Oxygen, Dissolved

DOC316.53.01241

Direct Measurement Method **Method 8157**

0 to 20.0 mg/L (or 0 to 200% saturation) O_2 **Clark-type Amperometric Sensor**

Scope and application: For water, wastewater and process water applications.

Test preparation

Instrument-specific information

This procedure is applicable to the meters and probes that are shown in Table 1. Procedures for other meters and probes can be different.

Table 1 Instrument-specific information

Meter	Probe
sens***ion*** 5 meters sens***ion*** 8 meters	sens***ion*** 5197000, 5197003 and 5197015
sensION™+ MM156 portable pH/EC/DO	sensION™+ 5049 multi-parameter
sensION™+ DO6 portable dissolved oxygen sensION™+ MM378 lab dual input, pH/ISE/EC/DO	sensION™+ 5130

Before starting

Refer to the meter documentation for meter settings and operation. Refer to probe documentation for probe preparation, maintenance and storage information.
Prepare the probe before initial use. Refer to probe documentation.
When the probe is disconnected from the meter for 1 hour or more, connect the probe to the meter for at minimum 1 hour to polarize the probe before calibration or measurement. When the probe is disconnected from the meter for less than 1 hour, a stabilization period of 5–25 minutes can be necessary.
Calibrate the probe before initial use. Refer to Calibration on page 4. For more accurate results, calibrate the probe at the start of each day.
Keep the probe at a constant temperature. An inaccurate calibration will occur if the temperature of the thermistor is different from the probe membrane.
Do not touch the metallic button on the side of the probe. The metallic button is a temperature sensor.
If the probe was used in a sample of high sodium concentration, put the probe in a solution of low sodium concentration for at least 10 minutes to recondition it before low-sodium samples are measured.
To measure dissolved oxygen levels less than 1 mg/L or 10% saturation, zero the probe before calibration. Refer to Zero the probe on page 5.
When measurements are complete, put the probe in the calibration and storage chamber. Keep the sponge moist in the chamber.
Analyze the samples immediately. The samples cannot be preserved for later analysis.
Air bubbles under the sensor tip can cause slow response or measurement errors. To remove the bubbles, carefully shake the probe.
Review the Safety Data Sheets (MSDS/SDS) for the chemicals that are used. Use the recommended personal protective equipment.
Dispose of reacted solutions according to local, state and federal regulations. Refer to the Safety Data Sheets for disposal information for unused reagents. Refer to the environmental, health and safety staff for your facility and/or local regulatory agencies for further disposal information.

DOMINIQUE DUTSCHER SAS

Items to collect

Description	Quantity
Sodium Ionic Strength Adjustor (ISA) Powder Pillow[1]	1
Beaker (laboratory test)	1
Wash bottle with deionized water	1
Lint-free cloth	1

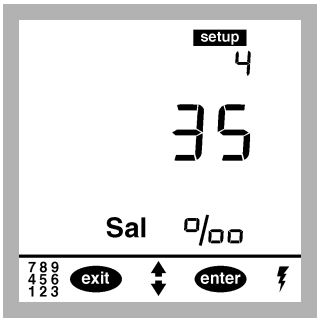
Refer to Consumables and replacement items on page 6 for order information.

Sample collection

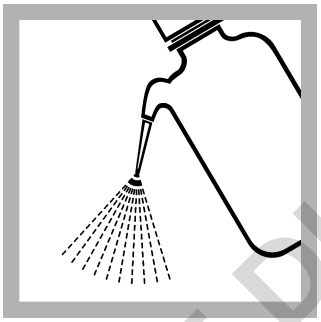
The main consideration with sample collection is to prevent contamination of the sample with atmospheric oxygen.

- Analyze the samples immediately. The samples cannot be preserved for later analysis.
- Collect samples in 300 mL glass BOD bottles. Completely fill the bottles.

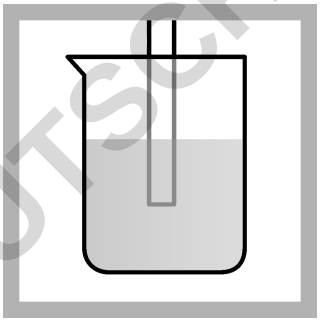
Test procedure



1. If the sample salinity was measured with a conductivity probe, enter the value in parts per thousand (ppt).



2. Rinse the probe with deionized water. Dry the probe with a lint-free cloth.



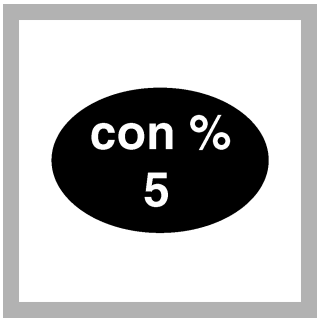
3. Laboratory test: Put the probe in a beaker that contains the solution. Make sure that the metallic button on the probe is in the solution. Do not let the probe touch the stir bar, bottom or sides of the container. Remove the air bubbles from under the probe tip. Stir the sample vigorously with the probe or use a stir stand and stir bar. **Field test:** Put the probe in the sample. Move the probe up and down to remove bubbles from the probe tip. To measure in deep water, pull the probe up and down by the cable to supply sufficient flow across the probe tip.



