DOC326.97.00098

Fish Farming Water Quality Test Kit

FF-1A (243002)

11/2017, Edition 1

User Manual

General information

In no event will the manufacturer be liable for direct, indirect, special, incidental or consequential damages resulting from any defect or omission in this manual. The manufacturer reserves the right to make changes in this manual and the products it describes at any time, without notice or obligation. Revised editions are found on the manufacturer's website.

Safety information

NOTICE

The manufacturer is not responsible for any damages due to misapplication or misuse of this product including, without limitation, direct, incidental and consequential damages, and disclaims such damages to the full extent permitted under applicable law. The user is solely responsible to identify critical application risks and install appropriate mechanisms to protect processes during a possible equipment malfunction.

Please read this entire manual before unpacking, setting up or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

Make sure that the protection provided by this equipment is not impaired. Do not use or install this equipment in any manner other than that specified in this manual.

Use of hazard information

⚠ DANGER

Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

Indicates a potentially hazardous situation that may result in minor or moderate injury.

NOTICE

Indicates a situation which, if not avoided, may cause damage to the instrument. Information that requires special emphasis.

Product overview

The Fish Farming Water Quality Test Kit includes the necessary items to measure important parameters in aquaculture. Refer to Table 1.

Some measurement methods use reagents and color discs to make a visual determination of the parameter concentration. Refer to Figure 1. Other measurement methods use reagents and titration procedures to measure the parameter concentration.

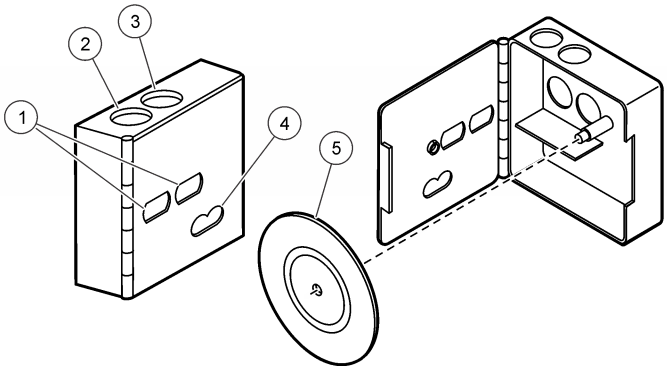
Table 1 Test kit parameters

Parameter	Range	Method
Alkalinity	0–100, 0–400 mg/L $CaCO_3$	Titration
Ammonia	0–3.0 NH_3–N	Color disc
Carbon dioxide	0–100 mg/L CO_2	Titration
Chloride	0–150, 0–600 mg/L Cl^-	Titration
Dissolved oxygen	0–4, 0–20 mg/L O_2	Titration
Hardness, total	0–342 mg/L $CaCO_3$	Titration

Table 1 Test kit parameters (continued)

Parameter	Range	Method
Nitrite	0–0.4 mg/L NO_2–N	Color disc
pH	4–10 pH units	Color disc
Supersaturation	Qualitative	Observation

Figure 1 Color comparator box



1 Windows for color matching	**4** Scale window
2 Left opening for viewing tube	**5** Color disc
3 Right opening for viewing tube	

Product components

Make sure that all components have been received. Refer to the list that follows. If any items are missing or damaged, contact the manufacturer or a sales representative immediately.

- Bottle, mixing
- Bottle, BOD, 60 mL
- Carrying case
- Clippers
- Color comparator box
- Color discs (3x)
- Color viewing tubes, plastic (2x)
- Dropper
- Thermometer (Item number 2676400)
- Tube, plastic 5.83 mL
- Bromcresol Green-Methyl Red Powder Pillows
- Chloride 2 Indicator Reagent Powder Pillows
- Silver Nitrate Titrant Solution
- Dissolved Oxygen 1 Powder Pillows
- Dissolved Oxygen 2 Powder Pillows
- Dissolved Oxygen 3 Powder Pillows (4x)
- Hardness 1 Buffer Solution
- Hardness 2 Indicator Solution
- Hardness 3 Titrant Solution
- NitriVer3 Powder Pillows
- Nessler Reagent Solution
- Phenolphthalein Reagent Solution
- Rochelle Salt Solution
- Sodium Thiosulfate Reagent Solution
- Sulfuric Acid Reagent Solution, 0.030 N
- Sodium Hydroxide Solution, 0.1 N
- Wide-range pH Indicator Solution

Alkalinity

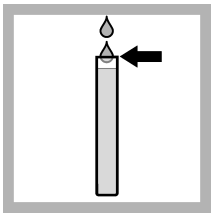
Test preparation

⚠ CAUTION

Review the Safety Data Sheets (MSDS/SDS) for the chemicals that are used. Use the recommended personal protective equipment.

- Hold the dropper vertically above the sample. Do not let the dropper touch the bottle during the titration.
- Rinse the tubes and bottles with sample before the test. Rinse the tubes and bottles with deionized water after the test.
- Alkalinity is the capacity of water to neutralize acids. Carbonates, bicarbonates and hydroxides are the primary sources of alkalinity in water.
- To verify the test accuracy, use a standard solution as the sample.
- To record the test result as mg/L $CaCO_3$, multiply the test result in gpg by 17.1.

Test procedure—Alkalinity, HR (gpg $CaCO_3$)

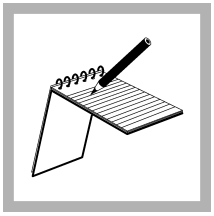


1. Fill the measuring tube with sample.

2. Pour the sample into the mixing bottle.

3. Add one drop of Phenolphthalein Indicator Solution. Swirl to mix.
If the solution is colorless, the Phenolphthalein (P) alkalinity is zero. Go to step 6.

