MISSOURI BREATH ALCOHOL PROGRAM

BREATH ALCOHOL OPERATOR MANUAL

This manual is provided for information purposes. Memorization is not required for certification. It is revised as necessary.

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Note: Each section is individually numbered.
ETHANOL

Ethanol is classified as an alcohol. Alcohol is the generic name for any chemical compound with a hydroxyl (-OH) functional group bound to a carbon atom of an alkyl group. There are many different types of alcohols and each has a unique molecular structure with specific chemical properties associated with that structure. Three of the most common simple alcohols are methanol (methyl alcohol), ethanol (ethyl alcohol), and isopropanol (isopropyl alcohol).

Ethanol is the type of alcohol in alcoholic beverages. It is also referred to as ethyl alcohol, grain alcohol, spirits, or simply alcohol. Throughout this text, the terms alcohol, ethyl alcohol, and ethanol will be used interchangeably. Regardless of the term used, ethanol is a drug that affects human behavior and performance.

All alcohols are toxic. The reason ethyl alcohol is used in alcoholic beverages is that it is not as toxic as other alcohols.

At room temperature ethyl alcohol is a clear, colorless liquid that has a slight odor and is miscible with water. Miscible means the alcohol and water will mix in all proportions. Ethanol is used as a solvent, an antiseptic, or as an additive in certain fuels. Alcohol is found in some medications and mouthwashes. Regardless of the source - whiskey or cold medication - the effects of the same amount of alcohol on the human body are the same.
ALCOHOLIC BEVERAGES

Alcohol can be produced naturally through the process of fermentation or synthetically through industrial means. However, only alcohol produced through fermentation may be sold for human consumption. Production of alcoholic beverages always begins with the process of fermentation.

Fermentation is the procedure by which yeast consume sugar or starch, and in turn, excrete ethanol. Beer and wine are produced through this process. The maximum alcohol concentration produced by this method is about 12-15% because any higher alcohol concentration kills the yeast.

In order to manufacture a beverage with a higher alcohol content (e.g. rum, vodka, gin, and whiskey), the alcohol mixture produced from fermentation must be distilled. Distillation is the controlled vaporization and collection of a substance, in this case ethyl alcohol. This process concentrates the ethanol so that the final product has a concentration higher than the original fermented mixture.

For alcoholic beverages, ethyl alcohol and water account for the vast majority of the beverage. The remaining components in an alcoholic beverage are referred to, collectively, as congeners. Congeners are responsible for the various tastes, aromas, and colors associated with a particular alcoholic beverage. Some congeners come from the primary plant material used in the fermentation mixture, while others are due to the addition of other components during the fermentation process. For example, tequila is made from the agave plant; gin is made from grain and flavored with the juniper berry. Sometimes congeners are also introduced during the aging process, such as during contact of the liquid with wooden containers.

HOW ALCOHOL IS MEASURED

In the United States the ethanol concentration of distilled beverages is designated by the proof system. Proof is approximately twice the percentage of the alcohol content by volume. For example, Brand “Z” Whiskey is 101 proof, which means its alcohol content is 50.5% by volume. Conversely, a beverage whose alcohol content by volume is 40% would be 80 proof.

\[ \text{Proof} = 2 \times \% \text{ Alcohol by Volume} \]

The alcohol content of beer, wine and distilled spirits are usually reported in terms of percent volume of alcohol. Beer, ale, and malt liquor are not required to label their product with the alcohol content. Most beers have less than about 5% alcohol by volume. Wines typically have about 10-12% alcohol by volume.

The alcohol content varies with the drink. For purposes of this text, one "drink" equals one 12 ounce serving of regular beer, one and a half ounces of 80 proof distilled spirits, or 5-6 ounces of wine. Each of these drinks contain approximately the same amount of alcohol. If any one of these is consumed in the same period of time, it will have about the same effect upon the body.
ABSORPTION OF ALCOHOL

Ethanol can enter the human body in several different ways: injection, inhalation, and ingestion. Ethanol has not been observed to accumulate in the body as a result of absorption through the skin. Injection of ethanol directly into the body is an extremely dangerous procedure because it produces a localized concentration of ethanol that can severely affect the heart and other vital organs (this phenomenon is referred to as the "bolus effect"). Another possible route for ethanol to enter the body is through inhalation of alcoholic vapors. When the alcoholic vapors come into contact with the lungs and mucous membranes lining the nasal passages and throat, then the ethanol can diffuse through these membranes into the blood. However, to reach significant levels of alcohol concentration requires exposure to a severely irritating environment for an extended period of time. It is, therefore, very unlikely that any individual would become intoxicated in this manner. The usual method for alcohol to enter the body is by ingestion of an alcoholic beverage. Ethanol is not digested, but absorbed unchanged.

The absorption of ethyl alcohol begins immediately following the introduction of the alcoholic beverage into the digestive system. Ethanol is readily absorbed through all mucosal surfaces, including the oral cavity and gastrointestinal tract.

Immediately after a sip of an alcoholic beverage, the breath would indicate high alcohol content. If analyzed, this breath sample would not be an accurate reflection of the alcohol concentration in the person’s body. This is sometimes referred to as residual alcohol or mouth alcohol.

Residual alcohol diminishes rapidly and is gone within a few minutes. Proper testing procedures combined with current evidential breath alcohol testing devices eliminate residual alcohol from the test result.

After passing through the mouth, the ethanol travels to the stomach. If alcohol is present in the stomach and some of it is regurgitated back into the mouth, a portion of that dose will be absorbed in the mouth. Regardless of how ethanol is introduced into the mouth, the presence of residual alcohol is gone in less than 15 minutes.

A portion of the ethyl alcohol can be absorbed into the body from the stomach. The length of time the ethanol remains in the stomach before being passed on to the remainder of the gastrointestinal tract can vary due to several factors. The most significant factor is the amount of food in the stomach. The pyloric sphincter controls the passage of material from the stomach to the small intestine. On a full stomach, the pyloric sphincter remains closed longer. Ethanol remains in the stomach for a longer period of time delaying its absorption. Slowing the alcohol absorption decreases the peak alcohol concentration, may prolong the time to reach the peak concentration, and reduces the impact of that alcohol on the person.
The type of food may affect the absorption rate, but the amount of food is the most significant factor. Even on a full stomach the peak alcohol level is usually reached within 30 to 40 minutes after the last drink.

From the stomach the ethyl alcohol enters the small intestine. Ethyl alcohol is rapidly absorbed into the body by the small intestine. The small intestine is where most of the alcohol is absorbed into the body. Ethanol is rather unique in that it is not digested, or broken down into smaller parts, but rather it is absorbed unchanged through the process of simple diffusion.

**THE DISTRIBUTION PROCESS**

Once ethanol has been absorbed it is distributed throughout the body. The ethanol travels through the liver, then is distributed to the various body tissues. A portion of the ethyl alcohol quickly reaches the brain tissue.

The amount of ethanol in the organs and tissues depends on the water content of each tissue or organ. Since ethyl alcohol is miscible with water, it will rapidly diffuse from an area of high alcohol concentration to an area of low concentration.

**BODY TYPE AND TOTAL BODY WATER**

The total amount of water in the body can vary from one individual to another based upon the weight (mass) of the person. Assuming the same body type, a 200 pound man must consume more ethanol than a 100 pound man to reach the same alcohol concentration. This is because the 200 pound man has more body water to dilute the alcohol.

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**EFFECT OF FOOD ON ALCOHOL ABSORPTION**

![Graph showing effect of food on alcohol absorption](image)
The amount of fat tissue also affects the total amount of body water. Since fat tissue has very little water it does not absorb ethyl alcohol. A 200 pound obese person will have less body water to dilute the alcohol than would a 200 pound lean person.

GENDER MAKES A DIFFERENCE

Total body water content also varies according to gender. On average, women have less body water than men do on a per pound basis due to body composition. The same ethanol intake in terms of body weight results in a higher alcohol concentration in women than in men. For example, a 120 pound man would have to consume more alcohol than a 120 pound woman to achieve the same concentration, because the man has more water in his body with which to dilute the ethyl alcohol.

THE ELIMINATION PROCESS

Ethanol is removed from the body through metabolism and excretion. The majority of ethanol is metabolized (oxidized) by the liver. There is also evidence to indicate that a small amount of alcohol is eliminated in the gastrointestinal tract, particularly the stomach. The process of metabolism in the liver accounts for the elimination of 90 to 96% of the alcohol consumed.

The process of excretion accounts for the elimination of 4 to 10% of the alcohol consumed. A small percentage of ethanol consumed is excreted unchanged into the urine. The amount of ethanol in the urine is proportional, within certain limits, to the ethanol concentration in the blood. The urine is stored in the bladder prior to its elimination from the body. The bladder is very poorly supplied with blood and very little of the urine alcohol is reabsorbed back into the blood stream.

Since ethyl alcohol is miscible with water, a small portion of the ethanol is excreted unchanged in sweat. Alcohol dissolved in perspiration is transported through the skin and then evaporated into the surrounding air. Most important for the purposes of determining alcohol concentration, alcohol is also excreted through human breath. Excretion of ethanol in the breath is the basis of the breath alcohol test. The exchange of oxygen and carbon dioxide occurs in the small tissue sacs of the lungs called the alveoli. When alcohol is present in the body, a portion of that alcohol will be eliminated in the breath because the ethanol can readily pass through the thin alveolar membrane and be exhaled in the breath. The concentration of the alcohol in the alveolar air is proportional to the amount of ethanol in the body.
A pure alveolar sample is impossible to collect; therefore, an end-expiratory breath sample is collected and analyzed. The end-expiratory sample will contain a lower alcohol concentration than a pure alveolar sample. Consequently, an end-expiratory breath sample will almost always benefit the individual taking the breath alcohol test.

Regardless of the method, elimination is a physiological process and as such is not significantly affected by exercise or stimulants such as caffeine. Hot coffee, a cold shower, or vigorous exercise cannot alter the rate of elimination. Currently, the only proven method for sobering up is to allow sufficient time for the body to eliminate the alcohol.

An individual's rate of metabolism is fairly constant, but the elimination rate can vary from person to person. The range of reported elimination rates varies from about 0.010 – 0.040 g/210 L per hour, with the majority of drinking drivers tested in the range of 0.012 – 0.028 g/210 L/h. The higher rates usually occur in alcohol abusers or alcohol dependent persons.

PUTTING IT ALL TOGETHER

Absorption, distribution, and elimination have all been discussed. Combining all these factors creates the alcohol concentration curve. Elimination begins immediately after the introduction of alcohol during the absorption phase. However, when the rate of absorption exceeds the rate of elimination, the amount of alcohol in the body will increase. After the drinking stops, at some point the amount of alcohol being absorbed will equal the amount being eliminated, which results in the peak alcohol concentration. During the elimination phase, the amount of alcohol absorbed is less than the amount eliminated so the alcohol concentration in the body will gradually decrease over time. The shape of the alcohol concentration curve will vary according to all the factors that affect absorption, distribution, and elimination of ethyl alcohol.
Depending on the various factors of absorption, distribution, and elimination of ethanol in the body, there are three possibilities when estimating the alcohol concentration at a time prior to the test.

The graph indicates that the alcohol concentration may be higher when driving (Car A) than at the time of the test. In this case the person was in the elimination phase between the two points indicated. The graph also shows the concentration may be the same at both driving and time of test (Car B). This time the amount of alcohol absorbed was equal to the amount eliminated. The last example (Car C) shows that the alcohol level when driving may be lower than at the time of the test. In this example, the person was in the absorption phase and the alcohol concentration was rising. Research indicates that the breath alcohol concentration is usually the same or higher at the time of driving compared to the time of the test.

**INTOXICATION WITH ETHANOL**

When the alcohol concentration reaches a certain level, the individual concerned is intoxicated. Intoxication refers to the reduction or loss of normal physical and mental faculties. Intoxication is based upon measurable changes in an individual's performance of a specific task, such as operating a motor vehicle. The term "intoxication" should be separated from the more common term "drunk." The term "drunk" is used as a descriptive word denoting a particular type of observed behavior.

A tremendous amount of research has been performed to identify the progressive levels of intoxication, induced by ethanol, with regards to impairment in the operation of a motor vehicle.

The single fundamental fact regarding alcohol consumption is that increasing alcohol concentration results in increasing impairment of normal physical and mental faculties. Judgment is the first area noticeably affected. Behavioral changes are sometimes observed and there is a loss of social inhibitions. Fine muscular coordination is affected and complex reaction time is lengthened. Complex reaction time is the time required for a person to perform two tasks almost simultaneously. At 0.08 percent alcohol concentration, current research has shown that all persons are impaired with regards to the operation of a motor vehicle. Increasing the alcohol concentration above 0.08 percent results in further impairment of normal physical and mental faculties. However, it is always important to remember that **there is no safe level of alcohol with regard to driving!** Both epidemiological and laboratory studies indicate even low ethanol concentrations may impair safe operation of a motor vehicle.
As the alcohol concentration continues to rise, it presents a threat to life. Persons with too high of a blood alcohol concentration should be carefully observed and consideration given to seeking medical assistance. High enough blood alcohol concentrations can result in individuals lapsing into comas and even death.

**EFFECTS OF ETHANOL ON THE CENTRAL NERVOUS SYSTEM**

The central nervous system (CNS) is the site where alcohol exerts its effects. The CNS is composed of the brain and the spinal cord and is responsible for transmitting nerve impulses to the various muscles and organs of the body. Ethanol acts as a *depressant* on the CNS, not as a stimulant.

