

Standard range: 20 to 1000 mg/L Cl⁻

Method
EZ3505sc

Scope and application: For industrial and municipal water.



Test preparation

Before starting

| |
|---|
| Chemical exposure hazard. Obey laboratory safety procedures and wear all of the personal protective equipment appropriate to the chemicals that are handled. Refer to the current safety data sheets (MSDS/SDS) for safety protocols. |
| Review the Safety Data Sheets (MSDS/SDS) for the chemicals that are used. Use the recommended personal protective equipment. Dispose of chemicals and wastes in accordance with local, regional and national regulations. |
| Review the Safety Data Sheets (MSDS/SDS) before the bottles are filled or the reagents are prepared. |
| All chemicals must be of reagent grade, ACS grade or better ¹ . The use of pro-analysis chemicals is recommended. Use of reagents that are not of sufficient quality can have a negative effect on the analyzer performance. |
| All EZ analyzers are put through long tests with standard solutions, reagents and dilution water prepared with Type I water or better water as specified in ASTM D1193-91. |
| To get the specifications shown on the data sheet, method and reagents sheet and acceptance test reports, the same water quality (or better) must be used to prepare the standard solutions, reagents and dilution water. |
| In addition, prepare the standard solutions for an EZ analyzer with water that does not contain the parameter to be measured or interferences for the method. |
| When operating the device, always make sure to follow the reagent recommendations given in Reagent consumption on page 2. |
| For longer-term storage, keep the reagents in a cold and dark place. Do not keep reagents longer than recommended. If applicable, keep the reagents in a refrigerator during measurements. Refer to Reagent consumption on page 2 for the reagent temperature. |
| The manufacturer recommends to replace the reagents, stock and standard solution at 28-day intervals unless specified differently in the sections that follow. Do not mix used reagents with freshly prepared reagents. If reagents, standards or DI water in the containers are replaced, discard all of the container contents in accordance with local, regional and national regulations. Rinse out all of the containers and then fill each container with freshly prepared new reagent. |

Specifications

Specifications are subject to change without notice.

| Specification | Details |
|-----------------|--|
| Analysis method | Direct measurement at regular intervals with a combination ion-selective electrode. The analyzer uses the standard additions method during measurements. |
| Parameter | Long description: Chloride Short description (default): Cl ⁻ Options: None |
| Unit | mg/L (default), g/L, ppm |
| Precision | The precision value is found on the full-scale range for standard test solutions. Refer to Table 1 . |
| Cleaning | Automatic or manual; frequency is freely programmable |

¹ Analytical Reagent (AR), Guaranteed Reagent (GR), UNIVAR, AnalaR, Premium Reagent (PR), ReagentCertified ACS reagent, ACS Plus reagent, puriss p.a. ACS reagent, ReagentPlus[®], TraceCERT[®], Suprapur[®], Ultrapur[®], or better are also possible.

| Specification | Details |
|---------------|--|
| Calibration | Automatic or manual; 2-point, offset or slope; frequency is freely programmable Note: The manufacturer recommends that a calibration is done when the reagents are replaced. |
| Validation | Automatic or manual; frequency is freely programmable |
| Interferences | Bromide (Br ⁻), sulfide (S ²⁻), iodide (I ⁻), cyanide (CN ⁻) ions, ammonia (NH ₃) and thiosulfate (S ₂ O ₃) ²⁻ may interfere. Mercury (Hg ⁺) interferes at all levels. Fats, oil, proteins, surfactants and tar interfere. |

Table 1 Measuring ranges

| Range code | Description | LOD (mg/L) | Range (mg/L) | Precision (%) | Cycle time (minutes) | |
|------------|---|------------|--------------|---------------|----------------------|----------|
| | | | | | Continuous | Default |
| A | 10% of standard range | 2 | 100 | 2 | 4 | 5 |
| B | 25% of standard range | 5 | 250 | 2 | 4 | 5 |
| C | 50% of standard range | 10 | 500 | 2 | 4 | 5 |
| 0 | Standard range | 20 | 1000 | 2 | 4 | 5 |
| V | Internal dispenser dilution (factor 5) | 100 | 5000 | 2 | 10 | 7 |
| W | Internal dispenser dilution (factor 10) | 200 | 10000 | 2 | 10 | 7 |

Summary of method

Summary

Chloride (Cl⁻) in the water sample is measured directly with an ion-selective electrode. The analyzer uses the standard additions method during the analysis steps.

