

## SCREENING DEVICE INTOXILYZER S-D2

The objective of this section is to familiarize the operator with the Intoxilyzer S-D2. The operation, calibration, and maintenance of the Intoxilyzer S-D2 are discussed.

### Principle of Operation:

The Intoxilyzer S-D2 uses an electro-chemical fuel cell. Two platinum electrodes measure the concentration of alcohol vapor in expired breath. When breath is drawn into the fuel cell, a small voltage is generated in proportion to its breath alcohol concentration. This fuel cell voltage is fed to an electronic amplifier and displayed on a digital display (liquid crystal) calibrated to read the **blood alcohol concentration** of the subject in g/100 ml, using the ratio of breath to blood concentration (2100 to 1), or grams of alcohol per 210 liters of breath.

The "Set" button serves to prepare the sampling system to accept a breath sample. It also saves on the battery by taking the fuel cell out of the circuit. The "Set" button should be depressed during storage.

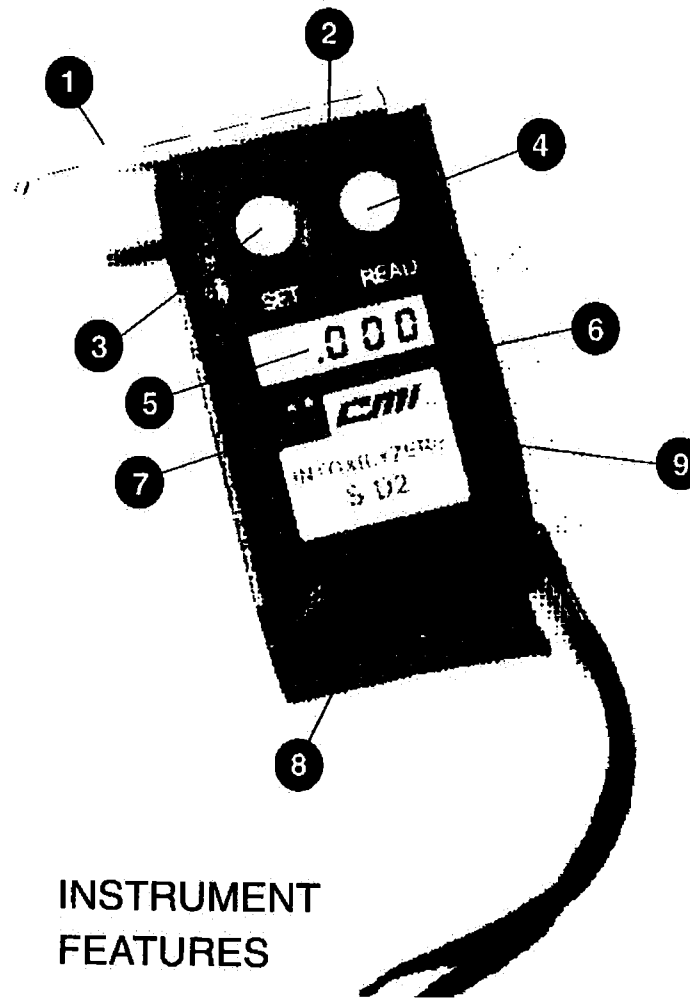
The instrument incorporates two breath-sampling lights controlled by an interlinked pressure switch and timer system. Light "A" indicates the subject is blowing hard enough to activate a pressure switch. The "**restricted**" or "**whistling**" mouthpieces are required to cause sufficient back-pressure. Light "B" indicates the individual has blown long enough to meet the preset timer requirements. This will ensure that a deep lung air sample has been analyzed.

The "Read" button has two functions. It serves to release the "Set" button and to activate the amplifier and display systems. During a test, it is depressed after the "A" and "B" lights have come on. The "Read" button should be held in until a final value is obtained.

The instrument is simple to operate and may be used as often as required providing a suitable delay allows the detector to clear the alcohol. If the previous sample is clear of alcohol, a new sample may be taken immediately. Normally, a second sample may be taken within two minutes. Following very high alcohol concentrations, the unit will require a few more minutes. Taking another breath sample, before the S-D2 is allowed to clear the alcohol, may result in an additive or higher than expected result.