Ethanol has such a wide range effect due to the large quantity consumed and the site of action. It is not the alcohol in the peripheral areas of the body which impairs a person's coordination, but the alcohol concentration in the CNS tissue. In the CNS, the alcohol acts to depress nerve transmission and to reduce coordination between various nerve centers.

Alcohol impairs driving ability. Research has demonstrated that impairment of the most important driving skills can occur at ethanol concentrations well below 0.08 g/210 liters. Operating a motor vehicle involves judgment, attention, psychomotor skills, vision, perception, tracking (steering), and information processing.

**Judgment** *The first effect of alcohol is the impairment of judgment.* Since the site of action for ethanol is the brain it follows that mental faculties are affected before physical faculties. Judgment is a general name given to various decision-making aspects of human behavior.

Alcohol affects the brain in reverse order of how the brain develops. So the higher levels for brain function such as judgment, logic and reason are affected first, and the lower involuntary functions, such as respiration and digestion, are affected last.

Alcohol depresses learned social and cultural inhibitions. Consumption of alcohol also results in an impairment of self-evaluation. Self-evaluation is the ability of an individual to judge his own behavior or performance. Alcohol has the ability to create a feeling of euphoria or a sense of well-being. Because of this artificial sense of well-being, combined with an increase in the pain threshold, an intoxicated individual may ignore minor or even serious injuries. Another aspect of judgment affected by alcohol is risk assessment. Intoxicated individuals will take greater risks than when sober.

**Attention** The ability to divide attention between two or more sources of information is a basic requirement of safe driving. Impairment of attention has been found at levels well below 0.08 g/210 L alcohol concentration.

**Psychomotor Skills** Psychomotor skills are motor actions (physical faculties) proceeding directly from mental activity. The degree of
impairment demonstrated by the traditional roadside tests such as walking and balancing can depend on the drinking experience of the driver.

**Vision** Ethanol depresses the coordination between the muscles that control the eyes. This lack of muscle coordination leads to blurring and double vision. Intoxicated individuals tend to narrow their visual field. Ethanol decreases the field of peripheral vision so drivers fail to perceive important peripheral events. Impairment of vision has been found at levels well below 0.08 g/210 L alcohol concentration.

**Perception** The ability to interpret complex sensory information can be adversely affected by ethanol. Impairment of perception has been found at levels well below 0.08 g/210 L alcohol concentration.

**Tracking** Tracking, or steering, is a relatively difficult task. The driver must maintain the vehicle within the lane limits and in the correct direction while monitoring the driving environment for other important information. The ability to steer is very susceptible to ethanol impairment and impairment has been found at levels well below 0.08 g/210 L alcohol concentration.

**Information Processing** Ethanol slows the rate of information processing by the brain. This effect has been noted on many different kinds of tasks. If there are two or more stimuli and if several responses are possible, response times lengthen significantly. Alcohol impaired drivers require more time to read a street sign or to recognize and respond to a traffic signal. Impairment of information processing has been found at levels well below 0.08 g/210 L alcohol concentration.

**TOLERANCE AND ETHANOL**

The least understood phenomenon of alcohol consumption is tolerance. Tolerance is usually defined as the effect that results from the chronic use of a drug when larger doses become necessary to achieve the same desired effect. However, in discussing alcohol tolerance it is more convenient to reverse this definition and consider tolerance as the effect where the expected changes in behavior or impairment in performance of a specific task are not observed.

There are two general types of tolerance: natural tolerance and learned tolerance.

**Natural Tolerance** Natural tolerance consists of three areas: inborn tolerance, physical tolerance, and stress tolerance.

- Certain individuals demonstrate a natural inborn (genetic) tolerance to low alcohol concentrations. This type of tolerance is most prominent in very low alcohol concentrations.

- Another form of natural tolerance is physical tolerance. The effect of a given alcohol concentration will always be greater in persons who are ill as compared to the same
persons when healthy. These individuals' normal physical and mental faculties are already affected due to their sickness, and this adds to the effects of the alcohol.

- Another form of natural tolerance is stress tolerance. In high stress or anxiety situations adrenaline is released in the human body to stimulate the body's response to the source of stress. In intoxicated individuals, this can result in those persons appearing less intoxicated than they really are. Stress tolerance is only a temporary effect lasting for a few minutes.

**Learned Tolerance**  Learned tolerance consists of three areas: behavioral tolerance, acquired tolerance, and acute tolerance.

- Behavioral tolerance is a result of the influence of the social setting and the social customs associated with alcohol consumption in a particular situation. An individual will behave differently in different social settings even though the alcohol concentration in that person is the same on both occasions. Mood, or sense of well-being, also influences a person's behavior at a particular alcohol concentration. A person who is depressed and unhappy is usually more depressed and unhappy following the consumption of alcohol. This effect is usually best observed at low levels of alcohol concentration, because higher levels may alter the person's perception of reality.

- Acquired tolerance results from the chronic use of alcohol. These individuals are indeed impaired in judgment, reaction, and coordination, but have learned through experience to disguise their outward appearance of intoxication. A novice drinker (one who has little or no experience with alcohol) will demonstrate greater outward effects than those expected at a given alcohol concentration. This is due to the absence of an acquired tolerance.

- The last type of learned tolerance is acute tolerance, or sometimes called the Mellanby Effect. Acute tolerance is the result of a person comparing his present condition with his past condition. In the absorption phase of the alcohol curve (position X), the individual compares his perceived state with when he was alcohol free. His perception has been altered so that the effects of the alcohol are overestimated. Later during the elimination phase (position Y) the same person compares his present perceived state with his peak alcohol concentration.
(position Z) and the effects of the alcohol are underestimated. In both instances the alcohol concentrations were equal and the person equally impaired. Since the individual perceives himself as less intoxicated during the elimination phase, this person is a greater risk when operating a motor vehicle. The person has lost the ability to accurately judge his performance.

Because of the various aspects of alcohol tolerance, judging an individual's intoxication can be very difficult when based solely on visual observation. Social prestige and interpersonal relationship may influence a person's judgment of another's intoxication.

Regardless of how a person appears, it is the impairment of the individual's normal physical and mental faculties that is important. An individual may consciously or unconsciously attempt to disguise his intoxication, but cannot alter the fact that his judgment, reactions, and coordination are impaired.

**ALCOHOL AND OTHER DRUGS**

When ethyl alcohol is consumed in combination with other chemical agents, illicit, prescribed, or over-the-counter, the symptoms of alcohol intoxication may be altered. This may explain a situation where an individual appears very intoxicated, but the alcohol test results are low.

While the intoxicating effects of alcohol can alter or be altered by other drugs, there is no known drug that can lessen the effects of ethanol on a person’s driving performance.

**IMPAIRMENT WITHOUT ETHANOL**

Ethyl alcohol is not the only agent that can produce the effects already described. Certain illnesses, diseases, or other drugs are able to produce symptoms similar to ethanol intoxication. Untreated diabetics or trauma victims may exhibit symptoms similar to ethanol intoxication.

Acetone, like ethanol, can cause impairment and may be mistaken for alcohol intoxication. Acetone can be present in an individual due to a prolonged fast, a low carbohydrate diet, or untreated diabetes. Modern evidential breath alcohol testing instruments can distinguish between acetone and ethyl alcohol, eliminating any affect from acetone on the alcohol result.
ETHANOL AND DRIVING PERFORMANCE

The relationship between alcohol and driving has been studied and analyzed for decades. From both epidemiological studies (surveys of accident data) and controlled studies of alcohol and driving skills, it has been clearly shown that ethyl alcohol impairs a person’s driving performance.

History of Alcohol and Motor Vehicle Crashes

Ethyl alcohol has been suspect as a factor in highway motor vehicle crashes since the appearance of the automobile. Studies as early as 1904 have shown that moderate and heavy drinkers are incapable of safely operating a motor vehicle.

Subsequent studies conducted in the United States and other nations since the 1930’s indicate a strong, direct link between increasing blood alcohol concentration (BAC) and increasing risk of motor vehicle collision.

In 1960, the National Safety Council recommended that an alcohol concentration above 0.10 be considered *prima facia* evidence of intoxication. As research continued, the committee recommended in 1971 an even lower presumptive level of 0.08. In 1986, based on the large field of work showing conclusive impairment in virtually all drinkers at levels as low as 0.05, the American Medical Association’s Council on Scientific Affairs recommended adoption of 0.05 as *per se* evidence of alcohol-impaired driving. While numerous other countries in Europe and elsewhere have adopted this standard or an even more stringent one, no state within the United States has yet adopted this standard.

Research clearly shows that a problem exists, that this problem is societal, and that a definite cause and effect relationship exists between alcohol in the body and the probability of a vehicle crash. Some of the facts that have emerged are:

- One out of every one hundred drivers has an alcohol concentration of 0.10 or more. On Saturday nights this statistic increases to one in ten.

- At alcohol concentrations as low as 0.02 g/210 L, alcohol affects driving ability and crash likelihood. The probability of causing a crash begins to increase significantly at 0.05 g/210 L and climbs rapidly after 0.08 g/210 L.

- For drivers with alcohol concentrations above 0.15 g/210 L on weekend nights, the likelihood of being killed in a single-vehicle crash is more than 380 times higher than it is for non-drinking drivers. The probability of a driver causing a vehicle crash increases from six times as great at an alcohol concentration of 0.10 g/210 L to twenty-five times as great with an alcohol concentration of 0.15 g/210 L.
Approximately 40% of all motor vehicle crashes in which death occurs are attributed to alcohol being a causative factor.

In the United States, alcohol related crashes result in approximately 17,000 deaths, one million injuries, and $45 billion in costs to society every year.
CHEMICAL TESTS FOR INTOXICATION

With over 1.4 million arrests annually for driving under the influence, the analysis of alcohol in biological specimens is one of the most common forensic tests utilized in the United States. Many different biological specimens have been and are used for the analysis of alcohol.

Because alcohol is freely miscible with water, any bodily fluid with significant water content will also possess meaningful levels of alcohol during intoxication. While this even applies to bodily fluids such as cerebrospinal fluid or breast milk, blood is the preferred and universally accepted specimen of bodily fluid for blood alcohol determination, although saliva or urine can also be used for this purpose.

Since alcohol is excreted unchanged through the breath, analysis of this biological sample can also be employed to determine alcohol concentration, and has been found to be advantageous for many reasons. Chemical analysis of blood and other body fluids are invasive as well as complicated and expensive to perform. Breath tests for alcohol concentration can be performed easily by trained law enforcement officers. Breath alcohol tests are non-invasive and give immediate results. They require only minimal subject participation. Most importantly, scientists agree that the best alternative to testing the brain for alcohol content (obviously not done on living subjects) is to test the arterial blood supply to the central nervous system, and breath alcohol concentration (BrAC) is directly proportional to arterial blood alcohol concentration (BAC). Many years of testing have validated the breath test as a reliable means of measuring the alcohol in the vascular system. This is an established scientific truth of great benefit to law enforcement. BrAC and BAC need not be compared, since both are equally reliable and established measures of intoxication.

WHY BREATH ALCOHOL TESTING WORKS

Blood alcohol analysis works because trained nurses and/or physicians use good sampling protocol and methods for collecting samples, and analysts and toxicologists use good protocol and methods for the analysis of the blood samples collected. Breath alcohol analysis works in the exact same fashion. When a trained, competent officer follows good protocol for the collection of a breath sample, and when that breath sample is analyzed on an established breath-alcohol instrument that is calibrated and operating properly, only then can a breath alcohol sample be considered an accurate measure of the alcohol content within a subject’s body.
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SECTION 2

MISSOURI DWI STATUTES

Introduction

The General Counsel’s Office of the Department of Revenue provides assistance to law enforcement officers and prosecutors in all areas where driver-licensing issues arise. Their telephone number is (573) 751-2580 and the fax number is (572) 751-815; their address is: General Counsel’s Office, PO Box 475, Jefferson City, MO 65105-0475.

Additionally, information and training concerning driving while intoxicated statutes and case laws are available through the Traffic Safety Resource Program of the Missouri Office of Prosecution Services. Their address is: Missouri Office of Prosecution Services, PO Box 899, Jefferson City, MO 65102. The TSRP prosecutors are:

Susan Glass
Susan.Glass@prosecutors.mo.gov
(573) 301-2630

and

Stephanie Watson
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(573) 301-8654
The following are hyperlinks to the Missouri Revised Statutes most pertinent to DWI enforcement.

**Chapter 302**  
Drivers' and Commercial Drivers' Licenses

302.500 Definitions.
302.505 Determination by department to suspend or revoke license, when made, basis--final, when.
302.510 Arresting officer, duties--certain arrests not to be basis for administrative suspension or revocation.
302.515 Notice of suspension or revocation by department--deemed received, when--contents.
302.520 Arresting officer to serve notice of suspension or revocation, when--to possess license, issue temporary permit, give written notice of driver's rights and responsibilities--application for hearing.
302.574 Temporary permit issued by officer, when--report required, contents--revocation of license, procedure--reinstatement, when--fees--proof of interlock device, when--violations, penalty.

