SMART3 BLE

Colorimeter

Operator's Manual

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.

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61910-01P

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GENERAL INFORMATION

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, pack instrument carefully in a suitable container with adequate packing material. A return authorization number must be obtained from LaMotte Company by calling 1-800-344-3100 or emailing tech@lamotte.com. Attach a letter with the authorization number to the shipping carton which describes the kind of trouble experienced.

GENERAL PRECAUTIONS

Before attempting to set up or operate this instrument it is important to read the instruction manual. Failure to do so could result in personal injury or damage to the equipment.

The Smart3 BLE Colorimeter should not be stored or used in a wet or corrosive environment. Care should be taken to prevent water or reagent chemicals from wet colorimeter tubes from entering the colorimeter chamber.

NEVER PUT WET TUBES IN COLORIMETER.

SAFETY PRECAUTIONS

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

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

Ensure that the protection provided by this equipment is not impaired. Do not intall or use this equipment in a manner that is not indicated in this manual.

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 its products.

WARRANTY

LaMotte Company warrants this instrument to be free of defects in parts and workmanship for 2 years from the date of shipment. Keep the proof of purchase for warranty verification. If it should become necessary to return the instrument during or the warranty period, contact our Technical Service Department at 1-800-344-3100 or 1-410-778-3100, ext. 3 or softwaresupport@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 with a new or refurbished meter as determined by LaMotte Company. The warranty set forth above is inclusive and no other warranty, whether written or oral, is expressed or implied.

SPECIFICATIONS

INSTRUMENT TYPE: Colorimeter

Readout	160 x 100 backlit LCD, 20 x 6 line graphical display
Wavelengths	428 nm, 525 nm, 568 nm, 635 nm
Wavelength Accuracy	±2% FS
Readable Resolution	Determined by reagent system
Wavelength Bandwidth	10 nm typical
Photometric Range	–2 to +2 AU
Photometric Precision	± 0.001 AU at 1.0 AU
Photometric Accuracy	±0.005 AU at 1.0 AU
Sample Chamber	Accepts 25 mm diameter flat-bottomed test tubes, 10 mm square cuvettes†, 16 mm COD test tubes
Light Sources	4 LEDs
Detectors	4 silicon photodiodes
Response Time	< 2 seconds
Display	Graphic Liquid Crystal Display with Backlight
Auto Shut Off	5, 10, 30 min, disabled
Firmware	Internet updatable (new tests, new calibrations etc). USB connection to Windows PC is required.
Modes	Pre-programmed tests, absorbance, %T
Pre-Programmed Tests	YES, with automatic wavelength selection
User Defined Tests	Up to 25 user tests can be input
Languages	English, Spanish, French, Portuguese, Italian, Chinese, Japanese (kana), Turkish
Temperature	Operation: 0-50 °C; Storage: -40-60 °C
Operation Humidity Range	0-90 % RH, non-condensing
Altitude	Up to 2000 m
Use	Indoor and outdoor
Pollution Degree	2
USB Port	Mini B
Power Requirements	USB wall adapter, USB computer connection or lithium ion rechargeable battery
Battery	Charge Life: Approximately 380 tests with backlight on to 1000 tests with backlight off. (Signal averaging disabled). Battery Life: Approximately 500 charges.
Electrical Rating	Rated voltage 5V⎓, Rated power of input current (1.0A) at mini-USB input port
Data Logger	500 test results stored for download to a PC
Waterproof	IP67 with USB port plug in place

Certifications	EZ-BLE™ PRoC™ Module:	FCC (USA):	FCC ID: WAP200
	CYBLE-022001-00 RF Radio:	Industry Canada (IC) Certification	7922A-200
		CE (European R & TTE):	2014/S3/EU
		MIC (Japan):	005-101007
		KC (Korea):	MSIP-CRMCyp-2001
	EMC:	EU:	2014/53/EU EN 61326-1, EN 300 328
		UKCA	
		US:	FCC CFR 47 Part 15, subpart B
		CAN:	ICES-003
		AS/NSZ:	CSPR 22
	Safety:	EU:	EN 61010-1
		AS/NSZ:	differences
		US/Canadian:	UI/CSA 61010-1
		RoHS	2011/65/EU + (EU) 2015/863
Dimensions (LxWxH)	3.5 x 7.5 x 2.5 inches, 8.84 x 19.05 x 6.35 cm		
Weight	13 oz, 362 g (meter only)		

†525 nm and 568 nm only

STATISTICAL & 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]

Accuracy: Accuracy is the nearness of a measurement to the accepted or true value.[3] 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 known amount of analyte in a determination of the analyte (i.e. 103.5 %).

Resolution: Resolution is the smallest discernible difference between any two measurements that can be made.[4] For meters this is usually how many decimal places are displayed. (i.e. 0.01). 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. A word of caution, 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 bad! This is not a useful measure of the performance of a test method.

Repeatability: Repeatability is the within-run precision.[5] 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.

Reproducibility: Reproducibility is the between-run precision.[6]

Detection Limit (DL): The detection limit (DL) for the SMART3 BLE is defined as the minimum value or concentration that can be determined by the meter, which is greater than zero, independent of matrix, glassware, and other sample handling sources of error. It is the detection limit for the optical system of the meter.

[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.

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

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

[5] 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.

[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.

CONTENTS AND ACCESSORIES

CONTENTS

Smart3 BLE Colorimeter	
Test Tubes, with Caps	Code 0290
COD/UDV Adapter	Code 1724
USB Wall Adapter	Code 1721
USB Cable	Code 1720-01
Smart3 BLE Colorimeter Quick Start Guide	
Smart3 BLE Colorimeter Manual	

ACCESSORIES

Test Tubes, with Caps (6)	Code 0290-6
Replacement Chamber	Code 3-0038
USB Cable	Code 1720-01
USB Wall Adapter	Code 1721
COD/UDV Adapter	Code 1724
BLE Mobile Printer	Code 5-0067
Car Charger	Code 5-0132
Small Field Carrying Case (37.5 27.5 x 13.75 cm)	Code 1910-GCS150
Large Field Carrying Case (45 x 32.5 x 20 cm)	Code 1910-GCS440

WARNING: Only use the USB cable (1720-01) that is supplied with the kit. Make no substitutions.

EPA COMPLIANCE

The Smart3 BLE Colorimeter 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.

COMPLIANCE

The meter has earned the European CE Mark and UKCA Mark of Compliance for electromagnetic compatibility and safety. The Declaration of Conformity for the Smart3 BLE colorimeter is available at www.lamotte.com.

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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

IP67 COMPLIANCE

The Smart3 BLE meets IP67 standards for protection against dust and immersion only when the USB port plug is in place. Documentation is available at www.lamotte.com.

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. Samples for testing these factors, as well as samples for pH, 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 before mixing.

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.

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.

AN INTRODUCTION TO COLORIMETRIC ANALYSIS

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 Smart3 BLE Colorimeter 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 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 Smart3 BLE Colorimeter passes one of four colored light beams through one of four optical filters which transmits only one particular color or band of wavelengths of light to the photodectector where it is measured. The difference in the amount of colored light transmitted by a colored sample is a measurement of the amount of colored light absorbed by the sample. In most colorimetric tests the amount of colored light absorbed is directly proportional to the concentration of the test factor producing the color and the path length through the sample. However, for some tests the amount of colored light absorbed is inversely proportional to the concentration.

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-nitrogen concentration in the sample (the greater the nitrate-nitrogen 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 demineralized or deionized water. Use sample water to **Scan Blank**. Insert the reacted reagent blank in the colorimeter chamber and select **Scan Sample**. Note 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 to **Scan Blank**.

COLORIMETER TUBES AND CHAMBER

The colorimeter uses one type of tube (Code 0290) for all test factors. The handling of the tubes is of utmost importance. Tubes must be clean and free from lint, fingerprints, dried spills and significant scratches, especially the central zone between the bottom and the sample line.

Scratches, fingerprints and water droplets on the tube can cause stray light interference leading to inaccurate results. Tubes that have been scratched in the light zone through excessive use should be discarded and replaced with new ones.

Tubes should always be washed on the inside and outside with mild detergent prior to use to remove dirt or fingerprints. The tubes should be allowed to air-dry in an inverted position to prevent dust from entering the tubes. Dry tubes should be stored with the caps on to prevent contamination.

After a tube has been filled and capped, it should be held by the cap and the outside surface should be wiped with a clean, lint-free absorbent cloth until it is dry and smudge-free. Handling the tube only by the cap will avoid problems from fingerprints. Always set the clean tube aside on a clean surface that will not contaminate the tube. It is imperative that the tubes and light chamber be clean and dry. The outside of the tubes should be dried with a clean, lint-free cloth or disposable wipe before they are placed in the meter chamber.

Tubes should be emptied and cleaned as soon as possible after reading a sample to prevent deposition of particulates on the inside of the tubes.

Variability in the geometry of the glassware and technique is the predominate cause of variability in results. Slight variations in wall thickness and the diameter of the tubes may lead to slight variations in the test results. To eliminate this error the tubes should be placed in the chamber with the same orientation each time.

Chambers which have been scratched through excessive use should be discarded and replaced with a new one.

■ METER CARE

The optical system of the Smart3 BLE must be kept clean and dry for optimal performance. Dry the colorimeter tubes before placing them in the chamber to avoid introducing moisture. For best results store the instrument in a area that is dry and free from aggressive chemical vapors.

■ 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 absorbance 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 wavelengths for the color of the reacted samples. Use these as a starting point.

■ CALIBRATION

As with all pre-calibrated meters, it is highly recommended, even if not required by regulations, that the user periodically verify the performance of the meter by running standards with a predetermined concentration. Results outside of specification are an indication that the meter needs to be adjusted. This can be done following the user calibration described on page 23.

■ CALIBRATION CURVES

The Smart3 BLE Colorimeter contains tests for the LaMotte reagent systems. The first step in using a non-LaMotte reagent system with your Smart3 BLE Colorimeter 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 Smart3 BLE Colorimeter. Select a wavelength the test as described above.

Plot the results (in ABS or %Transmittance) versus concentration to create a calibration curve. The calibration curve may then be used to identify the concentration of an unknown sample by testing the unknown, reading Absorbance or %T, and finding the corresponding concentration from the curve. The linear range of the reagent system can be determined and this information can be used to input a User Test into the Smart3 BLE Colorimeter (see Setup, page 28).

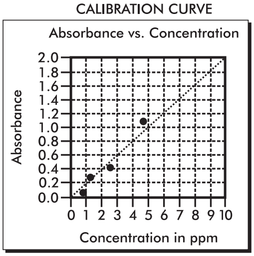
PROCEDURE

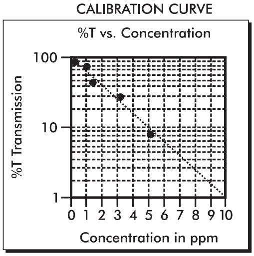
Prepare 5 or 6 standard solutions of the factor being tested. The concentration of these standards should be evenly distributed throughout the range of the reagent system, and should include a 0 ppm standard (distilled water). For instance, the solutions could measure 0, 10%, 30%, 50%, 70%, and 90% of the system's maximum range.

1. Turn on the Smart3 BLE Colorimeter. Select the appropriate wavelength from the absorbance mode. Be sure to select the appropriate wavelength for the color produced by the reagent system.
2. Use the unreacted 0 ppm standard to standardize the colorimeter by using it to scan blank.
3. Following the individual reagent system instructions, react each standard solution beginning with 0 ppm. Continue with standards in increasing concentration. Record the reading and the standard solution concentration on a chart. Readings can be recorded as percent transmittance (%T) or absorbance (A).
4. Plot results on graph paper or computer using any available plotting program. If results are as %T versus concentration, semilog graph paper must be used. Plot the standard solution concentrations on the horizontal, linear axis, and the %T on the vertical, logarithmic axis. If results are as absorbance versus standard solution concentration, simple linear graph paper can be used. Plot the standard solution concentration on the horizontal axis, and the absorbance on the vertical axis.
5. After plotting the results, draw a line, or curve, of best fit through the plotted points. The best fit may not connect the points. There should be approximately an equal number of points above the curve as below the curve. Some reagent systems will produce a straight line, while others produce a curve. Many computer spreadsheet programs can produce the curve of best fit by regression analysis of the standard solution data.

NOTE: Only reagent systems which produce a straight line can be used for a User Test.

A sample of each type of graph appears below:





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 B/100).
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 (F = (C x $^{D}/_{E}$)).

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 using the Smart3 BLE Colorimeter gives an over range message then the the sample must be diluted. 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	9.5 mL	20

If volumetric glassware is not available, dilutions can be made with the colorimeter 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.

Interferences due to high concentration of the substance being tested, can be overcome by sample dilution (see page 14)

STRAY LIGHT INTERFERENCE

When scanning samples in 16 mm tubes, such as COD, the sample chamber lid can not be closed. The COD adapter minimizes stray light. To further reduce stray light interference, do not scan sample in direct sunlight.

OPERATION OF THE SMART3 BLE COLORIMETER

OVERVIEW

The Smart3 BLE is a portable, microprocessor controlled, direct reading colorimeter. It has a graphical liquid crystal display and 6 button keypad. These allow the user to select options from the menu driven software, to directly read test results or to review stored results of previous tests in the data logger. The menus can be displayed in eight languages.

The test library consists of over 60 LaMotte tests and 25 “User Tests”. The LaMotte tests are precalibrated for LaMotte reagent systems.The colorimeter displays the result of these tests directly in units of concentration. The 25 “User Tests” may be used to enter additional calibrations. All of these tests may be arranged in any of 3 sequences. These sequences can be modified a limitless number of times to meet changing testing needs.

The optics feature 4 different colored LEDs. Each LED has a corresponding silicon photoiode with an integrated interference filter. The interference filters select a narrow band of light from the corresponding LED for the colorimetric measurements. The microporcessor automatically selects the correct LED/photodiode combination for the test.

A USB wall adapter, USB computer connection or lithium battery powers the Smart3 BLE.

Bluetooth wireless technology allows communication between the colorimeter and the BLE Mobile Printer (Code 5-0067 only) and firmware updates.

COMPONENTS

Figure 1 shows a diagram of the Smart3 BLE Colorimeter and its components.

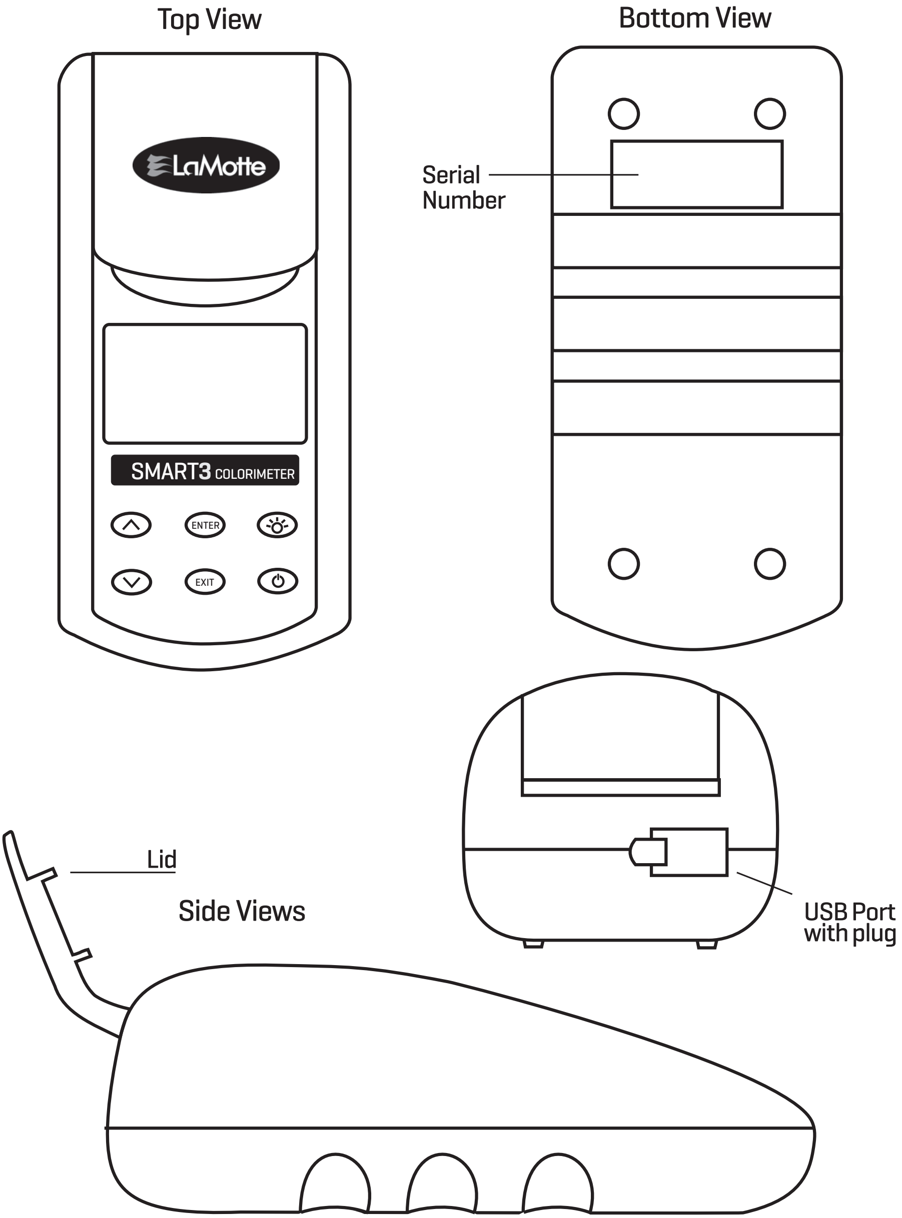


Figure 1

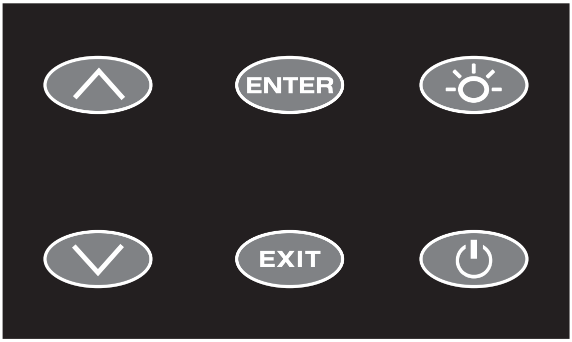
GENERAL OPERATING PROCEDURES

The operation of the Smart3 BLE Colorimeter is controlled by a microprocessor. The microprocessor is programmed with menu driven software. A menu is a list of choices. This allows a selection of various tasks for the colorimeter to perform, such as, scan blank, scan sample, and edit test sequences. The keypad is used to make menu selections which are viewed in the display. There are two selections accessible from the Main Menu: Testing Menu and Setup Menu.

THE KEYPAD

The keypad has 6 buttons which are used to perform specific tasks.

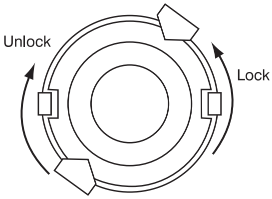
∧	This button will scroll up through a list of menu selections or go to the next character on a character selection line.
ENTER	The button is used to select choices in a menu viewed in the display and to add the selected character to the name and advance one character.
☼	This button controls the backlight on the display.
∨	This button will scroll down through a list of menu selections or go to the previous character selection line.
EXIT	This button exits to the previous menu on the name edit screen, the name will not be saved.
⏻	This button turns the meter on or off.



SAMPLE HOLDERS

The sample chamber is designed for 25 mm round tubes. An adapter to hold 16 mm COD tubes and 10 mm square UDV cuvettes is included. 10 cm cuvettes can be scanned only at 525 nm and 568 nm. The light path is blocked at 428 nm and 635 nm with the use of the adapter. COD tubes can be scanned at all wavelengths.

Position the COD/UDV Adapter (Code 1724) so that the notches in the adapter fit around the posts on the chamber. Turn the adapter counterclockwise until the arrows are at the top and bottom of the chamber and the adapter is locked into place. Turn the adapter clockwise to unlock the adapter and remove it from the chamber.

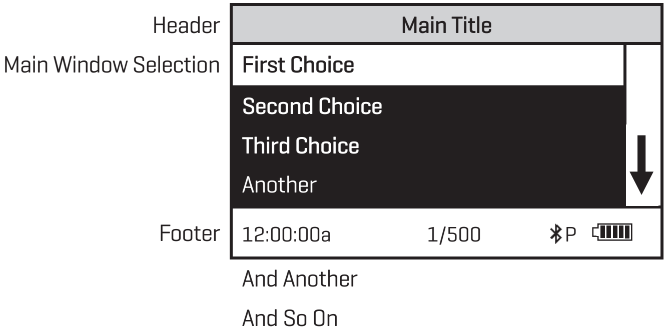


THE DISPLAY & THE MENUS

The display allows menu selections to be viewed and selected. These selections instruct the Smart3 BLE to perform specific tasks. The menus are viewed in the display using two general formats that are followed from one menu to the next. Each menu is a list of choices or selections.

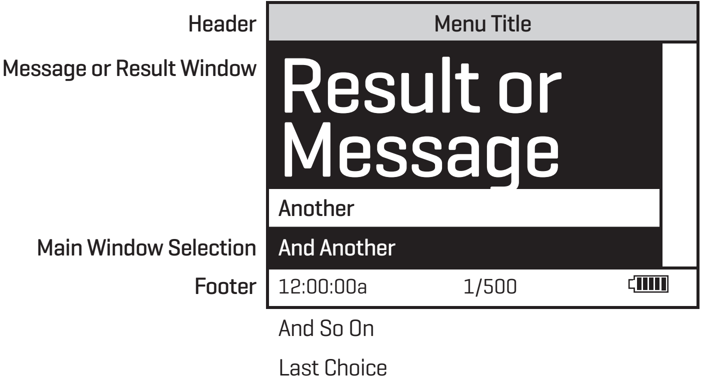
The display has a header line at the top and a footer line at the bottom. The header displays the title of the current menu. The footer line displays the time, the data logger status, the bluetooth/printer status and the battery status. The menu selection window is in the middle of the display between the header and the footer.

The menu selection window displays information in two general formats. In the first format only menu selections are displayed. Up to 4 lines of menu selections may be displayed. If more selections are available they can be viewed by pressing the arrow buttons ▲ ▼ to scroll the other menu selections into the menu selection window. Think of the menu selections as a vertical list in the display that moves up or down each time an arrow button ▲ ▼ is pressed. Some menus in the Smart3 BLE are looping menus. The top and bottom menu choices are connected in a loop. Scrolling down past the bottom of the menu will lead to the top of the menu. Scrolling up past the top of the menu will lead to the bottom of the menu.



A light bar will indicate the menu choice. As the menu is scrolled through, the light bar will highlight different menu choices. Pressing the ENTER button will select the menu choice that is indicated by the light bar.

In the second format the menu choice window takes advantage of the graphical capabilities of the display. Large format graphic information, such as test results or error messages or the LaMotte logo is displayed. The top two lines of the display are used to display information in a large, easy to read format. The menus work in the same way as previously described but two lines of the menu are visible at the bottom of the display.



As described previously, the EXIT 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 pushing the EXIT button. Pushing ⏻ at any time will turn the Smart3 BLE off.

The display may show the following messages:

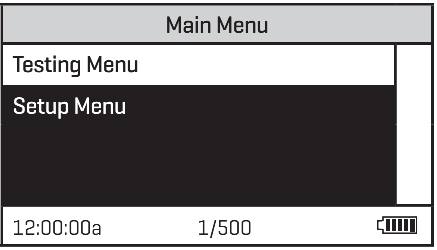
🔋	Battery Status
↑ ↓	More choices are available and can be viewed by scrolling up and/or down through the display.
Header	Identifies the current menu and information on units and reagent systems if applicable.
Footer	In the data logging mode the number of the data point is displayed and the total number of data points in the memory will be shown. The footer also shows current time and battery status.

TESTING

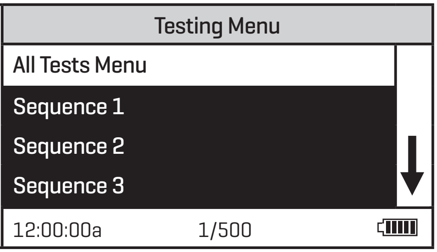
TESTING MENU

The Testing Menu is used to run all LaMotte pre-programmed tests, User Tests and Absorbance tests at one of four wavelengths. Testing from any of three sequences can also be done.

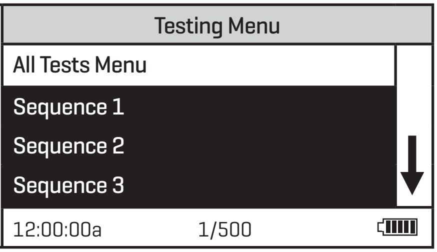
1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.



