Common components of all anesthetic units:

a. source of oxygen
b. regulator for oxygen (this may be part of the gas supply system)
c. flowmeter for oxygen
d. vaporizer

Used with a **breathing circuit** and **anesthetic waste gas scavenging system** for delivery of anesthetic to the patient

Anesthetic machines have **2 gas supplies:**

a. small, high-pressure tanks attached directly to the machine
b. hospital's central pipeline supply

Table 3.2 Characteristics of medical gas cylinders [2].

Size	Gas	Gas Symbol	Color Code (U.S.)	Capacity and Pressure (at 70°F)	Empty Cylinder Weight (pounds)
E	Oxygen	O_2	Green	660 L 1900 psi	14
E	Nitrous oxide	N_2O	Blue	1590 L 745 psi	14
G	Nitrous oxide	N_2O	Blue	13,800 L 745 psi	97
H	Oxygen	O_2	Green	6900 L 2200 psi	119
H	Nitrous oxide	N_2O	Blue	15,800 L 745 psi	119

psi, pounds per square inch.

Figure 3.32 The diameter index safety system (DISS) uses a gas-specific non-interchangeable thread pattern to avoid incorrect gas delivery. Gases are also color coded as apparent in the figure. Source: Thomas Riebold, College of Veterinary Medicine, Oregon State University, Corvallis, OR, USA. Reproduced with permission of Thomas Riebold.

MODERN ANESTHETIC MACHINE

Gas flow

- Anesthesia delivery apparatus: (1) gas delivery system, (2) vaporizer, (3) breathing circuit, (4) waste gas scavenge system
- High-, intermediate-, and low-pressure areas in the anesthetic machine

Flowmeter

- Controls the rate of gas delivery to the low-pressure area of the anesthetic machine and determines the fresh gas flow (FGF) to the anesthetic circuit
- Flowmeters are gas specific and calibrated at 760 mmHg and 20C

Vaporizers

- Vaporizers change liquid anesthetic into vapor and meter the amount of vapor leaving the vaporizer
- They work by splitting the carrier gas to flow into the vaporizing chamber (where it picks up anesthetic vapor) or to the bypass channel where it does not

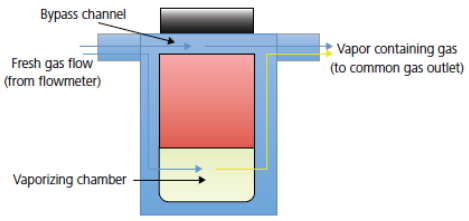

Figure 3.41 Schematic of a generic variable-bypass vaporizer demonstrating the splitting of the fresh gas flow to the vaporizing chamber and bypass channel. The splitting ratio and vapor pressure of the volatile anesthetic will determine the final percent output from the vaporizer. Source: Craig Mosley, Mosley Veterinary Anesthesia Services, Rockwood, ON, Canada.

Figure 3.47 An example of a Tec 3 style isoflurane-specific vaporizer. This style of vaporizer is very common in many veterinary practices. Source: Craig Mosley, Mosley Veterinary Anesthesia Services, Rockwood, ON, Canada.

- Factors that alter vaporizer output: temperature, flow, and pressure
- Most modern precision compensated vaporizers will maintain consistent output at flows between 0.5 and 10 L/min and temperatures between 15 and 35C
- Three main styles of vaporizers: (1) Ohmeda Tec, (2) Drager Vapor, (3) Penlon Sigma series

