Sodium

DOC316.53.01240

Direct ISE Method

Method 8322

10 to 1000 mg/L Na^+

Sodium ISE

Scope and application: For drinking water and process water.

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
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 ISENA381 sodium ISE
sensION™+ MM340 lab dual input, pH/mV/ISE sensION™+ MM374 lab dual input, pH/mV/EC/ISE sensION™+ MM378 lab dual input, pH/ISE/EC/DO	sensION+ 9650 sodium ISE with sensION+ 5044 reference

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.
After long-term storage, condition the probe. Condition the probe in 25 mL of 100-mg/L Sodium Standard Solution with the contents of one Sodium and Potassium ISA Powder Pillow. Wait for at least 30 minutes before use. If probe stabilization is slow after storage, continue to condition the probe for a maximum of 1 hour.
Calibrate the probe before initial use. Refer to Calibration on page 3.
Stir the standards and samples at a slow and constant rate to prevent the formation of a vortex.
Air bubbles under the sensor tip can cause slow response or measurement errors. To remove the bubbles, carefully shake the probe.
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.
During calibration, measure the standard solutions from lowest to highest concentration for best results.
Make sure that the calibration solutions and the samples are at the same temperature (± 2 °C (± 3.6 °F)) for best results.
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.
This procedure is specified for the HQd meters. The sensION+ meters can be used, but the menus and navigation will be different.

Items to collect

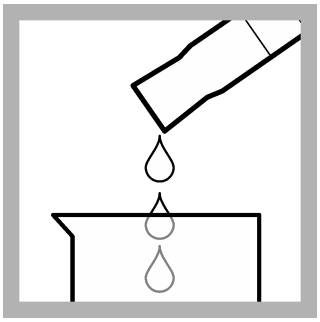
Description	Quantity
Sodium ISA Powder Pillow	1
Sodium Standard Solution, 100 mg/L	varies
Beaker, polypropylene, 50 mL, low form	3 or 4
Stir bar, magnetic, 2.2 x 0.5 cm (7/8 x 3/16 in.)	3 or 4
Stirrer, magnetic	1
Wash bottle with deionized water	1
Lint-free cloth	1

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

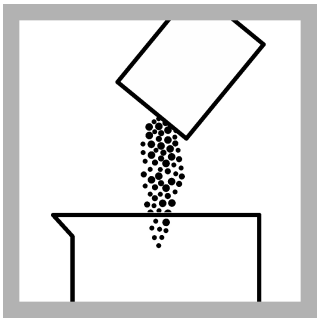
Sample collection and storage

- 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 up to 6 hours.
- Let the sample temperature increase to room temperature before analysis.

Test procedure

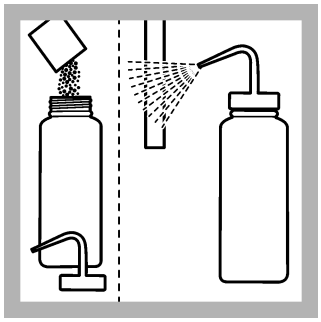


1. Add 25 mL of sample to a beaker.

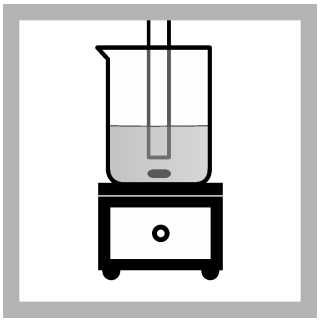


2. Add the contents of one Sodium ISA Powder Pillow.

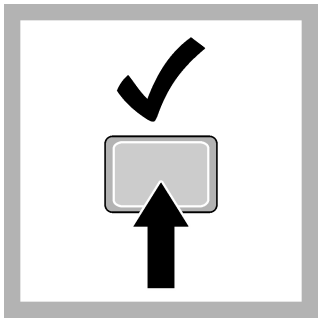
3. Add a stir bar and put the beaker on a magnetic stirrer. Stir at a moderate rate.



