

# **FRESH WATER AQUARIUM COMBINATION OUTFIT**

**MODEL AG-103 • CODE 3637**



 **LaMotte**

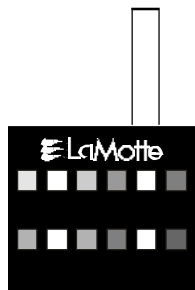
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This booklet provides step-by-step instructions for each of the tests provided in the AG-104 test kit. Please refer to the separate sheets for proper use of the Direct Reading Titrator and Axial Reader Comparator where noted.

## USE OF THE OCTET COMPARATOR

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The Octet Comparator contains eight permanent color standards. A test sample is inserted into the openings in the top of the comparator. The sample can then be compared to four color standards at once, and the value read off the comparator. For optimum color comparison, the comparator should be positioned between the operator and a light source, so that the light enters through the special light-diffusing screen in the back of the comparator. Avoid viewing the comparator against direct sunlight or an irregularly lighted background.

# ALKALINITY

QUANTITY	CONTENTS	CODE
100	BCG-MR Indicator Tablets	T-2311-J
60 mL	*Alkalinity Titration Reagent B	*4493DR-H
1	Test Tube, 5-10-15 mL, glass, w/cap	0778
1	Direct Reading Titrator, 0-200 Range	0382

**\*WARNING:** Reagents marked with a \* are considered hazardous substances. Material Safety Data Sheets (MSDS) are supplied for these reagents. For your safety read label and accompanying MSDS before using.

**NOTE:** Read Direct Reading Titrator Manual before performing test.

## PROCEDURE

1. Fill the test tube (0778) to 5 mL line with sample water.
2. Add one BCG-MR Indicator Tablet (T-2311). Cap and shake until dissolved. A blue-green color will develop.
3. Fill the Direct Reading Titrator (0382) with \*Alkalinity Titration Reagent B (4493DR). Insert Titrator into the center hole of the test tube cap.
4. While gently swirling the tube, slowly depress plunger to titrate until the blue-green color changes to pink. Read the test result where the plunger meets the titrator scale. Record results as Total Alkalinity in ppm ( $\text{CaCO}_3$ ).

**NOTE:** Each minor division on Titrator scale = 4 ppm Total Alkalinity as  $\text{CaCO}_3$ .

**EXAMPLE:** Plunger tip is 3 minor divisions below line 140. The test result is 140 plus (3 divisions x 4) equals 152 ppm.

5. If the plunger reaches the bottom line on the titrator scale (200 ppm) before the endpoint color change occurs, refill the titrator and continue titration. When recording the test result, be sure to include the value of the original amount of reagent dispensed (200 ppm).

When testing salt water aquariums, alkalinity may be called carbonate hardness. Multiply ppm Alkalinity by 0.056 to convert to German degrees of Hardness.

This test set provides Total Alkalinity readings only. For comprehensive analysis of Phenolphthalein (P), Total (T), Hydroxide, Carbonate, and Bicarbonate Alkalinity the Model WAT-MP-DR Test Set, Code 4533-DR is recommended.

# AMMONIA NITROGEN

## LOW RANGE

QUANTITY	CONTENTS	CODE
30 mL	Ammonia Nitrogen Reagent #1	4797WT-G
60 mL	*Ammonia Nitrogen Reagent #2	*4798PS-H
1	Pipet, 1.0 mL, plastic	0354
3	Test Tubes, 10 mL, glass, w/cap	0843
1	Distilled Water Ampoule, 5 mL	2748
1	Axial Reader	2071
1	Ammonia Nitrogen Comparator, 0.02-1.0 ppm	7593

**\*WARNING:** Reagents marked with a \* are considered hazardous substances. Material Safety Data Sheets (MSDS) are supplied for these reagents. For your safety, read label and accompanying MSDS before using.

### NOTES:

- A.** To compensate for color produced by the reagents, a blank should be run on deionized or distilled water. Any reading obtained should be subtracted from the test result.
- B.** Certain aquarium treatment chemicals interfere with this Nesslerization method. Some ketones, aldehydes, alcohol and amines cause interferences. Check treatment chemical label for contents and warning.
- C.** Read the Axial Reader Instruction Manual before performing test.

