Beckman

FIBER JUNCTION REFERENCE ELECTRODES (Silver-Silver Chloride Internals)

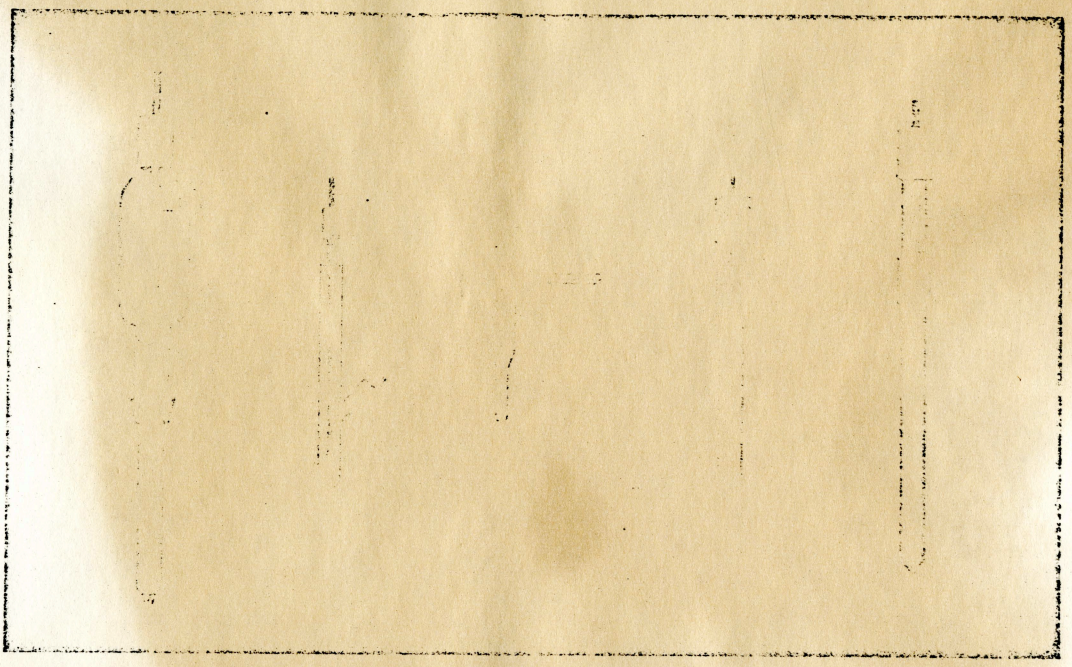

Figure 1. Typical Fiber Junction Reference Electrodes

Beckman Fiber Junction Reference Electrodes are designed for use in combination with Beckman Glass or Metallic Electrodes for pH determinations, oxidation-reduction potential measurements, or titrations with Beckman pH Meters or Titrators.

The sole purpose of the reference electrode is to permit the measurement of the potential developed at the surface of the glass or metallic electrode. The Silver-Silver Chloride internal element is surrounded by an electrolyte, normally a 4 Molar Potassium Chloride solution saturated with Silver Chloride. This solution contacts the internal element to form a conductive bridge between the element and the test solution in which the electrode is immersed. An asbestos fiber imbedded in the immersion tip allows a flow of the electrolyte solution from the electrode to establish electrical communication with the test solution.

Fiber junction reference electrodes are characterized by a chemically inert junction, a low electrical resistance, and a low volume flow rate of electrolyte solution. They are recommended for most general applications, but should not be used in very viscous material or suspensions that would clog the fiber junction. In these solutions, the use of Beckman Sleeve Junction Reference Electrodes is suggested.

The fiber junction reference electrodes are best suited for analyses at atmospheric pressures or pressures that do not exceed the hydrostatic head

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of the electrolyte solution within the electrode. The Silver-Silver Chloride internal element permits these electrodes to be used in temperatures from −5° to 100°C (with the exception of the small — 2⅝-inch long — electrode which has a temperature range of −5° to 50°C). Good stability is assured even when operating continuously at higher temperatures.

