

# Salt Water Aquarium

Combination Outfit

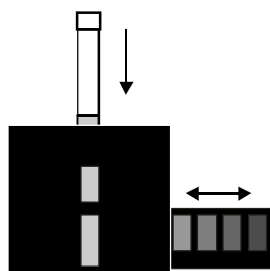
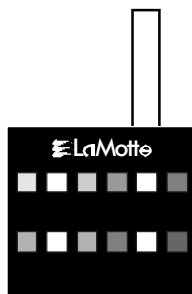
Model AG-104 • Code 3638-03



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 pH Octet Comparator

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.



## Use of the Octa-Slide Viewer

The Octa-Slide Viewer should be held so non-direct light enters through the back of the comparator. With sample tube inserted at top, slide the Octa-Slide bar through the viewer and march with color standard.

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# 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 tip meets the titrator scale. Record results as Total Alkalinity in ppm ( $\text{CaCO}_3$ ). 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 tip 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 Salicylate Method

QUANTITY	CONTENTS	CODE
60 mL	*Salicylate Ammonia #1	*3978LWT-H
30 mL	*Salicylate Ammonia #2	*3979WT-G
30 mL	Salicylate Ammonia #3	3982WT-G
2	Test Tubes, plastic, w/cap	0106
1	Octa-Slide Viewer	1100
1	Ammonia-Nitrogen Octa-Slide Bar, 0-2 ppm	3441

**\*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 (0106) to the 5 mL line with the water sample.
2. Add 10 drops of Salicylate Ammonia #1 (3978LWT). Cap and mix.
3. Add 7 drops of \*Salicylate Ammonia #2 (3979WT). Cap and mix. Wait one minute.
4. Add 7 drops of Salicylate Ammonia #3 (3982). Cap and mix. Wait 20 minutes.
5. Insert Ammonia Nitrogen Octa-Slide Bar (3441) into the Octa-Slide Viewer (1100). Insert test tube into Octa-Slide Viewer. Match sample color to a color standard. Record as ppm Ammonia Nitrogen (NH<sub>3</sub>-N).

To express results as Unionized Ammonia (NH<sub>3</sub>):

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

To express results as Ionized Ammonia (NH<sub>4</sub>):

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

Ammonia in water occurs in two forms: toxic unionized ammonia (NH<sub>3</sub>) and the relatively non-toxic ionized form, ammonium ion (NH<sub>4</sub><sup>+</sup>). This test method measures both forms as ammonia nitrogen (NH<sub>4</sub><sup>+</sup>-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 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 Ionized Ammonia Nitrogen ( $\text{NH}_4^+\text{-N}$ ), subtract the unionized ammonia-nitrogen determined in Step 2 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‰ at an ionic strength of 0.701m.

### 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. 1.0 ppm Total Ammonia Nitrogen  $\times$  0.1118 = 0.1118 ppm Unionized Ammonia Nitrogen.
3.

Total Ammonia-Nitrogen	1.0000 ppm
Unionized Ammonia-Nitrogen	– 0.1118 ppm
<hr/>	
Ionized Ammonia-Nitrogen	= 0.8882 ppm

## CARBON DIOXIDE

QUANTITY	CONTENTS	CODE
15 mL	*Phenolphthalein Indicator, 1%	*2246-E
60 mL	*Carbon Dioxide Reagent B	*4253-H
1	Direct Reading Titrator, 0-50 Range	0380
1	Test Tube, 5-10-12.9-15-20-25 mL, w/cap	0608

**\*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 test tube (0608) to 20 mL line with sample water. For best results, test on freshly obtained sample, and avoid splashing or prolonged contact with air.
2. Add 2 drops of \*Phenolphthalein Indicator, 1% (2246). If sample turns red, no free carbon dioxide is present. If sample is colorless, continue to Step 3.
3. Fill Direct Reading Titrator (0380) with \*Carbon Dioxide Reagent B (4253). Insert Titrator in center hole of test tube cap.
4. While gently swirling tube, slowly depress plunger to titrate sample until color changes to a faint pink which persists for 30 seconds. Read test result where the plunger tip meets the titrator scale. Record results as ppm Carbon Dioxide.

## 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
30 mL	*Sulfuric Acid, 1:1	*6141WT-G
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, w/cap	0608
1	Bottle, Water Sampling, 60 mL, glass	0688-DO

**\*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 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 Sampler, 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.

## **“Fixing” the Water Sample**

**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. Add 8 drops of \*Sulfuric Acid, 1:1 (6141WT). 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**

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 DRT (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 tip meets Titrator Scale. Record as ppm Dissolved Oxygen. Each minor division equals 0.2 ppm.