## PROCEDURE

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1. Fill a test tube (0843) to the 10 mL line with sample water.
2. Add 8 drops of Ammonia Nitrogen Reagent #1 (4797WT). Cap and swirl to mix. Wait one minute before proceeding to next step.  
**NOTE:** When testing salt (sea) water, increase the amount of this reagent to 20 drops to avoid a precipitate which may form.
3. Use pipet (0354) to add 1 mL of Ammonia Nitrogen Reagent #2 (4798PS). Cap and mix. Wait five minutes for color development. Remove cap.
4. Remove cap and insert tube into the Axial Reader Comparator (2071). Follow the Axial Reader instructions to compare the sample color with the color standards. Record result as ppm Ammonia-Nitrogen ( $\text{NH}_3\text{-N}$ ).  
To express results as Unionized Ammonia ( $\text{NH}_3$ ):

$$\text{Unionized Ammonia (NH}_3\text{)} = \text{ppm Ammonia Nitrogen (NH}_3\text{-N)} \times 1.2$$

To express results as Ionized Ammonia ( $\text{NH}_4^+$ ):

$$\text{Ionized Ammonia (NH}_4^+\text{)} = \text{ppm Ammonia Nitrogen (NH}_3\text{-N)} \times 1.3$$

**NOTE:** If the color of the test sample is darker than the highest color standard, repeat the test on a sample diluted 1 to 1 with ammonia free distilled water. Multiply this reading by a factor of 2 to compensate for the dilution. Read results in ppm Ammonia Nitrogen.

For the most accurate results, repeat steps 1-4 on a blank of deionized water and subtract any reading obtained from the test result.

Ammonia in water occurs in two forms: toxic unionized ammonia ( $\text{NH}_3$ ) and the relatively non-toxic form, ammonium ion ( $\text{NH}_4^+$ ). This test method measures both forms as ammonia-nitrogen ( $\text{NH}_4^+\text{-N}$ ) to give the total ammonia-nitrogen concentration in water. The actual proportion of each compound depends on temperature, alkalinity, and pH. A greater concentration of unionized ammonia is present when the pH value and salinity increase.

1. Consult the table on Page 6 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 ( $\text{NH}_3\text{-N}$ ), multiply the total ammonia-nitrogen test result by the percentage from the table.
3. To express the test result as ppm Ammonia Nitrogen ( $\text{NH}_4\text{-N}$ ), subtract the unionized ammonia nitrogen from the total ammonia-nitrogen.

pH	10°C		15°C		20°C		25°C	
	FW <sup>1</sup>	SW <sup>2</sup>	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

<sup>1</sup>Freshwater data from Trussel (1972).

<sup>2</sup>Seawater values from Bower and Bidwell (1978). Salinity for Seawater values = 34 ppt at an ionic strength of 0.701 m.

FOR EXAMPLE:

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  


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Ionized Ammonia-Nitrogen                = 0.8882 ppm

# DISSOLVED OXYGEN

For determining the dissolved oxygen content of water, this test kit uses the azide modification of the Winkler Method and employs a LaMotte Direct Reading Titrator in the final titration.

QUANTITY	CONTENTS	CODE
30 mL	*Manganous Sulfate Solution	*4167-G
30 mL	*Alkaline Potassium Iodide Azide Solution	*7166-G
50 g	*Sulfamic Acid Powder	*6286-H
60 mL	*Sodium Thiosulfate Solution (0.025N)	*4169-H
30 mL	Starch Indicator	4170WT-G
1	Direct Reading Titrator, 0 - 10 Range	0377
1	Test Tube, 5-10-12.9-15-20-25 mL, glass, w/cap	0608
1	Bottle, Water Sampling, 60 mL, glass	0688-DO
1	Spoon, 1.0 g	0697

**\*WARNING:** Reagents marked with a \* are considered hazardous substances. Material Safety Data Sheets (MSDS) are supplied for these reagents. For your safety, read label and accompanying MSDS before using.