Fiber junction reference electrodes include laboratory electrodes and several other electrodes designed specifically for process and industrial applications.

The side-arm reference electrode is designed for use with Beckman Submersion Assemblies for measurements in tanks or streams in which the process solution level is variable. A length of Neoprene tubing connects the side-arm of the electrode to a reservoir bottle located above the maximum level of the process solution. The elevated reservoir furnishes a sufficient hydrostatic head of electrolyte solution to prevent contamination of the electrode by the process solution.

The remote reference electrode is employed with Beckman Remote Reservoir Assemblies. The electrode and assembly are located at an elevation sufficient to overcome the process solution pressure. Electrical communication is maintained via a connecting tube which carries the electrolyte solution from the reservoir containing the electrode to a reference junction immersed in the process solution.

Fiber junction reservoir reference electrodes are used in applications where a substantial reserve supply of electrolyte solution is desired for prolonged service with minimum maintenance.

PREPARATION

The electrode tip is protected for shipment by a rubber cap. Remove this protector before placing the electrode in operation. Peel the protective coating from the immersion tips of the electrodes that are so protected.

Before commencing a series of measurements, determine that the electrolyte solution is at a high level. With the side-arm reference electrode, check to see that the separate reservoir is filled and that the solution flows from it into the electrode when connected to the tubing.

The remote reference electrode must have the sleeve covering the filling hole removed before installation in the reservoir assembly. The electrolyte solution in the electrode must be filled separately — it is not maintained at a maximum level by the solution in the reservoir assembly.

A sleeve also covers the filling hole of the standard (5-inch long) electrode, while a rubber cap covers the filling hole of the small (2⅝-inch long) electrode. Note that the filling hole on these electrodes must remain uncovered during operation to ensure a uniform flow of electrolyte solution.

The rubber plug sealing the solution filling hole on the reservoir electrodes must be removed or punctured to maintain a uniform flow of electrolyte solution during operation.

MAINTAINING ELECTROLYTE SOLUTION

Electrolytic contact between the reference electrode and sample depends upon the continuous flow of electrolyte solution through the fiber junction. Although this liquid junction has a low volume flow rate, the electrode should be checked frequently when first installed to determine what maintenance schedule will be necessary to keep the level of the electrolyte so the end of the internal element is always immersed. If the electrode is allowed to dry out, permanent damage may result.

Keep the electrolyte solution in the electrode saturated with Silver Chloride. Saturation will be maintained if a 4 Molar Potassium Chloride solution saturated with Silver Chloride is used.

CARE AND CLEANING

Clogging of the fiber junction of an electrode will be indicated by a drifting of the pH Meter reading. A clogged junction may be cleared by boiling the immersion tip of the electrode in distilled water until the electrolyte again flows freely. The solution will usually flow immediately if the electrode is placed in a beaker of electrolyte solution prior to use.

The electrolyte solution has a tendency to creep onto and encrust the outer surface with crystals. While encrustation does not harm the electrode, for maximum measurement accuracy it is recommended that the outer surface be washed or wiped clean. Application of Beckman Desicote® will facilitate cleaning and minimize encrustation, sorbed film effects and electrical leaks. Do not apply Desicote over the immersion tip of the electrode.

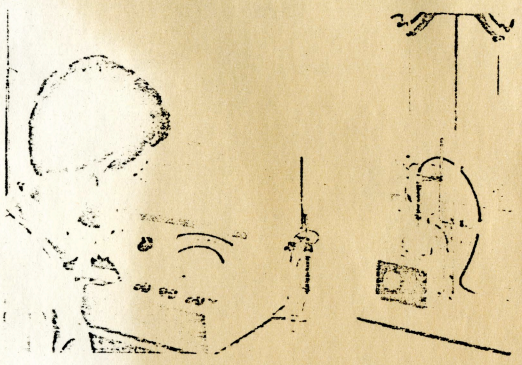
TESTING THE ELECTRODE

The accuracy of Beckman Reference Electrodes can be checked in several ways. A preferred method utilizes a Beckman pH Meter which has a millivolt scale. Connect the questionable reference electrode to the pH meter in the usual manner and plug a new reference electrode (one that is known to be good) into the glass electrode jack. Use a Beckman 700 Terminal Connector. A reference electrode with a calomel internal element may be used to check an electrode with a silver-silver chloride internal element, so the reading need not be taken at zero, as it will be if the reference electrodes have the same internal element.