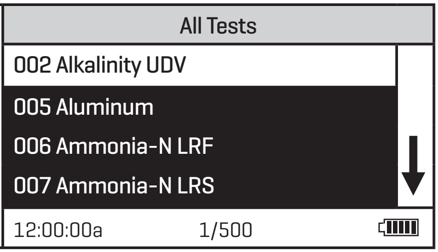
2. Press ENTER to select **Testing Menu**.



3. Press ∧ or ∨ to scroll to desired option. **All Tests** contains all of the available pre-programmed tests. The three sequences have user selected tests. Absorbance has %T/ABS tests.

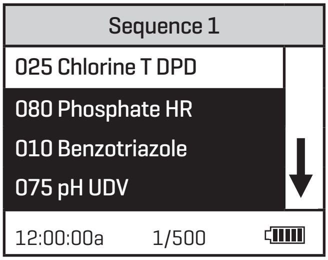


4. Press ENTER to select **All Tests**.

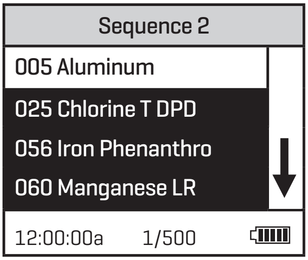


TEST SEQUENCES

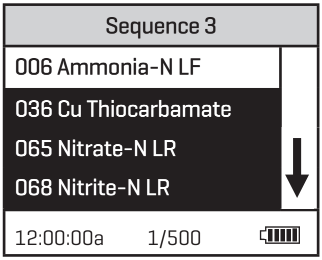
Sequence 1, Sequence 2, And Sequence 3 are alterable sequences. They may be edited using the Setup Menu. Any of the LaMotte pre-programmed tests or User Tests may be placed in these sequences in whatever testing order that is preferred. There are three intial sequences in the Smart3 BLE that can be customized by adding or deleting tests:



063 Molybdenum HR
086 Silica HR
036 Cu Thicarbamate
055 Iron Bipyridyl



065 Nitrate-N LR
068 Nitrite-N LR
079 Phenol
081 Phosphate LR
090 Sulfide LR



075 pH PR
081 Phosphate LR
087 Silica LR

These alterable sequences allow a series of tests to be setup that are run frequently. The order of the individual tests in the sequence can be determined by the user. After running a test, press ENTER to select the next test in the sequence. Continue this pattern until the entire sequence has been completed.

All Tests is a fixed sequence containing the LaMotte pre-programmed tests, User Tests, and Absorbance tests. Modification of the alterable sequences is accomplished through the Setup Menu. This menu is explained in greater detail in Setup Menu (page 28).

Pressing EXIT while in a sequence menu will escape back to the Testing Menu.

Pressing ⏻ the at any time will turn the colorimeter off.

NOTE: A sequence must contain at least one test.

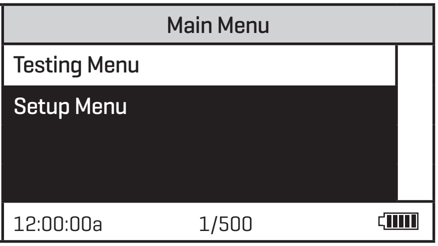
GENERAL TESTING PROCEDURES

The following is a step-by-step example of how to run tests from the Testing Menu. These test procedures are designed to be used with LaMotte SMART Reagent Systems.

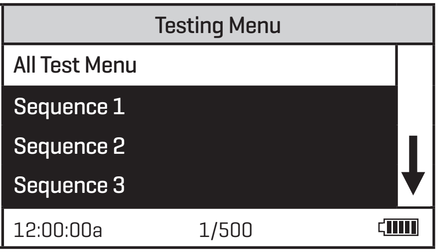
LaMotte Company continuously updates the list of pre-programmed tests as the calibrations become available. Call LaMotte Technical Services at 1-800-344-3100 (410-778-3100 outside the USA) or email at tech@lamotte.com for a current list of available calibrations.

TESTING WITH LaMOTTE PRE-PROGRAMMED TESTS

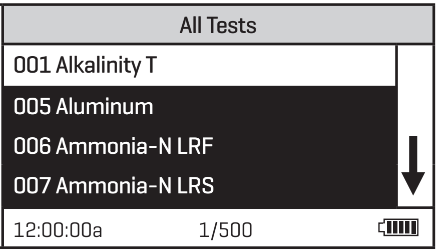
1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.



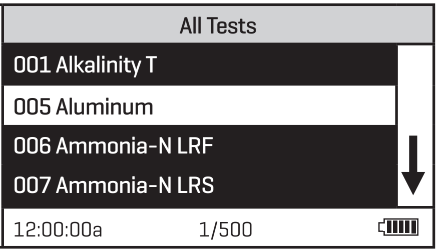
2. Press ENTER to select **Testing Menu**.



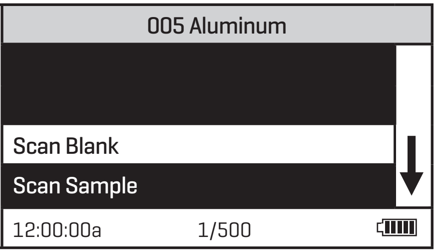
3. Press ENTER to select **All Tests Menu**.



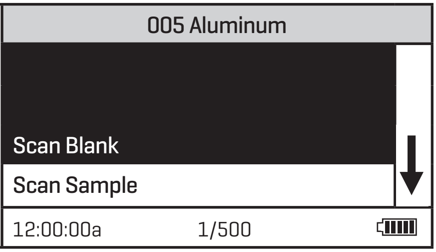
4. Press ∧ or ∨ to scroll to the desired test.



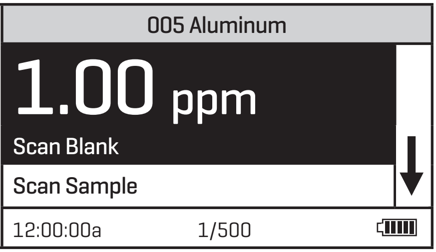
5. Press ENTER to select the test.



6. Insert the blank into the chamber. Close the lid. Press ENTER to scan the blank. The screen wil display **Scan Blank Blank Done** for about 1 second and then return to the test menu.

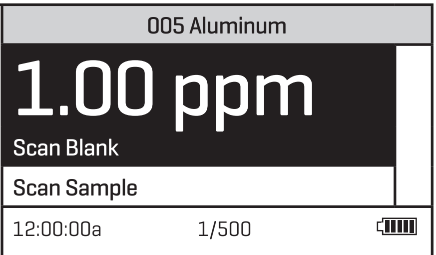


7. Insert the reacted sample into the chamber. Close the lid. Press ENTER to scan the sample. The screen will display **Scan Sample Sample Done** for about 1 second. The result will appear on the screen.



8. To repeat the test, press ENTER to scan the sample again. The last blank scanned is used by the colorimeter for repeated scans. A different blank can be used by pressing ▲ or ▼ to scroll to Scan Blank and then scanning another blank. Scroll with ▲ or ▼ and make another selection with ENTER. The %T or Absorbance of the last test can be viewed by scrolling down and choosing %T/Abs. Press EXIT to escape to previous menus.

   NOTE: The menus loop in this screen so either ▲ or ▼ will lead to the menu selection needed.



To use the Print Test function, see the Bluetooth Menu section (page 48).

CALIBRATING LaMOTTE PRE-PROGRAMMED TESTS

The LaMotte Pre-Programmed Tests have been pre-calibrated. Recalibration of the pre-programmed tests by the user is not possible. However, a procedure to standardize the calibration can be performed to obtain the most accurate readings or to meet regulatory requirements.

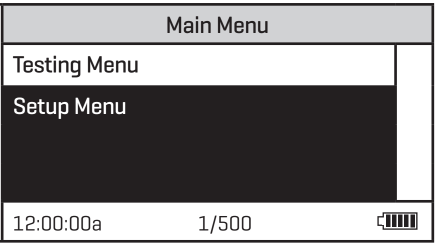
The LaMotte Pre-Programmed tests are standardized with one standard solution. To standardize over the full range of the test, the concentration of the standard should be chosen from the high end of the range. Alternatively, if samples do not cover the full range of the test, a standard should be chosen that is close to the concentration of the samples.

The standardization procedure should be followed as often as required by regulations and laws for compliance monitoring.

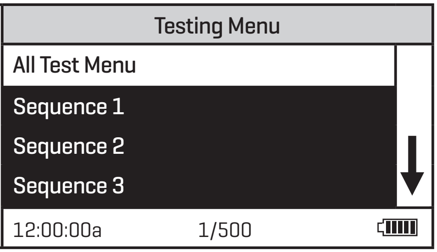
In the example below, the Aluminum calibration will be standardized.

Prepare a standard solution to be tested. In this example, 0.30 ppm aluminum.

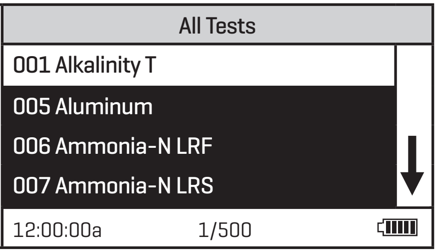
1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.



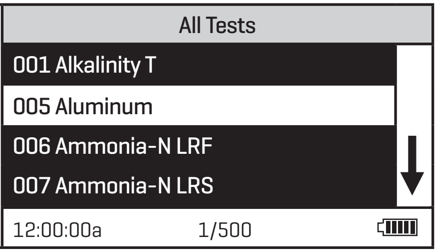
2. Press **ENTER** to select **Testing Menu**.



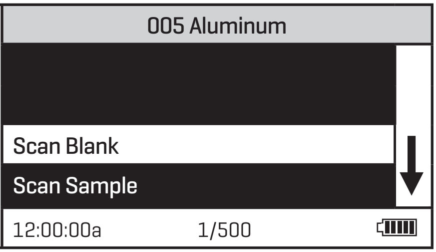
3. Press **ENTER** to select **All Tests Menu**.



4. Press ∧ or ∨ to scroll to the desired test factor.



5. Press ENTER to select the test.



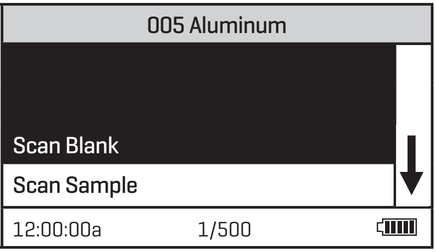
005 Aluminum

Scan Blank

Scan Sample

12:00:00a 1/500

6. Follow the test procedure in the manual to test the prepared standard. Insert the blank into the chamber. Close the lid. Press ENTER to scan the blank. The screen will display **Scan Blank Blank Done** for about 1 second and then return to the **Test Menu**.



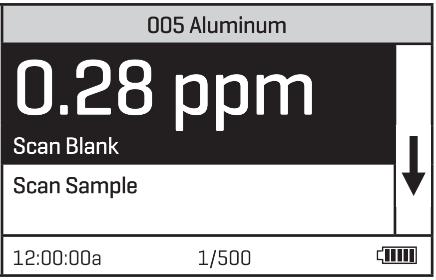
005 Aluminum

Scan Blank

Scan Sample

12:00:00a 1/500

7. Insert the reacted standard solution into the chamber. Close the lid. Press ENTER to scan the sample. The screen will display **Scan Sample Sample Done** for about 1 second. The result will appear on the screen.



005 Aluminum

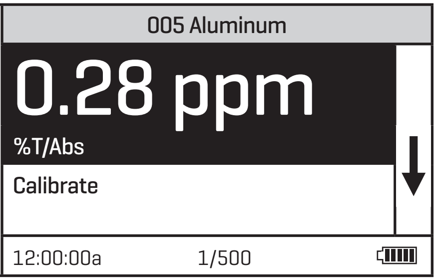
0.28 ppm

Scan Blank

Scan Sample

12:00:00a 1/500

8. The displayed result can now be standardized. Press ∧ or ∨ to scroll to **Calibrate**.



005 Aluminum

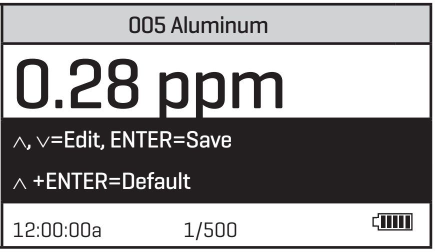
0.28 ppm

%T/Abs

Calibrate

12:00:00a 1/500

9. Press ENTER to select **Calibrate**. A reverse font (light background with dark characters) will appear to indicate that the reading can be adjusted.



005 Aluminum

0.28 ppm

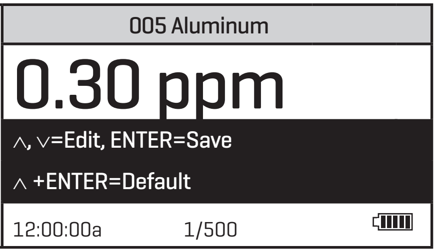
∧, ∨=Edit, ENTER=Save

∧ +ENTER=Default

12:00:00a 1/500

10. Press ▲ or ▼ to adjust the value shown to the concentration of the prepared standard, 0.30 in this example.

    NOTE: A maximum adjustment of 25% is possible.

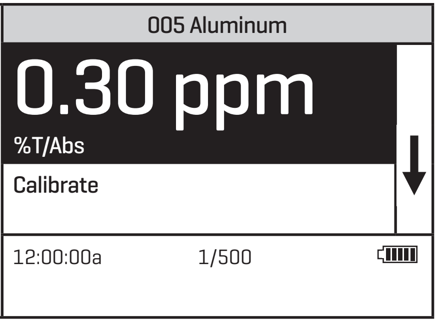


11. Press ENTER to save the value.

    To leave the Calibration procedure without saving the adjustment, press EXIT.

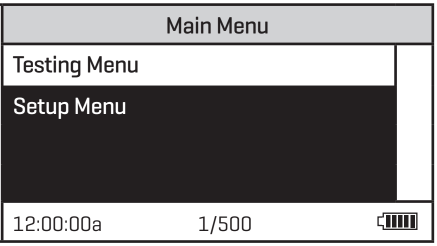
    Press ▲ and ENTER at any time to return to the default value.

    The calibration has now been standardized and can be used for testing. Scroll to **Scan Blank** and begin testing.

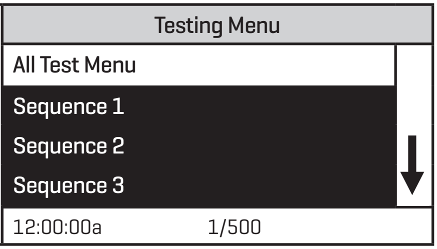


■ MEASURING IN THE ABSORBANCE MODE

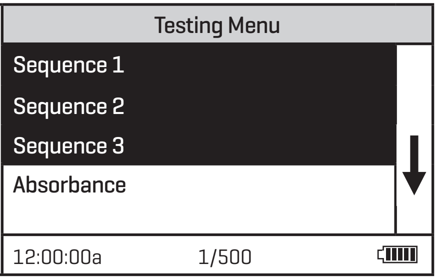
1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.



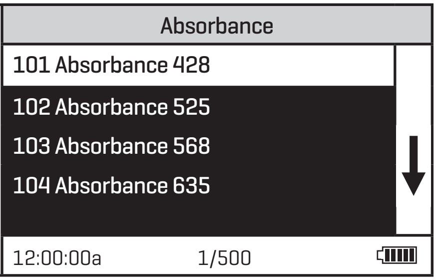
2. Press ENTER to select **Testing Menu**.



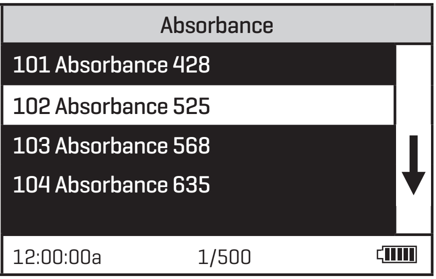
3. Press ▲ or ▼ to scroll to **Absorbance**.



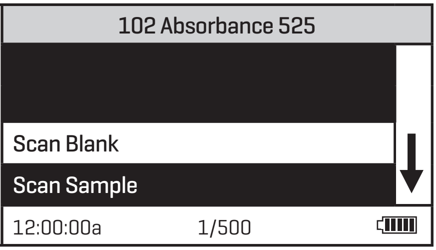
4. Press ENTER to select **Absorbance**.


Absorbance
101 Absorbance 428
102 Absorbance 525
103 Absorbance 568
104 Absorbance 635
12:00:00a 1/500

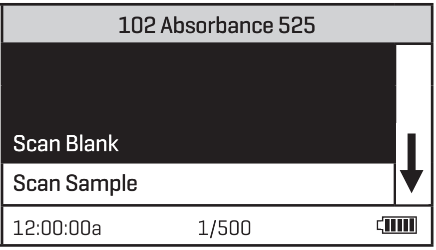
5. Press ∧ or ∨ to scroll to desired wavelength.


Absorbance
101 Absorbance 428
102 Absorbance 525
103 Absorbance 568
104 Absorbance 635
12:00:00a 1/500

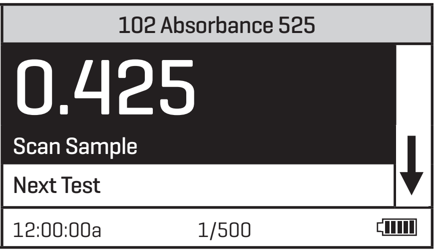
6. Press ENTER to select the wavelength.


102 Absorbance 525
Scan Blank
Scan Sample
12:00:00a 1/500

7. Insert the blank. Close the lid. Press ENTER to scan the blank. The screen wil display **Scan Blank Blank Done** for about 1 second and return to the Absorbance menu.


102 Absorbance 525
Scan Blank
Scan Sample
12:00:00a 1/500

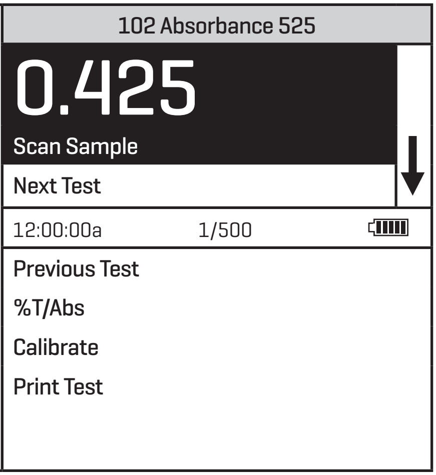
8. Insert the reacted sample. Press ENTER to scan the sample. The screen will display **Scan Sample Sample Done** for about 1 second. The result will appear on the screen.


102 Absorbance 525
0.425
Scan Sample
Next Test
12:00:00a 1/500

9. To repeat the test, scroll to **Scan Sample** and press **ENTER** to scan the sample again. The last blank scanned is used by the colorimeter for repeated scans. A different blank can be used by pressing ▲ or ▼ to scroll to **Scan Blank** and then scanning another blank. Scroll with ▲ or ▼ and make another selection with **ENTER**. The %T or Absorbance of the last test can be viewed by choosing %T/Abs. Press **EXIT** to escape to previous menus.

   NOTE: The menus loop in this screen so either ▲ or ▼ will lead to the menu selection needed.

   NOTE: The calibrate function does not work in the Absorbance mode.



102 Absorbance 525

0.425

Scan Sample

Next Test

12:00:00a 1/500

Previous Test

%T/Abs

Calibrate

Print Test

SETUP MENU

The Setup Menu allows the user to edit sequences, edit user tests, set the clock, edit the logging function, access factory setting, set the power saving function, set the backlight time, select a language, and select the Bluetooth Settings.

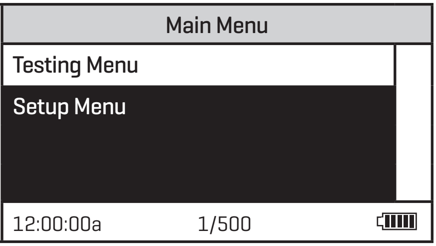
The default factory settings are:

Logging	Enabled
Power Save	5 minutes
Backlight Time	10 seconds
Language	English
Bluetooth Power	Disabled
Bluetooth Timeout	15 min
Looping Menu	Enabled

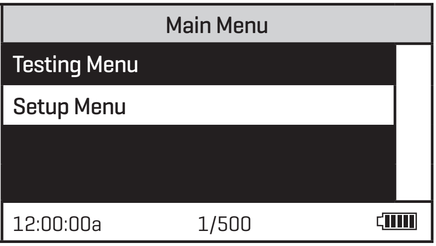
■ EDITING A SEQUENCE

The Edit Sequence menu allows three alterable test sequences (Sequence 1, Sequence 2, Sequence 3) to be edited.

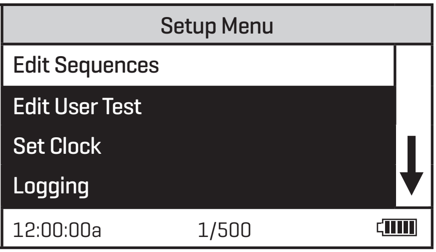
1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.



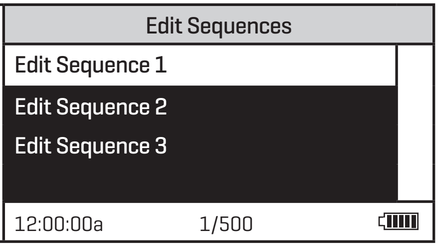
2. Press ⌃ or ⌄ to scroll to the **Setup Menu**.



3. Press ENTER to select **Setup Menu**.

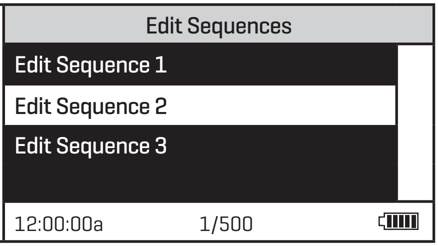


4. Press ENTER to select **Edit Sequences**.



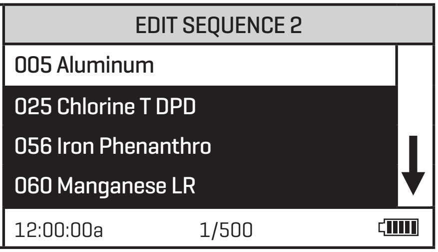
Edit Sequences
Edit Sequence 1
Edit Sequence 2
Edit Sequence 3
12:00:00a 1/500

5. Press ▲ or ▼ to scroll to the desired sequence.



Edit Sequences
Edit Sequence 1
Edit Sequence 2
Edit Sequence 3
12:00:00a 1/500

6. Press ENTER to select the sequence to be edited.



EDIT SEQUENCE 2
005 Aluminum
025 Chlorine T DPD
056 Iron Phenanthro
060 Manganese LR
↓
12:00:00a 1/500

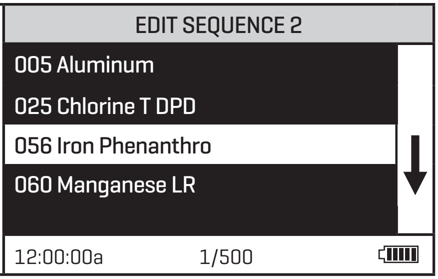
ADDING OR DELETING A TEST

There are three ways to alter a sequence: Insert Before, Insert After, and Delete. Insert Before adds a new test to the sequence before the selected test. Insert After adds a new test to the sequence after the selected test. Delete is used to remove an existing test from a sequence.

ADDING A TEST

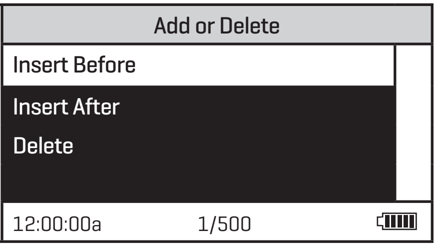
Below is a step-by-step example of how to add a test to SEQUENCE 2 starting from the EDIT SEQUENCE 2 menu.

1. To add a test before or after an existing test, press ▲ or ▼ to scroll to the existing test.

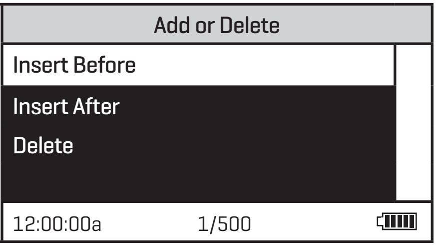


EDIT SEQUENCE 2
005 Aluminum
025 Chlorine T DPD
056 Iron Phenanthro
060 Manganese LR
↓
12:00:00a 1/500

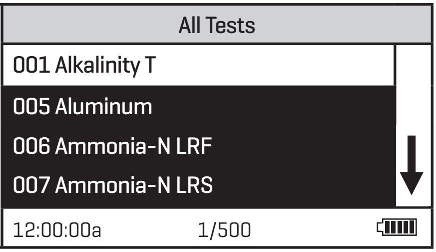
2. Press **ENTER** to select the existing test.