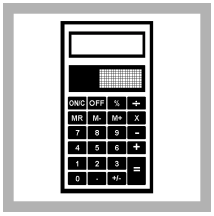
4. Add the Sulfuric Acid Standard Solution by drops. Mix after each drop. Count the drops until the color changes from pink to colorless.



5. Record the number of drops. The number of drops is the phenolphthalein alkalinity result as gpg $CaCO_3$.

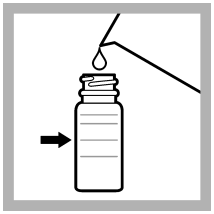
6. Add one Bromcresol Green-Methyl Red Powder Pillow. Swirl to mix.

7. Add the Sulfuric Acid Standard Solution by drops. Mix after each drop. Count the drops until the color changes from green to pink.



8. Add the number of drops from step 5 and step 7 to get the total (methyl orange) alkalinity result as gpg $CaCO_3$.

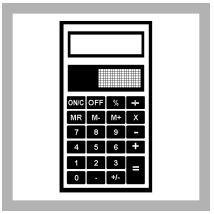
Test procedure—Alkalinity, LR (gpg $CaCO_3$)



1. Fill the bottle to the 15-mL mark with sample.

2. Add one drop of Phenolphthalein Indicator Solution. Swirl to mix.
If the solution is colorless, the Phenolphthalein (P) alkalinity is zero. Go to step 5.

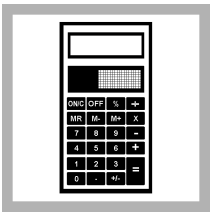
3. Add the Sulfuric Acid Standard Solution by drops. Mix after each drop. Count the drops until the color changes from pink to colorless.



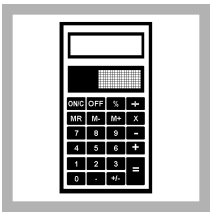
4. Divide the number of drops by 2.5 to get the phenolphthalein alkalinity result as gpg $CaCO_3$.

5. Add one Bromcresol Green-Methyl Red Powder Pillow. Swirl to mix.

6. Add the Sulfuric Acid Standard Solution by drops. Mix after each drop. Count the drops until the color changes from green to pink.



7. Add the number of drops from step 3 and step 6.



8. Divide the total number of drops by 2.5 to get the total (methyl orange) alkalinity result as gpg $CaCO_3$.

Determine the alkalinity relationships

The primary forms of alkalinity in water are hydroxide, carbonate and bicarbonate ions. The concentration of these ions in a sample can be determined from the phenolphthalein alkalinity and total alkalinity values. Refer to Table 2 and the steps that follow to determine the hydroxide, carbonate and bicarbonate alkalinities.

1. If the phenolphthalein (P) alkalinity is 0 mg/L, use Row 1.
2. If the phenolphthalein (P) alkalinity is equal to the total alkalinity, use Row 2.
3. Divide the total alkalinity by 2 to calculate one-half of the total alkalinity.
   a. Compare the phenolphthalein (P) alkalinity to one-half of the total alkalinity. Then, use Row 3, 4 or 5.
   b. Do the calculations in the row (if applicable).
4. Make sure that the sum of the three alkalinity types is equal to the total alkalinity.
   Example:

   A sample has 170 mg/L as $CaCO_3$ phenolphthalein alkalinity and 250 mg/L as $CaCO_3$ total alkalinity.

The phenolphthalein alkalinity of 170 mg/L is more than one-half of the total alkalinity, so use Row 5.

- Hydroxide alkalinity: 2 x 170 = 340; 340 – 250 = 90 mg/L hydroxide alkalinity
- Carbonate alkalinity: 250 – 170 = 80; 80 x 2 = 160 mg/L carbonate alkalinity
- Bicarbonate alkalinity: 0 mg/L

Sum of the alkalinity types: 90 mg/L hydroxide alkalinity + 160 mg/L carbonate alkalinity + 0 mg/L bicarbonate alkalinity = 250 mg/L total alkalinity.

Table 2 Alkalinity relationships

Row	Titration result	Hydroxide alkalinity	Carbonate alkalinity	Bicarbonate alkalinity
1	P alkalinity = 0	0	0	= Total alkalinity
2	P alkalinity = Total alkalinity	= Total alkalinity	0	0
3	P alkalinity is less than ½ of Total alkalinity	0	= P alkalinity × 2	= Total alkalinity – (P alkalinity × 2)
4	P alkalinity = ½ Total alkalinity	0	= Total alkalinity	0
5	P alkalinity is more than ½ Total alkalinity	= (P alkalinity × 2) – Total alkalinity	= (Total alkalinity – P alkalinity) × 2	0

Replacement items

Note: *Product and Article numbers may vary for some selling regions. Contact the appropriate distributor or refer to the company website for contact information.*

Description	Unit	Item no.
Bromcresol Green-Methyl Red Indicator Powder Pillows	100/pkg	94399
Phenolphthalein Indicator Solution, 1 g/L	15 mL SCDB	189736
Sulfuric acid standard solution, 0.030 N	100 mL MDB	2620532
Bottle, square, 29 mL, with 10, 15, 20 and 23-mL marks	6/pkg	232706
Measuring tube, plastic, 5.83 mL	each	43800

Optional items

Description	Unit	Item no.
Alkalinity standard solution, 500 mg/L as $CaCO_3$	1 L	2826253
Water, deionized	500 mL	27249

Ammonia

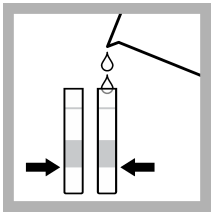
Test preparation

⚠ CAUTION

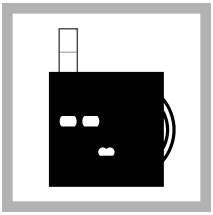
Review the Safety Data Sheets (MSDS/SDS) for the chemicals that are used. Use the recommended personal protective equipment.

