (chloramines).
SAMPLE HANDLING & PRESERVATION:	Chlorine in aqueous solutions is not stable, and the chlorine content of samples or solutions, particularly weak solutions, will rapidly decrease. Exposure to sunlight or agitation will accelerate the reduction of chlorine present in such solutions. For best results, start analysis immediately after sampling. Samples to be analyzed for chlorine cannot be preserved or stored.
INTERFERENCE:	The only interfering substance likely to be encountered in water is oxidized manganese. The extent of this interference can be determined by treating a sample with sodium arsenite to destroy the chlorine present so that the degree of interference can be measured. Iodine and bromine can give a positive interference, but these are not normally present unless they have been added as sanitizers.

PROCEDURE–FREE CHLORINE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **17 Cl Liquid-DPD**).
6. Scroll to **17 Cl Liquid-DPD**.
7. Rinse a tube (0290) with sample water. Fill to the 10 mL line with sample.
8. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove the tube from spectrophotometer.
10. Add 5 drops of DPD 1A Free Chlorine Reagent (P-6740).
11. Add 5 drops of *DPD 1B Free Chlorine Reagent (P-6741). Cap and mix.
12. Insert tube into chamber. Close lid. Press **ENTER** to scan sample. Record result as ppm free chlorine.

PROCEDURE–TOTAL CHLORINE

13. Add 5 drops of DPD 3 Total Chlorine Reagent (P-6743). Cap and mix.
    NOTE: For wastewater samples, Standard Methods for the Examination of Water and Wastewater recommends waiting 2 minutes for full color development.
14. Insert tube into chamber. Close lid. Press **ENTER** to scan sample. Record result as ppm total chlorine.
15. Subtract the Free Chlorine reading from the Total Chlorine reading to determine ppm combined chlorine.
16. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTE: For best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents is obtained.

CHLORINE–TOTAL, UDV

DPD UNIT DOSE VIAL METHOD • CODE 4312-J

QUANTITY	CONTENTS	CODE
1	Total Chlorine Unit Dose Vials, 20 pouches	4312-J

Equipment needed but not supplied:

STANDARD ACCESSORY PACKAGE • CODE 1961		
1	Package of 3 Vials (empty)	0156
1	Syringe, 3 mL, plastic	1184
1	Foil Storage Bag	9467

Or:

ADVANCED ACCESSORY PACKAGE • CODE 1962		
1	Pipettor, 3 mL	30528
1	Pipet Tips (0-5 mL)	30695
1	Cuvette Rack	31695
1	Package of 3 Vials (empty)	0156
1	Foil Storage Bag	9467

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The fact that chlorine can be easily detected and measured makes chlorine a favorite water sanitizer of those concerned with the public safety of water supplies. Chlorine concentrations in the range of 0.1 to 0.4 parts per million are usually maintained in municipal supplies.

Chlorine can be added in the form of chlorine gas, liquid sodium hypochlorite (bleach), granular calcium hypochlorite or as organic chlorine compounds. Chlorine is not present in natural water supplies; if it is present it is the result of chlorination of a water supply or of chlorinated compounds being discharged as waste from industrial operations. The presence of chlorine in concentrations above 0.5 parts per million should be considered evidence of pollution from chlorine treated effluents or from a process in which high concentrations of chlorine are used.

APPLICATION:	Drinking, surface, and saline waters; domestic and industrial wastes.
RANGE:	0.00-10.00 ppm
MDL:	0.10 ppm
METHOD:	In the absence of iodide, free available chlorine reacts instantly with DPD to produce a red color. Subsequent addition of potassium iodide evokes a rapid color response from the combined forms of chlorine (chloramines).
SAMPLE HANDLING & PRESERVATION:	Chlorine in aqueous solutions is not stable, and the chlorine content of samples or solutions, particularly weak solutions, will rapidly decrease. Exposure to sunlight or agitation will accelerate the reduction of chlorine present in such solutions. For best results, start analysis immediately after sampling. Samples to be analyzed for chlorine cannot be preserved or stored.
INTERFERENCES:	The only interfering substance likely to be encountered in water is oxidized manganese. The extent of this interference can be determined by treating a sample with sodium arsenite to destroy the chlorine present so that the degree of interference can be measured. Iodine and bromine can give a positive interference, but these are not normally present unless they have been added as sanitizers.

PROCEDURE

Use Square Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **18 Cl Total-UDV**).
6. Scroll to **18 Cl Total-UDV**.
7. Rinse a clean vial (0156) with sample water
8. Use the syringe (1184) to add 3mL of sample to the vial.
9. Insert the vial into chamber. Close lid. Select **ENTER** to scan blank. Wait for the instrument to blank.
10. Remove the vial from the Spectrophotometer.
11. Use the syringe (1184) to add 3mL of sample to a Total Chlorine UDV (4312).
12. Shake vigorously until powder dissolves completely.
    NOTE: If powder residue remains in the bottom of the vial after inverting or air bubbles form, invert once more and tap bottom of vial sharply once or twice to dislodge powder and bubbles. Mix.
13. Wait 2 minutes.
14. Insert vial into chamber. Close lid. Press **ENTER** to scan sample. Record result in ppm total chlorine.
15. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTES: For best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents is obtained.

UDVs from opened pouches should be used promptly. Store unused vials from opened pouches in the Foil Storage Bag (9467) to extend the shelf life of the reagent. Generally, UDVs stored in the bag should be used within 10 days if the humidity is less than 50% and within 5 days if humidity is greater than 50%. The Foil Storage Bag contains a desiccant pack with indicator. When the indicator in the window turns from blue to pink, the bag should be replaced.

CHLORINE DIOXIDE

DPD METHOD • CODE 3644-SC

QUANTITY	CONTENTS	CODE
100	DPD #1 IG Tablets	6903A-J
15 mL	Glycine Solution	6811-E
1	Tablet Crusher	0175

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Chlorine dioxide is used as a substitute for and an adjunct to chlorine in water treatment. It is better than chlorine in eliminating taste and odor in certain cases. Chlorine dioxide, unlike chlorine, does not produce carcinogenic chlorinated organic compounds when reacted with organic materials. A disadvantage is the higher cost of producing chlorine dioxide compared to chlorine.

APPLICATION:	Drinking water; swimming pool water; domestic and industrial wastewater; food sanitation.
RANGE:	0.00–7.00 ppm Chlorine Dioxide
MDL:	0.04 ppm
METHOD:	Chlorine dioxide reacts with DPD to form a red color in proportion to the concentration.
SAMPLE HANDLING & PRESERVATION:	Test as soon as possible to avoid loss of chlorine dioxide.
INTERFERENCE:	Chlorine interference can be removed with the use of glycine. Very high levels of chloramines may interfere if the test result is not read immediately. Oxidized manganses interferes but can be removed with arsenite. Bromine and iodine interfere. Chromate interference can be removed with a thioacetamide blank correction.

PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **20 Chlor Diox**).
6. Scroll to **20 Chlor Diox**.
7. Rinse a clean tube (0290) with sample water. Fill to 10 mL line with sample.
8. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove tube from Spectrophotometer. Add 5 drops of Glycine Solution (6811).
10. Add one Chlorine DPD #1 IG Tablet (6903A). Cap tube ad shake for 10 seconds. Invert slowly 5 times. Solution will turn pink if chlorine dioxide is present. Wait 15 seconds, but no longer than 30 seconds. Mix.
11. Insert tube into chamber. Close lid. Press **ENTER** to scan sample.
12. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

CHROMIUM, HEXAVALENT

DIPHENYLCARBOHYDRAZIDE METHOD
CODE 3645-SC

QUANTITY	CONTENTS	CODE
10 g	*Chromium Reagent Powder	*V-6276-D
1	Spoon, 0.1 g, plastic	0699
50	Filter Paper	0465-H
1	Funnel, Plastic	0459

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Chromium may be present in water containing waste from industries such as metal plating. It is considered to be a toxic chemical and, if present in an amount of over 0.5 ppm, is evidence of contamination from untreated or incompletely treated industrial waste.

Chromium is one of a class of heavy metals found in the bottom mud of polluted bodies of water. Certain shellfish are capable of concentrating this element, endangering the health of its ultimate consumer, human or animal.

APPLICATION:	Drinking, surface, and saline waters; domestic and industrial wastewaters.
RANGE:	0.00–1.00 ppm Chromium
MDL:	0.01 ppm
METHOD:	Hexavalent chromium reacts with 1,5 diphenylcarbohydrazide under acidic conditions to form a red-purple color in proportion to the amount of chromium present.
SAMPLE HANDLING & PRESERVATION:	Analysis for chromium should be made as quickly as possible after sample collection since storage in glass or plastic containers may result in low chromate values.
INTERFERENCES:	High concentrations of mercurous and mercuric ions may impart a blue color to the chromium determination. Iron and vanadium in concentrations above 1 mg/L may result in a yellow color. However, the vanadium color becomes negligible 10 minutes after the addition of diphenylcarbohydrazide.

PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **22 Chromium**).
6. Scroll to **22 Chromium**.
7. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
8. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove tube from Spectrophotometer. Use the 0.1g spoon (0699) to add one measure of *Chromium Reagent Powder (V-6276). Cap and shake until powder dissolves. Wait 3 minutes for full color development.
10. During waiting period, fold a piece of filter paper (0465) in half then half again to form a cone. Push corners together to open end, and insert into funnel (0459).
11. At the end of 3 minute waiting period, filter sample into a clean tube. Mix. Insert tube into chamber. Close lid. Press **ENTER** to scan sample. Record result.
12. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTES: To convert result to ppm chromate (CrO_4^{2-}) multiply by 2.23. To convert result to ppm sodium chromate (Na_2CrO_4) multiply by 3.12.

Highly buffered waters may give poor results and require a more careful pH adjustment. Before adding *Chromium Reagent Powder, adjust pH of sample to pH 3-4.

CHROMIUM-HEXAVALENT, TRIVALENT & TOTAL

DIPHENYLCARBOHYDRAZIDE METHOD
CODE 3698-SC

QUANTITY	CONTENTS	CODE
60 mL	*Sulfuric Acid, 5N	*7681-H
10 g	*Chromium Reagent Powder	*V-6276-D
15 mL	*Sodium Azide, 5%	*7683-E
30 mL	Potassium Permanganate, 0.5%	7682-G
60 mL	Deionized Water	5115PT-H
1	Pipet, plain, glass, w/cap	0341
1	Pipet, 1.0 mL, plastic	0354
1	Spoon, 0.1 g, plastic	0699
1	Graduated Cylinder, 50 mL, glass	0418
1	Erlenmeyer Flask, 125 mL, glass	0431
1	Test tube holder	1113
1	Filter Paper	0465
1	Funnel, Plastic	0459

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A toxic chemical, chromium is found in two forms in the water; trivalent chromium (Cr^{3+}) and hexavalent chromium (Cr^{6+}). Chromium enters the water from industrial waste. Hexavalent chromium is more toxic than trivalent chromium. Levels greater than 0.5 ppm indicate improperly treated industrial waste. It is important to maintain chromium levels at or below 0.5 ppm, because clams and other shellfish will store chromium in their systems, accumulating levels which may be dangerous to the consumer, whether human or animal.

APPLICATION:	Drinking, surface, and saline waters; domestic and industrial wastes.
RANGE:	0.00–1.00 ppm Chromium
MDL:	0.01 ppm
METHOD:	The trivalent chromium is converted to hexavalent chromium by permanganate under acidic conditions. Hexavalent chromium reacts with 1,5 diphenyl-carbohydrazide under acidic conditions to form a red-purple color in proportion to the amount of chromium present.
SAMPLE HANDLING & PRESERVATION:	Analysis for chromium should be made as quickly as possible after sample collection since storage in glass or plastic containers may result in low chromate values.
INTERFERENCES:	High concentrations of mercurous and mercuric ions may interfere.

HEXAVALENT CHROMIUM PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **22 Chromium**).
6. Scroll to **22 Chromium**.
7. Rinse a clean tube (0290) with sample water. Fill to 10 mL line with sample water.
8. Insert the tube into chamber, close lid and select **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove tube from Spectrophotometer. Use 0.1 g spoon (0699) to add one level measure of *Chromium Reagent Powder (V-6276). Cap and shake for one minute. Wait 3 minutes.
10. During the waiting period, fold a piece of filter paper in half, then in half again to form a cone. Push corners together to open end, and insert into funnel (0459).
11. At the end of 3 minute waiting period, filter sample into a clean tube (0290). Cap and mix. Insert tube into chamber. Close lid. Press **ENTER** to scan sample. Record result.
12. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

TOTAL CHROMIUM WITH ACID DIGESTION PROCEDURE

1. Fill graduated cylinder (0418) to 50 mL line with sample water. Transfer to Erlenmeyer flask (0431).
2. Use the 1 mL pipet (0354) to add 5 mL (five measures) of *Sulfuric Acid, 5N (7681). Swirl to mix.
3. NOTE: Highly buffered waters may require pH adjustment. Adjust the pH of highly buffered samples to 7.0 ±0.5. Continue procedure.
4. Place flask on burner or hot plate. Bring solution to a gentle boil.
5. Fill pipet (0341) with Potassium Permanganate, 0.5% (7682). While gently swirling flask, add Potassium Permanganate, 0.5% (7682), 2 drops at a time to boiling solution, until solution turns a dark pink color which persists for 10 minutes. Continue boiling.

6. Add one drop of *Sodium Azide, 5% (7683) to boiling solution. Boil for approximately 30 seconds. If pink color does not fade, add another drop of *Sodium Azide, 5%. Continue adding *Sodium Azide, 5% one drop at a time until pink color disappears.
7. Remove flask from heat. Cool sample under running water. This is the digested sample.
8. Pour digested sample into clean graduated cylinder (0418). Dilute to the 50 mL line with Deionized Water (5115).
9. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
10. Press **ENTER** to select **Programmed Tests**.
11. Scroll to and press ENTER to select **All Tests** (or another sequence containing **22 Chromium**).
12. Scroll to **22 Chromium**.
13. Rinse a clean tube (0290) with sample water. Fill to 10 mL line with sample water.
14. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
15. Remove tube from Spectrophotometer. Use 0.1 g spoon (0699) to add one level measure of *Chromium Reagent Powder (V-6276). Cap and shake for one minute. Wait 3 minutes.
16. During the waiting period, fold a piece of filter paper in half, then in half again to form a cone. Push corners together to open end, and insert into funnel (0459).
17. Filter sample into a clean tube (0290). Cap and mix. Insert tube of filtered sample into chamber. Close lid. Press **ENTER** to scan sample. Record result.
18. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

TRIVALENT CHROMIUM PROCEDURE

Subtract hexavalent chromium from total chromium. Record as ppm trivalent chromium.

Trivalent Chromium = Total Chromium – Hexavalent Chromium

COBALT

PAN METHOD • CODE 4851-01

QUANTITY	CONTENTS	CODE
60 mL	*Cobalt Buffer	*4852-H
60 mL	*Cobalt Indicator Reagent	*4853-H
30 mL	Stabilizer Solution	4854-G
2	Pipet, 1.0 mL, plastic	0354
1	Pipet, 0.5 mL, plastic	0353

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Cobalt rarely occurs in natural water. It is used in the manufacture of alloys to increase corrosion resistance and strength. It is found in wastewaters as a corrosion by-product.

APPLICATION:	Industrial wastewater.
RANGE:	0.00–2.00 Cobalt
MDL:	0.02 ppm
METHOD:	PAN (1-(2-Pyridylazo)-2-Naphthol) forms a greenish complex with Cobalt (Co^{+2}) at a pH of 5.
SAMPLE HANDLING & PRESERVATION:	Store samples in acid-washed plastic bottles. Adjust pH to less than 2 with nitric acid. Adjust sample pH to 5 before testing.
INTERFERENCES:	Iron (+2) and high concentrations of heavy metals.

PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **24 Cobalt**).
6. Scroll to **24 Cobalt**.
7. Rinse a tube (0290) with sample water. Fill to 10 mL with sample.
8. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove the tube from Spectrophotometer.
10. Use the 1.0 mL pipet (0354) to add 1 mL of *Cobalt Buffer (4852). Cap and mix.
11. Use the other 1.0 mL pipet (0354) to add 1 mL of *Cobalt Indicator Reagent (4853). Cap and mix.
12. Wait 3 minutes.
13. Use the 0.5 mL pipet (0353) to add 0.5 mL Stabilizer Solution (4854). Cap and invert 15 times to thoroughly mix.
14. Wait 5 minutes. DO NOT MIX.
15. Insert tube into chamber. Close lid. Press **ENTER** to scan sample. Record result in ppm cobalt.
16. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTE: For best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents is obtained.

COD, LOW RANGE

MERCURY FREE DIGESTION METHOD • Code 0072-SC
MERCURY DIGESTION METHOD • Code 0075-SC

QUANTITY	CONTENTS	CODE
25	*COD Low Level Mercury Free Tubes	*0072-SC
or 25	*COD Low Level Mercury Tubes	*0075-SC

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COD Low Level Mercury Free Tubes are not USEPA approved.

COD Low Level Mercury Tubes are USEPA approved.

Equipment needed but not supplied:

QUANTITY	CONTENTS	CODE
1	COD Adapter	5-0087
1	COD Reactor, 12 tube, 110V	5-0102
or 1	COD Reactor, 12 tube, 230V	5-0102-EX2
1	Measuring Pipet, 1.0 mL	2-2110
1	Pipet Bulb	2-2164

Chemical Oxygen Demand (COD) is a measure of the amount of organic matter in water which is susceptible to oxidation by chemical oxidants. COD can be empirically related to the Biological Oxygen Demand (BOD) and organic carbon content of a specific source of water. This correlation must be determined experimentally for each source of water.

APPLICATION:	Domestic and industrial wastes.
RANGE:	0–150 mg/L COD
MDL:	5 mg/L
METHOD:	Dichromate in the presence of silver salts, at high temperature in a closed system, oxidizes most organic compounds to 95-100% of the theoretical amount. This process is called digestion. As dichromate oxidizes the organic compounds, the amount of yellow color is reduced. The remaining yellow color is measured colorimetrically at the 420 nm and is directly proportional to the COD of the sample.
SAMPLE HANDLING & PRESERVATION:	Collect samples in glass and test as soon as possible. If samples must be stored, preservation is accomplished by the addition of concentrated H2SO4 to adjust the pH below 2. Samples with suspended solids should be homogenized in a blender (100 mL for 30 seconds) and then stirred gently with a magnetic stirrer.
INTERFERENCES:	Volatile organic compounds are not oxidized to the extent that they are in the vapor above the digestion solution. Therefore, they do not contribute to the COD reading. Chloride concentrations above 10% of COD interfere with the mercury free tubes. Chloride above 2000 ppm will interfere with the mercury tubes. Nitrite gives a positive interference of 1.1 ppm O_2 per ppm NO_2–N which is insignificant unless nitrite concentrations are very high. Other reduced inorganic compounds are stoichiometrically oxidized, causing a positive interference. Corrections can be made for these compounds based upon their stoichiometry and concentrations.

PROCEDURE

Use Universal Sample Holder.

1. Homogenize sample if necessary.
2. Preheat COD heater block to 150±2°C.
3. Remove cap from COD tube. Hold tube at a 45° angle. Use a volumetric pipet, to carefully add 2.0 mL sample water allowing the sample to run down the side of the tube.
4. Cap and mix thoroughly.
5. Rinse the outside of the tube with distilled water. Wipe dry with a paper towel.
6. Repeat steps 3 through 5 using 2.0 mL distilled water. This is the reagent blank.
7. Place tubes in preheated COD block heater and maintain temperature at 150±2°C for two hours.
8. At the end of the heating period turn the heater off. Wait 20 minutes for the tubes to cool to 120°C or less.
9. Remove tubes from block heater. Invert several times to mix.
10. Allow to cool to room temperature.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **25 COD LR 0-150**).
6. Scroll to **25 COD LR 0-150**.
7. Wipe the blank tube with a damp towel to remove fingerprints and smudges. Wipe with a dry towel.
8. Insert the tube into chamber - note orientation. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove tube from spectrophotometer.
10. Insert digested water sample tube into chamber. Position tube in same orientation as above. Press **ENTER** to scan sample. Record result. For the most accurate results, take three readings on each sample and average the results.
11. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTES: Reagents are light sensitive. Unused reagents should be stored in the shipping container, and in the refrigerator if possible, until needed.

A reagent blank should be run with each set of samples and with each lot of reagents.

The reacted blank will be stable if stored in the dark.

To eliminate error caused by contamination, wash all glassware with 20% sulfuric acid.

For greater accuracy, a minimum of three repetitions should be performed and the results averaged.

Some samples may be digested completely in less than two hours. The concentration may be measured at 15 minute intervals while the vials are still hot until the reading remains unchanged. The vials should be cooled to room temperature before the final measurement is taken.

COD, STANDARD RANGE

MERCURY FREE DIGESTION METHOD • CODE 0073-SC
MERCURY DIGESTION METHOD • CODE 0076-SC

QUANTITY	CONTENTS	CODE
25	*COD Standard Level Mercury Free Tubes	*0073-SC
or 25	*COD Standard Level Mercury Tubes	*0076-SC

***WARNING:** Reagents marked with an * are considered to be potential health hazards. To view or print a Safety Data Sheet (SDS) for these reagents go to www.lamotte.com. Search for the four digit reagent code number listed on the reagent label, in the contents list or in the test procedures. Omit any letter that follows or precedes the four digit code number. For example, if the code is 4450WT-H, search 4450. To obtain a printed copy, contact LaMotte by email, phone or fax.