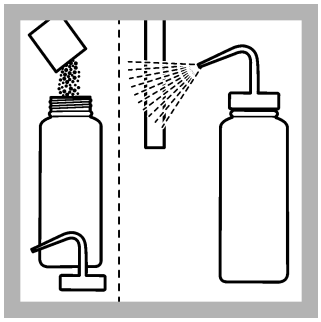
4. Rinse the probe with ISA rinse solution. Do not rinse with deionized water. Dry the probe with a lint-free cloth.
Refer to Clean the probe on page 5 to prepare ISA rinse solution.



5. Put the probe in the solution. Do not let the probe touch the stir bar, bottom or sides of the container. Make sure that the reference junctions are fully in the solution. Remove the air bubbles from under the probe tip.

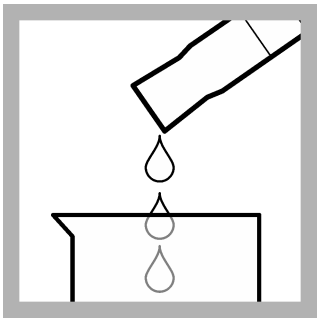


6. Push **Read**. A progress bar is shown. When the measurement is stable, the lock icon is shown.

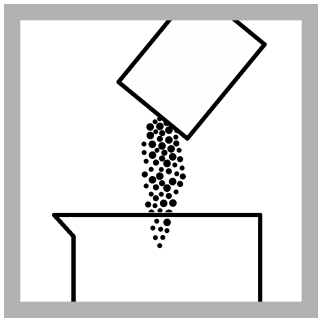


7. Rinse the probe with ISA rinse solution. Do not rinse with deionized water. Dry the probe with a lint-free cloth.

Calibration

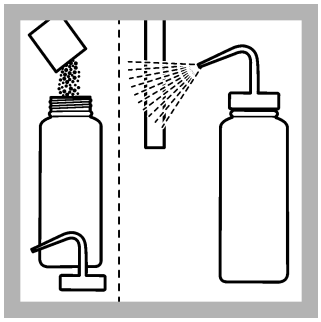


1. Add 25 mL of 10-mg/L Sodium Standard Solution to a beaker.
Refer to Prepare a 10-mg/L Sodium Standard Solution on page 4.

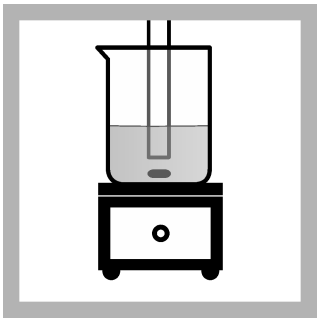


2. Add the contents of one Sodium ISA Powder Pillow.

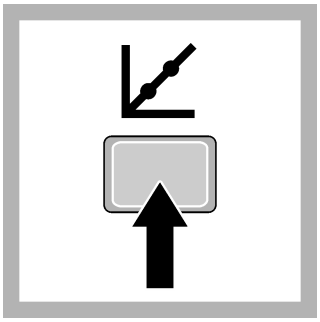
3. Add a stir bar and put the beaker on a magnetic stirrer. Stir at a moderate rate.



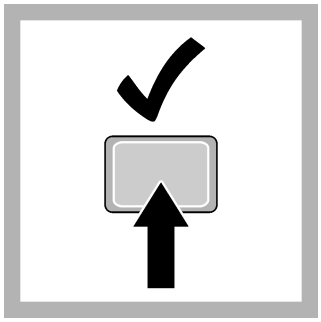
4. Rinse the probe with ISA rinse solution. Do not rinse with deionized water. Dry the probe with a lint-free cloth.
Refer to Clean the probe on page 5 to prepare ISA rinse solution.



