The Anesthesia Delivery System

Continuous Flow Machine for Gas Mixing and Vaporization

Breathing Circuit to provide for breathing and CO2 elimination
Continuous Flow Machine for Gas Mixing and Vaporization

Provides continuous flow of -

Oxygen for Life
Air to safely lower $F_{1}O_{2}$
Nitrous Oxide for partial anesthesia
Agent vapor for complete or partial anesthesia
SIMPLIFIED ANESTHESIA MACHINE SCHEMATIC DIAGRAM

No Oxygen safety features

- N2O Service Inlet 55 psi
- O2 Service Inlet 55 psi
- N2O 750 psi
- O2 2000 psi
- N2O Check Valve
- Pressure Regulator 35 psi
- Needle Valve
- Calibrated Vaporizers
- Fresh Gas Flow (FGF)
- Common Outlet
- Fresh Gas Hose
- Oxygen Flush Flow [first]

[Flow chart diagram with annotated components and connections]
Ohmeda Modulus 2+
GEDO Modulus 2 SE
Draeger Fabius with Real Needle Valves, Virtual Flowmeters
Direct-reading temperature-compensated Vaporizers
GE-Datex-Ohmeda Aestiva

Draeger Fabius GS
Breathing Circuit & CO$_2$ Absorber Schematics
Breathing Circuit & CO₂ Absorber Pictures
GEDO Aestiva CO2 Absorber
Machine Check Out

Calibrate Oxygen Monitor
Check Machine for gas delivery
Check Circuit for integrity
Check Ventilator for function
Check Exhaust for function
Calibrate Oxygen Monitor

Oxygen Monitor switched on, sensor in air 3 minutes, hole plugged.

Calibrate to read 21%.

Reconnect Oxygen sensor to inspired limb of breathing circuit

This is called “Circuit Oxygen”
Aestiva O2 Sensor in Air for Cal
Fabius O2 Sensor in Air for Cal
Beware of missing sensor
Some have obvious label (good) not Fabius, yet
Expose sensor to air
Ohmeda CD - Calibrate Oxygen

System Cal
Tell machine to calibrate to 21%.

See OIM Manual for detailed instructions and recommended intervals.
Allow the monitoring system to warm up for 5 minutes.

**CALIBRATE O₂**
---%FiO₂

**O₂ CALIBRATING**

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Expose sensor to room air for 3 minutes.
Turn Set Knob to 21.

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**ZERO CO₂, N₂O, AGENT**
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Zero

Turn Set Knob clockwise to zero.
Air sample taken internally.

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**SPAN CO₂, N₂O, AGENT**
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Span

Connect reservoir bag. Once "CO₂/Agt Line Blocked" or "CO₂/Agt Purge" alarm message is displayed, spray cal gas until reservoir bag is full. Then turn set knob clockwise to span.
Datex Capnomac Ultima

Similar Calibration
Fabius
Aestiva
Check Machine for Gas Delivery

Machine On
Oxygen flows smoothly
Disconnect oxygen hose
Oxygen alarm sounds
Switch ON oxygen tank
  Verify P > 1000 psi and Alarm silences
Check Vaporizer is present and not empty *
Switch ON oxygen tank (with tank wrench)
Check that $P > 1000$ psi
Other ADSs
Check Machine for Gas Delivery 2

Tank off with wrench
Turn oxygen flow up
Alarm sounds on oxygen failure
Connect oxygen hose to silence alarm
Turn up nitrous oxide and observe alarm and/or control
Perform negative pressure leak test now (possibly shown later when it makes sense)
Ensure there is no leak - Check circuit for integrity
Check Circuit for integrity

Attach circuit including reservoir bag
Occlude "Y" with thumb
Flush and fill bag to $P = 30 \text{ cmH}_2\text{O}$
Check Circuit for integrity

Attach circuit including reservoir bag
Occlude "Y" with thumb
Flush and fill bag to $P = 30 \text{ cmH}_2\text{O}$
Ensure there is no leak
Observer for 10 seconds
Pressure should not fall
Check Circuit for integrity

Attach circuit including reservoir bag
Occlude "Y" with thumb
Flush and fill bag to \( P = 30 \text{ cmH}_2\text{O} \)
Ensure there is no leak

Test pressure alarms
Continuing pressure alarm
12 cmH\textsubscript{2}O for > 20 seconds
High pressure alarm
> 60 cmH\textsubscript{2}O
Check Circuit for integrity

Attach circuit including reservoir bag

Occlude "Y" with thumb

Flush and fill bag to $P = 30 \text{ cmH}_2\text{O}$

Ensure there is no leak

Test Pressure Alarms

Open Relief (APL, pop off) Valve

Verify Reservoir bag empties
Check Circuit for integrity

Attach circuit including reservoir bag
Occlude "Y" with thumb
Flush and fill bag to $P = 30 \text{ cmH}_2\text{O}$
Ensure there is no leak
Test Pressure Alarms
Open Relief (APL, pop off) Valve
Verify Reservoir bag empties
Observe waste gas collector (scavenger) bag fills and empties
Leak and Compliance tests

Automated on Draeger Fabius and Tiro
Discussed a bit in next hour
Ensure that you can ventilate

By hand with reservoir
With mechanical ventilator
Check Waste Gas Collection System
Waste gas collector fills when reservoir bag empties. Empties into evacuation system (Scavenger).
Check Scavenger Valves + -
Newer ADSs have Vacuum Gauge and Vacuum Adjustment
We missed one potential leak

Low pressure system upstream of breathing circuit
Negative Pressure Leak Test

Is not necessary if there is no valve
Is not possible if no hose connector
Perform only with
GEDO (Ohmeda) Modulus 2+
Check Ventilator for function

Ventilate reservoir bag
Observe no volume loss
Check Suction for Function

Rarely used emergently
Very important when it is needed
Suction off if:
DISS hose unscrewed
Wall switch off
Hose disconnect from Canister
Canister switch off
Insert seated incorrectly
Any hole open
Flap valve closed
because unit was shaken
or canister is full
Flexible hose kinked
Flexible hose stepped on
Draeger Fabius GS

System Test
  Software, internal hardware

Cal Flow,
  Calibrates the flow sensor
  Later, compensate for Des high specific heat

Cal O2
  FIO2 Monitor like all others - expose to air

Leak Test
  Unique to this machine
  Automatic computation of leak and circuit compliance
  Press leak test button and follow directions:
  seal circuit, fill circuit, measure leak&compliance
All this is on

Anesthesia Department Web Site
http://etherweb.bwh.harvard.edu/
http://etherdev.bwh.harvard.edu/etherweb/education/resources/overview.php

Navigate to resources
All checkouts are there

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new Director, Bob Gimlich
Technology Matters!

I have done what I can to prepare you for your future
It is up to you to learn to use your tools as a true expert
The resources are available
The rest is up to you
Thank you