- Put the color disc on the center pin in the color comparator box (numbers to the front).
- Use sunlight or a lamp as a light source to find the color match with the color comparator box.
- Rinse the tubes with sample before the test. Rinse the tubes with deionized water after the test.
- If the color match is between two segments, use the value that is in the middle of the two segments.
- If the color disc becomes wet internally, pull apart the flat plastic sides to open the color disc. Remove the thin inner disc. Dry all parts with a soft cloth. Assemble when fully dry.
- To verify the test accuracy, use a standard solution as the sample.
- The recommended sample temperature is 20 °C. Warmer temperatures cause high results. Colder temperatures cause low results.
- More than 6 gpg hardness causes a white precipitate to develop. To remove the interference, add 1 drop of Rochelle salt reagent to the sample tube before the reagent is added.
- To measure very low quantities of ammonia, add ammonia-free water to one tube. Add 3 drops of the Nessler reagent. Put this tube in the left opening of the color comparator box as the reagent blank.
- To record the test result as mg/L NH_3, multiply the test result by 1.2. To record the test result as mg/L NH_4^+, multiply the test result by 1.3.

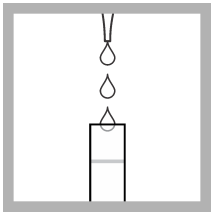
Test procedure—Ammonia-nitrogen (0–3.0 mg/L NH_3–N)



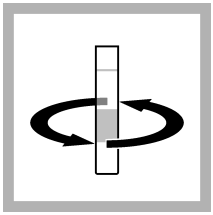
1. Fill two tubes to the first line (5 mL) with sample.



2. Put one tube into the left opening of the color comparator box.

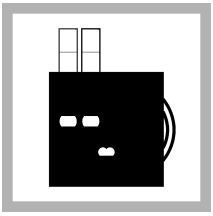


3. Add 3 drops of Nessler reagent to the second tube.

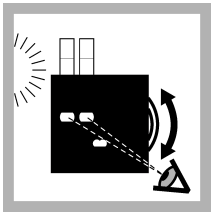


4. Swirl to mix. A yellow color develops.

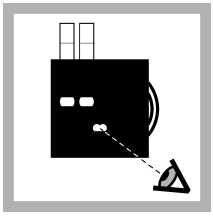
5. Wait 1 minute. Read the result within 5 minutes.



6. Put the second tube into the color comparator box.



7. Hold the color comparator box in front of a light source. Turn the color disc to find the color match.



8. Read the result in mg/L in the scale window.

Calculate the mg/L NH_3

Ammonia in water is in the form of the ammonium ion (NH_4^+) and un-ionized ammonia (NH_3). NH_3 is toxic to fish. Table 3 shows that the percent of NH_3 increases as the pH and temperature increase. This test kit measures NH_4^+ and NH_3 as ammonia nitrogen (NH_3–N).

To calculate the mg/L NH_3 in the sample, refer to Table 3 and the equation that follows.

mg/L NH_3 = ((mg/L NH_3–N x percent NH_3 from Table 3) ÷ 100) × 1.2

Example: *The test result is 1.6 mg/L NH_3–N. The sample pH is 7.6 and the sample temperature is 16 °C. The mg/L NH_3 is ((1.6 x 1.16) ÷ 100) × 1.2 = 0.02 mg/L NH_3.*

To calculate the mg/L NH_4^+ in the sample, refer to Table 3 and the equation that follows.

mg/L NH_4^+ = ((mg/L NH_3–N x (100 – percent NH_3 from Table 3)) ÷ 100) × 1.3

Example: *The test result is 1.6 mg/L NH_3–N. The sample pH is 7.6 and the sample temperature is 16 °C. The mg/L NH_4^+ is ((1.6 x (100 – 1.16)) ÷ 100) × 1.3 = 2.056 mg/L NH_4^+.*