Emergency information for all LaMotte reagents is available from Chem-Tel: (US, 1-800-255-3924) (International, call collect, 813-248-0585)

COD Standard Level Mercury Free Tubes are not USEPA approved.

COD Standard Level Mercury Tubes are USEPA approved.

Equipment needed but not supplied:

QUANTITY	CONTENTS	CODE
1	COD Adapter	5-0087
1	COD Reactor, 12 tube, 110V	5-0102
or 1	COD Reactor, 12 tube, 230V	5-0102-EX2
1	Measuring Pipet, 1.0 mL	2-2110
1	Pipet Bulb	2-2164

Chemical Oxygen Demand (COD) is a measure of the amount of organic matter in water which is susceptible to oxidation by chemical oxidants. COD can be empirically related to the Biological Oxygen Demand (BOD) and organic carbon content of a specific source of water. This correlation must be determined experimentally for each source of water.

APPLICATION:	Domestic and industrial wastes.
RANGE:	0–1500 mg/L COD
MDL:	20 mg/L
METHOD:	Dichromate in the presence of silver salts, at high temperature in a closed system, oxidizes most organic compounds to 95-100% of the theoretical amount. This process is called digestion. As dichromate oxidizes the organic compounds, a green complex is formed. The concentration of the green complex is measured at 620 nm and is directly proportional to the COD of the sample.
SAMPLE HANDLING & PRESERVATION:	Collect samples in glass and test as soon as possible. If samples must be stored, preservation is accomplished by the addition of concentrated H_2SO_4 to adjust the pH below 2. Samples with suspended solids should be homogenized in a blender (100 mL for 30 seconds) and then stirred gently with a magnetic stirrer.
INTERFERENCES:	Volatile organic compounds are not oxidized to the extent that they are in the vapor above the digestion solution. Therefore, they do not contribute to the COD reading. Chloride concentrations above 10% of COD interfere with the mercury free tubes. Chloride above 2000 ppm will interfere with the mercury tubes. Nitrite gives a positive interference of 1.1 ppm O_2 per ppm NO_2–N which is insignificant unless nitrite concentrations are very high. Other reduced inorganic compounds are stoichiometrically oxidized, causing a positive interference. Corrections can be made for these compounds based upon their stoichiometry and concentrations.

PROCEDURE

Use Universal Sample Holder.

1. Homogenize sample if necessary.
2. Preheat COD heater block to 150±2°C.
3. Remove cap from COD tube. Hold tube at a 45° angle. Use a volumetric pipet, to carefully add 2.0 mL sample water allowing the sample to run down the side of the tube.
4. Cap and mix thoroughly.
5. Rinse the outside of the tube with distilled water. Wipe dry with a paper towel.
6. Repeat steps 2 through 5 using 2.0 mL distilled water. This is the reagent blank.
7. Place tubes in preheated COD block heater and maintain temperature at 150±2°C for two hours.
8. At the end of the heating period turn the heater off. Wait 20 minutes for the tubes to cool to 120°C or less.
9. Remove tubes from block heater. Invert several times to mix.
10. Allow to cool to room temperature.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **26 COD SR 0-1500**).
6. Wipe the blank tube with a damp towel to remove fingerprints and smudges. Wipe with a dry towel.
7. Scroll to **26 COD SR 0-1500**.
8. Insert reagent blank tube into chamber - note orientation. Press **ENTER** to scan blank.
9. Remove tube from spectrophotometer.
10. Insert digested water sample tube into chamber. Position tube as instructed above. Press **ENTER** to scan sample. Record result. For the most accurate results, take three readings on each sample and average the results.
11. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTES: Reagents are light sensitive. Unused reagents should be stored in the shipping container, and in the refrigerator if possible, until needed.

A reagent blank should be run with each set of samples and with each lot of reagents.

The reacted blank will be stable if stored in the dark.

To eliminate error caused by contamination, wash all glassware with 20% sulfuric acid.

For greater accuracy, a minimum of three repetitions should be performed and the results averaged.

Some samples may be digested completely in less than two hours. The concentration may be measured at 15 minute intervals while the vials are still hot until the reading remains unchanged. The vials should be cooled to room temperature before the final measurement is taken.

COD, HIGH RANGE

MERCURY FREE DIGESTION METHOD • Code 0074-SC
MERCURY DIGESTION METHOD • Code 0077-SC

QUANTITY	CONTENTS	CODE
25	*COD High Level Mercury Free Tubes	*0074-SC
or 25	*COD High Level Mercury Tubes	*0077-SC

***WARNING:** Reagents marked with an * are considered to be potential health hazards. To view or print a Safety Data Sheet (SDS) for these reagents go to www.lamotte.com. Search for the four digit reagent code number listed on the reagent label, in the contents list or in the test procedures. Omit any letter that follows or precedes the four digit code number. For example, if the code is 4450WT-H, search 4450. To obtain a printed copy, contact LaMotte by email, phone or fax.

Emergency information for all LaMotte reagents is available from Chem-Tel: (US, 1-800-255-3924) (International, call collect, 813-248-0585)

COD High Level Mercury Free Tubes and COD High Level Mercury Tubes are not USEPA approved.

Equipment needed but not supplied:

QUANTITY	CONTENTS	CODE
1	COD Adapter	5-0087
1	COD Reactor, 12 tube, 110V	5-0102
or 1	COD Reactor, 12 tube, 230V	5-0102-EX2
1	Measuring Pipet, 1.0 mL	2-2110
1	Pipet Bulb	2-2164

Chemical Oxygen Demand (COD) is a measure of the amount of organic matter in water which is susceptible to oxidation by chemical oxidants. COD can be empirically related to the Biological Oxygen Demand (BOD) and organic carbon content of a specific source of water. This correlation must be determined experimentally for each source of water.

APPLICATION:	Domestic and industrial wastes.
RANGE:	0–15,000 mg/L COD
MDL:	500 mg/L
METHOD:	Dichromate in the presence of silver salts, at high temperature in a closed system, oxidizes most organic compounds to 95-100% of the theoretical amount. This process is called digestion. As dichromate oxidizes the organic compounds, a green complex is formed. The concentration of the green complex is measured at 605 nm and is directly proportional to the COD of the sample.
SAMPLE HANDLING & PRESERVATION:	Collect samples in glass and test as soon as possible. If samples must be stored, preservation is accomplished by the addition of concentrated H_2SO_4 to adjust the pH below 2. Samples with suspended solids should be homogenized in a blender (100 mL for 30 seconds) and then stirred gently with a magnetic stirrer.
INTERFERENCES:	Volatile organic compounds are not oxidized to the extent that they are in the vapor above the digestion solution. Therefore, they do not contribute to the COD reading. Contains mercury sulfate to prevent interference from chloride. Nitrite gives a positive interference of 1.1 ppm O_2 per ppm NO_2–N, which is insignificant unless nitrite concentrations are very high. Other reduced inorganic compounds are stoichiometrically oxidized, causing a positive interference. Corrections can be made for these compounds based upon their stoichiometry and concentrations.

PROCEDURE

Use Universal Sample Holder.

1. Homogenize sample if necessary.
2. Preheat COD heater block to 150±2°C.
3. Remove cap from COD tube. Hold vial at a 45° angle. Use a graduated pipet, to carefully add 0.2 mL sample water allowing the sample to run down the side of the tube.
4. Cap and mix thoroughly.
5. Rinse the outside of the tube with distilled water. Wipe dry with a paper towel.
6. Repeat steps 3 through 5 using 0.2 mL distilled water. This is the reagent blank.
7. Place tubes in preheated COD block heater and maintain temperature at 150±2°C for two hours.
8. At the end of the heating period turn the heater off. Wait 20 minutes for the tubes to cool to 120°C or less.
9. Remove tubes from block heater. Invert several times to mix.
10. Allow to cool to room temperature.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **27 COD HR 0-15000**).
6. Wipe the blank tube with a damp towel to remove fingerprints and smudges. Wipe with a dry towel.
7. Scroll to **27 COD HR 0-15000**.
8. Insert the tube into chamber - note orientation. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove tube from Spectrophotometer.
10. Insert digested water sample tube into chamber. Position tube as oriented above. Press **ENTER** to scan sample. Record result. For the most accurate results, take three readings on each sample and average the results.
11. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTES: Reagents are light sensitive. Unused reagents should be stored in the shipping container, and in the refrigerator if possible, until needed.

A reagent blank should be run with each set of samples and with each lot of reagents.

The reacted blank will be stable if stored in the dark.

To eliminate error caused by contamination, wash all glassware with 20% sulfuric acid.

For greater accuracy, a minimum of three repetitions should be performed and the results averaged.

Some samples may be digested completely in less than two hours. The concentration may be measured at 15 minute intervals while the vials are still hot until the reading remains unchanged. The vials should be cooled to room temperature before the final measurement is taken.

COLOR

PLATINUM COBALT METHOD
NO REAGENTS REQUIRED

Color in water may be attributed to humus, peat, plankton, vegetation, and natural metallic ions, such as iron and manganese, or industrial waste. Color is removed to make water suitable for domestic and industrial use. Color may have to be removed from industrial waste before it is discharged to a waterway.

APPLICATION:	Potable water and water with color due to natural materials.
RANGE:	0–1,000 color units
MDL:	15 cu
METHOD:	Color is determined by a meter that has been calibrated with colored standards of known platinum cobalt concentration. True color, the color of water in which the turbidity has been removed, is measured.
SAMPLE HANDLING & PRESERVATION:	Collect all samples in clean glassware. Determine color as soon as possible to avoid biological or chemical changes that could occur in the sample during storage.
INTERFERENCES:	Turbidity will interfere. Filter before testing.

PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **28 Color**).
6. Scroll to **28 Color**.
7. Rinse a tube (0290) with color-free water (distilled or deionized water). Fill to 10 mL line with color-free water.
8. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove tube from spectrophotometer. Empty tube.
10. Rinse tube with sample water. Fill to 10 mL line with water sample.
11. Insert tube with sample water. Close lid. Press **ENTER** to scan sample. Record result in color units.
12. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

COPPER, LOW RANGE

BICINCHONINIC ACID METHOD • CODE 3640-SC

QUANTITY	CONTENTS	CODE
50	*Copper IG Tablets	*3808A-H

***WARNING:** Reagents marked with an * are considered to be potential health hazards. To view or print a Safety Data Sheet (SDS) for these reagents go to www.lamotte.com. Search for the four digit reagent code number listed on the reagent label, in the contents list or in the test procedures. Omit any letter that follows or precedes the four digit code number. For example, if the code is 4450WT-H, search 4450. To obtain a printed copy, contact LaMotte by email, phone or fax.

Emergency information for all LaMotte reagents is available from Chem-Tel: (US, 1-800-255-3924) (International, call collect, 813-248-0585)

The copper content of drinking water generally falls below 0.03 parts per million, but copper levels as high as 1.0 part per million will give water a bitter taste. Waters testing as high as 1.0 part per million copper have probably been treated with a copper compound, like those used in the control of algae, or have become contaminated from untreated industrial wastes. The addition of copper sulfate to lakes causes an increase in the copper content of the sediments. Acid waters and those high in free carbon dioxide may cause the corrosion or “eating away” of copper, brass and bronze pipes and fittings. This corrosion results in the addition of copper into the water supply.

APPLICATION:	Drinking, surface, and saline waters; domestic and industrial wastes.
RANGE:	0.00–3.50 ppm Copper
MDL:	0.05 ppm
METHOD:	Copper ions form a purple complex with bicinchoninic acid around pH 6-7, in proportion to the concentration of copper in the sample.
SAMPLE HANDLING & PRESERVATION:	Copper has a tendency to be adsorbed to the surface of the sample container. Samples should be analyzed as soon as possible after collection. If storage is necessary, 0.5 mL of 20% HCl per 100 mL of sample will prevent “plating out.” However, a correction must be made to bring the reaction into the optimum pH range.
INTERFERENCES:	High concentrations of oxidizing agents, calcium, and magnesium interfere. Silver can also interfere.

PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **29 Copper BCA-LR**).
6. Scroll to **29 Copper BCA-LR**.
7. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
8. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove tube from Spectrophotometer and add one *Copper IG Tablet (3808A). Cap and shake vigorously until tablet dissolves. Solution will turn purple if copper is present. Wait 2 minutes.
10. At end of 2 minute waiting period, mix. Insert tube into chamber. Close lid. Press **ENTER** to scan sample. Record result.
11. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

COPPER

CUPRIZONE METHOD • CODE 4023

QUANTITY	CONTENTS	CODE
15 mL	*Copper A	*P-6367-E
15 mL	*Copper B	*P-6368-E

***WARNING:** Reagents marked with an * are considered to be potential health hazards. To view or print a Safety Data Sheet (SDS) for these reagents go to www.lamotte.com. Search for the four digit reagent code number listed on the reagent label, in the contents list or in the test procedures. Omit any letter that follows or precedes the four digit code number. For example, if the code is 4450WT-H, search 4450. To obtain a printed copy, contact LaMotte by email, phone or fax.

Emergency information for all LaMotte reagents is available from Chem-Tel: (US, 1-800-255-3924) (International, call collect, 813-248-0585)

The copper content of drinking water generally falls below 0.03 parts per million, but copper levels as high as 1.0 part per million will give water a bitter taste. Waters testing as high as 1.0 part per million copper have probably been treated with a copper compound, like those used in the control of algae, or have become contaminated from untreated industrial wastes. The addition of copper sulfate to lakes causes an increase in the copper content of the sediments. Acid waters and those high in free carbon dioxide may cause the corrosion or “eating away” of copper, brass and bronze pipes and fittings. This corrosion results in the addition of copper to the water supply.

APPLICATION:	Drinking, surface, and domestic waters; swimming pool water.
RANGE:	0.00–2.00 ppm Copper
MDL:	0.01 ppm
METHOD:	Copper ions form a blue complex with cuprizone, in a 1 to 2 ratio, at a pH of about 8, in proportion to the concentration of copper in the sample.
SAMPLE HANDLING & PRESERVATION:	Copper has a tendency to be adsorbed to the surface of the sample container. Samples should be analyzed as soon as possible after collection. If storage is necessary, 0.5 mL of 20% hydrochloric acid per 100 mL of sample will prevent “plating out”. However, a correction must be made to bring the reaction into the optimum pH range.
INTERFERENCES:	Hg+1 at 1 ppm. Cr+3, Co+2, and silicate at 10 ppm. As^{+3}, Bi^{+3}, Ca^{+2}, Ce^{+3}, Ce^{+4}, Hg^{+2}, Fe^{+2}, Mn^{+2}, Ni^{+2} and ascorbate at 100 ppm.

Many other metal cations and inorganic anions at 1000 ppm. EDTA at all concentrations.

PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **31 Cu-Cuprizone**).
6. Scroll to **31 Cu-Cuprizone**.
7. Rinse a tube (0290) with sample water. Fill to the 10 mL line with sample.
8. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove tube from Spectrophotometer and add 5 drops of *Copper A (P-6367). Cap and mix.
10. Add 5 drops of *Copper B (P-6368). Cap and mix.
11. Wait 5 minutes. Mix.
12. Insert tube into chamber. Close lid. Press **ENTER** to scan sample. Record result.
13. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTES: For best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents is obtained.

The reaction may stain the tubes. Scrub tubes thoroughly after each use.

COPPER

DIETHYLDITHIOCARBAMATE METHOD • CODE 3646-SC

QUANTITY	CONTENTS	CODE
15 mL	*Copper 1	*6446-E

***WARNING:** Reagents marked with an * are considered to be potential health hazards. To view or print a Safety Data Sheet (SDS) for these reagents go to www.lamotte.com. Search for the four digit reagent code number listed on the reagent label, in the contents list or in the test procedures. Omit any letter that follows or precedes the four digit code number. For example, if the code is 4450WT-H, search 4450. To obtain a printed copy, contact LaMotte by email, phone or fax.

Emergency information for all LaMotte reagents is available from Chem-Tel: (US, 1-800-255-3924) (International, call collect, 813-248-0585)

The copper content of drinking water generally falls below 0.03 parts per million, but copper levels as high as 1.0 part per million will give water a bitter taste. Waters testing as high as 1.0 part per million copper have probably been treated with a copper compound, like those used in the control of algae, or have become contaminated from untreated industrial wastes. The addition of copper sulfate to lakes causes an increase in the copper content of the sediments. Acid waters and those high in free carbon dioxide may cause the corrosion or “eating away” of copper, brass and bronze pipes and fittings. This corrosion results in the addition of copper into the water supply.

APPLICATION:	Cupric ions form a yellow colored chelate with diethyldithiocarbamate around pH 9-10 in proportion to the concentration of copper in the sample. Drinking, surface, and saline waters; domestic and industrial wastes.
RANGE:	0.00–6.00 ppm Copper
ML:	0.05 ppm
METHOD:	Cupric ions form a yellow colored chelate with diethyldithiocarbamate around pH 9-10 in proportion to the concentration of copper in the sample.
SAMPLE HANDLING & PRESERVATION:	Copper has a tendency to be adsorbed to the surface of the sample container. Samples should be analyzed as soon as possible after collection. If storage is necessary, 0.5 mL of 20% hydrochloric acid per 100 mL of sample will prevent “plating out.” However, a correction must be made to bring the reaction into the optimum pH range.
INTERFERENCES:	Bismuth, cobalt, mercurous, nickel and silver ions and chlorine (6 ppm or greater) interfere and must be absent.

PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **32 Copper DDC**).
6. Scroll to **32 Copper DDC**.
7. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
8. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove tube from Spectrophotometer and add 5 drops of *Copper 1 (6446). Cap and mix. Solution will turn yellow if copper is present.
10. Insert tube into chamber. Close lid. Press **ENTER** to scan sample. Record result.
11. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTE: The reaction may stain the tubes. Scrub the tubes thoroughly after each use.

COPPER, UDV

BICINCHONINIC ACID–UNIT DOSE VIAL METHOD
CODE 4314-J

QUANTITY	CONTENTS	CODE
1	*Copper Unit Dose Vials, 20 pouches	*4314-J

Equipment needed but not suppled:

STANDARD ACCESSORY PACKAGE • CODE 1961		
1	Package of 3 Vials (empty)	0156
1	Syringe, 3 mL, plastic	1184
1	Foil Storage Bag	9467

Or:

ADVANCED ACCESSORY PACKAGE • CODE 1962		
1	Pipettor, 3 mL	30528
1	Pipet Tip (0-5 mL)	30695
1	Cuvette Rack	31695
1	Package of 3 Vials (empty)	0156
1	Foil Storage Bag	9467

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Emergency information for all LaMotte reagents is available from Chem-Tel:
(US, 1-800-255-3924) (International, call collect, 813-248-0585)

The copper content of drinking water generally falls below 0.03 parts per million, but copper levels as high as 1.0 part per million will give water a bitter taste. Waters testing as high as 1.0 part per million copper have probably been treated with a copper compound, like those used in the control of algae, or have become contaminated from untreated industrial wastes. The addition of copper sulfate to lakes causes an increase in the copper content of the sediments. Acid waters and those high in free carbon dioxide may cause the corrosion or “eating away” of copper, brass and bronze pipes and fittings. This corrosion results in the addition of copper to the water supply.

APPLICATION:	Drinking, surface, and saline waters; domestic and industrial wastes.
RANGE:	0.00–4.00 Copper
MDL:	0.20 ppm
METHOD:	Cupric ions form a purple complex with bicinchoninic acid around pH 6–7, in proportion to the concentration of copper in the sample.
SAMPLE HANDLING & PRESERVATION:	Copper has a tendency to be adsorbed to the surface of the sample container. Samples should be analyzed as soon as possible after collection. If storage is necessary, 0.5 mL of 20% hydrochloric acid per 100 mL of sample will prevent “plating out”. However, a correction must be made to bring the reaction into the optimum pH range.
INTERFERENCES:	High concentrations of oxidizing agents, calcium, and magnesium interfere. Silver can also interfere.

PROCEDURE

Use Square Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **33 Copper-UDV**).
6. Scroll to **33 Copper-UDV**.
7. Rinse a clean vial (0156) with sample water.
8. Use the syringe (1184) to add 3 mL of sample to the vial.
9. Insert the vial into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
10. Remove vial from Spectrophotometer.
11. Use the syringe (1184) to add 3 mL of sample to a *Copper UDV vial (4314).
12. Wait 2 minutes.
13. Invert vial 3 times to mix.
    NOTE: If powder residue remains in the bottom of the vial after inverting, or air bubbles form, invert once more and tap bottom of vial sharply once or twice to dislodge powder or bubbles. Mix.
14. Insert vial into chamber. Close lid. Press **ENTER** to scan sample. Record result.
15. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTE: For best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents is obtained.

UDVs from opened pouches should be used promptly. Store unused vials from opened pouches in the Foil Storage Bag (9467) to extend the shelf life of the reagent. Generally, UDVs stored in the bag should be used within 10 days if the humidity is less than 50% and within 5 days if humidity is greater than 50%. The Foil Storage Bag contains a dessicant pack with indicator. When the indicator in the window turns from blue to pink, the bag should be replaced.

