

# Glider Oxygen Systems

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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

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# Why Do We Need Oxygen at High Altitudes?

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

**Any Questions??**

# FAA FAR 91.211 - Supplemental Oxygen

## Overview Summary

Supplemental Oxygen is required during;

- Flight of more than 30 minutes from 12,500 feet up to 14,000 feet for the entire flight crew
- Flight above 14,000 feet for the entire duration for the entire flight crew
- Flight above 15,000 feet unless all occupants of the aircraft are provided with supplemental oxygen

# FAA FAR 91.211 - Supplemental Oxygen

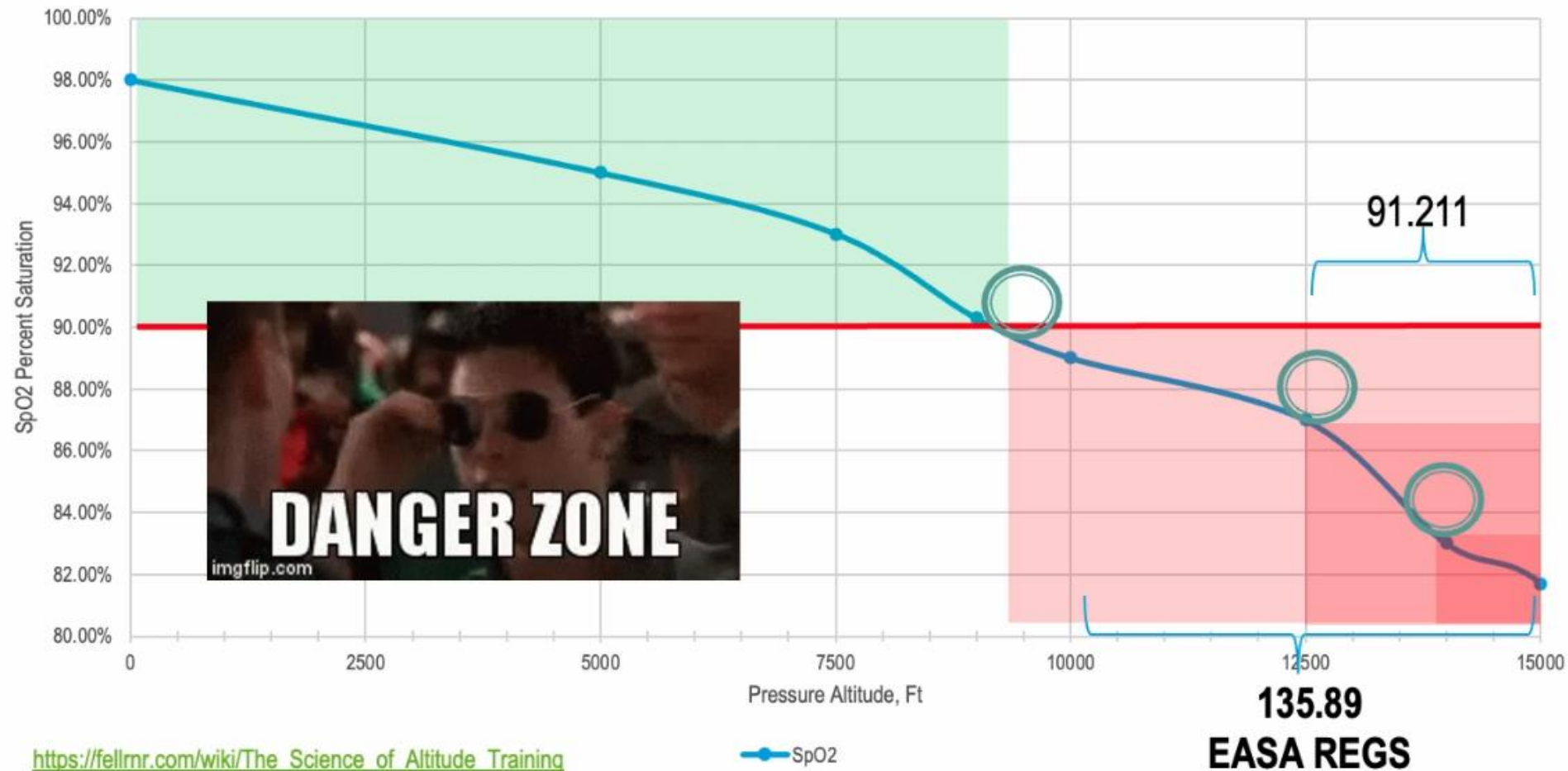
## Chapter and Verse

(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.

