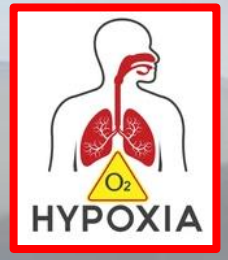
Glider Oxygen Systems

Presented at the 2023
Soaring Society of America
Convention - Reno Nevada

Updated: August 24, 2025



http://aviation.derosaweb.net/presentations

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PLEASE NOTE

This document may have been updated with new information, changes, or corrections.

Be sure to visit my presentation web site and download the latest version of this document. It could make an important difference to you!

http://aviation.derosaweb.net/presentations

Thank you, John OHM Ω

Why Do We Need Oxygen at High Altitudes?

1. **Because the FAA says we must!**
2. **Because we might die without it!**

Any Questions??

https://www.faa.gov/pilots/safety/pilotsafetybrochures/media/oxygen_equipment.pdf

FAA Oxygen "P.R.I.C.E." Check

PRESSURE: Ensure that there is enough oxygen pressure and quantity to complete the flight.

REGULATOR: Inspect the oxygen regulator for proper function. If you are using a continuous-flow system, ensure that the outlet assembly and plug-in coupling are compatible.

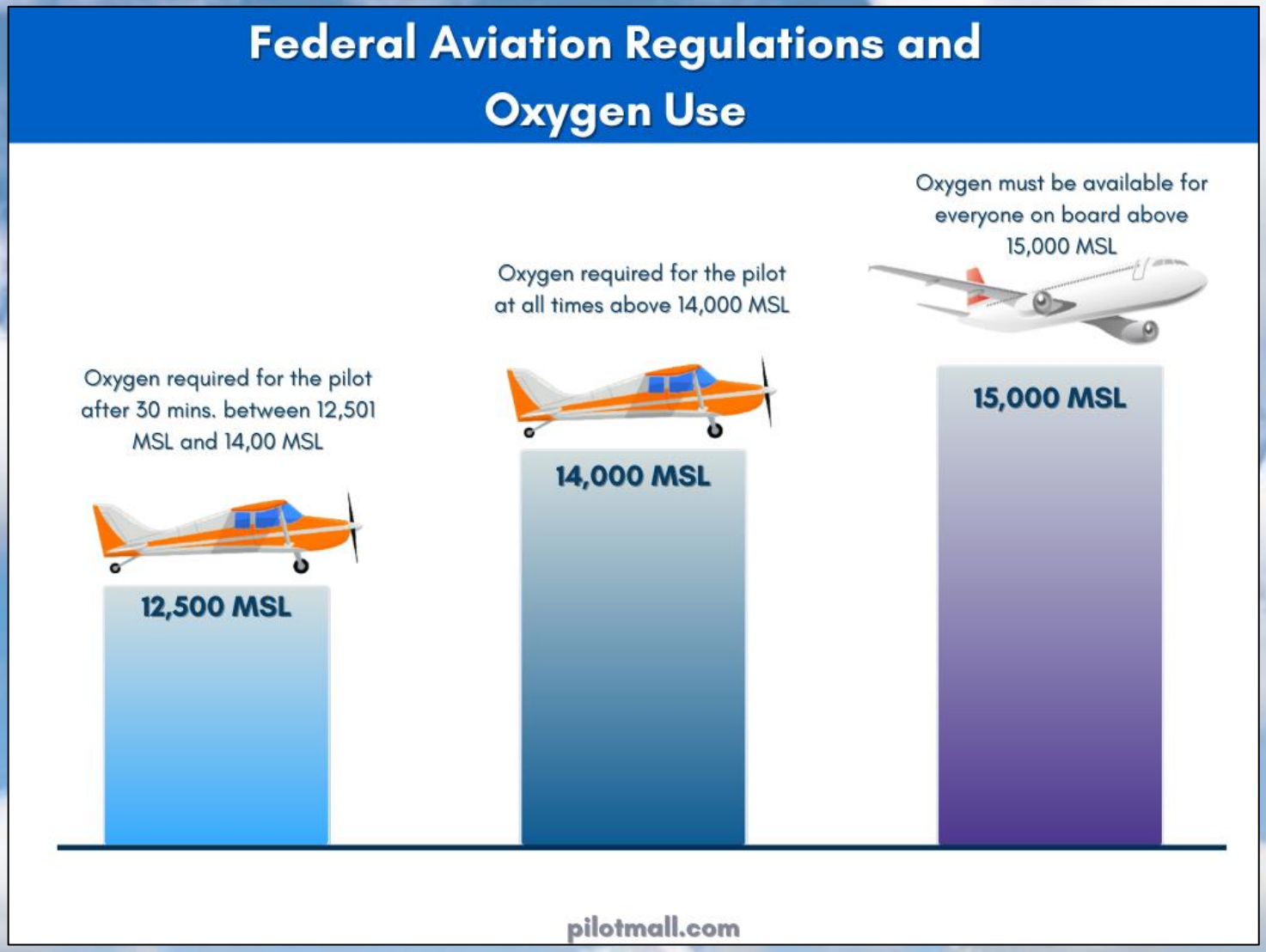
INDICATOR: Don the mask and check the flow indicator to ensure a steady flow of oxygen.

CONNECTIONS: Ensure that all connections are secured. This includes oxygen lines, plug-in coupling, and the mask.

EMERGENCY: Keep oxygen equipment in your aircraft ready to use for emergencies that require oxygen (e.g., hypoxia, smoke and fumes, rapid decompressions/decompression sickness). Also, brief passengers on the location of oxygen and how to use it.

https://www.faa.gov/pilots/safety/pilotsafetybrochures/media/oxygen_equipment.pdf

FAA FAR 91.211 - Supplemental Oxygen



FAA FAR 91.211 - Supplemental Oxygen

Chapter and Verse

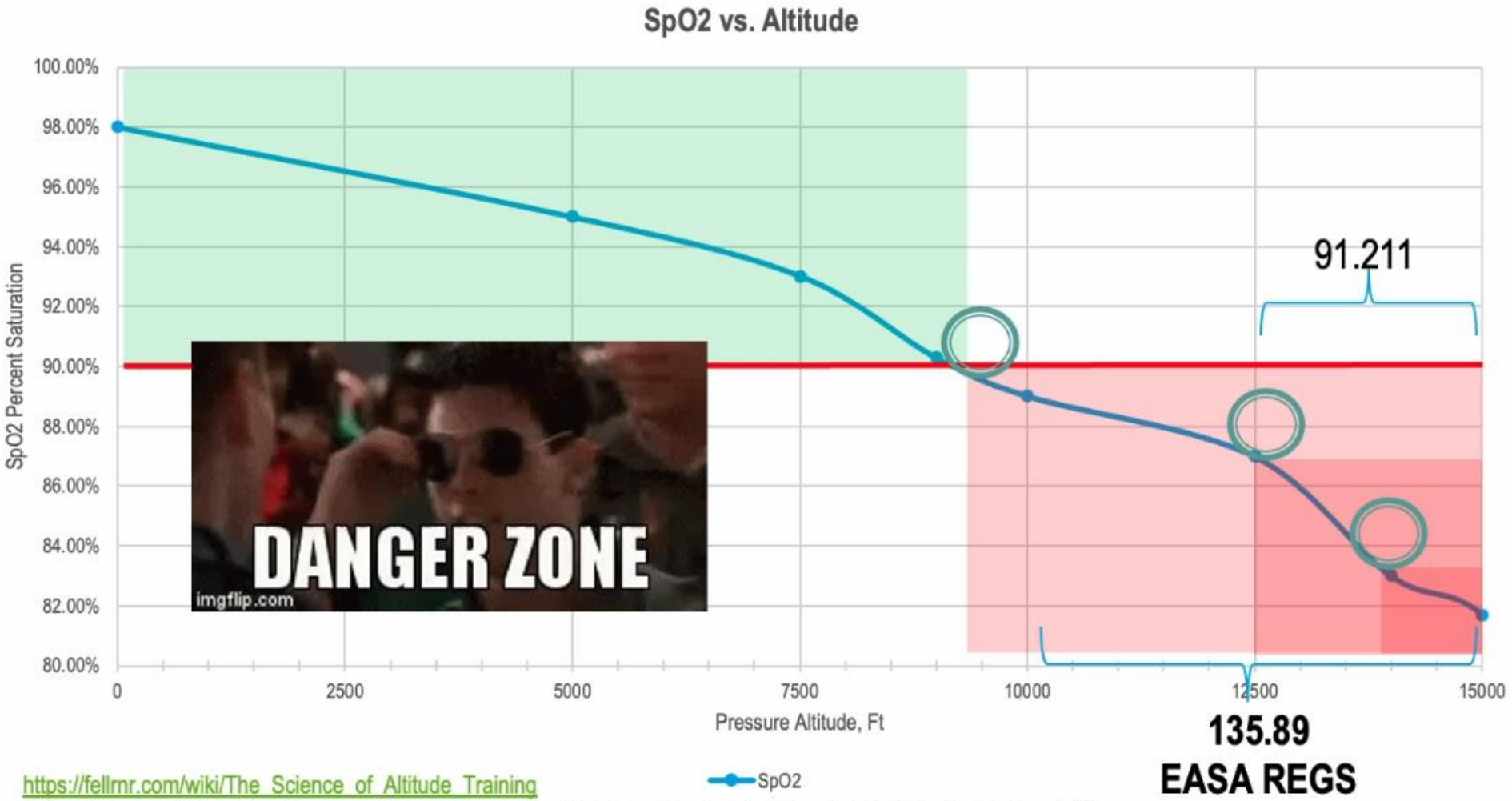
(a) General. No person may operate a civil aircraft of U.S. registry—

(1) At cabin pressure altitudes above 12,500 feet (MSL) up to and including 14,000 feet (MSL) unless the required minimum flight crew is provided with and uses supplemental oxygen for that part of the flight at those altitudes that is of more than 30 minutes duration; and

(2) At cabin pressure altitudes above 14,000 feet (MSL) unless the required minimum flight crew is provided with and uses supplemental oxygen during the entire flight time at those altitudes; and

(3) At cabin pressure altitudes above 15,000 feet (MSL) unless each occupant of the aircraft is provided with supplemental oxygen.

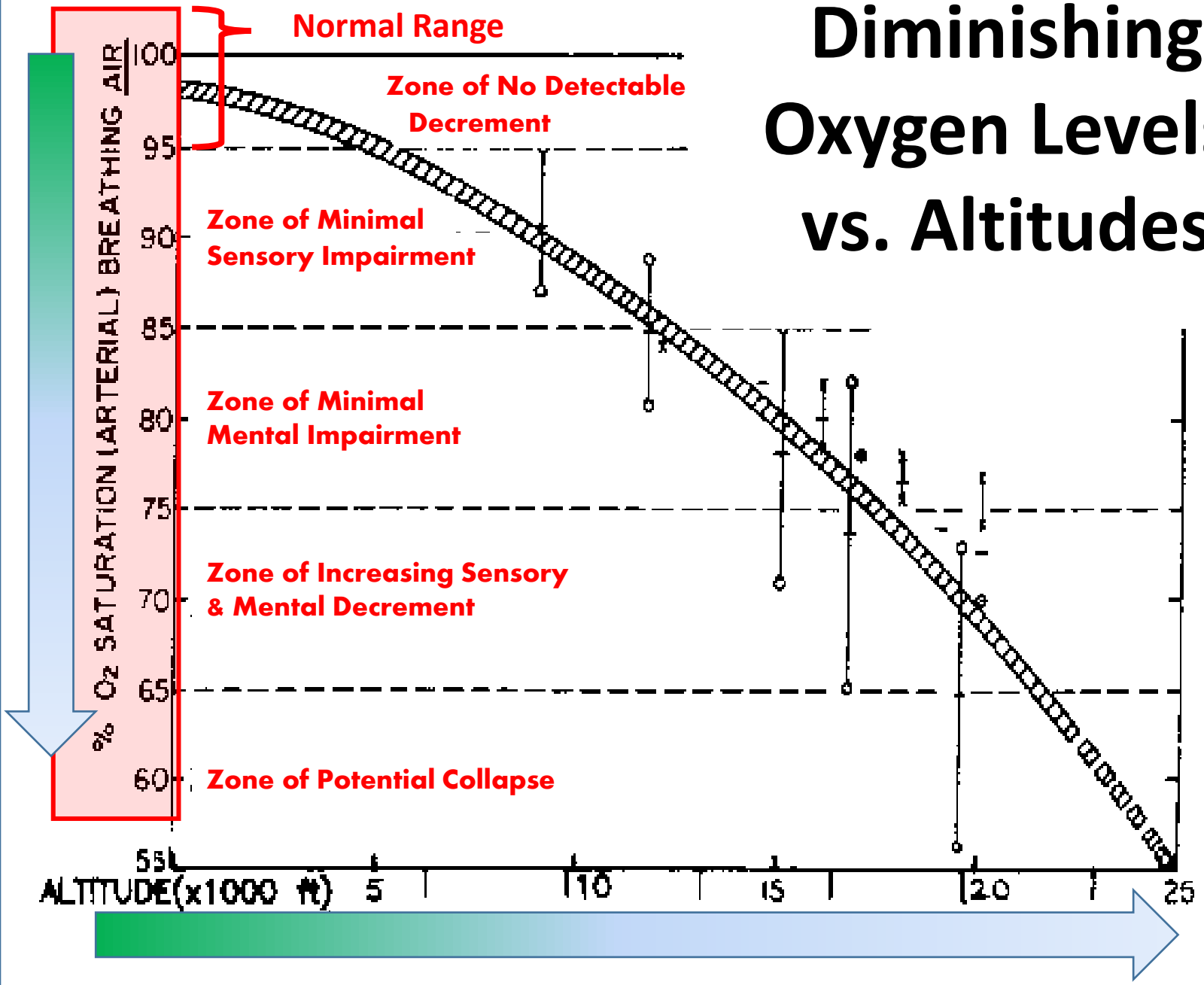
Is 91.211 “Safe Enough”?



https://fellrnr.com/wiki/The_Science_of_Altitude_Training

"The Pilot: An Air Breathing Mammal," Mehler, Stanley R. MD, Human Factors Bulletin, Flight Safety Foundation, 1981