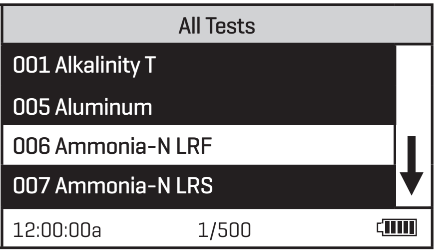
3. Press ▲ or ▼ to scroll to **Insert Before** or **Insert After**.



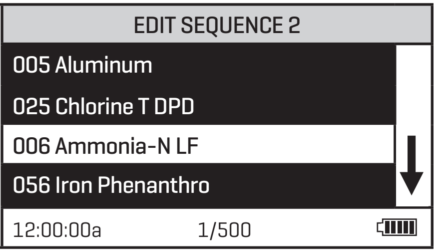
4. Press **ENTER** to select the option, **Insert Before**, in this example. The **All Test Menu** will appear.



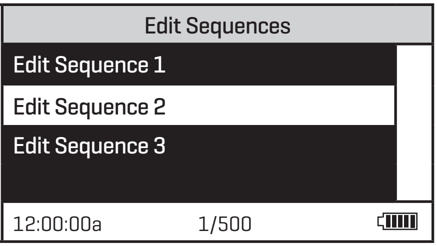
5. Press ▲ or ▼ to scroll to the test that will be added to the sequence. In this example, 006 Ammonia-N LRS.



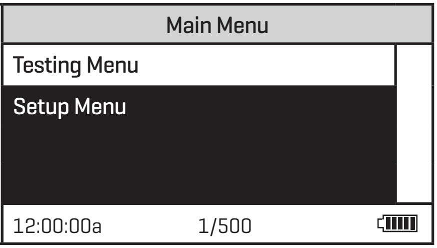
6. Press **ENTER** to select the test. The sequence will appear in the Edit Sequence menu and the new test will be added to the sequence. All changes in the sequence will be automatically saved.



7. Press EXIT to exit the **Edit Sequence** menu and return to the **Editing Sequences Menu**.



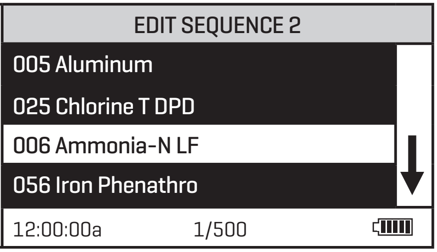
8. Press ENTER to select **Edit Sequences** to continue editing the sequences or press EXIT twice to return to the **Main Menu**.



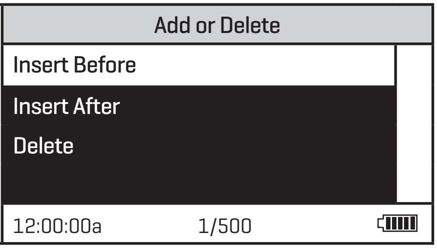
DELETING A TEST

Below is a step-by-step example of how to delete a test in SEQUENCE 2 starting from the EDIT SEQUENCE 2 menu.

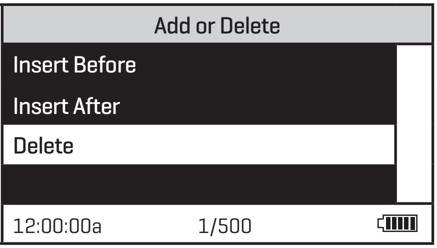
1. To delete a test, press ▲ or ▼ to scroll to the test in the sequence.



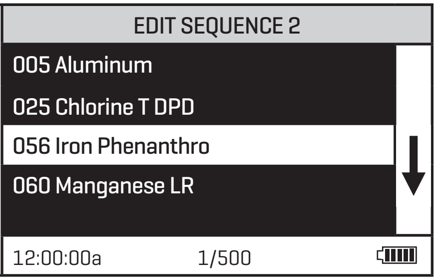
2. Press ENTER to select the test.



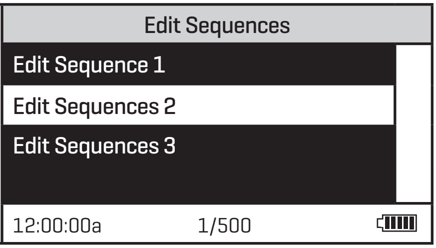
3. Press ▲ or ▼ to scroll to **Delete**.



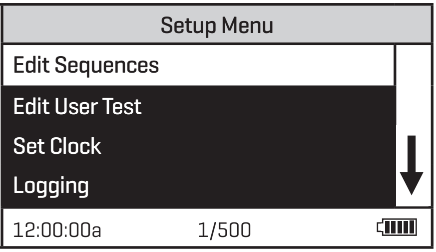
4. Press ENTER to select **Delete**. The sequence will appear in the **Edit Sequences** menu and the selected test will have been deleted. All changes to the sequence will automatically have been saved.



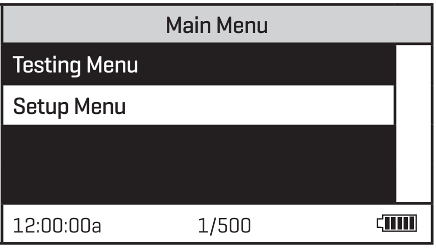
5. Press EXIT to exit the **Edit Sequence** menu and return to the **Edit Sequences Menu**.



6. Press EXIT to exit the **Edit Sequences** menu and return to the **Setup Menu**.



7. Press ENTER to select **Edit Sequences** to continue editing the sequences or press EXIT to return to the **Main Menu**.



■ EDIT USER TESTS

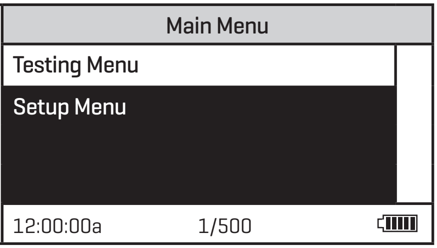
If a test other than the LaMotte programmed tests is performed regularly, a calibration for it may be entered in one of the 25 User Tests. These tests are originally named “User Test 1 - 25”. It will be possible to rename the test, select a wavelength, enter a new calibration, select the number of decimal places used to display the results, and select the units. A User Test may be added for a reagent system for which no precalibrated test exists. A calibration of a LaMotte reagent system may also be entered. The calibration of a User Test can be changed at any time.

The User Tests have the ability to handle 2 data points. The colorimeter will determine the absorbance of the standards and calculate a response that will be stored to determine the concentration of future samples of unknown concentration. These standards should cover all the concentrations for the range of the test being performed and be scanned beginning with the low concentration and finishing with the high concentration (for more information about this, see CALIBRATION CURVES, page 12). Prepare these standards prior to entering a new calibration.

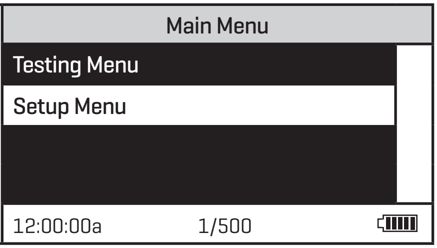
NOTE: A calibration procedure must be performed before using any of the User Tests.

The User Tests can be placed in any of the alterable sequences using Edit Sequences.

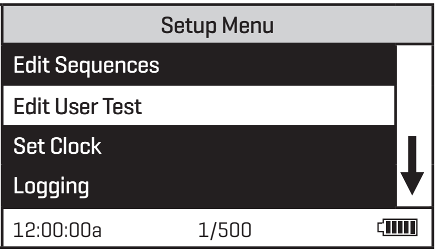
1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.



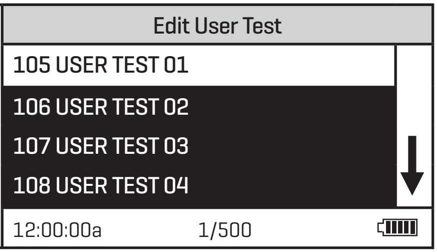
2. Press ▲ or ▼ to scroll to the **Setup Menu**.



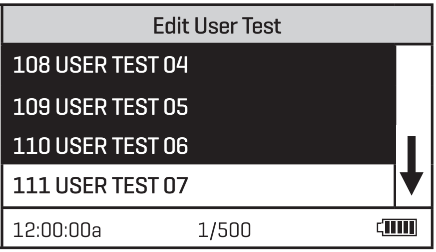
3. Press ENTER to select **Setup Menu**. Press ▼ to scroll to **Edit User Test**.



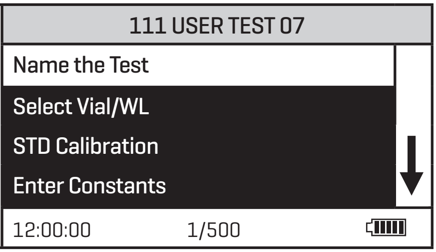
4. Press ENTER to select **Edit User Test**.



5. Press ▲ or ▼ to scroll to the desired user test.



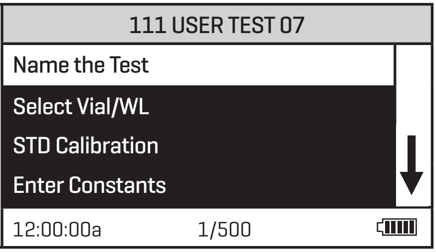
6. Press ENTER to select the **User Test**.



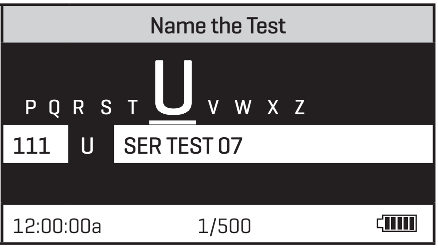
■ NAMING THE TEST

A User Test can be up to 16 characters long. The menu choices for each character are 26 upper case letters A to Z, 26 lower case letters a to z, ten numerals 0 to 9, a space, a dash (-) and a decimal point (.). The existing name is displayed on the bottom line of the display. The character which is to be edited will blink and that character is also displayed in the center of the display. The character can be changed by using ▲ or ▼ to scroll to other characters. Use ENTER to select a character. The edited name is saved at any time by pressing EXIT or by pressing ENTER after selecting the sixteenth character.

1. From the User Test menu, press ▼ to scroll to **Name the Test**.

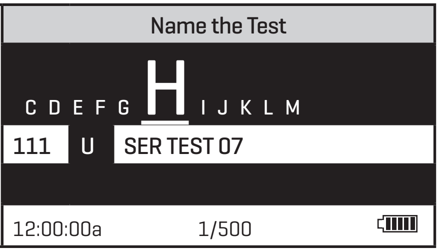


2. Press ENTER to select **Name the Test**. A blinking reverse font (dark background with a light character) will appear to indicate the character that will be adjusted. The same character will also appear in the center of the display.



3. Press ▲ or ▼ to scroll to the desired character. In this example, the test name will be H2O.

   The character for a blank space is located after the lower case z.



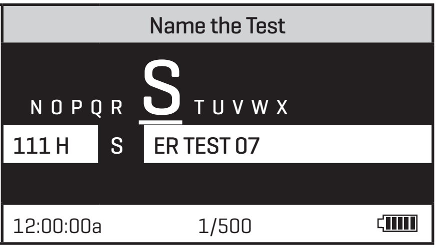
Name the Test

C D E F G H I J K L M

111 U SER TEST 07

12:00:00a 1/500

4. Press ENTER to save the character and move to the next character.



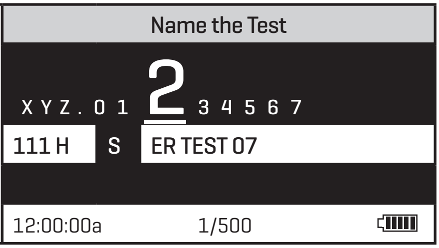
Name the Test

N O P Q R S T U V W X

111 H S ER TEST 07

12:00:00a 1/500

5. Press ▲ or ▼ to scroll to the desired character.



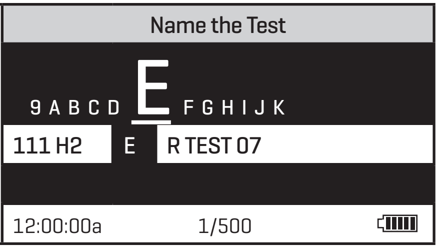
Name the Test

X Y Z . 0 1 2 3 4 5 6 7

111 H S ER TEST 07

12:00:00a 1/500

6. Press ENTER to save the character and move to the next character.



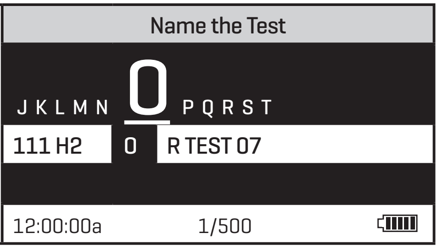
Name the Test

9 A B C D E F G H I J K

111 H2 E R TEST 07

12:00:00a 1/500

7. Press ▲ or ▼ to scroll to the desired character.



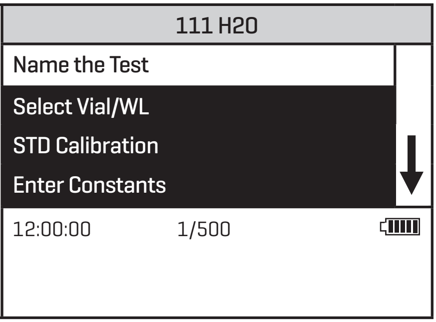
Name the Test

J K L M N O P Q R S T

111 H2 O R TEST 07

12:00:00a 1/500

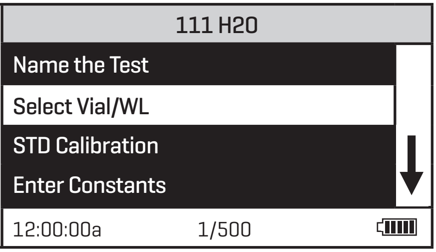
8. Press ENTER to save the character. Repeat the procedure until the test name is complete.
After selecting the last character in the name:
Hold down ▼ and press and release ENTER to save all selected characters and to delete all characters to the right of the cursor and exit the name edit screen.
Hold down ▲ and press and release ENTER to save all remaining characters and exit the name edit screen.
The meter will return to the **Edit Test** menu.



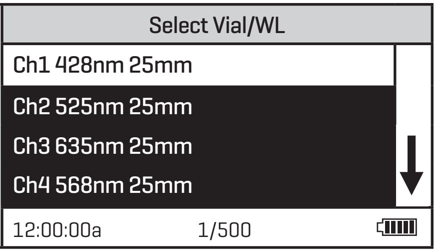
SELECT THE VIAL AND WAVELENGTH

The Smart3 BLE Colorimeter accepts three different vials (the 25 mm 0290 tube, UDVs and COD tubes) at 4 different wavelengths (428, 525, 560, and 635 nm). The colorimeter uses different settings for each of the twelve combinations of vial and wavelength.

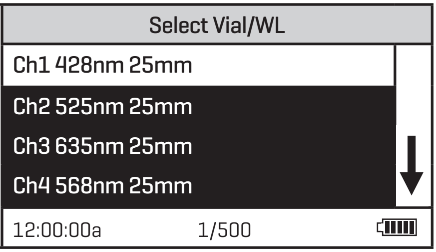
1. From the User Test menu, press ▲ or ▼ to scroll to **Select Vial/WL**.



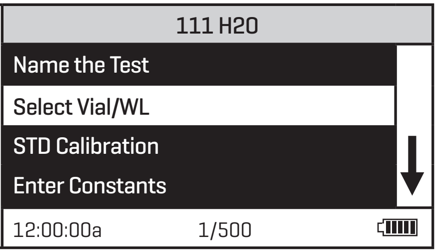
2. Press ENTER to select **Select Vial/WL**.



3. Press ▲ or ▼ to scroll to the channel with the desired wavelength and vial size combination. The screen will display **Storing...** for about 1 second and the meter will return to the **User Test** menu.



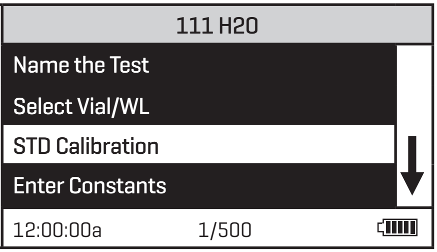
4. Press ENTER to select the Vial/WL option. The screen will display **Storing...** for about 1 second and the meter will return to the **Edit Test** menu.



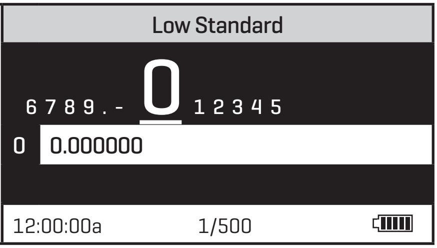
ENTERING A TWO POINT CALIBRATION

The Smart3 BLE Colorimeter can scan two reacted standards and create a calibration curve. To create a calibration curve with multiple data points see Entering a Multiple Point Calibration Curve (pg. 48).

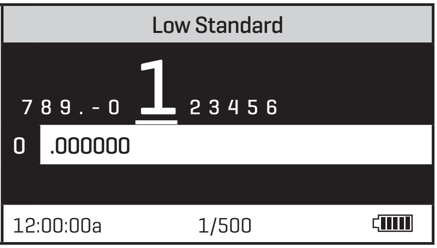
1. From the User Test menu, press ▲ or ▼ to scroll to STD (Standard) Calibration.



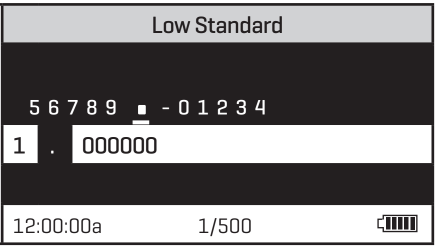
2. Press ENTER to select STD Calibration. The values for the standards will be entered. The screen will display the **Low Standard** screen. A blinking reverse font (dark background with a light character) will appear to indicate the character that will be adjusted. The same character will also appear in the center of the display.



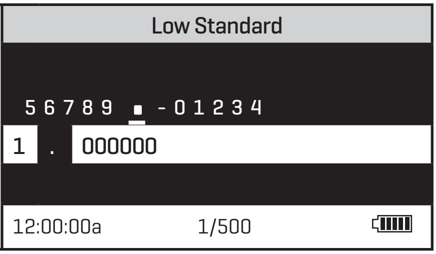
3. Press ▲ or ▼ to scroll to the first character of the low concentration. In this example, 1.00 ppm.



4. Press ENTER to save the character and move to the next character.



5. Press ▲ or ▼ to scroll to the desired character.



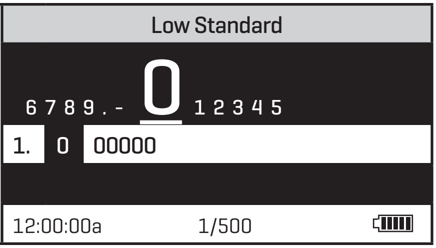
Low Standard

56789 ▪ -01234

1 . 000000

12:00:00a 1/500

6. Press ENTER to save the character and move to the next character.



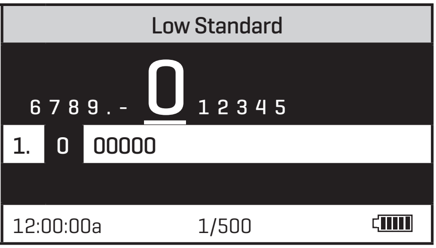
Low Standard

6789.- 0 12345

1. 0 00000

12:00:00a 1/500

7. Press ▲ or ▼ to scroll to the desired character.



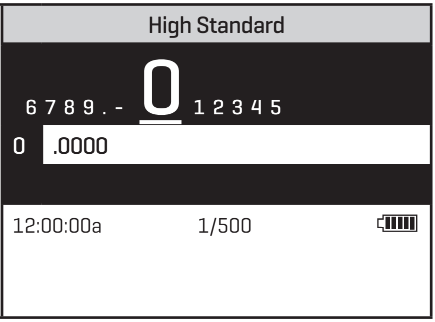
Low Standard

6789.- 0 12345

1. 0 00000

12:00:00a 1/500

8. Press ENTER to save the character. Repeat the procedure until the low concentration value is complete. (the character for a blank space is located after the 9.) After the final character is complete the meter will save the low concentration value. The screen will display the **High Standard** screen. A blinking reverse font (dark background with a light character) will appear to indicate the character that will be adjusted. The same character will appear in the center of the display.



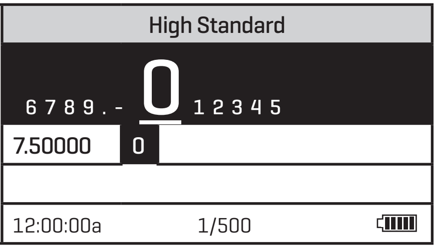
High Standard

6789.- 0 12345

0 .0000

12:00:00a 1/500

9. Use ▲ or ▼ and ENTER to select the characters for the high concentration value. In this example, 7.5 ppm.



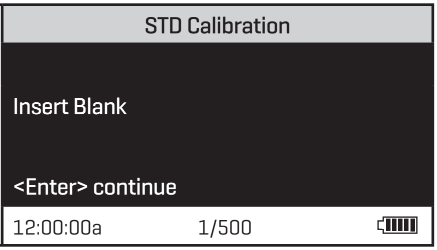
High Standard

6789.- 0 12345

7.50000 0

12:00:00a 1/500

10. After the final character is entered the meter will save the high concentration value. The screen will display instructions for completing the calibration procedure.



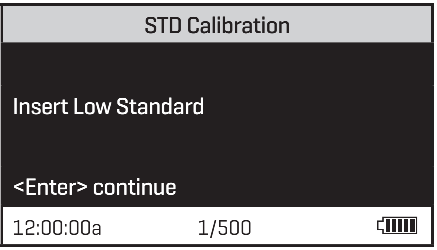
STD Calibration

Insert Blank

<Enter> continue

12:00:00a 1/500

11. The standards wil be scanned. Insert the blank. Press ENTER and the **Insert Low Standard** screen will appear.



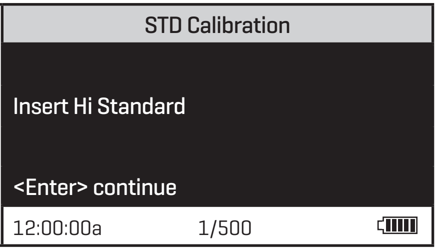
STD Calibration

Insert Low Standard

<Enter> continue

12:00:00a 1/500

12. Insert the low standard.
Press ENTER. The **Insert Hi Standard** screen will be displayed.



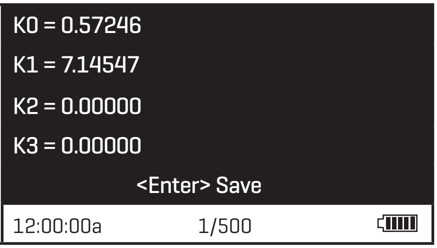
STD Calibration

Insert Hi Standard

<Enter> continue

12:00:00a 1/500

13. Insert the high standard. Press ENTER. The meter will display the constants for the calibration curve.

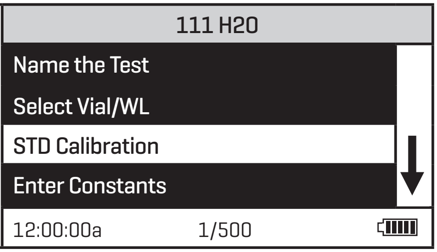


K0 = 0.57246
K1 = 7.14547
K2 = 0.00000
K3 = 0.00000

<Enter> Save

12:00:00a 1/500

14. Press ENTER to save the calibration curve and return to the **Edit User Test Menu**.



111 H20

Name the Test
Select Vial/WL
STD Calibration
Enter Constants

12:00:00a 1/500

ENTERING A MULTIPLE POINT CALIBRATION

The Smart3 BLE can directly create a 2 point calibration curve. (See Entering a Two Point Calibration on page 37). To create a multiple point calibration curve, constants obtained from a linear regression of multiple data points can be entered into the Smart3 BLE.

1. Scan reactions of multiple concentrations at the appropriate wavelength in the absorbance mode on the Smart3 BLE.
2. Plot the concentration (y axis) versus absorbance (x axis) in a program capable of linear regression such as Excel.
3. Enter the constants obtained from the linear regression equation into the Smart3 BLE.

