

Guth Laboratories, Inc. MODEL 2100 SIMULATOR OPERATION MANUAL



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PRICE \$5.00

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INTRODUCTION

The Guth Model 2100 Alcohol Breath Simulator is a State-of-the-Art, electronically temperature controlled, water-alcohol instrument for the purpose of providing a precise calibration standard. Temperature of the water-alcohol solution placed in the simulator is maintained at $34^{\circ}C \pm .05^{\circ}C$ or better.

The Guth Model 2100 Simulator is approved by the National Highway Traffic Safety Administration (NHTSA), published on their Conforming Products List (CPL), and is listed with Underwriters Laboratories, Inc. (UL), as meeting United States Safety Standards and Canadian Safety Standards (CUL).

CERTIFIED* SIMULATOR SOLUTION STANDARD

PLEASE NOTE: It is imperative your Simulator Solution be of the highest quality in order to acquire the scientific and legal standards of acceptance.

To establish a precise and accurate calibration standard when using a Guth simulator, GUTH LABORATORIES, INC. recommends using Guth Certified Simulator Solution. Guth Laboratories, Inc., a pioneer and leader in the science of alcohol breath testing, has provided Certified Simulator Solution to state, municipal, and local law enforcement agencies for many years.

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Guth Premixed Certified Simulator Solution is the only solution available which is prepared by a FDA / DEA Registered Laboratory.

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Guth Certified Simulator Solutions are prepared in standard concentrations of .02%, .04%, .05%, .08%, .10%, .15% and .20%. Other special concentrations are available. Please contact Guth Laboratories, Inc. for availability and pricing:

Toll free: (800) 233-2338 Fax: (717) 564-2555

or visit our web site at: www.guthlabs.com

STORAGE: Store Simulator Solution in a cool location. Do not place solution in a freezer – **DO NOT REFRIGERATE SIMULATOR.**

*Guth Certified Simulator Solutions are tested by recognized laboratories.

EXCLUSIVE FEATURES OF THE MODEL 2100 SIMULATOR

- MICROPROCESSOR CONTROLLED: Mercury column is eliminated.
- TEMPERATURE SENSOR: The Model 2100 incorporates a high precision temperature sensor.
- Maintains a precise temperature of $34^{\circ} \text{ C} \pm .05^{\circ} \text{ C}$ or better.
- Will not heat if temperature sensor is defective (shorted or open).
- GUTH LABORATORY GLASS CONTAINER: Graduated 500ml <u>+</u>5%.
- NON-MAGNETIC METAL TOP HOUSING ASSEMBLY: Provides uniform headspace heating.
- POWER SWITCH: Safety On/Off Double pole, double throw (DPDT).
- ELECTRICALLY ISOLATED: Internal power transformer and optically isolated control components prevent AC leakage.
- FUSE: External fuse provides protection in the event of an electrical malfunction.
- HIGH INTENSITY LED DISPLAY: Provides maximum visibility of temperature and heater activity.
- RELIABLE AGITATOR MOTOR.
- AGITATOR PADDLE: Designed by Guth Laboratories, Inc. Offers maximum circulation and uniformity of solution.
- HEATER ELEMENT: Electronically protected from overheating when removed from solution or when temperature sensor is defective.
- RFI PROTECTED: The heating element and motor will turn off when the simulator is subjected to a RF field of 10 volts/meter or greater.
- INTERNAL DIAGNOSTICS: Simulator computer performs internal diagnostics.
- MALFUNCTION INDICATION: Simulator provides an audible and visual indication if a malfunction occurs.
- POWER: 120 volts AC 60 Hz.
- RS-232 COMMUNICATIONS: Provides the ability to monitor the temperature and status of the simulator.

• OPTIONAL: SERIALIZED NIST REFERENCE MERCURY-IN-GLASS THERMOMETER FOR CALIBRATION CHECKS.

GUTH MODEL 2100 SIMULATOR



MODEL 2100 REAR VIEW



INSTRUCTIONS FOR USE OF THE GUTH MODEL 2100 ALCOHOL BREATH SIMULATOR:

- 1. Add tubing and connector to the simulator.
- 2. Remove the glass container from the simulator top housing.
- Pour 500 ml of Certified Simulator Solution into the simulator container. The Guth laboratory glass container has a 500 ml <u>+</u> 5% fill mark. The solution should never be less than 500 ml prior to inserting the top housing.
- 4. Reassemble the simulator with the glass container. Be sure the container is properly seated to the top housing **DO NOT OVERTIGHTEN**.
- 5. Turn the power ON. The simulator will alarm once and the display will completely illuminate as shown in figure 1. This indicates the display is functioning properly.



Figure 1

6. The L.E.D. test display in figure 1 will remain for approximately one second and then change to the COLD display as shown in figure 2.