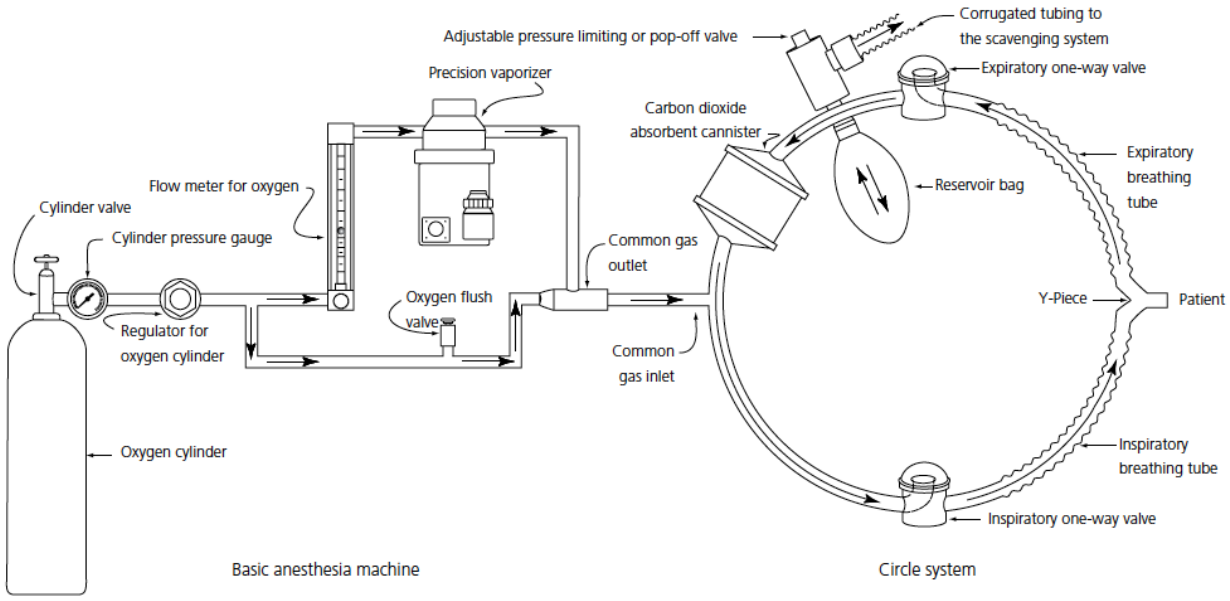

Figure 3.37 Diagram of the basic anesthetic machine and circle breathing system. The exact positions of the various components and specific features can vary markedly among manufacturers. Source: Kath Klassen, Vancouver Animal Emergency Clinic, Vancouver, Canada. Reproduced with permission of Kath Klassen.

Use of the wrong anesthetic in an agent-specific vaporizer

- Results in lower or higher anesthetic output (as a result of varying vapor pressures)

Oxygen flush valve

- Flush valves are designed to rapidly deliver large volumes of non-anesthetic containing gas to the patient breathing circuit in emergency situations
- Bypasses the flowmeter and vaporizer

Common gas outlet

- Gas reaching the common gas outlet has traveled from the gas supply (cylinder or pipeline), through the regulator, flowmeter, and vaporizer

Breathing system

- Primary purposes: (1) direct oxygen to the patient, (2) deliver anesthetic gas to the patient, (3) remove carbon dioxide from inhaled breaths (or prevent significant rebreathing of carbon dioxide), (4) provide a means of controlling ventilation.
- Two groups: those designed for rebreathing of exhaled gases (rebreathing or partial rebreathing system) and those designed to be used under circumstances of minimal to no rebreathing (non-rebreathing systems)

<u>Rebreathing (Circle systems)</u>

- Designed to produce a **unidirectional flow** of gas through the system and has a **means of absorbing CO2 from exhaled gases**
- Components include: fresh gas inlet, inspiratory one-way valve, breathing tubes, expiratory one-way valve, APL valve, reservoir bag, and carbon dioxide absorber

a. **Full rebreathing:** circle system using flow rates equal to, or nearing, the metabolic oxygen consumption of the patient, between 3 and 14 mL/kg/min
b. **Partial rebreathing:** circle system using a flow rate greater than metabolic oxygen consumption (e.g., 20 mL/kg/min) but less than that required to prevent rebreathing.
c. **Non- (minimal) rebreathing:** circle system using flow rates greater than 200 mL/ kg/min (flow rates that would normally not be used in most circumstances). For use in very small patients that need high floe rates (<5kg).

Questions

1. Name three factors that can affect vaporizer pressure.

2. True or False. Partial rebreathing is a circle system that uses flow rates equal to, or nearing, the metabolic oxygen consumption.

3. A green H medical gas cylinder contains how many liters of gas?
    a. 660L of oxygen
    b. 6900L of oxygen
    c. 1590L of Nitrous oxide
    d. 15800L of nitrous oxide

4. Name the 4 common components to all anesthetic units

Answers

1. Name three factors that can affect vaporizer pressure
   Temperature, flow, and pressure

2. True or **False**. Partial rebreathing is a circle system that uses flow rates equal to, or nearing, the metabolic oxygen consumption
    1. ***Full rebreathing:*** *circle system using flow rates equal to, or nearing, the metabolic oxygen consumption of the patient, between 3 and 14 mL/kg/min*
    2. ***Partial rebreathing:*** *circle system using a flow rate greater than metabolic oxygen consumption (e.g., 20 mL/kg/min) but less than that required to prevent rebreathing.*
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