



CL-2000 Chloride Test System Operating Instructions

The CL Test System offers a fast, accurate, and in-place determination of the total content (or more precisely the acid soluble content) of chlorides contained in concrete.

The test is easy to perform and requires only the test equipment contained entirely in a small briefcase.

Using a masonry drill bit, the concrete is pulverized at the required sample depth and collected in the dustpan provided. An accurately weighed 3 gram sample is dissolved in 20 ml of extraction liquid consisting of a precise, measured concentration of acid. The chloride ions react with the acid of the liquid in an electrochemical reaction.

An electrode, with an integral temperature sensor, is inserted into the liquid and the electrochemical reaction measured. A uniquely designed instrument converts the voltage generated by the chloride concentration and automatically applies the temperature correction. The percentage of chlorides, or lbs. of chloride per cu yd, is displayed directly on an LCD readout.

Conducted on site, the test gives immediate and direct information regarding the chloride content in critical locations prior to surface repair. In the laboratory the test may be used to measure chloride content of materials which have been pulverized to a fineness equal to that of concrete powder obtained with a masonry drill on a concrete member.

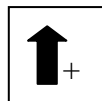
The test may be used on fresh, wet concrete.

Measurement

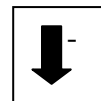
From main menu:

Select Function:
CAL MEAS

Move blinking cursor via the (key) in front of the item marked MEAS.



(plus arrow key) or



(minus arrow

Press



(enter key)

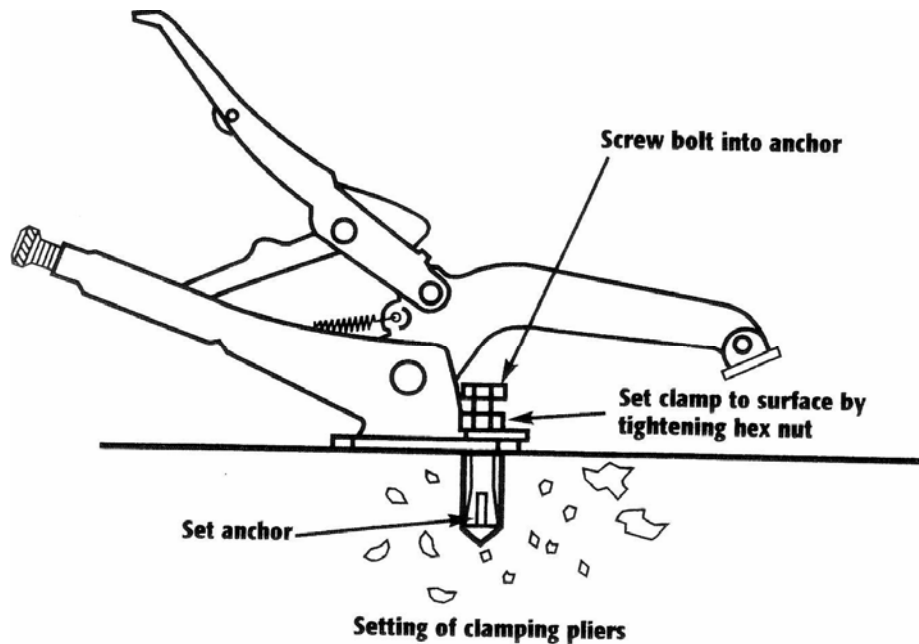


Figure 2

Concrete dust is drilled out to the required depth with the large $\frac{3}{4}$ inch bit mounted in the masonry drill. The drilling friction removes excessive water from the concrete dust, which should be protected immediately by placing in plastic bags.

It is advisable to select three test locations and drill $\frac{1}{4}$ inch of concrete for each sample. This will produce approximately 20 grams of dust, which is a common standard sample size. To produce a chloride profile through a concrete slab it is advisable to drill at three levels, e.g., near the top surface, close to the rebar position and 1-1/2 inches below the rebars.

Mix the dust sample on the pan and quarter carefully to ensure the sample's homogeneity, then weigh two separate 3-gram samples, using the scales provided. Keep one sample in a sealed plastic bag with location marked and the other sample for the field test.

Add the 3 gram sample to one of the 12 plastic jars containing 20 ml of chloride extraction liquid. Add the sample dust in stages to avoid excessive fizzing from the limestone present in the dust sample.

Note: Avoid contamination of samples during testing.

Preparation of Electrode for Calibration

The electrode is shipped without filling solution in the reference chamber. To fill the chamber, use the flip-spout bottle marked "electrode wetting agent," proceed as follows:

1. Lift the spout to a vertical position.

2. Insert the spout into the filling hole in the outer sleeve and add a small amount of filling solution to the chamber. Tip the electrode to moisten the O-ring and return it to a vertical position.
3. Holding the electrode by the barrel with one hand, push down on the white electrode cap, allowing the filling solution to wet the inner cone. If needed, the black cover cap may be removed one millimeter to allow sufficient travel of the electrode cones.
4. Release the white electrode cap. If it does not return to its original position immediately, check to see if the O-ring is moist enough; repeat steps 2 through 4 until the white cap has returned to original position. Add filling solution to the chamber, up to the filling hole. To ensure a proper flow rate—add to avoid erratic electrode potentials, this level should be maintained during all testing.

Remove the black cover cap and rinse the electrode thoroughly with distilled water and blot.