CYANIDE

PYRIDINE-BARBITURIC ACID METHOD
CODE 3660-01-SC

QUANTITY	CONTENTS	CODE
60 mL	Cyanide Buffer	2850PS-H
5 g	*Cyanide Cl Reagent	*2794DS-C
5 g	Cyanide Indicator Reagent	2793DS-C
15 mL	*Hydrochloric Acid 1N	*6130-E
15 mL	*Sodium Hydroxide 1N	*4004-E
2	Spoons, 0.1 g, plastic	0699
1	Pipet, plastic, 1.0 mL	0354
1	pH Short Range Test Paper, pH 9–14	2955
1	Stirring Rod, Plastic	0519

***WARNING:** Reagents marked with an * are considered to be potential health hazards. To view or print a Safety Data Sheet (SDS) for these reagents go to www.lamotte.com. Search for the four digit reagent code number listed on the reagent label, in the contents list or in the test procedures. Omit any letter that follows or precedes the four digit code number. For example, if the code is 4450WT-H, search 4450. To obtain a printed copy, contact LaMotte by email, phone or fax.

Emergency information for all LaMotte reagents is available from Chem-Tel: (US, 1-800-255-3924) (International, call collect, 813-248-0585)

The presence of cyanide in water has a significant effect on the biological activity of the system. Cyanides may exist in water in a variety of forms which vary in toxicity. Cyanide is a by-product of industrial waste from petroleum refining and plating.

APPLICATION:	Low level concentrations in drinking and surface waters; domestic and industrial waters. This method determines only those cyanides amenable to chlorination.
RANGE:	0.00–0.500 ppm Cyanide
MDL:	0.05 ppm
METHOD:	Cyanides react with a chlorine donor to form cyanogen chloride, which subsequently reacts with Pyridine and Barbituric Acid to form a red-blue compound in proportion to the amount of cyanide originally present. The concentration of the red-blue compound is determined spectrophotometrically.
SAMPLE HANDLING & PRESERVATION:	Cyanide solutions tend to be unstable and should be analyzed as soon as possible. Samples can be stabilized by adjusting the pH to greater than 12 with NaOH. However, the pH will have to be readjusted to pH 10.5 before performing the test.
INTERFERENCES:	Oxidizing agents and aldehydes can react with cyanide, while reducing agents, such as sulfite, react with the chlorine donor; both can cause negative interferences. Thiocyanate and cyanogen chloride both react as cyanide in this test and will give a positive interference. Color and turbidity can also interfere.

PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **35 Cyanide**).
6. Scroll to **35 Cyanide**.
7. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
8. Dip the end of plastic rod (0519) into water sample and touch it to a small piece (1/4 inch) of pH test paper (2955) to wet paper. Read pH immediately from color chart.

   a) If pH is below 10, raise the pH by adding *Sodium Hydroxide, 1N (4004) one drop at a time with stirring. Check pH after each drop with a new piece of pH test paper. Continue adjustment until pH is between 10.5 and 11.0.

   b) If pH is above 11.5, lower pH by adding *Hydrochloric Acid (6130) one drop at a time with stirring. Check pH after each drop with a new piece of pH test paper. Continue adjustment until pH is between 10.5 and 11.0.
9. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
10. Remove tube from Spectrophotometer. Use the 1.0 mL pipet (0354) to add 1.0 mL of Cyanide Buffer (2850PS) to tube. Cap and mix.
11. Use one 0.1 g spoon (0699) to add one level measure of *Cyanide Cl Reagent (2794DS). Cap and invert 10 times to mix. Wait 30 seconds.
12. During the 30 second waiting period, carefully fill a second 0.1 g spoon (0699) with one level measure of Cyanide Indicator Reagent (2793DS).
13. At the end of the 30 second waiting period, immediately add the level measure of *Cyanide Indicator Reagent (2793DS). Cap and shake vigorously for 20 seconds. Wait 20 minutes for maximum color development.
14. At the end of the twenty minute waiting period, mix. Insert tube into chamber. Close lid. Press **ENTER** to scan sample. Record result.
15. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

CYANURIC ACID

MELAMINE METHOD–TURBIDITY • CODE 366I-01-SC

QUANTITY	CONTENTS	CODE
2 x 100 mL	Cyanuric Acid Test Solution	4856-J
1	Syringe, 5 mL	0807

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Cyanuric acid is added to swimming pool water as a stabilizing agent for free chlorine residuals. It minimizes the loss of chlorine from the action of ultraviolet rays in sunlight. Cyanuric acid levels in pools should be maintained between 25 and 75 ppm and various public health associations recommend that the concentration should never exceed 100-150 ppm.

APPLICATION:	Swimming pool water.
RANGE:	0–200 ppm Cyanuric Acid
MDL:	16 ppm
METHOD:	A buffered solution of melamine forms a precipitate with cyanuric acid in proportion to the amount of cyanuric acid present. The amount of particles in suspension is measured turbidimetrically.
SAMPLE HANDLING & PRESERVATION:	Cyanuric acid samples should be analyzed as soon as possible after collection. Deterioration of the sample can be minimized by keeping samples in the dark or refrigerated until analysis can be performed.
INTERFERENCES:	No known interference from compounds normally found in pool water. Temperature of the sample should be maintained between 70°F and 80°F for best results. Check for stray light interference (see page 15).

PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **36 Cyanuric**).
6. Scroll to **36 Cyanuric**.
7. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
8. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove tube from Spectrophotometer and pour out water. Use a graduated cylinder or similar to measure 5 mL of sample water and pour into colorimeter tube.
10. Use the 5 mL syringe (0807) to add 5 mL of Cyanuric Acid Test Solution (4856). Cap and mix thoroughly. A precipitate will form if cyanuric acid is present. Wait 1 minute.
    NOTE: This reagent bottle has a special fitting which enables the syringe to be inserted into the top of the bottle. With syringe in place, invert bottle and withdraw syringe plunger until 5 mL of reagent is contained in the syringe barrel. Remove syringe from reagent bottle and depress plunger to dispense into the tube.
11. At end of 1 minute waiting period, mix thoroughly. Insert tube into chamber. Close lid. Press **ENTER** to scan sample. Record result.
12. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTE: For the most accurate results, the sample and reagents should be at 25 ±4°C.

CYANURIC ACID, UDV

MELAMINE–TURBIDITY–UNIT DOSE VIAL METHOD
CODE 4313-J

QUANTITY	CONTENTS	CODE
1	*Cyanuric Acid Unit Dose Vials, 20 pouches	*4313-J

Equipment but not suppled:

STANDARD ACCESSORY PACKAGE • CODE 1961		
1	Package of 3 Vials (empty)	0156
1	Syringe, 3 mL, plastic	1184
1	Foil Storage Bag	9467

Or:

ADVANCED ACCESSORY PACKAGE • CODE 1962		
1	Pipettor, 3 mL	30528
1	Pipet Tip (0-5 mL)	30695
1	Cuvette Rack	31695
1	Package of 3 Vials (empty)	0156
1	Foil Storage Bag	9467

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Emergency information for all LaMotte reagents is available from Chem-Tel:
(US, 1-800-255-3924) (International, call collect, 813-248-0585)

Cyanuric acid is added to swimming pool water as a stabilizing agent for free chlorine residuals. It minimizes the loss of chlorine from the action of ultraviolet rays in sunlight. Cyanuric acid levels should be maintained between 25 and 75 ppm and various public health associations recommend that the concentration should never exceed 100–150 ppm.

APPLICATION:	Swimming pool water.
RANGE:	0–150 Cyanuric Acid
MDL:	5 ppm
METHOD:	A buffered solution of melamine forms a precipitate with cyanuric acid in proportion to the amount of cyanuric acid present. The amount of particles in suspension is measured turbidimetrically.
SAMPLE HANDLING & PRESERVATION:	Cyanuric acid samples should be analyzed as soon as possible after collection. Deterioration of the sample can be minimized by keeping samples in the dark or refrigerated until analysis can be performed.
INTERFERENCES:	No known interference from compounds normally found in pool water. Temperature of the sample should be maintained between 70°F and 80°F for best results. Check for stray light interference (see page 16).

PROCEDURE

Use Square Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **37 Cyanuric-UDV**).
6. Scroll to **37 Cyanuric-UDV**.
7. Rinse a clean vial (0156) with sample water.
8. Use the syringe (1184) to add 3 mL of sample to the vial.
9. Insert the vial into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.Remove vial from Spectrophotometer.
10. Use the syringe (1184) to add 3 mL of sample to a *Cyanuric Acid UDV vial (4313).
11. Invert vial 3 times to mix.
12. Wait 2 minutes.
13. Invert vial 3 times to mix.
    NOTE: If powder residue remains in the bottom of the vial after inverting, or air bubbles forms, invert vial once more and tap bottom of vial sharply once or twice to dislodge powder or bubbles. Mix.
14. Insert vial into chamber. Close lid. Press **ENTER** to scan sample. Record result.
15. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTES: For best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents is obtained.

UDVs from opened pouches should be used promptly. Store unused vials from opened pouches in the Foil Storage Bag (9467) to extend the shelf life of the reagent. Generally, UDVs stored in the bag should be used within 10 days if the humidity is less than 50% and within 5 days if humidity is greater than 50%. The Foil Storage Bag contains a desiccant pack

DISSOLVED OXYGEN

WINKLER COLORIMETRIC METHOD • CODE 3688-SC

QUANTITY	CONTENTS	CODE
30 mL	*Manganese Sulfate Solution	*4167-G
30 mL	*Alkaline Potassium Iodide Azide	*7166-G
30 mL	*Sulfuric Acid 1:1	*6141WT-G
1	Sample Tube, screw cap	29180
1	Cap	28570

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Dissolved oxygen is vital to the survival of aquatic organisms. Naturally present, dissolved oxygen enters the water when plants photosynthesize. Wind and wave action also cause oxygen from the air to dissolve into water. Dissolved oxygen is consumed by aquatic animals and by the oxidation, or chemical breakdown, of dead and decaying plants and animals. The concentration of dissolved oxygen in natural waters can range from 0 to 14 ppm and is effected by temperature and salinity.

APPLICATION:	Drinking and surface waters; domestic and industrial wastewaters.
RANGE:	0.00–12.00 ppm Dissolved Oxygen
MDL:	0.25 ppm
METHOD:	This method uses the azide modification of the Winkler Method with a colorimetric determination of the yellow iodine produced from the reaction with the dissolved oxygen.
INTERFERENCES:	The presence of other oxidizing agents may cause positive interferences. Reducing may cause negative interferences. Nitrite interferences are eliminated with the azide modification.

COLLECTION & TREATMENT OF THE WATER SAMPLE

Steps 1 through 4 below describe proper sampling technique in shallow water. For sample collection at depths beyond arm's reach, special water sampling apparatus is required (e.g. the LaMotte Water Sampling Chamber, Code 1060; Model JT-1 Water Samplers, Code 1077; Water Sampling Outfit, Code 3103; or Water Sampling Bottle, Code 3-0026).

1. To avoid contamination, thoroughly rinse the screw cap Sample Tube (29180) with sample water.
2. Tightly cap Sample Tube and submerge to the desired depth. Remove cap and allow the Sample Tube to fill.
3. Tap the sides of the submerged tube to dislodge any air bubbles clinging to the inside. Replace the cap while the Sample Tube is still submerged.
4. Retrieve Sample Tube and examine it carefully to make sure that no air bubbles are trapped inside. Once a satisfactory sample has been collected, proceed immediately with Steps 5 and 6 to "fix" the sample.
   NOTE: Be careful not to introduce air into the sample while adding the reagents in steps 5 and 6. Simply drop the reagents into the sample. Cap carefully, and mix gently.
5. Add 2 drops of *Manganese Sulfate Solution (4167) and 2 drops of *Alkaline Potassium Iodide Azide (7166). Cap and mix by inverting several times. A precipitate will form. Allow the precipitate to settle below the shoulder of the tube before proceeding.
6. Add 8 drops of *Sulfuric Acid, 1:1 (6141WT). Cap and gently mix until the reagent and the precipitate have dissolved. A clear-yellow to brown-orange color will develop, depending on the oxygen content of the sample.

NOTE: It is very important that all "brown flakes" are dissolved completely. If the water has a high DO level this could take several minutes. If flakes are not completely dissolved after 5 minutes, add 2 drops of *Sulfuric Acid 1:1 (6141WT) and continue mixing.

Following the completion of step 6, contact between the water sample and the atmosphere will not affect the test result. Once the sample has been "fixed" in this manner, it is not necessary to perform the actual test procedure immediately. Thus, several samples can be collected and "fixed" in the field, and then carried back to a testing station or laboratory where the test procedure is to be performed.

PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **39 DO**).
6. Scroll to **39 DO**.
7. Rinse a clean tube (0290) with untreated sample water. Fill to the 10 mL line with sample. This tube is the BLANK.
8. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Fill a second tube (0290) to the 10 line with the treated “Fixed” sample. This tube is the SAMPLE.
10. Remove BLANK from spectrophotometer. Insert SAMPLE tube into chamber. Close lid. Press **ENTER** to scan sample. Record result.
11. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

FLUORIDE

SPADNS METHOD • CODE 3647-02-SC

QUANTITY	CONTENTS	CODE
4 x 30 mL	*Acid-Zirconyl-SPADNS Reagent	*3875-G
2 x 30 mL	*Sodium Arsenite Solution	*4128-G
1	Pipet, 0.5 mL, plastic	0353
1	Pipet, 1.0 mL, plastic	0354

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Fluoride may occur naturally in some ground waters or it may be added to public drinking water supplies to maintain a 1.0 mg/L concentration to prevent dental cavities. At higher concentrations, fluoride may produce an objectionable discoloration of tooth enamel called fluorosis, though levels up to 8 mg/L have not been found to be physiologically harmful.

NOTE: This procedure uses the EPA approved Reagent System for fluoride found in method 4500-F-D, 18th Edition of Standard Methods, page 1-27.

APPLICATION	Drinking and surface waters; domestic and industrial waters.
RANGE:	0.00–2.00 ppm Fluoride
MDL:	0.05 ppm
METHOD:	Colorimetric test based upon the reaction between fluoride and zirconium dye lake. The fluoride reacts with the dye lake, dissociating a portion of it into a colorless complex ion and dye. As the fluoride concentration increases, the color produced becomes progressively lighter.
SAMPLE HANDLING & PRESERVATION:	Samples may be stored and refrigerated in plastic containers.
INTERFERENCES:	The following substances produce a positive interference at the concentration given:

Chloride (Cl–)
Phosphate (PO_4^{-3})
Hexametaphosphate $(NaPO_3)_6$

The following substances produce a negative interference at the concentration given:

Alkalinity ($CaCO_3$)	5000 mg/L
Aluminum (Al^{3+})	0.1 mg/L
Iron (Fe^{3+})	10 mg/L
Sulfate (SO_4^{-2})	200 mg/L

Color and turbidity must be removed or compensated for in the procedure. Temperature should be maintained within 5°C of room temperature.

PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **41 Fluoride**).
6. Scroll to **41 Fluoride**.
7. This test requires a reagent blank. Rinse a clean tube (0290) with clear, colorless, fluoride free water. Fill to the 10 mL line with clear, colorless, fluoride free water.
8. Use the 0.5 mL pipet (0353) to add 0.5 mL of *Sodium Arsenite Solution (4128). Cap and mix.
9. Use the 1.0 mL pipet (0354) to add 2 measures of *Acid-Zirconyl SPADNS Reagent (3875). Cap and mix thoroughly. (This is the reagent blank.)
10. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
11. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample water. Repeat steps 6 and 7.
12. Insert tube into chamber. Close lid. Press **ENTER** to scan sample. Record result.
13. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

HYDRAZINE

p-DIMETHYLAMINOBENZALDEHYDE METHOD
CODE 3656-01-SC

QUANTITY	CONTENTS	CODE
2x60 mL	*Hydrazine Reagent A	*4841-H
10 g	Hydrazine Reagent B Powder	4842-D
1	Pipet, 1.0 mL, plastic	0354
1	Spoon, 0.15 g, plastic	0727

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Emergency information for all LaMotte reagents is available from Chem-Tel: (US, 1-800-255-3924) (International, call collect, 813-248-0585)

Hydrazine, N_2H_4, is added to the water in high pressure boilers to reduce corrosion by acting as an oxygen scavenger.

APPLICATION:	Boiler and cooling waters; industrial wastewaters.
RANGE:	0.000–1.000 ppm Hydrazine
MDL:	0.010 ppm
METHOD:	p-Dimethylaminobenzaldehyde reacts with hydrazine under acidic conditions to form a yellow color in proportion to the amount of hydrazine present.
SAMPLE HANDLING & PRESERVATION:	Samples should be analyzed as soon as possible after collection due to the ease with which hydrazine becomes oxidized. Acidification of the sample may increase the time between collection and analysis.
INTERFERENCES:	The substances normally present in water do not interfere with the test, with the exception of strong oxidizing agents.

PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **45 Hydrazine**).
6. Scroll to **45 Hydrazine**.
7. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
8. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove tube from spectrophotometer. Use the 1 mL pipet (0354) to add 4 mL of *Hydrazine Reagent A (4841). Cap and mix.
10. Use the 0.15 g spoon (0727) to add one measure of Hydrazine Reagent B Powder (4842). Cap and shake vigorously for 10 seconds. Wait 2 minutes for maximum color development. An undissolved portion of Hydrazine Reagent B may remain in bottom of tube without adversely affecting results.
11. At the end of the 2 minute waiting period, mix. Insert tube into chamber. Close lid. Press **ENTER** to scan sample. Record result.
12. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTE: For best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents is obtained.

HYDROGEN PEROXIDE, LOW RANGE

DPD METHOD • CODE 3662-SC

QUANTITY	CONTENTS	CODE
30 mL	Hydrogen Peroxide Reagent #1	6452-G
100	Hydrogen Peroxide LR IG Tablets	6454A-J
1	Tablet Crusher	0175

***WARNING:** Reagents marked with an * are considered to be potential health hazards. To view or print a Safety Data Sheet (SDS) for these reagents go to www.lamotte.com. Search for the four digit reagent code number listed on the reagent label, in the contents list or in the test procedures. Omit any letter that follows or precedes the four digit code number. For example, if the code is 4450WT-H, search 4450. To obtain a printed copy, contact LaMotte by email, phone or fax.

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Hydrogen peroxide, H_2O_2, is a colorless compound that is widely used as a bleaching or decolorizing agent in the manufacture of many commercial products. As an oxidizing compound it is also used in the treatment of sewage to reduce odors and corrosion due to hydrogen sulfide. It may also be used as a sanitizing agent for water treatment. Hydrogen peroxide is relatively unstable, and for this reason it dissipates quickly and leaves no residuals.

APPLICATION:	Drinking and surface waters; domestic and industrial wastes.
RANGE:	0.00–1.50 ppm Hydrogen Peroxide
MDL:	0.02 ppm
METHOD:	Hydrogen peroxide reacts with an excess of potassium iodide through the action of a catalyst and buffer to release an equivalent amount of iodine. The iodine in turn reacts with diethyl-p-phenylenediamine (DPD) to produce a pink-red color in proportion to the iodine released.
SAMPLE HANDLING & PRESERVATION:	Hydrogen peroxide is not stable in aqueous solutions. Exposure to sunlight and agitation will accelerate the reduction of hydrogen peroxide in dilute solutions. For best results start analysis immediately after sampling.
INTERFERENCE:	The likelihood of other oxidizing compounds interfering with this method is eliminated by the presence of hydrogen peroxide. Manganese may interfere and should be removed before analysis.

PROCEDURE

Use Universal Sample Holde.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **46 H Peroxide-LR**).
6. Scroll to **46 H Peroxide-LR**.
7. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
8. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank. (See Note)
9. Remove tube from Spectrophotometer and add 4 drops of Hydrogen Peroxide Reagent #1 (6452). Cap and mix.
10. Add one Hydrogen Peroxide LR IG Tablet (6454A). Crush tablet with tablet crusher (0175). Cap and mix for 30 seconds. Solution will turn pink if hydrogen peroxide is present. Wait 5 minutes for full color development.
11. At end of 5 minute waiting period, mix. Insert tube into chamber. Close lid. Press **ENTER** to scan sample. Record result.
12. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTES: For best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents is obtained.

For the most accurate results, the sample and reagents should be at 25±4°C.

HYDROGEN PEROXIDE, HIGH RANGE

DPD METHOD • CODE 4045-01

QUANTITY	CONTENTS	CODE
30 mL	Hydrogen Peroxide Reagent #1	6452-G
100	Hydrogen Peroxide LR IG Tablets	6454A-J
1	Tablet Crusher	0175
1	Pipet, glass	0342

***WARNING:** Reagents marked with an * are considered to be potential health hazards. To read complete safety information, go to page 3 in the User Manual.

Large quantities of hydrogen peroxide are added to a swimming pool to “shock” it. Shocking breaks down waste products and re-establishes a positive level of sanitizer. While many types of shock can be used with chlorine or bromine pools, only hydrogen peroxide can be used to shock biguanide pools.

Hydrogen peroxide, H_2O_2, is a colorless compound that is widely used as a bleaching or decolorizing agent in the manufacture of many commercial products. As an oxidizing compound it is also used in the treatment of sewage to reduce odors and corrosion due to hydrogen sulfide. It may also be used as a sanitizing agent for water treatment. Hydrogen peroxide is relatively unstable, and for this reason it dissipates quickly and leaves no residuals.