Diminishing Oxygen Levels vs. Altitudes

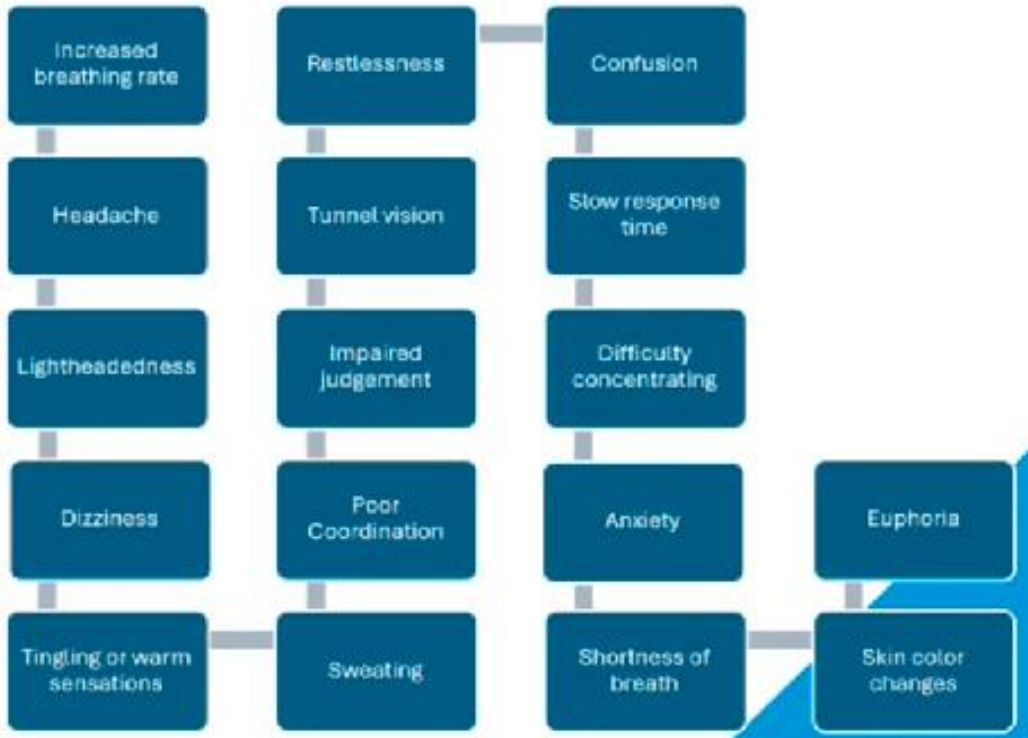


Altitude (feet)	Altitude (meters)	Oxygen Levels (%)	Altitude Category
0 ft	0 m	20.9 %	Low Altitude
1000 ft	305 m	20.1 %	Low Altitude
2000 ft	610 m	19.4 %	Low Altitude
3000 ft	914 m	18.6 %	Moderate Altitude
4000 ft	1219 m	17.9 %	Moderate Altitude
5000 ft	1524 m	17.3 %	Moderate Altitude
6000 ft	1829 m	16.6 %	Moderate Altitude
7000 ft	2134 m	16.0 %	Moderate Altitude
8000 ft	2438 m	15.4 %	High Altitude
9000 ft	2743 m	14.8 %	High Altitude
10,000 ft	3048 m	14.3 %	High Altitude
11,000 ft	3353 m	13.7 %	High Altitude
12,000 ft	3658 m	13.2 %	High Altitude
13,000 ft	3962 m	12.7 %	Very High Altitude
14,000 ft	4267 m	12.3 %	Very High Altitude
15,000 ft	4572 m	11.8 %	Very High Altitude
16,000 ft	4877 m	11.4 %	Very High Altitude
17,000 ft	5182 m	11.0 %	Very High Altitude
18,000 ft	5486 m	10.5 %	Extreme High Altitude
19,000 ft	5791 m	10.1 %	Extreme High Altitude
20,000 ft	6096 m	9.7 %	Extreme High Altitude
21,000 ft	6401 m	9.4 %	Extreme High Altitude
22,000 ft	6706 m	9.0 %	Extreme High Altitude
23,000 ft	7010 m	8.7 %	Extreme High Altitude
24,000 ft	7315 m	8.4 %	Extreme High Altitude
25,000 ft	7620 m	8.1 %	Extreme High Altitude
26,000 ft	7925 m	7.8 %	Ultra High Altitude
27,000 ft	8230 m	7.5 %	Ultra High Altitude
28,000 ft	8534 m	7.2 %	Ultra High Altitude
29,000 ft	8839 m	6.9 %	Ultra High Altitude

Diminishing Oxygen Levels vs. Altitudes

Signs of Hypoxia

SYMPTOMS



Signs of Hypoxia

As the degree of hypoxia increases, the classic medical signs and symptoms include:

1. Euphoria
2. Increased response time
3. Impaired judgment
4. Drowsiness
5. Headache
6. Dizziness
7. Tingling in fingers and toes
8. Numbness
9. Blue fingernails and lips (cyanosis)
10. Limp muscles

← It seems that our evolution has not helped us determine if we might be dying!

← Easiest to detect?

The danger to aircrew of an insidious condition that causes euphoria and impaired mental ability without any warning signs such as pain or discomfort are self-evident!

http://www.cfinotebook.net/notebook/aeromedical-and-human-factors/hypoxia

Further Reading

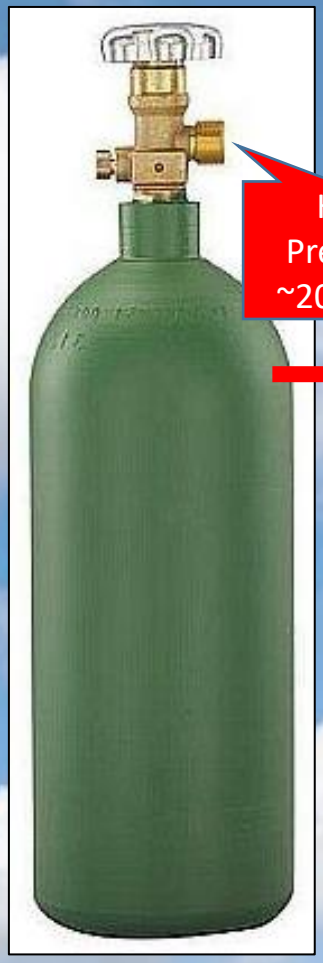
- Dr Dan Johnson (AME)
  - https://aviation.derosaweb.net/presentations/documents/Oxygen_Breathing-at-Altitude_Johnson.pdf
- Hypoxia
  - http://www.cfinotebook.net/notebook/aeromedical-and-human-factors/hypoxia
- AITHRE “High Altitude Hypoxia and ADSC Risks
  - https://drive.google.com/file/d/1iw706Lwhcwq7ibE6koyxa2ws5tS5yTpL/view

Components of Oxygen Systems

- Oxygen Tank
- Regulator
- Altitude Flow Control
- Oxygen Mask

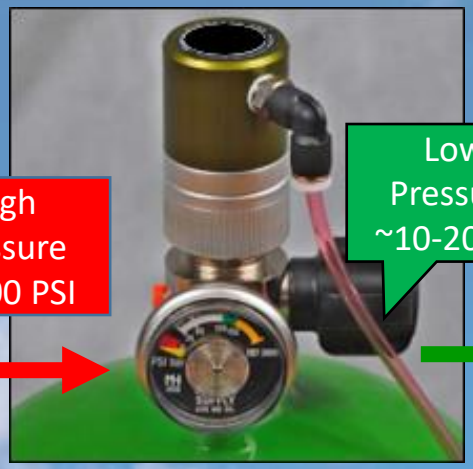
Basic Parts of an Oxygen System

High Pressure Oxygen Tank



High Pressure ~2000 PSI

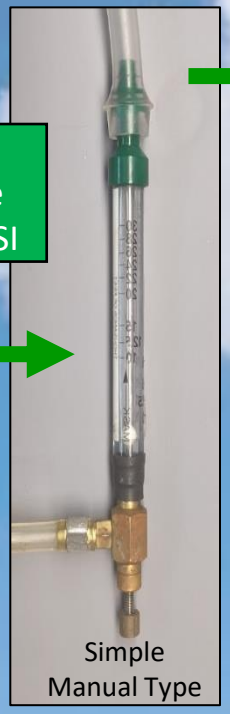
Oxygen Pressure Regulator



Low Pressure ~10-20 PSI

Regulators should never be removed until all oxygen is purged via the low-pressure side

Altitude Oxygen Flow Control Device

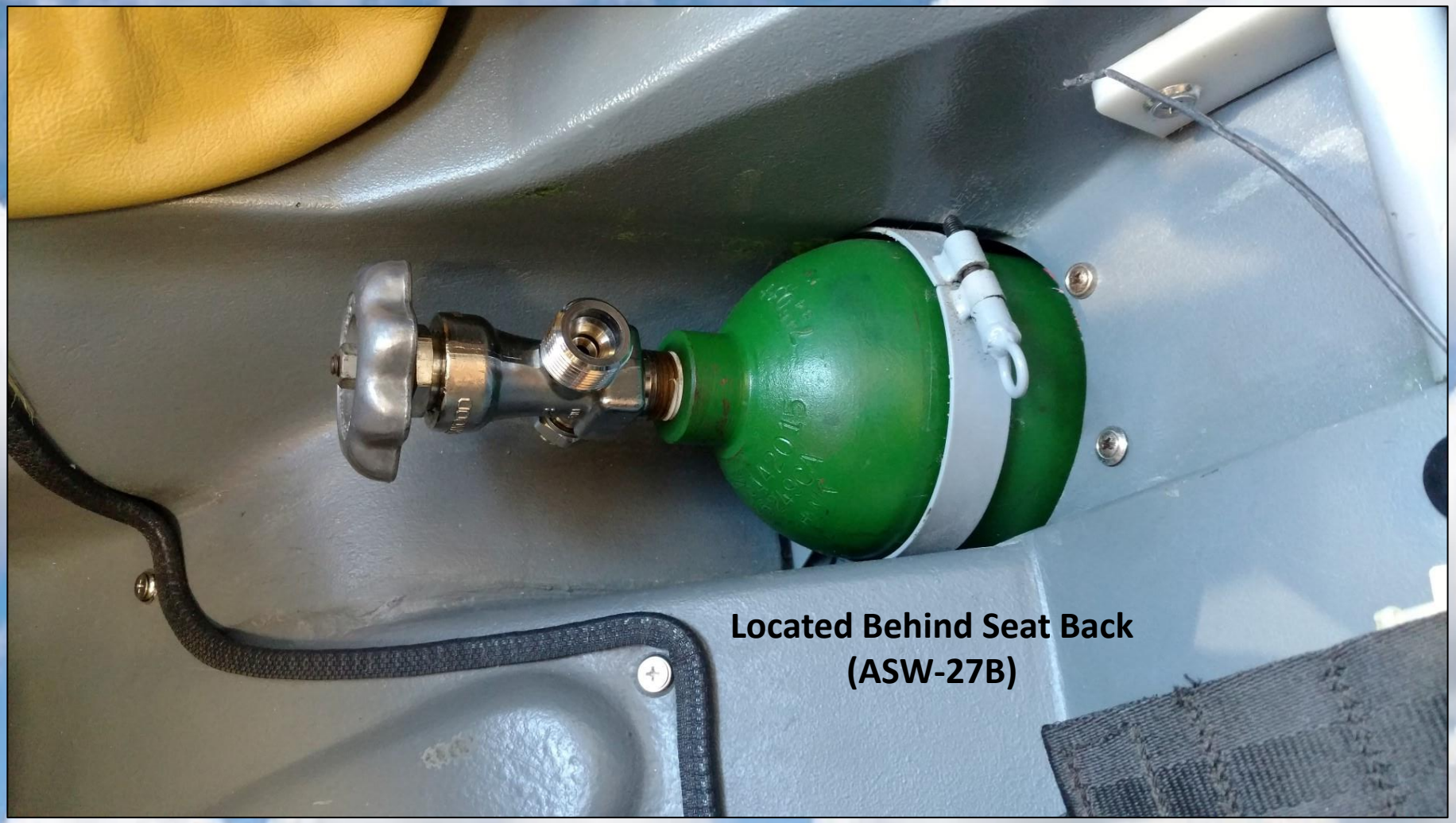


Simple Manual Type

Standard Cannula

Proper use of cannulas is shown in a later section

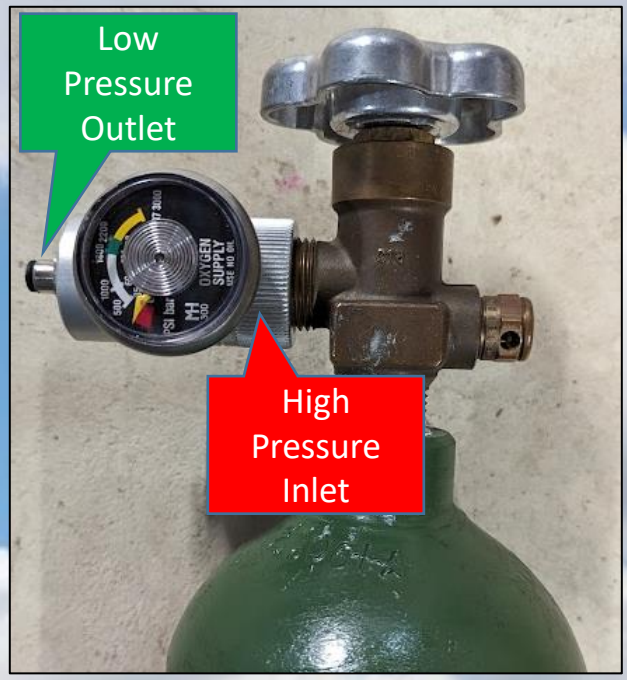
Oxygen Tank Typical Location in a Modern Glider



Oxygen Regulators

Your oxygen tank is under very high pressure (2000psi and above) which is dangerous and must be reduced to a breathable pressure level (~15psi). The Oxygen Pressure Regulator performs this most critically important oxygen pressure reduction.

The current aviation oxygen regulators come in many styles, some with (high pressure) gauges and some without, and some for use with a single mask and some that allow for multiple masks.



Altitude Flow Control

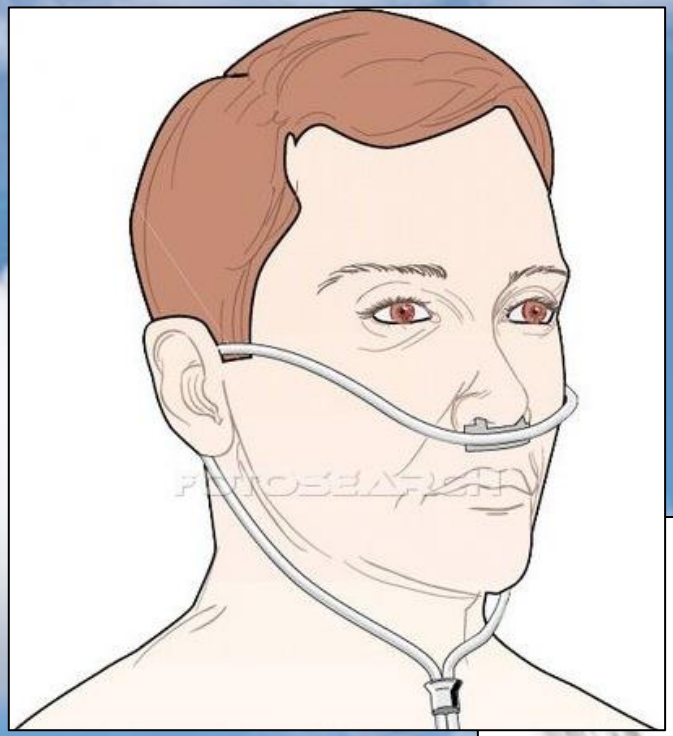
You need more oxygen the higher in altitude that you are traveling.

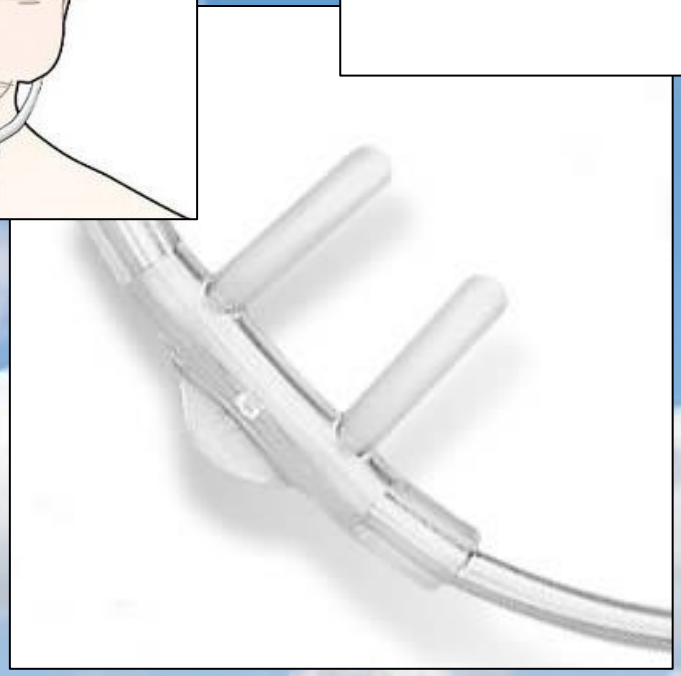
These devices control the flow, either manually or electronically, based on your current altitude.