Note: *The black cover cap should be on when electrode is not in use. If the electrode is not in use for periods of more than 2 to 3 days, the electrode should be drained, rinsed in distilled water, dried off, polished and protected with the cap. If this is not done, the wetting agent will evaporate leaving crystals. This will render the electrode useless, necessitating its replacement.*

The CL-2000 Laboratory in a briefcase components:

CL-3700 Chloride combination electrode with externally mounted temperature sensor, cable, and connectors.

CL-2020 Special battery powered, high impedance, electronic meter—with temperature compensation circuits and microprocessor for direct conversion to percentage of chlorides.

CL-2012 Replaceable pack containing 12 plastic bottles, each with 20 ml of extraction liquid and five plastic jars of different colored calibration liquids.

CL-1030 Spray bottle of electrode wetting agent.
Bottle of distilled water
Dust collecting pan and blower for sampling.
Clamping pliers, drill bit, anchors, wrench, and screwdriver. Scales for weighing 3 gm samples.

Weight of CL-2000 Laboratory, complete in briefcase is 10 lbs.

B-124 A rechargeable battery powered electric drill, complete with battery charger in a metal carrying case (use with CL-2000 *Laboratory in a briefcase*)

Note: *The CL-2000 test correlates to water soluble titration method.*

For the most accurate results the first sample in any test area should be checked every 15 minutes until the last three readings are within about 10 percent of each other. This is because, for safety reasons, a mild acid solution is used and it may take a longer time to completely dissolve chlorides from certain aggregates.

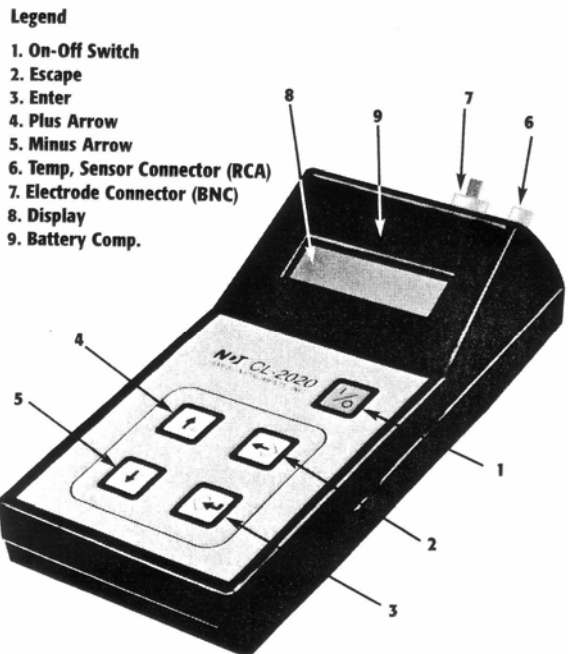




Figure 4

CHLORIDE ASHTO T-260 TEST PROCEDURE

Changing Meter Mode of Operation:

1. From meter main menu press and hold the  (escape key) simultaneously press and hold the  (enter key).


2. Meter will now display: **RESET**

3. Then the alternative menu will be displayed:

Select Function
Cal Meas mV

Measurement Procedure:

1. Use arrow keys to move blinking cursor in front of Meas display.

2. Press  (enter).

3. The meter will now display:

Value zz.z°C
y.yyy

Where zz.z is the temperature reading and y.yyy is the chloride percent concentration.


4. Place 3.0 +/-0.01g concrete sample in the 125 ml bottle with digestive solution. Shake vigorously to suspend the powder in the solution. Let powder digest for 3 minutes. The bottle may be opened after shaking to relieve pressure from effervescence due to the reaction; then close immediately.
5. Carefully remove the bottle cap and add 80 ml of stabilizing solution.
6. Replace cap and shake vigorously for one minute.
7. Remove bottle cap and place the electrode to a depth of mid-height in the extraction fluid.
8. Wait 3 minutes and record the measurement obtained.
9. After each measurement the electrode should be rinsed in distilled water.

ASHTO Calibration Method

The conversion of the sensors output to a specific chloride ion concentration is normally accomplished via comparison with standardized solutions. ASHTO specifically recommends that the standardized concentrations of 1.25%, 0.60%, 0.30%, 0.03% and 0.01% be used for calibration. It is further specified that this be accomplished by taking millivolt readings from 10 calibration runs, each consisting of the five calibration solutions. Thus, the mV function of the meter (see below for further details of this function). From this procedure a chloride concentration is obtained of the sample. This chloride concentration is further linearly correlated to a standard titration procedure. The values which are recommended by ASHTO for these correlations are currently programmed in the CL-2020. They have been made available to the user if further refinement of the test method is required.

Calibration Menu

1. Using the arrow keys, move the blinking cursor in front of the **Cal.**

2. Press  (enter key)


3. The meter should now display: **Select Constant**
A B C D

These constants correspond to the following formula,


$$\%Cl = A + By,$$

where $y = [(10^{(C+DmV)})-3](0.00333)$

4. Using the arrow keys, move the cursor in front of the constant you wish to change.



5. Press  (enter key)

6. Use arrow keys to change the values of the constant to that which you desire.

7. Press  (enter key)

8. The meter will now display: **saving value**

If you wish to return constants to their original values press and hold the

 (escape key) while simultaneously pressing the  (down arrow key)

mV Display

1. From the main menu use the arrow keys to move the blinking cursor in front of the **mV** display.