APPLICATION:	Drinking, industrial, domestic and swimming pool waters
RANGE:	0–60 ppm Hydrogen Peroxide
MDL:	1 ppm
METHOD:	Hydrogen peroxide reacts with an excess of potassium iodide through the action of a catalyst and buffer to release an equivalent amount of iodine. The iodine in turn reacts with diethyl-p-phenylenediamine (DPD) to produce a pink-red color in proportion to the iodine released.
SAMPLE HANDLING & PRESERVATION:	Hydrogen peroxide is not stable in aqueous solutions. Exposure to sunlight and agitation will accelerate the reduction of hydrogen peroxide in dilute solutions. For best results start analysis immediately after sampling.
INTERFERENCES:	The likelihood of other oxidizing compounds interfering with this method is eliminated by the presence of hydrogen peroxide. Manganese may interfere and should be removed before analysis

PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **47 H Peroxide-HR**).
6. Scroll to **47 H Peroxide-HR**.
7. Use the pipet (0342) to add 5 drops of the sample water to a tube (0290).
8. Dilute to the 10 mL line with distilled or hydrogen peroxide-free water.
9. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
10. Remove the tube from spectrophotometer and add 4 drops of Hydrogen Peroxide Reagent #1 (6452). Cap and mix.
11. Add one Hydrogen Peroxide LR IG Tablet (6454A). Crush tablet with Tablet Crusher (0175). Cap and mix for 30 seconds. Solution will turn pink if hydrogen peroxide is present. Wait 5 minutes for full color development.
12. At the end of 5 minute waiting period, mix. Insert tube into chamber. Close lid. Press **ENTER** to scan sample. Record result.
13. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTES: For best possible results, a blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents is obtained.

For the most accurate results, the sample and reagents should be at 25 ±4°C.

HYDROGEN PEROXIDE, SHOCK

DPD METHOD • CODE 4045-01

QUANTITY	CONTENTS	CODE
30 mL	Hydrogen Peroxide Reagent #1	6452-G
100	Hydrogen Peroxide LR IG Tablets	6454A-J
1	Tablet Crusher	0175
1	Pipet, glass	0342

***WARNING:** Reagents marked with an * are considered to be potential health hazards. To view or print a Safety Data Sheet (SDS) for these reagents go to www.lamotte.com. Search for the four digit reagent code number listed on the reagent label, in the contents list or in the test procedures. Omit any letter that follows or precedes the four digit code number. For example, if the code is 4450WT-H, search 4450. To obtain a printed copy, contact LaMotte by email, phone or fax.

Emergency information for all LaMotte reagents is available from Chem-Tel: (US, 1-800-255-3924) (International, call collect, 813-248-0585)

Large quantities of hydrogen peroxide shock are added to a swimming pool to "shock" it. Shocking breaks down waste products and re-establishes a positive level of sanitizer. While many types of shock can be used with chlorine or bromine pools, only hydrogen peroxide shock can be used to shock biguanide pools.

APPLICATION:	Swimming pools
RANGE:	0–225 ppm Hydrogen Peroxide Shock
MDL:	4 ppm
METHOD:	Hydrogen peroxide shock reacts with an excess of potassium iodide through the action of a catalyst and buffer to release an equivalent amount of iodine. The iodine in turn reacts with diethyl-p-phenylenediamine (DPD) to produce a pink-red color in proportion to the iodine released.
SAMPLE HANDLING & PRESERVATION:	Hydrogen peroxide shock is not stable in aqueous solutions. Exposure to sunlight and agitation will accelerate the reduction of hydrogen peroxide in dilute solutions. For best results start analysis immediately after sampling.
INTERFERENCES:	The likelihood of other oxidizing compounds interfering with this method is eliminated by the presence of hydrogen peroxide. Manganese may interfere and should be removed before analysis.

PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **48 H Perox-Shock**).
6. Scroll to **48 H Perox-Shock**.
7. Use the pipet (0342) to add 5 drops of the sample water to a tube (0290).
8. Dilute to the 10 mL line with distilled or hydrogen peroxide-free water.
9. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
10. Remove the tube from spectrophotometer and add 4 drops of Hydrogen Peroxide Reagent #1 (6452). Cap and mix.
11. Add one Hydrogen Peroxide LR IG Tablet (6454A). Crush tablet with Tablet Crusher (0175). Cap and mix for 30 seconds. Solution will turn pink if hydrogen peroxide is present. Wait 5 minutes for full color development.
12. At the end of 5 minute waiting period, mix. Insert tube into chamber. Close lid. Press **ENTER** to scan sample. Record result.
13. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTES: For best possible results, a blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents is obtained.

For the most accurate results, the sample and reagents should be at 25 ±4°C.

IODINE

DPD METHOD • CODE 3643-SC

QUANTITY	CONTENTS	CODE
100	DPD #1 IG Tablets	6903A-J
100	DPD #3 IG Tablets	6197A-J
15 mL	Glycine Solution	6811-E
1	Tablet Crusher	0175

***WARNING:** Reagents marked with an * are considered to be potential health hazards. To read complete safety information, go to page 3 in the User Manual.

Like chlorine and bromine, iodine is an effective germicidal agent employed in drinking water treatment, pool and spa water sanitation, food service sanitation, and other public health applications.

APPLICATION:	Drinking, surface, and saline waters; swimming pool water; domestic and industrial wastes.
RANGE:	0.00–14.00 ppm Iodine
MDL:	0.08 ppm
METHOD:	In a buffered sample iodine reacts with diethyl-p-phenylene-diamine (DPD) to produce a pink-red color in proportion to the concentration of iodine present.
SAMPLE HANDLING & PRESERVATION:	Iodine in aqueous solutions is not stable, and the iodine content of samples or solutions, particularly weak solutions, will rapidly decrease. Exposure to sunlight or agitation will accelerate the reduction of iodine present in such solutions. For best results start analysis immediately after sampling. Samples to be analyzed for iodine cannot be preserved or stored.
INTERFERENCE:	The only interfering substance likely to be encountered in water is oxidized manganese. The extent of this interference can be determined by treating a sample with sodium arsenite to destroy the iodine present so that the degree of interference can be measured. Chlorine and bromine can give a positive interference, but these are not normally present unless they have been added as sanitizers.

PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **50 Iodine**).
6. Scroll to **50 Iodine**.
7. Rinse a clean tube (0290) with sample water. Fill tube to the 10 mL line with sample.
8. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove tube from Spectrophotometer. Add one DPD #1 Tablet IG (6903A). Cap tube and shake for 10 seconds, Invert clowly 5 times. Solution will turn pink if iodine is present. Wait 15 seconds. Mix.
10. Insert tube into chamber. Close lid. Press **ENTER** to scan sample. Record result.
11. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

IRON

BIPYRIDYL METHOD • CODE 3648-SC

QUANTITY	CONTENTS	CODE
30 mL	*Iron Reagent #1	*V-4450-G
5 g	*Iron Reagent #2 Powder	*V-4451-C
1	Pipet, 0.5 mL, plastic	0353
1	Spoon, 0.1 g, plastic	0699

***WARNING:** Reagents marked with an * are considered to be potential health hazards. To read complete safety information, go to page 3 in the User Manual.

Most natural waters contain some iron. Its presence may vary from small traces to very large amounts in water which is contaminated by acid mine wastes. For domestic use, the concentration should not exceed 0.2 ppm and for some industrial applications not even a trace of iron can be tolerated. There are many means available for removing or reducing the iron content. Water softening resins are effective for removing small amounts of iron and special ion exchange materials are selective for iron removal. High concentrations of iron can be removed by such chemical processes as oxidation and lime or lime-soda softening. Because of the many means of removing or reducing the amount of iron in water, the particular method employed will depend largely on the form of iron which is present and the end use of the treated water.

APPLICATION:	Drinking, surface, and saline waters; domestic and industrial wastes.
RANGE:	0.00–6.00 Iron
MDL:	0,06 ppm
METHOD:	Ferric iron is reduced to ferrous iron and subsequently forms a colored complex with bipyridyl for a quantitative measure of total iron.
SAMPLE HANDLING & PRESERVATION:	The sample container should be cleaned with acid and rinsed with deionized water. Addition of acid to adjust the sample to pH 2–3 will prevent deposition of iron on the container walls. Samples should be analyzed as soon as possible.
INTERFERENCES:	Strong oxidizing agents interfere, as well as copper and cobalt in excess of 5.0 mg/L.

PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **51 Iron Bipyr**).
6. Scroll to **51 Iron Bipyr**.
7. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
8. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove the tube from Spectrophotometer. Use the 0.5 mL pipet (0353) to add on measure of *Iron Reagent #1 (V-4450). Cap and mix.
10. Use the 0.1 g spoon (0699) to add 0.1 g of *Iron Reagent #2 Powder (V4451). Cap and shake vigorously for 30 seconds. Wait three minutes for maximum color development.
11. At the end of 3 minute waiting period, do not mix. Insert tube into chamber. Close lid. Press **ENTER** to scan sample. Record result.
12. Turn the spectrophotometer **OFF**. Or insert another sample into chamber. Close lid. Press **ENTER** to scan sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTE: For best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents is obtained.

IRON

1,10-PHENANTHROLINE METHOD • CODE 3668-SC

QUANTITY	CONTENTS	CODE
15 mL	*Acid Phenanthroline Indicator	*2776-E
5 g	*Iron Reducing Reagent	*2777-C
1	Spoon, 0.1 g, plastic	0699

***WARNING:** Reagents marked with an * are considered to be potential health hazards. To read complete safety information, go to page 3 in the User Manual.

Most natural waters contain some iron. Its presence may vary from small traces to very large amounts in water which is contaminated by acid mine wastes. For domestic use, the concentration should not exceed 0.2 ppm and for some industrial applications not even a trace of iron can be tolerated. There are many means available for removing or reducing the iron content. Water softening resins are effective for removing small amounts of iron and special ion exchange materials are selective for iron removal. High concentrations of iron can be removed by such chemical processes as oxidation and lime or lime-soda softening. Because of the many means of removing or reducing the amount of iron in water, the particular method employed will depend largely on the form of iron which is present and the end use of the treated water.

APPLICATION:	Drinking, surface, and saline waters; domestic and industrial wastes.
RANGE:	0.00–4.50 ppm Iron
MDL:	0.04 ppm
METHOD:	Ferric iron is reduced to ferrous iron and subsequently forms a colored complex with phenanthroline for a quantitative measure of total iron.
SAMPLE HANDLING & PRESERVATION	The sample container should be cleaned with acid and rinsed with deionized water. Addition of acid to adjust the sample to pH 2–3 will prevent deposition of iron on the container walls. Samples should be analyzed as soon as possible after collection since ferrous iron undergoes oxidation to ferric iron.
INTERFERENCES:	Strong oxidizing agents, cyanide, nitrite, and phosphates, chromium, zinc in concentrations exceeding 10 times that of iron; cobalt and copper in excess of 5 mg/L, and nickel in excess of 2 mg/L. Bismuth, cadmium, mercury, , and silver precipitate phenanthroline.

PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **53 Iron Phen**).
6. Scroll to **53 Iron Phen**.
7. Rinse a clean tube (0290) with sample water. Fill to the 10 mL mark with sample.
8. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove the tube from Spectrophotometer. Remove the cap and add 6 drops of *Acid Phenanthroline Indicator (2776). Cap and invert the tube 4 times to mix reagents. Wait five minutes for maximum color development.
10. After five minutes, mix, insert tube into chamber, close lid and select **SCAN SAMPLE**. Record result as ppm Ferrous Iron.
11. Remove tube from Spectrophotometer. Use the 0.1g spoon (0699) to add one measure of *Iron Reducting Reagent (2777). Cap and invert 15-20 times to mix, wait 5 minutes for maximum color delelopment.
12. After 5 minutes, mix insert tube into spectrophotometer. Close lid. Press **ENTER** to scan sample. Record result as ppm Total Iron.
13. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.
14. Total Iron (ppm) - Ferrous Iron (ppm) = Ferric Iron (ppm)

NOTE: For best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents is obtained.

IRON, UDV

BIPYRIDYL–UNIT DOSE VIAL METHOD • CODE 4315-J

QUANTITY	CONTENTS	CODE
1	*Total Iron Unit Dose Vials, 20 pouches	*4315-J

***WARNING:** Reagents marked with an * are considered to be potential health hazards. To view or print a Safety Data Sheet (SDS) for these reagents go to www.lamotte.com. Search for the four digit reagent code number listed on the reagent label, in the contents list or in the test procedures. Omit any letter that follows or precedes the four digit code number. For example, if the code is 4450WT-H, search 4450. To obtain a printed copy, contact LaMotte by email, phone or fax.

Emergency information for all LaMotte reagents is available from Chem-Tel: (US, 1-800-255-3924) (International, call collect, 813-248-0585)

Equipment needed but not supplied:

STANDARD ACCESSORY PACKAGE • CODE 1961		
1	Package of 3 Vials (empty)	0156
1	Syringe, 3 mL, plastic	1184
1	Foil Storage Bag	9467

Or:

ADVANCED ACCESSORY PACKAGE • CODE 1962		
1	Pipettor, 3 mL	30528
1	Pipet Tip (0-5 mL)	30695
1	Cuvette Rack	31695
1	Package of 3 Vials (empty)	0156
1	Foil Storage Bag	9467

Most natural waters contain some iron. Its presence may vary from small traces to very large amounts in water which is contaminated by acid mine wastes. For domestic use, the concentration should not exceed 0.2 ppm and for some industrial applications not even a trace of iron can be tolerated. There are many means available for removing or reducing iron content. Water softening resins are effective for removing small amounts of iron and special ion exchange materials are selective for iron removal. High concentrations of iron can be removed by such chemical processes as oxidation and lime or lime-soda softening. Because of the many means of removing or reducing the amount of iron in water, the particular method employed will depend largely on the form of iron which is present and the end use of the treated water.

APPLICATION:	Drinking, surface, and saline waters; domestic and industrial wastes.
RANGE:	0.00–10.00 ppm
MDL:	0.07 ppm
METHOD:	Ferric iron is reduced to ferrous iron and subsequently forms a colored complex with for a quantitative measure of total iron.
SAMPLE HANDLING & PRESERVATION:	The sample container should be cleaned with acid and rinsed with deionized water. Addition of acid to adjust the sample. The pH 2-3 will prevent deposition of iron on the container walls. Samples should be analyzed as soon as possible.
INTERFERENCES:	Strong oxidizing agents interfere, as well as copper and cobalt in excess of 5.0 ppm.

PROCEDURE

Use Square Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **52 Iron-UDV**).
6. Scroll to **52 Iron-UDV**.
7. Rinse a clean vial (0156) with sample water.
8. Use the syringe (1184) to add 3 mL of sample to the vial.
9. Insert the vial into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
10. Remove the vial from the Spectrophotometer.
11. Use the syringe (1184) to add 3 mL of sample to an *Iron UDV vial (4315).
12. Shake vigorously for 15 seconds.
13. Wait 2 minutes.
14. Invert vial 3 times to mix.
    NOTE: If powder residue remains in the bottom of the vial after inverting, or air bubbles forms, invert vial once more and tap bottom of vial sharply once or twice to dislodge powder or bubbles. Mix.
15. Insert tube into chamber. Close lid. Press **ENTER** to scan sample. Record result.
16. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTES: For best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents is obtained.

UDVs from opened pouches should be used promptly. Store unused vials from opened pouches in the Foil Storage Bag (9467) to extend the shelf life of the reagent. Generally, UDVs stored in the bag should be used within 10 days if the humidity is less than 50% and within 5 days if humidity is greater than 50%. The Foil Storage Bag contains a desiccant pack with indicator. When the indicator in the window turns from blue to pink, the bag should be replaced.

LEAD

PAR METHOD • CODE 4031-01

QUANTITY	CONTENTS	CODE
250 mL	*Ammonium Chloride Buffer	*4032-K
15 mL	*Sodium Cyanide, 10%	*6565-E
30 mL	PAR Indicator	4033-G
30 mL	Stabilizing Reagent	4022-G
15 mL	*DDC Reagent	*4034-E
1	Syringe, 5 mL, plastic	0807
2	Pipet, 0.5 mL, plastic	0353

***WARNING:** Reagents marked with an * are considered to be potential health hazards. To view or print a Material Safety Data Sheet (MSDS) for these reagents go to www.lamotte.com. To obtain a printed copy, contact LaMotte by e-mail, phone or fax.

The average concentration of lead is 0.003 ppm in streams and less than 0.1 ppm in groundwater. Lead in a water supply may come from mine and smelter discharges or from industrial waste. Lead is used in the production of batteries, solder, pigments, insecticides, ammunition and alloys. Tetraethyl Lead has been used for years as an anti-knock reagent in gasoline. Lead may also enter water supplies when corrosive water dissolves pipes, plumbing fixtures and materials containing lead. Lead accumulates in the body and is toxic by ingestion.

APPLICATION:	Drinking and surface waters; domestic and industrial wastewaters.
RANGE:	0.00–5.00 Lead
MDL:	0.10 ppm
METHOD:	Lead and calcium ions form a red complex with PAR (4-(2'-pyridylazo)resorcinol), at a pH of about 10. When sodium diethyldithiocarbamate is added, the lead/PAR complex is destroyed leaving the calcium/PAR complex. The difference between the two measurements is due to the lead concentration.
SAMPLE HANDLING & PRESERVATION:	Analyze sample as soon as possible. If sample must be stored, acidify with nitric acid to a pH of below 2.
INTERFERENCES:	Calcium greater than 100 ppm (250 ppm $CaCO_3$) will interfere. Low concentrations of cerium, iron, manganese, magnesium, sulfur, tin, and EDTA will also interfere.

PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **54 Lead**).
6. Scroll to **54 Lead**.
7. Rinse a tube (0290) with sample water. Fill to 10 mL with sample.
8. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove the tube from Spectrophotometer. Empty the tube. Use the Syringe (0807) to add 5mL of sample to the tube.
10. Add 5 mL *Ammonium Chloride Buffer (4032) to fill the tube to the 10 mL line. Swirl to mix.
11. Add 3 drops *Sodium Cyanide, 10% (6565). Swirl to mix.
12. Use the 0.5 mL pipet (0353) to add 0.5 mL PAR Indicator (4033). Swirl to mix.
13. Use the 0.5 mL pipet (0353) to add 0.5 mL Stabilizing Reagent (4022). Cap and mix.
14. Insert tube into chamber. Close lid. Press **ENTER** to scan sample. Record result in ppm as Reading A.
15. Remove tube from Spectrophotometer. Add 3 drops *DDC Reagent (4034). Cap and mix.
16. Insert tube into chamber. Close lid. Press **ENTER** to scan sample. Record result in ppm as Reading B.
17. ppm Lead = Reading A–Reading B
18. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTE: For best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents is obtained.

MANGANESE, LOW RANGE

PAN METHOD • CODE 3658-01-SC

QUANTITY	CONTENTS	CODE
2 x 60 mL	*Hardness Buffer Reagent	*4255-H
30 mL	*Manganese Indicator Reagent	*3956-G
15 mL	*Sodium Cyanide, 10%	*6565-E
1	Pipet, 0.5 mL, plastic	0369
1	Pipet, 1.0 mL, plastic	0354

***WARNING:** Reagents marked with an * are considered to be potential health hazards. To view or print a Material Safety Data Sheet (MSDS) for these reagents go to www.lamotte.com. To obtain a printed copy, contact LaMotte by e-mail, phone or fax.

Manganese is present in ground water in the divalent state due to the lack of oxygen. In surface waters manganese may be in various oxidation states as soluble complexes or as suspended compounds. Manganese is rarely present in excess of 1 mg/L. It may cause an objectionable taste or cause staining problems in laundry, but manganese levels normally encountered in water seldom produce any health hazard.

Manganese is removed from water by various means including chemical precipitation, pH adjustment, aeration, superchlorination and the use of ion exchange resins.

APPLICATION:	Drinking and surface waters; domestic and industrial wastewaters.
RANGE:	0.00–0.70 ppm Manganese
MDL:	0.02 ppm
METHOD:	PAN (1–(2–Pyridylazo)–2–Naphthol) forms a red complex with Manganese (Mn^{2+}) at a pH of 10 to 11.
SAMPLE HANDLING & PRESERVATION:	Manganese may oxidize readily in neutral water and precipitate from solution. It may adhere to or be absorbed by container walls, especially glass. Acidified sample can be stored in plastic.
INTERFERENCES:	None. Test is quite specific.

PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **55 Manganese L**).
6. Scroll to **55 Manganese L**.
7. Rinse a tube (0290) with sample water. Fill to the 10 mL line with sample.
8. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove tube from Spectrophotometer. Use the 1.0 mL pipet (0354) to add 2.0 mL (two measures) of *Hardness Buffer Reagent (4255). Swirl to mix.
10. Add 2 drops of *Sodium Cyanide, 10% (6565). Cap and mix.
11. Use the 0.5 mL pipet (0369) to add 0.5 mL of *Manganese Indicator Reagent (3956). Cap and mix.
12. Immediately insert tube into chamber. Close lid. Press **ENTER** to scan sample. Record result.
13. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTE: For best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents is obtained.

