LaMotte

DPC-52

Water Testing Laboratory Manual

CODE 3509-01

DPC-2 Colorimeter Version

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INTRODUCTION

The Water Lab is a colorimeter laboratory for rapid, accurate measurement of pool or spa water chemistry. The Water Lab may be used to identify the causes of water quality problems and to determine appropriate corrective treatment. The test results obtained with this laboratory may be employed in most computer programs for pool water treatment. The outfit is portable, compact, and easy to use. An inexperienced operator with no knowledge of chemistry can learn to use the Water Lab in a matter of minutes. Careful attention to the procedures given in this manual is all that is required to produce consistently accurate and reliable test results.

The central component of the Water Lab is the battery-powered colorimeter, which electronically measures the color produced in the chemical test reactions. A separate User's Guide provides general operating procedures for the instrument and describes the proper technique for operating the Direct Reading Titrators used in the alkalinity and calcium hardness tests. Once you have become familiar with the general operating techniques of the Water Lab and its components, you will only need to refer to the condensed instructions provided on the separate laminated card.

TESTER'S GUIDE

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

- When conducting a series of tests on a given pool sample, you only need to set the colorimeter to 0.0 (zero) with the pool sample blank one time.
- Keep ALL reagents tightly capped between tests.
- Do not touch reagent tablets with your fingers. Use the tube cap or tweezers.
- Fill the test tubes to the line, with the bottom of the liquid (meniscus) on the line.
- Carefully wipe off colorimeter tubes before reading. Use a clean, soft tissue.
- Do not mix up pipets (eye droppers).
- When adding drops of reagents, hold dropper bottles and pipets vertically to insure consistent drop size.
- Thoroughly wash and rinse out test tubes when finished with testing. Use deionized water to rinse tubes.

FREE AVAILABLE, TOTAL & COMBINED CHLORINE DPD METHOD

Chlorine is added to pool water as a sanitizing agent to kill bacteria and other disease producing organisms. Chlorine is also used to control algae and to remove undesirable odors and colors.

Depending on what commercial chlorine product is used, chlorine may be added to pool water in a variety of forms - chlorine gas, liquid sodium hypochlorite, granular calcium hypochlorite, or organic chlorine compounds. When chlorine is added to water, it quickly forms hypochlorous acid, HOCl, the active ingredient which is responsible for chlorine's sanitizing capabilities. The hypochlorous acid is also known as the Free Available Chlorine. The presence of other compounds in the pool may consume the hypochlorous acid, or free available chlorine, and form other chloro compounds, such as chloramines or other organic nitrogen compounds. As chlorine combines with other compounds in the pool water, much of its sanitizing capability is lost, and higher levels of chlorine are necessary to achieve the same germ free water. Therefore, it is essential to chlorinate to the point of establishing a free available chlorine residual and then maintain it at the recommended level. For most pools, the free available chlorine residual should be maintained between 1.0 - 3.0 ppm.

The LaMotte DPD liquid test method distinguishes levels of Free Available Chlorine, Combined Chlorine and Total Residual Chlorine, using a single test sample.

RANGE:	0.1 - 5.0 ppm
METHOD:	In the absence of iodide, free available chlorine reacts instantly with the buffered diethyl-p-phenylenediamine indicator (DPD) to produce a red color in proportion to the amount of chlorine present. Subsequent addition of potassium iodide produces a rapid color response from the combined forms of chlorine (chloramines).
INTERFERENCE:	The only interfering substance likely to be encountered in pool 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 amount of interference can be measured.

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PROCEDURES

A. FREE AVAILABLE CHLORINE

1. Fill the water sample bottle (0688) with the pool water sample.
2. Dispense the water sample into a clean colorimeter tube (0967), until the tube is filled to the 10 mL line.
3. Insert the tube containing the untreated sample into the colorimeter chamber, and press the "Chlorine" button once. When the display indicates "Blank 0.0," press the "Chlorine" button again. Remove tube.
4. Add 5 drops of DPD 1A Free Chlorine Reagent (P-6740) and 5 drops of *DPD 1B Free Chlorine Reagent (P-6741).
5. Cap and mix. The development of a pink color indicates the presence of Free Available Chlorine.
6. Insert the treated sample into the colorimeter chamber. Read result in ppm Free Available Chlorine. Do not discard this treated sample if the test for Total Chlorine is to be made.