**NOTE:** Read the LaMotte Direct Reading Titrator Instruction Manual before performing the test procedure. The Titrator is calibrated in parts per million (ppm) Dissolved Oxygen.

## COLLECTION & TREATMENT OF THE WATER SAMPLE

Steps 1 through 4 below describe proper sampling technique in shallow water. For collection of sample 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; or Water Sampling Outfit, Code 3103).

1. To avoid contamination, rinse the Water Sampling Bottle (0688-DO) thoroughly with sample water.
2. Tightly cap the bottle. Submerge to the desired depth, and remove the cap to allow the bottle to fill.
3. Tap the sides of the submerged bottle to dislodge any air bubbles clinging to the inside of the bottle. Replace the cap while the bottle is still submerged.
4. Retrieve the bottle. Examine it carefully to make sure that no air bubbles are trapped inside of the bottle. Once a satisfactory sample has been collected, proceed immediately with Steps 5 and 6 to "fix" the sample.

**HARDNESS****ALKALINITY****pH****AMMONIA**

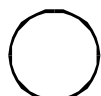
0353



0382



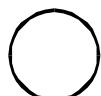
4487-DR-H



4484-J



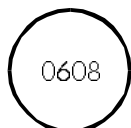
4483-E



T-5250-H



4259-E



0608



0230



0230



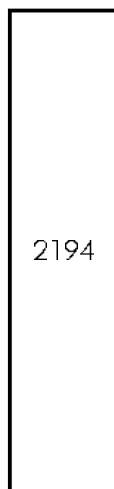
2218-G



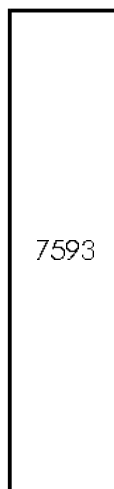
0382



0778



2194



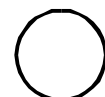
7593



4493-DR-H



4798PS-H



T-2311-J



4797WT-G

NITROGEN

NITRITE

DISSOLVED OXYGEN

0843

0843

0843

2748

0354

6761  
w/2071

7424-H

7423-G  
w/0392

0843

0843

0843

0354

0727

7797-D

0608

0697

0688-DO

4167-G

0377

4169-H

6286-H

4170WT-G

7166-G

## **“FIXING” THE WATER SAMPLE**

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**NOTE:** Be careful not to introduce air into the sample while adding the reagents in Steps 5 and 6. Drop the reagents into the test sample, cap carefully, and mix gently.

5. Add 8 drops of \*Manganous Sulfate Solution (4167) and 8 drops of \*Alkaline Potassium Iodide Azide Solution (7166). Cap and mix by inverting gently several times. A precipitate will form. Allow the precipitate to settle below the shoulder of the bottle before proceeding.
6. Use the 1.0g spoon (0697) to add one level measure of \*Sulfamic Acid Powder (6286). Cap and gently invert to mix, until both the reagent and the precipitate have dissolved. A clear yellow to brown-orange color will develop, depending on the oxygen content of the sample.

**NOTE:** 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.

## **TEST PROCEDURE**

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1. Fill the test tube (0608) to the 20 mL line with the “fixed” sample. Cap.  
**NOTE:** If the color of the “fixed” sample is already a very faint yellow, skip Step 3, perform Step 4, and begin the titration at Step 5.
2. Fill the Direct Reading Titrator (0377) with \*Sodium Thiosulfate Solution (4169). Insert into the center hole of the test tube cap.
3. While gently shaking the tube, slowly press the plunger to titrate until the yellow-brown color is reduced to a very faint yellow.
4. Remove the Titrator and cap. Be careful not to disturb the Titrator plunger, as the titration begun in Step 3 will be continued in Step 5. Add 8 drops of Starch Indicator Solution (4170WT). Solution will turn blue.
5. Replace the cap and Titrator and continue titrating until the blue color just disappears. Read result where plunger meets Titrator Scale. Record as ppm Dissolved Oxygen. Each minor division equals 0.2 ppm.
6. If the plunger reaches the bottom line on the Titrator scale (10 ppm) before the endpoint color change occurs, refill the Titrator and continue the titration. When recording the test result, be sure to include the value of the original amount of reagent dispensed (10 ppm).