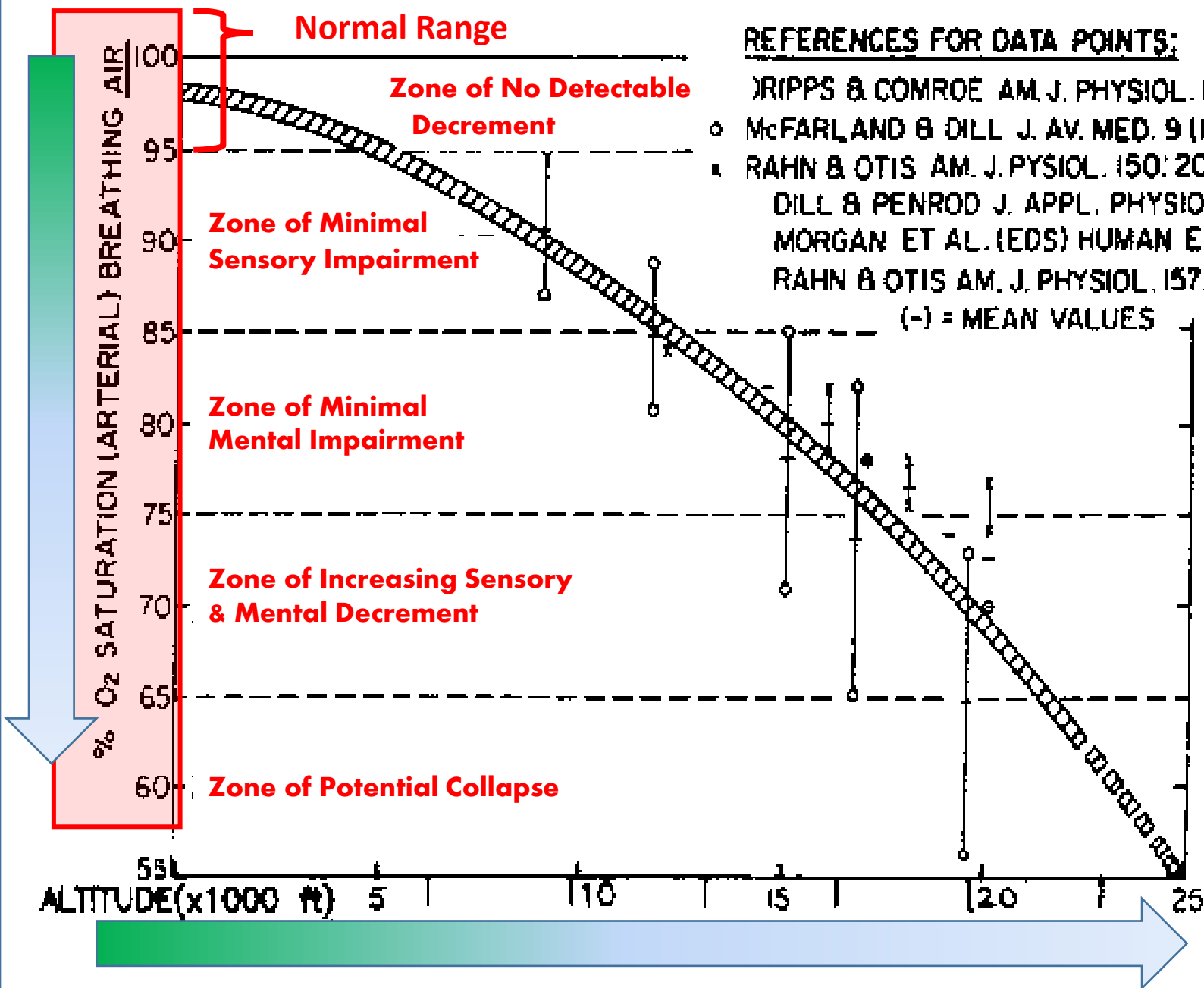
# Is 91.211 “Safe Enough”?

SpO2 vs. Altitude



[https://fellmr.com/wiki/The Science of Altitude Training](https://fellmr.com/wiki/The_Science_of_Altitude_Training)

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





# 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

← Seems that our evolution is not helping 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!