Table 3 Percent of NH_3 in water

pH	4 °C	6 °C	8 °C	10 °C	12 °C	14 °C	16 °C	18 °C	20 °C	22 °C	24 °C	26 °C	28 °C	30 °C	32 °C
7.0	0.11	0.13	0.16	0.18	0.22	0.25	0.29	0.34	0.39	0.46	0.52	0.60	0.69	0.80	0.91
7.2	0.18	0.21	0.25	0.29	0.34	0.40	0.46	0.54	0.62	0.82	0.83	0.96	1.10	1.26	1.44
7.4	0.29	0.34	0.40	0.46	0.54	0.63	0.73	0.85	0.98	1.14	1.31	1.50	1.73	1.98	2.26
7.6	0.45	0.53	0.63	0.73	0.86	1.00	1.16	1.34	1.55	1.79	2.06	2.36	2.71	3.10	3.53
7.8	0.72	0.84	0.99	1.16	1.35	1.57	1.82	2.11	2.44	2.81	3.22	3.70	4.23	4.82	5.48
8.0	1.13	1.33	1.56	1.82	2.12	2.47	2.86	3.30	3.81	4.38	5.02	5.74	6.54	7.43	8.42
8.2	1.79	2.10	2.45	2.86	3.32	3.85	4.45	5.14	5.90	6.76	7.72	8.80	9.98	11.29	12.72
8.4	2.80	3.28	3.83	4.45	5.17	5.97	6.88	7.90	9.04	10.31	11.71	13.26	14.95	16.78	18.77
8.6	4.37	5.10	5.93	6.88	7.95	9.14	10.48	11.97	13.61	15.41	17.37	19.50	21.78	24.22	26.80
8.8	6.75	7.85	9.09	10.48	12.04	13.76	15.66	17.73	19.98	22.41	25.00	27.74	30.62	33.62	36.72
9.0	10.30	11.90	13.68	15.65	17.82	20.18	22.73	25.46	28.36	31.40	34.56	37.83	41.16	44.53	47.91
9.2	15.39	17.63	20.08	22.73	25.58	28.61	31.80	35.12	38.55	42.04	45.57	49.09	52.58	55.99	59.31
9.4	22.38	25.33	28.47	31.80	35.26	38.84	42.49	46.18	49.85	53.48	57.02	60.45	63.73	66.85	69.79
9.6	31.36	34.96	38.38	42.49	46.33	50.16	53.94	57.62	61.17	64.56	67.77	70.78	73.58	76.17	78.55
9.8	42.00	46.00	50.00	53.94	57.78	61.47	64.99	68.31	71.40	74.28	76.92	79.33	81.53	83.51	85.30
10.0	53.44	57.45	61.31	64.98	68.44	71.66	74.63	77.35	79.83	82.07	84.08	85.88	87.49	88.92	90.19
10.2	64.53	68.15	71.52	74.63	77.46	80.03	82.34	84.41	86.25	87.88	89.33	90.60	91.73	92.71	93.58

Replacement items

Note: *Product and Article numbers may vary for some selling regions. Contact the appropriate distributor or refer to the company website for contact information.*

Description	Unit	Item no.
Nessler reagent	100 mL MDB	2119432
Color disc, ammonia nitrogen, Nessler, 0–3.0 mg/L	each	9262600
Color comparator box	each	173200
Plastic viewing tubes, 18 mm, with caps	4/pkg	4660004

Optional items

Description	Unit	Item no.
Caps for plastic viewing tubes (4660004)	4/pkg	4660014
Water, deionized	500 mL	27249
Glass viewing tubes, 18 mm	6/pkg	173006
Rochelle salt solution	29 mL DB	172533
Stoppers for 18-mm glass tubes and AccuVac Ampuls	6/pkg	173106

Carbon dioxide

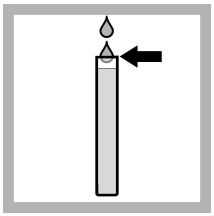
Test preparation

⚠ CAUTION

Review the Safety Data Sheets (MSDS/SDS) for the chemicals that are used. Use the recommended personal protective equipment.

- Hold the dropper vertically above the sample. Do not let the dropper touch the bottle during the titration.
- Rinse the tubes and bottles with sample before the test. Rinse the tubes and bottles with deionized water after the test.
- Dissolved carbon dioxide is in surface waters at concentrations less than 10 mg/L. Ground water can have higher concentrations. Fish may tolerate high concentrations of carbon dioxide if dissolved oxygen concentrations are also high. Fish usually stay away from areas where the concentration of carbon dioxide is high. The relationship of carbon dioxide to fish respiration and photosynthesis causes daily fluctuations in the CO_2 concentration. The concentration usually increases during the night and decreases during the day. High concentrations of carbon dioxide may become toxic to fish when dissolved oxygen levels are very low.

Test procedure—Carbon dioxide (0–100 mg/L CO_2)



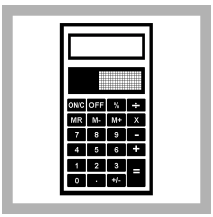
1. Fill the measuring tube with sample.

2. Pour the sample into the mixing bottle.

3. Add one drop of the Phenolphthalein Indicator Solution.

4. Turn the bottle left and right to mix.

5. Add the Sodium Hydroxide Solution by drops. Mix after each drop. Count the drops until a pink color stays for 30 seconds.



6. Multiply the number of drops of the sodium hydroxide solution by 5 to get the result in mg/L.

Replacement items

Note: *Product and Article numbers may vary for some selling regions. Contact the appropriate distributor or refer to the company website for contact information.*

Description	Unit	Item no.
Phenolphthalein Indicator Solution, 1 g/L	15 mL SCDB	189736
Sodium hydroxide standard solution, 0.01 N	100 mL MDB	67132
Bottle, square, 29 mL, with 10, 15, 20 and 23-mL marks	6/pkg	232706
Measuring tube, plastic, 5.83 mL	each	43800

Optional items

Description	Unit	Item no.
Water, deionized	500 mL	27249

Chloride

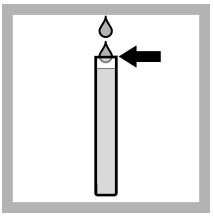
Test preparation

⚠ CAUTION

Review the Safety Data Sheets (MSDS/SDS) for the chemicals that are used. Use the recommended personal protective equipment.

- The chloride concentration in fish waters can be low or high. The concentration is usually higher near coastal regions. Measure chloride before and after salt is added to fish waters.
- Hold the dropper vertically above the sample. Do not let the dropper touch the bottle during the titration.
- Rinse the tubes and bottles with sample before the test. Rinse the tubes and bottles with deionized water after the test.
- Keep the silver nitrate titrant solution in the closed test kit case when not in use. The titrant solution slowly decomposes in light.
- To record the test result as mg/L chloride (Cl^-), multiply the NaCl result by 0.6.
- To verify the test accuracy, use a standard solution as the sample. Make sure to change the test result to mg/L chloride if the standard solution concentration is given as mg/L chloride (Cl^-).

