

**Operating Instructions and Technical Specifications
for
Jenway Lead Half Cell Ion Selective Electrode**

Jenway Part Number 924-511

Introduction

The lead half-cell ion selective electrode has a solid-state crystalline membrane. It requires the use of a double junction reference electrode (Jenway part number 924-017). The electrode is designed for the detection and analysis of lead ions (Pb^{2+}) in aqueous solutions and is suitable for use in both field and laboratory applications.

Installation

Connect the ion selective electrode and the reference electrode to the pH/mV or ion meter.

Remove the black protective caps and keep them in a safe place.

The ion selective electrode can be used immediately but pre soaking for 5 minutes in a 10ppm lead solution is recommended. After soaking rinse the electrodes with deionised water and dry before use.

The ionic strength of the standards and samples should be kept constant. This is achieved by the simple addition of an Ionic Strength Adjustment Buffer (ISAB) (Jenway part number 025-094). The ratio of ISAB to standard/sample varies according to the ISAB being used. Refer to the label on the ISAB bottle.

No temperature correction is necessary, however the standards and samples should be measured at the same temperature.

Begin calibration from the lowest concentration standard and rinse the tips of the electrodes with deionised water between measurements to avoid cross contamination. Calibration should cover the anticipated range of the samples.

Glass vessels should not be used for low concentration solutions as ions can be adsorbed onto the glass surfaces; polyethylene or similar is recommended.

Storage and Maintenance

After use rinse the ion selective electrode thoroughly with deionised water, wipe clean with a tissue or lint free cloth, replace the protective cap and store dry in its box.

If the electrode performance becomes sluggish, rinse with a dilute detergent solution, and then rinse thoroughly with deionised water and soak in a 1000ppm lead solution for 1 hour. If this does not improve the performance, carefully polish the crystalline surface of the ion selective electrode with a fine abrasive paper, then rinse with deionised water and soak for 15 minutes in 10ppm lead solution.

Avoid strongly acidic or alkaline samples, strong detergents and organic solvents.

Recommendations for successful analysis.

Jenway Ion Selective Electrodes can be used with any pH/mV meter or Ion meter. If the meter does not have a BNC socket and you have a BNC electrode please contact your Jenway distributor. Adapters are also available if the same electrode has to be used on more than one meter.

Meters with a 0.1 mV resolution are recommended whilst dedicated Ion meters will provide direct concentration readouts saving time and effort in constructing calibration curves and performing calculations. Your Jenway distributor can advise on the most suitable meter.

Magnetic stirrer/stirrer bars are recommended for laboratory analysis. Please operate at the lowest constant speed available.

Semi-logarithmic (4-cycle) graph paper is required for preparing calibration curves when you are using a mV meter.

Required Solutions:

Distilled or deionised water will be required to prepare Standards, ISABs and to rinse the electrode between measurements.

1000 ppm Stock Standard solution. Used for preparation of Standards. (Jenway Part Number 025-059)

ISAB. Used to adjust the Ionic strength of all standards and samples. (Jenway Part Number 025-094)

Operation

1. Connect the electrodes to the meter being used for analysis. If the electrodes have not already been pre soaked, immerse in 10ppm lead solution for 5 minutes and then rinse with deionised water.
2. Prepare a series of standards (at least 2) that bracket the expected sample concentration. This is best done by serial dilution of the stock solution. Ideally standards should be a decade in concentration apart e.g. 1, 10, and 100 ppm.
3. Dispense 50 ml of each standard into clean beakers (100 to 150 ml size is perfect).
4. Add ISAB in the appropriate ratio as detailed on the label.
5. Rinse the electrodes with deionised water and blot dry with a lint free cloth and place in the lowest standard and stir gently either with a magnetic stirrer set on the lowest setting or carefully by hand. When the reading is stable record the mV value.
6. Repeat step 5 for all subsequent standards proceeding from lowest to highest.
7. Plot a calibration curve on semi log paper using mV values on the linear Axis and concentration on the log scale.
8. Rinse the electrodes in deionised water and blot dry. Place the electrode in the sample and record the stable mV value.
9. Using the calibration curve determine the unknown sample concentration.