For Example:

$y = 0.001x^3 - 0.017x^2 + 0.181x - 0.049$

$K0 = -0.049$

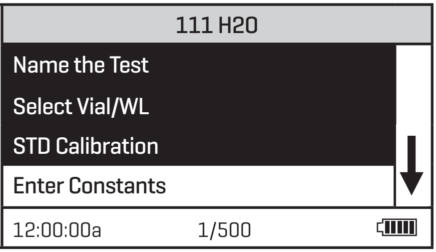
$K1 = 0.181$

$K2 = -0.017$

$K3 = 0.001$

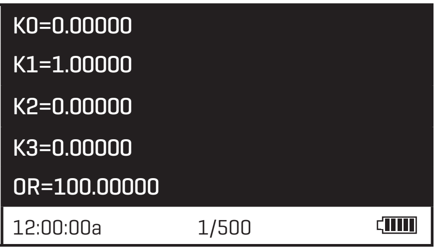
OR (Over Range) = 10

1. From the User Test menu, press ▲ or ▼ to scroll to **Enter Constants**.



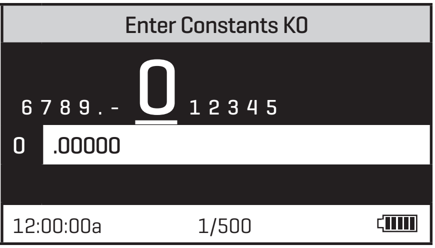
111 H2O
Name the Test
Select Vial/WL
STD Calibration
Enter Constants
12:00:00a 1/500

2. Press ENTER to select **Enter Constants**.



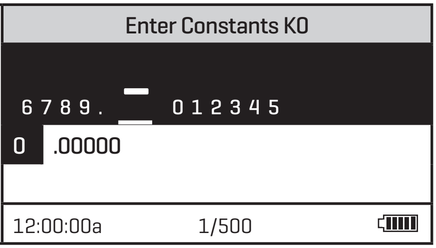
K0=0.00000
K1=1.00000
K2=0.00000
K3=0.00000
OR=100.00000
12:00:00a 1/500

3. Press ENTER to begin entering the values for the constants. A reverse font (dark background with a light character) will appear to indicate the character that will be adjusted. The same character will also appear in the center of the display.



Enter Constants K0
6 7 8 9 . - 0 1 2 3 4 5
0 .00000
12:00:00a 1/500

4. Press ▲ or ▼ to scroll to the first character of K0. In this example, – 0.049.



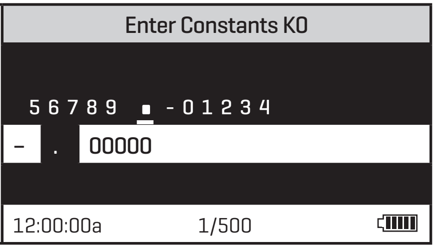
Enter Constants K0

6789.–012345

0 .00000

12:00:00a 1/500

5. Press ENTER to save the character and move to the next character.



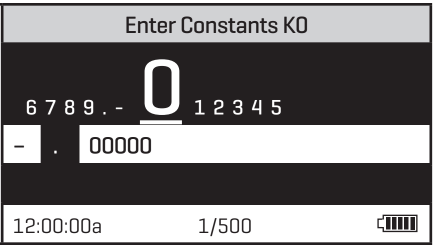
Enter Constants K0

56789 ▪ -01234

– . 00000

12:00:00a 1/500

6. Press ▲ or ▼ to scroll to the next character.



Enter Constants K0

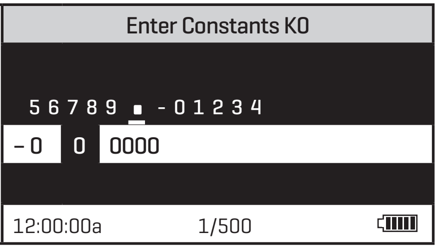
6789.-0 12345

– . 00000

12:00:00a 1/500

7. Press ENTER to save the character and move to the next character. Press ▲ or ▼ to scroll to the next character.

   Note: The character for a blank space is located after the 9.



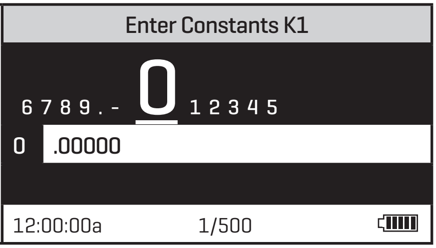
Enter Constants K0

56789 ▪ -01234

– 0 0 0000

12:00:00a 1/500

8. Press ENTER to save the character. Repeat the procedure until the K0 value is complete. After the final character is complete the meter will save the K0 value and the meter will display K1 screen.



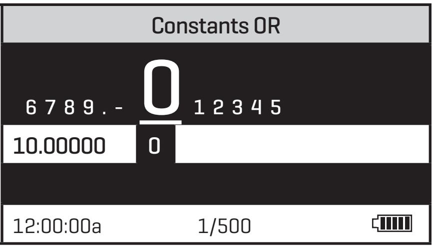
Enter Constants K1

6789.-0 12345

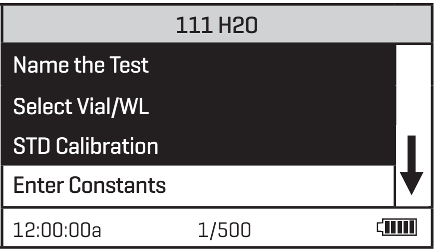
0 .00000

12:00:00a 1/500

9. Use ▲, ▼ and ENTER to select the characters for the remaining values: K1, K2, K3, and over range. In this example, 10 ppm.



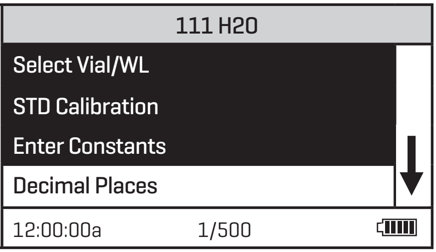
10. After the final character is entered the meter will save the constants. The screen will display **Storing...** and return to the **Edit Test** menu.



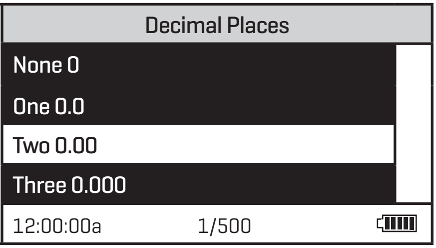
■ SELECTING THE NUMERICAL FORMAT OF THE RESULT

To input tests with very different ranges, the number of decimal places displayed for a result can be selected. A test which ranges from 20 to 1000 ppm should not be displayed with three decimal places. A test with a range from 0.010 to 0.500 needs three decimal places (the microprocessor will always calculate the concentration to many more significant figures than will be displayed). The choice of 0, 1, 2, or 3 decimal places are available.

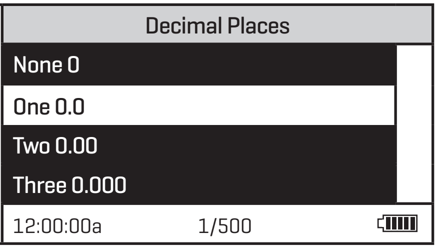
1. From the User Test menu, press ▲ or ▼ to scroll to **Decimal Places**.



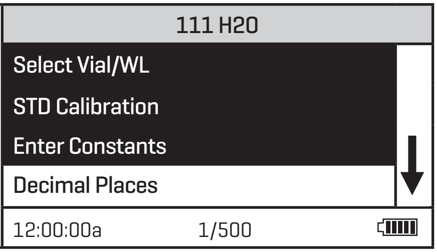
2. Press ENTER to select **Decimal Places**.



3. Press ▲ or ▼ to scroll to the desired number of decimal places.



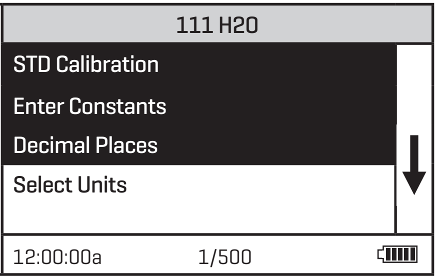
4. Press ENTER to select the decimal places. The screen wil display **Storing...** for about 1 second and the meter will return to the **Edit Test** menu.



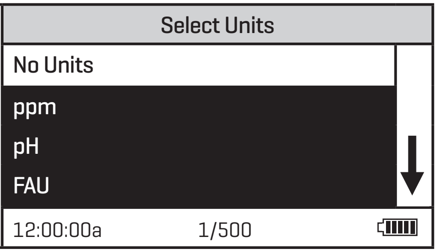
SELECTING THE UNITS OF CONCENTRATION

The Smart3 BLE Colorimeter has seven options for units of concentration. They are No Units, ppm, pH, FAU, ppb, ppt and mgL.

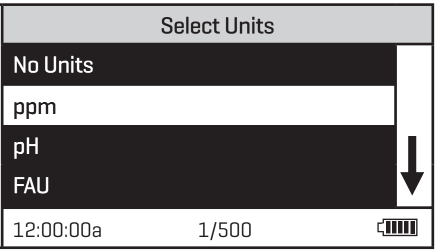
1. From the User Menu, press ▲ to scroll to **Select Units**.



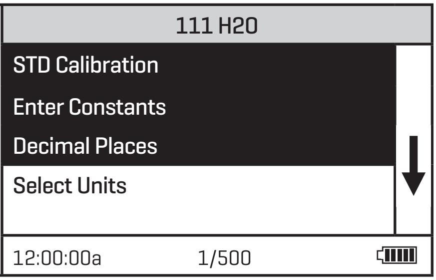
2. Press ENTER to select **Select Units**.



3. Press ▲ or ▼ to scroll to the desired units.



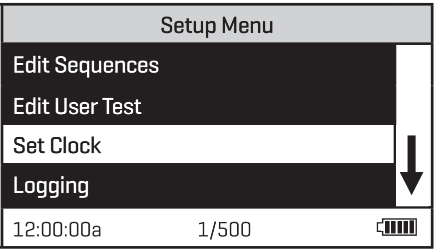
4. Press **ENTER** to select the units. The screen will display **Storing...** for about 1 second and the meter will return to the **Edit Test** menu.



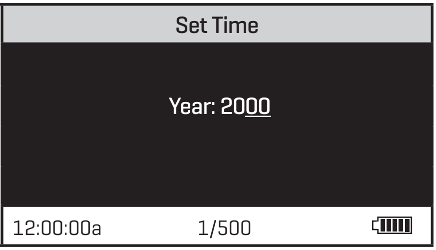
SETTING THE CLOCK

Setting the clock allows the correct time and date stamp to be stored with each reading in the data logger.

1. From the **Setup Menu**, press ▲ or ▼ to scroll to **Set Clock**.

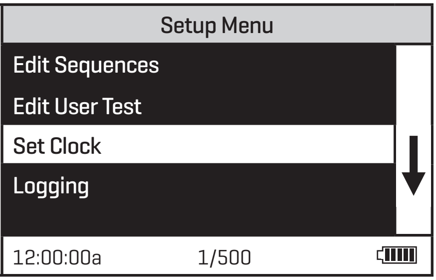


2. Press **ENTER** to select **Set Clock**. The year is displayed. Press ▲ or ▼ to scroll to the appropriate character. Press **ENTER** to select the character. The month, day, hour, format hour, minute, second, AM/PM will be displayed. Repeat for each.



Year: 2000

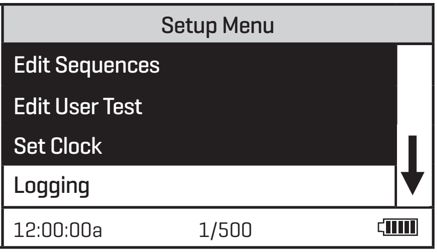
3. Press **ENTER** to select the final character. The time and date will be saved and the meter will return to the **Setup Menu**.



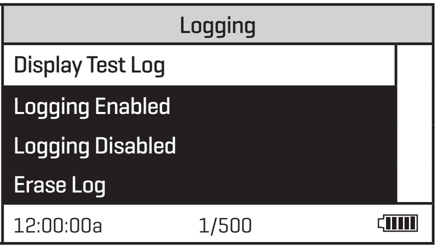
LOGGING DATA

The default setting for the data logger is enabled. The meter will log the last 500 data points. The counter in the center bottom of the display will show how many data points have been logged. The display will show 500+ when the data logger has exceeded 500 points and the data points are being overwritten.

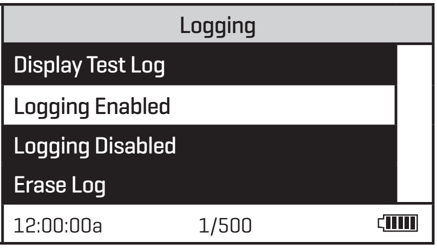
1. From the **Setup Menu**, press ▲ or ▼ to scroll to **Logging**.



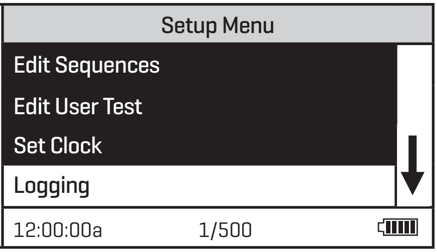
2. Press ENTER to select **Logging**.



3. Press ▲ or ▼ to scroll to desired function.



4. Press ENTER. The screen will display **Storing...** for about 1 second and return to the **Setup Menu**.



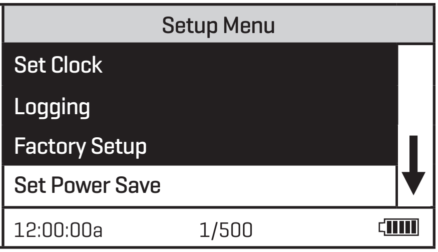
FACTORY SETUP

The Factory Setup menu is used in manufacturing of the Smart3 BLE Colorimeter. This menu is not for use by the operator in the field.

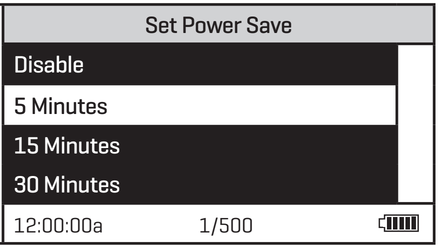
SETTING POWER SAVE

The power saving Auto Shutoff feature will turn the meter off when a button has not been pushed for a set amount of time. The default setting is disabled. To change the setting:

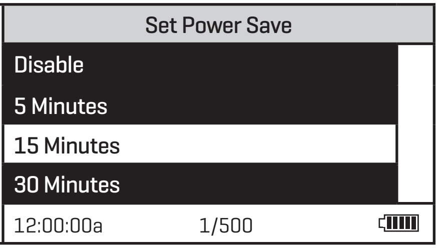
1. From the **Setup Menu**, press ▲ or ▼ to scroll to **Set Power Save**.



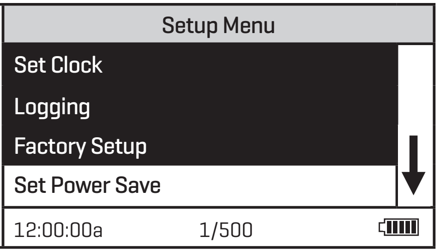
2. Press ENTER to select **Set Power Save**.



3. Press ▲ or ▼ to scroll to desired function.



4. Press ENTER. The screen will display **Storing....** for about 1 second and the meter will retun to the **Setup Menu**.

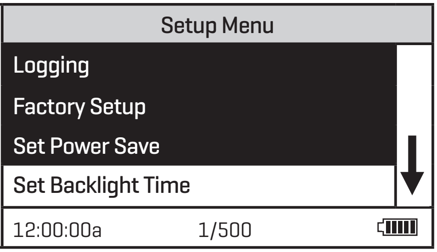


SETTING THE BACKLIGHT TIME

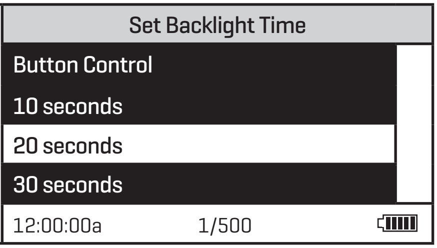
The backlight illuminates the display for enhanced viewing. The default setting is 10 seconds. If Button Control is chosen the backlight button on the key pad will act as an on/off switch and the backlight will remain on or off when the meter is being used. When one of the other settings – 10, 20 or 30 seconds – is chosen, the display will be illuminated for the specified amount of time after any button is pressed.

NOTE: The backlight feature uses a significant amount of power. The longer the backlight is on, the more frequently the battery will have to be charged if the USB/Wall Adapter is not being used.

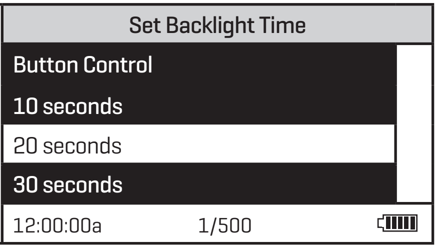
1. From the **Setup Menu**, press ▲ or ▼ to scroll to **Backlight Time**.



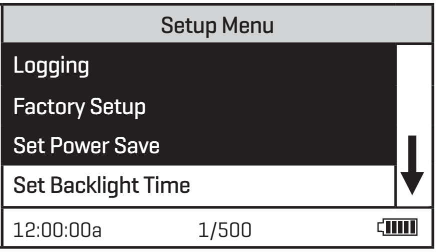
2. Press ENTER to select **Set Backlight Time**.



3. Press ▲ or ▼ to scroll to desired option.



4. Press ENTER. The screen will display **Storing...** for about 1 second and the meter will return to the **Setup Menu**.



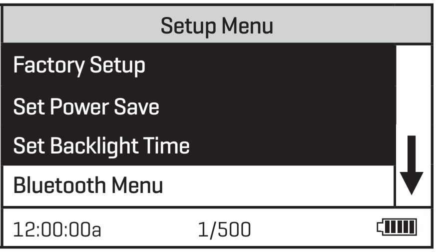
BLUETOOTH MENU

Enabling Bluetooth Power

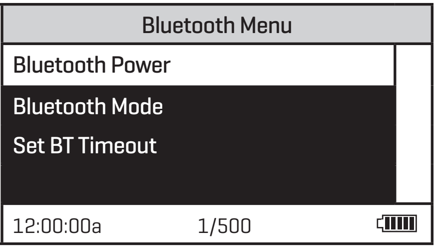
Bluetooth wireless technology allows communication between the colorimeter and a BLE Mobile Printer (Code 5-0067 only). Bluetooth Power must be enabled to use the BLE Mobile Printer (Code 5-0067). When Bluetooth Power is enabled, the Bluetooth icon will flash next to the battery icon on the bottom line of the display.

If the Bluetooth feature is not being used to connect to the printer, Bluetooth Power should be disabled to conserve the battery life. The default Bluetooth Power setting is disabled.

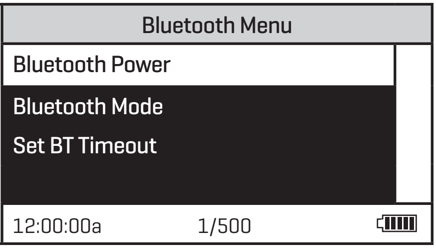
1. From the **Setup Menu**, press ▲ or ▼ to scroll to **Bluetooth Menu**.



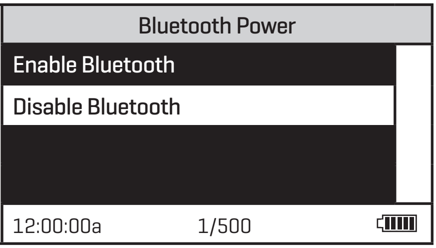
2. Press ENTER to select **Bluetooth Menu**.



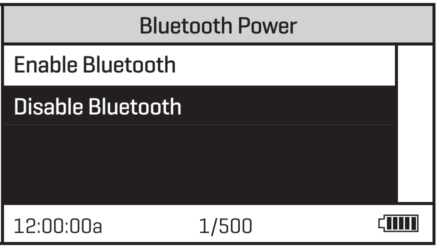
3. Press ▲ or ▼ to scroll to **Bluetooth Power**.



4. Press ENTER to select **Bluetooth Power**.



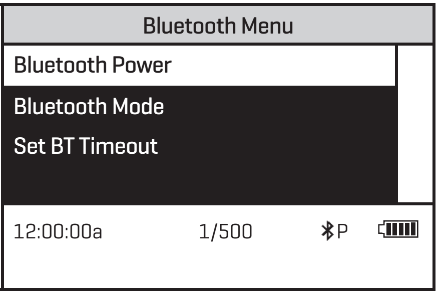
5. Press ▲ or ▼ to scroll to desired option.



6. Press ENTER to select the option.
Bluetooth Power must be enabled to use the BLE Mobile Printer (Code 5-0067).

The screen will display **Storing...** for about 1 second and the meter will return to the **Bluetooth Menu**.

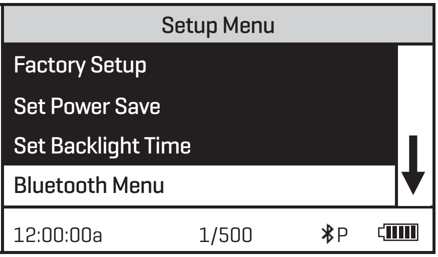
A flashing ᛒP symbol will indicate that Bluetooth is enabled.



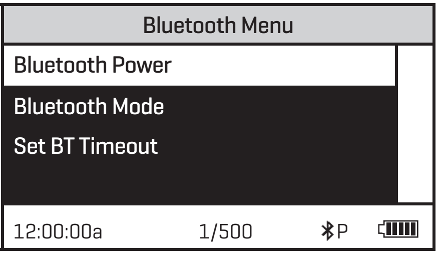
Setting The Bluetooth Mode

A Bluetooth connection is available only for the BLE Mobile Printer (Code 5-0067).

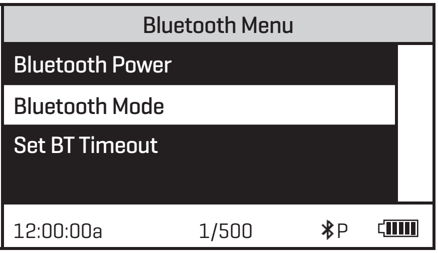
1. From the **Setup Menu**, press ▲ or ▼ to scroll to **Bluetooth Menu**.



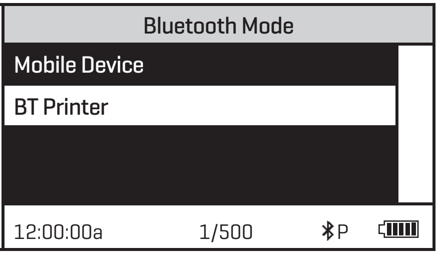
2. Press ENTER to select **Bluetooth Menu**.



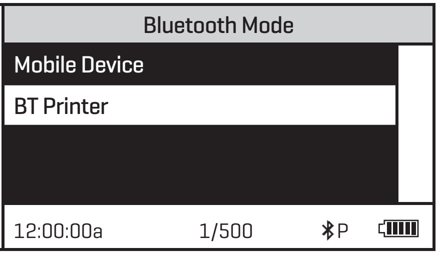
3. Press ▲ or ▼ to scroll to **Bluetooth Mode**.



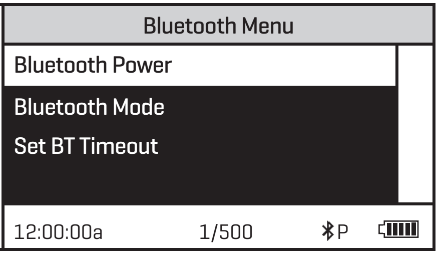
4. Press ENTER to select **Bluetooth Mode**.



5. Press ▲ or ▼ to scroll to **BT Printer**.



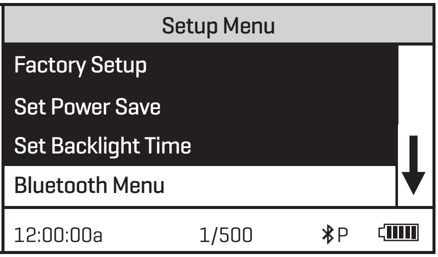
6. Press ENTER . The screen will display **Storing... BT Setup...** for about 1 second and the meter will return to the **Bluetooth Menu**.



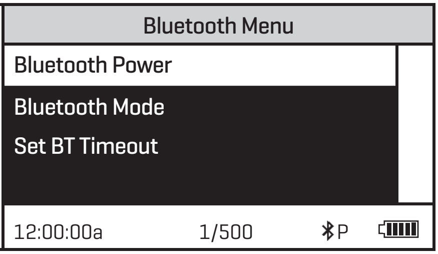
Setup Bluetooth Printing

A Bluetooth connection is available for the BLE Mobile Printer (Code 5-0067).

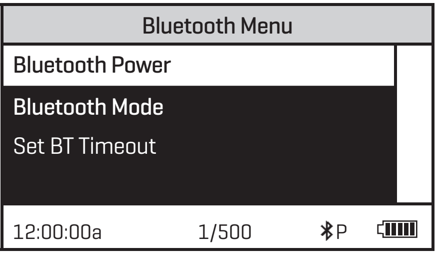
1. From the **Setup Menu**, press ▲ or ▼ to scroll to **Bluetooth Menu**.