B. TOTAL RESIDUAL CHLORINE

1. Add 5 drops of *DPD #3 Total Chlorine Reagent (P-6743) to the sample from Step A.6. Cap and mix. An increase in color indicates the presence of Combined Chlorine.
2. Insert the treated sample into the colorimeter chamber and press the "Chlorine" button. As soon as the display stabilizes, read result in ppm Total Residual Chlorine.

C. COMBINED CHLORINE

The Combined Chlorine concentration equals the difference between the Total Residual Chlorine reading (B.2.) and the Free Available Chlorine reading in (A.6.) above.

Total Residual Chlorine – Free Available Chlorine = Combined Chlorine

A Combined Chlorine level of 0.2 ppm or greater should be treated.

NOTES:

- If either Chlorine reading exceeds 5.0 ppm, the display will flash, repeat the test procedure on a diluted sample and multiply the test result by the appropriate dilution factor.
- Levels of Chlorine above 10 ppm can cause a bleaching effect of the DPD indicator and may give a false indication that no chlorine is present. If it is possible that the chlorine concentration may be greater than 10 ppm (e.g., after shock treatment), perform the test on a diluted sample and multiply the test result by the appropriate dilution factor.
- If, after adding both DPD 1A Free Chlorine Reagent and *DPD 1B Free Chlorine Reagent, a cloudy precipitate is present, retest by adding reagents first and water sample second to the tube.

BROMINE

Like chlorine, this member of the halogen family is an effective germicidal agent. It is sometimes used in place of chlorine for pool water disinfection. The desired level for bromine in pool water is 2.0 - 4.0 ppm.

RANGE:	0.22 - 10 ppm
METHOD:	Bromine reacts with buffered diethyl-p-phenylene diamine (DPD) to produce a pink-red color in proportion to the concentration of bromine present.
INTERFERENCE:	The only interfering substance likely to be encountered in pool 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 amount of interference can be measured.

PROCEDURE

1. Fill the water sample bottle (0688) with the pool water sample.
2. Dispense the water sample into a clean colorimeter tube (0967), until the tube is filled to the 10 mL line.
3. Insert the tube containing the untreated sample into the colorimeter chamber, and press the “Bromine” button. When the display reads “Blank 0.0,” press the “Bromine” button again. Remove tube.
4. Add 5 drops of DPD 1A Free Chlorine Reagent (P-6740) and 5 drops of *DPD 1B Free Chlorine Reagent (P-6741).
5. Cap and mix. The development of a pink color indicates the presence of Bromine.
6. Insert the treated sample into the colorimeter chamber. As soon as the display stabilizes, read result in ppm Bromine.

COLORIMETRIC pH

The term pH is an index of the amount of hydrogen ions present in a substance. A high pH means that the substance is alkaline, or basic, while a low pH means the water is acidic.

Sanitation of pool water is best accomplished at a slightly basic pH (pH 7.2 - pH 7.8). If the pool water is maintained under acidic conditions, the pool water may be corrosive and may allow the chlorine to escape from the pool as a gas. A highly basic pool water may also suppress the effectiveness of chlorine in the pool. The pH of pool water can be decreased by the addition of acids, such as hydrochloric acid (muriatic acid) or sodium bisulfate (dry acid), or increased by the addition of alkaline substances such as sodium carbonate (soda ash) or sodium bicarbonate (baking soda).

RANGE:	Phenol Red, pH 6.8 - 8.2
METHOD:	The Phenol Red Indicator exhibits a specific color change over a narrow pH range. The color changes are measured colorimetrically.
INTERFERENCE:	Sample color and turbidity interfere with the colorimetric pH measurement. Chlorine interference has been eliminated by the addition of a chlorine inhibitor to the pH indicator.