Manual Oxygen Flow Control Device

Electronic Oxygen Flow Control Device

Standard Oxygen Nasal Cannulas & Masks





Proper use of cannulas shown in a later section

Oxygen Delivery Systems

- Good - Continuous Flow
- Better - Oxygen Saving Cannulas
- Best - Pulse Oxygen Systems

Oxygen Delivery Systems

Good

"Continuous Flow"

“Good” System - Continuous Flow

Oxygen Tank

Oxygen Regulator

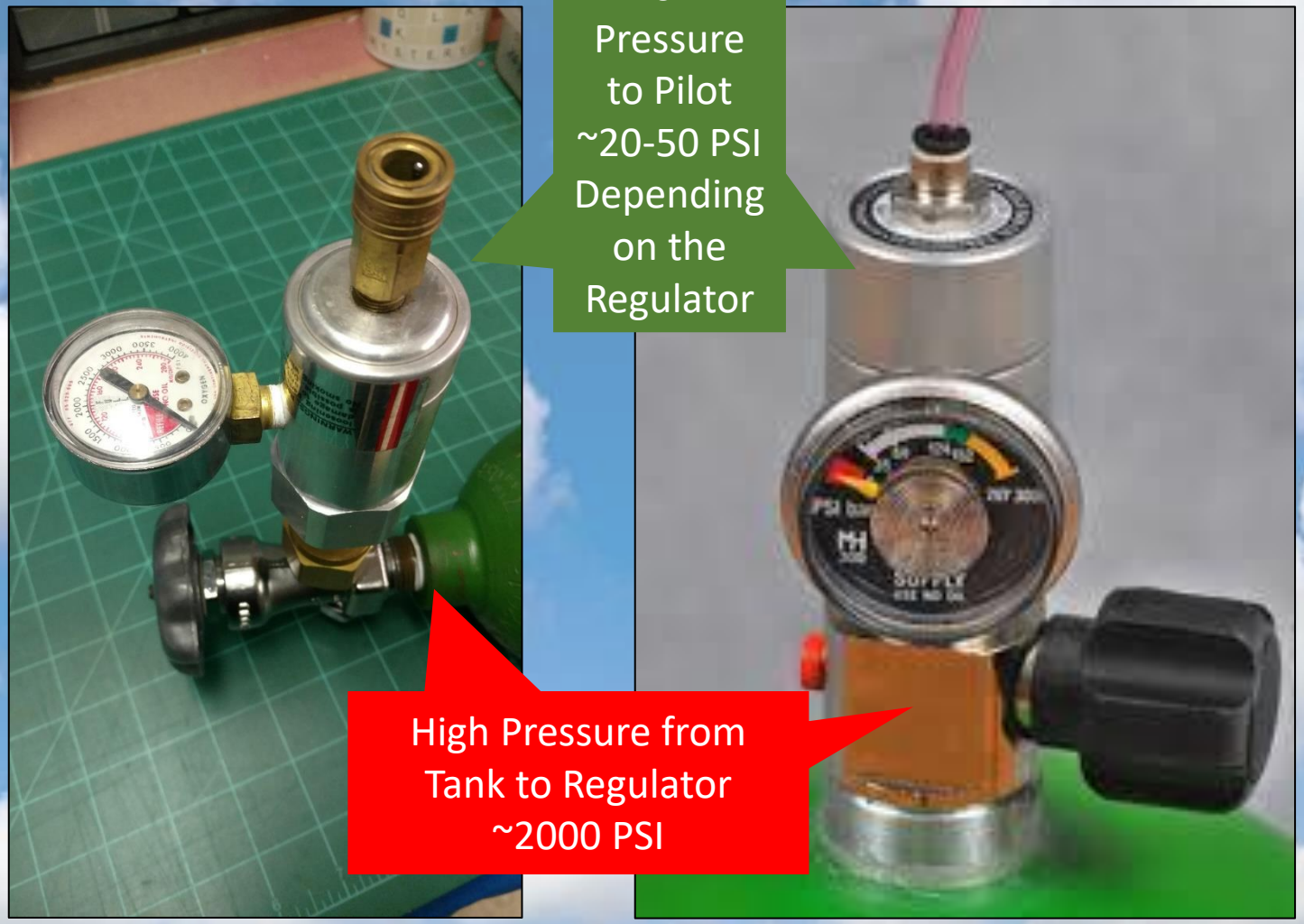
Manual Oxygen Flow Control Device

Standard Cannula

Continuous Flow Systems
Uses the <u>Greatest</u> Oxygen Amount

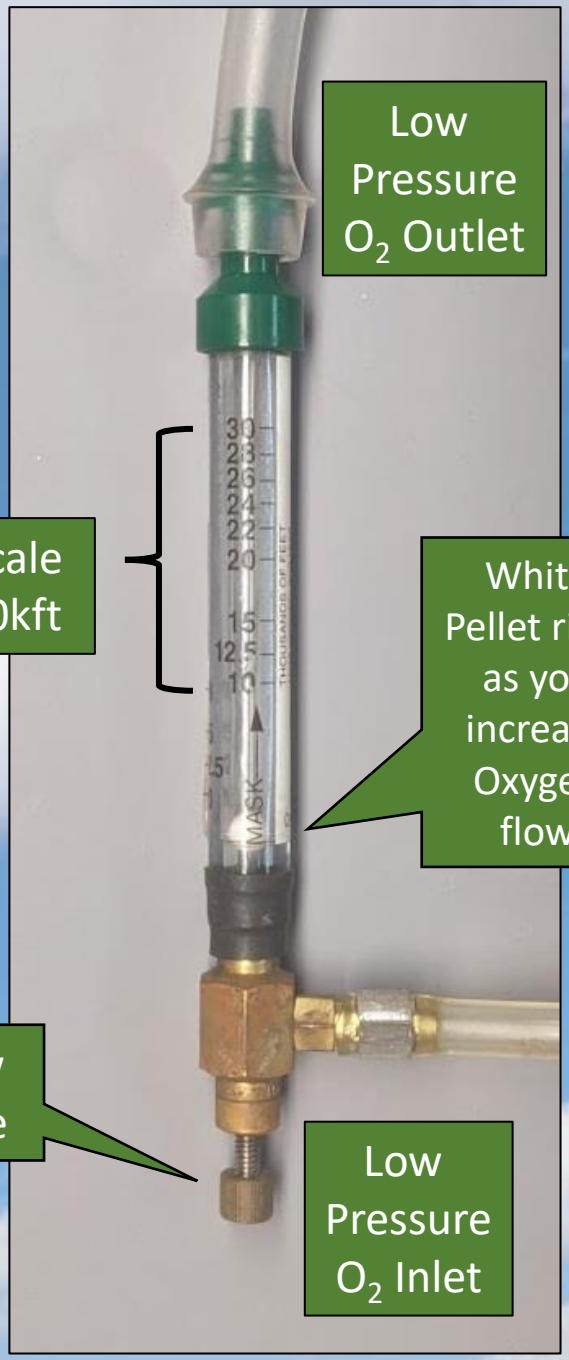
Oxygen Regulators

Lowers the Pressure to Allow the Pilot's Safe Use

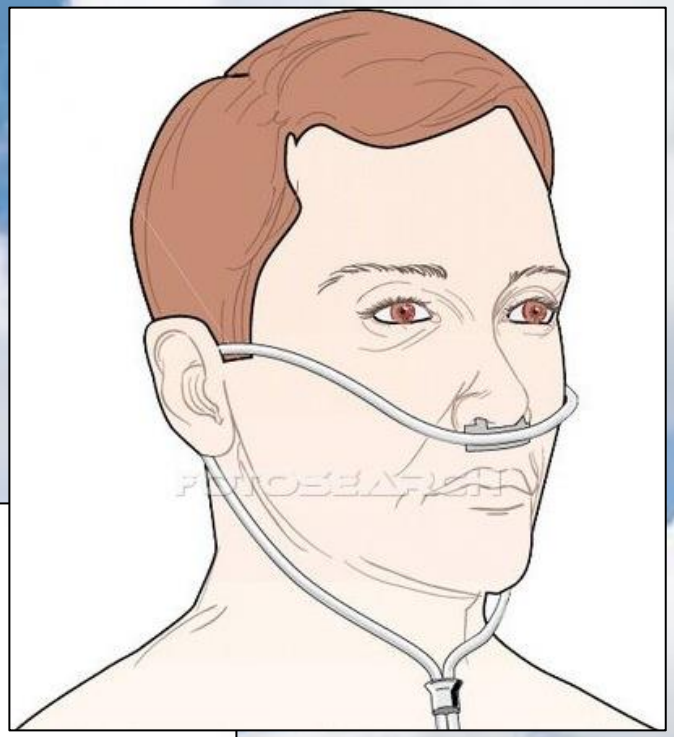


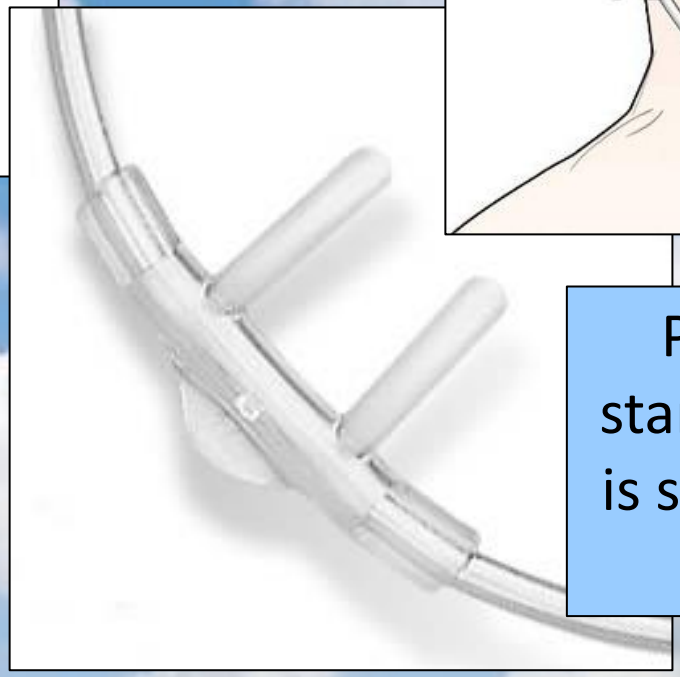
Oxygen Flow Monitoring and Control Based on Altitude

Simplest - Pellet Type



Standard Oxygen Nasal Cannulas

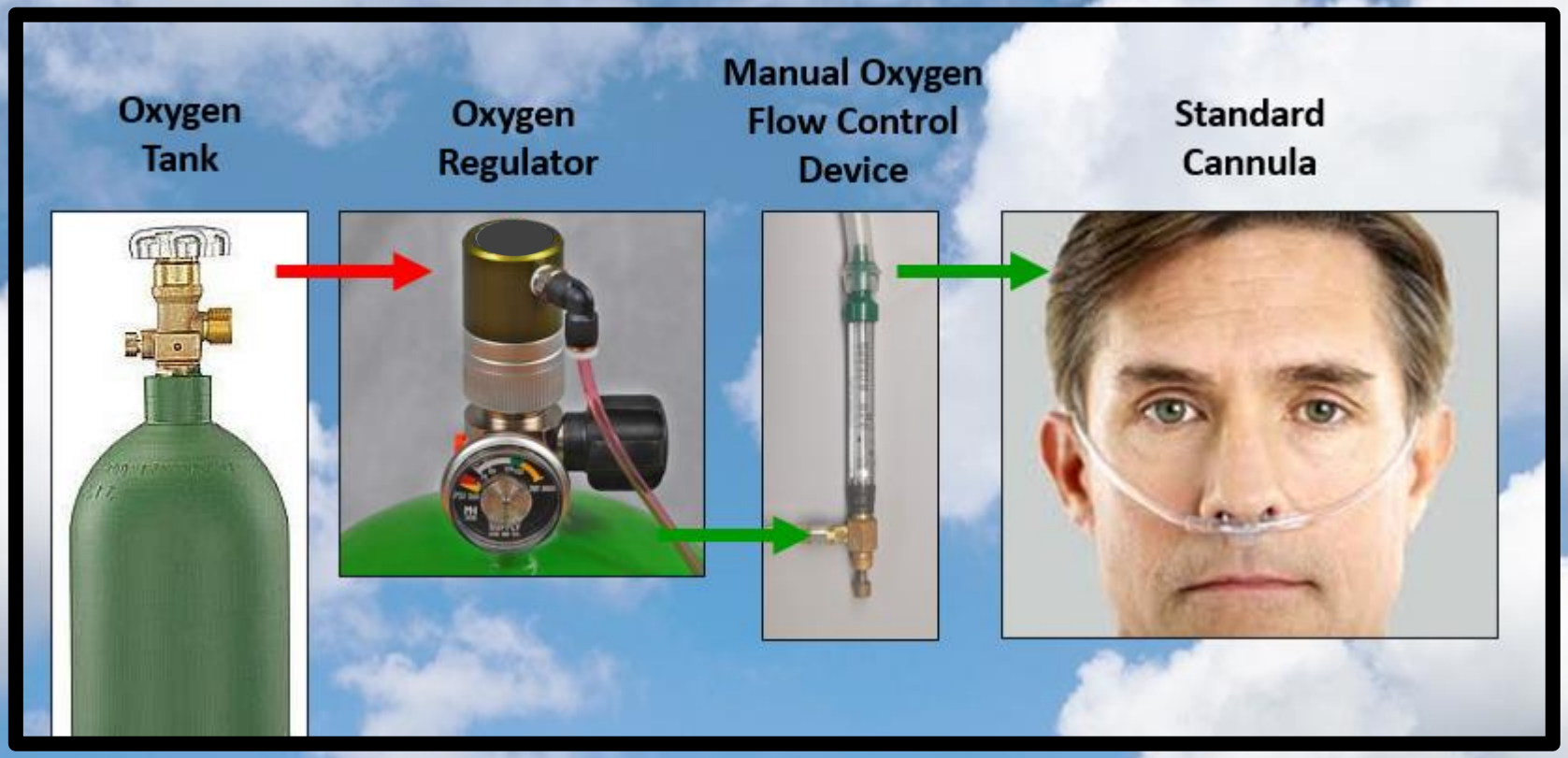




Wasteful!
Oxygen Flows Whether You Need it or Not!

Proper use of standard cannulas is shown in a later slide

Oxygen Delivery System - Continuous Flow



Pros

- Simplest System
- Least Expensive
- Uses Standard Cannula

Cons

- Greatest Oxygen Waste
- Manual Altitude Adjustment

Oxygen Delivery Systems

Better

“Oxygen Saver”

“Better” Continuous Flow System + Oxygen Saving

Oxygen Tank

Oxygen Regulator

Manual Oxygen flow control device

Oxygen Saving Nasal Cannula

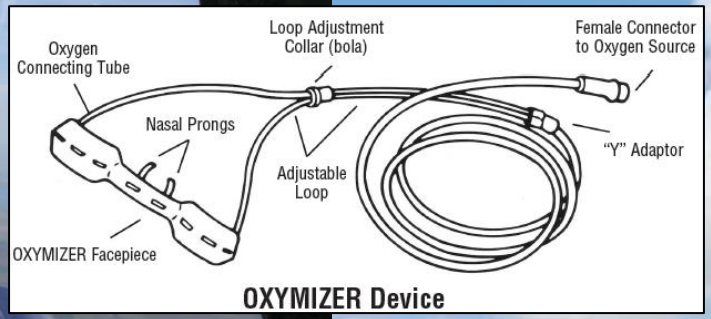
O_2 Saver Continuous Flow System
~50% Oxygen Conservation

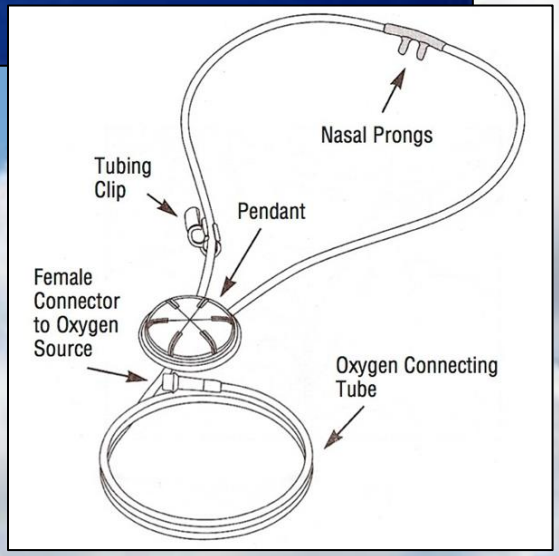
Oxysaver® & Oxymizer® Nasal Cannulas

This type of cannula "captures" some of the unused oxygen into the reservoir until your next breath. It isn't perfect but it helps!