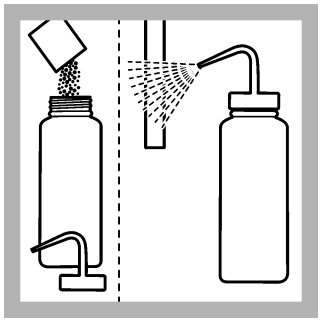
5. Put the probe in the solution. Do not let the probe touch the stir bar, bottom or sides of the container. Make sure that the reference junctions are fully in the solution. Remove the air bubbles from under the probe tip.



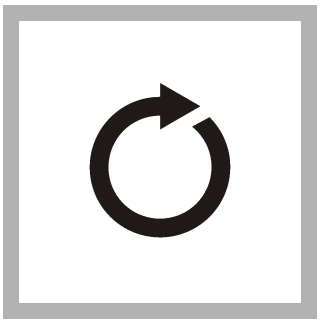
6. Push **Calibrate**. The standard solution value is shown.



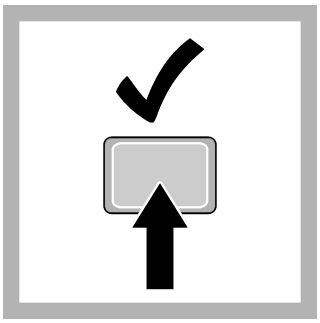
7. Push **Read**. A progress bar is shown. When the measurement is stable, the lock icon is shown.



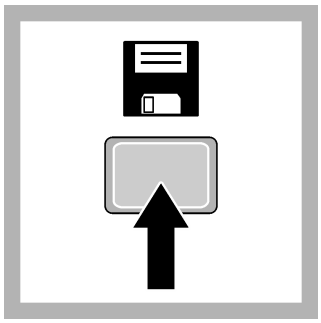
8. Rinse the probe with ISA rinse solution. Do not rinse with deionized water. Dry the probe with a lint-free cloth.



9. Do steps 1–8 again to measure the remaining standard solutions.



10. Push **Done**. A calibration summary is shown when the minimum number of calibration standards are measured.



11. Push **Store** to accept the calibration.

Prepare a 10-mg/L Sodium Standard Solution

Items to collect:

- 1000-mg/L Sodium Standard Solution
- 1.0-L volumetric flask
- Tensette pipet
- Deionized water

Prepare a 10-mg/L Sodium Standard Solution for calibration as follows:

1. Use a pipet to add 10 mL of 1000-mg/L Sodium Standard Solution to a 1.0-L volumetric flask.
2. Dilute to the mark with deionized water.

Interferences

The glass membrane responds to sodium as well as other ions. Typically, probe response to another ion increases the potential, and causes a positive error. The response to other ions can be semi-quantitatively determined through the Nikolsky equation, an extended Nernst equation:

$E = E° + (RT/(zF)) \ln [aNa + KNax \times ax]$

Where:

- ax = the activity of the interfering ion
- KNax = the selectivity coefficient for the interfering ion relative to sodium

If the probe is exposed to high levels of interferences, soak the probe in 1 M sodium chloride to help remove the absorbed ions from the glass membrane. The major interferences are silver and hydrogen ions. Hydrogen ion concentration is decreased by the ISA, which raises the pH.

If the samples are highly acidic, or have a high buffer capacity, check that the sample pH is above 9 after adding ISA. If necessary, add ammonium hydroxide (NH_4OH) to the calibration standards and samples in equal proportions to raise the pH. The ammonium hydroxide (NH_4OH) will not affect the measurement due to the low selectivity coefficient of NH_4^+ ion.

The ions that interfere in sodium determinations are given for molar concentrations of all ions. The smaller the value of the selectivity coefficient, the lower the interference. Approximate values of selectivity constants (K) are ordered from highest to lowest in Table 2.

Table 2 Interfering substances

Interfering substance	Interference level
Ag^+ (> 1000)	H^+ (20) - reduced by ISA addition
Li^+ (0.01)	K^+ (0.001)
Ti^+ (0.0002)	—

Accuracy check

Slope method

Use the slope method to validate the electrode response.

