

Using an IonX electrode to check the calibration of a regular RE-5 or 5C electrode

M. C. Miller's criterion requiring that the potential difference between two RE-5, or RE-5C electrodes be less than $\pm 5\text{mV}$ in order for a service electrode to be declared "calibrated" with respect to a non-service electrode, does not apply in the case of an IonX electrode.

IonX electrodes are pre-constructed and are supplied with a Certificate of Calibration. The electrode potential is quoted on the Certificate versus the Standard Hydrogen Electrode (SHE) potential. The electrode potential of an IonX electrode will be in the range, $316\text{mV} \pm 10\text{mV}$ versus SHE, which is the manufacturer's tolerance range for this type of electrode.

IonX electrodes are designed for field (service) use, however, if an IonX electrode is used to check the calibration of a regular RE-5, or RE-5C electrode, an understanding of what a potential difference reading means in such a case, is required.

Example:

Let's say that an IonX electrode has an electrode potential, as indicated on its Certificate of Calibration, of 321mV versus SHE, which is a potential within the manufacturer's specified range. Now, let's say that a potential difference reading of 8mV is recorded in tap water between the IonX electrode and a service RE-5, or RE-5C electrode. This means, in this example, that the potential of the service electrode is 313mV ($321\text{mV} - 8\text{mV}$) versus SHE, assuming that the IonX electrode was connected to the positive side of the voltmeter and the service electrode was connected to the negative side of the voltmeter.

Since the accepted electrode potential of a copper/saturated copper sulfate electrode is 316mV versus SHE, the service electrode potential in this example is within 3mV of the "Standard" value, which would be very acceptable (313mV compared to 316mV).

Consequently, the service electrode should be considered to be "calibrated" in this example. However, since the potential difference between the IonX and the service electrode was measured as 8mV , the service electrode would not have been declared calibrated by application of the $\pm 5\text{mV}$ criterion.

So, if an IonX electrode is to be used to check the calibration of a service electrode, the first step is to check the electrode potential value quoted on its Certificate of Calibration, and, based on the potential difference reading, determine the potential of the service electrode and compare that value to the "Standard" 316mV value.

Example Test Set Up

An example calibration test set up is illustrated in the photograph below, which shows an example IonX electrode (Serial # C1218), together with a regular RE-5C electrode, with their ceramic tips immersed in tap water. The IonX electrode is connected to the positive side of the

voltmeter and the regular RE-5C electrode is connected to the negative side of the voltmeter.
Note: The solutions inside both electrodes should be allowed to stabilize to room temperature.



Since the IonX electrode potential was quoted as 318mV versus SHE on its Calibration Certificate, and, since the voltmeter reading (potential difference reading) was indicated as 2mV (see the LCD in the above photograph), the electrode potential of the RE-5C electrode, in this example, would be inferred to be 316mV versus SHE (318mV minus 2mV).

However, had the Calibration Certificate for the IonX electrode indicated an electrode potential of, say, 325mV versus SHE, the voltmeter reading would have been 9mV (rather than 2mV), in the case of this particular RE-5C electrode (325mV minus 9mV = 316mV).