MANGANESE, HIGH RANGE

PERIODATE METHOD • CODE 3669-SC

QUANTITY	CONTENTS	CODE
10 g	Manganese Buffer Reagent	6310-D
15 g	*Manganese Periodate Reagent	*6311-E
1	Spoon, 0.1 g, plastic	0699
1	Spoon, 0.15 g, plastic	0727

***WARNING:** Reagents marked with an * are considered to be potential health hazards. To view or print a Material Safety Data Sheet (MSDS) for these reagents go to www.lamotte.com. To obtain a printed copy, contact LaMotte by e-mail, phone or fax.

Manganese is present in ground water in the divalent state due to the lack of oxygen. In surface waters, manganese may be in various oxidation states as soluble complexes or as suspended compounds. Manganese is rarely present in excess of 1 mg/L. It may impart an objectionable taste or cause staining problems in laundry, but manganese levels normally encountered in water seldom produce any health hazards. Manganese is removed from water by various means, including chemical precipitation, pH adjustment, aeration, superchlorination and the use of ion exchange resins.

APPLICATION:	Drinking and surface waters; domestic and industrial wastewaters.
RANGE:	0.0–15.0 ppm Manganese
MDL:	0.3 ppm
METHOD:	Periodate oxidizes soluble manganous compounds into permanganate.
SAMPLE HANDLING & PRESERVATION:	Manganese may oxidize readily in a neutral water and precipitate from solution. It may adhere to or be absorbed by container walls, especially glass. Acidified samples can be stored in plastic.
INTERFERENCES:	Reducing substances capable of reacting with periodate or permanganate must be removed or destroyed before the periodate oxidation is attempted.

PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **56 Manganese H**).
6. Scroll to **56 Manganese H**.
7. Rinse a tube (0290) with sample water. Fill to the 10 mL line with sample.
8. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove tube from Spectrophotometer. Use the 0.1 g spoon (0699) to add two measures of Manganese Buffer Reagent (6310). Cap and mix until powder dissolves.
10. Use the 0.15 g spoon (0727) to add one measure of *Manganese Periodate Reagent (6311). Cap and shake for one minute. An undissolved portion of the reagent may remain in the bottom of the tube without adversely affecting the test results. Wait two minutes for maximum color development. Solution will turn pink if manganese is present.
11. At the end of the two minute waiting period, mix. Insert tube into chamber. Close lid. Press **ENTER** to scan sample. Record result.
12. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

MOLYBDENUM

THIOGLYCOLATE METHOD • CODE 3699-03-SC

QUANTITY	CONTENTS	CODE
2 x 30 mL	*Mo Buffer	*3997-G
2 x 30 mL	*Molybdenum Oxidizing Reagent	*6485-G
2.5g	*Molybdenum Indicator Powder	*6486-S
1	Spoon, 0.05g, plastic	0696
2	Pipets, 1.0 mL, plastic w/cap	0372

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Emergency information for all LaMotte reagents is available from Chem-Tel: (US, 1-800-255-3924) (International, call collect, 813-248-0585)

Molybdenum occurs naturally in the earth's crust as molybdenite and wolfenite, and is an important element in many biochemical reactions, including nitrogen fixation. In industrial processes, such as the operation of boilers and cooling towers, molybdenum, in the form of sodium molybdate, is used as a corrosion inhibitor.

APPLICATION:	Boiler and cooling waters.
RANGE:	0.0–15.0 ppm Molybdenum
MDL:	0.2 ppm
METHOD:	Calcium thioglycolate reacts with molybdenum to give a yellow color with an intensity proportional to the amount of molybdenum present.
SAMPLE HANDLING & PRESERVATION:	Molybdenum samples may be stored in either plastic or glass containers.
INTERFERENCES:	Nickel levels less than 50 ppm do not interfere; aluminum levels less than 10 ppm do not interfere; chromate at higher concentrations interferes due to the intense yellow color. Ferrous iron levels below 50 ppm do not interfere, but low levels of ferric iron will cause a large blank. Highly buffered samples may exceed the capacity of the system possibly producing inaccurate results. Samples with high levels of nitrite will eventually develop a pale orange color. Scan the sample immediately to avoid this interference.

PROCEDURE

Use universal sample holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **61 MOLYBDENUM-HR**).
6. Scroll to **61 MOLYBDENUM-HR**.
7. Fill clean tube (0290) to 10 mL line with sample water.
8. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove tube from Spectrophotometer. Use a 1.0 mL pipet (0372) to add 1.0 mL of *Mo Buffer (3997). Cap and mix.
10. Use a second 1.0 mL pipet (0372) to add 1.0 mL of *Molybdenum Oxidizing Reagent (6485). Cap and mix.
11. Use 0.05 g spoon (0696) to add one measure of Molybdenum Indicator Powder (6486). Cap and mix until powder dissolves. Solution will turn yellow if molybdenum is present.
12. Insert tube into chamber. Close lid. Press **ENTER** to scan sample. Record result.
13. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NICKEL

DIMETHYLGLYOXIME METHOD • CODE 3663-01-SC

QUANTITY	CONTENTS	CODE
60 mL	*Hydrochloric Acid, 2.5N	*6251PS-H
30 g	*Ammonium Persulfate Reagent	*6566-G
30 mL	*Silver Nitrate Solution, 0.0141N	*6346WT-G
250 mL	Sodium Citrate, 10%	6253-K
60 mL	*Dimethylglyoxime, 1%	*6254-H
60 mL	*Ammonium Hydroxide, Conc.	*6537-H
3	Pipets, 1.0 mL, plastic	0354
1	Spoon, 0.1 g, plastic	0699
1	Test tube, 5-10-12.9-15-20-25, glass, w/cap	0608
1	Graduated Cylinder, 10 mL, glass	0416

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Nickel is not usually found in natural waters except as a result of contamination from industrial wastewaters as a corrosion product of stainless steel and nickel alloys. Nickel may also enter surface waters from plating bath process water.

APPLICATION:	Drinking and surface waters; domestic and industrial wastewaters.
RANGE:	0.00–8.00 ppm Nickel
MDL:	0.06 ppm
METHOD:	Nickel under basic conditions forms a colored complex with dimethylglyoxime in proportion to the concentration of nickel.
SAMPLE HANDLING & PRESERVATION:	Samples may be collected in either plastic or glass containers and preserved by adding 5 mL of concentrated nitric acid per liter.
INTERFERENCES:	Organic matter interferes. Cobalt, iron, copper, manganese and chromium do not interfere if each of the concentrations is below 15 ppm.

PROCEDURE

Use universal sample holder.

1. Use the 10 mL graduated cylinder (0416) to measure 10 mL of sample water. Pour into glass test tube (0608).
2. Use the 1 mL pipet (0354) to add 1 mL of *Hydrochloric Acid, 2.5N (6251).
3. Use the 0.1 g spoon (0699) to add 2 measures of *Ammonium Persulfate Reagent (6566). Add two drops of *Silver Nitrate Solution, 0.0141N (6346WT). Mix until the powder has dissolved. The solution will be slightly cloudy at this point.
4. Use 10 mL graduated cylinder (0416) to add 5 mL of Sodium Citrate, 10% (6253).
5. Use a second 1 mL pipet (0354) to add 1 mL of *Ammonium Hydroxide, Conc. (6537). Mix, then dilute to 25 mL with deionized water.
6. Use a third 1 mL pipet (0354) to add 1 mL of *Dimethylglyoxime, 1% (6254). Mix. Wait 20 minutes for color development.
7. At end of 20 minute waiting period fill a clean tube (0290) to the 10 mL line with the developed test sample.
8. Fill a second clean tube (0290) to 10 mL line with deionized water or untreated sample water. This is the blank.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **63 Nickel**).
6. Scroll to **63 Nickel**.
7. Insert the blank into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
8. Insert test sample into chamber. Close lid. Press **ENTER** to scan sample. Record result.
9. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NITRATE

ZINC REDUCTION TESTAB METHOD • CODE 3689-SC

QUANTITY	CONTENTS	CODE
50	*Nitrate IG Tablets	*3881A-H
1	Tablet Crusher	0175

***WARNING:** Reagents marked with an * are considered to be potential health hazards. To read complete safety information, go to page 3 in the User Manual.

Nitrogen is essential for plant growth, but excessive amounts in water supplies can result in nutrient pollution. Nitrates, in conjunction with phosphate, stimulate the growth of algae creating water quality problems. Nitrogen compounds may enter water as nitrates or be converted to nitrates from agricultural fertilizers, sewage, industrial and packing house wastes, drainage from livestock feeding areas and manure. Nitrates in large amounts in drinking water can cause “blue baby syndrome” (methemoglobenemia) in infants in less than 6 months of age and other health problems. US Public Health Service Drinking Water Standards state that 44 ppm nitrate should not be exceeded. To the sanitary and industrial engineer, concentrations of less than 4 ppm are acceptable.

APPLICATION:	Drinking, surface, and saline waters; domestic and industrial waters.
RANGE:	0–60 ppm Nitrate
MDL:	2.5 ppm
METHOD:	Zinc is used to reduce nitrate to nitrite. The nitrite that was originally present, plus the reduced nitrate, reacts with chromotropic acid to form a red color in proportion to the amount of nitrite in the sample.
SAMPLE HANDLING & PRESERVATION:	Analysis should be made as soon as possible. If analysis cannot be made within 24 hours, the sample should be refrigerated at 4°C. When samples must be stored for more than 24 hours, add 2 mL of concentrated sulfuric acid per liter of sample. For best results, the analysis for nitrate should be determined at temperatures between 20°C and 25°C.
INTERFERENCES:	Nitrite interferes at all concentrations. Strong oxidizing and reducing substances interfere. Low results might be obtained for samples that contain high concentrations of copper and iron.

PROCEDURE

Use universal sample holder

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **66 Nitrate-TesTab**).
6. Scroll to **66 Nitrate-TesTab**.
7. Rinse a tube (0290) with sample water. Fill to 10 mL with sample.
8. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove the tube from spectrophotometer.
10. Add one *Nitrate IG Tablet (3881A).
11. Use Tablet Crusher (0175) to crush tablet.
12. Cap tube.
13. Invert tube 60 times per minute for 2 minutes. (One inversion equals 180°).
14. Wait 5 minutes. Do NOT mix.
15. Insert tube into chamber. Close lid. Press **ENTER** to scan sample. Record result in ppm nitrate.
16. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTES: For best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples.

To convert nitrate (NO_3) results to nitrate-nitrogen (NO_3-N), divide by 4.4.

NITRATE-NITROGEN, LOW RANGE

CADMIUM REDUCTION METHOD • CODE 3649-SC

QUANTITY	CONTENTS	CODE
2 x 60 mL	*Mixed Acid Reagent	*V-6278-H
5 g	*Nitrate Reducing Reagent	*V-6279-C
1	Spoon, 0.1 g, plastic	0699
1	Dispenser Cap	0692

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Nitrogen is essential for plant growth, but the presence of excessive amounts in water supplies presents a major pollution problem. Nitrogen compounds may enter water as nitrates or be converted to nitrates from agricultural fertilizers, sewage, industrial and packing house wastes, drainage from livestock feeding areas, farm manures and legumes. Nitrates in large amounts can cause “blue babies” (methemoglobinemia) in infants less than six months of age. Nitrate concentration is an important factor to be considered in livestock products, where, in addition to causing methemoglobinemia, it is responsible for many other problems. Nitrates in conjunction with phosphate stimulate the growth of algae with all of the related difficulties associated with excessive algae growth.

U.S. Public Health Service Drinking Water Standards state that 10 ppm nitrate nitrogen should not be exceeded. To the sanitary and industrial engineer, concentrations of less than 1 ppm are acceptable.

APPLICATION:	Drinking, surface, and saline waters; domestic and industrial waters.
RANGE:	0.00–3.00 ppm Nitrate Nitrogen
MDL:	0.02 ppm
METHOD:	Powdered cadmium is used to reduce nitrate to nitrite. The nitrite that is originally present plus reduced nitrate is determined by diazotization of sulfanilamide and nitrite followed by coupling with N-(1 naphthyl)-ethylenediamine dihydrochloride to form a highly colored azo dye which is measured colorimetrically.
SAMPLE HANDLING & PRESERVATION:	Analysis should be made as soon as possible. If analysis cannot be made within 24 hours, the sample should be preserved by refrigeration at 4°C. When samples must be stored for more than 24 hours, they can be preserved by adding 2 mL of concentrated sulfuric acid per liter of sample. For best results, the analysis for nitrate should be determined at temperatures between 20°C and 25°C.
INTERFERENCES:	Nitrite interferes at all levels. Strong oxidizing and reducing substances interfere. Low results might be obtained for samples that contain high concentrations of iron and copper.

PROCEDURE

Use universal sample holder.

NOTE: Place Dispenser Cap (0692) on *Mixed Acid Reagent (V-6278). Save this cap for refill reagents.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **64 Nitrate-N LR**).
6. Scroll to **64 Nitrate-N LR**.
7. Rinse a clean tube (0290) with sample water. Fill to 10 mL line with sample.
8. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove tube from Spectrophotometer and pour off 5 mL into graduated cylinder or similar. Discard the remaining sample.
10. Pour the 5 mL sample from a graduated cylinder or similar into the tube. Use the graduated cylinder or similar to measure 5 mL of *Mixed Acid Reagent (V-6278) and add to tube. Cap and mix. Wait 2 minutes before proceeding to Step 9.
11. Use the 0.1 g spoon (0699) to add two measures of *Nitrate Reducing Reagent (V-6279). Cap.
12. Hold tube by index finger and thumb and mix by inverting approximately 50-60 times a minute for four minutes. Wait 10 minutes for maximum color development. NOTE: At end of waiting period an undissolved portion of Nitrate Reducing Reagent may remain in bottom of the tube without affecting results.
13. At the end of the 10 minute waiting period, mix. Insert tube into chamber. Close lid. Press **ENTER** to scan sample.. Record result.
14. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTES: For best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents is obtained.

To convert Nitrate Nitrogen (NO_3–N) results to ppm Nitrate (NO_3), multiply by 4.4.

NITRITE-NITROGEN, LOW RANGE

DIAZOTIZATION METHOD • CODE 3650-SC

QUANTITY	CONTENTS	CODE
2 x 60 mL	*Mixed Acid Reagent	*V-6278-H
5 g	*Color Developing Reagent	*V-6281-C
1	Spoon, 0.1 g, plastic	0699
1	Dispenser Cap	0692

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Nitrite represents an intermediate state in the nitrogen cycle, usually resulting from the bacterial decomposition of compounds containing organic nitrogen. Under aerobic conditions bacteria oxidize ammonia to nitrites; and under anaerobic conditions, bacteria reduce nitrates to nitrites. Nitrites are often used as preservatives when added to certain foods.

The nitrite concentration of drinking water rarely exceeds 0.1 ppm (mg/L).

APPLICATION:	Drinking, surface and saline waters; domestic and industrial wastes.
RANGE:	0.00–0.80 ppm Nitrite-Nitrogen
MDL:	0.02 ppm
METHOD:	The compound formed by diazotization of sulfanilamide and nitrite is coupled with N–(1–naphthyl)–ethylenediamine to produce a reddish-purple color, which is read colorimetrically.
SAMPLE HANDLING & PRESERVATION:	Samples should be analyzed as soon as possible. They may be stored for 24 to 48 hours at 4°C.
INTERFERENCES:	There are few known interfering substances at concentration less than 1000 times the nitrite-nitrogen concentration; however, the presence of strong oxidants or reductants may readily affect nitrite concentrations. High alkalinity (above 600 mg/L) will give low results due to a shift in pH.

PROCEDURE

Use universal sample holder.

NOTE: Place Dispenser Cap (0692) on *Mixed Acid Reagent (V-6278). Save this cap for refill reagents.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **67 Nitrite-N LR**).
6. Scroll to **67 Nitrite-N LR**.
7. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
8. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove tube from Spectrophotometer and pour off 5 mL into a graduated cylinder or similar. Discard the remaining sample.
10. Pour the 5 mL sample from the graduated cylinder into the colorimeter tube. Use graduated cylinder or similar to measure 5 mL of *Mixed Acid Reagent (V-6278) and add to tube. Cap and mix.
11. Use the 0.1 g spoon (0699) to add two measures of *Color Developing Reagent (V-6281). Cap and mix by gently inverting for 1 minute. Wait 5 minutes for maximum color development.
12. At the end of the 5 minute waiting period, mix. Insert tube into chamber. Close lid. Press **ENTER** to scan sample. Record result.
13. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTE: To convert nitrite-nitrogen (NO_2–N) results to ppm nitrite (NO_2), multiply results by 3.3.

NITROGEN, TOTAL

CHROMOTROPIC ACID WITH PERSULFATE DIGESTION METHOD • CODE 4026-02

QUANTITY	CONTENTS	CODE
25	*Total Nitrogen Hydroxide Reagent Tubes	*4040-G
10 g	*Digestion Reagent Powder	4036-D
60 mL	Deionized Water	*5115PS-H
5 g	*Total Nitrogen Reagent A Powder	*4041-C
60	*Total Nitrogen Reagent B Tablets	*4042A-I
25	*Total Nitrogen Acid Reagent Tubes	*4043-G
1	Spoon, 0.25 g, plastic	0695
1	Spoon, 0.15 g, plastic	0727
4	Pipets, 1.0 mL, plastic	0354
2	Funnels, plastic	0459

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Note: for greater accuracy, use laboratory grade pipets.

QUANTITY	CONTENTS	CODE
1	COD Adapter	5-0087
1	COD Reactor, 12 vial, 120V	5-0102
or 1	COD Reactor, 12 vial, 230V	5-0102-EX2

Optional Equipment:

QUANTITY	CONTENTS	CODE
1	Pipet, Measuring , 1.0 mL	2-2110
1	Pipet Bulb	2-2164
1	Wipes	2-2069
1	Test Tube Holder	2-2190

Nitrogen is essential for plant growth, but the presence of excessive amounts in water supplies presents a major pollution problem. Nitrogen compounds may enter water as nitrates or be converted to nitrates from agricultural fertilizers, sewage, industrial and packing house wastes, drainage from livestock feeding areas, farm manures and legumes. Nitrates in large amounts can cause “blue babies” (methemoglobinemia) in infants less than six months of age. Nitrate concentration is an important factor to be considered in livestock products, where, in addition to causing methemoglobinemia, it is responsible for many other problems. Nitrates in conjunction with phosphate stimulate the growth of algae with all of the related difficulties associated with excessive algae growth.

U.S. Public Health Service Drinking Water Standards state that 10 ppm nitrate nitrogen should not be exceeded. To the sanitary and industrial engineer, concentrations of less than 1 ppm are acceptable.

APPLICATION:	Drinking, surface, saline, domestic and industrial waters.
RANGE:	0–25 mg/L Total Nitrogen
MDL:	2 mg/L
METHOD:	All forms of nitrogen are converted to nitrate by an alkaline persulfate digestion. Interference from halogen oxides is eliminated by the addition of sodium metabisulfite. Nitrate in acid reacts with chromotropic acid to form a yellow color in proportion to the amount of nitrate in the treated sample.
SAMPLE HANDLING & PRESERVATION:	If the sample can not be analyzed immediately, the sample should be preserved by adjusting the pH to 2 or less with concentrated sulfuric acid and refrigerated at 4°C. Warm the sample to room temperature and neutralize with 5.0 N sodium hydroxide before analyzing.
INTERFERENCES:	Bromide (>60 ppm) and chloride (>1000 ppm) will have a positive interference.

PROCEDURE

Use universal sample holder

1. Preheat COD reactor to 105 ±2°C. Follow safety precautions.
2. Remove caps from two *Total Nitrogen Hydroxide Reagent Tubes (4040).
3. Use a 0.25 g spoon (0695) and a funnel (0459) to add one level measure of *Digestion Reagent Powder (4036) to each tube. Tap funnel to dispense powder completely.
4. Use a 1.0 mL pipet (0354) to add 2.0 mL of Deionized Water (5115PS), or organic-free water, to one tube. This is the blank.
5. Use another 1.0 mL pipet (0354) to add 2.0 mL of sample to the other tube. This is the sample.
6. Cap both tubes and shake vigorously for 30 seconds.
7. Place the tubes in the COD reactor for 30 minutes. Place a protective shiled around the reactor or conduct the test in a fume hood with the shield down.
8. After exactly 30 minutes, turn the reactor off. Carefully remove the tubes from the reactor and allow them to cool to room temperature.
9. At the end of the cooling period, turn spectrophotometer **ON**.
10. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
11. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
12. Press **ENTER** to select **Programmed Tests**.
13. Scroll to and press ENTER to select **All Tests** (or another sequence containing **62 Nitrogen T**).
14. Scroll to **62 Nitrogen T**.
15. Carefully remove caps from the digested tubes.
16. Use a 0.15 g spoon (0727) and a funnel (0459) to add one level measure of *Total Nitrogen Reagent A Powder (4041). Tap funnel to dispense powder completely. Cap the tubes and shake for 15 seconds.
17. Wait 3 minutes.
18. Remove the caps from the tubes. Add two *Total Nitrogen Reagent B Tablets (4042A) to each tube. Cap the tubes and shake for 45 seconds or until the tablet disintegrates.
19. Wait 2 minutes.
20. Remove the caps from the reacted tubes. Carefully remove the caps from two *Total Nitrogen Acid Reagent Tubes (4043). CAUTION: Tubes contain a strong acid.
21. Use another 1.0 mL pipet (0354) to add 2 mL of digested, treated blank to one

Total Nitrogen Acid Reagent Tube. This is the blank.