1. Prepare two standard solutions that are one decade apart in concentration (e.g., 1 mg/L and 10 mg/L or 10 mg/L and 100 mg/L). The minimum concentration is 0.2 mg/L.
2. Use the test procedure to measure the mV value of each standard solution.
3. Compare the mV value of each standard solution. The expected difference is 58 (± 3) mV at 25 °C (77 °F).

Standard solution method

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

Items to collect:

- Standard solution within the test range

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

Temperature check

For probes that do not have a temperature sensor, measure the temperature of the standard solutions and samples. Make sure that the calibration solutions and the samples are at the same temperature (± 2 °C (± 3.6 °F)) for best results.

Clean the probe

Clean the probe when:

- Drifting/inaccurate readings occur as a result of contamination on the glass sensor or the probe being left dry for extended periods of time.
- Slow stabilization time occurs as a result of contamination on the glass sensor.

- The slope is out of range as a result of contamination on the glass sensor.

For general contamination, complete the steps that follow.

1. Prepare the ISA rinse solution as follows:
   a. Add one Sodium Ionic Strength Adjustor (ISA) powder pillow (0.4 g) to every 25 mL of deionized water.
   b. Put the ISA rinse solution in a rinse bottle.
2. Rinse the probe with ISA rinse solution and blot dry with a lint-free cloth.
3. Soak the glass bulb for 12–16 hours in Hach Electrode Cleaning Solution.
4. Rinse or soak the probe for 1 minute in 25 mL of 100-mg/L Sodium Standard Solution that has Sodium ISA.
5. Soak the probe in pH 4 buffer for up to 20 minutes, then rinse with deionized water.
6. Calibrate the probe. Refer to Calibration on page 3.

Summary of method

The sodium electrode is a sodium-sensing element that is bonded into an epoxy body. When the sensing element touches sodium ions in a solution, a potential develops across the sensing element. The potential is proportional to the level of sodium ions in the sample. The potential is measured against a constant reference potential with a pH/mV meter or ISE meter.

Consumables and replacement items

HQd meters and probes

Description	Unit	Item no.
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™ ISENa381 digital combination sodium ISE probe, 1 m cable	each	ISENA38101
IntelliCAL™ ISENa381 digital combination sodium ISE probe, 3 m cable	each	ISENA38103

sensION+ meters and probes

Description	Unit	Item no.
sensION™+ MM340 lab dual input, pH/mV/ISE meter	each	LPV2200.97.0002
sensION™+ MM374 lab dual input, pH/mV/EC/ISE meter	each	LPV4110.97.0002
sensION™+ 9650 combination sodium ISE probe	each	LZW9650.97.0002

Recommended reagents and standards

Description	Unit	Item no.
Sodium and Potassium Ionic Strength Adjustor (ISA) Powder Pillows	100/pkg	4451569
Sodium Standard Solutions 100 mg/L as Na^+	1000 mL	2318153
Sodium Standard Solutions 1000 mg/L as Na^+	500 mL	1474949

Accessories

Description	Unit	Item no.
Beaker, polypropylene, 50 mL, low form	each	108041
Bottle, wash, 500 mL	each	62011
Graduated cylinder, polypropylene, 25 mL	each	108140
Pipet, TenSette®, 0.1–1.0 mL	each	1970001
Pipet tips for TenSette® Pipet, 0.1–1.0 mL	50/pkg	2185696
Probe clips, color-coded, for IntelliCAL probes	50/pkg	5818400
Probe holder, 3 probes, for sensION+ benchtop meters	each	LZW9321.99
Probe stand, universal	each	8508850
Stir bar, magnetic, 2.2 x 0.5 cm (7/8 x 3/16 in.)	each	4531500
Stirrer, electromagnetic, 120 VAC, with electrode stand	each	4530001
Stirrer, electromagnetic, 230 VAC, with electrode stand	each	4530002
Flask, volumetric, Class A, 1000-mL glass	each	1457453

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