**Chapter 577**  
Public Safety Offenses

577.001 Chapter definitions.
577.010 Driving while intoxicated—sentencing restrictions.
577.012 Driving with excessive blood alcohol content--sentencing restrictions.
577.013 Boating while intoxicated—sentencing restrictions.
577.014 Boating with excessive blood alcohol content--penalties--sentencing restrictions.
577.015 Operating an aircraft while intoxicated--penalties.
577.016 Operating an aircraft with excessive blood alcohol content--penalties.
577.017 Consumption of alcoholic beverages while driving--penalty.
577.019 Citation of law.
577.020 Chemical tests for alcohol content of blood--consent implied, when--administered, when, how--information available to person tested, contents--videotaping of chemical or field sobriety test admissible evidence.
577.021 Chemical testing authorized—reasonable efforts to test required--admissibility.
577.023 Aggravated, chronic, persistent and prior offenders, when--trial procedures--sentencing information.
577.029 Blood alcohol content tests, how made, by whom, when--person tested to receive certain information, when.
577.031 Persons administering tests not liable, when.
577.033 Inability of person to be tested to refuse, effect.
577.037 Chemical tests, results admitted into evidence, when, effect of.
577.041 Refusal to submit to chemical test--admissibility--request to include reasons and effect of refusal.
INSTRUMENTATION

The BAC DataMaster is a forensic breath-testing device that measures ethanol (commonly termed “alcohol”) and is based on the principles of infrared spectrometry. The DataMaster accurately determines the amount of alcohol in end-expiratory breath at the time the test is administered. Breath alcohol concentration (BrAC) is directly proportional to blood alcohol concentration (BAC). This is an established scientific truth of great benefit to law enforcement. BrAC and BAC need not be compared, since both are equally reliable and established measures of intoxication.

Following recommendations by the National Safety Council’s Committee on Alcohol and Other Drugs, the Department of Transportation established a conservative standard to legally define alcohol impairment while operating a motor vehicle. This standard is 0.080 grams of alcohol per 210 liters of breath (g/210 L) or per 100 milliliters of blood (g/100 mL). At this level of intoxication, there is well-founded agreement that any individual will be too impaired to drive safely.

It is important to remember that an arrest is not made on the basis of a breath test alone. It also depends on other factors, such as weaving on the roadway, odor of intoxicants, physical tests, and all those observations that gave you probable cause to believe the driver was under the influence of alcohol and/or drugs.

The DataMaster has been in production since the 1980’s and has been used for the purpose of forensic breath alcohol concentration measurement in over 30 different states and various other countries. The BAC DataMaster has been tested and approved prior to its use for evidential testing in Missouri by both the National Highway Traffic Safety Administration (NHTSA) and the Missouri Department of Health and Senior Services, and is listed on both the NHTSA Conforming Products List and in Missouri’s Regulations 19 CSR 25-30.050, Approved Breath Analyzers.
INFRARED SPECTROMETRY

The basis of infrared breath analysis is the absorption of infrared energy by alcohol molecules in a breath specimen. Infrared radiation is a portion of the electromagnetic spectrum. Infrared wavelengths are longer than visible light and are not visible to the human eye. Spectrometry, an analytical method that measures the absorption of radiant energy by a substance, is widely used in the scientific community.

THE ELECTROMAGNETIC SPECTRUM

The ethanol molecule is composed of two carbon atoms, six hydrogen atoms, and one oxygen atom that are held together in a fixed order by chemical bonds. These chemical bonds absorb infrared energy in a specific and consistent manner. The specific wavelengths absorbed and the absorption pattern are unique, similar to a fingerprint, for a given molecule such as ethanol. The amount of infrared energy absorbed is proportional to the amount of ethanol present in a breath sample.
DETERMINATION OF BREATH ALCOHOL CONCENTRATION

The BAC DataMaster uses a law of chemistry and physics known as the Beer-Lambert law to determine the alcohol concentration in a breath sample. The Beer-Lambert law states that the amount of energy absorbed by a particular substance is directly proportional to the number of absorbing molecules in the sample. The amount of infrared energy absorbed in a breath sample is proportional to the amount of ethanol present in a breath sample introduced into the instrument sample chamber.

The breath sample enters the sample chamber of the DataMaster where an infrared beam of light interacts with any ethanol present (see schematic diagram below). The amount of infrared energy absorbed in the sample chamber is then converted into the subject’s BrAC. To satisfy the Regulations’ requirement that the breath sample be end-expiratory air, the DataMaster automatically monitors breath flow, breath volume, and changes in the breath alcohol concentration to ensure a valid sample is obtained. The sample chamber of the DataMaster is maintained at a temperature (approximately 50 °C) to prevent condensation. Once the sample has been accepted, it is checked for the presence of interfering substances.

The BAC DataMaster reports the measured alcohol concentration in grams of alcohol per 210 liters of breath, as specified by Missouri statute.

Schematic Diagram of DataMaster Optical Bench
SPECIFICITY

The BAC DataMaster uses two wavelengths of infrared energy to achieve specificity for the analysis of ethanol. Some substances, such as acetone, also absorb infrared energy at these same wavelengths. However, no compound consistent with normal human breath will have the same ratio of absorption at these two wavelengths of infrared energy as ethanol. When the DataMaster detects these differing absorption ratios, it invalidates the test due to the presence of an interfering substance, displays INTERFERENCE, and prints INTERFERE on the Test Record. The DataMaster will not identify or measure the amount of the interfering substance. It is important to show that acetone is not present since it could be found in the breath of someone in a state of ketosis, such as an untreated diabetic or someone on a prolonged fast.

**INFRARED SPECTRUMS OF ETHANOL AND ACETONE**

![Ethanol Infrared Spectrum](image1)

![Acetone Infrared Spectrum](image2)
The display communicates information and instructions from the instrument to the operator.

The breath tube is the heated, reinforced plastic tube on the right rear side of the instrument that functions as the transport mechanism for breath samples from the testing subject to the instrument. It is heated to prevent condensation of water vapor. All breath samples and the room air used in the air blank sequences are directed to the sample chamber through this tube.

The “Ready” light indicates when the instrument is warmed up and ready to begin the testing process. During the testing process, the “Ready” light will not be illuminated until the subject has given an adequate breath sample for analysis.

The On/Off switch on the rear of the instrument turns the BAC DataMaster on or off.

The RFI antenna detects RFI (radio frequency interference) around the instrument.

The Insert Ticket slot, usually marked “INSERT TICKET”, serves as the entry point for the chemical test evidence ticket.

The Ticket Out slot, located directly above the Insert Ticket slot, serves as the exit point for the evidence ticket after the test is completed and the information has been printed onto the ticket.

The keyboard is used for data entry.
DATA ENTRY

The BAC DataMaster has a built-in electronic **keyboard** for data entry by the operator. Most of the keys on the DataMaster keyboard are used exactly like those on a computer keyboard. Just as on a computer keyboard, the top rows of keys on the DataMaster are control keys. There are only three control keys that can be activated by Type III permit holders in the state of Missouri.

Which keys they are and what they accomplish are as follows:

<table>
<thead>
<tr>
<th>Key</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>RUN</td>
<td>Starts a breath test sequence.</td>
</tr>
<tr>
<td>CPY</td>
<td>Provides another copy of the last ticket/test performed.</td>
</tr>
<tr>
<td>CLR</td>
<td>Clears any status messages out of the display.</td>
</tr>
</tbody>
</table>

On BAC DataMasters built since 2000, the **USER1** key at the bottom left-hand part of the keyboard is another control key that is available to Type III officers. Pressing and quickly releasing this key advances the printer one line feed. Pressing and holding this key advances the evidence ticket completely through to the “ticket out” slot.

RADIO FREQUENCY INTERFERENCE

Since the BAC DataMaster is an electrical instrument, it is susceptible to the possibility of radio frequency interference (RFI). Radio frequency interference is a disturbance that affects an electrical circuit due to electromagnetic radiation emitted from an external source (such as a walkie-talkie). The disturbance may interrupt, obstruct, or otherwise degrade or limit the effective performance of the circuit.

If the presence of a radio signal is detected during an analysis, the BAC DataMaster will invalidate the test, display “**RADIO INTERFERENCE**”, and print “**RADIO INTERFERENCE**” on the Test Record.
ADMINISTERING A SUBJECT TEST

To administer a subject test on the DataMaster in Missouri, Form #7, “Operational Checklist: DataMaster”, of 19 CSR 25-30 must be completed. This form can be found in 19 CSR 25-30, on page two of form DOR-2389 (Alcohol Influence Report) or on the DHSS website at:
http://health.mo.gov/lab/breathalcohol/

You should complete an Operational Checklist for each separate test conducted on a subject.

1. The first step of the operational checklist is an examination of the subject’s mouth. This examination can be performed in one of two ways: The officer can perform a limited visual examination of the subject’s mouth, or the officer can ask the subject whether they have any substances in their mouth. Substances are defined as solid or liquid foreign matter, but does not include dentures, dental work, studs, piercings, or tongue jewelry. Once this examination has been completed, the officer may begin the observation period.

2. An officer with a valid Type II or Type III permit must observe the subject for a minimum of fifteen (15) minutes. The observation period must be continuous and does not end until a breath sample has been provided into the breath analyzer. The officer must remain close enough to the subject during the observation period to reasonably ensure, using the senses of sight, hearing, or smell, that the test subject does not smoke, vomit, or have any oral intake. While the officer must remain close enough to the subject to do this, direct observation is not necessary ensure the test validity or accuracy. The permit holder should carefully observe the subject during both the fifteen-minute observation period as well as while the subject is providing his/her breath sample into the instrument, so that the subject’s actions, demeanor, and behavior can be documented.

3. Assure that the instrument is turned on. If it is not, turn it on and allow it to warm up (approximately 10 – 20 minutes). The instrument is ready to run a test when the green “Ready” Light is illuminated.

4. When the instrument is ready to take a subject sample and the 15 minute observation period has been performed, push the Run button on the keyboard.

The DataMaster will display “PASSWORD”. Type in the Agency’s password and press enter.
5. The instrument will display “INSERT TICKET”. Insert an evidence ticket into the Insert Ticket slot, face down, notch to the right, until it catches. The DataMaster will feed it to the proper position.

6. The DataMaster will now ask the officer the following series of questions. Use the keyboard to type in answers to the questions. After determining that the answer was correct, press the **ENTER/RETURN** key.

   a. ARREST TIME:
   b. SUBJECT’S NAME (L/F/M):
   c. SUBJECT’S DOB: (mm/dd/yy) format
   d. SUBJECT’S SEX (M/F):
   e. STATE:
   f. LICENSE NUMBER:
   g. ARRESTING OFFICER (L/F/M):
   h. OFFICER I.D.:
   i. TESTING OFFICER (L/F/M):
   j. OFFICER I.D.:
   k. PERMIT NUMBER:
   l. EXPIRATION DATE: (mm/dd/yy) format
   m. ACCIDENT (Y/N):
   n. MISCELLANEOUS [1]:
   o. MISCELLANEOUS [2]:

The last question that the display will prompt during data entry is: “**REVIEW DATA? (Y/N)**”. If the officer wishes to correct a mistake made during the data entry, or merely wishes to review the data, hit **Y** on the keyboard and the instrument will send the officer back through each of the questions a – o listed above. Once the officer is satisfied with the data, he should hit the **N** on the keyboard at this stage and the instrument will move out of data entry and into the automated test sequence.

During the automated test sequence the instrument display will show the following series of messages.

**PURGING**
All chambers and internal plumbing are cleansed of any residual substances by ambient (surrounding) air that is pulled in through the Breath Tube and pumped throughout the instrument by an internal pump. “.000” will appear on the display if the chamber is clear.

**AMBIENT ZEROING**
After the pump stops, the DataMaster determines zero references based on the ambient air in the Sample Chamber. During this cycle both of the specific wavelength filters are inserted into the infrared light path to establish zero references at each wavelength.

**BLANK TEST**
A measurement is taken after the “Ambient Zeroing”. “.000” will appear on the display if no contamination was detected.
INTERNAL STANDARD CHECK
During this cycle a quartz plate is inserted into the infrared path to assure that the accuracy of the DataMaster has not changed since it was last calibrated. Each DataMaster stores in memory the exact infrared absorption value of this quartz standard at the time of calibration. The instrument measures the absorption of the quartz plate and compares this measured value with the value obtained at calibration. The two values must agree within prescribed limits or the operation will be aborted.

After the DataMaster has successfully cycled through these steps of the automatic test sequence, the instrument will display “SUBJECT REFUSE? (Y/N)” If the subject refuses, hit Y on the keyboard and the instrument will abort the testing sequence and print a “REFUSED” ticket. If the subject is willing to take the test, type “N”.

7. The instrument will display “PLEASE BLOW” and emit a beeping sound. Insert a mouthpiece into the Breath Tube and have the subject blow at this time.

The officer should advise the subject as follows: “Place your mouth on the mouthpiece and blow long and steady into the tube until I tell you to stop.”

The breath sample has to meet the following three criteria to assure the collection of an adequate sample of expired air. These criteria are:

a. The total breath volume must be at least 1.5 liters.
b. A breath flow rate of approximately 3.5 – 4 liters per minute must be maintained until the alcohol concentration of the sample reaches an end-expiratory plateau.
c. The flow rate must then decrease to below 1.5 liters per minute.