Test procedure—Sodium chloride (0–2500 mg/L NaCl)



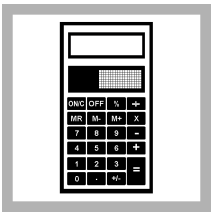
1. Fill the measuring tube with sample.

2. Pour the sample into the mixing bottle.

3. Add one Chloride 2 Indicator Powder Pillow.

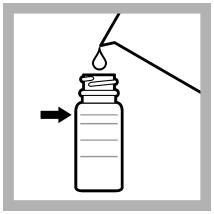
4. Turn the bottle left and right to mix.

5. Add the Silver Nitrate Titrant Solution by drops. Mix after each drop. Count the drops until the color changes to red-brown.



6. Multiply the total number of drops by 50 to get the result in mg/L.

Test procedure—Sodium chloride (0–500 mg/L NaCl)

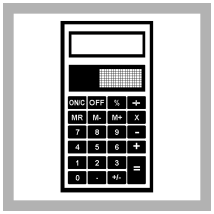


1. Fill the bottle to the 23-mL mark with sample.

2. Add one Chloride 2 Indicator Powder Pillow.

3. Turn the bottle left and right to mix.

4. Add the Silver Nitrate Titrant Solution by drops. Mix after each drop. Count the drops until the color changes to red-brown.



5. Multiply the total number of drops by 12.5 to get the result in mg/L.

Replacement items

Note: *Product and Article numbers may vary for some selling regions. Contact the appropriate distributor or refer to the company website for contact information.*

Description	Unit	Item no.
Chloride 2 Indicator Powder Pillows	100/pkg	104399
Chloride titrant, silver nitrate solution	100 mL MDB	39732
Bottle, square, 29 mL, with 10, 15, 20 and 23-mL marks	6/pkg	232706
Measuring tube, plastic, 5.83 mL	each	43800

Optional items

Description	Unit	Item no.
Water, deionized	500 mL	27249
Chloride standard solution, 1000 mg/L Cl^-	500 mL	18349

Dissolved oxygen

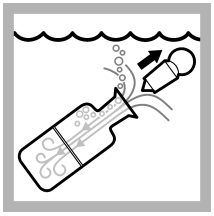
Test preparation

⚠ CAUTION

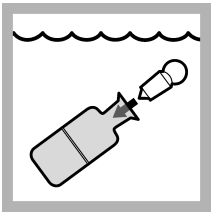
Review the Safety Data Sheets (MSDS/SDS) for the chemicals that are used. Use the recommended personal protective equipment.

- Hold the dropper vertically above the sample. Do not let the dropper touch the bottle during the titration.
- Air bubbles cause incorrect results. To prevent air bubbles below the stopper, tilt the bottle and tap the stopper quickly on the bottle neck. Look below the stopper to make sure that there are no air bubbles.
- Rinse the tubes and bottles with sample before the test. Rinse the tubes and bottles with deionized water after the test.
- Keep the sodium thiosulfate away from direct sunlight.
- If the sample contains high concentrations of chloride (e.g., sea water) the floc that develops in the bottle does not fall. Wait 4 or 5 minutes after the floc develops, then continue the test.
- If the high-range procedure gives a low result, use the prepared sample for the titration in the low-range procedure.
- Measure the dissolved oxygen (DO) concentration frequently to help monitor the health of fish and other organisms. The primary source of oxygen in fish waters comes from photosynthesis by phytoplankton. The dissolved oxygen concentration changes with fluctuations in the temperature, sunlight, atmospheric pressure, salinity, plant life and water turbulence.
- For better visibility of the titration endpoint, use starch indicator solution. Titrate the sample until the color starts to change from yellow-brown to light yellow, then add 2 drops of starch indicator solution. Continue the titration until the color changes from blue to colorless.

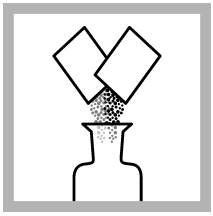
Test procedure—Dissolved oxygen (0–20 mg/L O_2)



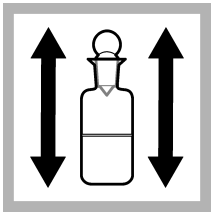
1. Hold the DO bottle with the stopper in the sample water. Remove the stopper and let the bottle fill to the top. Keep the bottle in the water.



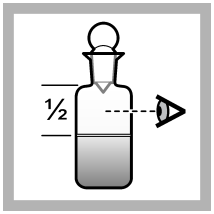
2. Tap the stopper quickly on the bottle neck. Remove the bottle from the water. Make sure that no air bubbles are trapped in the bottle.



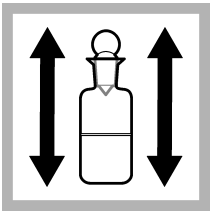
3. Add one Dissolved Oxygen 1 Powder Pillow and one Dissolved Oxygen 2 Powder Pillow.



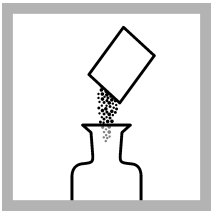
4. Immediately put the stopper on the bottle. Make sure that no air bubbles are below the stopper. Shake the bottle vigorously.