PROCEDURE

1. Dispense the water sample into a clean colorimeter tube (0967), until the tube is filled to the 10 mL line.
2. Use a 0.5 mL pipet (0369) to add exactly 0.5 mL of the *pH Indicator (WL-7027) to the tube. Cap and mix.
3. With "pH" appearing on the meter display, insert the treated sample into the colorimeter chamber. As soon as the display stabilizes, read the pH value.

   NOTE: If the colorimeter reading is out of range in either direction (i.e., pH is either less than 6.8 or greater than 8.2), adjust the pH by appropriate treatment and, after one complete filter cycle, test again.

CYANURIC ACID

Cyanuric acid is added to swimming pool water as a stabilizing agent for free available chlorine. It minimizes the loss of chlorine in pool water due to the action of ultraviolet rays from sunlight. After the pool has been stabilized with cyanuric acid, the free available chlorine residual should be maintained at the recommended level of 1.5 ppm to ensure proper sanitation.

The recommended level of stabilizer in pools is between 25 and 100 ppm. When readings above 150 ppm are encountered, it may be necessary to replace some of the pool water with fresh make-up water to reduce the concentration of cyanuric acid. If stabilizers are used, follow the manufacturer's instructions for their product to maintain the recommended levels of cyanuric acid.

RANGE:	10 - 200 ppm (Readings below 10 ppm may not be reliable.)
METHOD:	A buffered solution of melamine forms a precipitate with cyanuric acid in proportion to the amount of cyanuric acid present. The density of particles in suspension is measured turbidimetrically.
INTERFERENCE:	No known interference from compounds normally found in pool water. For best results, the temperature of the sample should be between 70°F and 80°F. As the temperature of the sample increases, cyanuric acid readings will decrease even though the actual concentration has not changed.

PROCEDURE

1. Use the 5 mL syringe (0807) to dispense 5 mL of *Cyanuric Acid Reagent (WL-4856) into the colorimeter tube (0967). Dilute to the 10 mL line with pool water sample.
2. Cap tube and mix thoroughly. The development of a white precipitate indicates the presence of Cyanuric Acid.
3. Wait one minute. With the "Cyanuric Acid" text appearing on the meter display, mix and insert the treated sample into the colorimeter chamber. As soon as the display stabilizes, read result in ppm Cyanuric Acid.

COPPER

Copper imparts an undesirable blue-green color to pool water. Acid water may cause corrosion of copper pipes and fittings and result in contamination of the pool. When copper compounds are used in the pool to control algae growth, it is essential to maintain the copper concentration at the recommended levels for an effective treatment, otherwise high concentrations of copper may cause staining problems. Copper concentrations above 0.5 ppm should be avoided in pool water.

RANGE:	0.0 - 3.0 ppm Copper
METHOD:	Cupric ions form a magenta color with bicinchoninic acid under neutral conditions, pH 6 - 8, in proportion to the concentration of copper in the sample.
INTERFERENCE:	If the Calcium Hardness is high, a precipitate may develop in the copper test. If this occurs, repeat the test but add two drops of *Iron Reagent 1 (4450) to the 10 mL sample before adding the Copper Tablet.

PROCEDURE

1. Fill colorimeter tube (0967) to the 10 mL line with the water sample.
2. Add one Copper Tablet (WL-3808) to the tube. Cap and mix to dissolve tablet. The development of a purple-red color indicates the presence of copper.
3. Wait 2 minutes. With the "Copper" text appearing on the meter display, place the treated sample into the colorimeter chamber. As soon as the display stabilizes, read result in ppm Copper.

IRON

Iron is a major source of staining in swimming pools. The unattractive orange-brown discoloration may appear on pool surfaces and also appear as a fine-particle sediment. Iron is readily oxidized by chlorine and oxygen in the water and may settle to the bottom as the insoluble ferric (Fe+3) form of iron. Usually levels of iron above 0.2 - 0.3 will cause staining to pool surfaces, therefore iron levels should be maintained below this concentration.