Analysis steps

The analysis vessel is rinsed and filled with new sample. The buffer reagent is added to adjust the pH and ionic strength of the solution. The ion-selective electrode then measures the electrical potential from the chloride ions. Then, the dispenser adds a known volume of the standard solution and a stir period starts. After the stir period, the electrode measures the electrical potential again. The analyzer uses the measured values to calculate the concentration of chloride in the sample.

Calibration

The calibration procedure measures the REF1 solution (Channel 9, REF1 valve) and the REF2 solution (Channel 10, REF2 valve).

Validation

The validation procedure measures the REF2 solution (Channel 10, REF2 valve).

Reagent consumption

Table 2, Table 3 and Table 4 show the consumption rate of the reagents and calibration standards. Examine the consumption of the reagents after 28 days to adjust the quantities prepared. Refer to [Necessary reagents](#) on page 3 to collect the necessary items to prepare the reagents.

Table 2 Reagent consumption

| Product information | | | Consumption | | Recommendation | | |
|---------------------|-------------|------------------------|---------------|---|----------------|--------------|------------------------------|
| Code | Label | Product | Each analysis | Per 28 days, rate of 1 analysis/5 minutes | Use life | Containers | Operation temperature |
| Red | Reagent 1 | Buffer | ~ 0.5 mL | ~ 4.0 L | 28 days | Plastic, 5 L | 10 to 30 °C (50 to 86 °F) |
| — | Dispenser 1 | x mg/L Cl ⁻ | ~ 0.6 mL | ~ 4.8 L | 28 days | Plastic, 5 L | 10 to 30 °C (50 to 86 °F) |

Table 3 Calibration standards

| Product information | | Consumption | Recommendation | |
|---------------------|---------------|-----------------|----------------|--|
| Label | Product | Per calibration | Use life | Containers |
| REF1 | REF1 standard | ~ 0.5 L | 28 days | Plastic, 1 L (align with recommendation) |
| REF2 | REF2 standard | ~ 0.5 L | 28 days | Plastic, 1 L (align with recommendation) |

Table 4 Calibration recommendations

| Calibration | Time (minutes) | | Recommended frequency | Solutions |
|-----------------------|----------------|---------------|-------------------------------|---------------|
| | No dilution | With dilution | | |
| 2-point (recommended) | 27 | 44 | Reagent replacement (28 days) | REF1 and REF2 |

DI water consumption

The volumes shown in [Table 5](#) are an estimation of the consumption for rinse and dilution water based on a standard operating procedure as given in the specifications of the EZ analyzer.

Note: Rinse water volumes can increase because of the sample matrix.

Note: The range codes A,B,C,0 are configured as default without the use of rinse and dilution water.

Table 5 DI water consumption

| Range code | Rinse water Type I (mL/analysis) | Dilution water Type I (mL/analysis) | Total (mL/analysis) | Per 28 days, rate of 1 analysis each 5 minutes |
|-----------------------------|----------------------------------|-------------------------------------|---------------------|--|
| A - B - C - 0 (no dilution) | — | — | — | — |
| V - W (with dilution) | 40 mL | 17 mL | 57 mL | 460 L |

Rinse water

If the analyzer does a dilution, a deionized water rinse must be used. If no dilution is done, use the sample to rinse. If there is a filter panel in front of the analyzer, make sure that the rinse water also flows through the filter.

Necessary reagents

The full list of reagents is shown in [Table 6](#). The product name, formula, molecular weight, CAS number and the necessary quantity to prepare 1 L of the reagents are given.

Table 6 Reagent list

| Solutions | Products | Formula | MW (g/mol) | CAS number | For each 1 L solution |
|--------------------------------|--|--|------------|------------|---|
| Reagent 1: Buffer Code: Red | Sodium nitrate | NaNO ₃ | 84.995 | 7631-99-4 | 425 g |
| Stock solution | Sodium chloride | NaCl | 58.44 | 7647-14-5 | 164.84 g |
| Dispenser 1: Standard | 100000 mg/L Cl ⁻ stock solution | — | — | — | Refer to Table 7 on page 4. |
| REF1 calibration standard | 100000 mg/L Cl ⁻ stock solution | — | — | — | Refer to Table 8 on page 5. |
| REF2 calibration standard | 100000 mg/L Cl ⁻ stock solution | — | — | — | Refer to Table 9 on page 5. |
| Validation standard (optional) | REF2 calibration standard | — | — | — | Refer to Validation standard on page 5. |
| Cleaning solution (optional) | Citric acid | C ₆ H ₈ O ₇ | 192.12 | 77-92-9 | 8 g |
| | Trisodium citrate | C ₆ H ₅ O ₇ Na ₃ | 258.07 | 68-04-2 | 16 g |

Reagent preparation

Prepare the reagents as follows. Refer to [Table 6](#) on page 3 to collect the applicable items. To calculate the correct reagent quantity, refer to [Reagent consumption](#) on page 2. Make sure to discard the remaining solution from the analyzer bottles before new reagents are added.