Saves ~50% of Oxygen

2 Year Lifespan





Oxysaver® & Oxymizer® Nasal Cannulas

Pendant Model (P-224)

The reservoir for the **pendant model** is contained in a hard plastic circle-shaped chamber that rests on a patient's chest, under their clothing.

Mustache Model (O-224)

The reservoir for the **mustache model** is contained in a chamber in the facepiece that sits directly under a patient's nose.

Upon exhalation, the reservoir is thrust forward, creating a chamber that stores oxygen.

Exhalation

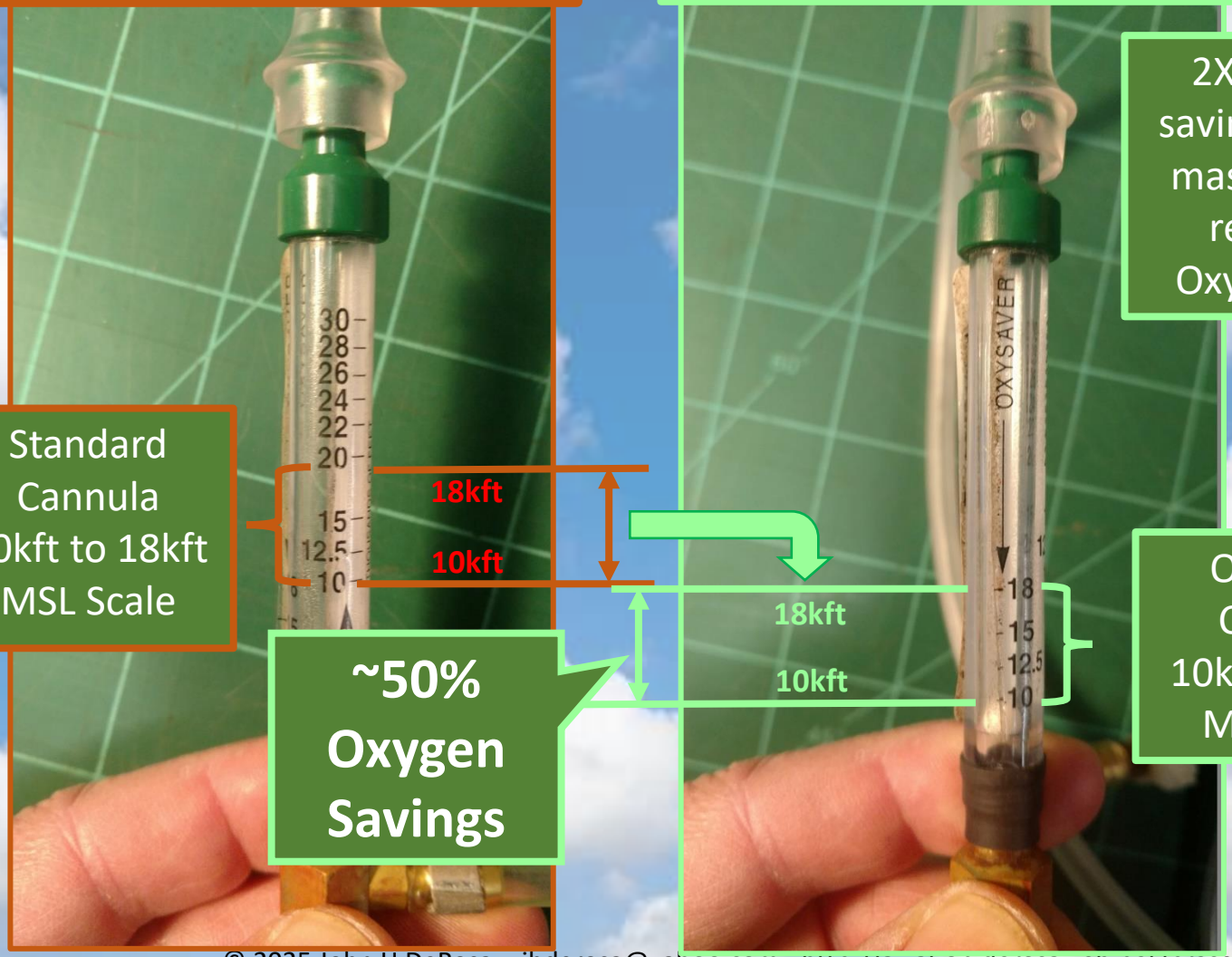
Upon inhalation, the membrane is drawn toward the patient, delivering a bolus of 80 – 100% pure oxygen in addition to continuous flow.

Inhalation

Oxysaver® & Oxymizer® Cannula use with Pellet Type Aerox Flowmeter

Standard Cannula

Oxysaver Cannula



Standard Cannula 10kft to 18kft MSL Scale

~50% Oxygen Savings

2X Oxygen savings due to mask's lower required Oxygen flow

Oxysaver Cannula 10kft to 18kft MSL Scale

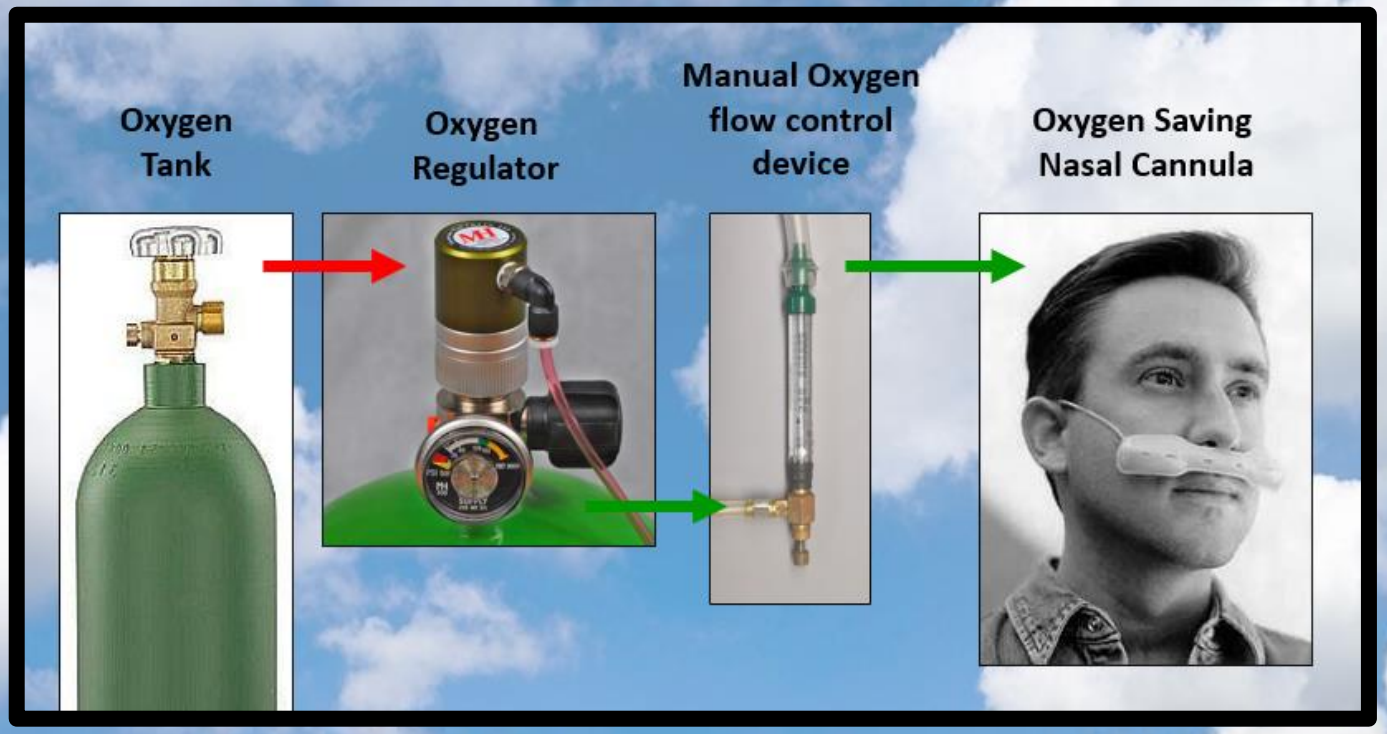
Oxysaver®
Saves Oxygen by a Factor of x4

DURATION* CHART FOR aerox SYSTEMS USING OXYSAVER® CANNULAS

	10,000 Ft. (MSL)					15,000 Ft. (MSL)					18,000 Ft. (MSL)				
Cylinder Size	A 180L 6CF	C 240L 9CF	D 400L 13CF	E-M 700L 22CF	F 1000L 33CF	A 180L 6CF	C 240L 9CF	D 400L 13CF	E-M 700L 22CF	F 1000L 33CF	A 180L 6CF	C 240L 9CF	D 400L 13CF	E-M 700L 22CF	F 1000L 33CF
Users	Hours of use					Hours of use					Hours of use				
1	12.0	16.0	26.7	46.7	66.7	6.7	8.9	14.8	25.9	37.0	4.6	6.2	10.3	17.9	25.6
2	6.0	8.0	13.3	23.3	33.3	3.3	4.4	7.4	13.0	18.5	2.3	3.1	5.1	9.0	12.8
3	4.0	5.3	8.9	15.6	22.2	2.2	3.0	4.9	8.6	12.3	1.5	2.1	3.4	6.0	8.5
4	3.0	4.0	6.7	11.7	16.7	1.7	2.2	3.7	6.5	9.3	1.2	1.5	2.6	4.5	6.4
5	2.4	3.2	5.3	9.3	13.3	1.3	1.8	3.0	5.2	7.4	0.9	1.2	2.1	3.6	5.1
6	2.0	2.7	4.4	7.8	11.1	1.1	1.5	2.5	4.3	6.2	0.8	1.0	1.7	3.0	4.3

* Approximate

Oxygen Delivery System – Oxygen Saving



Pros

- Simple System
- Inexpensive
- Saves ~50% Oxygen over standard cannulas

Cons

- Requires Specialized Cannula
- Manual Altitude Adjustment
- Wastes Some Oxygen

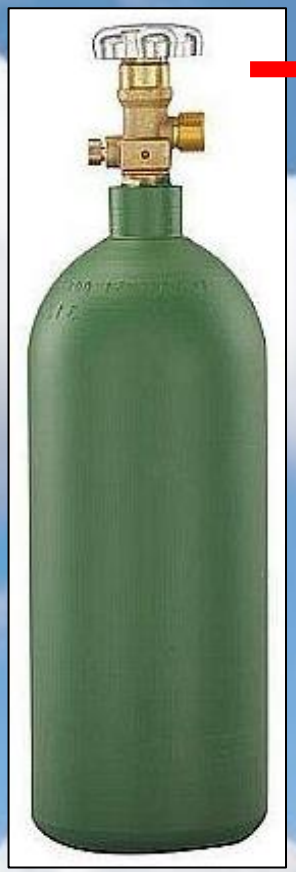
Oxygen Delivery Systems

Best

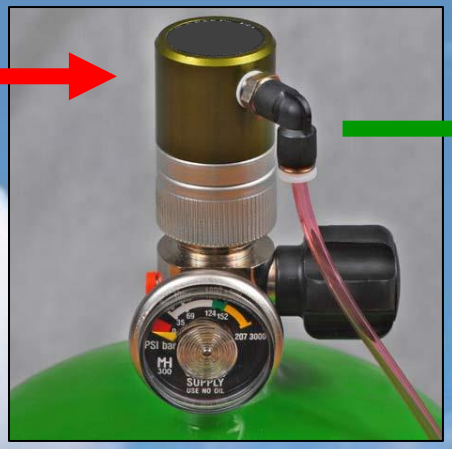
“Pulse Demand”

“Best” System - Pulse Demand Oxygen System

High Pressure Oxygen Tank



Oxygen Regulator



Electronic O_2 Flow Device

Standard Nasal Cannula

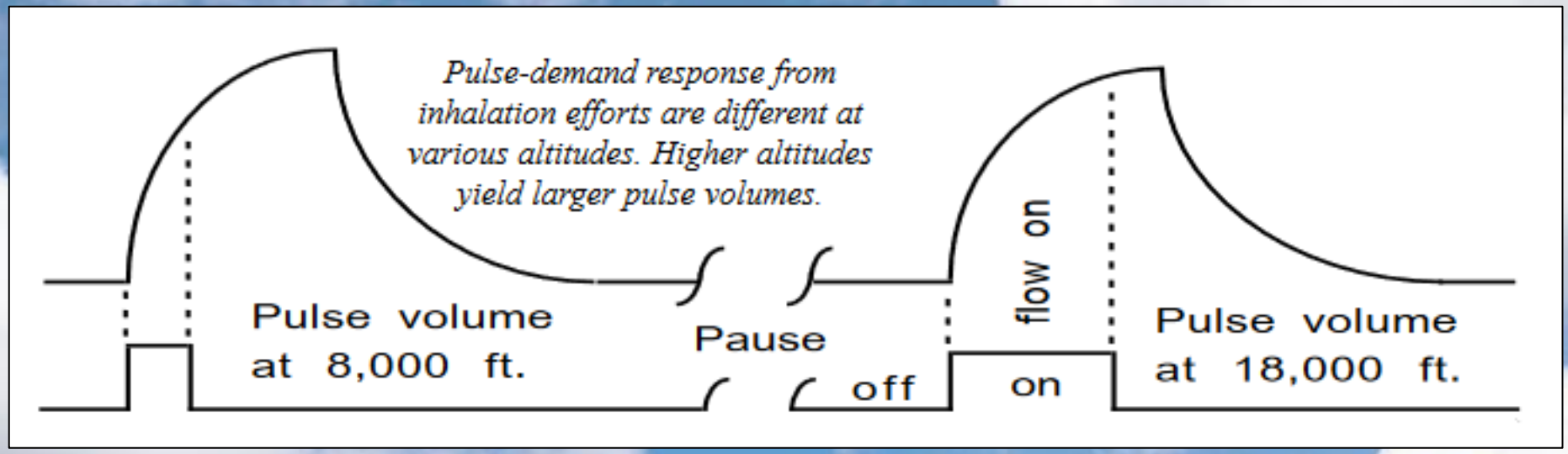
Note: Oxysaver cannulas do not help save any more oxygen

Oxygen is only provided when you take a breath!

Automatically adjusts for altitude!

~95% O_2 Conservation!