Figure 2

- 7. Scanning of the decimal dots across the bottom of the display indicates the simulator is heating.
- 8. When the solution reaches 33.6°C, the display will indicate the actual temperature. As the simulator controls the temperature, the last decimal point of the display will pulse indicating proper operation.
- 9. When 34.0°c has been obtained (as shown in Figure 3), the heater indicator will pulse less frequently. It is normal for the simulator to display the temperatures of 34.0c and 33.9c. The simulator is controlling the temperature properly.



- 10. Allow approximately fifteen minutes for the simulator to stabilize.
- 11. After the simulator is stabilized, it is ready for use (See diagram):



When manually operating the simulator, take a deep breath and blow into the mouthpiece for a 4 to 7 second duration.

The blowing technique should imitate a person providing a breath sample into the breath test simulator. After the breath test sample is introduced into the breath analyzer, the breath analyzer performs the analysis and provides a final result.

The following alternative means also fulfill the requirement of providing air through the tubing attached to the simulator: a simulator bellows pump, a pump-powered air source, or an atomizer. Several models of pumps are available through Guth Laboratories.

If a low reading is obtained, check all tubing for leaks. Be sure the glass container is properly tightened to the metal top housing. Loosen and re-tighten the laboratory glass container. **DO NOT OVERTIGHTEN.** Repeat the testing procedure.

IF THE SIMULATOR DOES NOT HEAT TO 34°C and you have purchased the OPTIONAL calibration thermometer:

Check the temperature with the NIST Reference Thermometer (if not available see page 9 ("**RETURNING A SIMULATOR**"). Remove the chrome cap from the fitting located on the center of the simulator. Carefully insert the NIST thermometer into this port.

If the NIST thermometer does not indicate a temperature of $34^{\circ}C \pm .15^{\circ}C$, inspect the thermometer for mercury separation.

- 1) If there is no separation, return the unit to Guth Laboratories, Inc. (See instructions page 9).
- 2) If there is a separation...Try another NIST thermometer (or) follow the instructions for rejoining a mercury separation.

CAUTION: If a mercury thermometer is accidentally broken, be very careful. Mercury is poisonous.. **DO NOT** allow direct contact with skin or mouth! Use rubber gloves to clean any spill.

INSTRUCTIONS FOR REJOINING MERCURY SEPARATIONS IN GLASS THERMOMETERS

All Guth precision thermometers are sealed under extremely high nitrogen pressure while drawing the mercury into the lower portion of the capillary. This process, when coupled with acid washed tubing and triple distilled mercury, although costly, greatly reduces the frequency of separations in the capillary portion of the thermometer.

Many instructions for rejoining separations begin with "the mercury may be retracted into the bulb by immersing it in a suitable mixture of dry ice and alcohol..." This statement is NOT specific enough. Determine the type of separation from the illustrations provided and proceed according to these instructions.

SEPARATION AT THE UPPER PORTION OF MERCURY COLUMN



All well constructed thermometers contain an expansion chamber or bubble at the extreme top of the capillary. This chamber serves a twofold purpose; one, to accommodate an overflow of mercury when the thermometer is subjected to temperatures in excess of its scale range and two, as a means of rejoining this type of separation.

With the thermometer in a vertical position, slowly heat the bulb under WARM tap water until the separated segments and a portion of the main (intact) column enter the top chamber. (Extreme care must be taken to insure that the mercury does NOT fill more than HALF to THREE-QUARTERS of the chamber volume; **otherwise, breakage of the bulb will result**). The nitrogen pressure will force a rejoining of the mercury. While positioning the thermometer vertically, examine the column as it cools and retracts to be sure it is intact.

SEPARATION IN THE CONTRACTION CHAMBER



Separation of mercury in the contraction chamber is an entirely different problem. Many thermometers contain scale ranges which begin well above ambient temperatures. These thermometers are provided with a contraction chamber or enlargement which prevents the mercury from entering the bulb at ambient temperatures. Unusual handling of the themometer may cause a separation in the contraction chamber.

The procedure to rejoin this mercury is relatively simple. If the separated mercury is in the form of a very slight amount, invert the thermometer and tap gently against the palm of the hand. *(It is recommended that protection be used in the palm of the hand - paper towel, cloth, etc. against glass breakage.)* This will cause a greater separation, adding volume and weight to the separated portion. The thermometer should then be righted and gripped firmly in the hand with bulb outward. Sharply swing the thermometer downward at one's side in a 270 to 180 degree arc. The centrifugal force thus generated will join the separated mercury to the main portion. If the original separation contained a large volume, only the latter step of swinging the thermometer downward need be followed.

SEPARATION IN THE LOWER AND MIDDLE PORTION OF THE COLUMN



Separations of this type are less frequent and more difficult to repair. There are more variables, and no one explanation will cover all types of thermometers.

The general procedure is to subject the bulb only to a temperature (in an ice bath or freezer) sufficient to retract all the mercury into the bulb. A slow and careful return to ambient temperature will return an intact column. Our experience has shown that additional problems may be caused in these procedures, and we point out the following cautions:

Allow thermometer to return to ambient or room air slowly, or breakage may occur. This breakage is caused by mercury thawing in the capillary more slowly than the mercury in the bulb thereby creating an impasse to the expanding mercury. In order to avoid this breakage, extreme care must be taken to allow the mercury in the bulb to liquify at the same rate as the mercury in the capillary.