Hints and tips.

1. Ensure that the temperature of all standards and samples are the same to reduce errors.
2. Using a magnetic stirrer for laboratory analysis is recommended but not essential. It is however important to have the stirrer set on a low constant speed which must be reproducible for all measurements.
3. Prior to sample measurement ensure that the electrodes are thoroughly rinsed with deionised water. It is worth performing this rinse twice given the possibility of carryover being greatest in high concentration solutions.
4. Prepare standards by serial dilution.

Methods of Analysis.

We have described direct potentiometry above. This method is simplified by using a direct reading ion meter. There are several other methods, which are useful. For full advice or copies of applications method sheets please contact applications@jenway.com

Known Addition: An incremental technique where the potential of the sample solution is measured followed by addition of a small volume of a higher concentration standard solution. The new potential is measured and from the difference in the two values, and using the known electrode slope, the unknown concentration is determined.

This method is ideal for samples whose matrix is not entirely clean or aqueous. In these instances calibration/measurement with clean aqueous standards is not appropriate thereby making direct potentiometry unsuitable. Known addition works because both standard and sample are measured in the same matrix.

Typical sample volume is 50 ml; typical standard volume is 5 ml. The standard should be approximately 100 times the sample concentration for accurate analysis.

Sample Addition: An incremental technique where the potential of a dilute standard solution is measured followed by the addition of a small volume of more concentrated sample. The new potential is recorded and the difference noted. Using this value (and the predetermined electrode slope) the unknown concentration is determined.

This method is ideal for dirty or viscous samples with an awkward matrix. The sample however needs to be relatively concentrated i.e. at least 100 times the Electrodes linear detection limit. The analysis does have the benefit of only requiring a small sample volume.

The sample matrix is basically broken down by dilution with the standard and therefore analysis is carried out in the same media.

End Point Titration: Flow Plus combination ISE's are ideal end point indicators and will produce a significant potential change at the equivalence point. The Ion in question must be contained in the titrand or the titrant and must therefore be in excess or absence at the end point.

Specification

Lead is a divalent cation. A 1 molar solution of Lead contains 207.200g/l of Lead. A 1000ppm solution is equivalent to 0.005 molar solution.

Physical Specification

Parameter	Specification	Jenway Part Number
Overall Length	155mm	013-161 or 013-173
Body Diameter	12mm	
Cap Diameter	16mm	
Diameter of Sensing Region	5mm	
Type of Plug Termination Fitted	Euro S7	
Length of Cable (waterproof or BNC)	1m	
d.c. Resistance at 25°C	<2.5M Ohm	
Minimum Feasible Sample Volume	5mls	

Chemical Specification

Parameter	Specification	Jenway Part Number
Standard solution	1000ppm Pb ²⁺ as Pb(NO ₃) ₂	025-059
Preconditioning	5 minutes in 10ppm solution	
Optimal pH Range	3 to 7	
Temperature Range	5 to 50°C	
Recommended ISAB	5M NaNO ₃	025-094
Recommended Ref. Electrode	Double Junction	924-017
Ref. Electrode Fill Solution	Diluted 5M NaNO ₃ *	025-094
Slope at 25°C	29.58mV/decade ±2mV	
Total Measuring Range	0.2 to 21,000ppm	
Linear Measuring Range	2.1 to 21,000ppm	
Detection Limit	0.2ppm	
Endpoint Time	Typically 10 to 30 seconds	
Potential Drift	2mV per day	
Recalibration	Once per day	
Must be Absent Interferences: Ions with selectivity coefficients above 0.001	Ag, Fe, Cu, Hg, S Cd	

* The concentration of the reference electrode fill solution should be similar to the diluted ISAB concentration in the sample solution. If the sample has a low ionic strength or no ISAB has been used, 0.1M electrode fill is recommended.