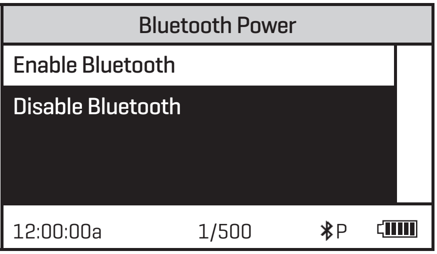
2. Press ENTER to select **Bluetooth Menu**.



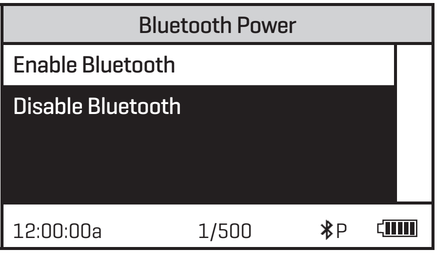
3. Press ▲ or ▼ to scroll to **Bluetooth Power**.



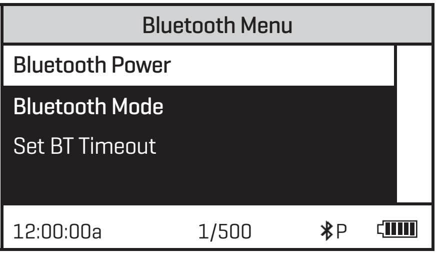
4. Press ENTER to select **Bluetooth Power**.



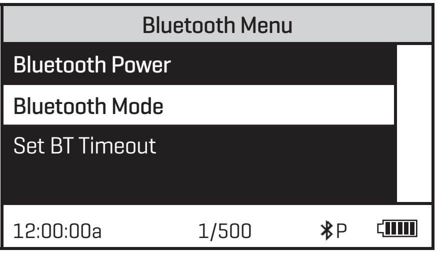
5. Press ▲ or ▼ to scroll to **Enable Bluetooth**.



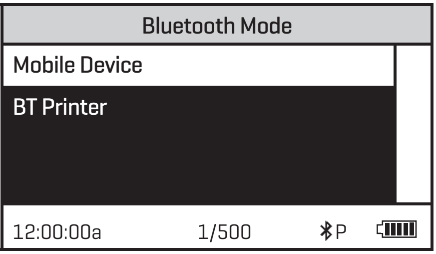
6. Press ENTER to select **Enable Bluetooth**.



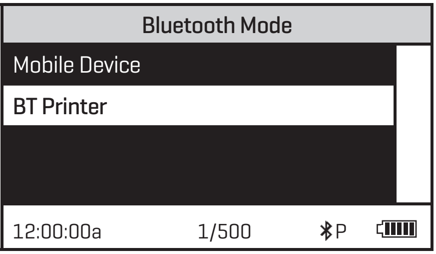
7. Press ▲ or ▼ to scroll to **Bluetooth Mode**.



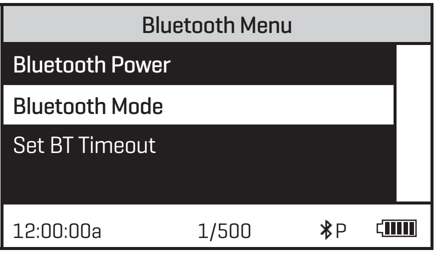
8. Press ENTER to select **Bluetooth Mode**.



9. Press ▲ or ▼ to scroll to **BT Printer**.



10. Press ENTER to select **BT Printer**. The meter is now ready to connect with a Bluetooth printer. When the meter is available for the Bluetooth connection the Bluetooth printer icon ᛒP next to the battery icon will flash.

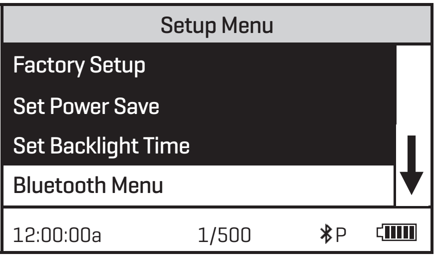


11. Turn on the Bluetooth printer. Within a few seconds it will connect to the meter. If the Bluetooth printer connection to the meter is successful the Bluetooth printer icon will remain on and no longer flash.

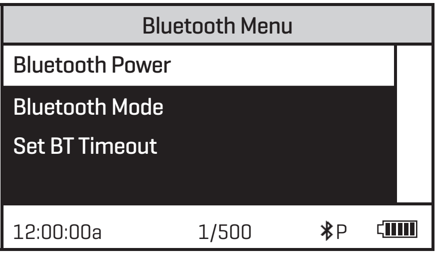
Set BT Timeout

The Bluetooth Timeout can be set to allow the Bluetooth feature to be on to allow data to be sent to the Bluetooth printer and then turn off after a specified amount of time.

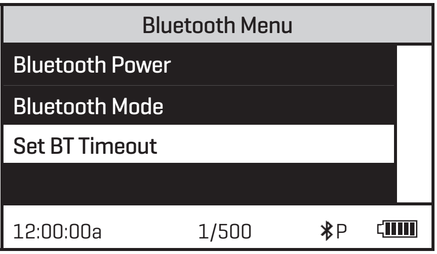
1. From the **Setup Menu**, press ▲ or ▼ to scroll to **Bluetooth Menu**.



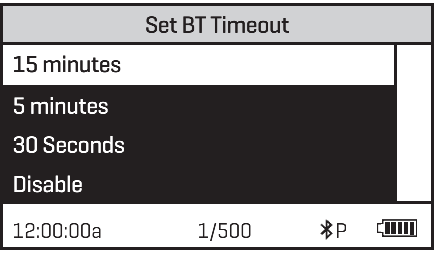
2. Press ENTER to select **Bluetooth Menu**.



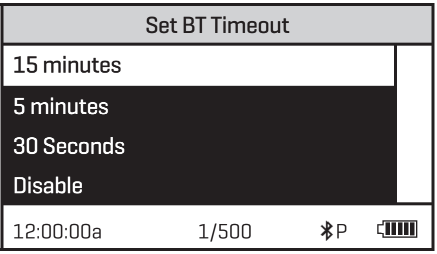
3. Press ▲ or ▼ to scroll to **Set BT Timeout**.



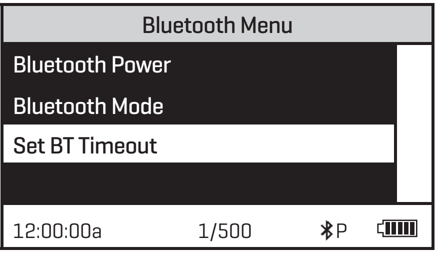
4. Press ENTER to select **Set BT Timeout**.



5. Press ▲ or ▼ to scroll to desired option.



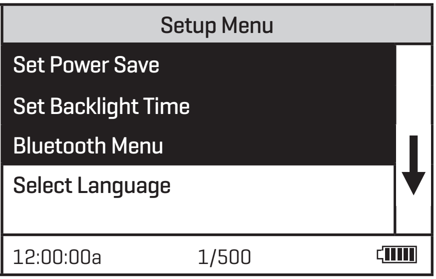
6. Press ENTER. The screen will display **Storing...** for about 1 second and the meter will return to the **Bluetooth Menu**.



SELECTING A LANGUAGE

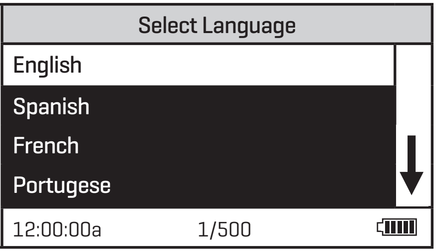
There are eight languages available in the Smart3 BLE: English, Spanish, French, Portuguese, Italian, Chinese, Japanese and Turkish.

1. From the **Setup Menu**, press ▲ or ▼ to scroll to **Select Language**.



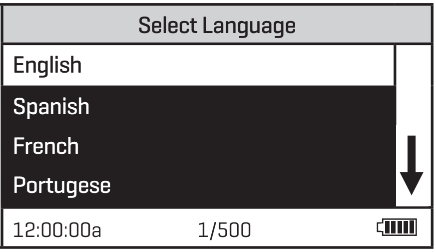
Setup Menu
Set Power Save
Set Backlight Time
Bluetooth Menu
Select Language
12:00:00a 1/500

2. Press ENTER to select **Select Language**.



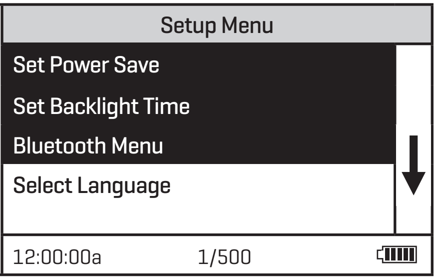
Select Language
English
Spanish
French
Portugese
12:00:00a 1/500

3. Press ▲ or ▼ to scroll to desired language.



Select Language
English
Spanish
French
Portugese
12:00:00a 1/500

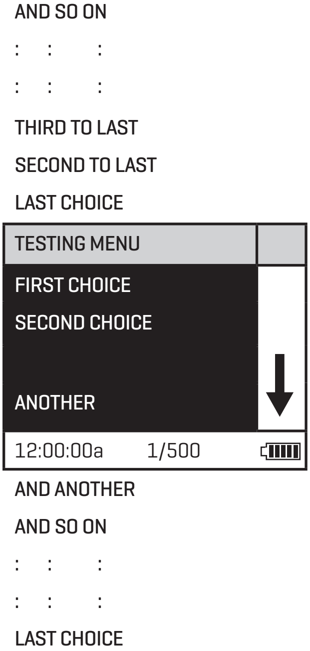
4. Press ENTER. The screen will display **Storing...** for about 1 second and the meter will return to the **Setup Menu**.



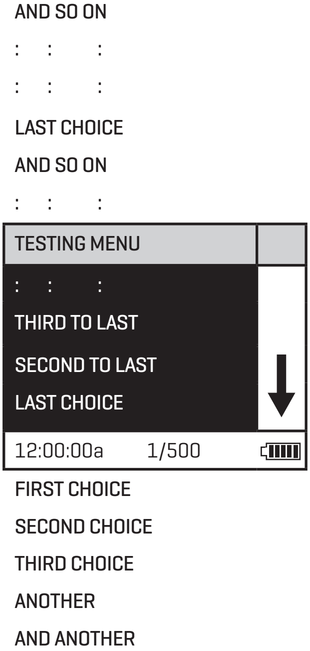
Setup Menu
Set Power Save
Set Backlight Time
Bluetooth Menu
Select Language
12:00:00a 1/500

LOOPING MENUS

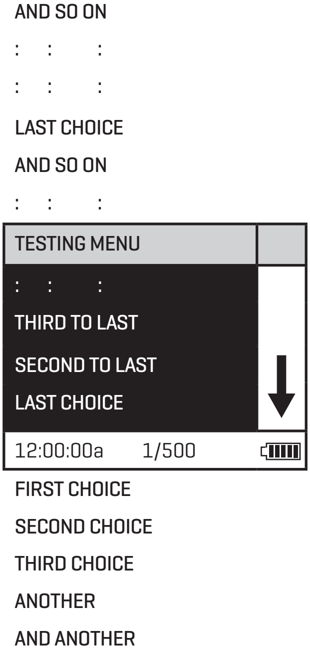
Long menus, such as All Tests, incorporate a looping feature which allows the user to quickly reach the last choice in the menu from the first choice. In a looping menu the last choices in the menu are above the first choice and scrolling upward moves through the menu in reverse order. Scrolling downward moves through the menu from first choice to last but the menu starts over following the last choice. So all menu choices can be reached by scrolling in either direction. The diagrams below demonstrate a looping menu.



AND SO ON
: : :
: : :
THIRD TO LAST
SECOND TO LAST
LAST CHOICE
TESTING MENU
FIRST CHOICE
SECOND CHOICE
ANOTHER
12:00:00a 1/500
AND ANOTHER
AND SO ON
: : :
: : :
LAST CHOICE



AND SO ON
: : :
: : :
LAST CHOICE
AND SO ON
: : :
TESTING MENU
: : :
THIRD TO LAST
SECOND TO LAST
LAST CHOICE
12:00:00a 1/500
FIRST CHOICE
SECOND CHOICE
THIRD CHOICE
ANOTHER
AND ANOTHER



AND SO ON
: : :
: : :
LAST CHOICE
AND SO ON
: : :
TESTING MENU
: : :
THIRD TO LAST
SECOND TO LAST
LAST CHOICE
12:00:00a 1/500
FIRST CHOICE
SECOND CHOICE
THIRD CHOICE
ANOTHER
AND ANOTHER

The feature called **Looping Menu** can be turned on and off in the **Setup Menu**. The default setting is ON.

DEVICE CONNECTION

The meter supports connections to a Windows® based PC over USB (Code 1720-01).

COMPUTER CONNECTION

USB Type A, USB mini B, Order Cable Code 1720-01

CONNECTING VIA USB

Using the provided USB cable, the meter can be connected to a Windows based PC. Before connecting a meter via USB, download and install the free WaterLink Connect 2 Windows application from http://softwarecenter.lamotte.com.

CONNECTING VIA BLUETOOTH

The meter uses Bluetooth Low Energy technology to allow communication between the meter and the BLE Mobile Printer (Code 5-0067 only). The meter will automatically connect to the nearest Bluetooth enabled printer. Barriers to wireless signals can reduce the range of wireless devices. The meter will work best if there are no walls between it and the receiving device.

WATERLINK CONNECT 2

The meter may be interfaced with any Windows-based 64-bit computer by using the LaMotte WaterLink Connect 2 program and a USB cable. The program will store test information and results in a local database and allow for exporting this data to a comma separated value (CSV) file. The meter will send the following data: name of test, sample value, sample units, time/date stamp, and meter name. To download WaterLink Connect 2 go to http:// softwarecenter.lamotte.com/. Select "WaterLink Connect 2 FREE Download".

FIRMWARE UPDATES

Occasionally, the firmware in the meter will require updates. To do so:

1. Download and install the WaterLink Connect 2 application for Windows at http://softwarecenter.lamotte.com/.
2. Plug meter into the computer with the provided USB cable (1720-01 only) and launch WaterLink Connect 2 application from the Start Menu.
3. A prompt will appear if firmware updates are available. Select Update. Testing and data transfer will not be possible until firmware has been updated.

For assistance contact Software Support at 1-800-344-3100 option 2.

BATTERY

BATTERY/AC OPERATION

The Smart3 BLE may be operated on battery power using a USB wall adapter or USB computer connection. If using the meter as a bench top unit, use the wall adapter if possible to extend the battery life. The meter will remain on when the USB adapter is used.

To charge the lithium ion battery with the wall adapter, plug the smaller end of the USB cable (USB mini B connector) into the meter and the larger end of the USB cable (USB type A connector) into the wall adapter. Plug the wall adapter into an AC outlet. Reinsert the rubber USB port plug after charging. Failure to insert the USB port plug when the meter is not connected to a computer by USB or actively charging by USB could result in damage to internal components.

To charge the battery from a computer, plug the smaller end of the USB cable (USB mini B connector) into the meter and the larger end of the USB cable (USB Type A connector) into a USB port on a computer. Reinsert the USB port plug after charging. Failure to insert the USB port plug when the meter is not connected to a computer by USB or actively charging by USB could result in damage to internal components.

The battery icon will show no bars and flash when the unit first turns on. Then the indicator will indicate the battery status by showing 0, 1, 2, 3, or 4 bars. It will take 6 hours to fully charge a low battery. The battery icon will flash when the battery is charging. The battery icon will show four bars and stop flashing when it is fully charged. The charging circuit will automatically switch to a float charge when the battery is fully charged. The charger may remain connected. Some computers will NOT supply power to their USB ports during standby operation. The wall adapter will charge the unit continuously. Storing the meter above ambient room temperature will decrease the battery charge more quickly than storage at room temperature. If the meter does not turn on, it means that the battery is at a very low charge. Charging the battery with the wall adapter in this state may take up to 10 hours. At low temperatures, approaching 0 °C, the battery will charge more slowly. It will not charge at all below 0 °C.

The battery icon will show no bars and continuously flash if the battery is getting low but the unit will still operate normally. A "Low Battery" message on the status bar of the display will replace the time when the battery voltage is too low for proper operation and accuracy may be degraded. A "Shutdown Low Batt" message on the display will appear for a few seconds before the power is switched off when the battery is too low to operate the unit. When the battery icon simultaneously flashes bars 1 and 2 followed by bars 3 and 4, it is an indication that the battery is damaged and technical support should be contacted.

To extend the life of the battery:

- Shut down the unit with the power switch when not taking measurements or use the power save option to have the unit automatically turn off after 5 minutes.
- Store the unit at a moderate temperature.
- Fully charge the battery before storing the unit for extended periods of time.
- Fully charge the battery at least once per year. Failure to do so may result in a permanently drained battery.
- Limit backlight use. The unit consumes three times the normal power when the backlight is on. Set the backlight time option to 10 seconds or select "Button Control" and keep the backlight off.

BATTERY REPLACEMENT

The lithium ion battery used in this unit should last for many years with normal use. When it no longer powers the unit long enough to meet testing requirements it should replaced. Contact LaMotte Company by phone (1-800-344-3100) or email (tech@lamotte.com) for more information.

MAINTENANCE

CLEANING

Clean the exterior housing with a damp, lint-free cloth. Do not allow water to enter the light chamber or any other parts of the meter. To clean the light chamber and optics area, point a can of compressed air into the light chamber and blow the pressurized air into the light chamber. Use a cotton swab dampened with Windex® window cleaner to gently swab the interior of the chamber. Do not use alcohol; it will leave a thin residue over the optics when dry.

RETURNS

Should it be necessary to return the meter, pack the meter carefully in a suitable container with adequate packing material. A return authorization number must be obtained from LaMotte Company by calling 800-344-3100 (US only) or 410-778-3100, faxing 410-778-6394, or emailing tech@lamotte.com. Often a problem can be resolved over the phone or by email. If a return of the meter is necessary, attach a letter with the return authorization number, meter serial number, a brief description of problem and contact information including phone and FAX numbers to the shipping carton.

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 the use of 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 local or regional waste administration or recycling services.

TROUBLESHOOTING

ERROR MESSAGES

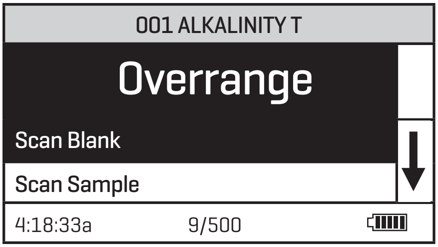
OVER RANGE

If the message OVERRANGE is displayed when scanning a sample, the sample may be over range or under range. If the sample is over range, the sample should be diluted and tested again (see Sample Dilution Techniques and Volumetric Measurements, page 14).

If overrange is displayed, scroll to **Calibrate** and press **ENTER** to view the result. The concentration is only an **approximation**. Press **EXIT** and continue testing.

Note: If **EXIT** is not pressed the meter will calibrate on the over range result.

Note: Over range results will also be displayed in the test log.



001 ALKALINITY T

Overrange

Scan Blank

Scan Sample

4:18:33a 9/500

CALIBRATION

As with all pre-calibrated meters, it is highly recommended, even if not required by regulations, that the user periodically verify the performance of the meter by running standards with a predetermined concentration. Results outside of specification are an indication that the meter needs to be adjusted. This can be done following the user calibration described on page 23.

STRAY LIGHT

The Smart3 BLE Colorimeter should have no problems with stray light. Make sure that the sample compartment lid is always fully closed, except when testing COD with the adapter.

TROUBLESHOOTING GUIDE

PROBLEM	REASON	SOLUTION
🔋 Flashing	Low battery. Readings are reliable.	Charge battery or use USB wall/ computer adapter.
"Low Battery"	Battery voltage is very low. Readings are not reliable.	Charge battery or use USB wall/ computer adapter.
"Shut Down Low Batt" Shut Down	Battery is too low to operate the unit.	Charge battery or use USB wall/ computer adapter.
"Overrange"	Sample is outside of acceptable range.	Dilute sample and test again.
Unusually large negative or positive readings when performing calibration	Incorrect standards used to calibrate meter.	Use fresh 0.0 standard in clean tube. Reset meter to factory default settings. Recalibrate meter.
Trouble connecting to Bluetooth device	Bluetooth not enabled. Too many Bluetooth devices near the meter.	Enable Bluetooth. Have only one Bluetooth device near the meter.
Trouble connecting to computer by USB	Broken connection.	Press and hold power button for 1 second.
Results not printing	Printer not on. The meter will only print to the BLE Mobile Printer (Code 5-0067). The Bluetooth Pairing option is not set correctly.	Turn printer on. Connect to the BLE Mobile Printer (Code 5-0067). See Setup Bluetooth Printing.

SMART3 BLE
Colorimeter

Test Procedures

LaMotte®

61910-BLE-R | 12.23.25

SMART3 REAGENT SYSTEMS

LaMotte Company continuously updates the list of pre-programmed tests as the calibrations become available.

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 and more information. Some reagent systems are not available for shipment to Canada.

Test Factor (Test #)	Range (ppm)	MDL	Test Method (# of Reagents)	# of Tests
Alkalinity, Tablet (001)	0–250	10	Colormetric	50
Aluminum (005) †	0.00–0.30	0.01	Eriochrome Cyanine R (4)	50
Ammonia Nitrogen-Low Range, Fresh Water (006)	0.00–1.00	0.05	Salicylate (3)	25
Ammonia Nitrogen-Low Range, Salt Water (007)	0.00–1.00	0.10	Salicylate (3)	25
Ammonia Nitrogen-High Range (008)	0.00–4.00	0.05	Nesslerization (2)	50
Barium (009)	0-200	5	Barium Chloride (1)	50
Biguanide (011)	0–70	2	Colorimetric (1)	50
Boron (014)	0.00-0.80	0.05	Azomethine-H (2)	50
Bromine, Liquid DPD (015)	0.00-9.00	0.10	DPD, Liquid (3)	144
Bromine, Tablet (016) †	0.00–9.00	0.10	DPD (3)	100
Cadmium (018)	0.00–1.00	0.02	PAN (4)	50
Carbohydrazide (019) *See Oxygen Scavengers*	0.000–0.900	0.04	Iron Reduction (3)	100
Chloride-TesTab (021) †	0.0–30.0	0.4	Argentometric (1)	50
Chlorine-Liquid DPD (024)	0.00–4.00	0.03	DPD (3)	144
Chlorine-Tablet DPD (025) †	0.00–4.00	0.03	DPD (3)	100
Chlorine Dioxide (022)	0.00–8.00	0.06	DPD/Glycine (2)	100
Chromium, Hexavalent (028)	0.00–1.00	0.01	Diphenylcarbohydrazide (1)	50
Chromium, Hex, Tri, Total (028)	0.00–1.00	0.01	Diphenylcarbohydrazide (5)	50
Cobalt (029)	0.00–2.00	0.04	PAN (3)	50
COD-Low Range (031) †	0–150	5	Digestion (1)	25
COD-Standard Range (032)	0-1500	50	Digestion (1)	25
COD-High Range (030) †	0–15000	500	Digestion (1)	25
Color (033)	0–1000 cu	20	Platinum Cobalt (0)	–
Copper-BCA (034)	0.00–3.50	0.04	Bicinchoninic Acid (1)	50
Copper-Cuprizone (035)	0.00–2.00	0.03	Cuprizone (2)	50
Copper-Thiocarbamate (036)	0.00–6.00	0.10	Diethyldithiocarbamate (1)	50
Cyanide (038)	0.00-0.35	0.03	Pyridine-Barbituric Acid (5)	50
Cyanuric Acid (039)	5-200	10	Melamine (1)	50