4. When the reading on the meter is stable, record the value or push **store** to save the value.

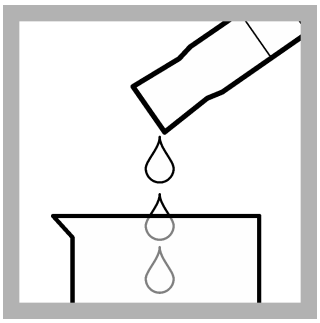
[1] High sodium samples only

DOMINIQUE DUTSCHER SAS

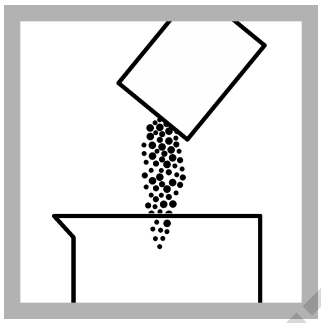


5. To change the units that show on the display (mg/L or % saturation), push **con %**.

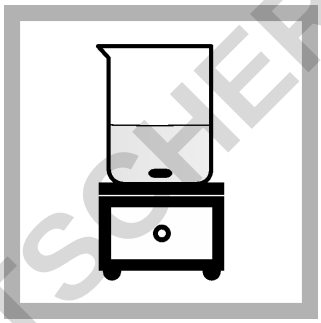
Test procedure—High-sodium samples



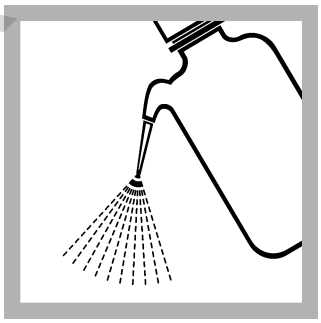
1. Add 400 mL of sample to a 600-mL beaker.



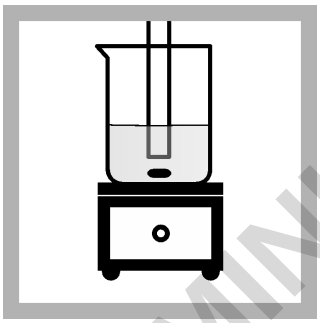
2. Add the contents of one Sodium ISA Powder Pillow to the beaker.



3. Add a stir bar and put the beaker on a magnetic stirrer. Stir at a moderate rate.



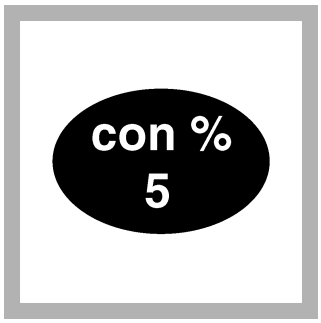
4. Rinse the probe with deionized water. Dry the probe with a lint-free cloth.



5. Put the probe in the solution. Do not let the probe touch the stir bar, bottom or sides of the container. Remove the air bubbles from under the probe tip.



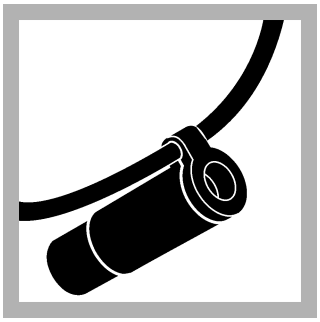
6. When the reading on the meter is stable, record the value or push **store** to save the value.



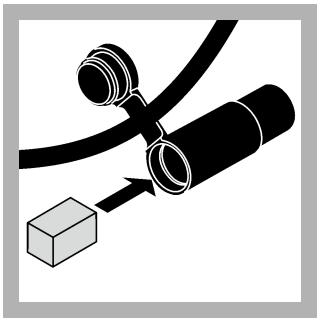
7. To change the units that show on the display (mg/L or % saturation), push **con %**.