Reagent 1: Buffer

1. Add 500 mL of deionized water to a beaker.
2. Add 425 g of sodium nitrate (NaNO₃).
3. Mix until fully dissolved.
4. Pour the solution into a 1000-mL volumetric flask.
5. Add deionized water to the mark.
6. Fully mix the solution.

Calibration standards

Calibrations are completed with two standards: a REF1 calibration standard and a REF2 calibration standard. The REF2 calibration standard is a dilution of a stock solution.

Stock solution

Prepare a 100000 mg/L Cl⁻ stock solution as follows. Refer to [Necessary reagents](#) on page 3 to collect the applicable items.

1. Add 700 mL of deionized water to a beaker.
2. Add 164.84 g of sodium chloride (NaCl).
3. Mix until fully dissolved.
4. Pour the solution into a 1000-mL volumetric flask.
5. Add deionized water to the mark.
6. Fully mix the solution.

Dispenser 1: Standard

Dilute the stock solution to prepare the Dispenser 1: Standard.

1. Use a pipet to add the applicable quantity (mL) of the stock solution into a 1000-mL volumetric flask. Refer to [Table 7](#).
2. Add deionized water to the mark.
3. Fully mix the solution.

Table 7 Dispenser 1: Standard preparation

| Range code | Standard concentration (mg/L) | Quantity (mL) of stock solution |
|------------|-------------------------------|---------------------------------|
| A | 2500 | 25 |
| B | 6250 | 62.5 |
| C | 12500 | 125 |
| 0 | 25000 | 250 |
| V | 25000 | 250 |
| W | 25000 | 250 |

REF1 calibration standard

Dilute the stock solution to prepare the REF1 calibration standard.

1. Use a pipet to add the applicable quantity (mL) of the stock solution into a 1000-mL volumetric flask. Refer to [Table 8](#).
2. Add deionized water to the mark.
3. Fully mix the solution.

Table 8 REF1 calibration standard preparation

| Range code | REF1 concentration (mg/L) | Quantity (mL) of stock solution |
|------------|---------------------------|---------------------------------|
| A | 10 | 0.1 |
| B | 25 | 0.25 |
| C | 50 | 0.5 |
| 0 | 100 | 1 |
| V | 500 | 5 |
| W | 1000 | 10 |

REF2 calibration standard

Dilute the stock solution to prepare the REF2 calibration standard.

1. Use a pipet to add the applicable quantity (mL) of the stock solution into a 1000-mL volumetric flask. Refer to [Table 9](#).
2. Add deionized water to the mark.
3. Fully mix the solution.

Table 9 REF2 Calibration standard preparation

| Range code | REF2 concentration (mg/L Cl ⁻) | Quantity (mL) of stock solution |
|------------|--|---------------------------------|
| A | 100 | 1 |
| B | 250 | 2.5 |
| C | 500 | 5 |
| 0 | 1000 | 10 |
| V | 5000 | 50 |
| W | 10000 | 100 |

Validation standard

By default, the automatic validation procedure is not enabled. When enabled, the default validation standard is the REF2 calibration standard. For best results, do not use the same solution that was used for calibration. Use a different standard solution from a different source for the validation standard. The concentration of the validation standard must be within the measuring range of the analyzer.

Before validation, connect the REF2 sample line to the validation standard. After validation, connect the REF2 sample line to the REF2 calibration standard again. For multi-channel setups, a different channel can be used.

Cleaning solution

By default, the automatic cleaning procedure is not enabled. When enabled, the default volume of cleaning solution that is used during each cleaning cycle is 30 mL.

The cleaning procedure must prevent the collection of chemicals in the analyzer. For an accurate cleaning procedure, examine the cleaning solution and the cleaning interval for each application. Make sure that the cleaning procedure is sufficient. Change the cleaning procedure if necessary.

The manufacturer recommends to use a citric acid and trisodium citrate solution. Refer to [Necessary reagents](#) on page 3. Prepare the solution as given in the steps that follow or use a commercially available solution.

1. Add 500 mL of deionized water to a beaker.
2. Add 8 g of citric acid ($C_6H_8O_7$).
3. Mix until fully dissolved.
4. Add 16 g of trisodium citrate ($C_6H_5O_7Na_3$).
5. Mix until fully dissolved.
6. Pour the solution into a 1000-mL volumetric flask.
7. Add deionized water to the mark.
8. Fully mix the solution.



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