CAUTION

Test reference electrodes only in high-impedance circuits such as those employed in Beckman pH Meters; otherwise the electrode will be damaged.

Set the pH Meter to read in millivolts. Take readings with this pair of reference electrodes in a beaker of buffer solution and then in a beaker of electrolyte (KCl) solution. The millivolt readings in the two solutions should be identical and also should be zero ±5 millivolts, if the electrodes have the same internal elements. If an electrode with a calomel internal element is in the glass electrode terminal and is being used to check one with a silver-silver chloride internal element, the reading should be +44 ±5 millivolts; the reverse situation should give a reading of −44 ±5 millivolts.



If the reading obtained in the electrolyte solution is zero (or ±44) ±5 millivolts, but the reading obtained in the buffer solution is not zero (or ±44) ±5 millivolts, the liquid junction is clogged. A clogged fiber junction may be cleared by placing the immersion tip in a beaker of distilled water and boiling for a short time. However, the junction may be clogged so thoroughly that this treatment will not suffice. In this case, spread a fine abrasive on a flat glass surface and rub the electrode tip lightly over it until the electrolyte solution begins to flow through the junction. The flow may be detected as a moist spot about the fiber when the electrode tip is dry. Placing a finger over the filling hole and pushing inward so that a slight pressure is created within the electrode will aid in starting the flow. Do not grind the tip any more than is necessary to clear the junction. Excessive grinding will cause the electrolyte solution to flow too rapidly, requiring frequent replenishment, while severe grinding will destroy the fiber junction.

If the readings in both the buffer and electrolyte solutions are not zero (or ±44) ±5 millivolts, it is because of a faulty internal element and the electrode should be discarded.

Reference electrodes can also be checked with Beckman pH instruments which do not have a millivolt scale. Compare them in a buffer solution with a glass electrode and a new reference electrode (of the same type). Standardize the instrument in a buffer solution using the glass electrode and the new reference electrode, then substitute reference electrodes and read the pH of the buffer solution. Using a buffer solution of a different pH value, take a reading with the glass electrode and new reference electrode and again substitute reference electrodes for another reading. Be sure to allow enough time for the instrument to reach equilibrium before taking a reading. If the reading is not within ±0.1 pH unit of the pH of the buffer, the old reference electrode will introduce errors in normal use.

STORAGE

Store the fiber junction reference electrodes in a dry medium or immerse the tip in a beaker containing electrolyte solution being used with the electrode.

If the electrode is stored dry, place the rubber protective cap over the immersion end, and see that the filling hole is properly covered. It may be necessary to immerse the electrode in hot distilled water after dry storage to resume the normal flow of electrolyte solution.

CAUTION

Keep the electrode filled with electrolyte solution during storage.

If the electrode tip is immersed in electrolyte solution during storage, the fiber junction will be maintained in a free-flowing condition, ready for immediate use.

CONTAMINATION

If the solution in the electrode becomes contaminated, repeatedly flush the electrode with fresh solution. Following the final flushing, refill with 4 Molar Potassium Chloride solution saturated with Silver Chloride.

INTERNAL CONSTRUCTION

The column inside the reference electrode is filled at the factory and requires no maintenance. A parting or separation of the column does not usually affect operation of the electrode.

SUPPLIES

BECKMAN PART NO.	DESCRIPTION
8262	4 Molar Potassium Chloride solution; saturated with Silver Chloride, 6 ounce bottle.
4787	4 Molar Potassium Chloride solution; saturated with Silver Chloride, 1 pint bottle.