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1. Mouthpiece
2. Sampling Port
3. "Set" Button
4. "Read" Button
5. Alcohol Level Display
6. Calibration Control (on Side)
7. Breath Sampling Lights
8. Battery (on Bottom)
9. Leather or Soft Case



**Explanation of the Fuel Cell Chemistry:**



Fast Reaction

Slow Reaction

**Repeated Sampling in Short Period**

**Effect**

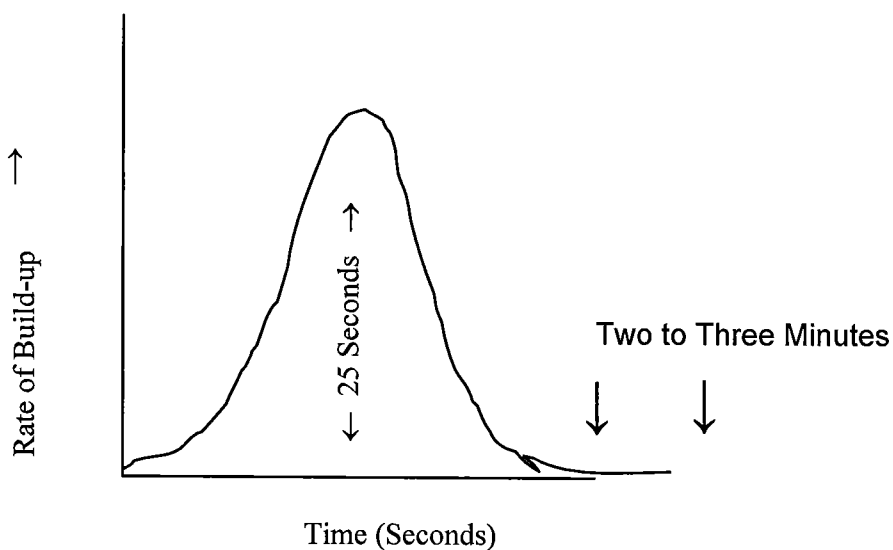
Acetic Acid Buildup

Reaction Slow-Up  
(Loss of Sensitivity)

Only With Passage of Time  
Reaction Occurs

The Fuel Cell Regains Sensitivity

Calibration should be accomplished in no more than two tries and when acetic acid has not built up. To check for acetic acid build-up, depress the "Read" button. The display should read "0.000 AC." The following figure demonstrates the build up and elimination of acetic acid and electrons.