The DataMaster allows a two-minute window for the completion of a breath test. At the end of the two minutes, the DataMaster will either print “INCOMPLETE TEST” or will ask again “SUBJECT REFUSE? (Y/N)” If the subject is refusing to take the test, hit Y on the keyboard and the instrument will abort the testing sequence and print a “REFUSED” ticket. If the subject is willing to try and take the test again, type “N” and an “INCOMPLETE TEST” will print on the evidence ticket.

Once the first two criteria above have been met, the green “Ready” Light will become illuminated again. After the flow rate has decreased to less than 1.5 liters per minute, the instrument will finish the analysis of the breath sample.

After the subject has finished giving a valid breath sample, the DataMaster will display “ANALYZING”. Remove the mouthpiece from the Breath Tube before the instrument displays “PURGING” and allow the DataMaster to complete the rest of the automated test sequence. Throw the mouthpiece away.

8. The DataMaster will purge the Sample Chamber at this point and the take another BLANK TEST. At the end of this testing sequence, the instrument will print the completed evidence ticket. Remove the evidence ticket and attach it to the “Operational Checklist: DataMaster”. Complete the certification portion of the checklist as appropriate.
Unless a copy of the evidence ticket is illegible, you should attach a copy of each separate evidence ticket obtained on a test subject.

Good hygiene suggests that a new mouthpiece be used for each separate breath test sequence performed on a test subject. A breath test sequence, or breath test, is a complete testing sequence from the checking of the subject’s mouth to the completion and printout of a test result or status code. This is different from a breath attempt or sample, which can occur multiple times during a single testing sequence depending upon a variety of factors such as a subject’s willingness to cooperate, physical capabilities, officer instruction and coaching, etc. Always use a new mouthpiece for a different test subject.
BAC DATAMASTER STATUS CODES

Occasionally, a message, or status code, will appear on the screen and/or on an evidential ticket printout. The following is a list of the messages that will appear on the display and/or on an evidential ticket printout. If one of the following messages is received while operating the BAC DataMaster, please follow the recommended action.

<table>
<thead>
<tr>
<th>STATUS CODE</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>RADIO INTERFERENCE</td>
<td>Find and remove source of radio transmission. Rerun test.</td>
</tr>
<tr>
<td>INVALID SAMPLE</td>
<td>Check mouth, wait an additional 15 minutes, try one or more tests. If unsuccessful, request blood sample under implied consent.</td>
</tr>
<tr>
<td>INTERFERENCE DETECTED</td>
<td>Try one more test. If interference is detected on the second test, request blood sample under implied consent.</td>
</tr>
<tr>
<td>INCOMPLETE SAMPLE</td>
<td>A complete and valid breath test was not given during sampling.</td>
</tr>
<tr>
<td>AMBIENT FAIL</td>
<td>Check for odors, check to see if mouthpiece was removed, try one or more tests. If unsuccessful, contact Type II.</td>
</tr>
<tr>
<td>BLANK ERROR</td>
<td>Check to see if mouthpiece was removed, try one or more tests. If unsuccessful, contact Type II.</td>
</tr>
<tr>
<td>FILTER ERROR</td>
<td>Try one or more tests. If unsuccessful, contact Type II.</td>
</tr>
<tr>
<td>CALIBRATION ERROR</td>
<td>Try one or more tests. If unsuccessful, contact Type II.</td>
</tr>
<tr>
<td>SYSTEM WON'T ZERO</td>
<td>Try one or more tests. If unsuccessful, contact Type II.</td>
</tr>
<tr>
<td>DETECTOR OVERFLOW</td>
<td>Try one or more tests. If unsuccessful, contact Type II.</td>
</tr>
<tr>
<td>PUMP ERROR</td>
<td>Try one or more tests. If unsuccessful, contact Type II.</td>
</tr>
<tr>
<td>PRINTER ERROR</td>
<td>Contact Type II and go to another instrument.</td>
</tr>
<tr>
<td>TEMPERATURE LOW</td>
<td>Out of service. Contact Type II and go to another instrument.</td>
</tr>
<tr>
<td>TEMPERATURE HIGH</td>
<td>Out of service. Contact Type II and go to another instrument.</td>
</tr>
<tr>
<td>FATAL SYSTEM ERROR</td>
<td>Out of service. Contact Type II and go to another instrument.</td>
</tr>
<tr>
<td>RAM ERROR</td>
<td>Out of service. Contact Type II and go to another instrument.</td>
</tr>
<tr>
<td>OUT OF SERVICE</td>
<td>Out of service. Contact Type II and go to another instrument.</td>
</tr>
</tbody>
</table>

If any status code appears on the display or on an evidential ticket other than those listed above, discontinue use of the instrument and contact a Type II responsible for maintaining the instrument.
BREATH ALCOHOL PROGRAM
TYPE III OPERATOR MANUAL

SECTION 3-B

Intoxilyzer 5000

Although the Intoxilyzer 5000 is still approved for evidential breath alcohol testing in Missouri, no Intoxilyzer 5000s are currently in service. If information regarding this instrument is required, please contact the Breath Alcohol Program directly for assistance.
BREATH ALCOHOL PROGRAM

TYPE III OPERATOR MANUAL

SECTION 3-C

Alco-Sensor IV with Printer Operation Guide

INSTRUMENTATION

The Alco-Sensor IV is a forensic breath-testing device that measures ethanol (commonly termed “alcohol”) using an electrochemical cell, also known as a fuel cell. The Alco-Sensor IV accurately determines the amount of alcohol in expired breath at the time the test is administered. Breath alcohol concentration (BrAC) is directly proportional to blood alcohol concentration (BAC). This is an established scientific truth of great benefit to law enforcement. BrAC and BAC need not be compared, since both are equally reliable and established measures of intoxication.

Following recommendations by the National Safety Council’s Committee on Alcohol and Other Drugs, the Department of Transportation established a conservative standard to legally define alcohol impairment while operating a motor vehicle. This standard is 0.080 grams of alcohol per 210 liters of breath (g/210 L) or per 100 milliliters of blood (g/100 mL). At this level of intoxication, there is well-founded agreement that any individual will be too impaired to drive safely.

It is important to remember that an arrest is not made on the basis of a breath test alone. It also depends on other factors, such as weaving on the roadway, odor of intoxicants, physical tests, and all those observations that gave you probable cause to believe the driver was under the influence of alcohol and/or drugs.

The Alco-Sensor IV has been in production since the 1980’s and has been used for the purposes of both preliminary and forensic breath alcohol concentration measurement in over 30 different states and various other countries. The Alco-Sensor IV has been tested and approved for evidential breath alcohol analysis by the National Highway Traffic Safety Administration (NHTSA). When used with a printer and DHSS-approved software it is approved for evidential testing in Missouri by the Missouri Department of Health and Senior Services and is listed on both the NHTSA Conforming Products List and in Missouri’s Regulations 19 CSR 25-30.050, Approved Breath Analyzers.
ALCOHOL FUEL CELL TECHNOLOGY

In its simplest form, the alcohol fuel cell consists of a porous, chemically inert layer coated on both sides with platinum oxide (called platinum black). The manufacturer impregnates the porous layer with an acidic electrolyte solution, and applies platinum wire electrical connections to the platinum black surfaces. The fuel cell assembly is mounted in a case, which includes a gas inlet that allows a breath sample to be introduced. The basic configuration of an alcohol fuel cell is illustrated in Figure 1.

Figure 1. Basic Fuel Cell Configuration

DETERMINATION OF BREATH ALCOHOL CONCENTRATION

The chemical reaction that takes place in an alcohol fuel cell converts alcohol to acetic acid. In the process, this conversion produces a fixed number of free electrons per molecule of alcohol. This reaction takes place on the upper surface of the fuel cell. H+ ions are freed in the process, and migrate to the lower surface of the cell, where they combine with atmospheric oxygen to form water, consuming one electron per H+ ion in the process. Thus, the upper surface has an excess of electrons, and the lower surface has a corresponding deficiency of electrons. If you connect the two surfaces electrically, a current flows through this external circuit to neutralize the charge. This current is a direct indication of the amount of alcohol consumed by the fuel cell. By measuring the amount of current, you can determine the amount of alcohol in the sample. The fuel cell produces a linear relationship between the amount of current generated from the alcohol oxidization reaction and the alcohol concentration in the breath sample. The Alco-Sensor IV automatically monitors breath flow to ensure a valid sample of expired air is obtained.

The Alco-Sensor IV reports the measured alcohol concentration in grams of alcohol per 210 liters of breath, as specified by Missouri statute.
SPECIFICITY

Due to the nature of their construction, the alcohol fuel cell used in the Alco-Sensor IV is highly specific for alcohol on the human breath. The following is an abbreviated list of substances tested by the University of Tennessee at Memphis to measure their response on the Alco-Sensor IV.

<table>
<thead>
<tr>
<th>Substance</th>
<th>Vapor Concentration (mg/l)</th>
<th>Alco-Sensor IV Response (gm/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetaldehyde</td>
<td>0.1</td>
<td>0.002</td>
</tr>
<tr>
<td>Acetone</td>
<td>0.1</td>
<td>0.0</td>
</tr>
<tr>
<td>Acetonitrile</td>
<td>0.1</td>
<td>0.0</td>
</tr>
<tr>
<td>Benzene</td>
<td>0.05</td>
<td>0.0</td>
</tr>
<tr>
<td>2-Butanol</td>
<td>0.1</td>
<td>0.002</td>
</tr>
<tr>
<td>Cyclohexane</td>
<td>0.1</td>
<td>0.0</td>
</tr>
<tr>
<td>Diethylether</td>
<td>0.1</td>
<td>0.0</td>
</tr>
<tr>
<td>Ethanol</td>
<td>0.1</td>
<td>0.100</td>
</tr>
<tr>
<td>Ethylacetate</td>
<td>0.06</td>
<td>0.0</td>
</tr>
<tr>
<td>Gasoline</td>
<td>0.1</td>
<td>0.002</td>
</tr>
<tr>
<td>Isoprene</td>
<td>0.1</td>
<td>0.002</td>
</tr>
<tr>
<td>Isopropanol</td>
<td>0.06</td>
<td>0.005</td>
</tr>
<tr>
<td>Methane</td>
<td>0.1</td>
<td>0.0</td>
</tr>
<tr>
<td>Methanol</td>
<td>0.04</td>
<td>0.008</td>
</tr>
<tr>
<td>MEK</td>
<td>0.06</td>
<td>0.0</td>
</tr>
<tr>
<td>n-Pentane</td>
<td>0.1</td>
<td>0.0</td>
</tr>
<tr>
<td>n-Hexane</td>
<td>0.1</td>
<td>0.0</td>
</tr>
<tr>
<td>n-Heptane</td>
<td>0.1</td>
<td>0.0</td>
</tr>
<tr>
<td>n-Octane</td>
<td>0.1</td>
<td>0.0</td>
</tr>
<tr>
<td>Mineral Spirits</td>
<td>0.1</td>
<td>0.0</td>
</tr>
<tr>
<td>Tetrachloroethylene</td>
<td>0.05</td>
<td>0.0</td>
</tr>
<tr>
<td>Toluene</td>
<td>0.05</td>
<td>0.0</td>
</tr>
<tr>
<td>Trichlorethylene</td>
<td>0.1</td>
<td>0.0</td>
</tr>
<tr>
<td>Xylene</td>
<td>0.1</td>
<td>0.0</td>
</tr>
</tbody>
</table>

The display communicates information and instructions from the instrument to the operator.

The mouthpiece functions as the transport mechanism for breath samples from the testing subject to the instrument. Proper insertion of the mouthpiece also turns the Alco-Sensor IV on. All breath samples and the room air used in the air blank sequences are directed to the sample chamber through the mouthpiece.

The SET Button cocks the sampling pump to accept the sample.

The RECALL Button allows the operator to print a previous test.

The MANUAL Button has no valid function during a subject breath test.

The Red Release Button ejects the mouthpiece, thereby also turning the instrument off.

The Printer Cable Connection sends data from the Alco-Sensor IV to the printer.

The use of the MANUAL button to obtain a breath alcohol test result is not considered a valid test result by the Missouri Department of Health and Senior Services. If the MANUAL button is accidentally depressed during a testing sequence, restart the testing sequence.
DATA ENTRY

The Alco-Sensor IV does not have a keyboard for data entry. The printed Test Record includes spaces for the operator to write in the Subject Name, I.D., Operator Name and I.D., and Location of instrument. It is the duty of the officer to correctly and adequately complete the test record with this information following a breath test sequence.

RADIO FREQUENCY INTERFERENCE

Since the Alco-Sensor IV is an electrical instrument, it is susceptible to the possibility of Radio Frequency Interference (RFI). Radio frequency interference is a disturbance that affects an electrical circuit due to electromagnetic radiation emitted from an external source (such as a walkie-talkie). The disturbance may interrupt, obstruct, or otherwise degrade or limit the effective performance of the circuit.

If the presence of a radio signal is detected during an analysis, the Alco-Sensor IV will invalidate the test, display “RFI!”, and print “Void: RFI” on the Test Record.

ADMINISTERING A SUBJECT TEST

To administer a subject test on the Alco-Sensor IV with Printer in Missouri, Form #8, “Operational Checklist: Alco-Sensor IV With Printer”, of 19 CSR 25-30 must be completed. This form can be found in 19 CSR 25-30, on page two of form DOR-2389 (Alcohol Influence Report) or on the DHSS website at: [http://health.mo.gov/lab/breathalcohol/](http://health.mo.gov/lab/breathalcohol/)

You should complete an Operational Checklist for each separate test conducted on a subject.