†Available for shipment to Canada

Test Factor (Test #)	Range (ppm)	MDL	Test Method (# of Reagents)	# of Tests
Cyanuric Acid, Tablet (040)	0-110	10	Melamine (1)	100
DEHA (042) *See Oxygen Scavengers*	0.00–0.70	0.01	Iron Reduction (3)	100
Dissolved Oxygen (043)	0.0–11.0	0.6	Winkler Colorimetric (3)	100
Erythorbic Acid (044) *See Oxygen Scavengers*	0.00–3.00	0.02	Iron Reduction (3)	100
Fluoride (045) †	0.0–2.0	0.1	SPADNS (2)	50
Hardness, Total, Tablet (047)	0–400	10	Colormetric	50
Hydrazine (049)	0.00–1.00	0.01	P-dimethyl-aminobenzaldehyde (2)	50
Hydrogen Peroxide-Low Range (051)	0.00–1.50	0.02	DPD (2)	100
Hydrogen Peroxide-High Range (050)	0–60	1	DPD (2)	100
Hydrogen Peroxide-Shock (052)	0–225	10	DPD (2)	100
Hydroquinone (053) *See Oxygen Scavengers*	0.00–2.00	0.01	Iron Reduction (3)	100
Iodine (054) †	0.0–14.0	0.2	DPD (2)	100
Iron-Bipyridyl (055) †	0.00–6.00	0.10	Bipyridyl (2)	50
Iron-Total, Ferrous, Ferric (056) †	0.0–5.0	0.1	1,10 Phenanthroline (2)	50
Lead (058)	0.0–5.0	0.1	PAR (5)	50
Manganese-Low Range (060) †	0.00–0.70	0.01	PAN (3)	50
Manganese-High Range (059) †	0.0–15.0	0.3	Periodate (2)	50
Methylethylketoxime (062) *See Oxygen Scavengers*	0.00–3.00	0.01	Iron Reduction (3)	100
Molybdenum-High Range (063)	0.0–50.0	0.6	Thioglycolate (3)	50
Nickel (064)	0.00–8.00	0.15	Dimethylglyoxime (6)	50
Nitrate Nitrogen-Low Range (065) †	0.00–3.00	0.10	Cadmium Reduction (2)	20
Nitrate TesTab (066) †	0–60	5	Zinc Reduction (1)	50
Nitrite Nitrogen-Low Range (068) †	0.00–0.80	0.02	Diazotization (2)	20
Nitrogen, Total (069) ***	0-25 mg/L	3 mg/L	Chromotropic Acid/Digestion (6)	25
Oxygen Scanvengers	various	various	DEHA (3)	50
Ozone-DPD Liquid (073)	0.00–3.00	0.03	DPD (4)	144
Ozone-Low Range (071)	0.00–0.40	0.01	Indigo Trisulfonate (3)	100
Ozone-High Range (072)	0.00–2.50	0.05	Indigo Trisulfonate (3)	20
pH-Chlorophenol Red (074) †	5.0–6.8	–	Chlorophenol Red (1)	100
pH-Phenol Red (075) †	6.6–8.4	–	Phenol Red (1)	100
pH-Phenol Red, Tablet (076)	6.6-8.4	–	Phenol Red (1)	50

***Requires COD Adapter Code 5-0087 and Heater Block.
†Available for shipment to Canada

Test Factor (Test #)	Range (ppm)	MDL	Test Method (# of Reagents)	# of Tests
pH-Thymol Blue (077) †	8.0–9.5	–	Thymol Blue (1)	100
Phenol (079)	0.00-6.00	0.05	Aminoabtipyrine (2)	50
Phosphate-Low Range (081) †	0.00–3.00	0.05	Ascorbic Acid Reduction (2)	50
Phosphate-High Range (080) †	0.0–70.0	0.5	Vanodomolybd-phosphoric Acid (1)	25
Phosphorus, ppb (082)	0–3000 ppb	50	Ascorbic Acid/Reduction (5)	50
Phosphorus, Total, Low Range (084) ***	0.00–3.50 mg/L	0.50	Ascorbic Acid/Digestion	25
Phosphorus, Total, High-Range (083) ***	5-100 mg/L	5	Molybdovanadate/Digestion (5)	25
Potassium (085) †	0.0-10.0	0.8	Tetraphenylboron (2)	100
Silica-Low Range (087)	0.00–4.00	0.05	Heteropoly Blue (4)	50
Silica-High Range (086)	0–75	1	Silicomolybdate (3)	50
Sulfate-High Range (089) †	0–100	3	Barium Chloride (1)	50
Sulfide-Low Range (090)	0.00–1.50	0.06	Methylene Blue (3)	50
Surfactants (092)	0.0-8.0	0.5	Bromphenol Blue (3)	100
Tannin (093)	0.0–10.0	0.1	Tungsto-molybdophosphoric Acid (2)	50
Turbidity (095)	0–400 FAU	3	Absorption (0)	–
Urea (096)	0.0-6.0	0.4	Urease/Salicylate	50
Zinc-Low Range (097) †	0.00–3.00	0.05	Zincon (6)	50

***Requires COD Adapter Code 5-0087 and Heater Block.
†Available for shipment to Canada

ALKALINITY

TABLET · CODE 3670-SC

QUANTITY	CONTENTS	CODE
50	ALKALINITY Tablets	3882A-H
1	Tablet Crusher	0175

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:** Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

READ SDS

To order individual reagents or test kit components, use the specified code number.

APPLICATION:	Drinking and surface waters; swimming pool water.
RANGE:	0–250 ppm as $CaCO_3$
MDL:	10 ppm
METHOD	The tablet contains buffers and indicators. 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

1. Press ⏻ and hold until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **001 Alkalinity T**) from **Testing Menu**.
4. Scroll to and select **001 Alkalinity T** from menu.
5. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter. Add one ALKALINITY Tablet (3882A). Crush with Tablet Crusher (0175).
8. Cap. Invert 10 times to mix. Insert tube into chamber. Close lid. Select **Scan Sample**.
9. Press ⏻ to turn the colorimeter off, select Print Test to print the results, or press EXIT to exit to a previous menu or make another menu selection.

ALUMINUM

ERIOCHROME CYANINE R METHOD · CODE 3641-01-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, 0.05 g, plastic	0696
2	Pipets, 1.0 mL, plastic	0354
1	Test Tube, glass, 5 mL w/cap	0230

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:** Chem-Tel USA 1-800-255-3924 Int'l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **005 Aluminum**) from **Testing Menu**.
4. Scroll to and select **005 Aluminum** from menu.
5. Rinse a clean colorimeter tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Insert tube into colorimeter chamber and select **Scan Blank**.
7. Rinse a clean test tube (0230) with sample water. Fill to the 5 mL line with sample.
8. Remove tube from colorimeter. Empty sample from tube (0290).
9. Add 5 mL sample from test tube (0230) to empty tube (0290).
10. Use the 0.05 g spoon (0696) to add one measure of Aluminum Inhibitor Reagent (7865). Cap and mix to dissolve powder.
11. Use a 1.0 mL pipet (0354) to add 2 mL of *Aluminum Buffer Reagent (7866). Cap and mix.
12. 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.
13. At end of 5 minute waiting period, mix, insert tube into chamber, close lid and select **Scan Sample**. Record result.
14. Press ⏻ to turn the colorimeter off, select Print Test to print the results, or press EXIT 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 3659-02-SC

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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

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:	0.05 ppm Fresh Water 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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **006 Ammonia-N LRF**) from **Testing Menu**.
4. Scroll to and select **006 Ammonia-N LRF** from menu.
5. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Insert tube into chamber, close lid and select **Scan Blank**. (See Note.)
7. Remove tube from colorimeter. Use the 1.0 mL plastic pipet (0354) to add 2.0 mL of *Salicylate Ammonia #1 (3978). Cap and mix.
8. Use the 0.15 g spoon (0727) to add two measures of *Salicylate #2 Reagent (7457). Cap and mix until dissolved. Wait 1 minute.
9. 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.
10. At the end of the 12 minute waiting period, immediately mix and insert tube into chamber, close lid and select **Scan Sample**. Record result.
11. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT to exit to a previous menu or make another menu selection.

CALCULATIONS:

To express results as Unionized Ammonia (NH_3):

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

To express results as Ionized Ammonia (NH_4):

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

To determine the percentages of Unionized and Ionized Ammonia-Nitrogen, consult the Appendix.

NOTE: It is strongly suggested that a reagent blank 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.

PROCEDURE - SALT WATER

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **007 Ammonia-N LRS**) from **Testing Menu**.
4. Scroll to and select **007 Ammonia-N LRS** from menu.
5. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Insert tube into chamber, close lid and select **Scan Blank**. (See Note.)
7. Remove tube from colorimeter. Use the 1.0 mL plastic pipet (0354) to add 2.0 mL of *Salicylate Ammonia #1 (3978). Cap and mix.
8. Use the 0.15 g spoon (0727) to add two measures of *Salicylate #2 Reagent (7457). Cap and mix until dissolved. Wait 1 minute.
9. 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.
10. At the end of the 20 minute waiting period, immediately mix and insert tube into chamber, close lid and select **Scan Sample**. Record result.

11. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press **EXIT** to exit to a previous menu or make another menu selection.

CALCULATIONS:

To express results as Unionized Ammonia (NH_3):

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

To express results as Ionized Ammonia (NH_4):

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

To determine the percentages of Unionized and Ionized Ammonia-Nitrogen, consult the Appendix.

NOTE: It is strongly suggested that a reagent blank 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.

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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:** Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Scroll to and select **All Tests** (or another sequence containing **008 Ammonia-N HR**) from **Testing Menu**.
4. Scroll to and select **008 Ammonia-N HR** from menu.
5. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Insert tube into chamber, close lid and select **Scan Blank**. (See Note)
7. Remove tube from colorimeter. Add 8 drops of Ammonia Nitrogen Reagent #1 (V-4797). Cap and mix. Wait 1 minute.
8. 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.
9. At end of the 5 minute waiting period, immediately mix, insert tube into chamber, close lid and select **Scan Sample**. Record result.
10. Press ⏻ to turn the colorimeter off, select Print Test to print the results, or press the EXIT exit to a previous menu or make another menu selection.

CALCULATIONS:

To express results as Unionized Ammonia (NH_3):

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

To express results as Ionized Ammonia (NH_4):

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

To determine the percentages of Unionized and Ionized Ammonia-Nitrogen, consult the Appendix.

NOTE: It is strongly suggested that a reagent blank 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.

BARIUM

BARIUM CHLORIDE METHOD • CODE 3638-SC

QUANTITY	CONTENTS	CODE
50 g	*Barium Reagent Powder	*6330-H
1	Spoon, 0.5g, plastic	0698

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:** Chem-Tel USA 1-800-255-3924 Int’l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

Barium is a naturally occurring metal that is found in rocks and, in trace amounts, in natural waters. A barium concentration above 2 ppm in drinking water is a classified as a contaminant. Barium sulfate is used in the medical field as an X-ray radio contrast agent for imaging the gastrointestinal tract. Barium has many industrial applications. It is used in the manufacture of paints, brakes, root canal fillings, glass, and motor oil detergents. Barium nitrate imparts a bright yellow-green color to fireworks and flares. Barium sulfate is a component of oil well drilling mud which is used to lubricate drill bits. Barium is also a constituent of some electro ceramics and high temperature yttrium barium copper oxide (YBCO) superconductors.

APPLICATION:	Industrial
RANGE:	0 – 200 ppm barium
MDL:	5 ppm
METHOD:	Barium is precipitated in an acid medium with sodium sulfate to form a barium sulfate suspension in proportion to the amount of barium present.
SAMPLE HANDLING & PRESERVATION:	Barium 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. Strontium will interfere. Check for stray light interference (see page 15).

PROCEDURE

1. Press and hold ⏻ until colorimeter turns on.
2. Press **ENTER** to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **009 Barium**) from **Testing Menu**.
4. Scroll to and select **009 Barium** from menu.
5. Rinse a tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Insert the tube into chamber, close the lid and select **Scan Blank**.
7. Remove the tube from the colorimeter.
8. Use the 0.5 g spoon (0698) to add one measure of *Barium Reagent Powder (6330). Cap and mix by inverting for one minute.
9. Insert tube into chamber, close lid and select **Scan Sample**. Record result in ppm barium.
10. Press ⏻ to turn the colorimeter off, select Print Test to print the results, or press **EXIT** to exit to a previous menu or make another menu selection.

NOTE: A while film is deposited on the inside of test tubes as a result of the barium test. Thoroughly clean and rinse test tubes after each test.

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

BIGUANIDE

COLORIMETRIC METHOD • CODE 4044

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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

Biguanide is a non-chlorine, non-bromine chemical sanitizer. It is more stable than chlorine or bromine and has little chemical odor. Biguanide 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 Biguanide
MDL:	2 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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **011 Biguanide**) from **Testing Menu**.
4. Scroll to and select **011 Biguanide** from menu.
5. Rinse a tube (0290) with sample water. Fill to 10 mL with sample.
6. Insert the tube into chamber, close lid and select **Scan Blank**.
7. Remove the tube from colorimeter.
8. Use the 1.0 mL pipet (0354) to add 2.0 mL of Biguanide Indicator (3994). Cap and invert three times to mix.
9. Wait 1 minute.
10. Insert the tube into chamber. Close lid
11. Select **Scan Sample**. Record result in ppm Biguanide.
12. Press ⏻ to turn the colorimeter off, select Print Test to print the results, or press EXIT 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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

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
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

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 (0108). 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. When 2 minutes remain on the first timer (Reagent Blank), press and hold ON button until colorimeter turns on.
11. Press and hold ⏻ until colorimeter turns on.
12. Press ENTER to select **Testing Menu**.
13. Select **All Tests** (or another sequence containing **014 Boron**) from **Testing Menu**.
14. Scroll to and select **014 Boron** from menu.At the end of the Reagent Blank 30 minute waiting period, remove Reagent Blank tube from meter chamber. Invert several times to mix.
15. Insert the tube into meter chamber, close lid and select **Scan Blank**.
16. Remove the tube from colorimeter.
17. At the end of the Sample Water 30 minute waiting period, remove Sample Water tube from Dark Storage Chamber. Invert several times to mix.
18. Insert tube into meter chamber, close lid and select **Scan Sample**. Record result in ppm boron.
19. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press the EXIT to exit to a previous menu or make another menu selection.

BROMINE

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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

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 Bromine
MDL:	0.10 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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **015 Bromine L DPD**) from **Testing Menu**.
4. Scroll to and select **015 Bromine L DPD** from menu.
5. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter. Add 5 drops of DPD 1A Free Chlorine Reagent (P-6740). Add 5 drops of *DPD 1B Free Chlorine Reagent (P-6741). Cap and mix. Solution will turn pink if bromine is present.
8. Insert tube into chamber, close lid and select **Scan Sample**.
9. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press the EXIT to exit to a previous menu or make another menu selection.

NOTE: To test for bromine in the presence of chlorine, add 5 drops of Glycine Solution (6811-E) (sold separately) before adding the DPD Reagents.

BROMINE

DPD TABLET 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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

Like chlorine, bromine is an effective germicidal agent employed in drinking water treatment, pool and spa water sanitization, 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 Bromine
MDL:	0.10 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)

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **016 Bromine T DPD**) from **Testing Menu**.
4. Scroll to and select **016 Bromine T DPD** from menu.
5. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter. Add one *DPD 1 IG Tablet (6903A). Cap tube and and shake for 10 seconds. Invert slowly 5 times. Solution will turn pink if bromine is present.
8. Insert tube into chamber, close lid and select **Scan Sample**.
9. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT to exit to a previous menu or make another menu selection.

PROCEDURE B: BROMINE IN THE PRESENCE OF CHLORINE

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **016 Bromine T DPD**) from **Testing Menu**.
4. Scroll to and select **016 Bromine T DPD** from menu.
5. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Insert tube into chamber close lid and select **Scan Blank**.
7. Remove blank from colorimeter. Add 5 drops of Glycine Solution (6811). Cap and mix.
8. 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. Insert tube into chamber, close lid and select **Scan Sample**.
9. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT 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.
2. Perform the test for bromine in the presence of chlorine.

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.

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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int’l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

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 ppm 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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **018 Cadmium**) from **Testing Menu**.
4. Scroll to and select **018 Cadmium** from menu.
5. Rinse a tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Insert the tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter. Use the 1.0 mL pipet (0354) to add 1.0 mL of *Buffered Ammonia Reagent (4020). Swirl to mix.
8. Add two drops of Sodium Citrate, 10% (6253). Swirl to mix.
9. Use a 0.5 mL pipet (0369) to add 0.5 mL of *PAN Indicator (4021). Swirl to mix.
10. Use a 0.5 mL pipet (0369) to add 0.5 mL Stabilizing Reagent (4022). Cap and mix.
11. Immediately insert tube into chamber, close lid and select **Scan Sample**. Record result.
12. Press ⏻ to turn the colorimeter off, select Print Test to print the results, or press EXIT 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.

CHLORIDE

ARGENTOMETRIC METHOD · CODE 3693-SC

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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

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:	0.4 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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **021 Chloride T**) from **Testing Menu**.
4. Scroll to and select **021 Chloride T** from menu.
5. Rinse a tube (0290) with sample water. Fill to 10 mL line with sample.
6. Insert the tube into chamber, close lid and select **Scan Blank**.
7. Remove the tube from colorimeter.
8. Add one *Chloride IG Tablet (3885A).
9. Use Tablet Crusher (0175) to crush tablet.
10. Cap tube.
11. Invert 2 times.
12. Wait 3 minutes. Do NOT mix.
13. Insert tube into chamber, close lid and select **Scan Sample**. Record result in ppm chloride.
14. Press ⏻ to turn the colorimeter off, select Print Test to print the results, or press EXIT 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°, multiply ppm by 0.9.

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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

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 sanitization 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:	0.03 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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **024 Chlorine L DPD**) from **Testing Menu**.
4. Scroll to and select **024 Chlorine L DPD** from menu.
5. Rinse a tube (0290) with sample water. Fill to 10 mL with sample.
6. Insert the tube into chamber, close lid and select **Scan Blank**.
7. Remove the tube from colorimeter.
8. Add 5 drops of DPD 1A Free Chlorine Reagent (P-6740).
9. Add 5 drops of *DPD 1B Free Chlorine Reagent (P-6741). Cap and mix.
10. Insert tube into chamber, close lid and select **Scan Sample**. Record result as ppm free chlorine.

PROCEDURE–TOTAL CHLORINE

1. 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.
2. Insert tube into chamber, close lid and select **Scan Sample**. Record result as ppm total chlorine.
3. Subtract the Free Chlorine reading from the Total Chlorine reading to determine ppm combined chlorine.
4. Press ⏻ to turn the colorimeter off, select Print Test to print the results, or press EXIT 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

DPD TABLET 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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

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 sanitization 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:	0.03 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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **025 Chlorine T DPD**) from **Testing Menu**.
4. Scroll to and select **025 Chlorine T DPD** from menu.
5. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter. Add one *Chlorine 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.
8. Immediately insert tube into chamber, close lid and select **Scan Sample**.

PROCEDURE–COMBINED CHLORINE

1. Add one *Chlorine DPD 3 IG Tablet (6197A) to sample from Step 8 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.
2. Insert sample into chamber, close lid and select **Scan Sample**. Record result as Total Chlorine.
3. Subtract free chlorine reading from total chlorine reading to obtain concentration of combined chlorine.
4. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT to exit to a previous menu or make another menu selection.

CHLORINE DIOXIDE

DPD METHOD · CODE 3644-SC

QUANTITY	CONTENTS	CODE
100	*DPD 1 IG Tablets	*6903A-J
15 mL	Glycine Solution	6811-E

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

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 and pool waters; domestic and industrial wastewater; food sanitization.
RANGE:	0.00–8.00 ppm Chlorine Dioxide
MDL:	0.06 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 manganese interferes but can be removed with arsenite. Bromine and iodine interfere. Chromate interference can be removed with a thioacetamide blank correction.

PROCEDURE

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **022 Chlorine Diox**) from **Testing Menu**.
4. Scroll to and select **022 Chlorine Diox** from menu.
5. Rinse a clean tube (0290) with sample water. Fill to 10 mL line with sample.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter. Add 5 drops of Glycine Solution (6811).
8. Add one *DPD 1 IG Tablet (6903A). Cap and shake for 10 seconds. Invert 5 times slowly. Solution will turn pink if chlorine dioxide is present.
9. Immediately insert tube into chamber, close lid and select **Scan Sample**.
10. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT 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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:** Chem-Tel USA 1-800-255-3924 Int'l, call collect, 813-248-0585

READ SDS

To order individual reagents or test kit components, use the specified code number.

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, & 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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **028 Chromium**) from **Testing Menu**.
4. Scroll to and select **028 Chromium** from menu.
5. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter. 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.
8. 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).
9. At the end of 3 minute waiting period, filter sample into a clean tube. Mix. Insert tube into chamber, close lid and select **Scan Sample**. Record result.
10. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT 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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

READ SDS

To order individual reagents or test kit components, use the specified code number.

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, & saline water; domestic and industrial waste.
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 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 interfere.

HEXAVALENT CHROMIUM PROCEDURE

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **028 Chromium**) from **Testing Menu**.
4. Scroll to and select **028 Chromium** from menu.
5. Rinse a clean tube (0290) with sample water. Fill to 10 mL line with sample water.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter. 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.
8. 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).
9. At the end of 3 minute waiting period, filter sample into a clean tube (0290). Cap and mix. Insert tube into chamber, close lid and select **Scan Sample**. Record result.
10. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT 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. NOTE: Highly buffered waters may require pH adjustment. Adjust the pH of highly buffered samples to 7.0 ±0.5. Continue procedure.
3. Place flask on burner or hot plate. Bring solution to a gentle boil.
4. 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.
5. 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.
6. Remove flask from heat. Cool sample under running water. This is the digested sample.
7. Pour digested sample into clean graduated cylinder (0418). Dilute to the 50 mL line with Deionized Water (5115).
8. Press and hold ⏻ until colorimeter turns on.
9. Press ENTER to select **Testing Menu**.
10. Select **All Tests** or another sequence containing **028 Chromium**) from **Testing Menu**.
11. Scroll to and select **028 Chromium** from menu.
12. Rinse a clean tube (0290) with sample water. Fill to 10 mL line with sample water.
13. Insert tube into chamber, close lid and select **Scan Blank**.
14. Remove tube from colorimeter. 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.
15. 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).
16. Filter sample into a clean tube (0290). Cap and mix. Insert tube of filtered sample into chamber, close lid and select **Scan Sample**. Record result.
17. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT 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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:** Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

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 ppm Cobalt
MDL:	0.04 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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **029 Cobalt**) from **Testing Menu**.
4. Scroll to and select **029 Cobalt** from menu.
5. Rinse a tube (0290) with sample water. Fill to 10 mL with sample.
6. Insert the tube into chamber, close lid and select **Scan Blank**.
7. Remove the tube from colorimeter.
8. Use the 1.0 mL pipet (0354) to add 1 mL of *Cobalt Buffer (4852). Cap and mix.
9. Use the other 1.0 mL pipet (0354) to add 1 mL of *Cobalt Indicator Reagent (4853). Cap and mix.
10. Wait 3 minutes.
11. Use the 0.5 mL pipet (0353) to add 0.5 mL Stabilizer Solution (4854). Cap and invert 15 times to thoroughly mix.
12. Wait 5 minutes. DO NOT MIX.
13. Insert tube into chamber, close lid and select **Scan Sample**. Record result in ppm cobalt.
14. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT 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 Range Mercury Free Tubes	*0072-SC
or 25	*COD Low Range Mercury Tubes	*0075-SC

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

COD Low Range Mercury Free Tubes are not USEPA approved.

COD Low Range Mercury Tubes are USEPA approved.

Equipment needed but not supplied:

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:	7.5 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 sulfuric acid 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.

When scanning samples in 16 mm tubes, such as COD, the sample chamber lid can not be closed. Use the COD adapter to minimize stray light interference. To further reduce stray light interference, do not Scan Sample in direct sunlight.

PROCEDURE

Use COD/UDV adapter.

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.
11. Press and hold ⏻ until colorimeter turns on.
12. Press ENTER to select **Testing Menu**.
13. Select **All Tests** (or another sequence containing **031 COD LR**) from **Testing Menu.**
14. Scroll to and select **031 COD LR** from menu.
15. Wipe the blank tube with a damp towel to remove fingerprints and smudges. Wipe with a dry towel.
16. Insert reagent blank tube into chamber. Select **Scan Blank**.
17. Remove tube from colorimeter.
18. Insert digested water sample tube into chamber. Select **Scan Sample**. Record result. For the most accurate results, take three readings on each sample and average the results.
19. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT 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.

COD – STANDARD RANGE

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

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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

READ SDS

To order individual reagents or test kit components, use the specified code number.

COD Standard Range Mercury Free Tubes are not USEPA approved.

COD Standard Range Mercury Tubes are USEPA approved.

Equipment needed but not supplied:

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:	50 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 sulfuric acid 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.

When scanning samples in 16 mm tubes, such as COD, the sample chamber lid can not be closed. Use the COD adapter to minimize stray light interference. To further reduce stray light interference, do not Scan Sample in direct sunlight.

PROCEDURE

Use COD/UDV adapter.

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 vial 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.
11. Press and hold ⏻ until colorimeter turns on.
12. Press ENTER to select **Testing Menu**.
13. Select **All Tests** (or another sequence containing **032 COD SR**) from **Testing Menu**.
14. Wipe the blank tube with a damp towel to remove fingerprints and smudges. Wipe with a dry towel.
15. Scroll to and select **032 COD SR** from menu.
16. Insert reagent blank tube into chamber. Select **Scan Blank**.
17. Remove tube from colorimeter.
18. Insert digested water sample tube into chamber. Select **Scan Sample**. Record result. For the most accurate results, take three readings on each sample and average the results.
19. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT 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 Range Mercury Free Tubes	*0074-SC
or 25	*COD High Range Mercury Tubes	*0077-SC

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

READ SDS

To order individual reagents or test kit components, use the specified code number.

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

Equipment needed but not supplied:

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:	0–15000 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 & RESERVATION:	Collect samples in glass and test as soon as possible. If samples must be stored, preservation is accomplished by the addition of concentrated sulfuric acid 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.

When scanning samples in 16 mm tubes, such as COD, the sample chamber lid can not be closed. Use the COD adapter to minimize stray light interference. To further reduce stray light interference, do not Scan Sample in direct sunlight.

