

TRAINING OUTLINE

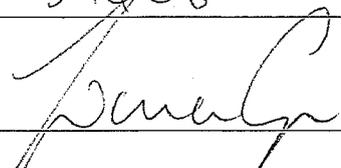
for

BAC DATAMASTER

INFRARED BREATH TEST INSTRUMENT

BASIC INSTRUCTOR

Date Approved: 3-14-08

Approved By: 

Fiona Couper, Ph.D.
Washington State Toxicologist

Prepared By

Washington State Patrol Breath Test Program

LESSON PLAN

BASIC INSTRUCTOR COURSE FOR DATAMASTER INSTRUMENT

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Prepared by the Breath Test Section

To be presented in 16 hours.

INSTRUCTIONAL OBJECTIVES:

1. The student will have a thorough understanding of the Datamaster program.
2. The student will understand the basic principles of infrared spectroscopy as it relates to the Datamaster.
3. The student will understand the basics of the Beer/Lambert Law.
4. The student will understand where infrared energy fits in the whole electromagnetic spectrum.
5. The student will understand the basic relationship between infrared energy and its absorption by ethanol.
6. The student will know the basic nomenclature of the Datamaster.
7. The student will be familiar with the "Error Message" codes and what they mean.
8. The student will understand how the Datamaster evaluates the presence of acetone.
9. The student will understand how the Datamaster evaluates for the presence of mouth alcohol.
10. The student will be familiar with the data entry questions and their meaning.
11. The student will be familiar with the steps of instrument operation and its purpose.
12. The student will know how to compute the $\pm 10\%$ between two breath tests.
13. The student will be able to explain the breath sampling parameters used in the instrument.

14. The student will know the importance and meaning of the external standard.
15. The student will know the importance of the simulator temperature and how to properly read, report, and instruct in this regard.
16. The student will be knowledgeable of the legal aspects of breath testing to include: Statutes, WAC's, Case Law.
17. The student will know the purpose and operation of the Supervisory Control Panel.
18. The student will be aware of common troubleshooting problems as they relate to operation.
19. The student will be able to teach the entire outlines used in the Basic and Refresher Operator Classes.
20. The student will be thoroughly familiar with the exams given in the Basic and Refresher Operator Classes and be able to discuss them.
21. The student will know how to conduct a Basic 16 hour class.
22. The student will know how to conduct a Refresher 4 hour class.
23. The student will be familiar with the training record keeping system.
24. The student will pass an examination with 80% and be qualified as a Datamaster Instructor.

I. INTRODUCTION

- A. This unit of instruction is designed to make you competent Infrared Breath Test Instructors by giving you a better understanding of the Datamaster instrument.
- B. Class Handouts:
 - 1. Basic Operator outline/exam.
 - 2. Operator Refresher outline/exam.
 - 3. Data entry questions, set key operations, F1 key functions, key board password, diagnostic check functions.
 - 4. Prepared overhead transparencies.

II. LEGAL ASPECTS

- A. DUI law, minor law, commercial driver's act.
- B. Implied Consent law.
- C. Case law.

III. NOMENCLATURE

- A. Heated Breath Tube.
 - 1. Heated so it is warm/hot to the touch. Apx. 50°C but not a required temperature.
 - 2. Heated to prevent condensation from forming in the tube.
 - 3. Loss of heat has no apparent effect on the breath tests results but could cause 'Ambient Fail'.
- B. Five-Way Valve.

1. Directs the vapor flow path for the simulator and breath samples into the sample chamber at the appropriate times.

C. Sample Chamber.

1. The IR path is 1.1 meters long through the use of mirrors and is said to be 'folded'.
2. It's heat range is 48°C - 52°C inclusive. If the temperature is outside this range the instrument will display a message.
3. The sample chamber holds 50 ml's. As air is blown through the chamber the excess air is vented through a one-way valve, not a closed system. When there is no more flow the air in the chamber becomes static and that's when the last three quarter second measurements are taken and averaged for that samples reading.
4. Infrared light source located at one end with the detector located at the far end.

D. Filters.

1. Alcohol and Interference filters narrow the infrared energy to two wavelengths. 3.37 and 3.44 microns.
2. Quartz standard/plate (Internal Standard) ensures that the instrument is working properly by checking the value received with a value which is stored into memory during calibration.

E. Detector.

1. Is made from a photosensitive material.
2. Reads the amount of infrared energy which is transmitted through the sample chamber.

IV. CHEMICAL PRINCIPLES

- A. The Datamaster is a forensic breath testing instrument which uses infrared spectroscopy to measure breath alcohol.

