METHOD 9050A

SPECIFIC CONDUCTANCE

1.0   SCOPE AND APPLICATION

        1.1   Method 9050 is used to measure the specific conductance of drinking, ground, surface, and saline waters and domestic and industrial aqueous wastes. Method 9050 is not applicable to solid samples or to organic samples.

2.0   SUMMARY OF METHOD

        2.1   The specific conductance of a sample is measured using a self-contained conductivity meter (Wheatstone bridge-type or equivalent).

        2.2   Whenever possible, samples are analyzed at 25°C. Unless a temperature correction routine is used by the instrument, samples of different temperatures must be equilibrated to and results reported at 25°C.

3.0   INTERFERENCES

        3.1   Platinum electrodes can degrade and cause erratic results. When this happens, as evidenced by erratic results or flaking off of the platinum black, the electrode should be replatinized.

        3.2   The specific conductance cell can become coated with oil and other materials. It is essential that the cell be thoroughly rinsed and, if necessary, cleaned between samples.

4.0   APPARATUS AND MATERIALS

        4.1   Self-contained conductivity instruments: an instrument consisting of a source of alternating current, a Wheatstone bridge, null indicator, and a conductivity cell or other instrument measuring the ratio of alternating current through the cell to voltage across it. The latter has the advantage of a linear reading of conductivity. Choose an instrument capable of measuring conductivity with an error not exceeding 1% or 1 uS/cm, whichever is greater.

        4.2   Platinum-electrode or non-platinum-electrode specific conductance cell.

        4.3   Water bath.

        4.4   Thermometer: capable of being read to the nearest 0.1°C and covering the range 23°C to 27°C. An electrical thermometer having a small thermistor sensing element is convenient because of its rapid response.

5.0   REAGENTS

        5.1 Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical

Reagents of the American Chemical Society, where such specifications are available. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

      5.2   Conductivity water: Pass distilled water through a mixed-bed deionizer and discard first 1,000 mL. Conductivity should be less than 1 uS/cm.

      5.3   Standard potassium chloride (0.0100 M): Dissolve 0.7456 g anhydrous KCl in conductivity water and make up to 1,000 mL at 25°C. This solution will have a specific conductance of 1,413 uS/cm at 25°C.

6.0   SAMPLE COLLECTION, PRESERVATION, AND HANDLING

      6.1   All samples must be collected using a sampling plan that addresses the considerations discussed in Chapter Nine of this manual.

      6.2   All sample containers must be prewashed and thoroughly rinsed. Both plastic and glass containers are suitable.

      6.3   Aqueous samples should be stored at 4°C and analyzed within 28 days.

7.0   PROCEDURE

      7.1   Determination of cell constant: Rinse conductivity cell with at least three portions of 0.01 N KCl solution. Adjust temperature of a fourth portion to 25.0 ± 0.1°C. Measure resistance of this portion and note temperature. Compute cell constant, C:

$$C = (0.001413)(R_{KCl}) \; 1 + 0.0191 \; (t - 25)$$

where:

R_{KCl} = measured resistance, ohms; and

t = observed temperature, °C.

      7.2   Conductivity measurement: Rinse cell with one or more portions of sample. Adjust temperature of a final portion to 25.0 ± 0.1°C. Measure sample resistance or conductivity and note temperature.

      7.3   Calculation: The temperature coefficient of most waters is only approximately the same as that of standard KCl solution; the more the temperature of measurement deviates from 25.0°C, the greater the uncertainty in applying the temperature correction. Report all conductivities at 25.0°C.

7.3.1   When sample resistance is measured, conductivity at 25°C is:

$$K = \frac{(1{,}000{,}000)(C)}{R_m[1 + 0.0191(t - 25)]}$$

where:

K = conductivity, uS/cm;
C = cell constant, cm-L;
R_m = measured resistance of sample, ohms; and
t = temperature of measurement.

7.3.2   When sample conductivity is measured, conductivity at 25°C is:

$$K = \frac{(K_m)(1{,}000{,}000)(C)}{1 + 0.0191(t - 25)}$$

where:

K_m =   measured conductivity, uS at t°C, and other units are defined as above.

NOTE: If conductivity readout is in uS/cm, delete the factor 1,000,000 in the numerator.

NOTE: In the International System of Units (SI) the reciprocol of the ohm is the siemens (S) and conductivity is reported as millisiemens per meter (mS/m); 1 mS/m = 10 µmhos/cm and 1 µS/cm = 1 µmho/cm. To report results in SI units of mS/m divide µmhos/cm by 10.

8.0 QUALITY CONTROL

8.1   Refer to Chapter One for specific quality control procedures.

8.2   Analyze an independently prepared check standard to verify calibration.

8.3   Analyze one duplicate sample for every 10 samples.

9.0 METHOD PERFORMANCE

9.1   Three synthetic samples were tested with the following results:

Conduc-tivity uS/cm	No. of Results	Relative Standard Deviation %	Relative Error %
147.0	117	8.6	9.4
303.0	120	7.8	1.9
228.0	120	8.4	3.0

10.0 REFERENCES

1.   Standard Methods for the Examination of Water and Wastewater, 16th ed. (1985), Method 205.

METHOD 9050A

SPECIFIC CONDUCTANCE

```
        ┌─────────────┐
        │    Start    │
        └──────┬──────┘
               │
               ▼
    ┌─────────────────────┐
    │  7.1 Determine      │
    │  cell constant.     │
    └──────────┬──────────┘
               │
               ▼
    ┌─────────────────────┐
    │  7.2 Measure        │
    │  conductivity;      │
    │  note temperature.  │
    └──────────┬──────────┘
               │
               ▼
    ┌─────────────────────┐
    │  7.3 Perform        │
    │  calculations.      │
    └──────────┬──────────┘
               │
               ▼
        ┌─────────────┐
        │    Stop     │
        └─────────────┘
```