RANGE:	0.1 - 7.0 ppm
METHOD:	Ferric Iron is reduced to ferrous iron and subsequently forms a colored complex with bipyridyl for a quantitative measure of total iron.
INTERFERENCE:	Copper in excess of 5.0 ppm may cause interference.

PROCEDURE

1. Rinse and fill colorimeter tube (0967) to the 10 mL line with water sample.
2. Use the 0.5 mL pipet (0369) to add 0.5 mL of *Iron 1 Reagent (WL-4450) to the sample in the tube.
3. Use the 0.1 g spoon (0699) to add one level measure of *Iron 2 Powder (WL-4451) to the sample. Cap tube and shake vigorously for 10 seconds. If a cloudiness persists in test sample, shake vigorously for another 10 seconds. (If the Iron concentration is expected to be greater than 3.0 ppm, add a second level measure of *Iron 2 Powder to ensure color development.)
4. Wait 3 minutes for maximum color development. With the “Iron” text appearing on the meter display, place the treated sample into the colorimeter chamber. As soon as the display stabilizes, read result in ppm Iron.

ALKALINITY

Alkalinity refers to the amount of bicarbonates, carbonates and hydroxides present in water. More specifically alkalinity is a measure of the buffering capacity of the water or the ability of water to resist changes in pH. If the alkalinity is too low, the pH will fluctuate erratically, while high alkalinity water may resist changes of pH altogether.

A low alkalinity water is indicated by great changes in pH values with small additions of an acid or base. Under low alkalinity conditions, the pH is extremely difficult to maintain. To raise the alkalinity to the desired range (usually between 80 - 125 ppm for most pool waters) sodium bicarbonate (baking soda) is added. Sodium Carbonate (soda ash) can also be used to raise the alkalinity; however, it may also raise the pH drastically. Water with a high alkalinity resists changes of pH. Acid has to be added in order to destroy the bicarbonates, carbonates, and hydroxides for the alkalinity to be lowered to the desired range.

RANGE:	0 - 200+ ppm as Calcium Carbonate ($CaCO_3$)
METHOD:	The alkalinity of pool water is determined by a titration procedure involving the use of a standard acid that is titrated to a Bromcresol Green-Methyl Red Indicator endpoint at about pH 4.6.
INTERFERENCE:	Sample turbidity and color may interfere with the determination of the endpoint. Cyanuric Acid may contribute to the alkalinity of pool water. High chlorine values may cause a yellow rather than red endpoint.
DIRECT READING TITRATOR METHOD:	Carefully read the User's Guide manual for use of the Direct Reading Titrator before performing the titration procedure described below. The titrator is calibrated in terms of Alkalinity in parts per million Calcium Carbonate and each minor division on the Titrator scale equals 4 ppm.

PROCEDURE

1. Fill the titration tube marked "ALK" (0644) to the line with the water sample to be tested.
2. Add one Alk 1 Indicator Tablet (WL-T-2311) to the sample. Cap the tube and shake to dissolve the tablet. A green-blue color will develop.
3. Fill the Direct Reading Titrator (0382) with Alk Titrant (WL-4493).
4. Titrate the test sample, while mixing, until the green-blue color changes to red. Read the test result directly from the scale where the large ring on the Titrator meets the Titrator barrel.
5. If the titration endpoint has not occurred when the plunger tip reaches the 200 ppm mark, refill the Titrator and continue the titration. Be sure to include the original amount added in the test result.
6. Results are expressed as Total Alkalinity in ppm Calcium Carbonate ($CaCO_3$).
7. Use the alkalinity test result to read the Acid Demand Index on the next page.

