

Hach CL17sc Calibration Verification and Adjustment Recommendations

HIGH LEVEL SUMMARY

- Hach does not recommend adjusting the CL17sc factory calibration based on reference test results, because it may lead to inaccurate chlorine readings and compliance violations.
- Verification of the factory calibration should be conducted periodically based on local regulations and/or user SOP.
- When process and lab instruments are built on the same technology, process analyzers deliver measurements that are free of variations caused by human interactions, as opposed to many lab and portable devices which require human operation.
- Measurements with the least human interaction are considered to be more accurate—for this reason, Hach does not consider it a good practice to adjust a colorimetric process analyzer based on a measurement value from a laboratory instrument unless (1) it is required by a regulatory agency and/or (2) Hach's verification procedures have been followed and found a discrepancy beyond an acceptable value.

DETAILED INFORMATION

The CL17sc calibration coefficients, derived from thorough testing, translate the colorimetric measurement into chlorine concentration according to a fundamental physical law (Lambert-Beer's Law). Therefore, Hach does not recommend adjusting the CL17sc factory (default) calibration coefficients (slope and/or offset).

Verification of the CL17sc performance (a procedure that does not assume changing calibration coefficients) should be conducted on a regular basis as required by local regulatory agencies and/or standard operating procedures.

Here are the common reasons why Hach discourages routine adjustment of the CL17sc calibration:

- A simple question arises when comparing measurements from two devices: which one is more accurate? Answer to this question may be found in the specifications for each device. However, that may not tell the whole story. Hach's rule of thumb: taking all other factors as equal, a process analyzer's measurements are free of variability provided by human interaction, and therefore likely to be more accurate when compared to a measurement generated by a laboratory or field device that requires a human to prepare the sample and conduct the analysis. The opposite assumption is not consistent with fundamentals of analytical chemistry and best practices.
- Many users make adjustments to the CL17sc based on reference measurement even when the readings are within the process analyzer's accuracy specification ($\pm 5\%$). This specification is within the margin of error defined for a CL17sc measuring a verified chlorine standard and does not consider accuracy of the reference method/analyzer. Once such an adjustment to CL17sc calibration is made, it may influence other measurements and cause problems or confusion in the future.

There are two Hach recommended approaches to verify calibration of CL17sc analyzer properly and make the right decision on adjusting the coefficients:

1. Calibration Verification Kit

Usually primary standards are employed to verify an analyzer performance to the declared accuracy specification and adjust calibration as necessary. Since there is no primary standard for chlorine in the target concentration range, the use of Hach Calibration Verification Kit shall demonstrate CL17sc readings being within $\pm 10\%$ of the

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prepared chlorine standard concentration for slope verification, and between 0 and 0.03 ppm for offset verification. If the test shows such results, it is unnecessary and not recommended to adjust the CL17sc calibration coefficients.

2. Grab Sample Verification

Grab Sample must be taken at the analyzer and verification should be conducted in the range of 0.5 – 5 mg/L. The test shall demonstrate a match between the expected chlorine concentration and the CL17sc readings, usually within $\pm 10\%$ (or a sum of accuracies specified for each compared analyzer) of the average for the two compared values.

- *Example: A grab sample with expected chlorine concentration of 2.2 ppm (measured by a reference instrument) returns CL17sc readings of 2.4 ppm. The discrepancy of 0.20 ppm shall be within 10% of the average between 2.2 ppm and 2.4 ppm (2.30 ppm), which is 0.23 ppm. This means that acceptable CL17sc readings are from 2.07 ppm to 2.53 ppm and in this case the instrument would pass verification, which means no need to adjust the CL17sc.*

NOTE: According to the USEPA Method 334.0, the acceptable difference may be up to $\pm 15\%$.

If the verification test shows such results, it is unnecessary and not recommended to adjust the CL17sc calibration coefficients.

If the verification tests show results outside of the acceptance criteria listed above, it is recommended to check if the analyzer is due for regular maintenance (e.g., tubing replacement and colorimeter cleaning) and perform it per the manufacturer's instructions (CL17sc User Manual, 5ed., p. 19). Once the maintenance is done, repeat the verification procedure and ensure that the results are within expected discrepancies as described above.

If the analyzer fails the verification procedure (repeatedly shows discrepancy outside of the acceptable range even after regular maintenance), both the CL17sc and reference instrument used in the grab sample test shall be inspected to ensure there is no problem with either (e.g., no error/warning messages present, software is up to date, routine checks and cleaning are completed, etc.). If everything is in order, the process analyzer calibration coefficients (either slope, or offset, or both) may be adjusted to match the reference instrument.

- *Disclaimer: Portable or handheld chlorine analyzers may have lower accuracy. Adjusting the CL17sc calibration based on the grab sample analysis conducted with portable or handheld units may lead to inaccurate readings and potential compliance violation.*

Use of a grab sample reference measurement instead of a chlorine standard to complete the CL17sc calibration workflow is possible, but is not recommended, because may lead to inaccurate chlorine readings and compliance violations. If adjustment of factory calibration is still needed after following the best practices outlined in this document, Hach recommends using the CL17sc Calibration Verification Kit (Part # 8568200).