



## ALCOHOL by ELECTRIC EBULLIOMETER

### EQUIPMENT

Dujardin-Salleron Electric Ebulliometer with thermometer installed, condenser hooked up to water supply and calculating slide rule or dial.

### REAGENTS

Distilled Water  
Dilute Antifoam  
Calibration standard

### PROCEDURE

#### For accurate testing:

1. Turn condenser water flow on.
2. Rinse the boiling chamber with distilled water. Close stopcock and fill to condenser. Empty. Refill with distilled water to the line, with meniscus above the line.
3. Push button on to start boiling. The first 3 minutes of boiling time, the heating element is on full power. After 3 minutes the power is cut 50% to maintain the boiling point at the stable reading.
4. The boiling point of the distilled water should be noted. To set the boiling point of water on the slide rule, subtract  $X$  degrees from the temperature observed.  
(**note:** Perform this subtraction only for the water reading due to the thermometer placement in the boiling chamber. The traditional style ebulliometer did not immerse the thermometer in the water, but read the temperature of the steam. The slide rules were developed for this water reading on steam so the subtraction step equalizes the procedures. The value for  $X$  can be found in the French translated instructions from Dujardin-Salleron, section 1.3 or on page 5.) To determine this value, refer to the notes section.
5. Introduce the sample by first rinsing the boiling chamber with the wine to be analyzed. Fill to the condenser, wait 30 seconds, and then drain.
6. Close stopcock and fill to the red mark with the sample (meniscus above the line). Add a few drops of dilute antifoam to prevent excessive foaming.
7. Turn on and allow boiling point to stabilize, note the temperature and convert to the appropriate alcohol using the calibrated slide rule.

### NOTES

\*Read directions supplied with ebulliometer.

The boiling point of water must be checked and double-checked a minimum of once a day, and more frequently during periods of unstable weather. (Every 2 hours is recommended, since an undetected barometric movement of 4 mm Hg can contribute to an error of 0.5%).

Sugar levels greater than 2% can depress the boiling point, and must be diluted.

Rinsing adequately between samples is required for reproducibility.

The ebulliometer must be kept clean. Boil out with NaOH and water followed by adequate water rinses. To clean residue build up on condenser, soaking the glass condenser and boiling chamber in a dilute solution of bleach followed by numerous water rinses works very well.

For precise dilutions, wine and distilled water should be measured at 20°C, and class A volumetric pipets and flasks should be used.

In newly fermented wines, excessive foaming may be prevented by the addition of dilute antifoam.

To determine the value of the Factor *X* to be subtracted from the boiling point of water when using only the **black lines** on the calculating slide rule or dial:

1. Boil water and note the boiling point
2. Boil a known standard or sample with predetermined alcohol standard and note the boiling point.
3. On the calculating dial, set the % alcohol of known standard to the observed boiling point.
4. Compare the observed boiling point of water with the 0.00% alcohol and note the difference.
5. The difference between the observed boiling point of water and the 0.00% alcohol value is the Factor *X*.

To use the **red lines** on the dial, just note the value of the red line corresponding to the observed boiling point of water when using the standard solution values as a reference to set the dial. This number will be the value of that correlation for future determinations. This value will need to be determined whenever the heating cartridge is replaced or any physical changes or repair are made to your electric ebulliometer.

The following is an example:

Boiling point Water = 99.8°C  
Boiling point 11.4% wine standard = 91.7°C

Set the dial to 11.4% alcohol at 91.7°

Notice that at 0% alcohol the temperature value should be 100.03°C.

Since the observed boiling point of water is actually 99.8°C calculate the difference by subtracting the actual from the theoretical for a value (Factor *X*).

For this example Factor *X* = 100.03° – 99.8° for a value of +0.23°. For each time the boiling point of water is determined, add 0.23° to the boiling point of water observed.

To match this factor and to facilitate easier calculations by using the red marks on the dial, note that the corresponding red mark is +2.25. Just set the boiling point of water observed to the +2.25 red mark and the factor value will be automatically integrated for accurate determination of wine sample % alcohol.

## INSTRUMENT REGULATION AND ELECTRONIC CALIBRATION CHECK

1. Unscrew the back panel by removing the 4 screws (the ones without washers).
2. Put water in the boiling chamber, filling to line.
3. Turn switch on and start timer. Watch for the relay to activate and check elapsed time. The relay should switch from position 0 to 1 (also clicks) at 3 minutes.
4. If timing is not set at 3 minutes, adjust with a screwdriver to turn the time delay rheostat (P1 on diagram). Making the adjustment in 1/8 turn increments. Counterclockwise adjustment increases the time delay, clockwise adjustment decreases the time.
5. Repeat the adjustment until the timing falls in the range of 2.5 to 3 minutes (3 minutes being optimal).
6. After the timing is set and the relay is activated, use a voltmeter to check the AC voltage of the heating cartridge. Using the voltmeter scale at 60 V AC, connect the voltmeter probes to the screws on the cartridge wire connector pot (B2 on diagram, heating cartridge has black or pink wires). Be very careful not to cross the black or pink wire leads and to check the voltage at the screwpot rather than at the wire connection point. If a problem should occur, the fuses are located above the plug adapter on the outside back panel. This is live voltage so exercise care to protect the instrument, and yourself, from damage.
7. The voltage for stabilized readings should be between 35 and 45 Volts (measuring after the relay activates to cut back power to heating cartridge). Adjust the voltage to the equivalent of 50% power by turning the potentiometer (P2 on diagram) to the proper voltage.
8. Turn off. Drain water.
9. Verify the adjustments by running a blank sample and checking the timing and watch for excess foaming or unstable temperature readings.