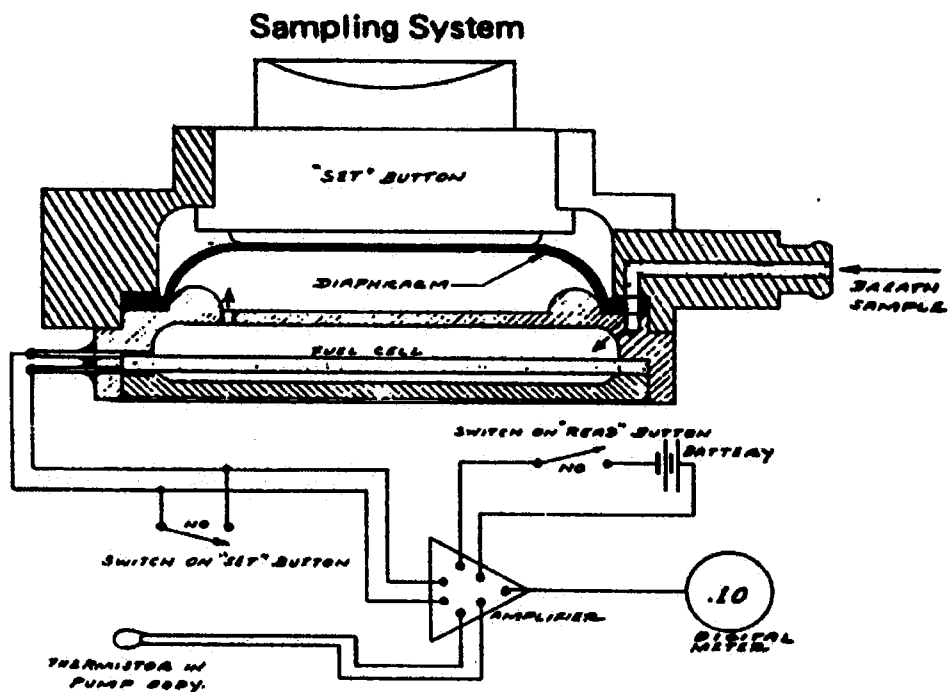
**Rate of Electron Build-Up**

## Description of Analysis:

The S-D2 contains a fuel cell sensor backed by a spring-loaded diaphragm and a sampling valve. When the valve is released, the diaphragm draws a one ml (cc) sample from the breath into the fuel cell for analysis. Alcohol in the cell reacts to form acetic acid. A signal is generated in the fuel cell proportional to alcohol concentration in the breath sample. An amplifier powered by the nine-volt, alkaline battery causes the result of the analysis to be displayed as alcohol concentration (0.###) when the "Read" button is depressed and held in.

The "Read" button operates in two stages. First, it releases the valve thus taking a sample. Secondly, when fully depressed, it switches the instrument "on" electrically.

When the "Set" button is depressed and locked in, the electric system is off. The "Set" button should be locked in to speed the chemical reaction and maximize the "burn-off" rate.



### **Operating Procedure:**

**The operator should observe the subject three minutes (prior to a screening device test) with nothing in the subject's mouth.** This will help prevent raw alcohol and smoke from damaging the detector. This time period will allow for most of the mouth alcohol to be absorbed. This deviates from the S-D2 manual instructions.

**If the subject is required to take an evidentiary test on the Intoxilyzer 5000, a full 20-minute deprivation period would be necessary. A 20-minute waiting period is only necessary for an evidentiary test (on the Intoxilyzer 5000.)**

1. Check the operating temperature (0-40° C or 32-104° F) on the side of the leather case. If any number is visible, proceed to step number 2. If a number is not visible, place the Intoxilyzer S-D2 in a warm place for approximately two minutes and recheck.
2. Depress and lock the "Set" button. After approximately two minutes, depress the "Read" button. When the display reads less than .002, proceed with the test. If not, repeat as many times as necessary.
3. Attach a clean mouthpiece. **Hold the instrument upside down to avoid introducing liquid into the sampling system.**
4. Take a sample. Instruct the subject to blow steadily into the mouthpiece for as long as possible or until told to stop. He must blow strongly enough to bring on light "A" and long enough to bring on light "B." When light "B" illuminates, press the "READ" button. Tell the subject to stop blowing. If light "B" does not illuminate, the subject has not provided a sufficient sample.
5. Observe the reading. To obtain an indication of the subject's blood alcohol concentration, continue to hold down the "READ" button and observe the display as it rises to a maximum reading.
6. Discard the mouthpiece and depress the "SET" button.

### **Interpretation of Results:**

The highest BAC displayed is the alcohol concentration of the subject. The Intoxilyzer S-D2, when properly calibrated, will read within  $\pm 10$  percent of the true value. This value is considered pre-evidentiary for the purposes of DUI, BUI, and HUI. Therefore, a blood, breath (Intoxilyzer 5000), or urine test will be necessary.

### **Diabetic Reaction (Acetone):**

**This instrument will not detect or react with acetone from the subject.** Therefore, it does not interfere with the alcohol concentration.

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**Mouth Alcohol:**

Keep in mind that mouth alcohol may give a false high level. Most of the mouth alcohol will be gone in three minutes.

**Calibration of the S-D2:**

A simulator is used to **calibrate** screening devices. **The current solution alcohol concentration is “0.11” g per 210 L vapor. The S-D2 is calibrated to “.110.”**

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## SUMMARY

### Purpose:

- Estimates the breath alcohol concentration
- Observation period
  - Three minutes

### Certification:

- Chemical Test Operators, Devices, and Instruments
  - NDCC 39-20-07 and 39-20-14
- Protect Instrument:
  - DO NOT blow smoke into devices
  - DO NOT breathe raw alcohol into devices
  - Avoid heat and direct sunlight in vehicles

### Intoxilyzer S-D2:

- Read the highest value obtained on the breath
- Contains a fuel cell detector
- Will detect other chemicals in the breath:
  - Methyl alcohol
  - Isopropyl alcohol
- Will not detect acetone
- Is temperature sensitive
  - Operating range: 0-40° C (32-104° F) (Note: The instrument will not work properly outside this temperature range.)