- B. Infrared spectroscopy is an analytical technique used to quantify the interaction between infrared light and organic molecules.
1. Organic molecules are those which contain carbon.
 2. Infrared describes a particular range of electromagnetic radiation.
 3. Wavelength and energy are inversely related, as the wavelength increases energy decreases.
- C. Ethanol molecules consist of six hydrogen, two carbon, and one oxygen atom arranged in a fixed order.
- D. When a molecule is exposed to infrared light the bonds between the atoms will oscillate-vibrate in a regular way. This phenomenon is known as absorbance.
1. This is dependant on the wavelength of infrared energy.
 2. A graph of absorbance versus wavelength is known as the infrared spectrum.
 3. Not all wavelengths of infrared are equally absorbed by a chemical substance.
- E. Absorbance is directly proportional to concentration (Beer/Lambert Law)
1. Datamaster relates absorbance to transmittance.

V. STEPS OF OPERATION

- A. After the operator has completed the 15 min. observation period and has pushed RUN, answered the 15 data questions plus Review Data Y/N?, the instrument will display 'Purging'.
1. Room air is being drawn through the breath tube into the sample chamber and being vented out of the one-way valve.
 2. Ensures that the sample chamber is clear of any alcohol from a previous test.
- B. Instrument displays 'Ambient Zeroing'.
1. If any atmospheric alcohol is present the instrument will set that to zero.

C. 'Blank Test'.

1. Instrument checks the sample chamber for contaminants.

D. 'Internal Standard'.

1. The quartz plate is pulled into the path of the infrared light and the value is checked against that at the time of calibration.

E. Instrument asks for subject sample. Sample is provided.

1. Lung capacity varies from individual to individual, 1 to 5L, approximately 2100ml for women and 2900 ml for men.
2. An end expiratory breath is ensured by sample acceptance parameters. BrAC versus time curve (BrAC measured ever 1/4 second), measures breath flow rate, time(min. 5 seconds), and volume minimum of 1.5 L.
3. If mouth alcohol is present the BrAC curve will peak sharply and then decline to actual deep lung BrAC. This produces a negative slope which the instrument measures and displays 'Invalid Sample'.
4. If the subject is unable (or unwilling) to provide an adequate sample within 2 minutes the instrument will ask if the subject is refusing the test. If 'N' is indicated or nothing is entered at all the test is ended and an 'Incomplete' is printed on the evidence document/ticket.

F. Alcohol molecules in the breath sample absorb the infrared light in proportion to the amount of alcohol in the sample.

1. This is a direct measurement of the amount of alcohol in the breath.
2. Instrument uses two wavelengths of infrared light to achieve specificity for breath alcohol. Other organic compounds absorb at these wavelengths but no compound found in human breath will have the same ratio at these wavelengths as ethanol.
3. If the absorption ratio falls outside of these specifications the display will indicate the presence of an interferant.

- G. Infrared energy which is transmitted through the sample will be detected and measured by the detector.
1. The detector converts the infrared energy to electrical energy.
- H. Electrical energy is sent to the central processing unit.
1. A-D convertor converts the electrical energy (analog in form) to digital form for the micro-processing.
 2. Digital signals placed into formula which calculates the amount of alcohol per 210L of breath. These results are displayed on the screen, sent to the printer memory and stored in the memory.
- I. 'Analyzing' appears after alcohol has been introduced into the chamber.
- J. Then 'Purging' appears again.
1. If the instrument cannot purge down to within .003 of original value during the first purge then 'System Won't Zero' is displayed and the test aborted.
 2. Instrument runs purge - blank test four times during the testing procedure. Before and after each sample.
- K. Instrument runs 'External Standard'.
1. External Standard test is independent check on operation and calibration of instrument.
 2. Temperature must be $34^{\circ}\text{C} \pm .2^{\circ}\text{C}$ and its value must fall between .090 and .110 g/210L inclusive. Emphasize that the operator visually checks the thermometer at the time they answer the question through the keyboard.
 3. The scale on the thermometer must be thoroughly understood and the units clearly reported: $34^{\circ}\text{C} \pm .2^{\circ}\text{C}$

Note: The simulator uses a mercury thermometer to measure the temperature. If the thermometer is broken there is a risk of mercury poisoning. A WSP technician must be notified immediately if this happens. Point out to operators the sections of code book: General Information and Emergency Information.