CALCULATING THE VOLUME OF POOLS & SPAS

Measurements in Feet

Rectangular Shape:	Length x Width x Average Depth x 7.5 = Volume in gallons
Round Shape:	Diameter x Diameter x Average Depth x 5.9 = Volume in gallons
Oval Shape:	Length x Width x Average Depth x 5.9 = Volume in gallons

ACID DEMAND & pH ADJUSTMENT

The Acid Demand Index states the amount of Muriatic Acid (Hydrochloric Acid 31%) required to reduce high alkalinity in pool or spa water to an optimum range of 80 - 120 ppm $CaCO_3$. This table is used in conjunction with the alkalinity test result; see the Alkalinity test procedure.

MURIATIC ACID REQUIREMENT

Alkalinity Reading ppm $CaCO_3$	Pool or Spa Volume in Gallons									
	100	250	500	1000	2500	5M	10M	20M	25M	50M
120	1	1	3	5	1	2	3	7	8	16
135	1	2	5	1	1	3	6	11	14	29
155	1	4	7	1	2	4	9	18	22	45
170	2	5	1	1	3	6	11	23	29	57
190	2	6	1	1	4	7	15	29	37	74
205	3	7	1	2	4	9	17	34	43	86
220	3	8	1	2	5	10	20	39	49	98
240	4	1	1	2	6	11	23	46	57	115
255	4	1	1	3	6	13	25	51	63	127
275	5	1	1	3	7	14	29	57	72	143
290	5	1	2	3	8	16	31	62	78	155
310	5	1	2	3	9	17	34	69	86	172
325	6	1	2	4	9	18	37	74	92	184
340	6	1	2	4	10	20	39	79	98	196
375	7	1	2	4	11	22	45	90	112	225
410	1	1	3	5	13	25	51	101	127	254
445	1	1	3	6	14	28	56	113	141	282
480	1	2	3	6	16	31	62	124	155	311
515	1	2	3	7	17	34	68	136	170	339
	Ounces Muriatic Acid					Pints Muriatic Acid				

WEIGHT & VOLUME CONVERSIONS

Pints Muriatic Acid x 16	**=**	**Fluid Ounces Muriatic Acid**
Pints Muriatic Acid ÷ 8	**=**	**Gallons Muriatic Acid**
Fluid Ounces Muriatic Acid x 0.09	**=**	**Pounds Dry Acid (Sodium Bisulfate)**
Pints Muriatic Acid x 1.4	**=**	**Pounds Dry Acid**
Gallons Muriatic Acid x 11.2	**=**	**Pounds Dry Acid**

ACID DEMAND ADJUSTMENT

In 10,000 gallons of water . . .

1½ lbs. of Sodium Bicarbonate increases the Total Alkalinity 10 ppm.
1 pt. of Muriatic Acid (Hydrochloric Acid 31%) reduces the Total Alkalinity 6 ppm.
2⅓ lbs. of Sodium Bisulfate (dry powder) reduces the Total Alkalinity 10 ppm.

NOTE: Always consult manufacturer's recommendations regarding maximum amount of acid to be added to pool at one time.

Example A: A round spa with a diameter of 8.5' and average depth of 3.0' gives an alkalinity test result of 205 ppm $CaCO_3$.

1. Calculate volume of water (see p. 13):

   8.5' x 8.5' x 3.0' x 5.9 = 1279 gallons

2. On the 205 ppm line in the Acid Demand Index above, read this volume as:

   1000 + 100 + 100 + 100

3. Index Reading = 2.0 + 0.2 + 0.2 + 0.2 = 2.6 pints
4. 2.6 pints x 1.4 = 3.6 lbs Dry Acid

Example B: A rectangular pool measures 20' x 40' with an average depth of 5' and gives an alkalinity test result of 170 ppm $CaCO_3$.

1. Calculate volume of water (see p. 13):

   40' x 20' x 5' x 7.5 = 30,000 gallons

2. In the Alkalinity Index, read this volume as:

   10,000 + 20,000

3. Index Reading = 11 + 23 = 34 pints Muriatic Acid
4. 34 pints ÷ 8 = 4.25 gallons x 11.2 = 47.6 lbs (see Note above.)

BASE DEMAND & pH ADJUSTMENT

In certain cases it may be necessary to monitor and adjust the alkalinity and/or pH of the pool water to a higher level for a better balance of chemical characteristics. Titration of a pool water sample with a standard base reagent to pH 7.4 provides a factor for corrective adjustment with soda ash or equivalent base chemical.