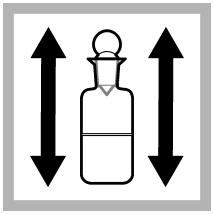
5. A brown-orange floc develops. The floc slowly falls. Wait until the top half of the bottle is clear.



6. Shake the bottle again. Wait until the top half of the bottle is clear.



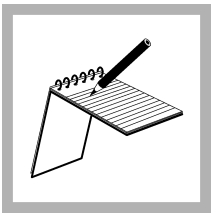
7. Remove the stopper. Add one Dissolved Oxygen 3 Powder Pillow.



8. Immediately put the stopper on the bottle. Shake the bottle. The floc dissolves and a yellow color develops.

9. Fill the measuring tube with the prepared sample. Pour the prepared sample into the mixing bottle.

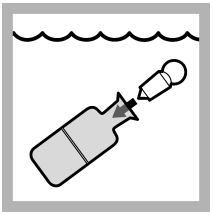
10. Add the Sodium Thiosulfate solution by drops. Mix after each drop. Count the drops until the solution is colorless.



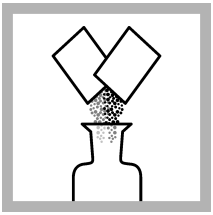
11. Record the number of drops. The number of drops of the titrant solution is equal to the result in mg/L.

Test procedure—Dissolved oxygen (0.2–4 mg/L O_2)

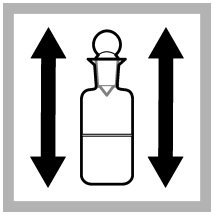
1. Hold the DO bottle with the stopper in the sample water. Remove the stopper and let the bottle fill to the top. Keep the bottle in the water.



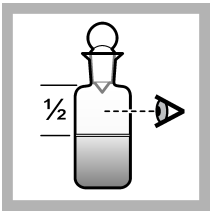
2. Tap the stopper quickly on the bottle neck. Remove the bottle from the water. Make sure that no air bubbles are trapped in the bottle.



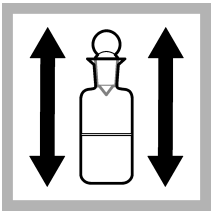
3. Add one Dissolved Oxygen 1 Powder Pillow and one Dissolved Oxygen 2 Powder Pillow.



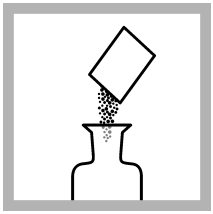
4. Immediately put the stopper on the bottle. Make sure that no air bubbles are below the stopper. Shake the bottle vigorously.



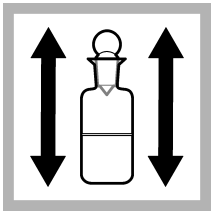
5. A brown-orange floc develops. The floc slowly falls. Wait until the top half of the bottle is clear.



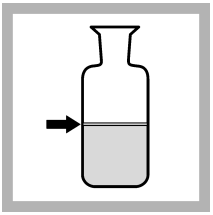
6. Shake the bottle again. Wait until the top half of the bottle is clear.



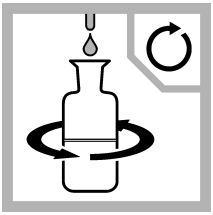
7. Remove the stopper. Add one Dissolved Oxygen 3 Powder Pillow.



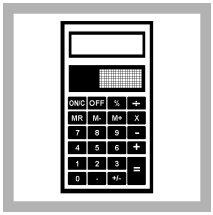
8. Immediately put the stopper on the bottle. Shake the bottle. The floc dissolves and a yellow color develops.



9. Pour the prepared sample from the bottle until the volume in the bottle is 30 mL.



10. Add the Sodium Thiosulfate solution by drops. Swirl to mix after each drop. Count the drops until the color changes to colorless.



11. Multiply the number of drops of the titrant solution by 0.2 to get the result in mg/L.

Replacement items

Note: *Product and Article numbers may vary for some selling regions. Contact the appropriate distributor or refer to the company website for contact information.*

Description	Unit	Item no.
Dissolved Oxygen 1 Reagent Powder Pillows, 60 mL	100/pkg	98199
Dissolved Oxygen 2 Reagent Powder Pillows, 60 mL	100/pkg	98299
Dissolved Oxygen 3 Reagent Powder Pillows	100/pkg	98799
Sodium Thiosulfate Standard Solution, stabilized, 0.0109 N	100 mL MDB	2408932
Clippers	each	96800
Bottle, BOD, 60 mL, with stopper	each	190902
Bottle, square, 29 mL, with 10, 15, 20 and 23-mL marks	6/pkg	232706
Measuring tube, plastic, 5.83 mL	each	43800

Optional items

Description	Unit	Item no.
Starch Indicator Solution	100 mL MDB	34932
Stopper, ground-glass for BOD bottles	each	190901
Water, deionized	500 mL	27249

Hardness, Total

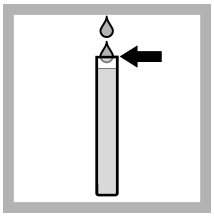
Test preparation

⚠ CAUTION

Review the Safety Data Sheets (MSDS/SDS) for the chemicals that are used. Use the recommended personal protective equipment.

- Hold the dropper vertically above the sample. Do not let the dropper touch the bottle during the titration.
- Rinse the tubes and bottles with sample before the test. Rinse the tubes and bottles with deionized water after the test.
- To record the test result as mg/L $CaCO_3$, multiply the test result in gpg by 17.1.
- To verify the test accuracy, use a standard solution as the sample.

