

Instruction Manual

HI 5315

Reference Electrode

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I. Introduction

The Hanna HI 5315 reference electrode is a silver-silver chloride double junction half-cell designed for use with ion selective electrodes or pH sensors. The electrode utilizes a quick flush sleeve design. The external reference electrolyte chamber is refillable. The internal chamber is a permanently filled, gel stabilized, chloride containing electrolyte.

II. Specifications

Type:	Ag/AgCl
Operating Temperature:	0-85°C
Operating pH:	0 to 14 pH
Dimensions:	12 mm (OD) x 120 mm insertion (0.47" x 4.72")
Connection:	Banana Plug
Wetted Materials:	PEI
$E^{\circ\text{SHE}}$ (calculated):	0.238V

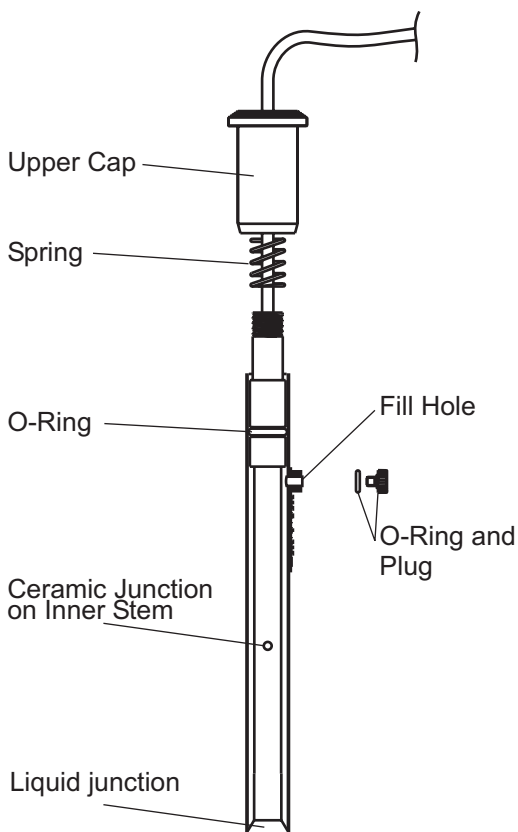
III. Theory of operation

A reference half-cell provides the electrolytic contact necessary to permit a voltage gradient to be measured across a measurement membrane, such as an ISE. A Ag/AgCl electrode is the most common type of reference. The Nernst expression for this type half-cell is expressed in the equation below. Note that the potential is a function of the chloride concentration.

$$E = E_{\text{AgCl}}^0 - 0.059 \log [\text{Cl}^-]$$

A chloride electrolyte completes the electrical circuit in the inner half-cell. A bridge electrolyte is used as a buffer zone between the inner half-cell and the sample. A small stable liquid junction voltage is generated where the sample and electrolyte come into contact. The size of this voltage, the identity of the diffusing ions and how this barrier is formed dictate stability. The barrier zone for this reference is a narrow ring shaped opening formed between the outer sleeve and the lower edge of the skirt shaped inner body.

IV. HI 5315 design elements



V. Reference Fill Solutions

The fill solution used in the external electrolyte chamber of this electrode is replaceable. Table 1 lists Hanna's ion selective electrode (ISE) offering along with the recommended fill solutions used when making an ion measurement. A bottle of this solution is provided with the ISE when shipped. The fill solutions listed will not interfere with the sensing electrode or react with the sample. They are formulated to minimize liquid junction potentials and to produce the most stable and reproducible electrode potential.

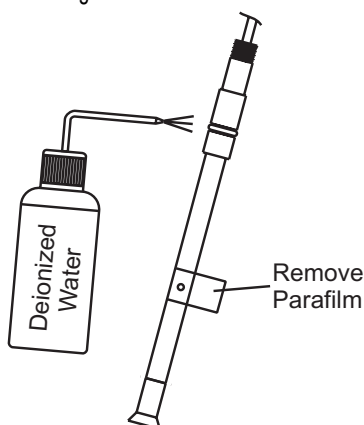
Verify you are using the correct fill solution with your electrode.

TABLE 1 Recommended Fill Solutions for ISE

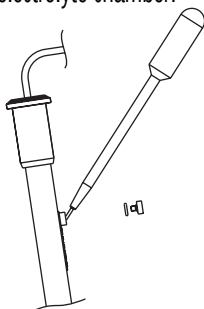
Code	Description	Fill Solution
HI 4002	Bromide half-cell	HI 7072
HI 4003	Cadmium half-cell	HI 7072
HI 4004	Calcium half-cell	HI 7082
HI 4007	Chloride half-cell	HI 7072
HI 4008	Cupric half-cell	HI 7072
HI 4009	Cyanide half-cell	HI 7072
HI 4010	Fluoride half-cell	HI 7075
HI 4011	Iodide half-cell	HI 7072
HI 4012	Lead/Sulfate half-cell	HI 7072
HI 4013	Nitrate half-cell	HI 7078
HI 4014	Potassium half-cell	HI 7076
HI 4015	Silver/Sulfide half-cell	HI 7072

VI. Electrode Preparation:

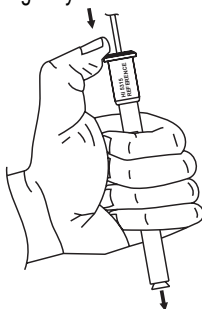
1. Remove the Parafilm® seal wrapped over the ceramic junction on inner stem and discard. This is only used for shipping and long term storage.
2. Rinse inner body with deionized water making certain to wet o-ring found on the inner stem.