## CALCIUM & MAGNESIUM (TOTAL) HARDNESS

QUANTITY	CONTENTS	CODE
15 mL	*Sodium Hydroxide Reagent w/Metal Inhibitors	*4259-E
50	Calcium Hardness Indicator Tablets	T-5250-H
15 mL	*Hardness Reagent # 5	*4483-E
100	Hardness Reagent # 6 Tablets	4484-J
60 mL	Hardness Reagent # 7	4487DR-H
1	Test Tube, 5-10-12.9-15-20-25 mL, glass, w/cap	0608
1	Direct Reading Titrator, 0-200 Range	0382
1	Pipet, 0.5 mL	0353

**\*WARNING:** Reagents marked with a \* are considered hazardous substances. Material Safety Data Sheets (MSDS) are supplied for these reagents. For your safety read label and accompanying MSDS before using.

**NOTE:** Carefully read the instruction manual for the LaMotte Direct Reading Titrator before performing the titration described below. The titrator is calibrated in terms of Hardness expressed as parts per million (ppm) Calcium Carbonate ( $\text{CaCO}_3$ ). Each minor division on the Titrator scale equals 4 ppm  $\text{CaCO}_3$ .

## PROCEDURE

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### TOTAL HARDNESS

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1. Fill the test tube (0608) to the 12.9 mL line with sample water.
2. Add five drops of \*Hardness Reagent #5 (4483) and mix.
3. Add one Hardness Reagent #6 Tablet (4484) and shake tube to dissolve tablet. A red color will develop.
4. Fill the Direct Reading Titrator (0382) with Hardness Reagent #7 (4487DR) in the manner described in the instruction manual. Insert the titrator in the center hole of the test tube cap.
5. While gently shaking the tube, slowly depress the plunger to titrate the sample until the red color changes to clear blue. Read the test result where the plunger meets the titrator scale. The result is expressed as Total Hardness in ppm  $\text{CaCO}_3$ .

**EXAMPLE:** Plunger is 3 minor divisions below line 80. Test result is 80 plus (3 divisions x 4) equals 92 ppm.

6. If the plunger reaches the bottom line on the titrator scale (200 ppm) before the endpoint color changes occurs, refill the titrator and continue the titration. When recording the test result, be sure to include the value of the original amount of reagent dispensed (200 ppm).
7. Parts per million  $\text{CaCO}_3$  test results may be converted to grains per gallon (gpg)  $\text{CaCO}_3$  by means of the following formula:

$$\text{gpg CaCO}_3 = \text{ppm CaCO}_3 \times 0.058$$

### CALCIUM HARDNESS

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1. Fill test tube (0608) to 12.9 mL line with sample water.
2. Add 6 drops of \* Sodium Hydroxide w/Metal Inhibitors (4259). Cap and mix.
3. Add one Calcium Hardness Indicator Tablet (5250). Cap and gently shake to dissolve tablet. A red color will appear.
4. Now perform titration as described in Steps 3 through 6 of the Total Hardness Test Procedure, titrating until the red color changes to blue. Results are expressed as Calcium Hardness in ppm  $\text{CaCO}_3$ .

### MAGNESIUM HARDNESS

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$$\begin{aligned} & \text{Magnesium Hardness (ppm CaCO}_3\text{)} \\ & = \text{Total Hardness} - \text{Calcium Hardness} \end{aligned}$$

## **ANALYSIS OF HARDNESS IN SALT WATER**

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When sea and estuarine waters containing very high levels of mineral salts are to be tested, the sample must be diluted to a practicable concentration before titration. This test is supplied with a calibrated pipet for performing the simple, convenient dilutions described below.

