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# **Water Conditioning Test Kit**

**AD-16E (148410)**

11/2017, Edition 1

**User Manual**



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## 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

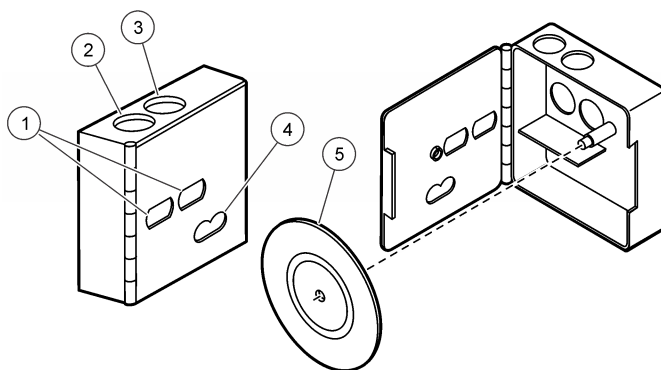
The Water Conditioning Demonstration Test Kit includes the necessary items to compare hard water to soft water and to measure important water quality parameters. Refer to [Table 1](#). A portable water softener is included to prepare soft water.

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
Hardness, total	0–20 gpg CaCO <sub>3</sub>	Titration
Iron	0–7 mg/L Fe	Color disc
Nitrate	0–40 mg/L NO <sub>3</sub> –N	Color disc
pH	pH units	Color disc
Soap demonstration	Qualitative	Observation
Total dissolved solids (TDS)	0–1999 ppm TDS	Pocket Pro TDS <sub>LR</sub> Tester

**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 (2x)
- Beaker, 100 mL, polypropylene
- Color comparator box
- Color discs (4x)
- Color viewing tubes, plastic (4x)
- Flask, Erlenmeyer, 250 mL (2x)
- Stopper, rubber, solid, size 6 (2x)
- Tube, plastic, 5.83 mL
- Carrying case
- Univer 3 Hardness Reagent Powder Pillows
- Hardness 3 Titrant Solution
- FerroVer Iron Reagent Powder Pillows
- NitraVer 5 Nitrate Reagent Powder Pillows
- Bromthymol Blue pH Indicator Powder Pillows
- Soap solution
- Pocket Pro Low Range TDS Tester
- Water softener, portable, high capacity

# Hardness, Total

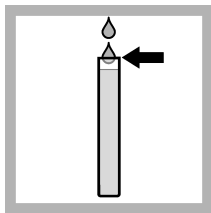
## Test preparation

### ⚠ 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  $\text{CaCO}_3$ , 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 $\text{CaCO}_3$ )



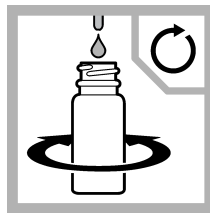
1. Fill the measuring tube with sample.



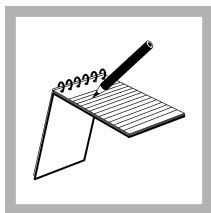
2. Pour the sample into the mixing bottle.



3. Add one UniVer 3 Hardness Reagent Powder Pillow. Turn the bottle left and right to mix. A pink color develops.



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



5. 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.
UniVer® 3 Hardness Reagent Powder Pillows	100/pkg	96299
Hardness 3 Titrant Solution	100 mL MDB	42632

## Replacement items (continued)

Description	Unit	Item no.
Bottle, square, with 25-mL mark	each	1704200
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



# Iron

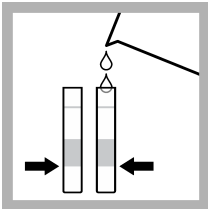
## Test preparation

### ⚠ CAUTION

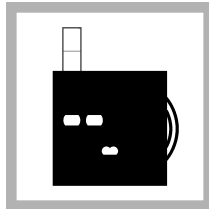
Review the Safety Data Sheets (MSDS/SDS) for the chemicals that are used. Use the recommended personal protective equipment.

- Put the color disc on the center pin in the color comparator box (numbers to the front).
- Use the indoor light color disc when the light source is fluorescent light. Use the outdoor light color disc when the light source is sunlight.
- 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.
- To verify the test accuracy, use a standard solution as the sample.
- If the sample contains rust or precipitated iron, fully mix the sample and then fill the tubes. Wait 2–5 minutes after the FerroVer reagent is added. Dissolved iron develops a color immediately.
- Samples that contain more than 30 mg/L iron can give low results. If high iron levels are possible, dilute the sample as follows. Use a 3-mL syringe to add 2.5 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 2. Use the syringe 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.

