Conductivity

DOC316.53.01199

USEPA Direct Measurement Method[1, 2] **Method 8160**

0.01 µS/cm to 200.0 mS/cm **Conductivity Probe**

Scope and application: For water and wastewater.

[1] USEPA accepted for reporting for Standard Method 2510-B
[2] Procedure is equivalent to Standard Method 2510-B for wastewater.

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
HQ14d portable single input, conductivity HQ30d portable single input, multi-parameter HQ40d portable dual input, multi-parameter HQ430d benchtop single input, multi-parameter HQ440d benchtop dual input, multi-parameter	IntelliCAL CDC401 Conductivity
sensION™+ MM156 portable pH/EC/DO	sensION+ 5049 multi-parameter
sensION™+ EC5 portable conductivity sensION™+ MM150 portable pH/ORP/EC	sensION+ 5048, 5059, 5060 or 5062 Conductivity
sensION™+ EC7 lab conductivity sensION™+ EC71 GLP lab conductivity sensION™+ MM374 lab dual input, pH/mV/EC/ISE sensION™+ MM378 lab dual input, pH/ISE/EC/DO	sensION+ 5070 Conductivity

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 an IntelliCAL™ probe is connected to an HQd meter, the meter automatically identifies the measurement parameter and is prepared for use.
Small differences in concentration between samples can increase the stabilization time. Make sure to condition the probe correctly. Try different stir rates to see if the stabilization time decreases.
If solutions are not at the reference temperature, the meter automatically adjusts the conductivity value to the value at the reference temperature.
Measurement errors can occur if the correct temperature correction value is not selected. Refer to Table 2 on page 3 for typical temperature correction values.
Do not touch the tip of the probe.
The cell constant is derived from the calibration standard.
Do not dilute conductivity standards and samples.
For the most accurate results with high conductivity samples, calibrate the cell constant or check the accuracy of the meter with a 111.3 mS/cm (1 Demal) certified conductivity standard.

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.

Items to collect

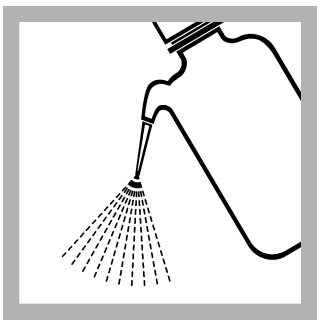
Description	Quantity
Beaker, 100 mL, polypropylene	1
Wash bottle with deionized water	1
Conductivity standard solution (refer to Recommended standards on page 5)	1

Refer to Consumables and replacement items on page 4 for order information.

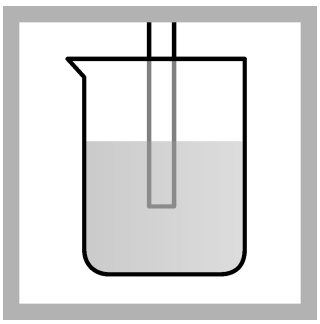
Sample collection and storage

- Collect samples in clean glass or plastic bottles.
- To preserve samples for later analysis, keep the samples at or below 6 °C (43 °F) for a minimum of 24 hours.
- Let the sample temperature increase to room temperature before analysis.

Test procedure

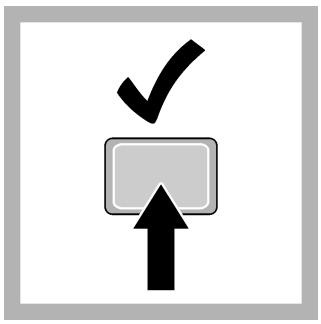


1. Rinse the probe with deionized water. Dry the probe with a lint-free cloth.

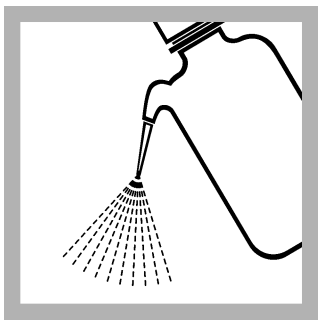


2. Laboratory test: Put the probe in a beaker that contains the solution. Do not let the probe touch the stir bar, bottom or sides of the container. Remove the air bubbles from under the probe tip. Stir the sample at a slow to moderate rate.
Field test: Put the probe in the sample. Move the probe up and down to remove bubbles from the electrode.

Make sure to put the temperature sensor fully in the sample.



3. Push **Read**. A progress bar is shown. When the measurement is stable, the lock icon is shown.



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

Conversions

Table 2 shows the conversions to change the readings on the display to other conductivity units.

Table 2 Unit conversion

From	To	Use this equation
mS/cm	µS/cm	mS/cm × 1000
µS/cm	mS/cm	µS/cm × 0.001
µS/cm	µmhos/cm	µS/cm × 1
mS/cm	mmhos/cm	mS/cm × 1
µS/cm	mg/L TDS	µS/cm × 0.64[1]
g/L TDS	mg/L TDS	g/L TDS × 1000
mS/cm	g/L TDS	mS/cm × 0.64
mg/L TDS	g/L TDS	mg/L TDS × 0.001
mg/L TDS	gpg TDS	mg/L TDS × 0.05842
g/L TDS	gpg TDS	g/L TDS × 58.42
µS/cm	ohms cm	1,000,000 ÷ µS/cm
mS/cm	ohms cm	1,000 ÷ mS/cm

Temperature correction

Table 3 shows typical temperature correction values for selected solutions from the linear temperature correction option.