NOTE: For accurate results in pools with low pH and high alkalinity readings, the alkalinity level must be adjusted to the proper range before performing the Base Demand test.

PROCEDURE

1. If the pH sample is yellow to orange, there is a base demand. Hold the tube flat against the pH coloruler (3164), parallel to the center channel, with the two standard colors on the right. Grasp the comparator tab and test tube between thumb and index finger, and hold toward a window or light. Use the glass pipet (0371) to add Base Reagent (WL-6460), one drop at a time, to the tube. Swirl the tube several times after each drop. Count the drops and continue titrating until the color matches the pH 7.4 standard color.
2. Use the number of drops added and the base demand table below, to determine the amount of Soda Ash (Sodium Carbonate, Na_2CO_3) required to adjust pool or spa water to an optimum pH of 7.4.

SODA ASH REQUIREMENT

Pool or Spa Volume in Gallons	Number Of Drops Of Base Titrant Added									
	1	2	3	4	5	6	7	8	9	10
100	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.4
250	0.1	0.2	0.3	0.4	0.5	0.5	0.6	0.7	0.8	0.9
500	0.2	0.4	0.5	0.7	1.1	1.1	1.2	1.4	1.6	1.8
1,000	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.4
2,500	0.9	1.8	2.7	3.5	5.3	5.3	6.2	7.1	8.0	8.8
5,000	1.8	3.5	5.3	7.1	10.6	10.6	12.4	14.1	1.0	1.1
10,000	3.5	7.1	10.6	14.1	1.3	1.3	1.5	1.8	2.0	2.2
20,000	7.1	14.1	1.3	1.8	2.7	2.7	3.1	3.5	4.0	4.4
25,000	8.8	1.1	1.7	2.2	3.3	3.3	3.9	4.4	5.0	5.5
50,000	1.1	2.2	3.3	4.4	6.6	6.6	7.7	8.8	9.9	11.0
	Ounces Soda Ash				Pounds Soda Ash					

Example: A rectangular pool measures 20' x 40' with an average depth of 5' and gives a base demand test result of 8 drops of Base Reagent.

1. Calculate volume of water (see p. 13):

   40' x 20' x 5' x 7.5 = 30,000 gallons

2. In the Base Demand Table, read this volume as:

   20,000 + 10,000

3. Reading from Table = 3.5 + 1.8 = 5.3 lbs Soda Ash

CALCIUM HARDNESS

Calcium Hardness is a scale forming element that will leave deposits on the side of a pool at the air-water interface where evaporation takes place. Calcium deposits inside pipes and fittings restrict flow and affect the heat exchange capacity of pool heaters. Recommended levels in pool water for Calcium Hardness are from 175 - 400 ppm Calcium Carbonate.

RANGE:	0 - 500 ppm as Calcium Carbonate ($CaCO_3$)
METHOD:	Calcon is used as the indicator at pH 12 - 13. Calcon yields a red color in the presence of calcium. The color changes to blue when the calcium ions are sequestered by EDTA.
INTERFERENCE:	Excessive amounts of heavy metals can interfere.
DIRECT READING TITRATOR METHOD:	Carefully read the User's Guide for use of the Direct Reading Titrator before performing the titration procedure described below. The Titrator is calibrated in terms of Calcium Hardness in parts per million Calcium Carbonate and each minor division on the Titrator scale equals 10 ppm.

PROCEDURE

1. Fill the titration tube marked "HARD" (0645) to the line with the water sample to be tested.
2. Add six drops of *Hard 1 Reagent (WL-4259) to the test sample. Cap and mix.
3. Add one Hard 2 Tablet (WL-T-5250). Cap and mix to dissolve the tablet. A red color will appear if Calcium Hardness is present.
4. Fill Direct Reading Titrator (0383) with Hardness Titrant (WL-4487) and titrate the test sample until red color changes through purple to blue. Read the test result directly from the scale where the large ring on the Titrator meets the Titrator barrel. Results are expressed as Calcium Hardness in ppm Calcium Carbonate.