PROCEDURE

Use COD/UDV adapter.

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 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.
11. Press and hold ⏻ until colorimeter turns on.
12. Press ENTER to select **Testing Menu**.
13. Select **All Tests** (or another sequence containing **030 COD HR**) from **Testing Menu**.
14. Wipe the blank tube with a damp towel to remove fingerprints and smudges. Wipe with a dry towel.
15. Scroll to and select **030 COD HR** from menu.
16. Insert reagent blank tube into chamber. Select **Scan Blank**.
17. Remove tube from colorimeter.
18. Insert digested water sample tube into chamber. Select **Scan Sample**. Record result. For the most accurate results, take three readings on each sample and average the results.
19. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT 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.

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:	0–1000 color units
MDL:	20 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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **033 Color**) from **Testing Menu**.
4. Scroll to and select **033 Color** from menu.
5. Rinse a tube (0290) with color-free water (distilled or deionized water). Fill to 10 mL line with color-free water.
6. Insert the tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter. Empty tube.
8. Rinse tube with sample water. Fill to 10 mL line with water sample.
9. Insert tube with sample water, close lid and select **Scan Sample**. Record result in color units.
10. Press ⏻ to turn the colorimeter off, select Print Test to print the results, or press EXIT 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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:** Chem-Tel USA 1-800-255-3924 Int'l, call collect, 813-248-0585

READ SDS

To order individual reagents or test kit components, use the specified code number.

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:	0.04 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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **034 Cu BCA T**) from **Testing Menu**.
4. Scroll to and select **034 Cu BCA T** from menu.
5. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter and add one *Copper IG Tablet (3808A). Cap and shake vigorously until tablet disintegrates. Solution will turn purple if copper is present. Wait 2 minutes.
8. At end of 2 minute waiting period, mix, insert tube into chamber, close lid and select **Scan Sample**. Record result.
9. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT 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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

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. Pools and spas.
RANGE:	0.00–2.00 ppm Copper
MDL:	0.03 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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **035 Cu Cuprizone**) from **Testing Menu**.
4. Scroll to and select **035 Cu Cuprizone** from menu.
5. Rinse a tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Insert the tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter and add 5 drops of *Copper A (6367). Cap and mix.
8. Add 5 drops of *Copper B (6368). Cap and mix.
9. Wait 5 minutes. Mix.
10. Insert tube into chamber, close lid and select **Scan Sample**. Record result.
11. Press ⏻ to turn the colorimeter off, select Print Test to print the results, or press EXIT 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 are 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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

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:	0.00–6.00 ppm Copper
MDL:	0.10 ppm
METHOD:	Copper 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

1. Press and hold ⏻ until colorimeter turns on.
2. Press **ENTER** to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **036 Cu Thiocarbamate**) from **Testing Menu**.
4. Scroll to and select **036 Cu Thiocarbamate** from menu.
5. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter and add 5 drops of *Copper 1 (6446). Cap and mix. Solution will turn yellow if copper is present.
8. Insert tube into chamber, close lid and select **Scan Sample**. Record result.
9. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press **EXIT** 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.

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 6.5-13	2944
1	Stirring Rod, Plastic	0519

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

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:	0.00–0.35 ppm Cyanide
MDL:	0.03 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 chloride both react as cyanide in this test and will give a positive interference. Color and turbidity can also interfere.

PROCEDURE

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to selct **Testing Menu**.
3. Select **All Tests** (or another sequence containing **038 Cyanide**) from **Testing Menu**.
4. Scroll to and select **038 Cyanide** from menu.
5. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Dip the end of plastic rod (0519) into water sample and touch it to a small piece (1/4 inch) of pH test paper (2944) 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.
7. Insert tube into chamber, close lid and select **Scan Blank**.
8. Remove tube from colorimeter. Use the 1.0 mL pipet (0354) to add 1.0 mL of Cyanide Buffer (2850PS) to tube. Cap and mix.
9. 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.
10. During the 30 second waiting period, carefully fill a second 0.1 g spoon (0699) with one level measure of Cyanide Indicator Reagent (2793DS).
11. 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.
12. At the end of the twenty minute waiting period, mix, insert tube into chamber, close lid and select **Scan Sample**. Record result.
13. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT to exit to a previous menu or make another menu selection.

CYANURIC ACID

MELAMINE METHOD–TURBIDITY • CODE 3661-01-SC

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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

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 waters.
RANGE:	5–200 ppm Cyanuric Acid
MDL:	10 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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **039 Cyanuric Acid L**) from **Testing Menu**.
4. Scroll to and select **039 Cyanuric Acid L** from menu.
5. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter and pour out water. Use a graduated cylinder or similar to measure 5 mL of sample water and pour into colorimeter tube.
8. 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.
9. At end of 1 minute waiting period, mix thoroughly, insert tube into chamber, close lid and select **Scan Sample**. Record result.
10. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT 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

TABLET · CODE 3673-SC

QUANTITY	CONTENTS	CODE
100	*CYANURIC ACID IG Tablet	*6996A-H
1	Tablet Crusher	0175

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

APPLICATION:	Swimming pool water.
RANGE:	0–110 ppm
MDL:	10 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.

PROCEDURE

1. Press ⏻ and hold until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **040 Cyanuric Acid T**) from **Testing Menu**.
4. Scroll to and select **040 Cyanuric Acid T** from menu.
5. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter. Add one *CYANURIC ACID IG Tablet (6996A). Crush with thoroughly with Tablet Crusher (0175). Cap.
8. Invert 3 times to mix.
9. Wait 2 minutes.
10. Do not mix. Insert tube into chamber. Close lid. Select **Scan Sample**.
11. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT to exit to a previous menu or make another menu selection.

DISSOLVED OXYGEN

WINKLER COLORIMETRIC METHOD · CODE 3688-SC

QUANTITY	CONTENTS	CODE
30 mL	*Manganous 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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

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:	This method is applicable for the determination of dissolved oxygen in drinking water, all surface waters and wastewater.
RANGE:	0.0–11.0 Dissolved Oxygen
MDL:	0.6 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 *Manganous 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 precipitate has 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.

PROCEDURE

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **043 Dissolved Oxygen**) from **Testing Menu**.
4. Scroll to and select **043 Dissolved Oxygen** from menu.
5. Rinse a clean tube (0290) with untreated sample water. Fill to the 10 mL line with sample. This tube is the BLANK.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Fill a second tube (0290) to the 10 line with the treated "Fixed" sample. This tube is the SAMPLE.
8. Remove BLANK from colorimeter, insert SAMPLE tube into chamber, close lid and select **Scan Sample**. Record result.
9. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT to exit to a previous menu or make another menu selection.

NOTE: 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.

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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

READ SDS

To order individual reagents or test kit components, use the specified code number.

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, pp. 1-27.

APPLICATION	Drinking and surface waters; domestic and industrial waters.
RANGE:	0.0–2.0 ppm Fluoride
MDL:	0.1 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^-) 7000 mg/L Phosphate (PO_4^{-3}) 16 mg/L $(NaPO_3)_6$ 1 mg/L

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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **045 Fluoride**) from **Testing Menu**.
4. Scroll to and select **045 Fluoride** from menu.
5. 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.
6. Use the 0.5 mL pipet (0353) to add 0.5 mL of *Sodium Arsenite Solution (4128). Cap and mix.
7. 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.)
8. Insert tube into chamber, close lid and select **Scan Blank**.
9. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample water. Repeat steps 6 and 7 .
10. Insert tube into chamber, close lid and select **Scan Sample**. Record result.
11. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT to exit to a previous menu or make another menu selection.

HARDNESS, TOTAL

TABLET · CODE 3671-SC

QUANTITY	CONTENTS	CODE
50	*HARDNESS IG Tablets	*3883A-H
1	Tablet Crusher	0175

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

APPLICATION:	Drinking and surface waters; swimming pool water.
RANGE:	0 to 400 mg/L (as CaCO3) 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 sample. However, the added acid will have to be neutralized with NaOH before testing.
INTERFERENCES:	Heavy metals will interfere.

PROCEDURE

1. Press ⏻ and hold until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **047 Hardness T**) from **Testing Menu**.
4. Scroll to and select **047 Hardness T** from menu.
5. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter. Add one *HARDNESS IG Tablet (3883A). Crush THOROUGHLY with Tablet Crusher (0175). Cap.
8. Invert 3 times to mix.
9. Insert tube into chamber. Close lid. Select **Scan Sample**.
10. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT to exit to a previous menu or make another menu selection.

HYDRAZINE

p-DIMETHYLAMINOBENZALDEHYDE METHOD • CODE 3656-01-SC

QUANTITY	CONTENTS	CODE
2 x 60 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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

READ SDS

To order individual reagents or test kit components, use the specified code number.

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

APPLICATION:	Water and boiler water, industrial waste water.
RANGE:	0.00–1.00 ppm Hydrazine
MDL:	0.01 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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **049 Hydrazine**) from **Testing Menu**.
4. Scroll to and select **049 Hydrazine** from menu.
5. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter. Use the 1 mL pipet (0354) to add 4 mL of *Hydrazine Reagent A (4841). Cap and mix.
8. 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.
9. At the end of the 2 minute waiting period, mix, insert tube into chamber, close lid and select **Scan Sample**. Record result.
10. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT 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
2 x 100	*Hydrogen Peroxide LR IG Tablets	*6454A-J
1	Tablet Crusher	0175

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int’l, call collect, 813-248-0585

READ SDS

To order individual reagents or test kit components, use the specified code number.

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 waste water.
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.
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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **051 H Peroxide LR**) from **Testing Menu**.
4. Scroll to and select **051 H Peroxide LR** from menu.
5. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Insert the tube into chamber, close lid and select **Scan Blank**.
7. Remove the tube from colorimeter and add 4 drops of Hydrogen Peroxide Reagent #1 (6452). Cap and mix.
8. 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.
9. At the end of 5 minute waiting period, mix, insert tube into chamber, close lid and select **Scan Sample**. Record result.
10. Press ⏻ to turn the meter off, select Print Test to print the results, or press EXIT 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 – HIGH RANGE

DPD METHOD · CODE 4045-01

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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

READ SDS

To order individual reagents or test kit components, use the specified code number.

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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **050 H Peroxide HR**) from **Testing Menu**.
4. Scroll to and select **050 H Peroxide HR** from menu.
5. Use the pipet (0342) to add 5 drops of the sample water to a tube (0290).
6. Dilute to the 10 mL line with distilled or hydrogen peroxide-free water.
7. Insert the tube into chamber, close lid and select **Scan Blank**.
8. Remove the tube from colorimeter and add 4 drops of Hydrogen Peroxide Reagent #1 (6452). Cap and mix.
9. 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.
10. At the end of 5 minute waiting period, mix, insert tube into chamber, close lid and select **Scan Sample**. Record result.
11. Press ⏻ to turn the meter off, select Print Test to print the results, or press EXIT 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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:** Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

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:	10 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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **052 H Peroxide Shock**) from **Testing Menu**.
4. Scroll to and select **052 H Peroxide Shock** from menu.
5. Use the pipet (0342) to add 5 drops of the sample water to a tube (0290).
6. Dilute to the 10 mL line with distilled or hydrogen peroxide-free water.
7. Insert the tube into chamber, close lid and select **Scan Blank**.
8. Remove the tube from colorimeter and add 4 drops of Hydrogen Peroxide Reagent #1 (6452). Cap and mix.
9. 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.
10. At the end of 5 minute waiting period, mix, insert tube into chamber, close lid and select **Scan Sample**. Record result.
11. Press ⏻ to turn the meter off, select Print Test to print the results, or press EXIT 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 TABLET · 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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

Like chlorine and bromine, iodine is an effective germicidal agent employed in drinking water treatment, pool and spa water sanitization, 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
MLD:	0.2 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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **054 Iodine T DPD**) from **Testing Menu**.
4. Scroll to and select **054 Iodine T DPD** from menu.
5. Rinse a clean tube (0290) with sample water. Fill tube to the 10 mL line with sample.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter. Add one *DPD 1 IG Tablet IG (6903A). Cap and shake 10 seconds. Invert slowly 5 times. Solution will turn pink if iodine is present. Wait 15 seconds. Mix.
8. Insert tube into chamber, close lid and select **Scan Sample**. Record result.
9. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT 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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

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 ppm Iron
MDL:	0.10 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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **055 Iron Bipyridyl**) from **Testing Menu**.
4. Scroll to and select **055 Iron Bipyridyl** from menu.
5. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter. Use the 0.5 mL pipet (0353) to add one measure of *Iron Reagent #1 (V-4450). Cap and mix.
8. Use the 0.1 g spoon (0699) to add 0.1 g of *Iron Reagent #2 Powder (V-4451). Cap and shake vigorously for 30 seconds. Wait three minutes for maximum color development.
9. At the end of 3 minute waiting period, DO NOT MIX. Insert tube into chamber, close lid and select **Scan Sample**. Record result.
10. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT 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

I,IO-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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int’l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

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:	0.0–5.0 ppm Iron
MDL:	0.1 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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **056 Iron Phenthro**) from **Testing Menu**.
4. Scroll to and select **056 Iron Phenthro** from menu.
5. Rinse a clean tube (0290)with sample water. Fill to the 10 mL mark with sample.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove the tube from colorimeter. 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.
8. After five minutes, mix, insert tube into chamber, close lid and select **Scan Sample**. Record result as ppm Ferrous Iron.
9. Remove the tube from colorimeter. Use the 0.1g spoon (0699) to add one measure of *Iron Reducing Reagent (2777). Cap and invert 15 times times to mix. Wait 5 minutes for maximum color development.
10. After 5 minutes, mix, insert tube into chamber, close lid and select **Scan Sample**. Record result as ppm Total Iron.
11. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT to exit to a previous menu or make another menu selection.
12. 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.

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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

READ SDS

To order individual reagents or test kit components, use the specified code number.

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 wastewater.
RANGE:	0.0–5.0 ppm Lead
MDL:	0.1 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

1. Press and hold ⏻ until colorimeter turns on.
2. Press **ENTER** to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **058 Lead**) from **Testing Menu**.
4. Scroll to and select **058 Lead** from menu.
5. Rinse a tube (0290) with sample water. Fill to 10 mL with sample.
6. Insert the tube into chamber, close lid and select **Scan Blank**.
7. Remove the tube from colorimeter. Empty the tube. Use the Syringe (0807) to add 5mL of sample to the tube.
8. Add 5 mL *Ammonium Chloride Buffer (4032) to fill the tube to the 10 mL line. Swirl to mix.
9. Add 3 drops *Sodium Cyanide, 10% (6565). Swirl to mix.
10. Use the 0.5 mL pipet (0353) to add 0.5 mL PAR Indicator (4033). Swirl to mix.
11. Use the 0.5 mL pipet (0353) to add 0.5 mL Stabilizing Reagent (4022). Cap and mix.
12. Insert tube into chamber, close lid and select **Scan Sample**. Record result in ppm as Reading A.
13. Remove tube from colorimeter. Add 3 drops *DDC Reagent (4034). Cap and mix.
14. Insert tube into chamber, close lid and select **Scan Sample**. Record result in ppm as Reading B.
15. Calculate result:
    Lead (ppm) = Reading A - Reading B
16. Press ⏻ to turn the colorimeter off, select Print Test to print the results, or press **EXIT** 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
2x60 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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

READ SDS

To order individual reagents or test kit components, use the specified code number.

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:	0.01 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 samples can be stored in plastic.
INTERFERENCES:	None. Test is quite specific.

PROCEDURE

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **060 Manganese LR**) from **Testing Menu**.
4. Scroll to and select **060 Manganese LR** from menu.
5. Rinse a tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter. Use the 1.0 mL pipet (0354) to add 2.0 mL (two measures) of *Hardness Buffer Reagent (4255). Swirl to mix.
8. Add 2 drops of *Sodium Cyanide, 10% (6565). Cap and mix.
9. Use the 0.5 mL pipet (0369) to add 0.5 mL of *Manganese Indicator Reagent (3956). Cap and mix.
10. Immediately insert tube into chamber, close lid and select **Scan Sample**. Record result.
11. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT 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

*Reagent is a potential health hazard. **READ SDS:**
lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

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 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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **059 Manganese HR**) from **Testing Menu**.
4. Scroll to and select **059 Manganese HR** from menu.
5. Rinse a tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter. Use the 0.1 g spoon (0699) to add two measures of *Manganese Buffer Reagent (6310). Cap and mix until powder dissolves.
8. 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.
9. At the end of the two minute waiting period, mix, insert tube into chamber, close lid and select **Scan Sample**. Record result.
10. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT to exit to a previous menu or make another menu selection.

MOLYBDENUM – HIGH RANGE

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	0354

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

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.

APPLICATIONS:	Boiler and cooling water.
RANGE:	0.0–50.0 ppm Molybdenum
MDL:	0.6 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 inteference.

PROCEDURE

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **063 Molybdenum HR**) from **Testing Menu**.
4. Scroll to and select **063 Molybdenum HR** from menu.
5. Fill clean tube (0290) to 10 mL line with sample water.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter. Use a 1.0 mL pipet (0354) to add 1.0 mL of *Mo Buffer (3997). Cap and mix.
8. Use a second 1.0 mL pipet (0372) to add 1.0 mL of *Molybdenum Oxidizing Reagent (6485). Cap and mix.
9. 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. Mix the tube to remove bubbles.
10. Insert tube into chamber, close lid and select **Scan Sample**. Record result.
11. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT 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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

READ SDS

To order individual reagents or test kit components, use the specified code number.

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 wastewater.
RANGE:	0.00–8.00 ppm Nickel
MDL:	0.15 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

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.
9. Press and hold ⏻ until colorimeter turns on.
10. Press ENTER to select **Testing Menu**.
11. Select **All Tests** (or another sequence containing **064 Nickel**) from **Testing Menu**.
12. Scroll to and select **064 Nickel** from menu.
13. Insert the blank into chamber, close lid and select **Scan Blank**.
14. Insert test sample into chamber, close lid and select **Scan Sample**. Record result.
15. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT to exit to a previous menu or make another menu selection.

NOTE: It is strongly suggested that a reagent blank 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.

NITRATE

ZINC REDUCTION · CODE 3689-SC

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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

READ SDS

To order individual reagents or test kit components, use the specified code number.

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:	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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **066 Nitrate T**) from **Testing Menu**.
4. Scroll to and select **066 Nitrate T** from menu.
5. Rinse a tube (0290) with sample water. Fill to 10 mL line with sample.
6. Insert the tube into chamber, close lid and select **Scan Blank**.
7. Remove the tube from colorimeter.
8. Add one *Nitrate IG Tablet (3881A).
9. Use Tablet Crusher (0175) to crush tablet.
10. Cap tube.
11. Invert tube 60 times per minute for 2 minutes (one inversion equals 180°).
12. Wait 5 minutes. Do not mix.
13. Insert tube into chamber, close lid and select **Scan Sample**. Record result in ppm nitrate.
14. Press ⏻ to turn the colorimeter off, select Print Test to print the results, or press EXIT button 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.

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

NITRATE-NITROGEN – LOW RANGE

CADMIUM REDUCTION METHOD · CODE 3649-01-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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:** Chem-Tel USA 1-800-255-3924 Int’l, call collect, 813-248-0585

READ SDS

To order individual reagents or test kit components, use the specified code number.

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:	This method determines nitrate levels in drinking, surface, saline waters, domestic and industrial waters.
RANGE:	0.00–3.00 ppm Nitrate Nitrogen
MDL:	0.10 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

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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **065 Nitrate-N LR**) from **Testing Menu**.
4. Scroll to and select **065 Nitrate-N LR** from menu.
5. Rinse a clean tube (0290) with sample water. Fill to 10 mL line with sample.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter and pour off 5 mL into graduated cylinder or similar. Discard the remaining sample.
8. Pour the 5mL 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.
9. Use the 0.1 g spoon (0699) to add two measures of *Nitrate Reducing Reagent (V-6279). Cap.
10. Hold tube by index finger and thumb and mix by inverting approximately 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.
11. At the end of the 10 minute waiting period, mix, insert tube into chamber, close lid and select **Scan Sample**. Record result.
12. Press ⏻ to turn the colorimeter off, select Print Test to print the results, or press EXIT button 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 are 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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

READ SDS

To order individual reagents or test kit components, use the specified code number.

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:	This method is applicable for the determination of nitrite in 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

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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **068 Nitrite-N LR**) from **Testing Menu**.
4. Scroll to and select **068 Nitrite-N LR** from menu.
5. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter and pour off 5 mL into a graduated cylinder or similar. Discard the remaining sample.
8. 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.
9. 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.
10. At the end of the 5 minute waiting period, mix, insert tube into chamber, close lid and select **Scan Sample**. Record result.
11. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT button 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.

OXYGEN SCAVENGERS

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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int’l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

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:	0.00–0.70 ppm DEHA (Diethylhydroxylamine) 0.000–0.900 ppm Carbohydrazide 0.00–3.00 ppm Erythorbic Acid 0.00–2.00 ppm Hydroquinone 0.00–3.00 ppm Methylethylketoxime
MDL:	0.01 ppm DEHA 0.04 ppm Carbohydrazide 0.02 ppm Erythorbic Acid 0.01 ppm Hydroquinone 0.01 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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **042 DEHA**) from **Testing Menu**.
4. Scroll to and select **042 DEHA** from menu.
5. Rinse a tube (0290) with sample water. Fill to 10 mL with sample.
6. Insert the tube into chamber, close lid and select **Scan Blank**.
7. Remove the tube from colorimeter.
8. Add 3 drops of *DEHA Reagent #1 (4791). Swirl to mix.
9. Add 3 drops of DEHA Reagent #2 (4792). Swirl to mix.
10. Add 3 drops of *DEHA Reagent #3 (4793). Invert 3 times to mix.
11. Insert the tube into chamber. Close lid.
12. Wait 15 minutes. Do not open the lid during the waiting time. The reaction is photosensitive.
13. Remove tube from chamber. Invert 2 times to mix.
14. Immediately insert tube into chamber, close lid and select **Scan Sample**. Read within 30 seconds. Record result in ppm DEHA.
15. Press ⏻ to turn the colorimeter off, select Print Test to print the results, or press EXIT 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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **019 Carbohydrazide**)from **Testing Menu**.
4. Scroll to and select **019 Carbohydrazide** from menu.
5. Rinse a tube (0290) with sample water. Fill to 10 mL with sample.
6. Insert the tube into chamber, close lid and select **Scan Blank**.
7. Remove the tube from colorimeter.
8. Add 3 drops of *DEHA Reagent #1 (4791). Swirl to mix.
9. Add 3 drops of DEHA Reagent #2 (4792). Swirl to mix.
10. Add 3 drops of *DEHA Reagent #3 (4793). Invert 3 times to mix.
11. Insert the tube into chamber. Close lid.
12. Wait 15 minutes. Do not open the lid during the waiting time. The reaction is photosensitive.
13. Remove tube from chamber. Invert 2 times to mix.
14. Immediately insert tube into chamber, close lid and select **Scan Sample**. Read within 30 seconds. Record result in ppm carbohydrazide.
15. Press ⏻ to turn the colorimeter off, select Print Test to print the results, or press EXIT 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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **044 Erythorbic Acid**) from **Testing Menu.**
4. Scroll to and select **044 Erythorbic Acid** from menu.
5. Rinse a tube (0290) with sample water. Fill to 10 mL with sample.
6. Insert the tube into chamber, close lid and select **Scan Blank**.
7. Remove the tube from colorimeter.
8. Add 3 drops of *DEHA Reagent #1 (4791). Swirl to mix.
9. Add 3 drops of DEHA Reagent #2 (4792). Swirl to mix.
10. Add 3 drops of *DEHA Reagent #3 (4793). Invert 3 times to mix.
11. Insert the tube into chamber. Close lid.
12. Wait 15 minutes. Do not open the lid during the waiting time. The reaction is photosensitive.
13. Remove tube from chamber. Invert 2 times to mix.
14. Immediately insert tube into chamber, close lid and select **Scan Sample**. Read within 30 seconds. Record result in ppm erythorbic acid.
15. Press ⏻ to turn the colorimeter off, select Print Test to print the results, or press EXIT 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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **053 Hydroquinone**)from **Testing Menu**.
4. Scroll to and select **053 Hydroquinone** from menu.
5. Rinse a tube (0290) with sample water. Fill to 10 mL with sample.
6. Insert the tube into chamber, close lid and select **Scan Blank**.
7. Remove the tube from colorimeter.
8. Add 3 drops of *DEHA Reagent #1 (4791). Swirl to mix.
9. Add 3 drops of DEHA Reagent #2 (4792). Swirl to mix.
10. Add 3 drops of *DEHA Reagent #3 (4793). Invert 3 times to mix.
11. Insert the tube into chamber. Close lid.
12. Wait 15 minutes. Do not open the lid during the waiting time. The reaction is photosensitive.
13. Remove tube from chamber. Invert 2 times to mix.
14. Immediately insert tube into chamber, close lid and select **Scan Sample**. Read within 30 seconds. Record result in ppm hydroquinone.
15. Press ⏻ to turn the colorimeter off, select Print Test to print the results, or press EXIT 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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **062 M E Ketoxime**) from **Testing Menu**.
4. Scroll to and select **062 M E Ketoxime** from menu.
5. Rinse a tube (0290) with sample water. Fill to 10 mL with sample.
6. Insert the tube into chamber, close lid and select **Scan Blank**.
7. Remove the tube from colorimeter.
8. Add 3 drops of *DEHA Reagent #1 (4791). Swirl to mix.
9. Add 3 drops of DEHA Reagent #2 (4792). Swirl to mix.
10. Add 3 drops of *DEHA Reagent #3 (4793). Invert 3 times to mix.
11. Insert the tube into chamber. Close lid.
12. Wait 15 minutes. Do not open the lid during the waiting time. The reaction is photosensitive.
13. Remove tube from chamber. Invert 2 times to mix.
14. Immediately insert tube into chamber, close lid and select **Scan Sample**. Read within 30 seconds. Record result in ppm methylethylketoxime.
15. Press ⏻ to turn the colorimeter off, select Print Test to print the results, or press EXIT 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 3651-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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

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, pool and aquatic waters.
RANGE:	0.00–0.40 ppm Ozone, Low Range 0.00–2.50 ppm Ozone, High Range
MDL:	0.01 ppm Ozone, Low Range 0.05 ppm Ozone, 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

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 (3988-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.
9. Press and hold ⏻ until colorimeter turns on.
10. Press ENTER to select **Testing Menu**.
11. Select **All Tests** (or another sequence containing **071 Ozone IB LR**) from **Testing Menu**.
12. Scroll to and select **071 Ozone IB LR** from menu.
13. Insert the Reagent Blank tube into chamber, close lid and select **Scan Blank**.
14. Insert reacted Sample Tube into chamber, close lid and select **Scan Sample**. Record result.
15. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT 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

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 25 mL of *Ozone Buffer (3991) to amber glass bottle marked HR Reagent (3988-MT-G).
2. Use the 50 mL graduated cylinder to carefully add 25 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.
9. Press and hold ⏻ until colorimeter turns on.
10. Press ENTER to select **Testing Menu**.
11. Select **All Tests** (or another sequence containing **072 Ozone IB HR**) from **Testing Menu**.
12. Scroll to and select **072 Ozone IB HR** from menu.
13. Insert the Reagent Blank tube into chamber, close lid and select **Scan Blank**.
14. Insert reacted Sample Tube into chamber, close lid and select **Scan Sample**. Record result.
15. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT 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.