### Calibration:

- Calibrate with a Standard Simulator Solution
    - 0.11 g per 210 L (±5 percent)
    - Range 0.105 to 0.115 g/210 L (checking calibration only)
    - Unit should be checked once a month and calibrated as needed to ensure proper estimation of breath alcohol concentration
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## THE SIMULATOR AND STANDARD SOLUTION

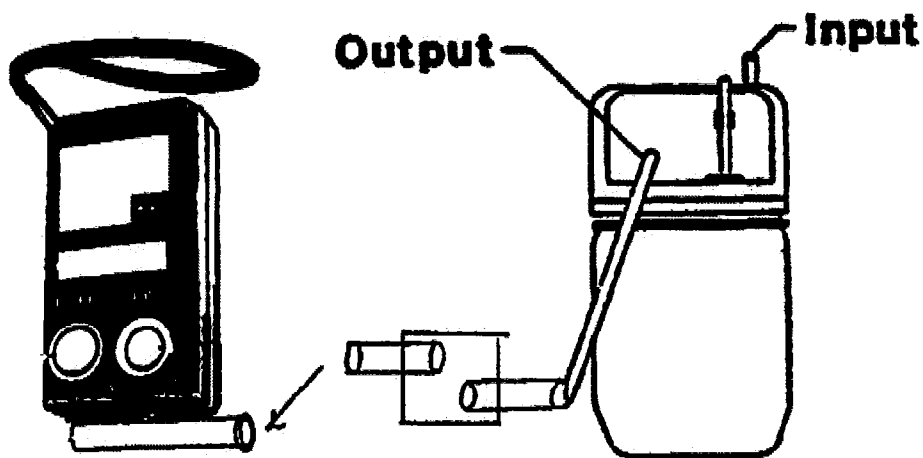
The Simulator is a specially designed, constant temperature, wet-bath instrument devised for the purpose of providing a standard alcohol vapor. The solution is provided every three months to agencies without access to an Intoxilyzer 5000.

The screening devices should be calibrated soon after the simulator solution is changed. The solutions temperature is maintained at  $34.0 \pm 0.2$  ° C. This temperature variation will not result in an unacceptable error.

Change the solution according to the directions provided below.

The Simulator should be plugged in and warmed up to operating temperature. The operator should blow through the Simulator for a few seconds before attaching the output tube to the mouthpiece of the Screening Device. This equilibrates the vapor above the solution with the proper amount of alcohol.

Below is the standard set-up for attaching the simulator to the Intoxilyzer S-D2 for performing the calibration or calibration check. **Note: The Intoxilyzer S-D2 is held UPSIDE DOWN to prevent fluid from the Simulator entering the sample chamber of the S-D2.**



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### WARNING

To avoid filling the sample chamber with water, be careful not to connect the input port of the simulator to the Intoxilyzer S-D2.