DOMINIQUE DUTSCHER SAS

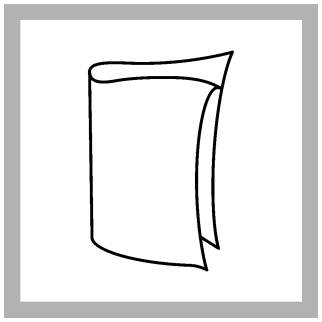
Calibration



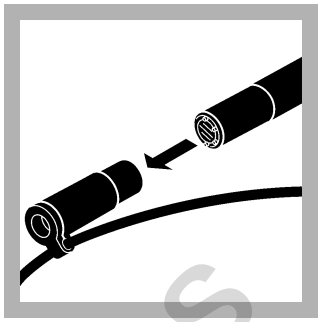
1. Attach the probe cable to the calibration and storage chamber. Put the probe cable through the bottom of the chamber lid before the chamber lid is filled with water.



2. Put the chamber in water. Squeeze the chamber two times to pull water in the lower chamber through the inlet. Do not fully fill the lower chamber with water. As an alternative, open the bottom of the chamber and insert a moist sponge.



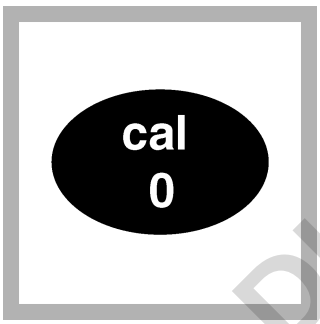
3. If the probe cap is wet, carefully dry the probe cap with a soft cloth.



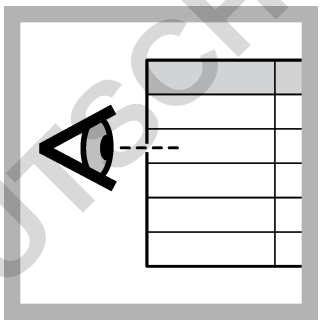
4. Put the probe in the calibration and storage chamber. Make sure that the probe tip stays dry.



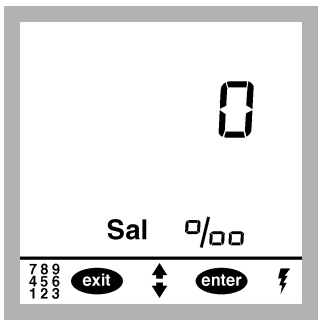
5. Wait 10 minutes for the atmosphere in the chamber to become stable.
To decrease stabilization time, squeeze the lower chamber two times to push water saturated air in the chamber.



6. Push **cal**.



7. Enter the barometric pressure and altitude. Refer to Enter the barometric pressure and altitude on page 4.



8. The display shows the current value for sample salinity (‰). Set the salinity to zero (0 ‰), then push **enter**. The display shows 100%.



9. Push **READ**. When the calibration is complete, the meter goes back to measurement mode.

Enter the barometric pressure and altitude

Use one of the procedures that follow to enter the barometric pressure and altitude.

Sea level equivalent

DOMINIQUE DUTSCHER SAS

1. Identify the barometric pressure at sea level.
2. At the meter, enter the barometric pressure at sea level. Refer to the meter documentation.
3. Enter the local altitude.

True barometric pressure

1. Identify the local barometric pressure with a mercury barometer.
2. At the meter, enter the local barometric pressure. Refer to the meter documentation.
3. Enter 0 m (0 ft) for the altitude.

Zero the probe

To measure dissolved oxygen levels less than 1 mg/L or 10% saturation, zero the probe before calibration. In addition, zero the probe after the sensing membrane is replaced or the internal filling solution is changed.

Note: *A new DO probe can cause a 0.02 to 0.05 mg/L positive error in an oxygen-free (anoxic) solution. If this level of error is not satisfactory, zero the probe.*

Items to collect:

- 0.25 g Sodium Sulfite (or one Silica 3 Reagent Powder Pillow)
- 1000-mg/L Cobalt Standard Solution, 0.1 mL
- 250-mL beaker

1. Add 150 mL of sample to a 250-mL beaker.
2. Add a stir bar and put the beaker on a magnetic stirrer. Stir at a moderate rate.
3. Add 0.25 g Sodium Sulfite or the contents of one Silica 3 Reagent Powder Pillow to the beaker. Stir to dissolve the reagent.
4. Add 0.1 mL of 1000-mg/L Cobalt Standard Solution to the beaker to catalyze the reduction of dissolved oxygen.
5. Rinse the probe with deionized water. Dry the probe with a lint-free cloth.
6. Put the probe in the solution. Do not let the probe touch the stir bar, bottom or sides of the container. Remove the air bubbles from under the probe tip.
7. Wait 10 minutes to condition the probe. Measure the solution within 30 minutes.
8. Push **cal**. "CAL" shows on the display.
9. Push **READ** three times.
10. Push **0** then push **READ**. When the zeroing procedure is complete, the meter goes back to read mode.

