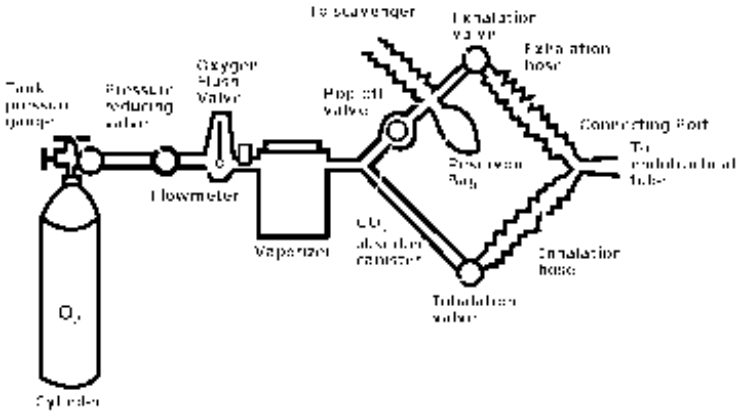
# Anesthesia Machines & Systems

*Drs. Foster & Smith Educational Staff*

The primary purpose of the anesthetic machine and system is to deliver an inhaled (gas) anesthetic to the animal to keep him unconscious through surgery. There are two basic types of anesthetic systems used for small animals: rebreathing and nonrebreathing.
Rebreathing system

Rebreathing systems are used for animals weighing over 10 pounds. The following diagram shows the parts of a rebreathing system which allows recirculation of exhaled gases to the animal. Each breath contains exhaled gas that has had the carbon dioxide removed and fresh oxygen and anesthetic added.

## Rebreathing system




A. Oxygen source with pressure gauge - Oxygen is supplied to the animal. It also is the carrier gas that brings the inhaled anesthetic to the pet.

B. Pressure reducing valve - This valve decreases the high pressure from the oxygen tank to a usable level.

C. Flowmeter - This allows the anesthetist to determine the rate the oxygen will flow to the animal.

D. Oxygen flush valve - This valve allows oxygen to flow directly to the animal bypassing the anesthesia. It is used to quickly increase the amount of oxygen and decrease the anesthesia in the system. This is done at the end of the anesthesia or if the animal is at too deep of a plane of anesthesia during the surgery.

E. Vaporizer - The vaporizer converts the liquid anesthetic to a gas state and adds controlled amounts of the gas anesthetic to the oxygen that is flowing through the machine.

F. Inhalation valve - This allows the gases to flow only to the animal and not back to the vaporizer, by way of a one-way valve.

G. Inhalation hose - This hose carries the gases to the animal.

H. Connecting port - The rebreathing system has a Y piece which connects the inhalation hose, endotracheal tube, and exhalation hose.

I. Endotracheal tube - This tube is placed into the animal's trachea (windpipe) to allow the oxygen and gases to be breathed into the lungs.

J. Exhalation hose - This hose carries the gases the animal breathed out back to the anesthetic machine.

K. Exhalation valve - This allows the exhaled gases to flow only into the anesthetic machine, not back to the animal, by way of a one-way valve.

L. Rebreathing (reservoir) bag - This is an inflatable rubber bag which allows the accumulation of fresh and expired gas during exhalation so that a reservoir of gas is available for the next breath. The bag also acts as a safety device to prevent rapid pressure increases in the system. It can be manually squeezed to 'bag' an animal as needed during surgery to assist breathing.

M. Pop-off valve - This is a pressure relief valve that allows the release of waste gases and extra pressure from the



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system into the scavenger hose.

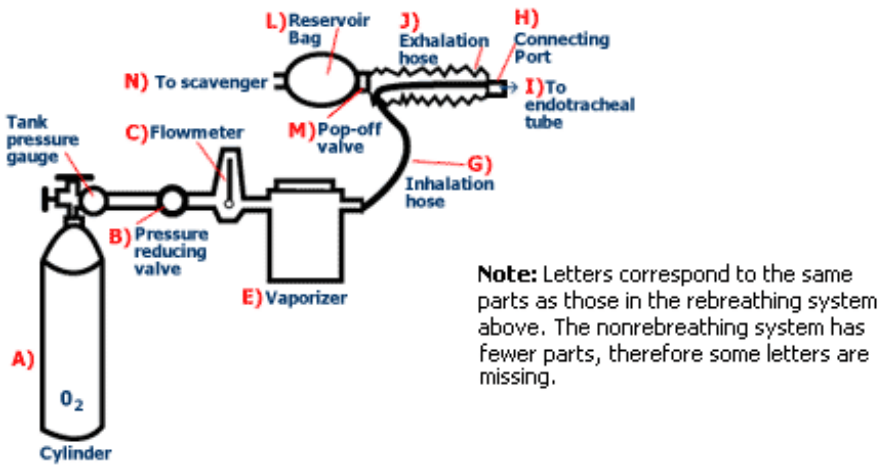
N. Scavenger hose - This hose carries waste gases (e.g., oxygen, nitrous oxide, inhalation anesthetic, and carbon dioxide) out of the system and out of the building.

O. $CO_2$ absorber canister - Any gases that do exit through the pop-off valve pass through the carbon dioxide absorber before returning to the animal. The chemicals in the container remove carbon dioxide from the gases that pass through it.

Nonrebreathing system

The nonrebreathing system is used for those animals that are typically under about 10 pounds. These smaller animals need a higher flow of gases to prevent rebreathing of carbon dioxide. In this type of system, little or no exhaled gases are returned to the animal, but exit through the pop-off valve into the scavenger hose. A nonrebreathing system is usually not used in the larger pets, since the high gas flow wastes oxygen and anesthetic. High flow rates also lead to heat and fluid loss from the pet. Heated and humidified exhaled gases are replaced in the respiratory system by an inspired gas mixture that is cool and dry. The following is a diagram of a nonrebreathing system.

## Nonrebreathing system




The first three parts are the same as with the rebreathing system.

A. Oxygen source with pressure gauge

B. Pressure reducing valve

C. Flowmeter

It is at this point that the system changes. The nonrebreathing system does not have each of the parts of a rebreathing system. It does have:

E. Vaporizer - The vaporizer converts the liquid anesthetic to a gas state and adds controlled amounts of the gas anesthetic to the oxygen that is flowing through the machine.

G. Inhalation hose - The gases exit the vaporizer and go directly into a hose for delivery to the animal.

H. Connecting port - This connects the inhalation and exhalation hoses to the endotracheal tube.

I. Endotracheal tube - This tube is placed into the animal's trachea to allow the oxygen and gases to be breathed into the lungs.

J. Exhalation hose - Exhaled gases pass through this tube directly to the reservoir bag.

L. Rebreathing (reservoir) bag - Exhaled gases pass into the reservoir bag.

M. Pop-off valve - This is a pressure relief valve that allows the release of waste gases and extra pressure from the system into the scavenger hose.

N. Scavenger hose - Exhaled gases pass from the reservoir bag and out of the system (and building) through the



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scavenger hose.

Comparison of systems

The two types of systems have their advantages and disadvantages. These are taken into account by the veterinarian when he or she decides which system to use for each individual animal.

| Advantages of Rebreathing Systems | Advantages of Nonrebreathing Systems |
|---|---|
| • Less oxygen and anesthetic gases are used because of the lower flow rates<br>• Less waste gases are produced<br>• The animal's heat and moisture from respirations are conserved | • Depth of anesthesia can be changed more rapidly<br>• Less resistance occurs during respirations (small animals may have difficulty inhaling with enough force to draw air through a rebreathing system) |



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