OZONE

DPD LIQUID METHOD · CODE 4881-01

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
2 x 15 mL	Glycine Solution	6811-E

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

READ SDS

To order individual reagents or test kit components, use the specified code number.

Note: The primary use for this kit is in applications that use only ozone and no other oxidizing disinfectants.

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:	Bottled water, aquatic waters, and non-chlorinated waters.
RANGE:	0.00 – 3.00 mg/L Ozone
MDL:	0.03 mg/L
METHOD:	In the presence of iodide, ozone reacts instantly with the buffered diethyl-p-phenylenediamine indicator (DPD) to produce a red color in proportion to the amount of ozone present.
SAMPLE HANDLING & PRESERVATION:	Ozone in aqueous solutions, particularly weak solutions, is not stable. Exposure to sunlight or agitation will accelerate the reduction of ozone. Fill sample containers to the top and cap tightly. Analyze samples as soon as possible after collection.
INTERFERENCES:	Interferences are other oxidizers, such as, chlorine, bromine, iodine, and oxidized manganese. The DPD reagent system used in this kit has a significant interference from chlorine. The interference from chlorine only is eliminated with the addition of glycine.

PROCEDURE – OZONE ONLY

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **073 Ozone L DPD**) from **Testing Menu**.
4. Scroll to and select **073 Ozone L DPD** from menu.
5. Rinse a tube (0290) with sample water. Fill to 10 mL with sample.
6. Insert the tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter.
8. Add 5 drops DPD #3 Total Chlorine Reagent (6743). Swirl to mix.
9. Add 5 drops DPD #1 A Free Chlorine Reagent (6740) and 5 drops *DPD #1B Free Chlorine Reagent (6741).
10. Cap and invert to mix. Make reading within 30 seconds.
11. Insert tube into chamber, close lid and select **Scan Sample**. Record result as mg/L ozone.
12. Press ⏻ to turn the meter off, select Print Test to print the results, or press EXIT 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 are obtained.

PROCEDURE - OZONE WITH CHLORINE PRESENT

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **073 Ozone L DPD**) from **Testing Menu**.
4. Scroll to and select **073 Ozone L DPD** from menu.
5. Rinse a tube (0290) with sample water. Fill to 10 mL with sample.
6. Insert the tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter.
8. Add 5 drops DPD #3 Total Chlorine Reagent (6743). Swirl to mix.
9. Add 5 drops DPD #1 A Free Chlorine Reagent (6740) and 5 drops *DPD #1B Free Chlorine Reagent (6741).
10. Cap and invert to mix. Make reading within 30 seconds.
11. Insert tube into chamber, close lid and select **Scan Sample**. Record result as Reading A (ozone + total chlorine).
12. Rinse a tube (0290) with sample water. Fill to 10 mL with sample.
13. Add 5 drops of Glycine Solution (6811). Swirl to mix.
14. Add 5 drops DPD #3 Total Chlorine Reagent (6743). Swirl to mix.
15. Add 5 drops DPD #1 A Free Chlorine Reagent (6740) and 5 drops *DPD #1B Free Chlorine Reagent (6741).
16. Cap and invert to mix. Make reading within 30 seconds.
17. Insert tube into chamber, close lid and select **Scan Sample**. Record result as Reading B (chlorine).
18. Calculate the ozone concentration in mg/L ozone.

    Reading A – Reading B = mg/L ozone

19. Press ⏻ to turn the meter off, select Print Test to print the results, or press EXIT 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 are obtained.

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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

READ SDS

To order individual reagents or test kit components, use the specified code number.

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.
METHOD:	The various pH indicators exhibit a specific color change over a narrow pH range. The color changes are measured colorimetrically.
SAMPLE HANDLING & PRESERVATION:	Sample should be analyzed immediately after collection.
INTERFERENCES:	Sample color and turbidity interfere with the colorimetric pH measurement. Color interference may be removed bystandardizing the instrument with the original water sample. Two drops of 0.1N sodium thiosulfate per 100 mL of sample will eliminate chlorine interference.

INDICATOR, RANGE, & TEST NAME:	pH Indicator	pH	Smart3 Test Name
	Chlorphenol Red	5.0-6.8	074 pH CPR
	Phenol Red	6.6-8.4	075 pH PR
	Thymol Blue	8.0-9.5	077 pH TB

PROCEDURE

1. Use Indicator, Range, & Test Name chart to select the indicator, corresponding to anticipated pH range and to determine corresponding test name to select from colorimeter menu.
2. Press and hold ⏻ until colorimeter turns on.
3. Press ENTER to select **Testing Menu**.
4. Select **All Tests** (or another sequence containing the appropriate pH test name) from **Testing Menu**.
5. Scroll to and select the appropriate pH test name from menu.
6. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
7. Insert tube into chamber, close lid and select **Scan Blank**.
8. Remove tube from colorimeter. Use the 0.5 mL pipet (0369) to add exactly 0.5 mL of the pH indicator for the chosen range. Cap and mix.
9. Insert tube into chamber, close lid and select **Scan Sample**. Record result.
10. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT to exit to a previous menu or make another menu selection.

pH - PHENOL RED

TABLET · CODE 3672-SC

QUANTITY	CONTENTS	CODE
100	pH PHENOL RED Tablets	3880A-H
1	Tablet Crusher	0175

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

READ SDS

To order individual reagents or test kit components, use the specified code number.

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:	6.6 to 8.4
MDL:	Not Applicable
METHOD:	The phenol red indicator exhibits a specific color change over a narrow pH range. The color changes are measured colorimetrically.
SAMPLE HANDLING & PRESERVATION:	Sample should be analyzed immediately after collection.
INTERFERENCES:	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.

PROCEDURE

1. Press ⏻ and hold until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **076 pH T**) from **Testing Menu**.
4. Scroll to and select **076 pH T** from menu.
5. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter. Add one pH PHENOL RED Tablet (3880A). Crush with Tablet Crusher (0175). Cap.
8. Invert 3 times to mix.
9. Insert tube into chamber. Close lid. Select **Scan Sample**.
10. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT 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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

READ SDS

To order individual reagents or test kit components, use the specified code number.

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.

APPLICATION:	Drinking and surface waters; domestic and industrial waste water.
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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **079 Phenol**) from **Testing Menu**.
4. Scroll to and select **079 Phenol** from menu.
5. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter. Use the 0.1 g spoon (0699) to add one measure of Aminoantipyrine Reagent (7825). Cap and mix.
8. Use the plain pipet (0352) to add 4 drops of *Ammonium Hydroxide Solution (7826). Cap and mix.
9. 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.
10. Insert tube into chamber, close lid and select **Scan Sample**. Record result.
11. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT 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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

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:	0.05 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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **081 Phosphate LR**) from **Testing Menu**.
4. Scroll to and select **081 Phosphate LR** from menu.
5. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter. Use 1.0 mL pipet (0354) to add 1.0 mL of *Phosphate Acid Reagent (V-6282). Cap and mix.
8. Use the 0.1 g spoon (0699) to add one measure of Phosphate Reducing Reagent (V-6283). Cap and mix until powder dissolves. Wait 5 minutes for full color development. Solution will turn blue if phosphates are present.
9. At end of 5 minute waiting period, mix, insert tube into chamber, close lid and select **Scan Sample**. Record result.
10. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT 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 mL, plastic	0354

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

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 water.
RANGE:	0–70 ppm Orthophosphate
MDL:	1 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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **080 Phosphate HR**) from **Testing Menu**.
4. Scroll to and select **080 Phosphate HR** from menu.
5. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter. 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.
8. After 5 minute waiting period, mix, insert tube into chamber, close lid and select **Scan Sample**. Record result.
9. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT to exit to a previous menu or make another menu selection.

PHOSPHATE ppb

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

*Reagent is a potential health hazard. **READ SDS:**
lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

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:	0–3000 ppb Orthophosphate
MDL:	50 ppb
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

1. Press and hold ⏻ until colorimeter turns on.
2. Press **ENTER** to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **082 Phosphate ppb**) from **Testing Menu**.
4. Scroll to and select **082 Phosphate ppb** from menu.
5. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter. Use 1.0 mL pipet (0354) to add 1.0 mL of *Phosphate Acid Reagent (V-6282). Cap and mix.
8. 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.
9. At end of 5 minute waiting period, mix, insert tube into chamber, close lid and select **Scan Sample**. Record result.
10. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press **EXIT** 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

NOTE: For greater accuracy, use laboratory grade pipets.

Equipment needed but not supplied:

1	COD Reactor, 12 tubes, 120V	5-0102
or 1	COD Reactor, 12 tubes, 230V	5-0102-EX2

Optional Equipment:

1	Volumetric pipet, 5.0 mL	2-2174
2	Volumetric pipets, 1.0 mL	2-2170
1	Graduated pipet, 0-5 mL	2-2167
1	Pipet Bulb	2-2164
1	Wipes	2-2069
1	Test Tube Holder	2-2190

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:** Chem-Tel USA 1-800-255-3924 Int'l, call collect, 813-248-0585

READ SDS

To order individual reagents or test kit components, use the specified code number.

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:	0.50 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 COD/UDV adapter.

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 completely dissolves.
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, press and hold ⏻ until colorimeter turns on.
7. Press ENTER to select **Testing Menu**.
8. Select **All Tests** (or another sequence containing **084 Phosphate T LR**) from **Testing Menu**.
9. Scroll to and select **084 Phosphate T LR** from the menu.
10. Carefully remove the cap 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.
11. Wipe the tube with a damp towel to remove fingerprints and smudges. Wipe with a dry towel.
12. Insert the tube into the chamber. Select **Scan Blank**. Remove the tube from the colorimeter.
13. Use another 1 mL pipet (0354) to add *1.0 mL of Phosphate Acid Reagent (V-6282). Cap and invert tube to mix.
14. 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.
15. Wait 5 minutes.
16. Wipe the vials with a damp towel to remove fingerprints and smudges. Wipe with a dry towel.
17. Insert the tube into the chamber. Select **Scan Sample**. Record the result as Total Phosphorus in mg/L PO_4.
18. Press ⏻ to turn the colorimeter off, select Print Test to print the results, or press EXIT to exit to a previous menu or make another menu selection.

NOTES: For greater accuracy, use laboratory grade pipets.

PHOSPHORUS, TOTAL – HIGH RANGE

MOLYBDOVANADATE METHOD WITH ACID PERSULFATE DIGESTION
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

NOTE: For greater accuracy, use laboratory grade pipets.
Equipment needed but not supplied:

1	COD Reactor, 12 vial, 120V	5-0102
Or 1	COD Reactor, 12 vial, 23V	5-0102-EX2
Or 1	COD Reactor, 25 vial, 115V/230V	5-0094

Optional Equipment:

1	Volumetric pipet, 2.0 mL	2-2168
2	Volumetric pipet, 5.0 mL	2-2174
1	Graduated pipet, 0-5 mL	2-2167
1	Pipet Bulb	2-2164
1	Wipes	2-2069
1	Test Tube Holder	2-2190

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

READ SDS

To order individual reagents or test kit components, use the specified code number.

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:	5–100 mg/L Total Phosphorus as phosphate
MDL:	5 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 digestion. Orthophosphate reacts in acidic 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.

PROCEDURE

Use COD/UDV adapter.

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 the 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 dissolves completely.
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, press and hold ⏻ until colorimeter turns on.
10. Press ENTER to select **Testing Menu**.
11. Select **All Tests** (or another sequence containing **083 Phosphate T HR**) from **Testing Menu**.
12. Scroll to and select **083 Phosphate T HR** from the menu.
13. Wipe the tubes with a damp towel to remove fingerprints and smudges. Wipe with a dry towel.
14. Insert the blank tube into the chamber. Select **Scan Blank**. Remove the blank tube from the colorimeter.
15. Insert the sample tube into the chamber. Select **Scan Sample**. Record the result as Total Phosphorus in mg/L PO$_4$.
16. Press ⏻ to turn the colorimeter off, select Print Test to print the results, or press EXIT to exit to a previous menu or make another menu selection.

NOTE: For greater accuracy, use laboratory grade pipets.

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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

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 water.
RANGE:	0.0–10.0 ppm Potassium
MDL:	0.8 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.
INTERFERENCE:	Calcium and magnesium interfere at very high concentrations. Check for stray light interference (see page 15).

PROCEDURE

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **085 Potassium**) from **Testing Menu**.
4. Scroll to and select **085 Potassium** from menu.
5. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter. Add 4 drops of *Sodium Hydroxide, 1.0N (4004WT). Cap and mix.
8. Use the 0.05 g spoon (0696) to add one measure of *Tetraphenylboron Powder (6364). Cap and shake vigorously for 20 seconds until all of the powder has dissolved. Wait 5 minutes.
9. At end of 5 minute waiting period, mix tube again to suspend any settled precipitate. Insert tube into chamber, close lid and select **Scan Sample**. Record result.
10. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT 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 are 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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:** Chem-Tel USA 1-800-255-3924 Int’l, call collect, 813-248-0585

READ SDS

To order individual reagents or test kit components, use the specified code number.

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:	0.00–4.00 ppm Silica
MDL:	0.05 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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **087 Silica LR**) from **Testing Menu**.
4. Scroll to and select **087 Silica LR** from menu.
5. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Insert tube into chamber, close lid and select **Scan Blank**. (See Note)
7. Remove tube from colorimeter. Add 6 drops *Silica Reagent #1 (V-4466). Cap and invert to mix.
8. Add 12 drops of *Silica Reagent #2 (V-4467). Cap and mix. Wait 5 minutes.
9. Add 8 drops of *Silica Reagent #3 (V-4468). Cap and mix. Wait 2 minutes.
10. 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.
11. At end of 5 minute waiting period, mix, insert tube into chamber, close lid and select **Scan Sample**. Record result.
12. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT 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 are 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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:** Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

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:	Boilers and cooling towers; domestic and industrial wastes.
RANGE:	0–75 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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **086 Silica HR**) from **Testing Menu**.
4. Scroll to and select **086 Silica HR** from menu.
5. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter. Add 6 drops *Silica Reagent #1 (V-4466). Cap and invert to mix.
8. Add 12 drops of *Silica Reagent #2 (V-4467). Cap and mix. Wait 5 minutes.
9. At end of 5 minute waiting period, add 8 drops of *Silica Reagent #3 (V-4468). Cap and mix.
10. Insert tube into chamber, close lid and select **Scan Sample**. Record result.
11. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT 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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:** Chem-Tel USA 1-800-255-3924
Int’l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

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:	0–100 ppm Sulfate
MDL:	3 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.
INTERFERENCE:	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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **089 Sulfate HR**) from **Testing Menu**.
4. Scroll to and select **089 Sulfate HR** from menu.
5. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter. 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.
8. Mix tube again. Insert tube into chamber, close lid and select **Scan Sample**. Record result.
9. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT to exit to a previous menu or make another menu selection.

NOTE: 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	*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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

READ SDS

To order individual reagents or test kit components, use the specified code number.

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:	0.00–1.50 ppm Sulfide
MDL:	0.06 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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **090 Sulfide LR**) from **Testing Menu**.
4. Scroll to and select **090 Sulfide LR** from menu.
5. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter. Use the 1.0 mL pipet (0354) to add 1.0 mL of *Sulfide Reagent A (V-4458). Cap and mix.
8. Add 6 drops of Sulfide Reagent B (V-4459). Cap and mix. Wait 1 minute. Solution will turn blue if sulfides are present.
9. 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.
10. Insert tube into chamber, close lid and select **Scan Sample**. Record result.
11. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT 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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:** Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

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:	0.0–8.0 ppm as Linear Alkyl Sulfonates (LAS)
MDL:	0.5 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 surfactants and nonionic surfactants.

PROCEDURE

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **092 Surfactants**) from **Testing Menu**.
4. Scroll to and select **092 Surfactants** from menu.
5. Rinse a tube (0290) with sample water. Fill to 10 mL line with sample.
6. Insert the tube into chamber, close lid and select **Scan Blank**.
7. Remove the tube from colorimeter.
8. Use the 0.5 g spoon (0698) to add 0.5 g pH Adjustment Powder (4509). Cap and mix until powder dissolves.
9. Use the 0.1 g spoon (0699) to add two measures of Sodium Chloride Reagent (4877). Cap and mix until powder disintegrates.
10. Use the 1.0 mL pipet (0354) to add 2.0 mL of *DS Indicator (4508).
11. Cap the tube. Hold the tube by the index finger and thumb. 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.
12. Wait 5 minutes. DO NOT MIX.
13. Insert tube into chamber, close lid and select **Scan Sample**. Record result in ppm LAS.
14. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT 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
1	Pipet, plain, plastic	0352
1	Pipet, 1.0 mL, plastic	0354

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:** Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

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 wastewater, boiler water, and natural water.
RANGE:	0.0–10.0 ppm Tannic Acid
MDL:	0.1 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

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **093 Tannin**) from **Testing Menu**.
4. Scroll to and select **093 Tannin** from menu.
5. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter. Use the plain pipet (0352) to add 4 drops of *Tannin Reagent #1 (7833). Cap and mix.
8. 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.
9. At end of 30 minute waiting period, mix, insert tube into chamber, close lid and select **Scan Sample**. Record result.
10. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT 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 water for non-compliance monitoring. (For compliance monitoring at low turbidity levels, use a commercial nephelometer.)
RANGE:	0–500 FAU (Formazin Attenuation Units)
MDL:	3 FAU
METHOD:	Absorptimetric, 180° detector
SAMPLE HANDLING & PRESERVATION:	Measure sample as soon as possible after collection.
INTERFERENCES:	Check for stray light interference (see page 15).

PROCEDURE

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **095 Turbidity**) from **Testing Menu**.
4. Scroll to and select **095 Turbidity** from menu.
5. Rinse a clean tube (0290) with deionized water (turbidity free). Fill to the 10 mL line with deionized water.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. 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.
8. Insert tube into chamber, close lid and select **Scan Sample**. Record result. Turbidity measurements should be taken as soon as possible after sample has been collected.
9. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT 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 SOLUTIONS

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.

UREA

UREASE/SALICYLATE METHOD · CODE 3674-SC

QUANTITY	CONTENTS	CODE
2 x 25	Urease Delivery Strips	2939-G
2 x 60 mL	*Salicylate Ammonia #1	*3978-H
25 g	*Salicylate #2 Reagent	*7457-G
25 g	*Salicylate #3 Reagent Powder	*7458-G
1	Pipet, 1.0 mL, plastic	0354
1	Spoon, 0.15 g, plastic	0727
1	Spoon, 0.1 g, plastic	0699

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:** Chem-Tel USA 1-800-255-3924 Int'l, call collect, 813-248-0585

READ SDS

To order individual reagents or test kit components, use the specified code number.

NOTE: Store Urease Delivery Strips at 2 – 8°C (36 - 46°F).

Urea is the main nitrogen-containing contaminant in swimming pools. It reacts with free available chlorine to form chloramines which can cause taste and odor problems and eye irritation. Urea also acts as a nutrient for algae and bacteria. It is introduced by bather's sweat and is the main component of urine.

APPLICATION:	Swimming pool water
RANGE:	0.0–6.0 mg/L Urea
MDL:	0.4 ppm
METHOD:	Urease catalyzes the hydrolysis of urea to produce ammonia. 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 urea concentration in the sample.
SAMPLE HANDLING & PRESERVATION:	Urea solutions are unstable and should be analyzed as soon as possible.
INTERFERENCES:	High concentrations of reducing agents will react with the chlorine donor and result in a negative interference. Color and turbidity can also interfere.

PROCEDURE

1. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **096 Urea**) from **Testing Menu**.
4. Scroll to and select **096 Urea** from menu.
5. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Submerge a Urease Delivery Strip (2939) in the sample. Plunge the strip up and down for 30 seconds. (Avoid hitting the bottom of the tube.) Remove and discard strip.
8. Wait exactly 5 minutes.
9. At the end of 5 minute waiting period, use the 1.0 mL plastic pipet (0354) to add 2.0 mL of *Salicylate Ammonia #1 (3978). (Fill pipet to the line for accurate results.) Cap tube.
10. Invert 2 times to mix. (Do not shake vigorously.)
11. Use the 0.15 g spoon (0727) to add two level measures of *Salicylate #2 Reagent (7457). (To add a level spoon of powder, tap spoon on edge of reagent container to remove excess powder. Do not add excess powder.) Cap tube.
12. Invert to mix for 30 seconds or until powder dissolves. (Do not shake vigorously.)
13. Wait exactly one minute.
14. At the end of one minute waiting period use the 0.1 g spoon (0699) to add two level measures of *Salicylate #3 Reagent (7458). (To add a level spoon of powder, tap spoon on edge of reagent container to remove excess powder. Do not add excess powder.)
15. Cap and shake vigorously for at least 30 seconds until all solid has dissolved.
16. Wait exactly 12 minutes for maximum color development.
17. Insert tube into chamber. Close lid. Select **Scan Sample**.
18. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT to exit to a previous menu or make another menu selection.

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	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

*Reagent is a potential health hazard. **READ SDS:** lamotte.com. **Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585

To order individual reagents or test kit components, use the specified code number.

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 waste water.
RANGE:	0.00–3.00 ppm Zinc
MDL:	0.05 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	CrO4(II)	50
Fe (II)	9		

PROCEDURE

A. PREPARATION OF DILUTE ZINC INDICATOR SOLUTION

1. Use a pipet (0352) to add exactly 5.0 mL of *Zinc Indicator Solution (6314) to a 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. Press and hold ⏻ until colorimeter turns on.
2. Press ENTER to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **097 Zinc LR**) from **Testing Menu**.
4. Scroll to and select **097 Zinc LR** from menu.
5. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
6. Insert tube into chamber, close lid and select **Scan Blank**. (See Note)
7. Remove tube from colorimeter. 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.
8. Add 3 drops of *Sodium Cyanide, 10% (6565). Cap and mix.
9. Use the 1 mL pipet assembly to add 1 mL of *Dilute Zinc Indicator Solution (6321). Cap and mix.
10. Use a second plain pipet (0352) to add 4 drops of *Formaldehyde Solution, 37% (5128). Cap and mix by inverting 15 times.
11. Insert tube into chamber, close lid and select **Scan Sample**. Record result.
12. Press ⏻ to turn colorimeter off, select Print Test to print the results, or press EXIT 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 ppm Ammonia Nitrogen (NH_{3+}–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	14.97	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