22. Use another 1.0 mL pipet (0354) to add 2 mL of digested, treated sample to the other Total Nitrogen Acid Reagent Tube. This is the sample.
23. Cap the tubes and invert 10 times to mix. CAUTION: The tubes will be hot. NOTE: Invert slowly and completely for accurate results. Hold tubes with caps up. Invert the tube and wait for the air bubble to flow to the bottom of the tube. Turn the tube upright and wait for the air bubble to return to the top of the tube. This is one inversion.
24. Wait 5 minutes.
25. Wipe the tubes with a damp towel to remove fingerprints and smudges. Wipe with a dry towel.
26. Insert the blank tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
27. Insert the sample tube into the chamber. Close lid. Press **ENTER** to scan sample. Record the result as Total Nitrogen in mg/L N.
28. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTE: For greater accuracy, use laboratory grade pipets.

OXYGEN SCAVENGERS

TEST FOR DEHA (DIETHYLHYDROXYLAMINE), CARBOHYDRAZIDE, ERYTHORBIC ACID, HYDROQUINONE, METHYLETHYLKETOXIME

IRON REDUCTION METHOD • CODE 4857

QUANTITY	CONTENTS	CODE
15 mL	*DEHA Reagent #1	*4791-E
15 mL	DEHA Reagent #2	4792-E
15 mL	*DEHA Reagent #3	*4793-E

***WARNING:** Reagents marked with an * are considered to be potential health hazards. To read complete safety information, go to page 3 in the User Manual.

Oxygen can lead to corrosion in many parts of a boiler. Oxygen scavengers are added to the water to eliminate oxygen and thus decrease the chance of corrosion. Diethylhydroxylamine (DEHA) is a volatile oxygen scavenger used in boilers. It can also passivate steel and has a low toxicity.

APPLICATION:	Boilers
RANGE:	0.000–0.700 ppm DEHA (Diethylhydroxylamine) 0.000–0.900 ppm Carbohydrazide 0.00–3.00 ppm Erythorbic Acid 0.00–1.80 ppm Hydroquinone 0.00–3.00 ppm Methylethylketoxime
MDL:	0.005 ppm DEHA 0.005 ppm Carbohydrazide 0.02 ppm Erythorbic Acid 0.01 ppm Hydroquanine 0.02 ppm Methylethylketoxime
METHOD:	Ferric iron is reduced to ferrous iron by oxygen scavengers in proportion to the concentration in the sample. The resulting ferrous iron reacts with an indicator to produce a purple color.
SAMPLE HANDLING & PRESERVATION:	Analyze samples immediately. Rinse sample containers and glassware with 1:1 hydrochloric acid to avoid iron contamination.
INTERFERENCES:	Other oxygen scavengers, such as DEHA, carbohydrazide, erythorbic acid, hydroquinone and methylethylketoxime will interfere. Stray light and substances which complex iron or reduce ferric iron will also interfere.

DEHA PROCEDURE

Use universal sample holder

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **38 DEHA**).
6. Scroll to **38 DEHA**.
7. Rinse a tube (0290) with sample water. Fill to 10 mL with sample.
8. Insert the vial/tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove the tube from spectrophotometer.
10. Add 3 drops of *DEHA Reagent #1 (4791). Swirl to mix.
11. Add 3 drops of DEHA Reagent #2 (4792). Swirl to mix.
12. Add 3 drops of *DEHA Reagent #3 (4793). Invert 3 times to mix.
13. Insert the tube into chamber. Close lid.
14. Wait 15 minutes. Do not open the lid during the waiting time. The reaction is photosensitive.
15. Remove tube from chamber. Invert 2 times to mix.
16. Immediately insert tube into chamber. Close lid. Press **ENTER** to scan sample. Read within 30 seconds. Record result in ppm DEHA.
17. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTE: For best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents is obtained.

CARBOHYDRAZIDE PROCEDURE

Use universal sample holder

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **14 Carbohydrazide**).
6. Scroll to **14 Carbohydrazide**.
7. Rinse a tube (0290) with sample water. Fill to 10 mL with sample.
8. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove the tube from spectrophotometer.
10. Add 3 drops of *DEHA Reagent #1 (4791). Swirl to mix.
11. Add 3 drops of DEHA Reagent #2 (4792). Swirl to mix.
12. Add 3 drops of *DEHA Reagent #3 (4793). Invert 3 times to mix.
13. Insert the tube into chamber. Close lid.
14. Wait 15 minutes. Do not open the lid during the waiting time. The reaction is photosensitive.
15. Remove tube from chamber. Invert 2 times to mix.
16. Immediately insert tube into chamber. Close lid. Press **ENTER** to scan sample. Read within 30 seconds. Record result in ppm carbohydrazide.
17. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTE: For best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents is obtained.

ERYTHORBIC ACID PROCEDURE

Use universal sample holder

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **40 Erythorbic Acid**).
6. Scroll to **40 Erythorbic Acid**.
7. Rinse a tube (0290) with sample water. Fill to 10 mL with sample.
8. Insert the vial/tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove the tube from spectrophotometer.
10. Add 3 drops of *DEHA Reagent #1 (4791). Swirl to mix.
11. Add 3 drops of DEHA Reagent #2 (4792). Swirl to mix.
12. Add 3 drops of *DEHA Reagent #3 (4793). Invert 3 times to mix.
13. Insert the tube into chamber. Close lid.
14. Wait 15 minutes. Do not open the lid during the waiting time. The reaction is photosensitive.
15. Remove tube from chamber. Invert 2 times to mix.
16. Immediately insert tube into chamber. Close lid. Press **ENTER** to scan sample. Read within 30 seconds. Record result in ppm erythorbic acid.
17. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTE: For best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents is obtained.

HYDROQUINONE PROCEDURE

Use universal sample holder

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **49 Hydroquinone**).
6. Scroll to **49 Hydroquinone**.
7. Rinse a tube (0290) with sample water. Fill to 10 mL with sample.
8. Insert the vial/tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove the tube from spectrophotometer.
10. Add 3 drops of *DEHA Reagent #1 (4791). Swirl to mix.
11. Add 3 drops of DEHA Reagent #2 (4792). Swirl to mix.
12. Add 3 drops of *DEHA Reagent #3 (4793). Invert 3 times to mix.
13. Insert the tube into chamber. Close lid.
14. Wait 15 minutes. Do not open the lid during the waiting time. The reaction is photosensitive.
15. Remove tube from chamber. Invert 2 times to mix.
16. Immediately insert tube into chamber. Close lid. Press **Enter** to scan sample. Read within 30 seconds. Record result in ppm hydroquinone.
17. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTE: For best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents is obtained.

METHYLETHYLKETOXIME PROCEDURE

Use universal sample holder

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **58 M-e-ketoxime**).
6. Scroll to **58 M-e-ketoxime**.
7. Rinse a tube (0290) with sample water. Fill to 10 mL with sample.
8. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove the tube from spectrophotometer.
10. Add 3 drops of *DEHA Reagent #1 (4791). Swirl to mix.
11. Add 3 drops of DEHA Reagent #2 (4792). Swirl to mix.
12. Add 3 drops of *DEHA Reagent #3 (4793). Invert 3 times to mix.
13. Insert the tube into chamber. Close lid.
14. Wait 15 minutes. Do not open the lid during the waiting time. The reaction is photosensitive.
15. Remove tube from chamber. Invert 2 times to mix.
16. Immediately insert tube into chamber. Close lid. Press **Enter** to scan sample. Read within 30 seconds. Record result in ppm methylethylketoxime.
17. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTE: For best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents is obtained.

OZONE

INDIGO METHOD • CODE 365I-SC

QUANTITY	CONTENTS	CODE
15 mL	Chlorine Inhibitor	3990-E
250 mL	Ozone Buffer	3991-K
30 mL	Indigo Blue Stock Solution	3989-G
1	Sampling Apparatus	0681
1	Pipet, transfer, 1.0 mL	2-2170
1	Pipet, transfer, 5 mL	0329
1	Pump, 10 mL	30527
1	Bottle, HR Reagent, amber glass	3988-MT-G
1	Graduated Cylinder, 50 mL, glass	0418

***WARNING:** Reagents marked with an * are considered to be potential health hazards. To view or print a Safety Data Sheet (SDS) for these reagents go to www.lamotte.com. Search for the four digit reagent code number listed on the reagent label, in the contents list or in the test procedures. Omit any letter that follows or precedes the four digit code number. For example, if the code is 4450WT-H, search 4450. To obtain a printed copy, contact LaMotte by email, phone or fax.

Emergency information for all LaMotte reagents is available from Chem-Tel: (US, 1-800-255-3924) (International, call collect, 813-248-0585)

Ozone is sometimes used in place of, or in conjunction with, chlorine or other halogens for disinfection of pool, spa, or drinking waters. Recently, large aquatic facilities have begun using ozone as a disinfectant in many artificial habitats.

APPLICATION:	Drinking water; swimming pool water.
RANGE:	0.00–0.40 ppm Ozone, Low Range 0.00–1.50 ppm Ozone, High Range
MDL:	0.02 ppm, Low Range 0.05 ppm, High Range
METHOD:	Ozone rapidly and stoichiometrically decolorizes Indigo Trisulfonate under acidic conditions.
SAMPLE HANDLING & PRESERVATION:	Ozone is extremely unstable in aqueous solutions. Test must be performed immediately and the sample must not be agitated.
INTERFERENCES:	Manganese at any level interferes.

PROCEDURE–LOW RANGE

Use universal sample holder.

A. PREPARATION OF HR REAGENT

NOTE: The quantity of Indigo Blue Stock Solution (3989) supplied will prepare one batch of HR Reagent for the High Range Ozone procedure or five batches of HR Reagent for the Low Range Ozone procedure.

1. Use the 50 mL graduated cylinder to carefully add 45 mL of Ozone Buffer (3991) to amber glass bottle marked HR Reagent (6988-MT-G).
2. Use the 5 mL transfer pipet (0329) and pump (30527) to add 5 mL of Indigo Blue Stock Solution (3989) to the amber glass bottle. Cap and mix.

B. DETERMINATION OF OZONE

3. Use the 1.0 mL transfer pipet (2-2170) and pump (30527) to add 1.0 mL of HR Reagent (3988) to each of 2 clean tubes (0290).
4. If chlorine is present add 3 drops Chlorine Inhibitor (3990) to each tube. Cap tubes.
5. Take one of the prepared tubes (0290) and sampling apparatus (0681) to sampling site.
6. Lower end of tubing of sampling apparatus to desired depth. Slowly withdraw and depress plunger several times to purge syringe and tubing. Slowly withdraw plunger to fill purged syringe.
7. Remove plastic tubing from syringe. Remove cap from the prepared tube. Place tip of syringe against inside of the prepared tube. Slowly depress plunger and fill to the 10 mL line and cap. This is the Sample Tube.
   NOTE: Do not shake or invert the sample.
8. Fill the second prepared tube (0290) to the 10 mL line with ozone free water. This is the Reagent Blank.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **71 Ozone-LR**).
6. Scroll to **71 Ozone-LR**.
7. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.

8. Insert reacted Sample Tube into chamber. Close lid. Press **Enter** to scan sample. Record result.
9. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTE: HR Reagent must be made fresh each week. If reagent is refrigerated, it may be kept up to 3 weeks.

PROCEDURE–HIGH RANGE

Use universal sample holder.

A. PREPARATION OF HR REAGENT

NOTE: The quantity of Indigo Blue Stock Solution (3989) supplied will prepare one batch of HR Reagent for the High Range Ozone procedure or five batches of HR Reagent for the Low Range Ozone procedure.

1. Use the 50 mL graduated cylinder to carefully add 35 mL of Ozone Buffer (3991) to amber glass bottle marked HR Reagent (6988-MT-G).
2. Use the 50 mL graduated cylinder to carefully add 15 mL of Indigo Blue Stock Solution (3989) to the amber glass bottle. Cap and mix.

B. DETERMINATION OF OZONE

3. Use the 1.0 mL transfer pipet (2-2170) and pump (30527) to add 1.0 mL of HR Reagent (3988) to each of 2 clean tubes (0290).
4. If chlorine is present add 3 drops Chlorine Inhibitor (3990) to each tube. Cap tubes.
5. Take one of the prepared tubes (0290) and sampling apparatus (0681) to sampling site.
6. Lower end of tubing of sampling apparatus to desired depth. Slowly withdraw and depress plunger several times to purge syringe and tubing. Slowly withdraw plunger to fill purged syringe.
7. Remove plastic tubing from syringe. Remove cap from the prepared tube. Place tip of syringe against inside of the prepared tube. Slowly depress plunger and fill to the 10 mL line and cap. This is the Sample Tube.
   NOTE: DO NOT SHAKE OR INVERT THE SAMPLE.
8. Fill the second prepared tube (0290) to the 10 mL line with ozone free water. This is the Reagent Blank.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.

4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **72 Ozone-HR**).
6. Scroll to **72 Ozone-HR**.
7. Insert the Reagent Blank tube into chamber. Close lid. Press **ENTER** to scan blank.
8. Insert reacted Sample Tube into chamber. Close lid. Press **Enter** to scan sample. Record result.
9. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTE: HR Reagent must be made fresh each week. If reagent is refrigerated, it may be kept up to 3 weeks.

pH

COLORIMETRIC METHOD • CODE 3700-01-SC

QUANTITY	CONTENTS	CODE
60 mL	Chlorphenol Red Indicator	V-2209-H
60 mL	Phenol Red Indicator	V-2304-H
60 mL	Thymol Blue Indicator	V-2213-H
3	Pipets, 0.5 mL, plastic w/caps	0369

The term pH (always written with a lower case p and an upper case H) is correctly defined as the negative logarithm of the hydrogen ion concentration. More simply, the term pH can be considered to be an index of the amount of hydrogen ion present in a substance, or is a measure of the acidity of the substance. This index is important as it can be used to quickly identify the acid, neutral or alkaline (basic) nature of materials. Acidic substances have a pH less than 7.0, neutral substances have a pH equal to 7.0 and alkaline substances have a pH greater than 7.0.

Most natural waters have pH values from pH 5.0 to pH 8.5. Acidic, freshly fallen rain water may have a pH value of pH 5.5 to pH 6.0. When it reacts with soils and minerals containing weakly alkaline materials, the hydroxyl ion concentration will increase and the hydrogen ion concentration will decrease. Then the water may become slightly alkaline with a pH of 8.0 to 8.5. Natural sea water has a pH value of 8.1, and changes from this value indicate that water from an inland source is entering the body of sea water.

Waters more acidic than pH 5.0 and more alkaline than pH 8.5 to 9.0 should be viewed with suspicion. Mine drainage and acidic industrial wastes are the principal factors in increasing the acidity of water, and alkaline industrial wastes are the cause of high pH values.

Because pH measurements can be made so simply, and because they can tell so much about the past and future reactions of water, they are routinely made in water quality studies. Sudden changes in pH values serve as warning signals that water quality may be adversely affected through the introduction of contaminants.

APPLICATION: Drinking, surface, and saline waters; swimming pool water; domestic and industrial wastes.

RANGE: The various pH indicators exhibit a specific color change over a narrow pH range. The color changes are measured colorimetrically.

METHOD: Sample should be analyzed immediately after collection.

SAMPLE HANDLING & PRESERVATION: Sample color and turbidity interfere with the colorimetric pH measurement. Color interference may be removed by standardizing the instrument with the original water sample. Two drops of 0.1N sodium thiosulfate per 100 mL of sample will eliminate chlorine interference.

INTERFERENCES:

pH Indicator	pH	SMART Spectro Test Range
Chlorphenol Red	5.0–7.0	74 pH CPR
Phenol Red	6.6–8.4	75 pH PR
Thymol Blue	8.0–9.5	76 pH TB

PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing the appropriate pH test name).
6. Scroll to and select the appropriate pH test name from menu.
7. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
8. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove tube from Spectrophotometer. Use the 0.5 mL pipet (0369) to add exactly 0.5 mL of the pH indicator for the chosen range. Cap and mix.
10. Insert tube into chamber. Close lid. Press **Enter** to scan sample. Record result.
11. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

PHENOL

AMINOANTIPYRINE METHOD • CODE 3652-01-SC

QUANTITY	CONTENTS	CODE
5 g	Aminoantipyrine Reagent	7825-C
30 mL	*Ammonium Hydroxide Solution	*7826-G
2 x 60 mL	Potassium Ferricyanide Solution	7827-H
1	Spoon, 0.1 g, plastic	0699
1	Pipet, plain, plastic	0352
1	Pipet, 1.0 mL, plastic	0354

***WARNING:** Reagents marked with an * are considered to be potential health hazards. To view or print a Safety Data Sheet (SDS) for these reagents go to www.lamotte.com. Search for the four digit reagent code number listed on the reagent label, in the contents list or in the test procedures. Omit any letter that follows or precedes the four digit code number. For example, if the code is 4450WT-H, search 4450. To obtain a printed copy, contact LaMotte by email, phone or fax.

Emergency information for all LaMotte reagents is available from Chem-Tel: (US, 1-800-255-3924) (International, call collect, 813-248-0585)

Phenols may occur in domestic and industrial waste waters and in drinking water supplies. Chlorination of waters containing phenols may produce odiferous and objectionable tasting chlorophenols. Natural waters seldom contain more than 1 mg/L phenol.

Phenols may be removed from water by various treatment processes including chlorination and activated carbon absorption.

APPLICATION:	Drinking and surface waters; domestic and industrial wastewaters.
RANGE:	0.00–6.00 ppm Phenol
MDL:	0.05 ppm
METHOD:	4-Aminoantipyrine is oxidized in the presence of all ortho- and meta- substituted phenols to form a colored complex in proportion to the amount of phenol present.
SAMPLE HANDLING & PRESERVATION:	Phenols are subject to biological and chemical oxidation. Samples should be analyzed within 4 hours after collection. If sample cannot be analyzed within 4 hours it can be preserved by acidification with phosphoric acid to pH 4.0.
INTERFERENCES:	Oxidizing and reducing chemicals, alkaline pH values, and phenol decomposing bacteria may interfere with the test.

PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **77 Phenol**).
6. Scroll to **77 Phenol**.
7. Rinse a clean tube (0290) with sample water. Fill to the 10 line with sample.
8. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove tube from Spectrophotometer. Use the 0.1 g spoon (0699) to add one measure of Aminoantipyrine Reagent (7825-C). Cap and mix until powder dissolves.
10. Use the plain pipet (0352) to add 4 drops of *Ammonium Hydroxide Solution (7826). Cap and mix.
11. Use the 1 mL pipet (0354) to add 2 mL of Potassium Ferricyanide Solution (7827). Cap and mix. Solution will almost immediately develop a reddish hue if phenols are present.
12. Insert tube into chamber. Close lid. Press **Enter** to scan sample. Record result.
13. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTE: For best possible results, a reagent blank should be determined to account for any contribution to the test results by the reagent system. To determine the reagent blank, follow the test procedure to scan a distilled or deionized water blank. Then follow the procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents is obtained.

PHOSPHATE–LOW RANGE

ASCORBIC ACID REDUCTION METHOD
CODE 3653-SC

QUANTITY	CONTENTS	CODE
60 mL	*Phosphate Acid Reagent	*V-6282-H
5 g	Phosphate Reducing Reagent	V-6283-C
1	Pipet, 1 mL, plastic	0354
1	Spoon, 0.1 g, plastic	0699

***WARNING:** Reagents marked with an * are considered to be potential health hazards. To view or print a Safety Data Sheet (SDS) for these reagents go to www.lamotte.com. Search for the four digit reagent code number listed on the reagent label, in the contents list or in the test procedures. Omit any letter that follows or precedes the four digit code number. For example, if the code is 4450WT-H, search 4450. To obtain a printed copy, contact LaMotte by email, phone or fax.

Emergency information for all LaMotte reagents is available from Chem-Tel: (US, 1-800-255-3924) (International, call collect, 813-248-0585)

Phosphorus is an important nutrient for aquatic plants. The amount found in water is generally not more than 0.1 ppm unless the water has become polluted from waste water sources or excessive drainage from agricultural areas. When phosphorus is present in excess of the concentrations required for normal aquatic plant growth, a process called eutrophication takes place. This creates a favorable environment for the increase in algae and weeds. When algae cells die, oxygen is used in the decomposition and fish kills often result. Rapid decomposition of dense algae scums with associated organisms give rise to foul odors and hydrogen sulfide gas.

APPLICATION:	Drinking, surface, and saline waters; domestic and industrial wastes (Method based on reactions that are specific for orthophosphate).
RANGE:	0.00–3.00 ppm Orthophosphate
MDL:	0.04 ppm
METHOD:	Ammonium molybdate and antimony potassium tartrate react in a filtered acid medium with dilute solution of PO_4^{-3} to form an antimony-phosphomolybdate complex. This complex is reduced to an intense blue colored complex by ascorbic acid. The color is proportional to the amount of phosphate present. (Only orthophosphate forms a blue color in this test.) Polyphosphates (and some organic phosphorus compounds) may be converted to the orthophosphate form by sulfuric acid digestion. Organic phosphorus compounds may be converted to the orthophosphate form by persulfate digestion.
SAMPLE HANDLING & PRESERVATION:	If benthic deposits are present in the area being sampled, great care should be taken not to include these deposits. If the analysis cannot be performed the same day of collection, the sample should be preserved by the addition of 2 mL of concentrated sulfuric acid or 40 mg mercuric chloride per liter and refrigerated at 4°C.
INTERFERENCES:	a. No interference from copper, iron, or silicate at concentrations many times the concentration of sea water. However, high iron concentrations can cause precipitation and subsequent loss of phosphorus. b. Salt error for samples ranging from 5% to 20% salt content was found to be less than 1%. c. Mercuric chloride, $HgCl_2$, when used as the preservative, interferes when the chloride levels are low (less than 50 mg/L). This interference is overcome by spiking samples with a minimum of 50 mg/L of sodium chloride.

PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **78 Phosphate L**).
6. Scroll to **78 Phosphate L**.
7. Rinse a clean tube (0290) with sample water. Fill to the 10 line with sample.
8. Insert the vial/tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove tube from Spectrophotometer. Use 1.0 mL pipet (0354) to add 1.0 mL of *Phosphate Acid Reagent (V-6282). Cap and mix.
10. Use the 0.1 g spoon (0699) to add one measure of Phosphate Reducing Reagent (V-6283). Cap and shake until powder dissolves. Wait 5 minutes for full color development. Solution will turn blue if phosphates are present.
11. At end of 5 minute waiting period, mix. Insert tube into chamber. Close lid. Press **Enter** to scan sample. Record result.
12. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

PHOSPHATE–HIGH RANGE

VANADOMOLYBDOPHOSPHORIC ACID METHOD
CODE 3655-SC

QUANTITY	CONTENTS	CODE
4 x 30 mL	*VM Phosphate Reagent	*4410-G
1	Pipet, 1.0 mL, plastic	0354

***WARNING:** Reagents marked with an * are considered to be potential health hazards. To view or print a Safety Data Sheet (SDS) for these reagents go to www.lamotte.com. Search for the four digit reagent code number listed on the reagent label, in the contents list or in the test procedures. Omit any letter that follows or precedes the four digit code number. For example, if the code is 4450WT-H, search 4450. To obtain a printed copy, contact LaMotte by email, phone or fax.

Emergency information for all LaMotte reagents is available from Chem-Tel: (US, 1-800-255-3924) (International, call collect, 813-248-0585)

Phosphate treatments in boiler and cooling water and other industrial water systems are run at levels up to 100 ppm orthophosphate. These high levels permit the use of a simpler, high range test.

APPLICATION:	Boiler, cooling, and industrial waters.
RANGE:	0.0–70.0 ppm Phosphate
MDL:	1.0 ppm
METHOD:	Orthophosphate reacts in acid conditions with ammonium vanadomolybdate to form vanadomolybdophosphoric acid. This yellow color is proportional to the concentration of orthophosphate and is read colorimetrically.
SAMPLE HANDLING & PRESERVATION:	If the analysis cannot be performed the same day of collection, the sample should be preserved by the addition of 2 mL of concentrated sulfuric acid or 40 mg mercuric chloride per liter and refrigerated at 4°C.
INTERFERENCES:	Silica interferes only if the sample is heated. Arsenate, fluoride, thorium, bismuth, sulfide, thiosulfate, and thiocyanate cause negative interference.

PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **79 Phosphate H**).
6. Scroll to **79 Phosphate H**.
7. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
8. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove tube from Spectrophotometer. Use the 1.0 mL pipet (0354) to add 2.0 mL of *VM Phosphate Reagent (4410). Cap and mix. Wait 5 minutes for full color development.
10. After 5 minute waiting period, mix. Insert tube into chamber. Close lid. Press **Enter** to scan sample. Record result.
11. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

PHOSPHORUS-TOTAL, LOW RANGE

ASCORBIC ACID REDUCTION WITH PERSULFATE DIGESTION METHOD • CODE 4024-01

QUANTITY	CONTENTS	CODE
25	*Total Phosphorus Acid Reagent Tubes	*4035-G
5 g	*Digestion Reagent Powder	*4036-C
2 X 30 mL	*Total Phosphorus LR Hydroxide Reagent	*4038-G
2 X 30 mL	*Phosphate Acid Reagent	*V-6282-G
5 g	Phosphate Reducing Reagent	V-6283-C
1	Spoon, 0.15 g, plastic	0727
3	Pipets, 1.0 mL, plastic	0354
1	Spoon, 0.1 g, plastic	0699
2	Funnels, plastic	0459

***WARNING:** Reagents marked with an * are considered to be potential health hazards. To view or print a Safety Data Sheet (SDS) for these reagents go to www.lamotte.com. Search for the four digit reagent code number listed on the reagent label, in the contents list or in the test procedures. Omit any letter that follows or precedes the four digit code number. For example, if the code is 4450WT-H, search 4450. To obtain a printed copy, contact LaMotte by email, phone or fax.

Emergency information for all LaMotte reagents is available from Chem-Tel: (US, 1-800-255-3924) (International, call collect, 813-248-0585)

Note: for greater accuracy, use laboratory grade pipets.

QUANTITY	CONTENTS	CODE
1	COD Adapter	5-0087
1	COD Reactor, 12 vial, 120V	5-0102
or 1	COD Reactor, 12 vial, 230V	5-0102-EX2

Optional Equipment:

QUANTITY	CONTENTS	CODE
1	Volumetric pipet, 5.0 mL	2-2174
2	Volumetric pipets, 1.0 mL	2-2170
1	Pipet Bulb	2-2164
1	Wipes	2-2069
1	Test Tube Holder	2-2190

Phosphorus in natural waters and wastewaters occurs almost exclusively in the form of orthophosphates, condensed phosphates (pyro-, meta- and other polyphosphates) and organically bound phosphates. Phosphates may be added in small amounts to water supplies during treatment. Larger amounts are introduced to water used for cleaning or laundering as components of commercial cleaning preparations. Phosphates are used to treat boiler water and are components of agricultural and residential fertilizers. Phosphorus is an important nutrient for aquatic plants. The amount found in natural water is generally not more than 0.1 mg/L unless the water has become polluted from wastewater sources or excessive drainage from agricultural areas.

APPLICATION:	Drinking, surface and saline waters; domestic and industrial waste water.
RANGE:	0.00–3.50 mg/L Total Phosphorus as phosphate
MDL:	0.07 mg/L
METHOD:	Pretreatment of the sample with heat and acid provides conditions for the hydrolysis of condensed inorganic phosphates. Heat, acid and persulfate convert the organic phosphates to orthophosphate during the digestion. Ammonium molybdate and antimony potassium tartrate react in a filtered acid medium with dilute solutions of phosphate to form an antimony-phosphomolybdate complex. This complex is reduced to an intense blue colored complex by ascorbic acid. The color is proportional to the amount of phosphate present.
SAMPLE HANDLING & PRESERVATION:	Rinse sample bottle with 1:1 hydrochloric acid followed by deionized water. Do not use phosphate detergents. If the sample can not be analyzed immediately, the sample should be preserved by adjusting the pH to 2 or less with concentrated sulfuric acid and refrigerated at 4°C. Warm the sample to room temperature and neutralize with 5.0 N sodium hydroxide before analyzing.
INTERFERENCES:	Large amounts of turbidity may interfere. Aluminum (>200 ppm), arsenate (any level), chromium (>100 ppm), copper (>10 ppm), Iron (>100 ppm), Nickel (>300 ppm), silica (>50 ppm), silicate (>10 ppm), sulfide (>90 ppm) and zinc (>80 ppm) will interfere.

PROCEDURE

Use Universal Sample Holder.

1. Preheat COD reactor to 150 ±2°C. Follow safety precautions.
2. Remove cap from a *Total Phosphorus Acid Reagent Tube (4035). Use a 1.0 mL pipet (0354) to add 5.0 mL of sample.
3. Use the 0.15 g spoon (0727) and a funnel (0459) to add one level measure of *Digestion Reagent Powder (4036). Tap funnel to dispense powder completely. Cap tube tightly and shake until powder dissolves completely.
4. Place the tube in the COD reactor for 30 minutes.
5. At the end of the heating period, turn the reactor off. Carefully remove the tube from the reactor and allow it to cool to room temperature.
6. At the end of the cooling period, turn spectrophotometer **ON**.
7. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
8. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
9. Press **ENTER** to select **Programmed Tests**.
10. Scroll to and press ENTER to select **All Tests** (or another sequence containing **82 Phosphorus T LR**).
11. Scroll to **82 Phosphorus T LR**.
12. Carefully remove the caps from the digested tube. Use another 1 mL pipet (0354) to add 1.0 mL of *Total Phosphorus LR Hydroxide Reagent (4038) to the tube. Cap and invert to mix.
13. Wipe the vial with a damp towel to remove fingerprints and smudges. Wipe with a dry towel.
14. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank. Remove the tube.
15. Use another 1 mL pipet (0354) to add *1.0 mL of Phosphate Acid Reagent (V-6282). Cap and invert tube to mix.
16. Use the 0.1g spoon (0699) and a funnel (0459) to add one level spoon of Phosphate Reducing Reagent (V-6283). Tap funnel to dispense powder completely. Cap tube and shake until powder dissolves.
17. Wait 5 minutes.
18. Wipe the tubes with a damp towel to remove fingerprints and smudges. Wipe with a dry towel.
19. Insert the tube into the chamber. Press **Enter** to scan sample. Record the result as Total Phosphorus in mg/L PO_4.

20. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTE: For greater accuracy, use laboratory grade pipets.

PHOSPHORUS-TOTAL, HIGH RANGE

MOLYBDOVANADATE WITH ACID PERSULFATE DIGESTION METHOD • CODE 4025-01

QUANTITY	CONTENTS	CODE
25	*Total Phosphorus Acid Reagent Tubes	*4035-G
60 mL	Deionized Water	5115PS-H
5 g	*Digestion Reagent Powder	*4036- C
2 X 30 mL	*Total Phosphorus HR Hydroxide Reagent	*4037-G
30 mL	*Total Phosphorus HR Indicator Reagent	*4039-G
1	Spoon, 0.15 g	0727
3	Pipets 1.0 mL, plastic	0354
1	Pipet, 0.5 mL	0353
1	Funnel, plastic	0459

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Note: for greater accuracy, use laboratory grade pipets.

QUANTITY	CONTENTS	CODE
1	COD Reactor, 12 vial, 120V	5-0102
1	COD Reactor, 12 vial, 230V	5-0102-EX2
or 1	COD Reactor, 12 vial, 230V	5-0094

Optional Equipment:

QUANTITY	CONTENTS	CODE
1	Volumetric Pipet, 2.0 mL	2-2168
1	Volumetric pipet, 5.0 mL	2-2174
2	Graduated pipets, 0-5 mL	2-2167
1	Pipet Bulb	30503
1	Wipes	2-2069
1	Test Tube Holder	2-2190

Phosphorus in natural waters and wastewaters occurs almost exclusively in the form of orthophosphates, condensed phosphates (pyro-, meta- and other polyphosphates) and organically bound phosphates. Phosphates may be added in small amounts to water supplies during treatment. Larger amounts are introduced to water used for cleaning or laundering as components of commercial cleaning preparations. Phosphates are used to treat boiler water and are components of agricultural and residential fertilizers. Phosphorus is an important nutrient for aquatic plants. The amount found in natural water is generally not more than 0.1 mg/L unless the water has become polluted from wastewater sources or excessive drainage from agricultural areas.

APPLICATION:	Boiler, cooling, and industrial water.
RANGE:	0.0–100.0 mg/L Total Phosphorus as phosphate
MDL:	5.0 mg/L
METHOD:	Pretreatment of the sample with heat and acid provides conditions for the hydrolysis of condensed inorganic phosphates. Heat, acid and persulfate convert the organic phosphates to orthophosphate during the digestion. Orthophosphate reacts in acid conditions with ammonium vanadomolybdate to form vanadomolybdophosphoric acid. The resulting yellow color is proportional to the concentration of orthophosphate.
SAMPLE HANDLING & PRESERVATION:	Rinse sample bottle with 1:1 hydrochloric acid followed by deionized water. Do not use phosphate detergents. If the sample can not be analyzed immediately, the sample should be preserved by adjusting the pH to 2 or less with concentrated sulfuric acid and refrigerated at 4°C. Warm the sample to room temperature and neutralize with 5.0 N sodium hydroxide before analyzing.
INTERFERENCES:	Large amounts of turbidity may interfere. Silica and arsenate interfere only if the sample is heated. Arsenite, fluoride, thorium, bismuth, molybdate, thiosulfate, and thiocyanate cause negative interference. Ferrous iron concentrations above 100 ppm will interfere.

NOTE: For greater accuracy, use laboratory grade pipets. To order reagent refills, order code R-4025.

PROCEDURE

Use Universal Sample Holder.

1. Preheat COD reactor to 150 ±2°C. Follow safety precautions.
2. Remove cap from a *Total Phosphorus Acid Reagent Tube (4035). Use a 1.0 mL pipet (0354) to add 5.0 mL of Deionized Water (5115PS). This is the blank.
3. Remove cap from a *Total Phosphorus Acid Reagent Tube (4035). Use another 1.0 mL pipet (0354) to add 5.0 mL of sample water. This is the sample.
4. Use the 0.15 g spoon (0727) and a funnel (0459) to add one level measure of *Digestion Reagent Powder (4036) to each tube. Tap funnel to dispense powder completely. Cap tube tightly and shake until powder completely dissolves.
5. Place the tubes in the COD reactor for 30 minutes.
6. At the end of the heating period, turn the reactor off. Carefully remove the tubes from the reactor block and allow them to cool to room temperature.
7. Carefully remove the caps from the digested tubes. Use another 1 mL pipet (0354) to add 2.0 mL of *Total Phosphorus HR Hydroxide Reagent (4037) to each tube. Cap and invert to mix.
8. Use the 0.5 mL pipet (0353) to add 0.5 mL *Total Phosphorus HR Indicator Reagent (4039) to each tube. Cap and invert to mix. Wait 7 minutes.
9. During the waiting period, turn spectrophotometer **ON**.
10. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
11. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
12. Press **ENTER** to select **Programmed Tests**.
13. Scroll to and press ENTER to select **All Tests** (or another sequence containing **83 Phosphorus T HR**).
14. Scroll to **83 Phosphorus T HR**.
15. Wipe the vials with a damp towel to remove fingerprints and smudges. Wipe with a dry towel.
16. Insert the blank into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank. Remove the tube.
17. Insert the sample tube into the chamber. Close lid. Press **Enter** to scan sample. Record the result as Total Phosphorus in mg/L PO_4.
18. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

POTASSIUM

TETRAPHENYLBORON METHOD • CODE 3639-SC

QUANTITY	CONTENTS	CODE
30 mL	*Sodium Hydroxide, 1.0N	*4004WT-G
5 g	*Tetraphenylboron Powder	*6364-C
1	Spoon, 0.05 g, plastic	0696

***WARNING:** Reagents marked with an * are considered to be potential health hazards. To view or print a Safety Data Sheet (SDS) for these reagents go to www.lamotte.com. Search for the four digit reagent code number listed on the reagent label, in the contents list or in the test procedures. Omit any letter that follows or precedes the four digit code number. For example, if the code is 4450WT-H, search 4450. To obtain a printed copy, contact LaMotte by email, phone or fax.

Emergency information for all LaMotte reagents is available from Chem-Tel: (US, 1-800-255-3924) (International, call collect, 813-248-0585)

Potassium, as the seventh most common element on the Earth, may be found in minor quantities in most water supplies. It seldom exceeds 10 ppm in drinking water and usually is less than 2 ppm. In some brine or runoff in agricultural areas the potassium concentration may reach 100 ppm.

APPLICATION:	Drinking, surface, and saline waters.
RANGE:	0.0–10.0 ppm Potassium
MDL:	0.5 ppm
METHOD:	Potassium reacts with sodium tetraphenylborate to form a colloidal white precipitate in quantities proportional to the potassium concentration.
SAMPLE HANDLING & PRESERVATION:	Store samples in polyethylene bottles, not in soft glass where leaching of potassium from the glass may occur. Samples may be acidified to pH 2 with nitric acid, but should be neutralized before analyzing.
INTERFERENCES:	Calcium and magnesium interfere at very high concentrations. Check for stray light interference.

PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **81 Potassium**).
6. Scroll to **81 Potassium**.
7. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
8. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove tube from Spectrophotometer. Add 4 drops of *Sodium Hydroxide, 1.0N (4004WT). Cap and mix.
10. Use the 0.05 g spoon (0696) to add one measure of *Tetraphenylboron Powder (6364). Cap and shake vigorously until all of the powder has dissolved. Wait 5 minutes.
11. At end of 5 minute waiting period, mix tube again to suspend any settled precipitate. Immediately insert tube into chamber. Close lid. Press **Enter** to scan sample. Record result.
12. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTES: For best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents is obtained.

For the most accurate results, the sample and reagents should be at 25±4°C.

SILICA–LOW RANGE

HETEROPOLY BLUE METHOD • CODE 3664-SC

QUANTITY	CONTENTS	CODE
30 mL	*Silica Reagent #1	*V-4466-G
30 mL	*Silica Reagent #2	*V-4467-G
30 mL	*Silica Reagent #3	*V-4468-G
10 g	Silica Reagent #4	V-6284-D
1	Spoon, 0.1 g, plastic	0699

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Emergency information for all LaMotte reagents is available from Chem-Tel: (US, 1-800-255-3924) (International, call collect, 813-248-0585)

Silicon dioxide, SiO_2, commonly known as silica, occurs in all natural water. Silica may be present as suspended, insoluble particles in a colloidal or polymeric state. It may also be present in a reactive form as silicic acid or silicate ions. Silica is a major nutrient for diatoms. A silica cycle occurs in many bodies of water containing organisms, such as diatoms, that use silica in their skeletal structure. The silica removed from the water may be slowly returned to solution by the decomposition of the dead organisms. The major source of silica in natural water is from the decomposition of silicate minerals in the drainage basin from which the waters flow.

The presence of silica is particularly objectionable in water used for boiler feed water purposes, as it may cause the formation of a hard, dense scale which has unusually high resistance to heat transfer. Serious loss of turbine efficiency results from insoluble silica turbine blade deposits caused by vaporization of silica from boiler water.

APPLICATION:	Drinking, surface, and saline waters; domestic and industrial wastes.
RANGE:	0.00–2.50 ppm Silica
MDL:	0.03 ppm
METHOD:	Reactive silica forms a complex with ammonium molybdate in an acidic solution to produce a yellow-green color in proportion to the amount of silica present. Phosphate also reacts with molybdate but the addition of oxalic acid eliminates the molybdophosphoric acid complex. This silica molybdate complex is then reduced by ascorbic acid to produce an intense blue color.
SAMPLE HANDLING & PRESERVATION:	Silica samples may be preserved by refrigeration at 4°C in plastic containers up to one week without any change in silica concentration.
INTERFERENCES:	Sulfides and large amounts of iron interfere. Color and turbidity may be removed by standardizing the instrument with the original water sample. Since silica is a component of glass waste and a common contaminant, it is suggested to run a reagent blank using silica-free water. The blank value is subtracted from the sample concentrations.

PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **85 Silica Lo**).
6. Scroll to **85 Silica Lo**.
7. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
8. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove tube from Spectrophotometer. Add 6 drops *Silica Reagent #1 (V-4466). Cap and invert to mix.
10. Add 12 drops of *Silica Reagent #2 (V-4467). Cap and mix. Wait 5 minutes.
11. Add 8 drops of *Silica Reagent #3 (V-4468). Cap and mix. Wait 2 minutes.
12. Use the 0.1 g spoon (0699) to add one measure of Silica Reagent #4 (V-6284). Cap and mix gently until powder has dissolved. Wait 5 minutes for full color development.
13. At end of 5 minute waiting period, mix. Insert tube into chamber. Close lid. Press **Enter** to scan sample. Record result.
14. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTE: For best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents is obtained.

SILICA–HIGH RANGE

SILICOMOLYBDATE METHOD • CODE 3687-SC

QUANTITY	CONTENTS	CODE
30 mL	*Silica Reagent #1	*V-4466-G
30 mL	*Silica Reagent #2	*V-4467-G
15 mL	*Silica Reagent #3	*V-4468-G

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Emergency information for all LaMotte reagents is available from Chem-Tel: (US, 1-800-255-3924) (International, call collect, 813-248-0585)

Silicon dioxide, SiO_2, commonly known as silica, occurs in all natural water. Silica may be present as suspended, insoluble particles in a colloidal or polymeric state. It may also be present in a reactive form as silicic acid or silicate ions. Silica is a major nutrient for diatoms. A silica cycle occurs in many bodies of water containing organisms, such as diatoms, that use silica in their skeletal structure. The silica removed from the water may be slowly returned to solution by the decomposition of the dead organisms. The major source of silica in natural water is from the decomposition of silicate minerals in the drainage basin from which the waters flow.

The presence of silica is particularly objectionable in water used for boiler feed water purposes, as it may cause the formation of a hard, dense scale which has unusually high resistance to heat transfer. Serious loss of turbine efficiency results from insoluble silica turbine blade deposits caused by vaporization of silica from boiler water.