1. The first step of the operational checklist is an examination of the subject’s mouth. This examination can be performed in one of two ways: The officer can perform a limited visual examination of the subject’s mouth, or the officer can ask the subject whether they have any substances in their mouth. Substances are defined as solid or liquid foreign matter, but does not include dentures, dental work, studs, piercings, or tongue jewelry. Once this examination has been completed, the officer may begin the observation period.

2. An officer with a valid Type II or Type III permit must observe the subject for a
minimum of fifteen (15) minutes. The observation period must be continuous and does not end until a breath sample has been provided into the breath analyzer. The officer must remain close enough to the subject during the observation period to reasonably ensure, using the senses of sight, hearing, or smell, that the test subject does not smoke, vomit, or have any oral intake. While the officer must remain close enough to the subject to do this, direct observation is not necessary ensure the test validity or accuracy. The permit holder should carefully observe the subject during both the fifteen-minute observation period as well as while the subject is providing his/her breath sample into the instrument, so that the subject’s actions, demeanor, and behavior can be documented.

3. Make sure that the printer is attached to the Alco-Sensor IV.

4. Turn the printer on. If display shows LO BAT, or if the printer otherwise does not function, recharge the printer battery or plug into wall before continuing.

5. Insert an Alco-Sensor IV mouthpiece into the Alco-Sensor IV. This turns the instrument on.

6. Observe the temperature displayed on the instrument display panel. This temperature must read between 10 °C and 40 °C. The instrument will then display the current time and date and will move immediately into the automated test sequence.

7. During the automated test sequence the instrument display will show the following series of messages.

   **ALTERNATING “<” AND “>” SYMBOLS**
   The Alco-Sensor IV is monitoring the fuel cell output to ensure that the system is stable and free of alcohol.

   **BLNK**
   When unit displays BLNK, the unit runs a blank test and then displays the result of the test. “.000” will appear on the display if the fuel cell is free of alcohol. If not, the test sequence will void.

8. When “TEST” is displayed on the display panel, the Alco-Sensor IV is ready to take a sample of the subject’s breath.

   **The officer should advise the subject as follows: “Place your mouth on the mouthpiece and blow long and steady until I tell you to stop.”**

   The breath sample has to meet the following three criteria to assure the collection of an adequate sample of expired air. These criteria are:

   a. The subject must blow with sufficient flow rate to sound the tone in the instrument and have a “+” appear on the instrument display.

   b. During the breath flow, this flow rate must be maintained continuously until a minimum acceptable volume has been delivered.
c. The flow rate must then decrease as flow diminishes naturally from a subject. If the flow rate decreases too abruptly, the instrument will void the testing sequence and print “Void: DEFICIENT SAMPLE”. If the sample is not sufficient for analysis, the display will have the message “NOGO”. The subject has two more attempts to deliver an adequate breath sample before the testing sequence is voided.

The Alco-Sensor IV allows a 60 – 70 second window for the completion of a breath attempt. If three insufficient samples were delivered during this timeframe, the instrument will void the testing sequence and print “Void: INSF SAMP”. If a complete breath sample has simply not been acquired by the end of the three minutes, the Alco-Sensor IV will print “Void: TIME OUT”.

If a suitable sample has been delivered, a single click will be heard by the operator.

As soon as an adequate breath sample has been delivered to the Alco-Sensor IV, the alternating “<” and “>” will reappear, indicating that the instrument is analyzing the breath sample. Once the instrument has completed analysis of the breath sample, it will beep for three (3) seconds while displaying the measured Breath Alcohol Concentration.

After the instrument is done displaying the measured BAC, the Alco-Sensor IV will show alternating “.” on the display as it sends the test sequence information to the attached printer.

9. Once the Alco-Sensor IV is done sending data to the printer, it will show the display message “SET”. At this point depress the SET button to cock the sampling pump back into position for the next test sequence.

10. Tear off the test record and fill in subject and testing operator’s information.

11. At this point, the instrument is done conducting a breath alcohol test. Press the red release button to eject the mouthpiece.

12. Turn off the printer.

13. Attach the printout to the “Operational Checklist: Alco-Sensor IV With Printer” and finish completing the Operational Checklist. Complete the certification portion of the checklist as appropriate.

Unless a copy of the evidence ticket is illegible, you should attach a copy of each separate evidence ticket obtained on a test subject.

Good hygiene suggests that a new mouthpiece be used for each separate breath test sequence performed on a test subject. A breath test, or breath test sequence, is a complete testing sequence from the starting of the test on the instrument until a printout of a test result or status code is achieved. This is different from a breath sample or attempt, which can occur multiple times during a single testing sequence depending upon a variety of factors such as a subject’s willingness to cooperate, physical capabilities, officer instruction and coaching, etc. Always use a new mouthpiece for a different test subject.
ALCO-SENSOR IV STATUS MESSAGES

Occasionally, a message, or status code, will appear on the screen or on the evidential printout of the Alco-Sensor IV. The following is a list of some of the more common messages that may appear. If one of the following messages is received while operating the Alco-Sensor IV with printer, please follow the recommended action.

DISPLAYED MESSAGES

<table>
<thead>
<tr>
<th>STATUS CODE</th>
<th>EXPLANATION AND CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOGO</td>
<td>An insufficient sample was given. Subjects are afforded three (3) attempts to deliver a proper sample before test is voided.</td>
</tr>
<tr>
<td>MEM/WARN</td>
<td>Warns that the internal memory is almost full.</td>
</tr>
<tr>
<td>MEM/FULL</td>
<td>The internal memory is full. Contact Type II to empty instrument memory before taking a subject's breath sample.</td>
</tr>
<tr>
<td>SET</td>
<td>The SET button needs to be depressed to cock the sampling pump.</td>
</tr>
<tr>
<td>VOID</td>
<td>A condition not conducive to taking a breath sample exists. Turn the unit off and restart the testing sequence.</td>
</tr>
<tr>
<td>&gt;XXX</td>
<td>Sample concentration in excess of instrument limit (&gt;0.400)</td>
</tr>
<tr>
<td>RFI!</td>
<td>Radio Frequency Interference (RFI) was detected. Find and remove the source of RFI and restart the test.</td>
</tr>
<tr>
<td>TMP&gt;</td>
<td>Out of service. Contact Type II and go to another instrument.</td>
</tr>
<tr>
<td>TMP&lt;</td>
<td>Out of service. Contact Type II and go to another instrument.</td>
</tr>
</tbody>
</table>

PRINTED MESSAGES

| Void: SET PUSH | The SET button was depressed during the breath sample. Restart the testing sequence. |
| Void: RFI      | Radio Frequency Interference (RFI) was detected. Find and remove the source of RFI and restart the test. |
| Void: INSF SAMP| Subject gave three (3) insufficient samples and test was therefore voided. Change mouthpiece and try again or request blood under implied consent. |
| Void: TIME OUT | A sufficient sample was not given during the time limit. |
| Void: DEFICIENT SAMPLE | The subject stopped blowing abruptly, rather than allowing their breath flow to slowly decrease as it ran out. Restart test. |
| Subject Test: Man | The MANUAL button was depressed during breath sampling. This is not considered a valid test. Restart the testing sequence. |

If any message appears on the display or on an evidential printout other than those listed above, discontinue use of the instrument and contact a Type II responsible for maintaining the instrument.
BREATH ALCOHOL PROGRAM
TYPE III OPERATOR MANUAL

SECTION 3-D

Intox DMT Operation Guide

INSTRUMENTATION

The Intox DMT is a forensic breath-testing device that measures ethanol (commonly termed “alcohol”) and is based on the principles of infrared spectrometry. The DMT accurately determines the amount of alcohol in expired breath at the time the test is administered. Breath alcohol concentration (BrAC) is directly proportional to blood alcohol concentration (BAC). This is an established scientific truth of great benefit to law enforcement. BrAC and BAC need not be compared, since both are equally reliable and established measures of intoxication.

Following recommendations by the National Safety Council’s Committee on Alcohol and Other Drugs, the Department of Transportation established a conservative standard to legally define alcohol impairment while operating a motor vehicle. This standard is 0.080 grams of alcohol per 210 liters of breath (g/210 L) or per 100 milliliters of blood (g/100 mL). At this level of intoxication, there is well-founded agreement that any individual will be too impaired to drive safely.

It is important to remember that an arrest is not made on the basis of a breath test alone. It also depends on other factors, such as weaving on the roadway, odor of intoxicants, physical tests, and all those observations that give an officer probable cause to believe the driver was under the influence of alcohol and/or drugs.

The DMT has been used for the purpose of forensic breath alcohol concentration measurement in a number of different states and in other countries. The Intox DMT has been tested and approved prior to its use for evidential testing in Missouri by both the National Highway Traffic Safety Administration (NHTSA) and the Missouri Department of Health and Senior Services, and is listed on both the NHTSA Conforming Products List and in Missouri’s Regulations 19 CSR 25-30.050, Approved Breath Analyzers.
INFRARED SPECTROMETRY

The basis of infrared breath analysis is the absorption of infrared energy by alcohol molecules in a breath specimen. Infrared radiation is a portion of the electromagnetic spectrum. Infrared wavelengths are longer than visible light and are not visible to the human eye. Spectrometry, an analytical method that measures the absorption of radiant energy by a substance, is widely used in the scientific community.

THE ELECTROMAGNETIC SPECTRUM

[Diagram of the electromagnetic spectrum showing increasing energy and wavelength, with a scale ranging from 0.0001 nm to 100 m, and categories such as Gamma rays, X-rays, Ultraviolet, Infrared, Radio waves, Radar, TV, FM, AM, and Visible light between 400 nm and 700 nm.]

ETHANOL AND INFRARED ENERGY

The ethanol molecule is composed of two carbon atoms, six hydrogen atoms, and one oxygen atom that are held together in a fixed order by chemical bonds. These chemical bonds absorb infrared energy in a specific and consistent manner. The specific wavelengths absorbed and the absorption pattern are unique, similar to a fingerprint, for a given molecule such as ethanol. The amount of infrared energy absorbed is proportional to the amount of ethanol present in a breath sample.
DETERMINATION OF BREATH ALCOHOL CONCENTRATION

The Intox DMT uses a law of chemistry and physics known as the Beer-Lambert law to determine the alcohol concentration in a breath sample. The Beer-Lambert law states that the amount of energy absorbed by a particular substance is directly proportional to the number of absorbing molecules in the sample. The amount of infrared energy absorbed in a breath sample is proportional to the amount of ethanol present in a breath sample introduced into the instrument sample chamber.

The breath sample enters the sample chamber of the DMT where an infrared beam of light interacts with any ethanol present (see schematic diagram below). The amount of infrared energy absorbed in the sample chamber is then converted into the subject’s BrAC. To satisfy the Regulations’ requirement that the breath sample be end-expiratory air, the DMT automatically monitors breath flow, breath volume, and changes in the breath alcohol concentration to ensure a valid sample is obtained. The sample chamber of the DMT is maintained at a temperature (approximately 50 °C) to prevent condensation. Once the sample has been accepted, it is checked for the presence of interfering substances.

The Intox DMT reports the measured alcohol concentration in grams of alcohol per 210 liters of breath, as specified by Missouri statute.

Schematic Diagram of Intox DMT Optical Bench

INTOX DMT OPTICAL BENCH
SPECIFICITY

The Intox DMT uses three wavelengths of infrared energy to achieve specificity for the analysis of ethanol. Some substances, such as acetone, also absorb infrared energy at these same wavelengths. However, no compound consistent with normal human breath will have the same ratio of absorption at these three wavelengths of infrared energy as ethanol. When the DMT detects these differing absorption ratios, it invalidates the test due to the presence of an interfering substance, displays **INTERFERENCE DETECTED**, and prints **INTERFERENCE DETECTED** on the Test Record. The DMT will not identify or measure the amount of the interfering substance. It is important to show that acetone is not present since it could be found in the breath of someone in a state of ketosis, such as an untreated diabetic or someone on a prolonged fast.

**INFRARED SPECTRUMS OF ETHANOL AND ACETONE**

![Infrared Spectrum of Ethanol](image1)

![Infrared Spectrum of Acetone](image2)
The **breath tube** is the heated, reinforced plastic tube on the right rear side of the instrument that functions as the transport mechanism for breath samples from the testing subject to the instrument. It is heated to prevent condensation of water vapor. All breath samples and the room air used in the air blank sequences are directed to the sample chamber through this tube. The breath tube for the DMT also acts as the RFI (radio frequency interference) antenna, detecting RFI around the instrument.

The **display** is a touch-screen interface that communicates information and instructions between the instrument and the operator.

The **On/Off switch** on the rear of the instrument turns the Intox DMT on or off.

The **Bar Code Reader** reads operator ID cards as well as subject drivers’ licenses to aid operators in the speedy and accurate transfer of information to the instrument during a breath test sequence. *(Use is optional)*

The **keyboard** is used for data entry. Information entered via the keyboard is stored in the instrument’s electronic memory and printed.

The **Dry Gas Compartment** is the secure storage compartment integrated within the instrument for storage of a compressed gas cylinder. *(Use is optional)*

The **External Printer** is used to print all test data from the instrument. *(Actual printers used may vary)*
ADMINISTERING A SUBJECT TEST

To administer a subject test on the DMT in Missouri, Form #11, “Blood Alcohol Test Report - Intox DMT” must be completed. This form will be completed automatically by the DMT during the breath test sequence, and a printed and signed copy of the form will be printed at the end of the test sequence.