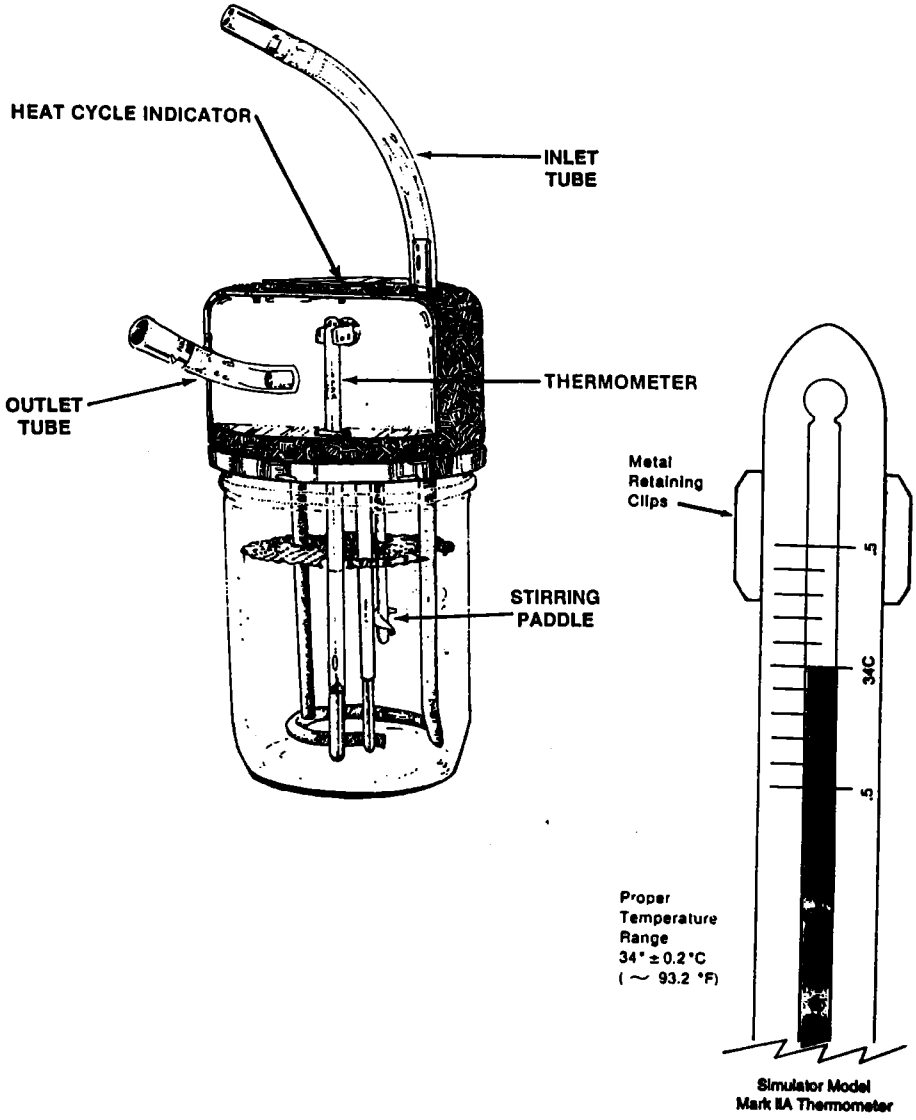
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**Model Mark IIA Simulator:**

The Mark IIA Simulators are used for calibrating the S-D2 instruments. The outlet tube is connected to the mouthpiece on the S-D2.



### **Calibration:**

Using the simulator solution sent by the Toxicology Section, plug in the simulator and allow the simulator to reach the correct temperature ( $34.0^{\circ} \pm 0.2^{\circ} \text{ C}$ ).

Check the simulator for proper operation and leaks.

If the calibration screw is not accessible through the leather case, remove the wrist strap and take the Intoxilyzer S-D2 out of the leather carrying case.

Turn the calibration screw a half turn counterclockwise.

Depress the "Read" button for ten seconds and note the alcohol concentration of less than .002 AC. If not, depress the "Set" button. Wait approximately two minutes. Repeat this step until the AC is less than .002.

Attach a mouthpiece and connect the simulator and Intoxilyzer S-D2 mouthpiece together. Blow simulator solution through the mouthpiece and observe the "A" and "B" lights. Blow the solution hard enough to illuminate the "A" light and long enough to illuminate the "B" light. When the "B" light illuminates, depress the "Read" button and continue to hold it in.

Observe the display. Immediately after the introduction of a good sample, the numbers on the display should increase rapidly. Within a few seconds, the numbers will slow and eventually stop increasing. Approximately three or four seconds later, the numbers will begin to decrease. Prior to this decrease, the calibration screw must be adjusted so the instrument displays the expected alcohol concentration (0.110). If the displayed value is too high, the screw should be turned clockwise. If too low, the screw should be turned counterclockwise. If the displayed numbers begin to decrease before this adjustment is made, calibration should be attempted again by repeating steps four through seven.

Return the S-D2 to the carrying case and attach the wrist strap, if necessary.