APPLICATION:	Boiler and cooling waters; domestic and industrial wastes.
RANGE:	0–50 ppm Silica
MDL:	1 ppm
METHOD:	Silica forms a complex with ammonium molybdate in an acidic solution to produce a yellow color in proportion to the amount of silica present. Phosphate also reacts with molybdate but the addition of oxalic acid eliminates the molybdophosphoric acid complex.
SAMPLE HANDLING & PRESERVATION:	Silica samples may be preserved by refrigeration at 4°C in plastic containers up to one week without any change in silica concentration.
INTERFERENCES:	Sulfides and large amounts of iron interfere. Color and turbidity may be removed by standardizing the instrument with the original water sample.

PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **86 Silica Hi**).
6. Scroll to **86 Silica Hi**.
7. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
8. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove tube from Spectrophotometer. Add 6 drops *Silica Reagent #1 (V-4466). Cap and invert to mix.
10. Add 12 drops of *Silica Reagent #2 (V-4467). Cap and mix. Wait 5 minutes.
11. At end of 5 minute waiting period, add 8 drops of *Silica Reagent #3 (V-4468). Cap and mix.
12. Insert tube into chamber. Close lid. Press **Enter** to scan sample. Record result.
13. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTE: To extend the range to 100 ppm, perform a 2:1 dilution of water sample, with silica-free water. Perform test and multiply result by 2.

SULFATE-HIGH RANGE

BARIUM CHLORIDE METHOD • CODE 3665-SC

QUANTITY	CONTENTS	CODE
10 g	*Sulfate Reagent	*V-6277-D
1	Spoon, 0.1 g, plastic	0699

***WARNING:** Reagents marked with an * are considered to be potential health hazards. To read complete safety information, go to page 3 in the User Manual.

The most common mineral forms of sulfur are iron sulfide, lead sulfide, zinc sulfide and as calcium sulfate and magnesium sulfate. In most fresh waters the sulfate ion is the second or third most abundant anion, being exceeded only by bicarbonate and, in some cases, silicate. Sulfur, in the form of sulfate, is considered an important nutrient element. Mineral springs are rich in sulfate and feed appreciable quantities of this compound to the watershed. Acid mine water drainage is a form of pollution which may contribute extremely large amounts of sulfate content to natural waters. Other sources of sulfate include waste material from pulp mills, steel mills, food processing operations and municipal wastes. Many bacteria obtain sulfur from sulfate for the synthesis of amino acids. In lakes and streams low in oxygen, this process of sulfate reduction causes the production of hydrogen sulfide, with its characteristic offensive odor. Calcium sulfate and magnesium sulfate contribute significantly to the hardness of water. Under natural conditions, the quantities ordinarily to be expected in lakes are between 3 and 30 parts per million.

APPLICATION:	Drinking and surface waters; domestic and industrial wastes.
RANGE:	6–100 ppm Sulfate
MDL:	5 ppm
METHOD:	Sulfate ion is precipitated in an acid medium with barium chloride to form a barium sulfate suspension in proportion to the amount of sulfate present.
SAMPLE HANDLING & PRESERVATION:	Sulfate samples may be preserved by refrigeration at 4°C up to 7 days in glass or plastic containers without any change in concentration.
INTERFERENCES:	Suspended matter and color interference may be removed by a filtration step. Silica in excess of 500 mg/L will interfere. Check for stray light interference (see page 15).

PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **89 SULFATE-HR**).
6. Scroll to **89 SULFATE-HR**.
7. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
8. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove tube from Spectrophotometer. Use the 0.1 g spoon (0699) to add one measure of *Sulfate Reagent (V-6277). Cap and shake until powder dissolves. A white precipitate will develop if sulfates are present. Wait 5 minutes.
10. Mix tube again. Insert tube into chamber. Close lid. Press **Enter** to scan sample. Record result.
11. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTES: If the sulfate concentration of the test sample is greater than 100 ppm, it is recommended that a dilution be made with deionized water and the results multiplied by the dilution factor.

A white film is deposited on the inside of test tubes as a result of the sulfate test. Thoroughly clean and rinse test tubes after each test.

For the most accurate results, samples and reactions should be at 25±4°C.

SULFIDE-LOW RANGE

METHYLENE BLUE METHOD • CODE 3654-02-SC

QUANTITY	CONTENTS	CODE
2 X 30 mL	*Sulfide Reagent A	*V-4458-G
15 mL	*Sulfide Reagent B	*V-4459-E
2 x 60 mL	Sulfide Reagent C	4460-H
2	Pipets, 1.0 mL, plastic	0354

***WARNING:** Reagents marked with an * are considered to be potential health hazards. To view or print a Safety Data Sheet (SDS) for these reagents go to www.lamotte.com. Search for the four digit reagent code number listed on the reagent label, in the contents list or in the test procedures. Omit any letter that follows or precedes the four digit code number. For example, if the code is 4450WT-H, search 4450. To obtain a printed copy, contact LaMotte by email, phone or fax.

Emergency information for all LaMotte reagents is available from Chem-Tel: (US, 1-800-255-3924) (International, call collect, 813-248-0585)

Sulfide occurs in many well water supplies and sometimes is formed in lakes or surface waters. In distribution systems, it may be formed as a result of bacterial action on organic matter under anaerobic conditions. It may also be found in waters receiving sewage or industrial wastes. Lake muds rich in sulfates produce hydrogen sulfide during periods of very low oxygen levels that result from stagnation. Concentrations of a few hundredths of a part per million (or milligram per liter) cause a noticeable odor. At low concentrations, this odor is described as “musty”; at high concentration, as “rotten eggs.” Removal of sulfide odor is accomplished by aeration or chlorination. Hydrogen sulfide, a toxic substance, acts as a respiratory depressant in both humans and fish.

APPLICATION:	Drinking, surface, and saline waters; domestic and industrial wastes.
RANGE:	0.00–1.00 ppm Sulfide
MDL:	0.02 ppm
METHOD:	Under suitable conditions the sulfide ion reacts with p-aminodimethylaniline and ferric chloride to produce methylene blue in proportion to the sulfide concentration. Ammonium phosphate is added to remove the color due to the ferric iron.
SAMPLE HANDLING & PRESERVATION:	Samples must be taken with a minimum of aeration since sulfide is volatilized by aeration and any oxygen which is taken up will destroy sulfides by chemical action. Samples that are used for total sulfide concentrations may be preserved by adding 2M zinc acetate solution at a dosage of 2 mL per liter of sample. This precipitates sulfide as inert zinc sulfide. Determination of dissolved sulfides in samples not preserved with zinc acetate must be started within 3 minutes of sampling.
INTERFERENCES:	Strong reducing agents such as sulfite, thiosulfate, and hydrosulfite prevent the formation of the color or diminish its intensity. High concentrations of sulfide will inhibit the reaction, but dilution of the sample prior to analysis eliminates this problem.

PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **90 Sulfide-LR**).
6. Scroll to **90 Sulfide-LR**.
7. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
8. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove tube from Spectrophotometer. Use the 1.0 mL pipet (0354) to add 1.0 mL of *Sulfide Reagent A (V-4458). Cap and mix.
10. Add 6 drops of Sulfide Reagent B (V-4459). Cap and mix. Wait 1 minute. Solution will turn blue if sulfides are present.
11. Use the 1.0 mL pipet (0354) to add 2.0 mL of Sulfide Reagent C (4460). Cap and mix. Color development is immediate and stable.
12. Insert tube into chamber. Close lid. Press **ENTER** to scan sample. Record result.
13. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

SURFACTANTS

ION PAIR EXTRACTION–BROMPHENOL BLUE INDICATOR METHOD • CODE 4876-01

QUANTITY	CONTENTS	CODE
50 g	pH Adjustment Powder	4509- H
10 g	Sodium Chloride Reagent	4877-D
2 X 60 mL	*DS Indicator Reagent	*4508-H
1	Spoon, 0.5 g, plastic	0698
1	Spoon, 0.1 g, plastic	0699
1	Pipet, 1.0 mL, plastic	0354

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Aqueous waste from households and industrial laundering operations is the main source of surfactants in waters. Surfactants are found in low concentrations in natural water except in areas of an outfall or other point source.

APPLICATION:	Surface water, wastewater.
RANGE:	0.00–8.0 ppm as Linear Alkyl Sulfonates (LAS).
MDL:	1.0 ppm
METHOD:	The presence of LAS in the water sample causes the transfer of bromphenol blue dye from the organic reagent layer to the aqueous layer. The amount of color in the aqueous layer is proportional to the concentration of the LAS in the sample. LAS are Methylene Blue Active Substances (MBAS). This calibration is based on sodium lauryl sulfate (dodecyl sodium sulfate). Some linear alkyl sulfonates may have a slightly different response. Prepare standards of a known concentration and follow the test procedure below to determine a conversion factor.
SAMPLE HANDLING & PRESERVATION:	Analyze samples as soon as possible. May be stored at 4°C for 24 hours. Warm to room temperature before testing.
INTERFERENCES:	Cationic and non-ionic surfactants.

PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **94 Surfactants**).
6. Scroll to **94 Surfactants**.
7. Rinse a tube (0290) with sample water. Fill to 10 mL line with sample.
8. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove the tube from spectrophotometer.
10. Use the 0.5 g spoon (0698) to add 0.5 g pH Adjustment Powder (4509). Cap and mix until powder dissolves.
11. Use the 0.1 g spoon (0699) to add two measures of Sodium Chloride Reagent (4877). Cap and mix until powder disintegrates.
12. Use the 1.0 pipet (0354) to add 2.0 mL of *DS Indicator (4508).
13. Cap and shake for 1 minute.
    NOTE: Bubbles on the sides of the tube will interfere with the results. Swirl the tube to remove bubbles if they are present.
14. Wait 5 minutes. DO NOT MIX.
15. Insert tube into chamber. Close lid. Press **Enter** to scan sample. Record result in ppm LAS.
16. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTE: For best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents is obtained.

TANNIN

TUNGSTO-MOLYBDOPHOSPHORIC ACID METHOD
CODE 3666-01-SC

QUANTITY	CONTENTS	CODE
30 mL	*Tannin Reagent #1	*7833-G
2 x 60 mL	*Tannin Reagent #2	*7834-H
	Pipet, plain, plastic	0352
	Pipet, 1.0 mL, plastic	0354

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Tannin and lignin are examples of hydroxylated aromatic compounds found in discharge wastewater from paper mills, in some boiler water treatment, in natural brackish water, and in wastewater from leather tanning plants. The taste and odor of these compounds is generally offensive so that their control is important in many areas.

APPLICATION:	Industrial wastewaters; boiler and cooling waters; natural waters.
RANGE:	0.00–10.00 ppm Tannic Acid
MDL:	0.2 ppm
METHOD:	The hydroxylated aromatic compounds will reduce a mixture of tungstophosphoric and molybdophosphoric acids to form a blue color in proportion to the concentration of aromatic hydroxyl groups.
SAMPLE HANDLING & PRESERVATION:	Sample should be analyzed as soon as possible after collection.
INTERFERENCES:	Other reducing compounds such as ferrous iron and sulfites. Results may be expressed as tannin like compounds, or aromatic hydroxy compounds.

PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **96 TANNIN**).
6. Scroll to **96 TANNIN**.
7. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
8. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove tube from Spectrophotometer. Use the plain pipet (0352) to add 4 drops of *Tannin Reagent #1 (7833). Cap and mix.
10. Use the 1.0 mL pipet (0354) to add 2.0 mL of *Tannin Reagent #2 (7834). Cap and mix. Wait 30 minutes for full color development.
11. At end of 30 minute waiting period, mix. Insert tube into chamber. Close lid. Press **Enter** to scan sample. Record result.
12. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTES: For best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents is obtained.

For the most accurate results, the sample and reagents should be at 20±2°C.

TURBIDITY

ABSORPTION METHOD • NO REAGENTS REQUIRED

Turbidity is a measure of water clarity and is independent of color. Turbidity is caused by undissolved and suspended solids. Mud, silt, algae, and microorganisms can all cause turbidity. Turbidity is a gross measurement of water quality.

APPLICATION:	Surface and industrial waters for non-compliance monitoring. (For compliance monitoring at low turbidity levels, use a commercial .)
RANGE:	0–400 FTU
MDL:	2 FTU
METHOD:	Absorptimetric
SAMPLE HANDLING & PRESERVATION:	Measure sample as soon as possible after collection.
INTERFERENCES:	Check for stray light interference

PROCEDURE

Use Universal Sample Holder.

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **98 Turbidity**).
6. Scroll to **98 Turbidity**.
7. Rinse a clean tube (0290) with deionized water (turbidity free). Fill to the 10 mL line with deionized water.
8. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Rinse a second clean tube (0290) with sample water. Fill to the 10 mL line with sample. Cap tube. Wipe off excess water and fingerprints. Shake to resuspend particulate matter. Remove all bubbles before measurement.
10. Insert tube into chamber. Close lid. Press **Enter** to scan sample. Record result. Turbidity measurements should be taken as soon as possible after sample has been collected.

11. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTE: For the most accurate results, the sample should be at 25±4°C.

FORMAZIN STOCK SOLUTION

The turbidity calibration curve for this instrument was prepared by using formazin solutions as a reference. A 4000 FTU standard solution is available (Order Code 6195-H, 60 mL) that can be diluted with low turbidity water to prepare solutions within the test range.Dilutions from this stock solution should be prepared fresh daily with low turbidity water.

Alternatively, a stock turbidity solution of 400 NTU can be prepared by observing safety precautions and carefully following the procedure below.

Preparation of Formazin Stock Solution

1. Dissolve 1.000 g of Hydrazine Sulfate in deionized water and dilute to the mark in a 100 mL volumetric flask.
2. Dissolve 10.00 g of hexamethylenetetramine in deionized water and dilute to the mark in a 100 mL volumetric flask.
3. Mix 5 mL of each solution in a 100 mL volumetric flask and allow to sit undisturbed for 24 hours at 25 +/- 3 °C.
4. At the end of the waiting period, dilute to the mark with deionized water and mix. Store in amber glass.
5. The concentration of this stock solution is 400 FTU. This stock solution is stable for one month. Dilutions from this stock solution should be prepared fresh daily with low turbidity water.

ZINC-LOW RANGE

ZINCON METHOD • CODE 3667-01-SC

QUANTITY	CONTENTS	CODE
30 mL	*Zinc Indicator Solution	*6314-G
120 mL	*Methyl Alcohol	*6319-J
10 g	Sodium Ascorbate Powder	6316-D
25 g	*Zinc Buffer Powder	*6315-G
15 mL	*Sodium Cyanide, 10%	*6565-E
30 mL	*Formaldehyde Solution, 37%	*5128-G
1	Dilute Zinc Indicator Solution Bottle, with 1 mL pipet assembly	6321-MT-G
1	Graduated Cylinder, 10 mL, glass	0416
1	Spoon, 0.5 g, plastic	0698
2	Pipets, plain, plastic	0352
1	Spoon, 0.1 g, plastic	0699

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Zinc enters the domestic water supply from the deterioration of galvanized iron and brass pipes, and from industrial wastes. Zinc is an essential element for body growth and development and is an important plant nutrient. Concentrations of zinc above 5.0 mg/L in drinking water can cause a bitter astringent taste. In the U.S., zinc concentrations may vary between 0.06 to 7.0 mg/L, with an average value of 1.33 mg/L.

APPLICATION:	Drinking and surface waters; domestic and industrial wastewaters.
RANGE:	0.00–3.00 ppm Zinc
MDL:	0.025 ppm
METHOD:	Zinc forms a blue colored complex with Zincon in a solution buffered at pH 9.0. Other heavy metals are complexed by cyanide and the zinc cyanide complex is released by the addition of formaldehyde before the other metal cyanide complexes are destroyed. Sodium ascorbate is added to reduce the interference of manganese.
SAMPLE HANDLING & PRESERVATION:	Sample should be analyzed within 6 hours after collection. The addition of hydrochloric acid will help preserve the metal ion content, however the acid should be neutralized before analysis.
INTERFERENCES:	The following ions interfere in concentrations greater than those listed.

ION	MG/L	ION	MG/L
Cd(II)	1	Cr(III)	10
Al (III)	5	Ni(II)	20
Mn (II)	5	Co (II)	30
Fe (III)	7	CrO_4(II)	50
Fe (II)	9		

PROCEDURE

Use universal sample holder.

A. PREPARATION OF DILUTE ZINC INDICATOR SOLUTION

1. Use a pipet (0352) to measure exactly 5.0 mL of *Zinc Indicator Solution (6314) into 10 mL graduated cylinder (0416). The bottom of the curved surface (the meniscus) of liquid should be at 5.0 mL mark. Pour this into the bottle labeled *Dilute Zinc Indicator Solution (6321-MT-G).
2. Use unrinsed graduated cylinder to add 10.0 mL and then 7.8 mL (total of 17.8 mL) of *Methyl Alcohol (6319) to bottle labeled *Dilute Zinc Indicator Solution (6321). Cap and mix ingredients in this bottle. Do not leave this bottle uncapped.

B. DETERMINATION OF ZINC

1. Turn spectrophotometer **ON**.
2. Allow instrument to warm up for 15 minutes. Or press ESC to skip warm up.
3. Press **ENTER** to select **NO** and skip the system calibration. Or press ^ and press ENTER to select YES and begin the system calibration.
4. Press **ENTER** to select **Programmed Tests**.
5. Scroll to and press ENTER to select **All Tests** (or another sequence containing **99 Zinc-LR**).
6. Scroll to **99 Zinc-LR**.
7. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
8. Insert the tube into chamber. Close lid. Press **ENTER** to scan blank. Wait for the instrument to blank.
9. Remove tube from Spectrophotometer. Use 0.1 g spoon (0699) to add one measure of Sodium Ascorbate Powder (6316). Use 0.5 g spoon (0698) to add one measure of *Zinc Buffer Powder (6315). Cap and shake vigorously for 1 minute. Some undissolved buffer may remain in the bottom of the tube.
10. Add 3 drops of *Sodium Cyanide, 10% (6565). Cap and mix.
11. Use the 1 mL pipet assembly to add 1 mL of *Dilute Zinc Indicator Solution (6321). Cap and mix.
12. Use a second plain pipet (0352) to add 4 drops of *Formaldehyde Solution, 37% (5128). Cap and mix by inverting 15 times.
13. Insert tube into chamber. Close lid. Press **Enter** to scan sample. Record result.
14. Turn the spectrophotometer **OFF**. Or insert another sample into chamber, close lid, press **ENTER** to scan another sample. Or press **ESCAPE** to exit to a previous menu or make another menu selection.

NOTE: For best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents is obtained.

APPENDIX

Ammonia in water occurs in two forms: toxic unionized ammonia (NH_3) and the relatively non-toxic ionized form, ammonium ion (NH^{4+}). This test method measures both forms as ammonia-nitrogen (NH_3–N) to give the total ammonia-nitrogen concentration in water. The actual proportion of each compound depends on temperature, salinity, and pH. A greater concentration of unionized ammonia is present when the pH value and salinity increase.

1. Consult the table below to find the percentage that corresponds to the temperature, pH, and salinity of the sample.
2. To express the test result as ppm Unionized Ammonia-Nitrogen (NH_3–N), multiply the total ammonia-nitrogen test result by the percentage from the table.
3. To express the test result as Ionized Ammonia-Nitrogen (NH^{4+}–N), subtract the unionized ammonia-nitrogen determined in Step 2 from the total ammonia-nitrogen.

	10°C		15°C		20°C		25°C	
pH	FW1	SW2	FW	SW	FW	SW	FW	SW
7.0	0.19	----	0.27	----	0.40	----	0.55	----
7.1	0.23	----	0.34	----	0.50	----	0.70	----
7.2	0.29	----	0.43	----	0.63	----	0.88	----
7.3	0.37	----	0.54	----	0.79	----	1.10	----
7.4	0.47	----	0.68	----	0.99	----	1.38	----
7.5	0.59	0.459	0.85	0.665	1.24	0.963	1.73	1.39
7.6	0.74	0.577	1.07	0.836	1.56	1.21	2.17	1.75
7.7	0.92	0.726	1.35	1.05	1.96	1.52	2.72	2.19
7.8	1.16	0.912	1.69	1.32	2.45	1.90	3.39	2.74
7.9	1.46	1.15	2.12	1.66	3.06	2.39	4.24	3.43
8.0	1.83	1.44	2.65	2.07	3.83	2.98	5.28	4.28
8.1	2.29	1.80	3.32	2.60	4.77	3.73	6.55	5.32
8.2	2.86	2.26	4.14	3.25	5.94	4.65	8.11	6.61
8.3	3.58	2.83	5.16	4.06	7.36	5.78	10.00	8.18
8.4	4.46	3.54	6.41	5.05	9.09	7.17	12.27	10.10
8.5	5.55	4.41	7.98	6.28	11.18	8.87	14.96	12.40

[1]Freshwater data from Trussel (1972).

[2]Seawater values from Bower and Bidwell (1978). Salinity for Seawater values = 34% at an ionic strength of 0.701m.

FOR EXAMPLE:

If a fresh water sample at 20°C has a pH of 8.5 and the test result is 1.0 ppm as Total Ammonia-Nitrogen:

1. The percentage from the table is 11.18% (or 0.1118).
2. 1 ppm Total Ammonia-Nitrogen x 0.1118 = 0.1118 ppm Unionized Ammonia-Nitrogen.
3. Total Ammonia-Nitrogen 1.0000 ppm

Unionized Ammonia-Nitrogen	–	0.1118 ppm
Ionized Ammonia-Nitrogen	=	0.8882 ppm