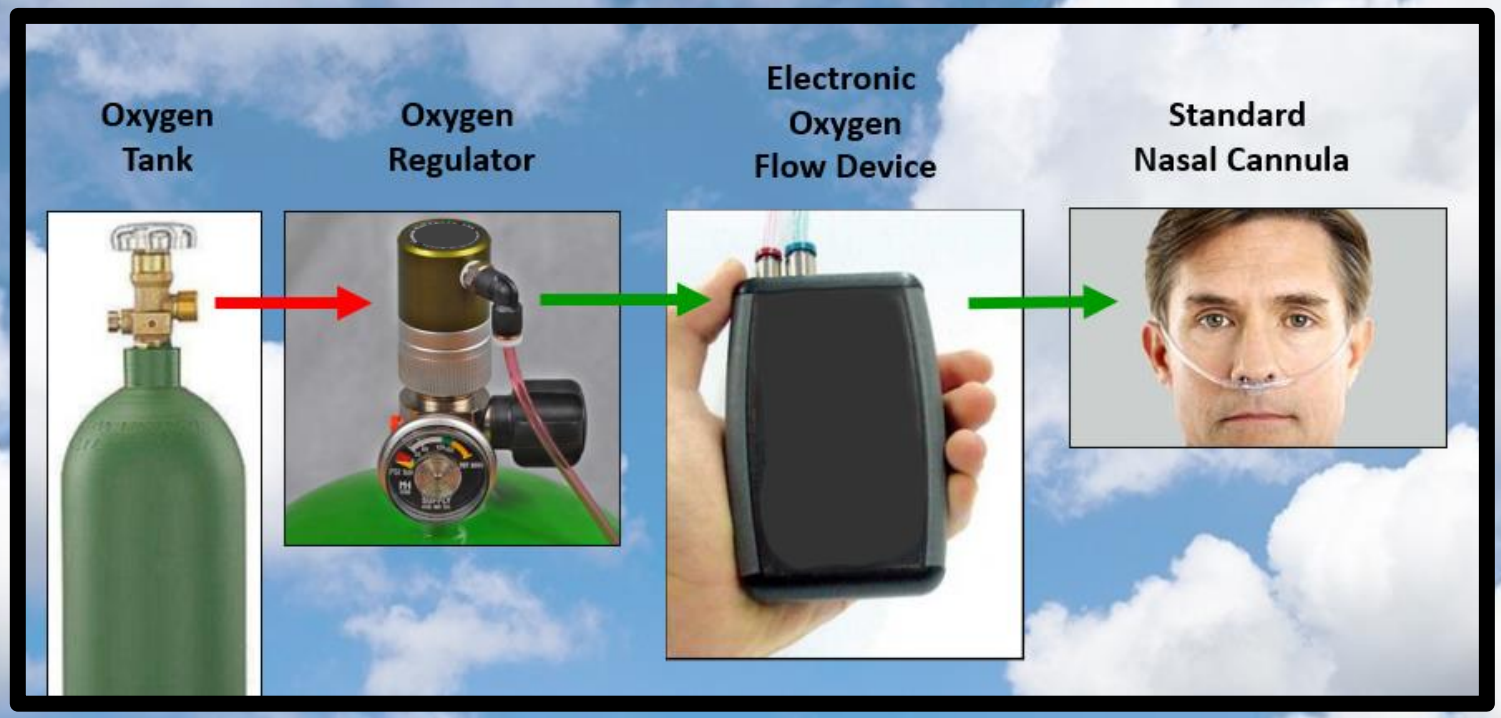
Altitude Pulse Demand O_2 Flow Control (Electronic Type)



Pulse Demand Systems Only Provides Oxygen When You Breathe In Saves >95% of Oxygen

Source: https://www.mhoxygen.com/2016/wp-content/uploads/EDS-Oxygen-Infomd.pdf

Oxygen Delivery System – Pulse Control



Pros

- Saves the Maximum O_2 (~95%)
- Automatic Altitude Adjustment
- Alarms given for issues
- Uses Standard Cannulas

Cons

- Expensive
- Complex System
- Power Source Required

Altitude Pulse Demand O_2 Flow Control

Mountain High System

https://www.mhoxygen.com

Uses a Standard Oxygen Nasal Cannula

Altitude Pulse Demand O_2 Flow Control

Mountain High System

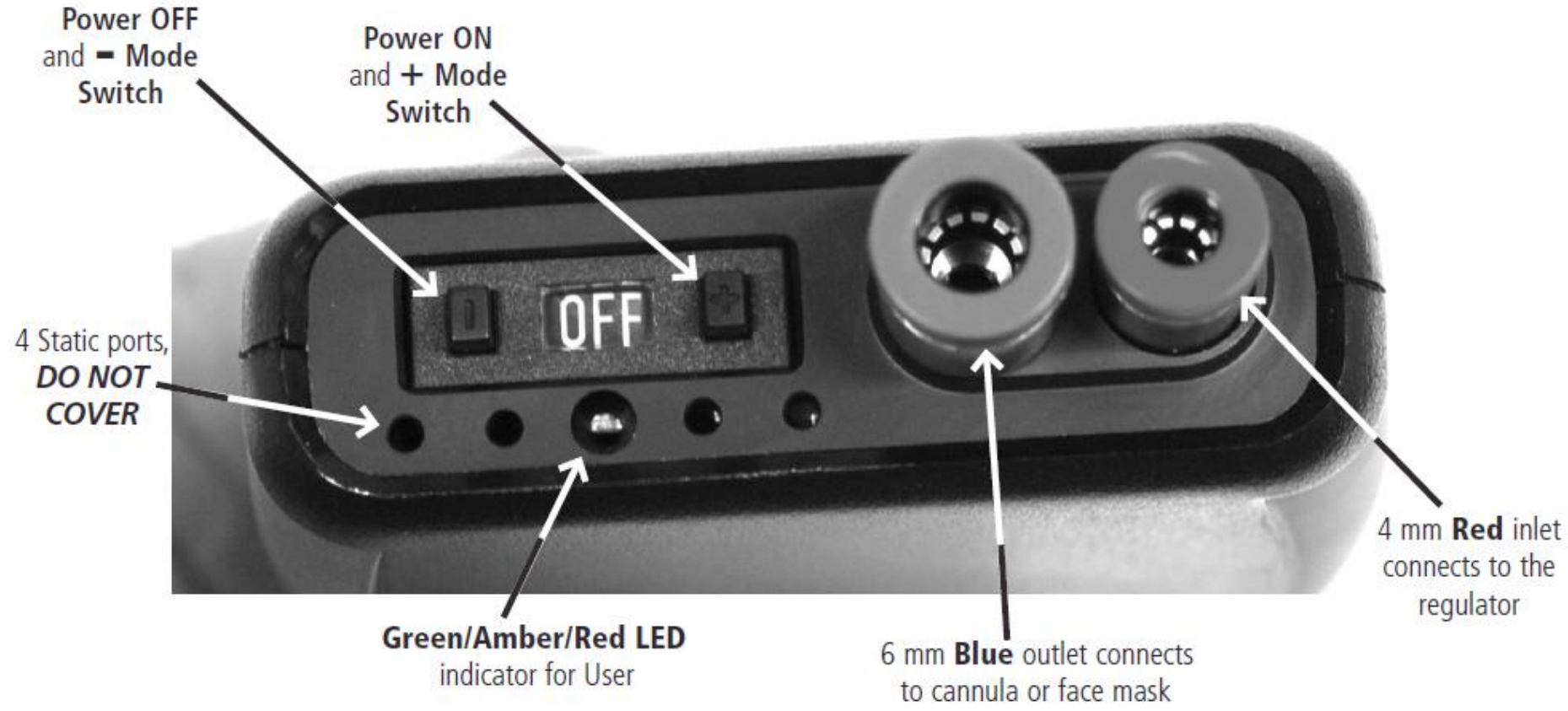
Single Place
EDS Model O_2D_1

Two Place
EDS Model O_2D_2

Second Generation

Altitude Pulse Demand O_2 Flow Control

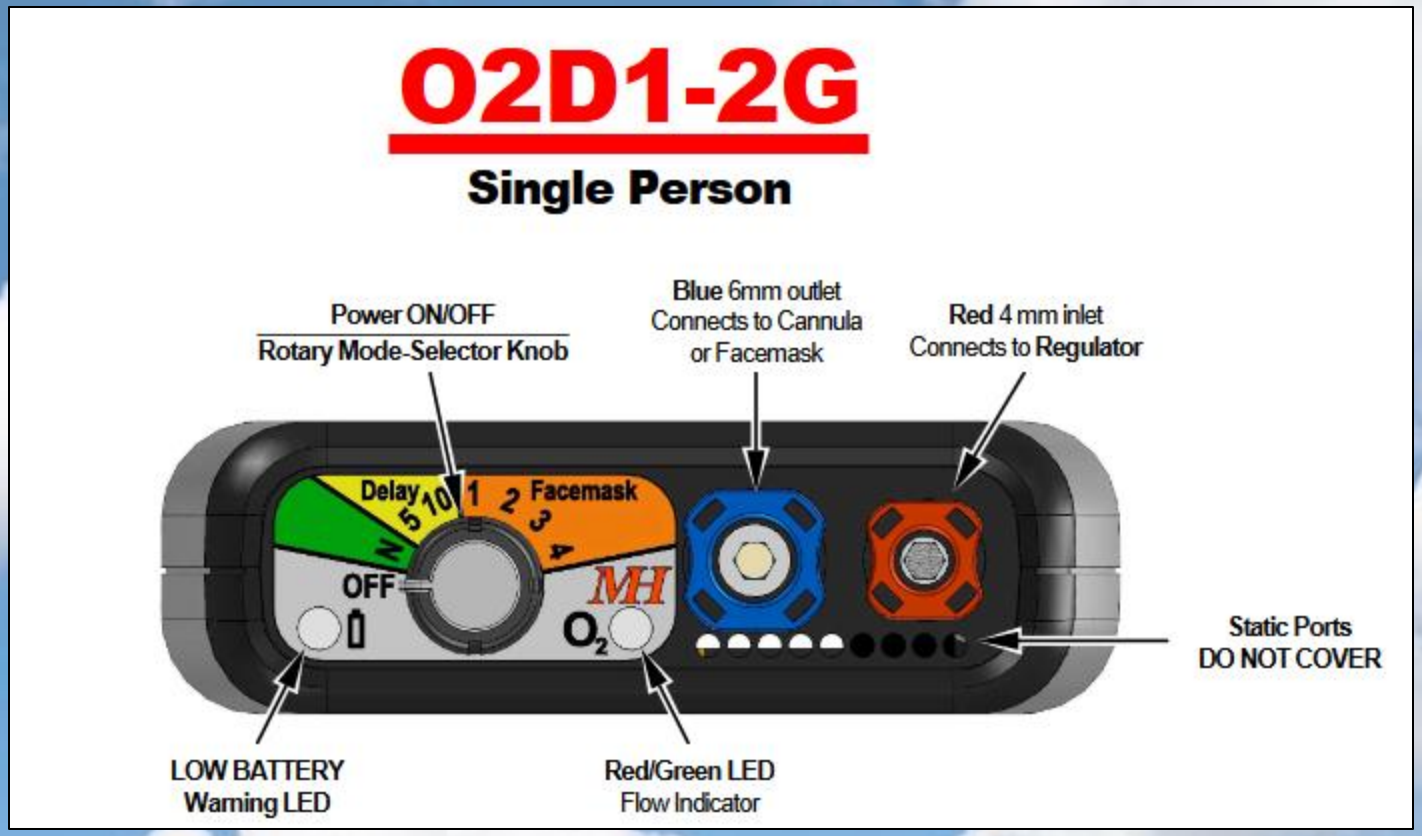
Mountain High - 1st Generation



Audible Alarms: Flow-Fault, Apnea & Tachypnea Sensing

Altitude Pulse Demand O_2 Flow Control

Moutain High – 2nd Generation



Audible Alarms: Flow-Fault, Apnea & Tachypnea Sensing

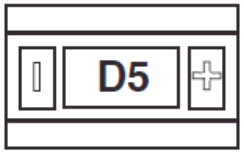
I start oxygen as soon as I am in the glider to help my "flat lander" acclima-tion.

Altitude Pulse Demand O_2 Flow Control

Mountain High System

D MODES: "Day" or "Delayed"

The *D5* setting will cause the MH EDS-O2D2 unit to delay oxygen flow until it senses a pressure altitude of 5,000 ft. and above. The *D10* setting delays oxygen flow until 10,000 ft. and above. NOTE: When the barometric pressure is low, it will start operation at a slightly lower altitude than when the barometric pressure is high.



Flow start: D5--5,000 ft., D10--10,000 ft. **Use with:** Cannula
Flow amount: Standard **Altitude Compensating?:** Yes

F MODES: "Face Mask"

The *F* mode settings *(F5, F10, F15, and F20)* are called the *"Face mask"* settings. They supplement the standard oxygen flow with a richer flow by adding approximately the selected number of feet (in thousands) to the MH EDS-O2D1's perceived altitude.

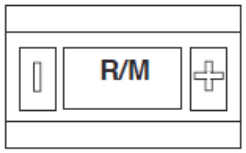
Flow start: All altitudes
Flow amount:
Enriched: F5 =Standard+5,000 ft
F10=Standard+10,000 ft
F15=Standard+15,000 ft.
F20=Standard+20,000 ft.

Use with: Cannula or face mask
Altitude Compensating?: Yes

Example: If you are at a pressure altitude of 5,000 ft. and select the F10 setting you will receive the effective flow rate of 5,000 + 10,000 = 15,000 ft. The "F" modes are useful for people for whom the standard oxygen supply does not achieve the desired blood oxygen saturation or for those who prefer to use a face mask rather than a cannula.

R/M: "Reserve/Manual"

This last switch setting, *R/M,* for *"Reserve" or "Manual"* provides the maximum oxygen flow regardless of altitude. The pulse duration does not vary with altitude.



Flow start: All altitudes **Use with:** Cannula or face mask
Flow amount: Maximum **Altitude Compensating?**: No

Model Number	Pressure PSI	Capacity Cu. Ft. /Liters	Diameter	Length	(Empty) Weight	10,000 Ft. *MH4	10,000 Ft. *MH3	10,000 Ft. °EDS	15,000 Ft. *MH4	15,000 Ft. *MH3	15,000 Ft. °EDS	18,000 Ft. *MH4	18,000 Ft. *MH3	18,000 Ft. °EDS	20,000 Ft. *MH4	20,000 Ft. **EDS	25,000 Ft. *MH4	25,000 Ft. **EDS
AL-113	2216	4.0/113	3.2in/8.1cm	8.3in/21cm	1.7lb/0.8kg	1.6	4.7	6.9	1.1	2.6	3.4	0.9	2.0	2.6	0.8	1.8	0.6	1.2
AL-180	2216	5.8/165	3.2in/8.1cm	11.8in/30cm	2.7lb/1.2kg	2.3	6.9	10.1	1.6	3.8	4.9	1.3	2.9	3.8	1.2	2.6	0.8	1.7
AL-248	2015	8.8/248	4.4in/11.1cm	10.6in/27cm	3.8lb/1.7kg	3.5	10.3	15.2	2.4	5.7	7.4	2.0	4.3	5.7	1.8	3.9	1.3	2.6
AL-415	2015	14.7/415	4.4in/11.1cm	16.2in/41.0cm	5.4lb/2.5kg	5.8	17.2	25.4	4.0	9.5	12.3	3.4	7.2	9.6	3.0	6.6	2.1	4.3
AL-647	2216	22.8/647	5.3 in/ 13.3cm	16.5in/42.0cm	8.4lb/3.8kg	9.1	26.9	39.6	6.3	14.8	19.2	5.3	11.3	14.9	4.6	10.3	3.3	6.7
AL-682	2015	24.1/682	4.4 in/11.1cm	25.6in/65.0cm	8.2lb/3.7kg	9.6	28.3	41.8	6.6	15.6	20.2	5.6	11.9	15.7	4.9	10.8	3.5	7.0
CFF-480	3000	18.2/515	4.5 in/11.4cm	14.4in/36.5cm	3.7lb/1.7kg	7.2	21.4	31.6	5.0	11.8	15.3	4.2	9.0	11.9	3.7	8.2	2.6	5.3
CFFC-048	2216	48.2/1365	6.8 in/17.2 cm	19.7 in/50.0cm	6.2lb/2.8kg	19.1	56.7	83.6	13.2	31.2	40.5	11.2	23.8	31.5	9.8	21.6	7.0	14.1
CFFC-022	1850	22.0/623	5.20 in/13.2cm	19.9in/50.5cm	3.6lb/1.6kg	8.7	25.9	38.2	6.0	14.2	18.5	5.1	10.8	14.4	4.5	9.9	3.2	6.4
KF-011	1850	11.0/311	3.62 in/9.3cm	19.1in/48.5cm	2.0lb/0.9kg	4.4	12.9	19.1	3.0	7.1	9.2	2.5	5.4	7.2	2.2	4.9	1.6	3.2
KF-077**	1850	77.0/2180	7.60 in/19.4cm	29.5in/75.0cm	11.4lb/5.2kg	30.5	90.6	133.6	21.1	49.8	64.7	17.8	38.0	50.3	15.7	34.5	11.1	22.5
KF-115**	1850	115.0/3257	9.10 in/23.1cm	31.5in/80.0cm	16.6lb/7.5kg	45.6	135.4	199.6	31.6	74.5	96.6	26.6	56.7	75.2	23.4	51.56	16.7	33.6

:

& MH4 are the Mountain High portable adjustable flowmeters. *MH3 uses Oxymizer cannula scale.