# 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.

Source: <https://medium.com/faa/no-air-up-there-dccde7f8debf>

# Components of Oxygen Systems

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



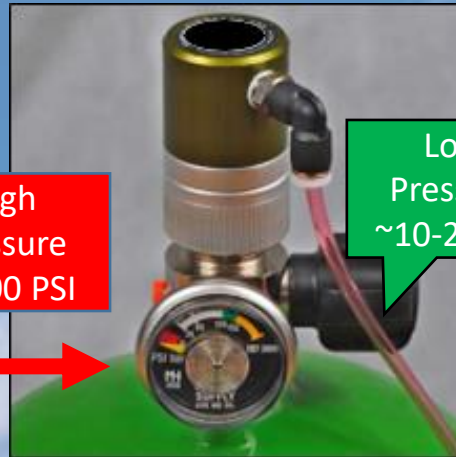
# Basic Parts of an Oxygen System

High Pressure  
Oxygen Tank



High  
Pressure  
~2000 PSI

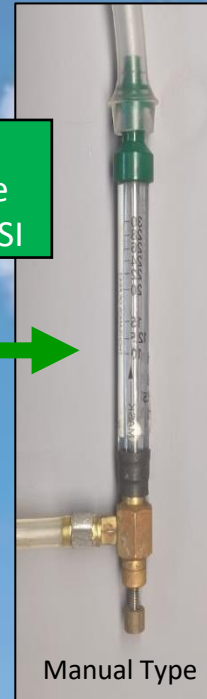
Oxygen  
Pressure  
Regulator



Low  
Pressure  
~10-20 PSI

Regulators should  
never be removed  
until you have  
purged all oxygen  
from the system