    Note: *If the zeroing procedure does not complete, a beep is heard and the faulty probe icon shows on the display.*
11. If the zeroing procedure does not complete and the meter goes to read mode, add more Sodium Sulfite and Cobalt Standard Solution to the beaker then do steps 7–10 again.
12. To exit and not complete the zeroing procedure, push **EXIT** until the meter goes back to read mode.

Interferences

Oxidizing gases (e.g., chlorine, chlorine dioxide, sulphur trioxide and bromine) can react at the cathode and cause positive interferences. Reducing gases (e.g., hydrogen, hydrogen sulfide, sulfur dioxide and boranes) can react at the anode. After exposure to

DOMINIQUE DUTSCHER SAS

reducing gases, clean the anode and replace the internal filling solution and membrane cap as necessary.

Accuracy check

Examine the meter calibration

1. Put the probe in the calibration and storage chamber. Wet the sponge that is in the chamber.
   Note: *If there is no sponge in the chamber, put a small quantity of water in the chamber.*
2. Wait at least 10 minutes for the probe to become stable.
3. At the meter, enter the current barometric pressure and altitude. Refer to the meter documentation.
4. If the meter does not show "100% saturation", calibrate the meter. Refer to the meter documentation.

Clean the probe

Clean the probe when:

- Drifting/inaccurate readings occur as a result of contamination on the sensing element or incorrect storage conditions.
- Slow response time occurs as a result of contamination on the sensing element.
- The slope is out of range as a result of contamination on the sensing element.

For general contamination, complete the steps that follow.

1. Rinse the probe with deionized water. Blot dry with a lint-free cloth.
2. If harsh contaminants are attached to the probe, polish the probe tip with a soft cloth or cotton swab to remove the contaminants.
3. Soak the probe in deionized water for 1 minute.

Method performance

The accuracy of the measurements is dependent on many factors that are related with the overall system, which includes the meter, the probe and calibration solutions. Refer to the meter or probe documentation for more information.

Summary of method

The probe is a Clark-type amperometric sensor used to measure dissolved oxygen in aqueous solutions. The probe has an anode/cathode electrode system and potassium chloride-based electrolyte. The replaceable oxygen-permeable Teflon® membrane of the probe keeps the sample away from the electrodes. At a constant temperature, the electric current changes linearly with the oxygen concentration of the solution. A built-in thermistor supplies automatic temperature compensation. The unit % Dissolved Oxygen is dependent on the temperature and salinity of the sample and the barometric pressure of the environment where the measurement is done.

Consumables and replacement items

sensION+ meters and probes

Description	Unit	Item no.
sensION™+ DO6 portable dissolved oxygen meter	each	LPV4500DL.97.02
sensION™+ MM156 portable pH/EC/DO meter	each	LPV4030.97.0002
sensION™+ MM378 lab dual input, pH/ISE/EC/DO meter	each	LPV4130.97.0002
sens***ion***™ DO probe, 1 m cable	each	5197000
sens***ion***™ DO probe, 3 m cable	each	5197003
sens***ion***™ DO probe, 15 m cable	each	5197015

DOMINIQUE DUTSCHER SAS

sensION+ meters and probes (continued)

Description	Unit	Item no.
sensION™+ 5130 polarographic dissolved oxygen probe	each	LZW5130.97.0002
sensION™+ 5049 multi-parameter probe	each	LZW5049.97.0002

Optional reagents and apparatus

Description	Unit	Item no.
Colbalt Standard Solution, 1000 mg/L	100 mL	2150342
Silica 3 Reagent Powder Pillow (contains Sodium Sulfite)	100/pkg	27169
Sodium Sulfite	100 g	2386026
BOD Accessory Kit, dissolved oxygen probe, includes funnel and spacer	each	5197100
Calibration storage chamber, dissolved oxygen probe	each	5197400

DOMINIQUE DUTSCHER SAS

DOMINIQUE DUTSCHER SAS

FOR TECHNICAL ASSISTANCE, PRICE INFORMATION AND ORDERING:
In the U.S.A. – **Call toll-free 800-227-4224**
Outside the U.S.A. – **Contact the HACH office or distributor serving you.**
On the Worldwide Web – **www.hach.com**; E-mail – **techhelp@hach.com**

HACH COMPANY
WORLD HEADQUARTERS
Telephone: (970) 669-3050
FAX: (970) 669-2932

© Hach Company/Hach Lange GmbH, 2007–2015. All rights reserved.

03/2015, Edition 8