3. Reassemble electrode by gently pushing the inner assembly into the outer body (from the bottom). Slide the spring and upper cap down the cable and over the top of the inner stem. Screw the upper cap into place.
4. Unscrew and remove the fill hole plug and o-ring on fill hole spout.
5. Select the appropriate fill solution from Table 1. Use the dropper pipette provided to add a few drops of fill solution to the electrode. Invert electrode to wet the o-ring and rinse the electrolyte chamber.



6. Holding the body of the electrode gently press the upper cap with your thumb. This permits the fill solution to drain out of the body. Release your thumb and verify electrode returns to its original position. (You may need to gently assist for this to occur).



7. Tighten the upper electrode cap onto the body and fill electrode body until the fill solution volume is just below the fill hole.
8. Position the reference electrode with appropriate ion selective electrode (ISE) in a Hanna HI 76404 electrode holder (or equivalent) and connect banana plug to the reference jack of the ISE meter.

VII. General Guidelines

- During measurement always operate electrode with the fill hole open.
- Verify protective cap has been removed.
- During normal use, fill solution will slowly drain out of the tapered cone junction at the bottom of the electrode. Excessive loss (> 4 cm drop within 24 hours) is not normal. If this occurs verify the upper cap is tightened and the interface between the internal cone and outer body is free of debris.
- Add fill solution daily to maintain a good head pressure. For optimum reference response, this level should be maintained and not be allowed to drop more than 2-3 cm (1-inch) below fill hole.
- When changing from one fill solution to another, drain 1st fill solution, rinse with an aliquot of the new solution, drain, then refill with new fill solution.
- Components found in the fill solutions should not interfere with the ion being measured. Verify the correct solution is being used.
- Do not use an electrode if crystallized salts are visible inside the electrode. Drain electrode, disassemble and rinse internal body with deionized water. Reassemble and refill with fresh fill solution.
- If an erratic measurement occurs, check to see if foreign matter is seen trapped near the internal cone. Drain and refill with fresh fill solution.
- The internal chamber of this electrode is gel filled. If the electrode has been left dry for long periods of time the gel may be dehydrated giving unstable readings. Disassemble electrode and soak internal assembly in HI 7075 fill solution. Verify the ceramic junction is wetted by the fill solution. Warming the solution slightly (50°C) before soaking it will hasten this process. Permit the electrode to cool completely while immersed in this solution.

VIII. Disassembly - Assembly

Disassembly is normally not required or recommended. If crystals or other matter are seen between outer body and inner cone, the electrode may be disassembled for cleaning or inspection. Protect the cone surface from oils or dirt by using gloves or lab tissues.

1. Drain fill solution from electrode body by depressing the upper cap while holding the outer body.
2. Rinse inner body with deionized water and drain by pressing the upper cap.
3. Unscrew upper cap and slide cap and spring up the sensor cable toward the connector.
4. Push the inner body through the outer sleeve by gently pushing down on the inner body near the threads.
5. Grasp the cone and gently pull assembly out of sleeve.
6. Cone may be cleaned with deionized water and a soft lab tissue (HI 731318).
7. Clean and inspect internal surface of outer body.
8. Reassemble electrode by gently pushing the inner stem assembly into the outer body, sliding spring down cable, and screwing cap into place. (Refer to Section VI; Electrode Preparation).
9. Refill electrolyte, flush junction, and then top off electrolyte.

IX. Storage

The HI 5315 reference electrode may be stored in air or aqueous solutions between sample measurements.

If the electrode will be used frequently and needs to be ready for use, take measures to prevent evaporation of fill solution. Top off fill solution, replace o-ring and fill hole plug on the fill hole opening, and place protective cap over junction tip. Store electrode upright. Before using, flush junction once and top off fill solution.

For long term storage, disassemble electrode and wash all salts from assembly with deionized water. Wrap ceramic junction on inner stem with Parafilm® or other sealing film. Store dry and disassembled.

WARRANTY

Hanna Instruments ISE series electrodes are warranted to be free of defects in material and workmanship for 6 months from date of purchase when used for their intended purpose and maintained according to instructions. If they fail to work when first used contact your dealer immediately. Damage due to accidents, misuse, misapplication, tampering or lack of prescribed maintenance is not covered.

Hanna Instruments reserves the right to modify the design, construction or appearance of its products without advance notice.