Position the thermometer vertically and allow it to return to ambient temperatures. Extreme care must be taken to insure the thermometer is not jarred or at the slightest angle while the nitrogen gas and the mercury return into the capillary. If this care is not taken, mercury will enter the capillary prior to the gas. This will cause gas bubbles to develop in the bulb and, in turn, cause considerable inaccuracy which may be undetectable when the thermometer is placed into use.

RETURNING A SIMULATOR:

If you have been unsuccessful in reuniting the mercury column, or repairing the simulator in the field, please call our Product Service Department for assistance or a RMA (Return Material Authorization) number.

GUTH LABORATORIES, INC. 590 NORTH 67th STREET HARRISBURG, PA 17111-4511 (717) 564-5470 or (800) 233-2338

<u>NOTE:</u> When returning the simulator, it is imperative the laboratory glass container is attached. This is necessary to protect critical parts of the simulator. Remove the glass container, empty contents, dry thoroughly, and replace container. Carefully wrap the simulator in bubble wrap, newspaper, paper towels, etc. Package the simulator well placing packing material UNDER, AROUND, and ABOVE the simulator. Insure your package for \$600.00 per simulator.

IF THE SIMULATOR DISPLAYS AN ERROR:

The Model 2100 provides internal diagnostics checking for several conditions which prevent the simulator from maintaining the correct temperature. When a condition or malfunction occurs, the simulator will deactivate the heater and the agitator motor. The simulator will alarm indicating a malfunction and display the error code. This will continue until the malfunction is corrected or the simulator is reset.

RESETTING THE SIMULATOR

Turning the power off and on will reset the simulator.

ERROR CODES

The following list of error codes indicate the cause and corrective action:



REMEDY: Turn the simulator off. reassemble top housing and container.

No solution in container or simulator power has been turned on with top housing not attached to the container.

Fill container with 500 ml of certified solution and



The temperature sensor is open or the sensor is shorted. The computer is receiving no signal to allow it to control the temperature.

REMEDY: Cannot be remedied in the field. Requires service*



Electronics need to be reset.

REMEDY: Turn "off" - wait 3-5 seconds, then turn "on".



The temperature of the solution is above 34.2°C or radio frequency interference (RFI) has been detected.

REMEDY: Turn the simulator off and allow solution to cool. Turn the simulator on. If the condition continues to occur, simulator requires service*.

Remove the source of radio interference or change location of the simulator. Reset the simulator.



Electronics need to be reset.

REMEDY: Turn "off" - wait 3-5 seconds, then turn "on".



Excessive amount of time to obtain operating temperature (longer than 15 minutes). The heating element may be open or the solution was too cold.

REMEDY: Reset the electronics. (Turn "off" for 3-5 seconds, then turn "on".) If the simulator does not heat, the heating element may be defective. Requires service*



The temperature of the solution is below 33.8° C after it has initially obtained 34.0° C.

REMEDY: Turn off the simulator and turn on. If the simulator does not heat, the heating element may be defective. Requires service*

*REQUIRES SERVICE - Simulator must be repaired by a Guth certified technician or returned to Guth Laboratories, Inc. (Seeinstructions on page 9.)



MODEL 2100 - BLOCK DIAGRAM

RECORDS (SERIAL NUMBERS, CALIBRATION AND NOTES)

NIST TRACEABLE THERMOMETER – SERIAL NUMBER_____

CERTIFIED BY_____DATE_____

TEST TEMPERATURE ℃ NIST TRUE TEMPERATURE ℃

MODEL 2100 - SERIAL NUMBER_____

CALIBRATION CHECK DATE	CHECKED BY

NOTE: Only a Guth Laboratories, Inc. certified technician shall perform Field calibration.

<u>UNDERWRITERS LABORATORIES, INC.</u> <u>UL SYMBOLS AND WARNINGS</u>



Power: 120 VAC 60Hz., 77 watts

Mains supply fluctuation not to exceed ±10% of the nominal voltage.

Do not position instrument so that it is difficult to disconnect the power cord.

Disconnect power cord and empty solution before moving instrument.

Disconnect power cord before changing solution.

Disconnect power cord before replacing fuse.

Fuse Replacement: Buss type GMW 1 amp @ 125 vac Fast Acting

Indoor Use Only

Altitude up to 2000m (6562 ft.)

Temperature 5°C to 33°C (41°F to 91°F)

Maximum Relative Humidity 80% for Temperatures up to 31°C (~88°F), decreasing linearly to 50% Relative Humidity.

Transient Over voltages according to Installation Category II.

Pollution Degree 2 in accordance with IEC 664.



When Instrument is operated at an elevated temperature, the outside of the glass container may become hot.