Flows at the standard protocol of 1.0 liter/minute per 10,000 ft. with facemask.

s Electronic Delivery System.

alculated with cannula and N, D5, D10 mode.

alculated with facemask and F Mode.

uminum cylinders are manufactured with alloy 6061-T6, and are DOT 3AL rated and in compliance with Transport Canada.

ylinders have an aluminum core with carbon filament fiber wrap and are DOT-SP 10945-2216 rated and comply with Transport Canada.

linders have an aluminum core with fiber wrap and are DOT SP 11005-3000 and comply with Transport Canada.

inders are

inder leng

06/2017 - *Specifications and prices subject to change without notice.*

MH
Aviation Oxygen Systems
MOUNTAIN HIGH
Equipment & Supply Company

Toll Free: 800-468-8185
Telephone: 541-548-7500
Fax: 541-923-4141
sales@mhoxygen.com
www.MHoxygen.com
Redmond OR 97756-7537

Source: https://www.mhoxygen.com/2016/wp-content/uploads/Cyl-Dimensions-Chart-6_17-md.pdf.pdf

Altitude Pulse Demand O_2 Flow Control

Shown at the 2023 Soaring Society of America Convention

Aithre* AVI System

https://aithreaviation.com

Single Place

Two Place

*** Pronounced "Eye-thra"**

Altitude Pulse Demand O_2 Flow Control

Aithre AVI – General System Schematic

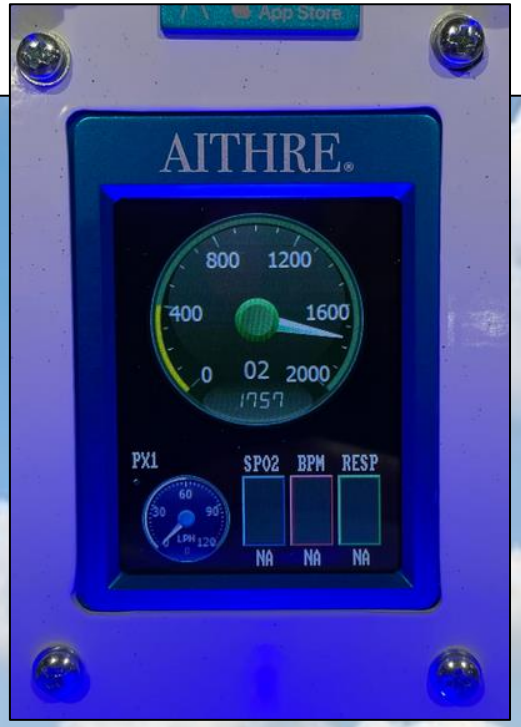
- Bluetooth Connections
- iPhone App Control & Logging
- Optional Equipment;
  - Instrument Panel Oxygen Switch & Connections
  - Instrument Panel Touch Screen
  - Carbon Monoxide (CO) Sensor
  - Oximeter Input

Boom Cannula and Adaptor

The first boom cannula with Illyrian support.

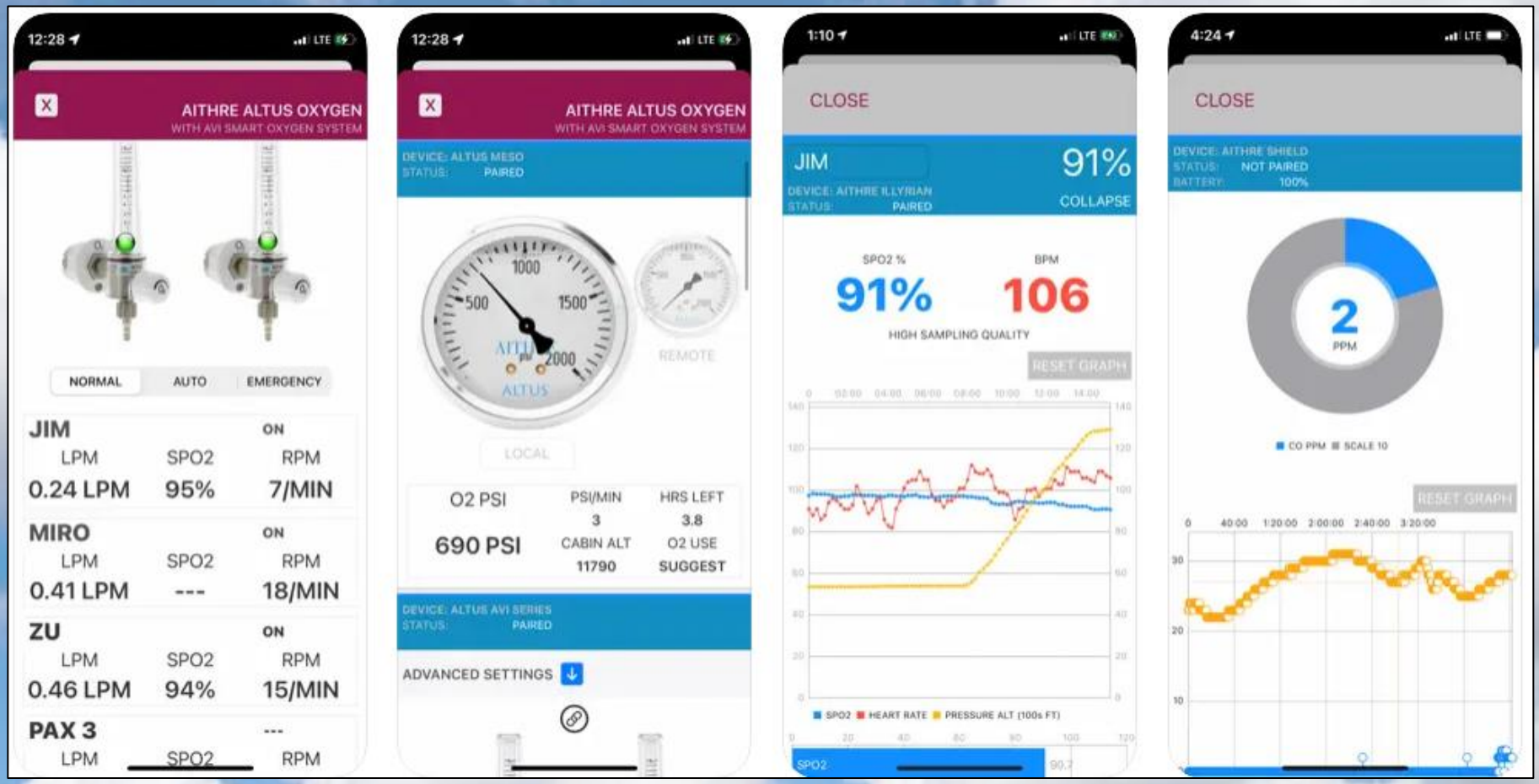
Elegant Panel Placards

Push-button and cannula placards make your panel sharp.



Altitude Pulse Demand O_2 Flow Control

Aithre AVI - iPhone Application



Altitude Pulse Demand O_2 Flow Control

Aithre Instrument Panel Equipment

Altitude Pulse Demand O_2 Flow Control

MH Oxygen.com
Aviation Oxygen Systems

- **Cost*:** $1043 (single place)
- **Pros**
  - Alarms
  - Compact shape
  - Internally Powered (AA Batteries)
- **Cons**
  - No Bluetooth
  - No Logging
  - Requires MH Regulator

AITHRE

- **Cost*:** $1093 (single place)
- **Pros**
  - Alarms
  - iPhone App Integration
  - Bluetooth
  - Optional Equipment
    - Panel O_2 Switch
    - Oximeter Input
    - Cabin CO Sensor
- **Cons**
  - Less compact shape
  - Externally Powered (12Vdc)
  - Requires Aithre Regulator

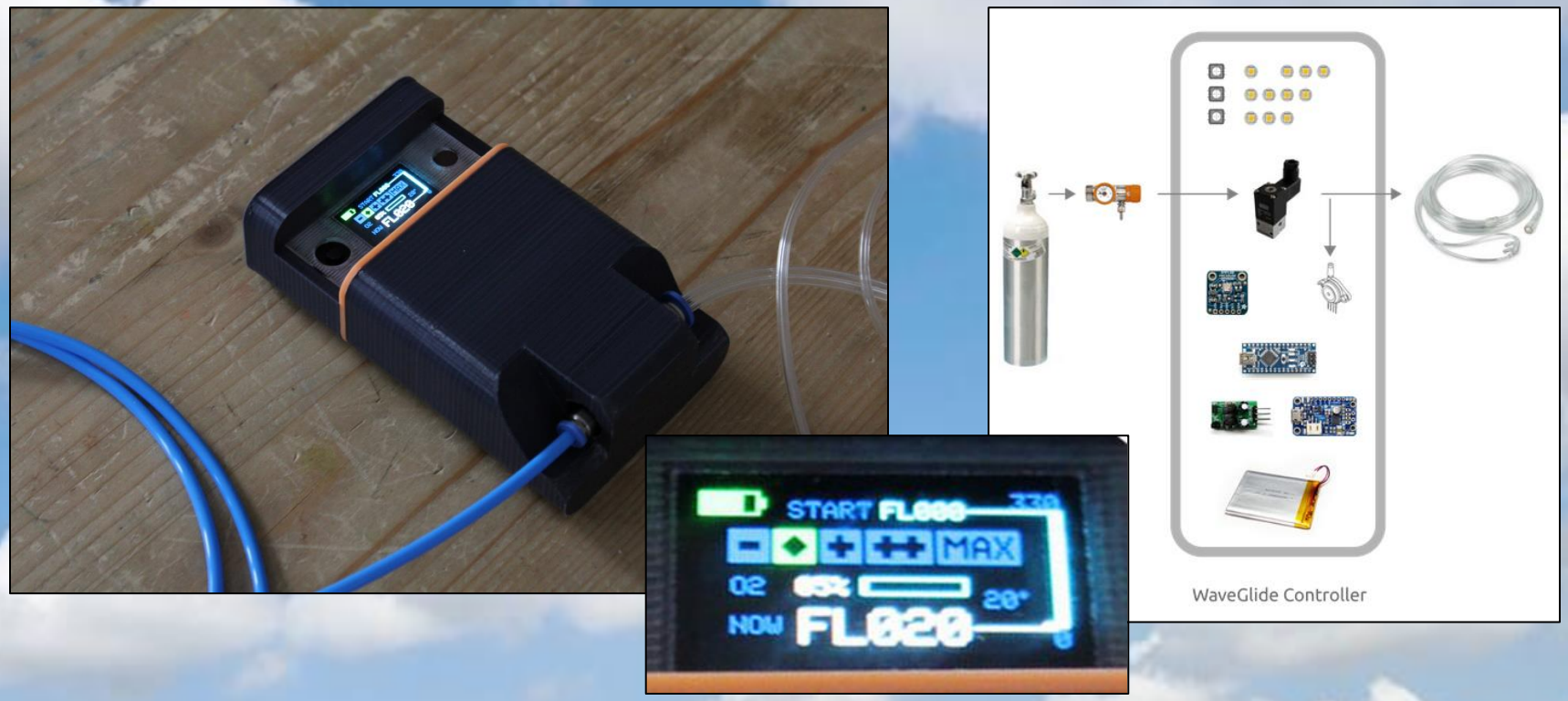
*Including manufacturer's regulator & 47 liter oxygen tank

Altitude Pulse Demand O_2 Flow Control

Build Your Own Pulse System?????

http://nortd.github.io/WaveGlide

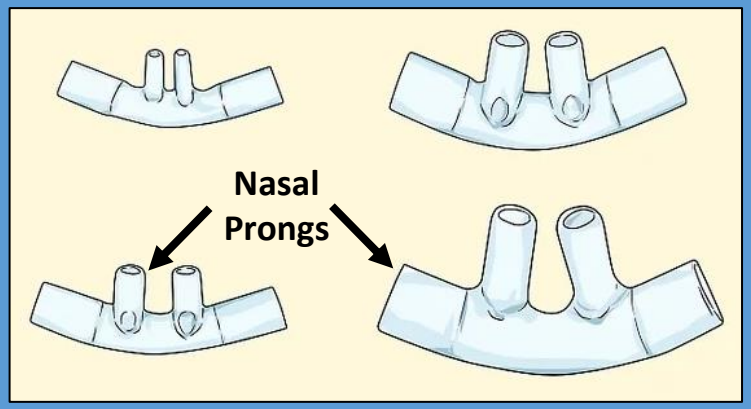
http://sgbaselfricktal.ch/sauerstoff-im-segelflug/



Proper Use of a Nasal Cannula

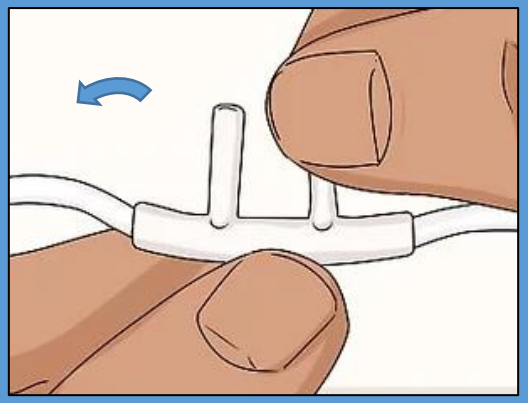
How to Use a Nasal Cannula

Nasal prongs must fit correctly into your nostrils to properly conserve and deliver oxygen



Step 1 - Purchase the appropriately sized nasal prongs for your nostril size. This minimizes escaping oxygen and for reliable triggering of pulse systems.

- Larger prongs are better unless uncomfortable.
- Only use “low flow” cannulas.

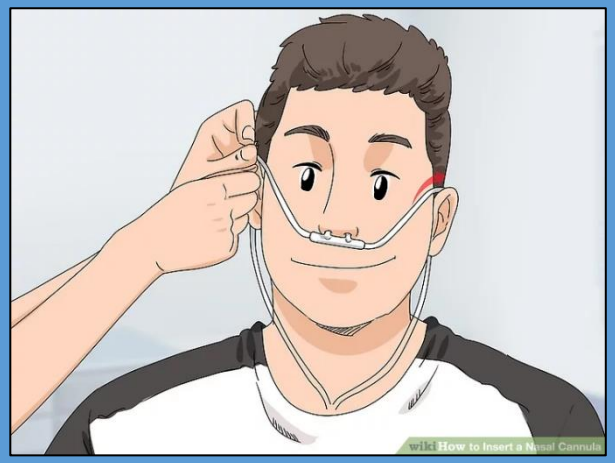


Step 2 - The nasal prongs are curved. Insert them so that they curve into and toward the bottom of your nostrils.

Source: https://www.wikihow.com/Insert-a-Nasal-Cannula

How to Use a Nasal cannula

Routing of the Oxygen Delivery Tubes



Step 3 – Loop the tubes up and over both ears

Step 4 – Move the slider towards your chin

Note

Some pilots report that alternate methods of wearing a cannula from what is described herein provides better oxygen flow for them.

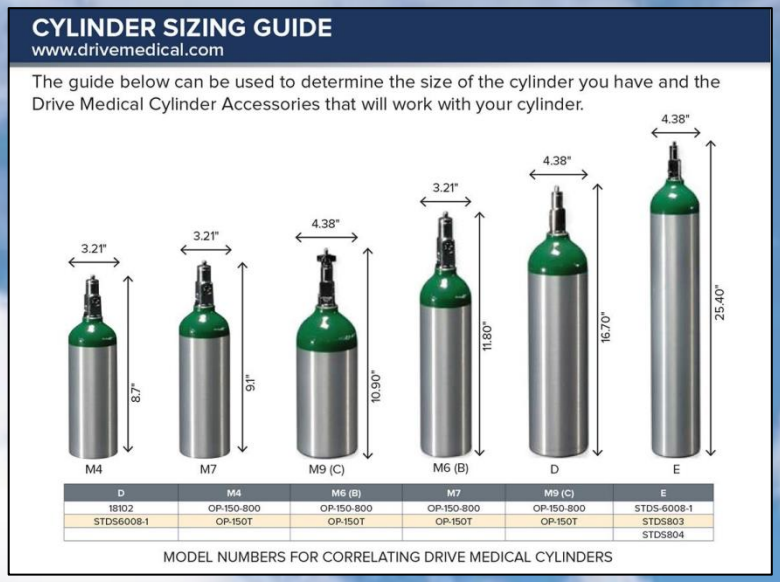
Source: https://www.wikihow.com/Insert-a-Nasal-Cannula

Oxygen Bottle Information

Oxygen Equipment Resources

- **New Equipment**
  - http://mhoxygen.com
  - http://aithreaviation.com
  - http://craggyaero.com
  - https://cumulus-soaring.com
  - http://wingsandwheels.com
  - http://aircraftspruce.com
- **Used**
  - https://www.mhoxygen.com/closeout-refurbished/
  - http://glidersource.com
- **Repair and Testing**
  - https://www.mhoxygen.com/technical-services/
  - http://aithreaviation.com

Oxygen Tanks – Many Different Sizes



D	M4	M6 (B)	M7	M9 (C)	E
18102	OP-150-800	OP-150-800	OP-150-800	OP-150-800	STDS-6008-1
STDS6008-1	OP-150T	OP-150T	OP-150T	OP-150T	STDS803
					STDS804

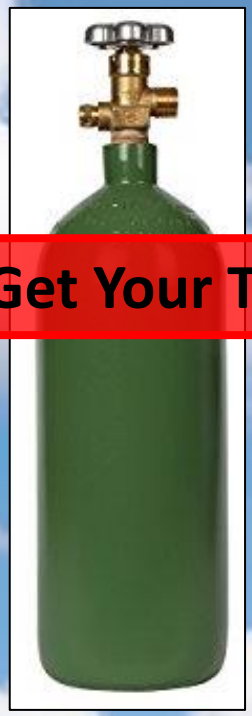
Many European manufactured gliders have oxygen tank sleeves for 100mm diameter tanks.