Table 3 Temperature correction

Solution	Percent per °C
Ultrapure water	4.55
Salt (NaCl)	2.125
NaOH	1.72
Dilute ammonia	1.8810
10% HCl	1.325
5% sulfuric acid	0.9698

Interferences

To remove the conductivity that occurs from hydroxide ions, adjust the sample pH as follows:

1. Add 4 drops of phenolphthalein indicator solution to 50 mL of sample. The sample becomes pink.
2. Add 1 drop of gallic acid solution at a time until the pink color is gone.
3. Measure the conductivity.

Accuracy check

Standard solution method

Use the standard solution method to validate the test procedure, the reagents (if applicable) and the instrument.

Items to collect:

- Sodium chloride standard solution with a conductivity value that is near the value of typical samples

[1] TDS is an empirically-derived value from the conductivity measurement. Select a value of 0.5 for simplicity and suitability to a wide variety of waters.

1. Use the test procedure to measure the concentration of the standard solution.
2. Compare the expected result to the actual result.

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

Electrolytic conductivity is the movement of ions in a solution, which makes an electrical current and is the reciprocal of the solution resistivity. The ions come from inorganic dissolved solids (e.g., chloride, nitrate, sulfate and phosphate anions and sodium, calcium, magnesium, iron and aluminum cations). Organic material such as oils, phenols, alcohols and sugars do not have sufficient conductivity for a good estimate of the concentration.

Conductivity meters measure the resistance that occurs in an area of the solution that is defined by the physical design of the probe. A voltage is applied between the electrodes, and the voltage decrease caused by the resistance of the solution is used to calculate the conductivity for each centimeter. The basic unit of measure for conductivity is the Siemen (or mho), which is the reciprocal of the ohm. Other common units for aqueous solutions are milliSiemens/cm (10^{-3} S or mS/cm) and microSiemens/cm (10^{-6} S or µS/cm).

Consumables and replacement items

HQd meters and probes

Description	Unit	Item no.
HQ14d portable single input, conductivity meter	each	HQ14D53201000
HQ30d portable single input, multi-parameter meter	each	HQ30D53000000
HQ40d portable dual input, multi-parameter meter	each	HQ40D53000000
HQ430d benchtop single input, multi-parameter meter	each	HQ430D
HQ440d benchtop dual input, multi-parameter meter	each	HQ440D
IntelliCAL™ standard conductivity probe, 1 m cable	each	CDC40101
IntelliCAL™ standard conductivity probe, 3 m cable	each	CDC40103
IntelliCAL™ rugged conductivity probe, 5 m cable	each	CDC40105
IntelliCAL™ rugged conductivity probe, 10 m cable	each	CDC40110
IntelliCAL™ rugged conductivity probe, 15 m cable	each	CDC40115
IntelliCAL™ rugged conductivity probe, 30 m cable	each	CDC40130

sensION+ meters and probes

Description	Unit	Item no.
sensION™+ EC7 lab conductivity meter	each	LPV3010.97.0002
sensION™+ EC71 GLP lab conductivity meter	each	LPV3110.97.0002
sensION™+ MM374 lab dual input, pH/mV/EC/ISE meter	each	LPV4110.97.0002
sensION™+ MM378 lab dual input, pH/ISE/EC/DO meter	each	LPV4130.97.0002
sensION™+ 5048 portable multi-parameter (pH, conductivity, ORP and temperature) probe	each	LZW5048.97.0002
sensION™+ 5049 portable multi-parameter (pH, conductivity, dissolved oxygen and temperature) probe	each	LZW5049.97.0002
sensION™+ 5059 portable multi-parameter (pH, conductivity and temperature) probe	each	LZW5059.97.0002
sensION™+ 5060 portable platinum conductivity cell probe	each	LZW5060.97.0002
sensION™+ 5062 portable titanium conductivity cell probe	each	LZW5062.97.0002
sensION™+ 5070 laboratory platinum conductivity cell probe	each	LZW5070.97.0002

Recommended standards

Description	Unit	Item no.
NaCl conductivity standards:		
Sodium chloride standard solution, 180 ± 10 mS/cm, 90 ± 1 mg/L TDS	100 mL	2307542
Sodium chloride standard solution, 1000 ± 10 mS per cm, 500 ± 5 mg/L TDS	100 mL	1440042
Sodium chloride standard solution, 1990 ± 20 mS/cm, 995 ± 10 mg/L TDS	100 mL	210542
Sodium chloride standard solution, 18,000 ± 50 mS/cm, 9000 ± 25 mg/L TDS	100 mL	2307442
KCl conductivity standards:		
KCl, 0.1 M, 12.88 mS/cm at 25 °C (77 °F)	500 mL	C20C250
KCl, 0.01 M, 1413 µS/cm at 25 °C (77 °F)	500 mL	C20C270
KCl, 0.001 M, 148 µS/cm at 25 °C (77 °F)	500 mL	C20C280
Certified conductivity standards:		
KCl, 1 Demal, 111.3 mS/cm ± 0.5% at 25 °C (77 °F)	500 mL	S51M001
KCl, 0.1 Demal, 12.85 mS/cm ± 0.35% at 25 °C (77 °F)	500 mL	S51M002
KCl, 0.01 Demal, 1408 mS/cm ± 0.5% at 25 °C (77 °F)	500 mL	S51M003
NaCl, 0.05%, 1015 µS/cm ± 0.5% at 25 °C (77 °F)	500 mL	S51M004

Optional reagents and accessories

Description	Unit	Item no.
Beaker, polypropylene, 100-mL	each	108042
Gallic acid solution	50 mL SCDB	1442326
Hydrochloric Acid Solution, 6 N, 1:1	500 mL	88449
Phenolphthalein indicator solution	15 mL SCDB	16236
Wash bottle, 125-mL	each	62014
Water, deionized	4 L	27256

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