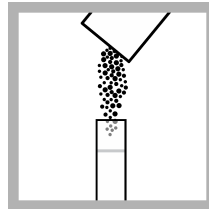
## Test procedure—Iron (0–7 mg/L Fe)



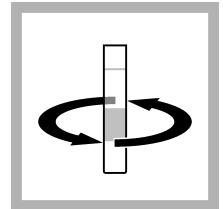
1. Fill two tubes to the first line (5 mL) with sample.



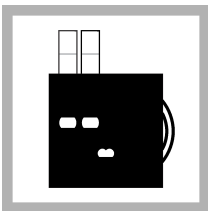
2. Put one tube into the left opening of the color comparator box.



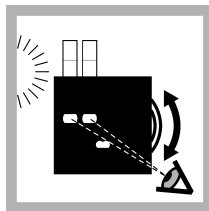
3. Add one FerroVer Iron Reagent Powder Pillow to the second tube.



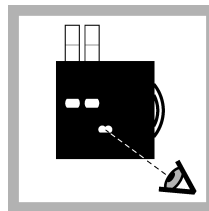
4. Swirl to mix. An orange color develops.



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 mg/L in the scale window.

## Replacement items

Description	Unit	Item no.
FerroVer® Iron Reagent Powder Pillows, 5 mL	100/pkg	92799
Color disc, iron, indoor light, 0–7 mg/L	each	9261000
Color disc, iron, outdoor light, 0–7 mg/L	each	9263700
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
Iron standard solution, 1 mg/L Fe	500 mL	13949
Stoppers for 18-mm glass tubes and AccuVac Ampuls	6/pkg	173106
Syringe, Luer-Lok® Tip, 3 mL	each	4321300

# pH

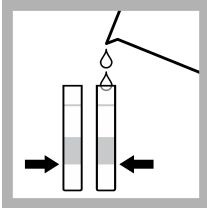
## Test preparation

### ⚠ CAUTION

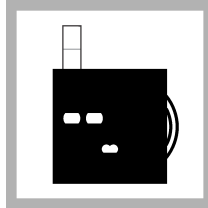
Review the Safety Data Sheets (MSDS/SDS) for the chemicals that are used. Use the recommended personal protective equipment.

- 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.
- More than 1 mg/L chlorine interferes with the test. To remove chlorine from the sample, add 1 drop of 0.1 N sodium thiosulfate solution to 25 mL of sample and mix. Use this dechlorinated sample in the test procedure. The sodium thiosulfate removes a maximum of 10 mg/L chlorine from the sample.
- The bromthymol blue indicator solution gives the most accurate results in the 6.0–8.0 pH units range. For accurate results above or below this range, use a test kit that uses the thymol blue or wide range pH indicator.

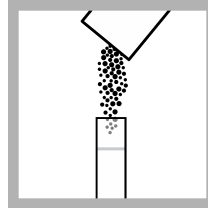
## Test procedure—pH (5.6-8.4 pH units)



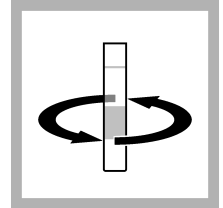
1. Fill two tubes to the first line (5 mL) with sample.



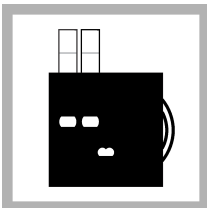
2. Put one tube into the left opening of the color comparator box.



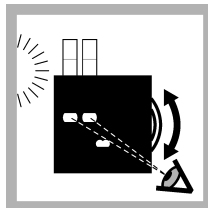
3. Add one Bromthymol Blue Indicator Powder Pillow to the second tube.



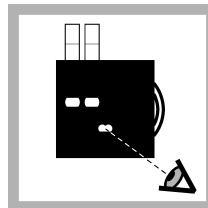
4. Swirl to mix.



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

Description	Unit	Item no.
Bromthymol Blue Indicator Powder Pillows	100/pkg	2067299
Color disc, pH, bromthymol blue, 5.6–8.4 pH units	each	9261200
Color comparator box	each	173200
Plastic viewing tubes, 18 mm, with caps	4/pkg	4660004

## Optional items

Description	Unit	Item no.
pH 7.0 buffer solution, colorless	500 mL	1222249
Caps for plastic viewing tubes (4660004)	4/pkg	4660014
Water, deionized	500 mL	27249
Glass viewing tubes, 18 mm	6/pkg	173006
Sodium thiosulfate, 0.1 N	100 mL MDB	32332
Stoppers for 18-mm glass tubes and AccuVac Ampuls	6/pkg	173106

# Nitrate

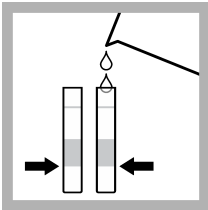
## Test preparation

### ⚠ CAUTION

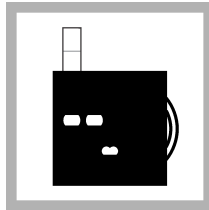
Review the Safety Data Sheets (MSDS/SDS) for the chemicals that are used. Use the recommended personal protective equipment.

