

Oxygen Failure in the OR

Etiology

Loss of Pipeline Oxygen

- Exhaustion of central O₂ supply.
- Obstruction of central O₂ supply line to OR.
- O₂ shutoff valve in OR is off.
- Obstruction or disconnection of O₂ hose in the OR.
- Failure of O₂ regulator in the anesthesia machine.

Faulty Oxygen Supply

- Crossing of pipelines during construction/repairs.
- Incorrect connection of gas hoses.
- Non-O₂ cylinder at the O₂ yoke.
- Wrong gas in the O₂ cylinder.
- Broken flowmeter.

Prevention

Preanesthesia Machine Check

- Check pipeline pressure ~50 psi.
- Check O₂ tanks >50% full.
- Calibrate O₂ analyzer.

Supply-Side Safety Features

- Color-coded gas tanks
- DISS, PISS, and Quick Connects

Anesthesia Machine Safety Features

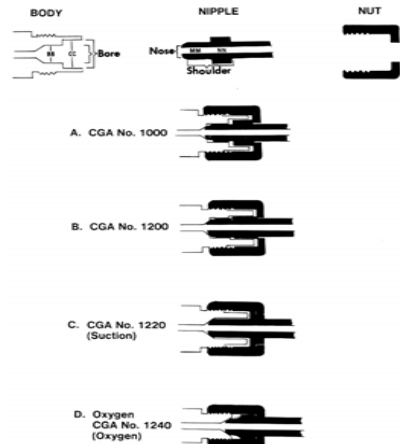
- Flowmeter arrangement
- O₂:N₂O ratio controller
- Oxygen supply failure protection device ("fail-safe valve")

Gas Cylinders

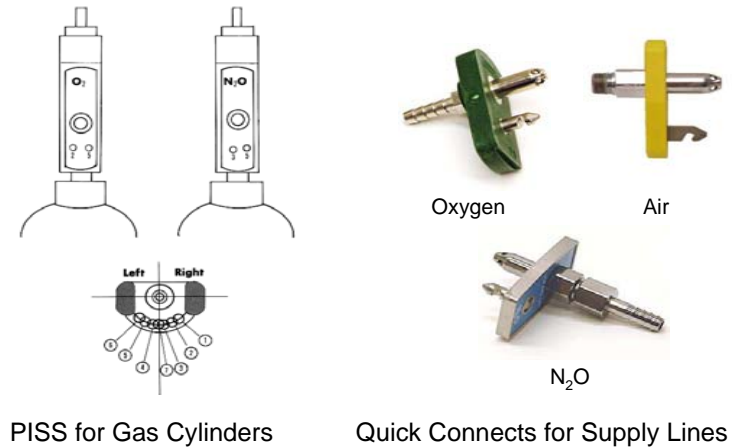
Gas	E-Cylinder Capacity (L)	Pressure (psi)	Color (USA)	Color (Int'l)	Form
O ₂	660	1900	Green	White	Gas
Air	625	1900	Yellow	White & Black	Gas
N ₂ O	1590	745	Blue	Blue	Liquid
N ₂	650	1900	Black	Black	Gas

How long can you use an O₂ tank starting at 430 psi running at 5 L/min?

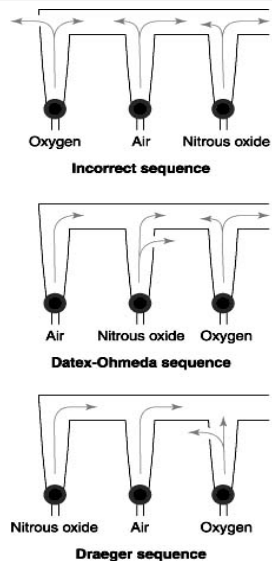
Diameter Index Safety System



Pin Index Safety System

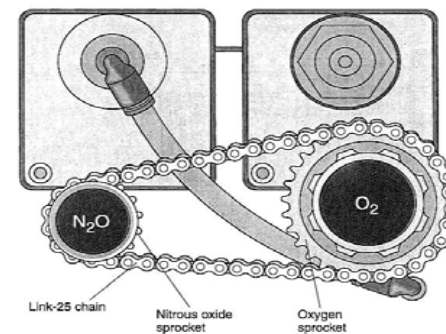


Flowmeter Arrangement



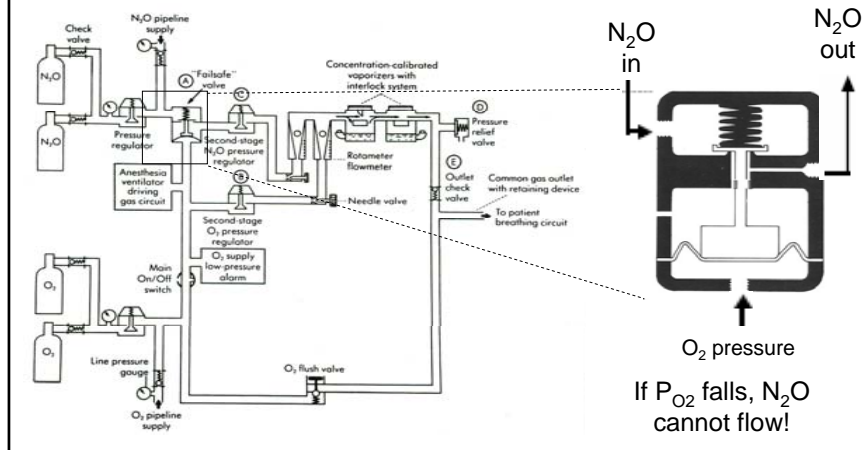
- A leak in the upstream O₂ flowmeter ("Incorrect sequence") results in a hypoxic gas mixture.
- A leak in the Datex-Ohmeda or Draeger flowmeter arrangements may deliver less Air or N₂O than expected, but the mixture will NOT be hypoxic because O₂ is closest to the FGF outlet.

O₂:N₂O Ratio Controller



Linkage mechanisms between flow valves can be either mechanical (above), pneumatic, or electronic.

Oxygen Failure Protection Device



Detection

- Pressure gauges fall (pipeline, tanks)
- Low O_2 alarms (O_2 supply failure, F_iO_2 analyzer)
- Flowmeters fall (O_2 and other gases)
- O_2 flush inoperative
- Bellows inoperative
- Apnea alarms (spirometer, capnograph)
- Increasing O_2 flow makes the problem worse
- Hypoxemia, hypercarbia
- Arrhythmias, bradycardia, cardiac arrest

Management

- Notify surgeon, call for help.
- Verify problem (pressure gauges, flowmeters, O_2 flush, O_2 analyzer, capnograph).
- Switch to O_2 cylinder (calculate remaining time).
- Use manual ventilation to conserve O_2 .
- Check valves, hoses, couplers.
- D/C supply lines if crossed pipelines suspected.
- Call for backup O_2 tanks.
- Close breathing circuit, manually ventilate.
- Switch to self-inflating bag (Ambu-Bag), Jackson-Reese with external tank, or mouth-to-ETT if necessary.
- Consider switch to TIVA until cause of failure is known.

References

- Dorsch JA and Dorsch SE. *Understanding Anesthesia Equipment: Construction, Care, and Complications, 3rd ed.* Baltimore: Williams & Wilkins, 1994.
- Gaba DM, Fish KJ, and Howard SK. *Crisis Management in Anesthesiology.* Philadelphia: Churchill Livingstone, Inc., 1994.
- Morgan GE, Mikhail MS, and Murray MJ. *Clinical Anesthesiology, 4th ed.* New York: McGraw-Hill Companies, Inc., 2006.