1. The first step of the operational checklist is an examination of the subject’s mouth. This examination can be performed in one of two ways: The officer can perform a limited visual examination of the subject’s mouth, or the officer can ask the subject whether they have any substances in their mouth. Substances are defined as solid or liquid foreign matter, but does not include dentures, dental work, studs, piercings, or tongue jewelry. Once this examination has been completed, the officer may begin the observation period.

2. An officer with a valid Type II or Type III permit must observe the subject for a minimum of fifteen (15) minutes. The observation period must be continuous and does not end until a breath sample has been provided into the breath analyzer. The officer must remain close enough to the subject during the observation period to reasonably ensure, using the senses of sight, hearing, or smell, that the test subject does not smoke, vomit, or have any oral intake. While the officer must remain close enough to the subject to do this, direct observation is not necessary ensure the test validity or accuracy. The permit holder should carefully observe the subject during both the fifteen-minute observation period as well as while the subject is providing his/her breath sample into the instrument, so that the subject’s actions, demeanor, and behavior can be documented.

3. Assure that the instrument is turned on. If it is not, turn it on and allow it to warm up (approximately 30 minutes). The instrument is ready to run a test when the bottom of the display shows “Ready <Push Run>”.

4. When the instrument is ready to take a subject sample and after the mouth examination and 15 minute observation period have been performed, push the Run button on the display.

5. The instrument will first display “Scan Operator’s Card?” followed by “Scan Driver’s License?” If you are using a card reader, insert the Operator Card and/or subject’s
driver’s license when prompted. Otherwise, answer “No” to the questions and fill in the test fields manually.

The DMT will now display the screen shown on the right. The officer should double-check the accuracy of all fields filled in by information supplied via the card reader, and use the keyboard to type in answers to all fields not already completed.

The fields to be completed are:
- Subject Name
- Subject License # and State Licensed
- Date of Birth
- Gender
- Operator Name
- Operator Permit # and Expiration Date
- Arresting Officer Name
- Arresting Officer ID
- Arrest Time

There is also a checkbox within the Operator Information portion of the display concerning whether the operator also performed the 15 minute observation period. By default, this boxed is checked, and the Operator Name is auto-filled in the Observation Information portion of the display. However, if the operator was not the observer, uncheck this box. This will then allow the operator to fill in the correct observer’s name.

After determining that all the information is correct, press the **OK** button.

During the automated test sequence the instrument display will show the following series of messages.

**PURGE**
All chambers and internal plumbing are cleansed of any residual substances by ambient (surrounding) air that is pulled in through the Breath Tube and pumped throughout the instrument by an internal pump. “.000” will appear on the display if the chamber is clear.

**AMBIENT CHECK AND AMBIENT ZEROING**
After the pump stops, the DMT determines zero references based on the ambient air in the Sample Chamber. During this cycle all three of the specific wavelength filters are inserted into the infrared light path to establish zero references at each wavelength.

**BLANK CHECK**
A measurement is taken after the “Ambient Zeroing”. “.000” will appear on the display if no contamination was detected.
INTERNAL STANDARD CHECK
During this cycle a quartz plate is inserted into the infrared path to assure that the accuracy of the DMT has not changed since it was last calibrated. Each Intox stores in memory the exact infrared absorption value of this quartz standard at the time of calibration. The instrument measures the absorption of the quartz plate and compares this measured value with the value obtained at calibration. The two values must agree within prescribed limits or the test sequence will be aborted.

After the DMT has successfully completed the preceding test sequence, the instrument will display: “Did the subject refuse?” If the subject refuses, press the Yes box on the screen. The instrument will print “REFUSED” on the blood alcohol test report and terminate the test sequence. If the subject is willing to take the breath test, press the No box.

6. The instrument will display “PLEASE BLOW” and emit a beeping sound. Insert a mouthpiece into the Breath Tube and have the subject blow at this time.

The officer should advise the subject as follows: “Place your mouth on the mouthpiece and blow long and steady into the tube until I tell you to stop.”

The breath sample has to meet the following three criteria to assure the collection of an adequate sample of expired breath. These criteria are:

a. A minimum single breath sample volume of at least 1.5 liters must be delivered.
b. A minimum breath flow rate of 3 liters per minute must be maintained until the minimum breath volume has been delivered.
c. The breath alcohol concentration must show that it has reached end-expiratory air (rate of change in concentration must be within prescribed limits).

During breath sampling, a horizontal green bar is displayed in the bottom right-hand portion of the screen. The first two sample criteria have been met when the green bar crosses the gray line in the middle of the display box. After the flow rate has decreased to less than 3 liters per minute, the instrument will finish the analysis of the breath sample.

The DMT allows a two-minute window for the completion of a breath test. If a breath test meeting the necessary criteria has not been given during this time period, the DMT will ask again “SUBJECT REFUSE?” and display both “YES” and “No” boxes on the screen. If the subject is refusing to provide a breath sample, press the “Yes” box on the screen and the instrument will abort the testing sequence and will print “REFUSED” on the blood alcohol test report. If the subject did not appear to be refusing to take the test and is willing to try and provide a sample again, press the “No” box on the screen and a status code of “INCOMPLETE” will print on the test report.
After the subject has finished giving a valid breath sample, the DMT will display “ANALYZING”. Remove the mouthpiece from the Breath Tube before the instrument displays “PURGING” and allow the DMT to complete the rest of the automated test sequence. Throw the mouthpiece away. The DMT will purge the Sample Chamber at this point and the take another BLANK TEST.

Once the breath test and all operational steps performed by the instrument are completed and all test results have been accepted by the instrument, the DMT will ask the operator to complete the operator certifications on the bottom of the test report form. Following test certification, the operator will sign the report form on the display of the DMT using a stylus. If a witness to the test was present, they can also sign the display after the operator has signed it.

The last item to appear during the test sequence is the “Remarks/Comments” box. This provides an opportunity for the operator to add any additional information to the BAC test record they feel is relevant.

The completed blood alcohol test report will then print from the instrument’s external printer. A signed copy of the last maintenance report will also print directly after the test report.

Good hygiene suggests that a new mouthpiece be used for each separate breath test sequence performed on a test subject. A breath test, or breath test sequence, is a complete testing sequence from the starting of the test on the instrument until a printout of a test result or status code is achieved. This is different from a breath sample or attempt, which can occur multiple times during a single testing sequence depending upon a variety of factors such as a subject’s willingness to cooperate, physical capabilities, officer instruction and coaching, etc. Always use a new mouthpiece for a different test subject.
INTOX DMT STATUS CODES

Occasionally, a message, or status code, will appear on the screen and/or on an evidential ticket printout. The following is a list of the messages that will appear on the display and/or on an evidential ticket printout. If one of the following messages is received while operating the DMT, please follow the recommended action.

<table>
<thead>
<tr>
<th>STATUS CODE</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAINTENANCE TEST REQUIRED</td>
<td>Out of service. Contact Type II and go to another instrument.</td>
</tr>
<tr>
<td>INCOMPLETE</td>
<td>A complete and valid breath test was not given during sampling. Try one or more tests. An additional observation period is not warranted.</td>
</tr>
<tr>
<td>INVALID SAMPLE</td>
<td>Conduct new oral examination and new observation period. Try one or more tests. If unsuccessful, request blood sample under implied consent.</td>
</tr>
<tr>
<td>RFI DETECTED</td>
<td>Find and remove source of radio transmission. Rerun test.</td>
</tr>
<tr>
<td>INTERFERENCE DETECTED</td>
<td>Try one more test. If interference is detected on the second test, request blood sample under implied consent.</td>
</tr>
<tr>
<td>AMBIENT FAIL</td>
<td>Check for odors, check to see if mouthpiece in breath tube, try one or more tests. If unsuccessful, contact Type II.</td>
</tr>
<tr>
<td>PUMP ERROR</td>
<td>Check to see if mouthpiece in breath tube, try one or more tests. If unsuccessful, contact Type II.</td>
</tr>
<tr>
<td>SUCKBACK ERROR</td>
<td>Subject sucked air through the breath tube during sampling. Reinstruct on the correct method for providing a sample and try one or more tests. If unsuccessful, request blood sample under implied consent.</td>
</tr>
<tr>
<td>BLANK ERROR</td>
<td>Check to see if mouthpiece in breath tube, try one or more tests. If unsuccessful, contact Type II.</td>
</tr>
<tr>
<td>FILTER WHEEL ERROR</td>
<td>Try one or more tests. If unsuccessful, contact Type II.</td>
</tr>
<tr>
<td>FILTER (1, 2 or 3) WON’T ZERO</td>
<td>Try one or more tests. If unsuccessful, contact Type II.</td>
</tr>
<tr>
<td>DETECTOR OVERFLOW</td>
<td>Out of service. Contact Type II and go to another instrument.</td>
</tr>
<tr>
<td>INTERNAL STANDARD ERROR</td>
<td>Out of service. Contact Type II and go to another instrument.</td>
</tr>
<tr>
<td>SAMPLE CHAMBER TEMPERATURE CHECK</td>
<td>Out of service. Contact Type II and go to another instrument.</td>
</tr>
<tr>
<td>BREATH TUBE TEMPERATURE CHECK</td>
<td>Out of service. Contact Type II and go to another instrument.</td>
</tr>
</tbody>
</table>

If any status code appears on the display or on an evidential ticket other than those listed above, discontinue use of the instrument and contact a Type II responsible for maintaining the instrument.
INSTRUMENTATION

The Intoxilyzer 8000 is a forensic breath-testing device that measures ethanol (commonly termed “alcohol”) and is based on the principles of infrared spectrometry. The Intoxilyzer 8000 accurately determines the amount of alcohol in expired breath at the time the test is administered. Breath alcohol concentration (BrAC) is directly proportional to blood alcohol concentration (BAC). This is an established scientific truth of great benefit to law enforcement. BrAC and BAC need not be compared, since both are equally reliable and established measures of intoxication.

Following recommendations by the National Safety Council’s Committee on Alcohol and Other Drugs, the Department of Transportation established a conservative standard to legally define alcohol impairment while operating a motor vehicle. This standard is 0.080 grams of alcohol per 210 liters of breath (g/210 L) or per 100 milliliters of blood (g/100 mL). At this level of intoxication, there is well-founded agreement that any individual will be too impaired to drive safely.

It is important to remember that an arrest is not made on the basis of a breath test alone. It also depends on other factors, such as weaving on the roadway, odor of intoxicants, physical tests, and all those observations that gave you probable cause to believe the driver was under the influence of alcohol and/or drugs.

The Intoxilyzer 8000 has been used for the purpose of forensic breath alcohol concentration measurement in at least 18 different states and various other countries. The Intoxilyzer 8000 has been tested and approved prior to its use for evidential testing in Missouri by both the National Highway Traffic Safety Administration (NHTSA) and the Missouri Department of Health and Senior Services, and is listed on both the NHTSA Conforming Products List and in Missouri’s Regulations 19 CSR 25-30.050, Approved Breath Analyzers.
INFRARED SPECTROMETRY

The basis of infrared breath analysis is the absorption of infrared energy by alcohol molecules in a breath specimen. Infrared radiation is a portion of the electromagnetic spectrum. Infrared wavelengths are longer than visible light and are not visible to the human eye. Spectrometry, an analytical method that measures the absorption of radiant energy by a substance, is widely used in the scientific community.

THE ELECTROMAGNETIC SPECTRUM

The ethanol molecule is composed of two carbon atoms, six hydrogen atoms, and one oxygen atom that are held together in a fixed order by chemical bonds. These chemical bonds absorb infrared energy in a specific and consistent manner. The specific wavelengths absorbed and the absorption pattern are unique, similar to a fingerprint, for a given molecule such as ethanol. The amount of infrared energy absorbed is proportional to the amount of ethanol present in a breath sample.
DETERMINATION OF ALCOHOL CONCENTRATION

The Intoxilyzer 8000 uses a law of chemistry and physics known as the Beer-Lambert law to determine the alcohol concentration in a breath sample. The Beer-Lambert law states that the amount of energy absorbed by a particular substance is proportional to the number of absorbing molecules in the sample. The amount of infrared energy absorbed on a breath alcohol instrument is proportional to the amount of ethanol present in a breath sample introduced into the instrument sample chamber.

The breath sample enters the sample chamber of the 8000 where an infrared beam of light interacts with any ethanol present (see schematic diagram below). The amount of infrared energy absorbed in the sample chamber is then converted into the subject’s BrAC. The 8000 automatically monitors breath flow rate, breath volume, and changes in the breath alcohol concentration to ensure a valid sample is obtained. The sample chamber of the Intoxilyzer 8000 is maintained at a steady temperature (approximately 47 °C) to prevent condensation.

If an improper environmental testing condition, an improper instrument testing condition, or if an operational mistake is detected at any point during the test, the Intoxilyzer 8000 will stop the analysis and invalidate the test. The reason for the invalidation will be displayed and printed; no analytical results will be printed.

The Intoxilyzer 8000 reports the measured alcohol concentration in grams of alcohol per 210 liters of breath, as specified by Missouri statute.