- 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.
- The reagent contains a small quantity of cadmium metal that does not dissolve. Dispose of reacted solutions according to local, state and federal regulations.
- To verify the test accuracy, use a standard solution as the sample.
- If the sample contains more than 40 mg/L nitrate-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  $\text{NO}_3^-$ , multiply the test result by 4.4.

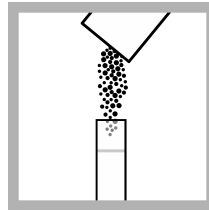
## Test procedure—Nitrate-nitrogen (0–40 mg/L $\text{NO}_3^-$ -N)



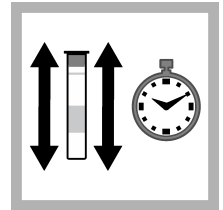
1. Fill two tubes to the first line (5 mL) with sample.



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



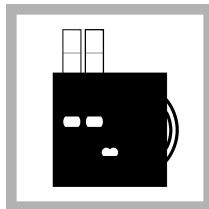
3. Add one NitraVer 5 Nitrate Reagent Powder Pillow to the second tube.



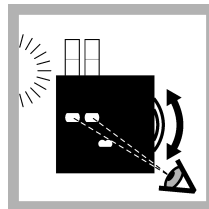
4. Put a cap on the tube. Shake vigorously for 1 minute.



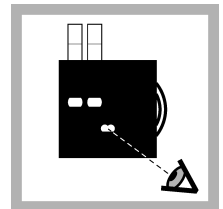
5. Wait 1 minute. An amber color develops.



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

Description	Unit	Item no.
NitraVer® 5 Nitrate Reagent Powder Pillows, 5 mL	100/pkg	1403599
Color disc, nitrate nitrogen, 0–40 mg/L	each	9261400
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
Nitrate nitrogen standard solution, 10.0 mg/L NO <sub>3</sub> -N	500 mL	30749
Stoppers for 18-mm glass tubes and AccuVac Ampuls	6/pkg	173106
Water, deionized	500 mL	27249

# Soap demonstration

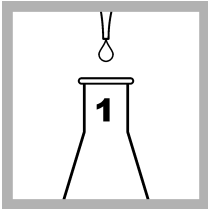
## Test preparation

### ⚠ CAUTION

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

- The test procedure shows the difference when soap is added to hard water vs. soft water. In hard water, calcium and magnesium ions react with the soap to form a white precipitate or scum. In soft water, the concentration of calcium and magnesium ions is very low and the soap reacts with dirt and oils. The higher the hardness concentration, the more soap is necessary to clean effectively.
- Rinse the flasks with soft water after the test.

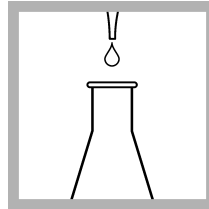
## Test procedure—Soap demonstration



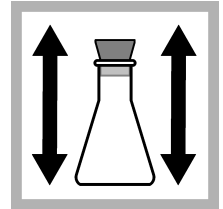
1. Fill a flask to the 50-mL mark with a soft water sample.



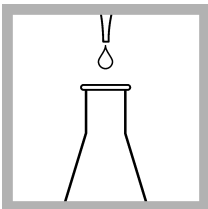
2. Fill a second flask to the 50-mL mark with a hard water sample.



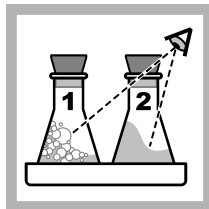
3. Add 1 or 2 drops of the soap solution to each flask.



4. Put a stopper on each flask and shake vigorously. The flask with the soft water develops soap suds.



5. Continue to add drops of the soap solution to the hard water sample until soap suds remain in the flask.



6. Compare the soft and hard water samples. The number of drops of soap solution added to form soap suds for soft water is significantly less than for hard water.