CALCIUM HARDNESS ADJUSTMENT

In 10,000 gallons of water . . .

1 lb. Calcium Chloride increases Calcium Hardness 11 ppm.

PARTS LIST & SERVICE

DPC-52 WATER TESTING LABORATORY CODE 3509-01

To order reagent refills or part replacements, contact LaMotte Company at 800-344-3100. Order Reagent Refill Package by prefixing "R" before the kit code (R-3509-01). The Reagent Refill Package consists of a complete set of reagents exactly as furnished in the original outfit. Alternatively, reagents (and accessories) may be purchased individually, using the code numbers given in the parts list below.

If you have any questions regarding the DPC-52 Water Testing Laboratory, call LaMotte Company, Technical Services at 800-344-3100.

TEST FACTOR	CODE	QTY.	DESCRIPTION
CHLORINE/ BROMINE	P-6740-G	30 mL	DPD 1A Free Chlorine Reagent
	*P-6741-G	30 mL	DPD 1B Free Chlorine Reagent
	*P-6743-G	30 mL	DPD 3 Total Chlorine Reagent
pH	*WL-7027-H	60 mL	*pH Indicator
	0369	1	Pipet, plastic, 0.5 mL
CYANURIC ACID	*WL-4856-K	250 mL	*Cyanuric Acid Reagent
	0807	1	Syringe, plastic, 5 mL
COPPER	WL-3808-J	100	Copper Tablets
IRON	*WL-4450-H	60 mL	*Iron 1 Reagent
	*WL-4451-D	10 g	*Iron 2 Powder
	0369	1	Pipet, plastic, 0.5 mL, w/cap
	0699	1	Spoon, 0.1 g
ALKALINITY	WL-T-2311-J	100	Alk 1 Indicator Tablets
	WL-4493-H	60 mL	Alk Titrant
	0644	1	Alk Titration tube, 5 mL, w/cap
	0382	1	Direct Reading Titrator, 0-200 range
BASE	WL-6460-H	60 mL	Base Reagent
	0371	1	Pipet, glass, w/cap
	3164	1	pH ColoRuler, pH 7.4 & 7.6
CALCIUM HARDNESS	*WL-4259-E	15 mL	*Hardness 1 Reagent
	WL-T-5250-J	100	Hardness 2 Tablets
	WL-4487-H	60 mL	Hardness Titrant
	0645	1	Hardness Titration Tube, 5.2 mL, w/cap
	0383	1	Direct Reading Titrator, 0 - 500 range
ACCESSORIES	0688	2	Water Sampling Bottles
	0513	1	Test Tube Brush
	WL-0967	6	Colorimeter Tubes, printed, 0 - 5, w/caps
	1729-01	1	DPC-2 Digital Colorimeter

WARRANTY

This Instrument is guaranteed to be free from defects in material and workmanship for a period of one (1) year from the original purchase date. In the event that a defect is found during the warranty time frame, LaMotte Company agrees that it will be repaired or replaced without charge except for the transportation costs. This guarantee does not cover batteries.

This product can not be returned without a return authorization number from LaMotte Company. For warranty support or a Return Authorization Number, contact LaMotte Company at 1-800-344-3100 or tech@lamotte.com.

Limitations

This guarantee is void under the following circumstances:

• Damage due to operator negligence, misuse, accident or improper application.

• Damage or alterations from attempted repairs by an unauthorized (non-LaMotte) service.

• Damage due to improper power source, AC adapter or battery.

• Damage caused by acts of God or natural disaster.

• Damage occurred while in transit with a shipping carrier.

LaMotte Company will service and repair out-of-warranty products at a nominal charge.

LaMOTTE COMPANY

Helping People Solve Analytical Challenges℠

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