## NITRATE NITROGEN

QUANTITY	CONTENTS	CODE
2 x 60 mL	*Mixed Acid Reagent	*V-6278-H
5g	*Nitrate Reducing Reagent	*V-6279-C
1	Spoon, 0.1g, plastic	0699
2	Test Tubes, 2.5 & 5.0 mL, w/cap	0820
1	Bottle, water sample	0688
1	Nitrate-N Comparator, .25-10.0 ppm	3109
1	Dispenser Cap	0692

**\*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 1:** Nitrites can cause serious interference in this test and should be determined and compensated for if present.

**NOTE 2:** The best results are obtained when all solutions are kept close to 23°C.

**NOTE 3:** Place Dispenser Cap (0692) on \*Mixed Acid Reagent (V-6278). Save this cap for refill reagents.

### Procedure

1. Fill sample bottle (0688) with sample water.
2. Fill the test tube (0820) to the first line (2.5 mL) with the sample from the sample bottle.
3. Add the \*Mixed Acid Reagent (V-6278) to the second line (5.0 mL total). Cap and mix. Wait two minutes.
4. Use the 0.1g spoon (0699) to add one level measure (avoid any excess) of \*Nitrate Reducing Reagent (V-6279). Cap and invert the tube 50-60 times in one minute. Wait 10 minutes.
5. Mix before inserting tube into the Nitrate-N Comparator (3109). Match sample color with a color standard. Record result as ppm Nitrate Nitrogen (N). To obtain ppm Nitrate (NO<sub>3</sub>), multiply result by 4.4.

## 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
1	Pipet, 1.0 mL, plastic	0354
1	Pipet, plain, plastic w/cap	0357
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

<b>QUANTITY</b>	<b>CONTENTS</b>	<b>CODE</b>
30 mL	Cresol Red Indicator	2212-G
1	Test Tube, 5 mL, glass	0230
1	Cresol Red Comparator, 7.7 - 8.4	2165-01

### **Procedure**

1. Rinse the test tube with the sample water, then refill the tube to the 5 mL line.
2. Add 8 drops of Cresol Red Indicator (2212) to the sample, one drop at a time, holding the dropper bottle vertically to dispense uniformly sized drops.
3. Cap the tube and invert several times to mix the contents.
4. Insert test tube into the Cresol Red Comparator (2165-01). Match sample color to a color standard. Record as pH.

# SALINITY

QUANTITY	CONTENTS	CODE
15 mL	*Salinity Indicator Reagent A	*7460-E
60 mL	*Salinity Titration Reagent B	*7461-H
60 mL	Demineralizer Bottle	1151
1	Test Tube, 5-10-15 mL, glass, w/cap	0778
1	Direct Reading Titrator, 0-20 Range	0378
1	Direct Reading Titrator, 0-1.0 Range	0376

**\*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 Demineralizer Bottle instructions and Direct Reading Titrator Manual before performing test.

**TEST RANGE:** 0-20 ppt Salinity

## Procedure

1. Fill test tube (0778) to 10 mL line with Demineralized Water (1151).
2. Fill the 1.0 mL Titrator (0376) to 0 mark with sample water. Wipe any excess water off the Titrator.
3. Dispense 0.5 mL of sample water into test tube by depressing plunger until tip is at 0.5 mark. Discard remaining water in Titrator.
4. Add 3 drops of \*Salinity Indicator Reagent A (7460). Cap and gently swirl to mix.
5. Fill 0-20 Direct Reading Titrator (0378) with \*Salinity Titration Reagent B (7461). Insert Titrator in hole of test tube cap.
6. While gently swirling the tube, slowly depress plunger to titrate sample until yellow color changes to pink-brown. Read test result directly in ppt Salinity where plunger tip meets scale. Each minor Titrator division = 0.4 ppt Salinity.

**EXAMPLE:** Plunger tip is 3 minor divisions below 10, test result is 10 plus  $(3 \times 0.4) = 11.2$  ppt.

**Relationship Between Salinity and Specific Gravity  
of Artificial Sea Water**

<b>Salinity (0/00)</b>	<b>Specific Gravity (20°C [68°F])</b>
0.00	1.0000
2.78	1.0020
5.55	1.0041
8.33	1.0061
11.10	1.0082
13.88	1.0102
16.66	1.0123
19.43	1.0144
22.21	1.0164
24.98	1.0185
27.76	1.0206
30.53	1.0227
33.31	1.0248
36.09	1.0269
38.86	1.0290
41.63	1.0311
44.41	1.0332
47.18	1.0353
49.96	1.0374
52.73	1.0396
55.51	1.0417

**NOTE:** 0/00 = ppt (parts per thousand)



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