## 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.
Soap solution	100 mL MDB	39532
Water softener, portable, high capacity	each	3050001

## Replacement items (continued)

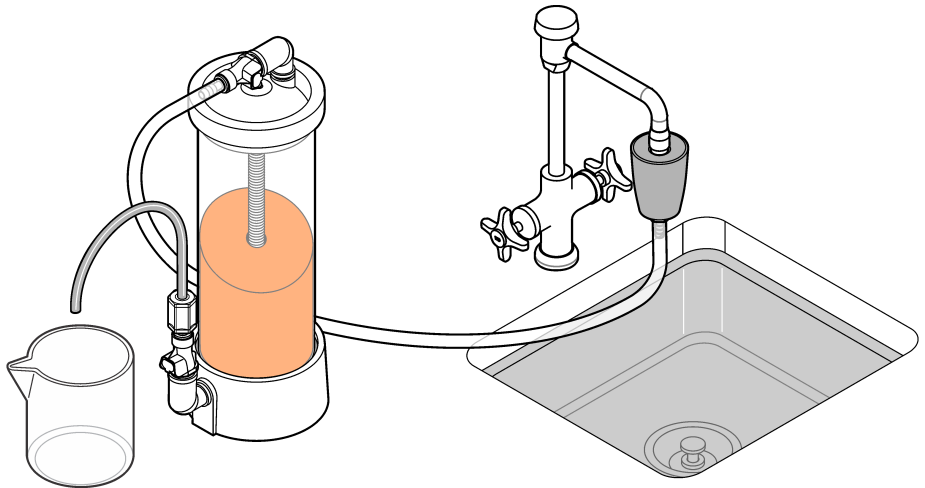
Description	Unit	Item no.
Flask, Erlenmeyer, 250 mL	each	50546
Stopper, rubber, solid, size 6	12/pkg	211806



## Water softener operation and maintenance

Use the portable water softener to remove hardness from water samples. Refer to [Figure 2](#).

**Figure 2 Water softener operation**



### Initial use

Keep the softener resin wet. If the resin becomes dry, complete the steps that follow to prevent cracks in the softener case.

1. Attach the faucet adapter to the faucet.
2. Tilt the softener to the side and let the resin move equally through the case.
3. Turn the outlet spout so that the water goes into a sink, beaker or other container.
4. Slowly open the faucet and let the softener fill with water.
5. When the resin is fully wet, move the softener back to the vertical position.

### Regenerate the water softener resin

Regenerate the softener resin when the water from the softener is 1 gpg (17.1 mg/L) or more. The softener can remove 104 g (1600 grains) of hardness before regeneration is necessary.

To regenerate the softener resin, complete the steps that follow.

1. Add 370 g of sodium chloride into the top of the softener. Do not use table salt, which contains anticaking agents that will clog the softener. As an alternative, use salt products for home softener regeneration.
2. Let a small stream of water flow through the softener. The sodium ions in the salt displace the hardness ions from the softener resin.  
*Note: As an alternative, dissolve the salt in water and let the salt solution flow through the softener.*
3. Let water flow through the softener for a few minutes to rinse the resin.

### Storage

To put the softener in the carrying case for storage, disconnect the spout and the inlet tube at the quick-connect fittings to prevent leakage.

To drain water from the softener, turn the softener upside down with the fittings attached. Water will drain from the inlet tube until mostly empty. Remove the quick-connect fittings to complete the draining.

## Optional items

Description	Unit	Item no.
Sodium chloride (NaCl), ACS	454 g	18201H

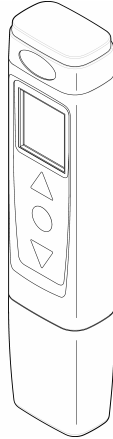
## Total dissolved solids (TDS)

TDS is a measure of the dissolved solids in water. High TDS levels (more than 500 ppm) can cause scaling problems in water pipes and heaters. High TDS levels can also cause an unsatisfactory taste in potable water. The TDS concentration in natural waters can be very different from one location to another because of the minerals and solubilities of the minerals in the locations.

The TDS tester (Figure 3) measures the electrical current from ionized solids such as salts and minerals, then converts the electrical current to a concentration. Refer to the documentation that is supplied with the TDS tester to measure the TDS value of samples and to calibrate the TDS tester. Documentation is also available online.

**Note:** The TDS value of water before and after the water goes through a softener does not change significantly because the hardness ions are replaced with sodium ions.

**Figure 3 Pocket Pro TDS Tester**



## Optional items

Description	Unit	Item no.
Sodium chloride standard solution, 85.47 mg/L NaCl (180 $\mu$ S/cm)	100 mL	2307542
Sodium chloride standard solution, 491 mg/L NaCl (1000 $\mu$ S/cm)	100 mL	1440042
Sodium chloride standard solution, 1000 mg/L NaCl (1990 $\mu$ S/cm)	100 mL	210542
Water, deionized	500 mL	27249







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