Diagram of Intoxilyzer 8000 Optical Bench
SPECIFICITY

The Intoxilyzer 8000 uses two different wavelengths of infrared energy to achieve specificity for the analysis of ethanol. Other substances, such as acetone, also absorb infrared energy at some of the same wavelengths as ethanol. However, no compound consistent with normal human breath will have the same ratio of absorption at these wavelengths of infrared energy as alcohols. When the Intoxilyzer 8000 detects these differing absorption patterns, it will invalidate the test due to the presence of an interfering substance, display “INTERFERENT DETECT”, and print “INTERFERENT DETECT” on the Test Record. The Intoxilyzer 8000 will not identify or measure the amount of the interfering substance. It is important to show that acetone is not present since it could be found in the breath of someone in a state of ketosis, such as an untreated diabetic or someone on a prolonged fast.

INFRARED SPECTRUMS OF ETHANOL AND ACETONE
INTOXILYZER 8000 EXTERNAL COMPONENTS

The **Digital Display** communicates information and instructions from the instrument to the operator.

The **Breath Tube** is the heated, reinforced plastic tube located on the top of the instrument that functions as the transport mechanism for breath samples from the testing subject to the instrument. It is heated to prevent condensation of water vapor. All breath samples and the room air used in the air blank sequences are directed to the sample chamber through this tube.

The **Start Test Button**, which is the green button in the middle of the instrument, starts a breath test sequence.

The **Barcode Scanner**, located underneath the display, is used for scanning operator permit cards and subject driver licenses.

The **Mouthpiece Holder** is located on the top of the instrument and is heated so that mouthpieces can be kept at a comfortable temperature for test subjects.

The **Keyboard** is used for data entry and folds up and locks in place to help make the Intoxilyzer 8000 more portable.

The **External Printer** is used to print all test data from the instrument. *(Actual printer used may vary)*
ADMINISTERING A SUBJECT TEST

To administer a subject test on the Intoxilyzer 8000 in Missouri, Form #12, “Blood Alcohol Test Report – Intoxilyzer 8000” must be completed. This form will be completed automatically by the 8000 during the breath test sequence, and a copy of the form will be printed at the end of the test sequence.

1. The first step of the operational checklist is an examination of the subject’s mouth. This examination can be performed in one of two ways: The officer can perform a limited visual examination of the subject’s mouth, or the officer can ask the subject whether they have any substances in their mouth. Substances are defined as solid or liquid foreign matter, but does not include dentures, dental work, studs, piercings, or tongue jewelry. Once this examination has been completed, the officer may begin the observation period.

2. An officer with a valid Type II or Type III permit must observe the subject for a minimum of fifteen (15) minutes. The observation period must be continuous and does not end until a breath sample has been provided into the breath analyzer. The officer must remain close enough to the subject during the observation period to reasonably ensure, using the senses of sight, hearing, or smell, that the test subject does not smoke, vomit, or have any oral intake. While the officer must remain close enough to the subject to do this, direct observation is not necessary ensure the test validity or accuracy. The permit holder should carefully observe the subject during both the fifteen-minute observation period as well as while the subject is providing his/her breath sample into the instrument, so that the subject’s actions, demeanor, and behavior can be documented.

3. Assure that the power switch is ON and the screen is displaying “READY MODE”. If the 8000 is not on, turn it on and allow it to warm up (approximately 15 – 20 minutes). Make sure that the printer is turned on as well.
If the Intoxilyzer 8000 screen is displaying “STANDBY MODE”, press the start button. It takes approximately two minutes for the 8000 to move from ‘standby’ to ‘ready’. The first minute warms up system components. The second minute runs a system diagnostic check.

Once the 8000 is ready to conduct tests, the scrolling display will show the “READY MODE” message.

4. At this point, press the Start Test button to initiate the instrument test sequence.

5. To begin entering officer and subject data, the instrument will first display “Please scan ID or press enter”. If you are using an Operator Card, place the card in the optical path of the reader and it will automatically input the operator’s information. Otherwise, hit the enter button on the display and complete the following questions.
   a. Operator Name:
   b. Operator Permit Number:
   c. Permit Expiration Date: (mm/dd/yyyy) format

At this point the operator has manually entered the same information that would have been read from an operator card. All operators will then be asked the following questions:
   d. Arresting Officer Name:
   e. Arresting Officer ID Number:
   f. Witness Name (If there was a witness to the test)

The instrument will next display “Please scan DL or press enter”. If you have the subject’s driver’s license, place the license with the bar code in the optical path of the reader and it will automatically input the subject’s information. Otherwise, hit the enter button on the display and complete the following questions.
   g. Subject Name:
   h. Subject Date of Birth: (mm/dd/yyyy) format
   i. Sex (M/F): (M/F) format
   j. Subject Drivers License Number:
   k. DL State of Issue:

The last question that the display will prompt during data entry is: “REVIEW DATA? Y/N”. If the officer wishes to correct a mistake made during the data entry, or merely wishes to review the data, hit Y and then the ENTER button on the keyboard and the instrument will send the officer back through each of the questions a – k listed above. Once the officer is satisfied with the data, he should hit the N and then the ENTER button on the keyboard at this stage and the instrument will move out of data entry and into the automated test sequence.

During the automated test sequence the instrument display will show the following series of messages.
PURGING and AIR BLANK
All chambers and internal plumbing are cleansed of any residual substances by ambient (room) air that is pulled in through the Breath Tube and pumped throughout the instrument by an internal pump. This is done before the diagnostic check, before a subject sample and after a subject sample to ensure that the instrument is clean of any residual alcohol from previous tests. After the initial purging, the 8000 measures the amount of infrared light that is striking the detector when only room air is in the sample chamber. It uses this to establish a “zero reference” point.

DIAGNOSTIC CHECK
The Intoxilyzer 8000 then runs a diagnostic check to ensure that all instrument systems are operating correctly. After this diagnostic check, a second Air Blank is taken.

INTERNAL REFERENCE CHECK
The last part of the automated test sequence prior to a subject giving a breath sample is the internal reference check. The internal reference check ensures that the measured signal is consistent with the reference created at the time of calibration.

6. After the Intoxilyzer 8000 has successfully cycled through these steps of the automatic test sequence, the instrument will display “PLEASE BLOW/R UNTIL THE TONE STOPS” initially, followed with the displayed message “PLEASE BLOW/R”, accompanied by an intermittent beeping tone. If the subject refuses, hit the “R” button on the keyboard. The instrument will print, “Subject Test Refused” on the BAC test report and terminate the test sequence. If the subject is not refusing to take the breath test, insert a mouthpiece into the Breath Tube and have the subject blow at this time.

The officer should advise the subject as follows: “Place your mouth on the mouthpiece and blow long and steady into the tube until I tell you to stop.”

The breath sample has to meet the following three criteria to assure the collection of an adequate sample of expired breath. These criteria are:

a. A minimum breath flow rate must be maintained until the minimum breath volume has been delivered.

b. During the breath sample, the minimum flow rate must be maintained continuously for a minimum time and minimum sample volume.

c. The breath alcohol concentration must show that it has reached end-expiratory air.

The Intoxilyzer 8000 allows a three-minute window for the providing a complete breath sample. If a complete breath sample has not been acquired by the end of the three minutes, the Intoxilyzer 8000 will print “DEFICIENT SAMPLE”.

After the subject has finished giving a valid breath sample and the breath flow rate decreases to below the sampling threshold, the instrument will finish the analysis of the breath sample. The instrument will then complete another “Air Blank”.
Once the breath test and all operational steps performed by the instrument are completed and all test results have been accepted by the instrument, the Intoxilyzer 8000 will then ask the operator to input any comments to be printed on the test report. The operator will then be asked to certify the test results by answering the operator certification questions both on the operational checklist as well as on the bottom of the BAC test report.

After the test certifications have been completed, the external printer of the Intoxilyzer 8000 will print both the BAC Test Report Form as well as an unsigned copy of the most recent maintenance report.

Good hygiene suggests that a new mouthpiece be used for each separate breath test sequence performed on a test subject. A breath test, or breath test sequence, is a complete testing sequence from the starting of the test on the instrument until a printout of a test result or status code is achieved. This is different from a breath sample or attempt, which can occur multiple times during a single testing sequence depending upon a variety of factors such as a subject’s willingness to cooperate, physical capabilities, officer instruction and coaching, etc. Always use a new mouthpiece for a different test subject.
INTOXILYZER 8000 OPERATIONAL MESSAGES

Occasionally, a message, or status code, will appear on the screen and/or on a BAC Test Report. The following is a list of the messages that will appear on the display and/or on an evidential ticket printout. If one of the following messages is received while operating the Intoxilyzer 8000, please follow the recommended action.

<table>
<thead>
<tr>
<th>DISPLAY MESSAGE</th>
<th>TEST-RECORD MESSAGE</th>
<th>EXPLANATION AND CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>DISABLED MODE</td>
<td>N/A</td>
<td>Out of service. Contact Type II and go to another instrument.</td>
</tr>
<tr>
<td>INVALID SAMPLE</td>
<td>INVALID SAMPLE</td>
<td>Check mouth, wait an additional 15 minutes, try one or more tests. If unsuccessful, request blood sample under implied consent.</td>
</tr>
<tr>
<td>INTERFERENT DETECT</td>
<td>INTERFERENT DETECT</td>
<td>Try one more test. If interference is detected on the second test, request blood sample under implied consent.</td>
</tr>
<tr>
<td>DEFICIENT SAMPLE</td>
<td>DEFICIENT SAMPLE</td>
<td>A complete and valid breath sample was not provided in the time allotted.</td>
</tr>
<tr>
<td>RFI DETECT</td>
<td>RFI DETECT</td>
<td>Find and remove source of radio transmission. Attempt to conduct another test.</td>
</tr>
<tr>
<td>AMBIENT FAIL</td>
<td>AMBIENT FAIL</td>
<td>Check for odors, check to see if mouthpiece was removed, try one or more tests. If unsuccessful, contact Type II.</td>
</tr>
<tr>
<td>PURGE FAIL</td>
<td>PURGE FAIL</td>
<td>Check for odors, check to see if mouthpiece was removed, try one or more tests. If unsuccessful, contact Type II.</td>
</tr>
<tr>
<td>NO SAMPLE GIVEN</td>
<td>NO SAMPLE GIVEN</td>
<td>No breath was provided by subject during the time allotted.</td>
</tr>
<tr>
<td>VOLTAGE/CURRENT FAILURE</td>
<td>VOLTAGE/CURRENT FAILURE</td>
<td>The instrument internal voltages are unstable. Please Contact a Type II and go to another instrument.</td>
</tr>
</tbody>
</table>

If any status code appears on the display or on a BAC Test Report other than those listed above, discontinue use of the instrument and contact a Type II responsible for maintaining the instrument.
INSTRUMENTATION

The Intox EC/IR II is a forensic breath-testing device that measures ethanol (commonly termed “alcohol”) using an electrochemical cell, also known as a fuel cell. The EC/IR II accurately determines the amount of alcohol in expired breath at the time the test is administered. Breath alcohol concentration (BrAC) is directly proportional to blood alcohol concentration (BAC). This is an established scientific truth of great benefit to law enforcement. BrAC and BAC need not be compared, since both are equally reliable and established measures of intoxication.

Following recommendations by the National Safety Council’s Committee on Alcohol and Other Drugs, the Department of Transportation established a conservative standard to legally define alcohol impairment while operating a motor vehicle. This standard is 0.080 grams of alcohol per 210 liters of breath (g/210 L) or per 100 milliliters of blood (g/100 mL). At this level of intoxication, there is well-founded agreement that any individual will be too impaired to drive safely.

It is important to remember that an arrest is not made on the basis of a breath test alone. It also depends on other factors, such as weaving on the roadway, odor of intoxicants, physical tests, and all those observations that give an officer probable cause to believe the driver was under the influence of alcohol and/or drugs.

The EC/IR II has been used for the purpose of forensic breath alcohol concentration measurement in a number of different states and in other countries. The Intox EC/IR II has been tested and approved prior to its use for evidential testing in Missouri by both the National Highway Traffic Safety Administration (NHTSA) and the Missouri Department of Health and Senior Services, and is listed on both the NHTSA Conforming Products List and in Missouri’s Regulations 19 CSR 25-30.050, Approved Breath Analyzers.
ALCOHOL FUEL CELL TECHNOLOGY

In its simplest form, the alcohol fuel cell consists of a porous, chemically inert layer coated on both sides with platinum oxide (called platinum black). The manufacturer impregnates the porous layer with an acidic electrolyte solution, and applies platinum wire electrical connections to the platinum black surfaces. The fuel cell assembly is mounted in a case, which includes a gas inlet that allows a breath sample to be introduced. The basic configuration of an alcohol fuel cell is illustrated in Figure 1.

Figure 1. Basic Fuel Cell Configuration

DETERMINATION OF BREATH ALCOHOL CONCENTRATION

The chemical reaction that takes place in an alcohol fuel cell converts alcohol to acetic acid, water, and free electrons. When the top and bottom surfaces of the fuel cell are connected via an electrical circuit, current flows through this circuit to neutralize the charge created by the breakup of alcohol. The current created is a direct indication of the amount of alcohol consumed by the fuel cell. By measuring the amount of current, you can determine the amount of alcohol in the sample. The fuel cell produces a direct relationship between the amount of current generated from the alcohol oxidization reaction and the alcohol concentration in the breath sample.