### **TOTAL HARDNESS DILUTION (1 TO 25.8)**

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1. Use the 0.5 mL pipet (0353) to transfer 0.5 mL of the salt water to be tested to the titration tube (0769).
2. Fill the tube to the 12.9 mL line with distilled water.
3. Follow steps 2 through 5 under the Total Hardness test procedure. Multiply the resulting Titrator reading by 25.8 to obtain the test result expressed as Total Hardness in ppm  $\text{CaCO}_3$ .

### **CALCIUM HARDNESS DILUTION (1 TO 12.9)**

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1. Use the 0.5 mL pipet (0353) to transfer 1.0 mL (two measures) of the salt water to be tested to the titration tube (0769).
2. Fill the tube to the 12.9 mL line with distilled water.
3. Follow steps 2 through 4 under Calcium Hardness test procedure. Multiply the resulting Titrator reading by 12.9 to obtain the test result expressed as Calcium Hardness in ppm  $\text{CaCO}_3$ .
4. Calcium Hardness test result may be converted to ppm Calcium Chloride ( $\text{CaCl}_2$ ) by means of the following formula:

$$\text{ppm CaCl}_2 = \text{ppm CaCO}_3 \times 1.11$$

### **MAGNESIUM HARDNESS OF SALT WATER**

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Magnesium Hardness = Total Hardness - Calcium Hardness

Magnesium Hardness test result may be converted to ppm Magnesium Chloride ( $\text{MgCl}_2$ ) by means of the following formula:

$$\text{ppm MgCl}_2 = \text{Mg Hardness as ppm CaCO}_3 \times 0.95$$

# NITRITE

QUANTITY	CONTENTS	CODE
30 mL	Nitrite Nitrogen Reagent A	7423-G
60 mL	*Nitrite Nitrogen Reagent B	*7424-H
10 g	Nitrite Nitrogen Reagent C-R	7797-D
3	Test Tubes, 10 mL, glass, w/cap	0843
1	Pipet, 1.0 mL, plastic	0354
1	Pipet, plain, plastic, w/cap	0392
1	Spoon, 0.15 g, plastic	0727
1	Distilled Water Ampoule, 5 mL	2748
1	Axial Reader	2071
1	Nitrite Comparator, 0.02-0.3 ppm	6761

**\*WARNING:** Reagents marked with a \* are considered hazardous substances. Material Safety Data Sheets (MSDS) are supplied for these reagents. For your safety, read label and accompanying MSDS before using.

**NOTE:** Read Axial Reader Manual before performing test.

## PROCEDURE

1. Fill three test tubes (0843) to the 10 mL line with sample water. Insert two tubes as blanks in the Axial Reader.
2. Use the plain pipet (0357) to add 10 drops of Nitrite Nitrogen Reagent A (7423) to third test tube.
3. Use the 1.0 mL pipet (0354) to add 1.0 mL of \*Nitrite Nitrogen Reagent B (7424). Cap and invert to mix. Allow to stand for 30 to 45 seconds.
4. Use the 0.15g spoon (0727) to add one level measure (avoid any excess) of Nitrite Nitrogen Reagent C-R. Cap and mix. Allow to stand for 3 minutes. A pink color indicates the presence of nitrite.
5. Remove cap and insert tube in the Axial Reader comparator. Follow the Axial Reader instructions to compare the sample color with the standards. Record result as ppm Nitrite ( $\text{NO}_2$ ).

# pH

QUANTITY	CONTENTS	CODE
30 mL	*Wide Range Indicator	*2218-G
1	Test Tube, 5 mL, glass, w/cap	0230
1	Wide Range Comparator, 7.7 - 8.4	2194

**\*WARNING:** Reagents marked with a \* are considered hazardous substances. Material Safety Data Sheets (MSDS) are supplied for these reagents. For your safety, read label and accompanying MSDS before using.

## PROCEDURE

1. Fill a test tube (0230) to the 5 mL line with the sample water.
2. Add 10 drops of \*Wide Range Indicator (2218). Cap and mix.
3. Cap the tube and invert several times to mix the contents.
4. Insert test tube into the Wide Range Comparator (2194). Match sample color to a color standard. Record as pH.



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