O^2 Tanks Lifespan and hydrostatic Testing

Steel
Lifespan Unlimited*
Test every 5 years*

Aluminum
Lifespan Unlimited*
Test every 5 years*

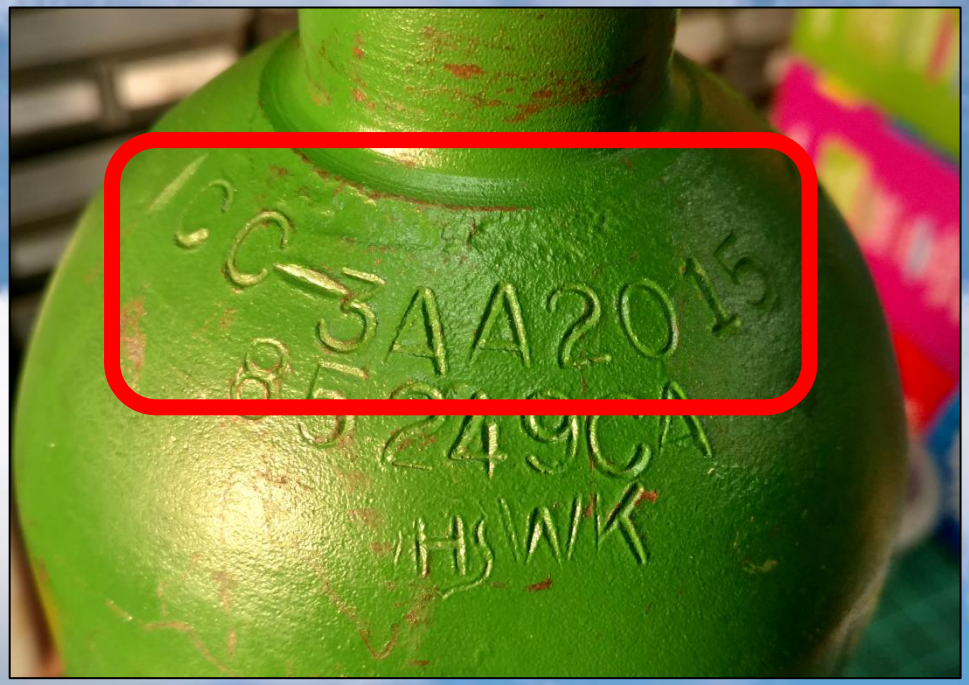
Carbon Fiber
Lifespan 15 years*
Test every 5 years*



Get Your Tank Hydrostatic Tested Before Next Flying Season*

* For full details of hydrostatic pressure testing please refer to
https://www.ecfr.gov/current/title-49/subtitle-B/chapter-I/subchapter-C/part-180#p-180.209(a)

US Steel Oxygen Tank Markings



DOT (ICC*) Specification "3AA2015"

"3AA" is the specification (steel)
"2015" is the max service pressure

Steel Cylinder Shown
Aluminum is Similar

More Details

- **https://www.mhoxygen.com/2016/wp-content/uploads/Oxygen_Cylinder_Markings.pdf**
- **http://www.esabna.com/euweb/oxy_handbook/589oxy3_10.htm**
- **https://www.eiga.eu/publications/eiga-documents/doc-3619-catalogue-of-control-marks-on-cylinders/**

* Prior to the Federal Department of Transportation (DOT) there was the Interstate Commerce Commission (ICC)

US Steel Oxygen Tank Markings

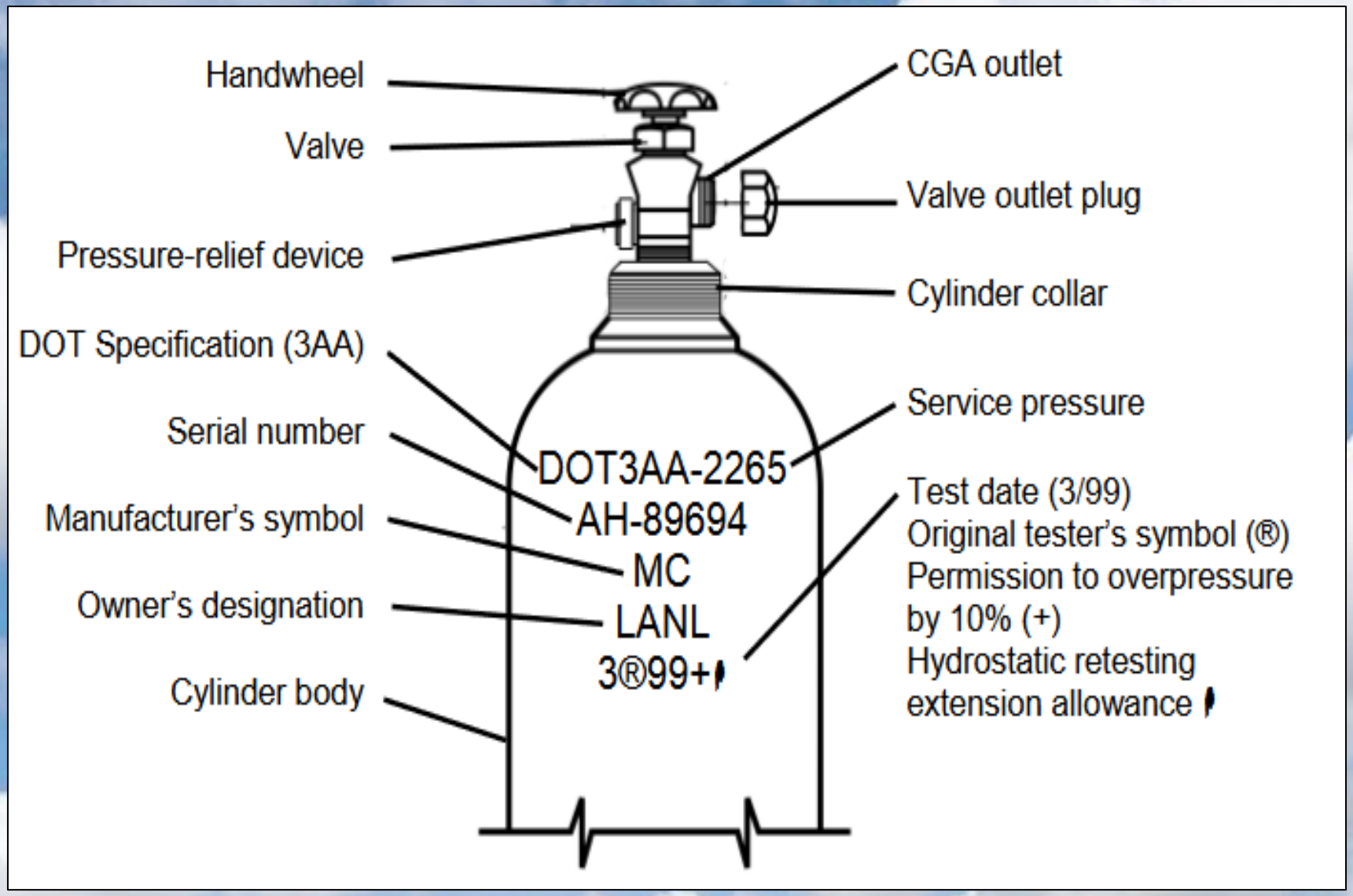
Hydrostatic Pressure Testing Information

Month/Year of the Testing
7 57 = July 1957
3 84 = March 1984
12 94 = Dec 1994
10 00 = Oct 2000

The "+" symbol means the cylinder can be safely filled to 10% above its rated service pressure.
I.E. from 2015.0 PSI to 2216.5 PSI

These markings identify the organization performing the hydrostatic testing. These can be numbers, letters and/or symbols.

US Steel Oxygen Tank Details



Basic Parts of an Oxygen System

NOTE: There are many types of Oxygen Tank valves
This presentation deals only
with the **CGA-540** type of valve

CGA-540
O2 Valve

Common Oxygen Tank Valve Types

CGA-540

Common for US Aviation

CGA-870

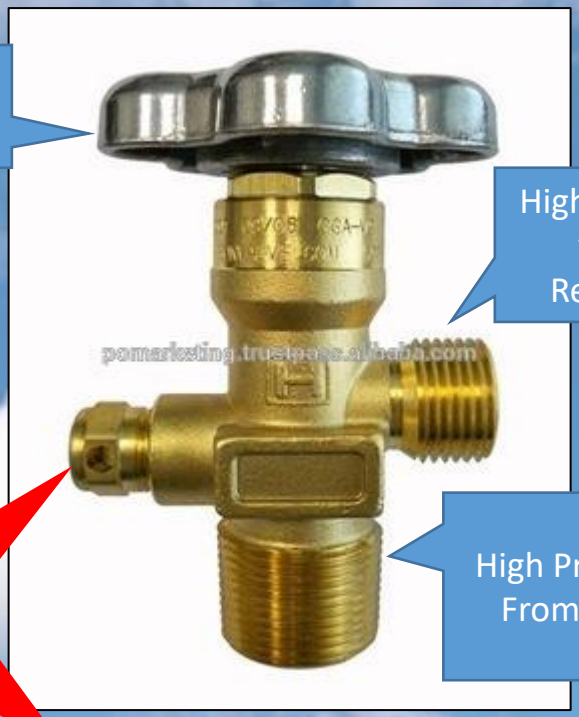
Common for Medical Use

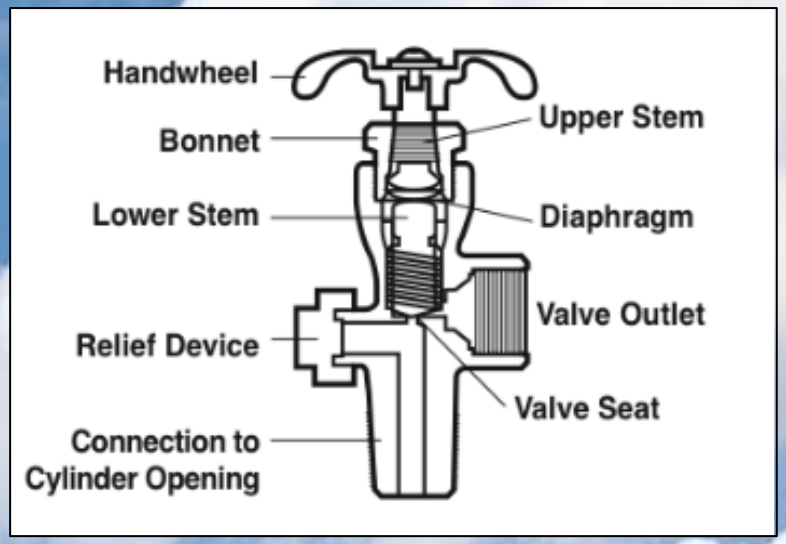
DIN477-9

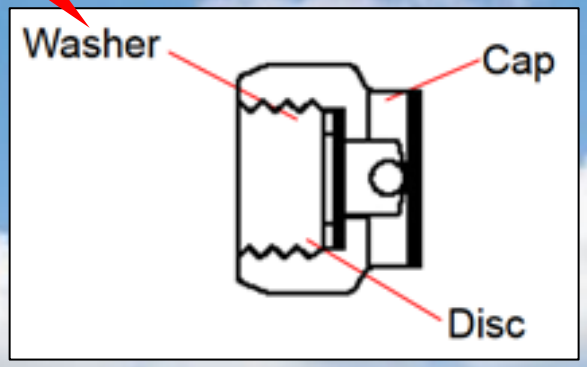
Common Metric

Mountain High can supply regulators and adapters for these metric valves

Commonly Used CGA-540 Valve Assembly





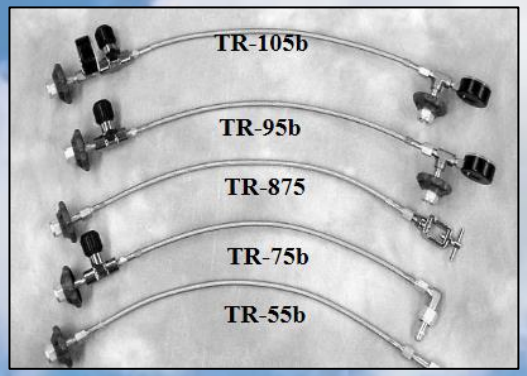


Commonly Used CGA-540 Valve - Disassembled

Transfilling Oxygen Bottles at the Gliderport

Typical Refilling (Transfilling) at a Gliderport

Trans-Filling Oxygen Bottles, Carts, Hoses, Valves and Adapters



From ➔ To

Glider High Pressure Oxygen Bottle

Courtesy of http://www.craggyaero.com/mh_transfillers.htm

Typical Refilling (Transfilling) at a Gliderport

Two Large Commercial O_2 Tanks

O2 Tank 1
"Low Pressure" use for initial fill (~90% Full)

Step 1

Step 2

O2 Tank 2
Secondary "High Pressure" used to "Top-off" the tank to highest pressure

Glider O_2 Tank

Typical Refilling (Transfilling) at a Gliderport

Videos About Transfilling

- https://www.youtube.com/watch?v=CbXmZf8NVGo
- https://www.youtube.com/watch?v=4skMjERWOgo
- https://www.youtube.com/watch?v=5iEw3xBAQ5M
- https://www.youtube.com/watch?v=9Ylkb8fAQbI
- https://www.youtube.com/watch?v=gjhOWQONCX0
- https://www.youtube.com/watch?v=gvn6cBPQq8E

Oximeters

Oximeter Fingertip O_2 Level Testing

LCD Type – Best in Full Sunlight

OLED Type – Shade Use Only

Inexpensive $15-$40

eBay, Amazon, Walmart, etc.

Get One & Use It During Flight!

Oximeter Fingertip O_2 Level Testing

Alarm Monitoring and Date Logging

SORRY - OLED Type – Shade Use Only

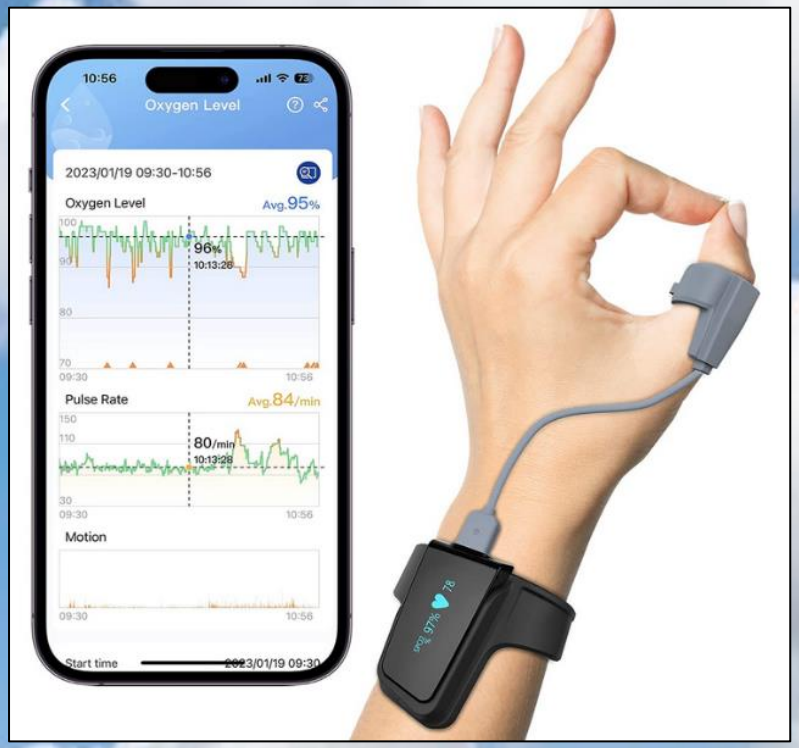
More Expensive ~$150

Get One & Use It During Flight!