The Intox EC/IR II also incorporates an infrared spectrophotometer which monitors the release of both alcohol and carbon dioxide during exhalation. Analyzing the release of these two chemicals using proprietary algorithms, the EC/IR II can detect sample irregularities occurring during exhalation due to mouth alcohol.

The Intox EC/IR II reports the measured alcohol concentration in grams of alcohol per 210 liters of breath, as specified by Missouri statute.
SPECIFICITY

Due to the nature of their construction, the alcohol fuel cell used in the Intox EC/IR II is highly specific for alcohol on the human breath. The following is an abbreviated list of substances tested by the University of Tennessee at Memphis to measure their response on the Alco-Sensor IV, which uses the same electrochemical cell as the Intox EC/IR II.

### ALCO-SENSOR IV RESPONSE TO VARIOUS SUBSTANCES

<table>
<thead>
<tr>
<th>Substance</th>
<th>Vapor Concentration (mg/l)</th>
<th>Alco-Sensor IV Response (gm/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetaldehyde</td>
<td>0.1</td>
<td>0.002</td>
</tr>
<tr>
<td>Acetone</td>
<td>0.1</td>
<td>0.0</td>
</tr>
<tr>
<td>Benzene</td>
<td>0.05</td>
<td>0.0</td>
</tr>
<tr>
<td>2-Butanol</td>
<td>0.1</td>
<td>0.002</td>
</tr>
<tr>
<td>Cyclohexane</td>
<td>0.1</td>
<td>0.0</td>
</tr>
<tr>
<td>Diethylether</td>
<td>0.1</td>
<td>0.0</td>
</tr>
<tr>
<td>Ethanol</td>
<td>0.1</td>
<td>0.100</td>
</tr>
<tr>
<td>Ethylacetate</td>
<td>0.06</td>
<td>0.0</td>
</tr>
<tr>
<td>Gasoline</td>
<td>0.1</td>
<td>0.002</td>
</tr>
<tr>
<td>Isoprene</td>
<td>0.1</td>
<td>0.002</td>
</tr>
<tr>
<td>Isopropanol</td>
<td>0.06</td>
<td>0.005</td>
</tr>
<tr>
<td>Methane</td>
<td>0.1</td>
<td>0.0</td>
</tr>
<tr>
<td>Methanol</td>
<td>0.04</td>
<td>0.008</td>
</tr>
<tr>
<td>MEK</td>
<td>0.06</td>
<td>0.0</td>
</tr>
<tr>
<td>n-Pentane</td>
<td>0.1</td>
<td>0.0</td>
</tr>
<tr>
<td>n-Hexane</td>
<td>0.1</td>
<td>0.0</td>
</tr>
<tr>
<td>n-Octane</td>
<td>0.1</td>
<td>0.0</td>
</tr>
<tr>
<td>Mineral Spirits</td>
<td>0.1</td>
<td>0.0</td>
</tr>
<tr>
<td>Toluene</td>
<td>0.05</td>
<td>0.0</td>
</tr>
<tr>
<td>Trichlorethylene</td>
<td>0.1</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Using proprietary algorithms, Intoximeters, Inc. achieves further specificity for ethanol over other substances, including other alcohols, by measuring differences in the reaction time of the substance reacting on the fuel cell compared to the known reaction time of ethanol on the fuel cell. When the EC/IR II detects a reaction time other than the one expected, it invalidates the test, displays **INTERFERING SUBSTANCE**, and prints **INTERFERING SUBSTANCE** on the Test Record. The EC/IR II will not identify or measure the amount of the interfering substance.

The **Breath Tube** is the heated, reinforced tube on the left side of the instrument that functions as the transport mechanism for breath samples from the testing subject to the instrument. It is heated to prevent condensation of water vapor. All breath samples and the room air used in the air blank sequences are directed to the sample chamber through this tube.

The **Display Panel** communicates information and instructions from the instrument to the operator.

The **Power Switch** on the rear of the instrument turns the Intox EC/IR II on or off.

The **Bar Code Reader** reads operator ID cards as well as subject drivers’ licenses to aid operators in the speedy and accurate transfer of information to the instrument during a breath test sequence. *(Use is optional)*

The **Keyboard** is used for data entry. Information entered via the keyboard is stored in the instrument’s electronic memory and printed.

The **Dry Gas Compartment** is the secure storage compartment integrated within the instrument for storage of a compressed gas cylinder. *(Use is optional)*

The **External Printer** is used to print all test data from the instrument. *(Actual printers used may vary)*
ADMINISTERING A SUBJECT TEST

To administer a subject test on the EC/IR II in Missouri, Form #13, “Blood Alcohol Test Report - Intox EC/IR II” must be completed. This form will be completed automatically by the EC/IR II during the breath test sequence, and a copy of the form will be printed at the end of the test sequence.

1. The first step of the operational checklist is an examination of the subject’s mouth. This examination can be performed in one of two ways: The officer can perform a limited visual examination of the subject’s mouth, or the officer can ask the subject whether they have any substances in their mouth. Substances are defined as solid or liquid foreign matter, but does not include dentures, dental work, studs, piercings, or tongue jewelry. Once this examination has been completed, the officer may begin the observation period.

2. An officer with a valid Type II or Type III permit must observe the subject for a minimum of fifteen (15) minutes. The observation period must be continuous and does not end until a breath sample has been provided into the breath analyzer. The officer must remain close enough to the subject during the observation period to reasonably ensure, using the senses of sight, hearing, or smell, that the test subject does not smoke, vomit, or have any oral intake. While the officer must remain close enough to the subject to do this, direct observation is not necessary ensure the test validity or accuracy. The permit holder should carefully observe the subject during both the fifteen-minute observation period as well as while the subject is providing his/her breath sample into the instrument, so that the subject’s actions, demeanor, and behavior can be documented.

3. Assure that the instrument is turned on. If it is not, turn it on and allow it to warm up (approximately 10 – 20 minutes). The instrument is ready to run a test when the display shows “PRESS ENTER TO START”.

4. When the instrument is ready to take a subject sample and after the mouth examination and 15 minute observation period have been performed, push the Enter button on the keyboard.

5. To begin entering officer and subject data, the instrument will first display “Swipe Operator Card: Or Press ENTER”. If you are using an Operator Card, place the card...
into the card slot of the reader and it will automatically input the operator’s information. Otherwise, hit the enter button on the display and complete the following questions.

a. Operator Name:
b. Operator Permit Number:
c. Permit Expiration Date: \((mm/dd/yyyy)\) format

At this point the operator has manually entered the same information that would have been read from an operator card. All operators will then be asked the following questions:

d. Check Mouth? [Y/N]:
e. 15 Minutes Observed? [Y/N]:
f. Observed By: \((default\ answer\ is\ name\ of\ operator)\)

The instrument will next display “Please Swipe Driver’s License: Or Press ENTER”. If you have the subject’s driver’s license, place the license with the bar code into the card slot of the reader and it will automatically input the subject’s information. Otherwise, hit the enter button on the display and complete the following questions.

g. Subject Last Name:
h. Subject First Name:
i. Subject M.I.:
j. Subject Date of Birth: \((mm/dd/yyyy)\) format
k. Sex Gender: \((M/F)\) format
l. Subject Driver’s License #: m. State of Issuance:

At this point the operator has manually entered the same information that would have been read from the driver’s license. All operators will then be asked the following questions:

n. Arresting Officer’s Name:
o. Arresting Officer’s ID:

The last screen the display will show during data entry is: “Starting Test Sequence: SPACE=Begin ENTER=Verify”. If the officer wishes to correct a mistake made during the data entry, or merely wishes to review the data, hit the ENTER button on the keyboard and the instrument will send the officer back through each of the questions a – k listed above. Once the officer is satisfied with the data, the space bar on the keyboard at this stage and the instrument will move out of data entry and into the automated test sequence.

During the automated test sequence the instrument display will show the following series of messages.

**DIAGNOSTIC CHECK**
To begin the automated test sequence, the EC/IR II does an analysis of its internal components to make sure that everything is working properly and that the instrument is ready to conduct a subject breath test.
**INSTRUMENT PURGE**

After the diagnostic check has been passed, the EC/IR II pumps ambient (room) air through the breath tube and analytical bench. This is done before and after a subject sample to ensure that the instrument is clean of any residual sample from a previous breath test.

**BLANK CHECK**

At this point the Intox EC/IR II measures both the amount of infrared light that is striking the detector when ambient (room) air is in the sample chamber, as well as the amount of reaction on the fuel cell when only room air is in the sample chamber. The EC/IR II sets this reading as “0.000” (alcohol-free) and that is the first Blank Check.

6. After the Intox EC/IR II has successfully cycled through these steps of the automatic test sequence, the instrument will display “PLEASE BLOW/R”, accompanied by a beep. If the subject refuses, hit the “R” button on the keyboard. The instrument will print, “Test refused” on the BAC test report and terminate the test sequence. If the subject is not refusing to take the breath test, insert a mouthpiece into the Breath Tube and have the subject blow at this time.

The officer should advise the subject as follows: “**Place your mouth on the mouthpiece and blow long and hard into the tube until I tell you to stop.**”

The breath sample has to meet the following three criteria to assure the collection of an adequate sample of expired breath. These criteria are:

- a. A minimum breath flow rate must be maintained until the minimum breath volume has been delivered.
- b. During the breath sample, the minimum flow rate must be maintained continuously for a minimum time and minimum sample volume.
- c. The flow rate must then decrease as flow diminishes naturally from the subject.

The Intox EC/IR II allows a maximum of 6 separate breath samples during the breath test sequence until a sample meeting all three criteria listed above has been achieved. The EC/IR II purges the sample chamber between each successive breath attempt before another breath sample can be provided, so please remove the mouthpiece from the breath tube between breath attempts to allow for proper purging. Each breath sample attempt has a three-minute window for completion. If none of the 6 breath attempts results in a complete breath sample, the EC/IR II will print a test report of “Insufficient sample”. If the subject fails to give a breath sample during the three minute test window, the Intox EC/IR II will print “Breath timeout – No sample provided”.

After the subject has finished giving a valid breath sample and the breath flow rate decreases to below the sampling threshold, the instrument will finish the analysis of the breath sample. The instrument will then complete another “Blank Check”.

Once the breath test and all operational steps performed by the instrument are completed and all test results have been accepted by the instrument, the Intox EC/IR II will then ask the operator to input any comments to be printed on the test report.
After the test comments have been completed, the external printer of the EC/IR II will print both the BAC Test Report Form as well as an unsigned copy of the most recent maintenance report.

Good hygiene suggests that a new mouthpiece be used for each separate breath test sequence performed on a test subject. A breath test, or breath test sequence, is a complete testing sequence from the starting of the test on the instrument until a printout of a test result or status code is achieved. This is different from a breath sample or attempt, which can occur multiple times during a single testing sequence depending upon a variety of factors such as a subject’s willingness to cooperate, physical capabilities, officer instruction and coaching, etc. Always use a new mouthpiece for a different test subject.
INTOX EC/IR II TEST STATUS CODES

Occasionally, a status message, or code, will appear on the screen and/or on the BAC Test Report. The following is a list of the messages that will appear on the display and/or on an evidential ticket printout. If one of the following messages is received while operating the EC/IR II, please follow the recommended action.

<table>
<thead>
<tr>
<th>STATUS CODE</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAINTENANCE TEST REQUIRED</td>
<td>Out of service. Contact Type II and go to another instrument.</td>
</tr>
<tr>
<td>MOUTH ALCOHOL</td>
<td>Conduct new oral examination and new observation period. Try one or more tests. If unsuccessful, request blood sample under implied consent.</td>
</tr>
<tr>
<td>INSUFFICIENT SAMPLE</td>
<td>A complete and valid breath test was not given during sampling. Try one or more tests. An additional observation period is not warranted. You may want to request blood sample under implied consent.</td>
</tr>
<tr>
<td>INTERFERING SUBSTANCE</td>
<td>Try one more test. If an interfering substance is detected on the second test, request blood sample under implied consent.</td>
</tr>
<tr>
<td>BREATH TIMEOUT</td>
<td>No breath sample was provided during the three minute test window for a breath attempt. You may want to request blood sample under implied consent.</td>
</tr>
<tr>
<td>BREATH AT IMPROPER TIME</td>
<td>Subject began to blow when instrument was not ready to accept sample. Try one or more tests. An additional observation period is not warranted. You may want to request blood sample under implied consent.</td>
</tr>
<tr>
<td>CHECK AMBIENT CONDITIONS</td>
<td>Check for odors, check to see if mouthpiece in breath tube, try one or more tests. If unsuccessful, contact Type II.</td>
</tr>
<tr>
<td>OPERATOR ABORT</td>
<td>Operator aborted the test sequence prior to test completion. Try one or more tests. An additional observation period is not warranted.</td>
</tr>
<tr>
<td>AMBIENT DETECTED</td>
<td>Check for odors, check to see if mouthpiece in breath tube, try one or more tests. If unsuccessful, contact Type II.</td>
</tr>
<tr>
<td>ETHANOL BASELINE ERROR</td>
<td>Out of service. Contact Type II and go to another instrument.</td>
</tr>
<tr>
<td>SET SOLENOID ERROR</td>
<td>Out of service. Contact Type II and go to another instrument.</td>
</tr>
</tbody>
</table>

If any status code appears on the display or on a BAC Test Report other than those listed above, discontinue use of the instrument and contact a Type II responsible for maintaining the instrument.