### **Maintenance:**

**It is recommended that the unit be checked for calibration, once a month, and recalibrated if necessary.** Operators should run a calibration check to assure accuracy in testing. To do this, a test of a new simulator standard should be run. If the value obtained is more than five percent higher or lower, the unit should be recalibrated using the above procedure.

**Example:** A simulator solution of 0.11 percent should read from 0.105 - 0.115 AC.

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If the Intoxilyzer S-D2 shows any of the following, you should contact the Toxicology Section or a Field Inspector for troubleshooting and repair (please enclose a note detailing the problem):

1. Fails to zero properly (.000 to .001 AC).
2. Fails to recalibrate.
3. Fails to accept a sufficient sample.
4. Fails to illuminate the display, light "A" or light "B."

**Battery:**

**Other than recalibrating the device, changing the battery is the only maintenance that should be done by chemical test operators.**

If while depressing the "Read" button, "L0.00" is displayed, the battery voltage is low and must be replaced. This will occur when the voltage falls to  $7 \pm 0.5$  volts. The operator should replace the battery with a nine-volt, alkaline battery. **Do not use rechargeable batteries.** After replacing the battery, the Intoxilyzer S-D2 should be checked and recalibrated, if necessary.

**Mouthpieces:**

The S-D2 requires "restricted" mouthpieces. They may be ordered over the phone from the Toxicology Lab. Be sure to mention that you need "restricted" mouthpieces for the Intoxilyzer S-D2.

**Temperature:**

The S-D2 should be kept out of direct sunlight and at room temperature. Extreme heat inside motor vehicles may damage the instrument. Cold temperatures may require warming the S-D2 prior to use. As a general rule, use the S-D2 in a temperature-controlled vehicle.

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Ref.: Lion Alcolmeter™ S-D2 Operating Instruction Manual, Lion Laboratories, P.C.; Barry, South Glamorgan; Wales, United Kingdom; 1995; and the Intoxilyzer S-D2, Service Manual, Breath Alcohol Testing Instrument; CMI, Inc., Owensboro, KY, 1996.

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## APPROVED METHOD FOR OPERATING THE INTOXILYZER S-D2

July 1, 2006

### SCREENING TESTS

The following device and method are approved to conduct onsite screening tests under sections 20.1-15-15 and 39-20-14 of the North Dakota Century Code for the purpose of estimating the alcohol content of a person's blood.

### DEVICE

The INTOXILYZER S-D2, manufactured by Lion Laboratories, P.C.; Barry, South Glamorgan, Wales, United Kingdom; is approved for the administration of onsite screening tests to estimate the alcohol content of a person's blood.

### APPROVED METHOD FOR OPERATING THE INTOXILYZER S-D2

1. Ascertain that the subject has nothing to eat, drink, or smoke within three minutes prior to the subject providing a breath sample.
2. Check the operating temperature (0-40°C) on the side of the leather case. If any number is visible, proceed to step number 3. If a number is not visible, place the INTOXILYZER S-D2 in a pocket close to your body for approximately two minutes and recheck.
3. Press the 'Read' button for approximately 10 seconds. The display should read less than 0.002. If a higher reading is shown, depress and lock the 'Set' button and place the INTOXILYZER S-D2 in a pocket close to your body for approximately two minutes and repeat step number 3.
4. Depress and lock the 'Set' button.
5. Attach a mouthpiece.
6. Instruct the subject to blow steadily into the mouthpiece for as long as possible or until told to stop. The subject must blow strong enough to bring on Light A and long enough to bring on Light B. When Light B illuminates, press the 'READ' button. Tell the subject to stop blowing. If Light B does not illuminate, the subject has not provided a satisfactory sample. The operator may ask the subject to repeat blowing into the mouthpiece.
7. Continue to hold down the 'READ' button and observe the display. The maximum reading is the correct estimate of the subject's alcohol concentration.
8. Discard the mouthpiece and depress the 'SET' button.

A test administered according to the operating procedure or the Insert in the leather case of the INTOXILYZER S-D2 device, shall be deemed to be in accordance with the Approved Method.

*Margaret Anderson*  
1 July 2006