Test procedure—Hardness (0–20 gpg $CaCO_3$)



1. Fill the measuring tube with sample.

2. Pour the sample into the mixing bottle.

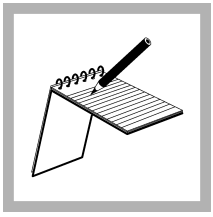
3. Add three drops of the Hardness 1 Buffer Solution.

4. Turn the bottle left and right to mix.

5. Add one drop of the Hardness 2 Indicator Solution. A pink color develops.

6. Turn the bottle left and right to mix.

7. Add the Hardness 3 Titrant Solution by drops. Mix after each drop. Count the drops until the color changes from pink to blue.



8. Record the number of drops. The number of drops of the titrant solution is the result in gpg.

Replacement items

Note: *Product and Article numbers may vary for some selling regions. Contact the appropriate distributor or refer to the company website for contact information.*

Description	Unit	Item no.
Hardness 1 Buffer Solution	100 mL MDB	42432
Hardness 2 Indicator Solution	100 mL MDB	42532
Hardness 3 Titrant Solution	100 mL MDB	42632

Replacement items (continued)

Description	Unit	Item no.
Bottle, square, 29 mL, with 10, 15, 20 and 23-mL marks	6/pkg	232706
Measuring tube, plastic, 5.83 mL	each	43800

Optional items

Description	Unit	Item no.
Standard solution, hardness (20 gpg) and iron (2 mg/L)	500 mL	47949
Water, deionized	500 mL	27249

Nitrite

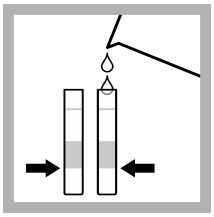
Test preparation

⚠ CAUTION

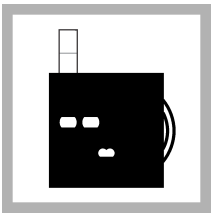
Review the Safety Data Sheets (MSDS/SDS) for the chemicals that are used. Use the recommended personal protective equipment.

- Put the color disc on the center pin in the color comparator box (numbers to the front).
- Use sunlight or a lamp as a light source to find the color match with the color comparator box.
- Rinse the tubes with sample before the test. Rinse the tubes with deionized water after the test.
- If the color match is between two segments, use the value that is in the middle of the two segments.
- If the color disc becomes wet internally, pull apart the flat plastic sides to open the color disc. Remove the thin inner disc. Dry all parts with a soft cloth. Assemble when fully dry.
- Undissolved reagent does not have an effect on test accuracy.
- If the sample contains more than 0.5 mg/L nitrite-nitrogen, dilute the sample as follows. Use the dropper to add 1 mL of sample to each tube. Dilute the sample to the 5-mL mark with deionized water. Use the diluted sample in the test procedure and multiply the result by 5.
- To record the test result as mg/L NO_2^-, multiply the test result by 3.33.
- Nitrite-nitrogen develops during the biological decomposition of organic nitrogen compounds. Nitrites are quickly oxidized to nitrates and are not usually found in surface waters. Levels of nitrite more than the natural residual amounts can be acutely poisonous to fish.

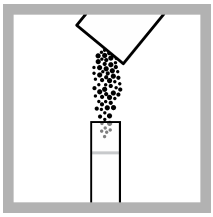
Test procedure—Nitrite-nitrogen LR (0–0.4 mg/L NO_2^-–N)



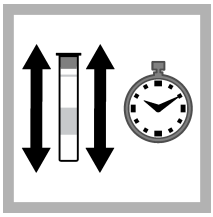
1. Fill two tubes to the first line (5 mL) with sample.



2. Put one tube into the left opening of the color comparator box.

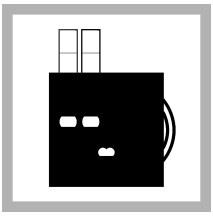


3. Add one NitriVer 3 Nitrite Reagent Powder Pillow to the second tube.

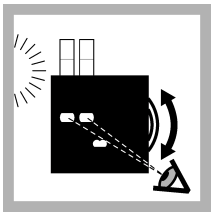


4. Put a cap on the tube. Shake for 1 minute. A pink color develops.

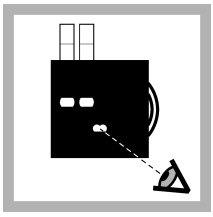
5. Wait 10 minutes. Read the result within 15 minutes.



6. Put the second tube into the color comparator box.



7. Hold the color comparator box in front of a light source. Turn the color disc to find the color match.



8. Read the result in mg/L in the scale window.

Replacement items

Note: *Product and Article numbers may vary for some selling regions. Contact the appropriate distributor or refer to the company website for contact information.*

Description	Unit	Item no.
NitriVer 3 Nitrite Reagent Powder Pillows, 5 mL	100/pkg	1407899
Color disc, nitrite nitrogen, 0–0.4 mg/L	each	9262300
Color comparator box	each	173200
Plastic viewing tubes, 18 mm, with caps	4/pkg	4660004

Optional items

Description	Unit	Item no.
Caps for plastic viewing tubes (4660004)	4/pkg	4660014
Dropper, glass, 0.5- and 1.0-mL marks	5/pkg	1419705
Glass viewing tubes, 18 mm	6/pkg	173006
Stoppers for 18-mm glass tubes and AccuVac Ampuls	6/pkg	173106
Water, deionized	500 mL	27249

pH

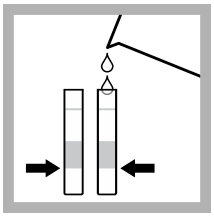
Test preparation

⚠ CAUTION

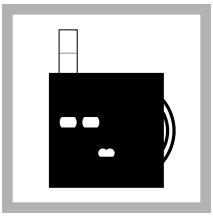
Review the Safety Data Sheets (MSDS/SDS) for the chemicals that are used. Use the recommended personal protective equipment.