4. The solutions are made by the State Toxicology Laboratory, are assigned a batch number and have affidavits sent with them.
 5. Instrument pumps air through simulator and samples headspace (vapor above solution). A known air-water partition ratio exists in the headspace (Henry's Law). Once the sample enters the sample chamber its alcohol content is determined in exactly the same way as the subject sample.
- L. Instrument analyzes, then purges the chamber and is ready for second subject sample. After the final blank test the evidence document is printed out.

VI. SUPERVISORY CONTROL PANEL

A. Nomenclature.

1. SET - used to view the options under which a Datamaster is operating. When the option has been reached press ADV key to change the option.
2. F1 - allows you access to nine functions and to initiate them press F2.
3. SUP - initiates a supervisory test. This test allows you to check the value of a simulator solution or purge the sample chamber depending on what is connected to the simulator ports.
4. TST - allows you to run a diagnostic check, which tests the mechanical and computer function, and the calibration.
5. MTR - allows you to check the detector voltage.
6. NV - allows you to by-pass sampling parameters.
7. ABT - allows you to abort any test currently being performed by the Datamaster. **Do Not Press This Button During 'Ambient Zeroing'.**
8. CLR - used to clear the display and return it to a flashing READY - PUSH RUN.
9. CPY - used to retrieve a copy of the last test performed, as long as none of the following have occurred: RUN button pushed, power outage, ABT pushed, TST pushed.
10. CAL - on older instruments, used to calibrate the instrument. **Do Not Push This Button.**

B. Instrument option settings for a practical instruction class.

1. Ensure that the time and date are correct when the instruments are powered on.
2. Press F1 so that the display reads 'Reset Options' then push F2 to have to options reset for a breath test.
3. Use the SET and ADV keys to set the supervisory tests to 1. With the new software for '94 series it resets automatically.
4. Use the SET and ADV keys to set the data collection to OFF.
5. CRC/RAM ERROR at - - - is displayed, press CLR.

VII. TROUBLESHOOTING

A. 'Ambient Fail', 'System Won't Zero'

1. If messages appear on the display, restart the test.
2. If occurs again, run SUP test without simulator attached.
3. Purge until external standard readout is .000.
4. To avoid this problem purge the instruments between classes and blow the moisture out of the simulator tubing.
5. If there is a recurring problem contact a Technician.

B: Printer problems and ticket problems.

1. If a ticket does not feed out properly check to see if the operator has inserted it properly. Push CPY to get a copy of the last test.
2. If the instrument does not ask for the ticket let the test time out and then insert the ticket before pushing RUN. This will occur when the operator pulls the ticket out of the printer prematurely or there is a power failure.
3. No printing on ticket - the ribbon may be worn or out of its track. Call a technician.

4. Ticket does not feed into printer. Check to see if the ticket has been pushed underneath the printer mouth.
- C. 'Invalid Sample'
1. Operator may be blowing too hard. Moderate, long flow wanted.
 2. If this is a recurring problem, call a technician.
- D. 'Radio Interference'
1. Check that no one is transmitting on a radio, and restart the test.
- E. 'Calibration Error'
1. If it appears it is often the traveling arm that hold the quartz that is sticking. Restart the test again.
- F. Data collection not working or display reads 'eLe ek04'.
1. Press F1 so that display reads 'Clear Memory'. Push F2 to execute.
 2. Use SET and ADV keys to turn off data collection.
- G. If any of the following messages are displayed the instrument will not function. Call a technician.
1. Fatal System Error.
 2. RAM/CRC Error.
 3. Not Calibrated.
 4. Temperature High or Low.
 5. Pump Error.
 6. Blank Error.
 7. Data Memory Battery Low.

VIII. PRACTICAL

- A. Review lesson plan for conducting a Basic Operator course.
- B. Review lesson plan for conducting an Operator Refresher course.
- C. Review all handouts.
- D. Review Operator Exams in detail.
- E. Assign each student a section of the lesson plan for conducting a course of instruction in Infrared Breath Test Refresher training to teach in front of this class. (apx. 20 min. each.)
- F. Critique each student and allow the class to comment.

IX. ODDS AND ENDS

- A. Have a legible class roster completed for each operator class instructed. Rosters should be sent to the Seattle Breath Test Section, or to your local technician for entry into the training system. The original is then sent to the State Toxicology Lab.
- B. Basic Operator and Refresher students must obtain 80% on their exams to pass.
- C. Be sure each student conducts an acceptable practical test on the Datamaster.
- D. Operator cards are valid for 3 years. There is a 90 day grace period but let operators know that they should not count on a refresher class being available during their grace period, so do not WAIT.

X. WRITTEN EXAMINATION

- A. Must obtain 80% on the instructor exam.
- B. If fail to make 80%, a review shall be conducted and the test retaken.