Oximeter Fingertip O_2 Level Testing

Alarm Monitoring and Date Logging

SORRY - OLED Type – Shade Use Only



More Expensive ~$200+

Watch Type O_2 Level Testing

Alarm Monitoring and Date Logging

SORRY - OLED Type – Shade Use Only

Garmin Aviator

I kept getting "hold still" warnings

Most Expensive $600+

Get One & Use It During Flight!

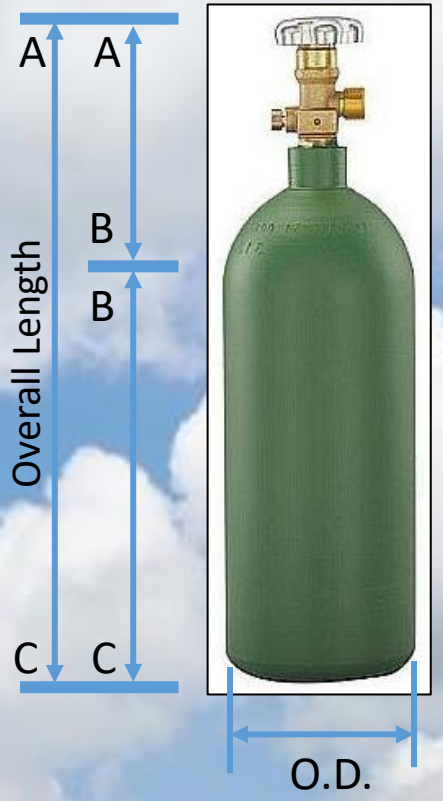
Miscellaneous Information

Oxygen Tanks – How to Search for the Right Size

If your glider did not come with a properly size oxygen bottle, then you will need to find one. Finding the correct size can be an effort especially for metric sizes.

The easiest way to determine the correct size O_2 tank is by locating an owner of your same model of glider and ask them to measure their tank using the ideas shown below.

- ❑ Determining the **Circumference** O_2 tank that will fit.
  - The easy way to directly measure a bottle's circumference is by using a tailor's cloth tape (not a common metal tape measure) **or** wrapping piece(s) of paper around the bottle (mark, unroll, and measure with a ruler).
  - Generally, this is by measuring the O.D. (Outside Diameter) of your O_2 tank sleeve. Note: that many non-US built glider sleeves are made to fit 100mm (~4") metric O_2 bottles.
  - Convert the O.D. to **Circumference** (Circumference=3.14 x O.D.)
- ❑ Determining the overall **Length** of the bottle you will need.
  - Measure the depth of your glider's oxygen tank sleeve. This typically represents the part of the bottle from B to C shown at right
  - Then measure the distance from A to B (neck and valve) to estimate the overall length of A to C
- ❑ Armed with the **Length and Circumference** you can start your search. I found that a likely source of used bottles of various sizes is by visiting a local oxygen provider (AirGas, etc) and look through their inventory. Or by asking eBay sellers to determine the size of their bottle for sale using the procedure as shown above. **Glidersource.com** and **groups.google.com/g/rasprime** are good too.

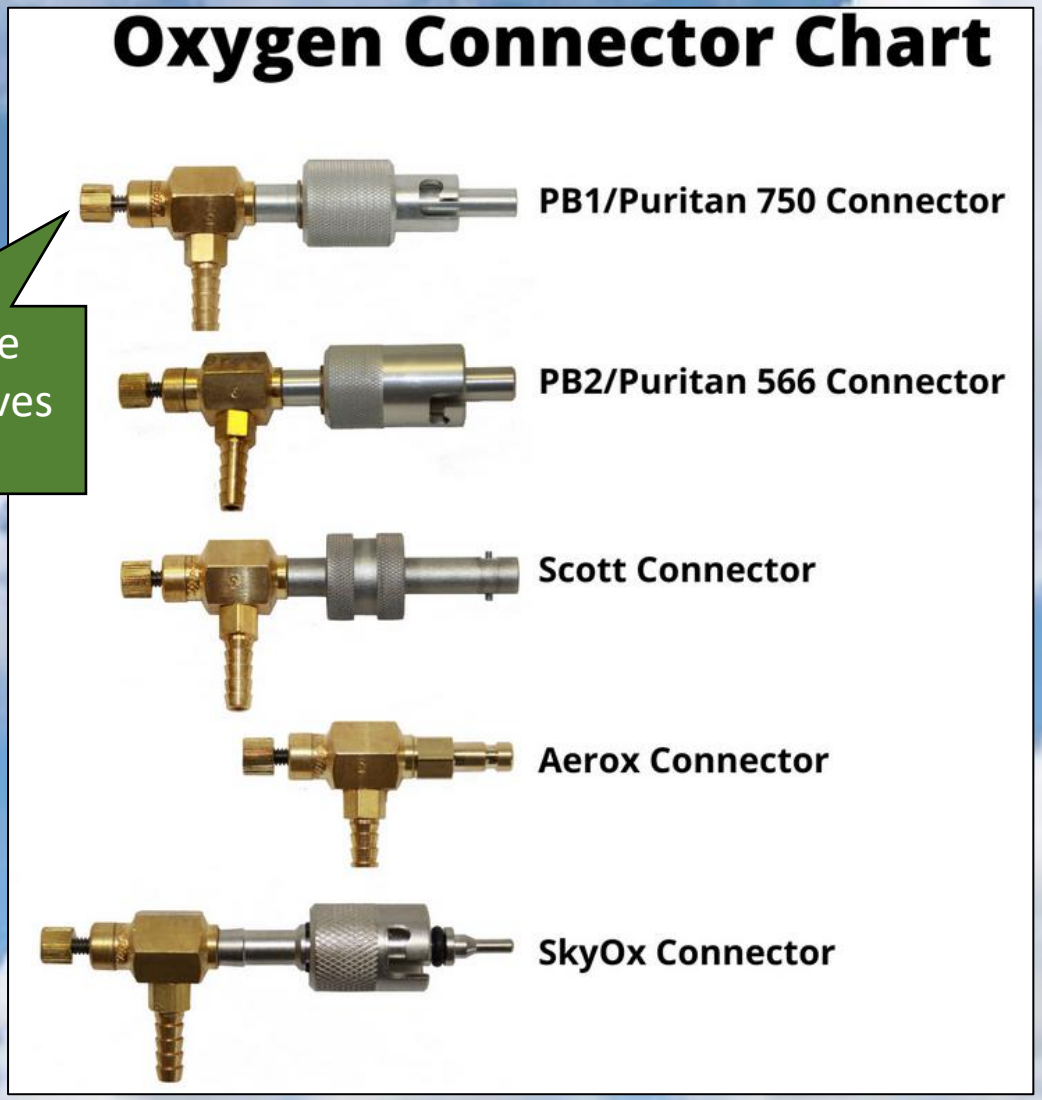


High Altitude Oxygen Masks

Commonly used above 18,000ft
often during wave flight

Connectors Between Regulator & Flow Monitoring Device

Manual Altitude Flow Control Valves (on all types)



Source: https://www.aerox.com/identify-your-connector

The Future?

Molecular Sieve Oxygen Generators (MSOG)

A compressor pump is used to pressurize intake air and feed it through zeolite sieve beds. The sieve beds retain the nitrogen in the air and pass oxygen through the adsorption technique (PSA).

The Future?

AITHRE TURBO OXYGEN MAKER PORTABLE

$2,745.00 MSRP

https://aithreaviation.com/products/aithre-turbo-oxygen-maker-portable

The Aithre Turbo Oxygen Maker portable is the World's first oxygen generator optimized specifically for light aircraft and general aviation. With enough oxygen supply to circumnavigate the World many times, the Aithre Turbo Oxygen Maker will unlock your aircraft potential and support your mission, no matter where it takes you.

Aithre Turbo Oxygen Maker Specifications

- Up to 18k MSL for one person and up to 15k MSL for two people (Illyrian II SPO2% determine personal altitude limits)
- >93% O2 purity for 2000 hours or 2 years at 1 LPM
- 12-14V direct aircraft power, 80 Watts (6 Amps at 14V)
- Weight: 3kg (6.8 lbs)
- Size: 22.5 cm x 14.5 cm x 15 cm (8.8” x 5.7” x 5.9”)
- Integrated flow, pressure altitude, humidity, and temperature monitoring
- Twin dual ball bearing cooling fans
- Over-temperature protection and fault outputs
- Aithre Connect iOS app compatible
- Sieve bed replacement that will need to occur every 2 years or 2000 hours of usage to ensure high purity oxygen generation

Aithre Turbo Oxygen Maker Specifications

Oxygen Output: continuous >93% pure oxygen at 1 LPM

Operational Altitude: 18k MSL for one person and up to 15k MSL for two people. (Illyrian II SPO2% determine personal altitude limits)

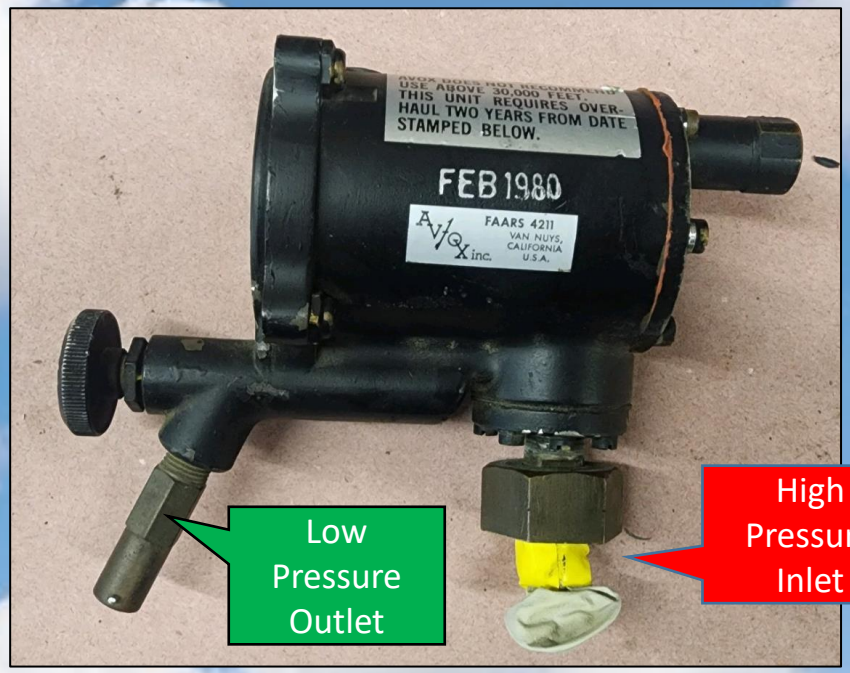
<u>Power Requirements</u>
Voltage: Relies on ship's power 12-14V
Amperage: 80W or approximately 6 amps at 14V

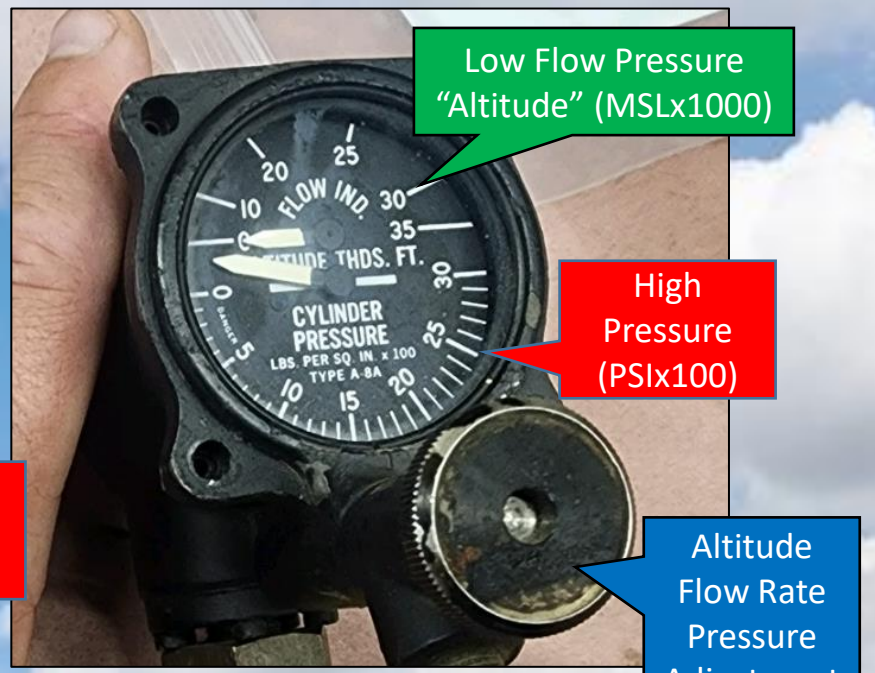
Size : 22.5 cm x 14.5 cm x 15 cm (8.8" x 5.7" x 5.9"
Weight: 3kg (6.8 lbs)

Service Life: Sieve bed replacement that will need to occur every 2 years or 2000 hours of usage to ensure high purity oxygen generation

Memory Lane - Vintage Oxygen Regulator

This 1960's* era vintage regulator has a high pressure inlet that is "hard piped" directly to the oxygen bottle. It has a low pressure outlet to the pilot's mask. This regulator has a dual gauge which shows both the oxygen cylinder's high pressure level and a flow Indicator of the continuous low pressure oxygen rate set for the aircraft's current altitude by the large black knob.





*** The "Feb 1980" date is the last time the unit was tested.**

Signs of Hypoxia YES, AGAIN!

As the degree of hypoxia increases, the classic medical signs and symptoms include:

- **Euphoria**
- **Increased response time**
- **Impaired judgment**
- **Drowsiness**
- **Headache**
- **Dizziness**
- **Tingling in fingers and toes**
- **Numbness**
- **Blue fingernails and lips (cyanosis)**
- **Limp muscles**

The danger to aircrew of an insidious condition that causes euphoria and impaired mental ability without any warning signs such as pain or discomfort are self-evident!

http://www.cfinotebook.net/notebook/aeromedical-and-human-factors/hypoxia

My Personal Oxygen System

Online Resources

- FAA
  - https://www.faa.gov/pilots/safety/pilotsafetybrochures/media/oxygen_equipment.pdf
- Manufacturers
  - Mountain High – Aviation Oxygen Products
  - Aerox/SkyOx - Aviation Oxygen Systems
  - Aithre - aithreaviation.com
- Learning Resources
  - DG-Aviation - The Correct Usage of Oxygen
  - FAA - Oxygen Equipment Use in General Aviation Operations
  - CFI Notebook - Aviation Supplemental Oxygen
  - Skybrary - Aircraft Oxygen Systems
- Other Miscellaneous Documentation
  - https://aviation.derosaweb.net/oxygen/documents/

See My Other Presentations

- Glider Electrical Wiring
- Transceiver Troubleshooting
- Oxygen Systems
- Working with Glider Air Lines
- Sailplane Wiring
- Trailer Wiring & LED Lights
- Trailer Chains
- Pilot Relief Systems
- Battery Testing
- Spar Alignment Tool
- L'Hotellier Fittings
- Carbon Fiber Panels
- IGC Filename Decoding
- Blanik L-23 Strut Work
- Survival & Bailout Kits
- Removing Painted Contest IDs

http://aviation.derosaweb.net/presentations

Let me know of any comments!
jhderosa@yahoo.com

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