- Put the color disc on the center pin in the color comparator box (numbers to the front).
- Use sunlight or a lamp as a light source to find the color match with the color comparator box.
- Rinse the tubes with sample before the test. Rinse the tubes with deionized water after the test.
- If the color match is between two segments, use the value that is in the middle of the two segments.
- If the color disc becomes wet internally, pull apart the flat plastic sides to open the color disc. Remove the thin inner disc. Dry all parts with a soft cloth. Assemble when fully dry.
- To verify the test accuracy, use a buffer solution as the sample.
- Chlorine can interfere with the test. To remove chlorine from the sample, add 1 drop of sodium thiosulfate solution to 5 mL of sample and mix. Use this dechlorinated sample in the test procedure. One drop of the sodium thiosulfate removes a maximum of 50 mg/L chlorine from the sample.
- The pH of water is a measure of the hydrogen ion concentration on a scale of 0 (very acidic) to 14 (very alkaline), with pH 7 being neutral. The pH of most natural waters ranges from pH 4 to pH 9. Dissolved carbon dioxide, carbonates, bicarbonates and acid rain cause changes in the pH. Phytoplankton and other aquatic plant life remove carbon dioxide from the water during photosynthesis, which causes the pH to increase during the day. To make an estimate of the pH cycle of a body of water, make pH measurements at different times of the day. The best pH values for fish production measured at sunrise are approximately 6.5 to 9. The acid and alkaline death points for most fish are approximately pH 4 and pH 11.

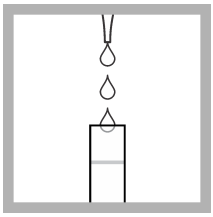
Test procedure—pH (4–10 pH units)



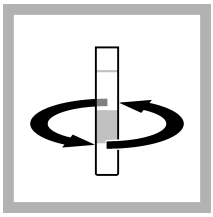
1. Fill two tubes to the first line (5 mL) with sample.



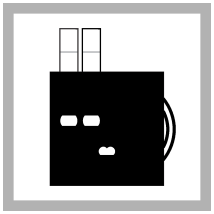
2. Put one tube into the left opening of the color comparator box.



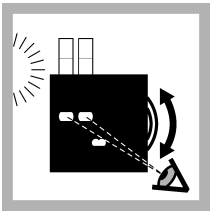
3. Add 6 drops of wide range pH indicator solution to the second tube.



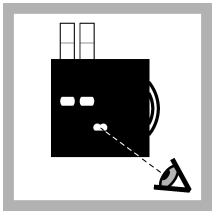
4. Swirl to mix.



5. Put the second tube into the color comparator box.



6. Hold the color comparator box in front of a light source. Turn the color disc to find the color match.



7. Read the result in pH units in the scale window.

Replacement items

Note: *Product and Article numbers may vary for some selling regions. Contact the appropriate distributor or refer to the company website for contact information.*

Description	Unit	Item no.
Wide range pH indicator solution	100 mL MDB	2329332
Color disc, pH, wide range	each	990100
Color comparator box	each	173200
Plastic viewing tubes, 18 mm, with caps	4/pkg	4660004
Sodium Thiosulfate Standard Solution, stabilized, 0.0109 N	100 mL MDB	2408932

Optional items

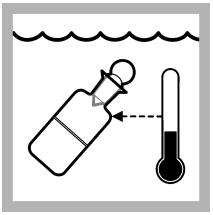
Description	Unit	Item no.
Caps for plastic viewing tubes (4660004)	4/pkg	4660014
Glass viewing tubes, 18 mm	6/pkg	173006
Stoppers for 18-mm glass tubes and AccuVac Ampuls	6/pkg	173106
Water, deionized	500 mL	27249

Supersaturation

Test preparation

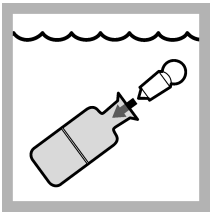
- Supersaturation occurs when more air dissolves in water than is soluble, which can cause gas bubble disease in fish.
- The temperature of the collected sample must not change for accurate results.
- Be careful to not trap air bubbles during sample collection. To prevent air bubbles during sample collection, tilt the bottle and tap the stopper quickly on the bottle neck. Look below the stopper to make sure that there are no air bubbles.

Test procedure—Supersaturation

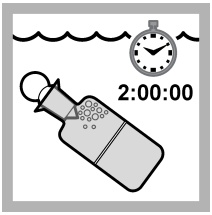


1. Soak the DO bottle in the sample water until the bottle is the same temperature as the sample water.

2. Hold the DO bottle with the stopper in the sample water. Remove the stopper and let the bottle fill to the top. Keep the bottle in the water.



3. Tap the stopper quickly on the bottle neck. Keep the bottle in the water so that the temperature does not change.



4. Look for gas bubbles during a period of several hours. Gas bubbles are an indication that the water is supersaturated with gas.

Replacement items

Note: *Product and Article numbers may vary for some selling regions. Contact the appropriate distributor or refer to the company website for contact information.*

Description	Unit	Item no.
Bottle, BOD, 60 mL, with stopper	each	190902
Stopper, ground-glass for BOD bottles	each	190901

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