Oxygen Flow  
Control Device  
By Altitude



Manual Type

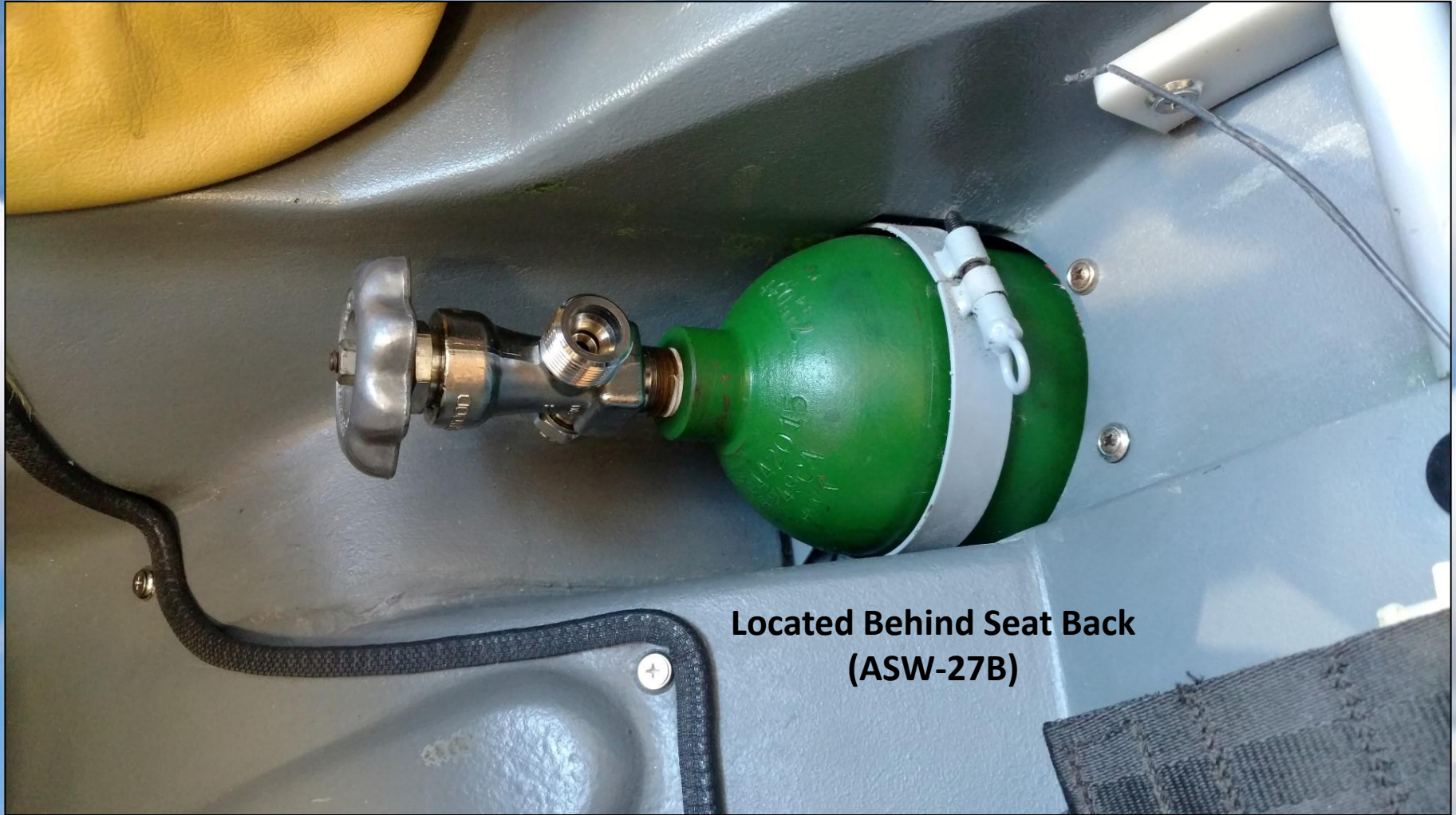
Standard  
Cannula



Proper use of  
cannulas shown  
in a later section



# Oxygen Tank Typical Location in a Modern Glider



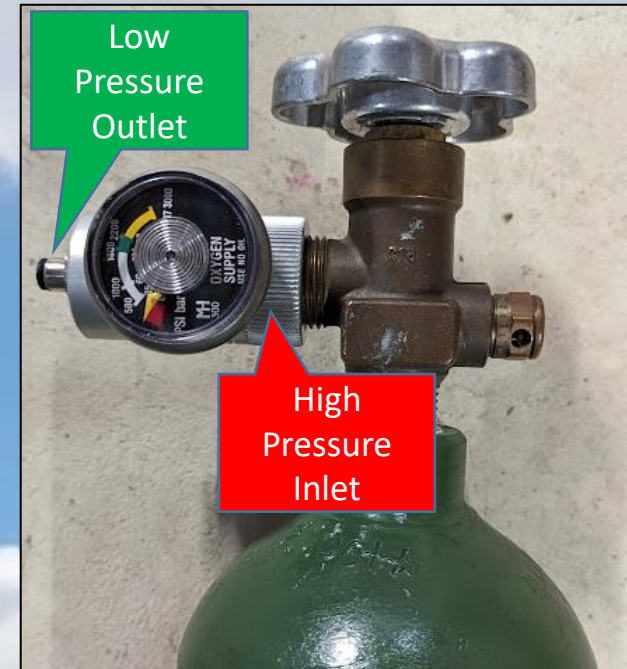
**Located Behind Seat Back  
(ASW-27B)**

# 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.**



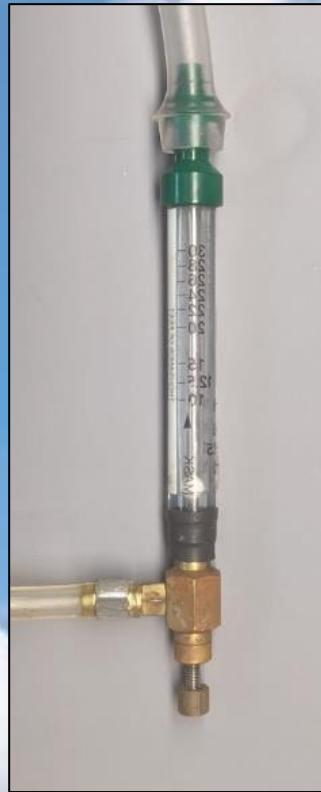


# Altitude Flow Control

**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.**

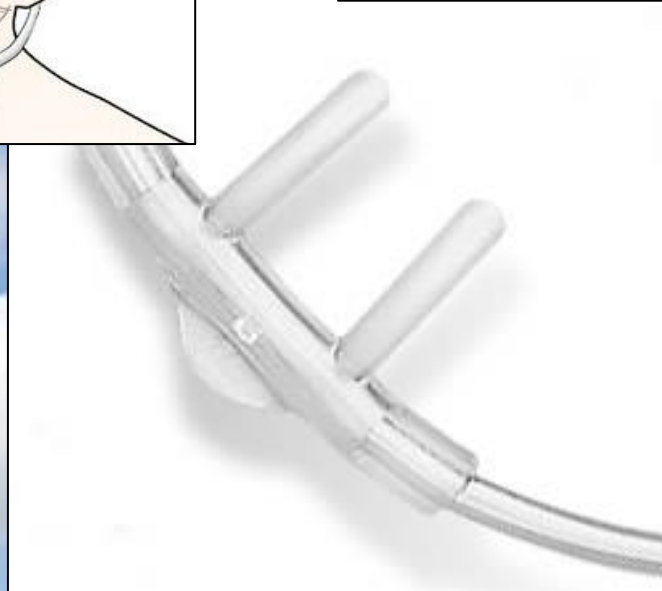
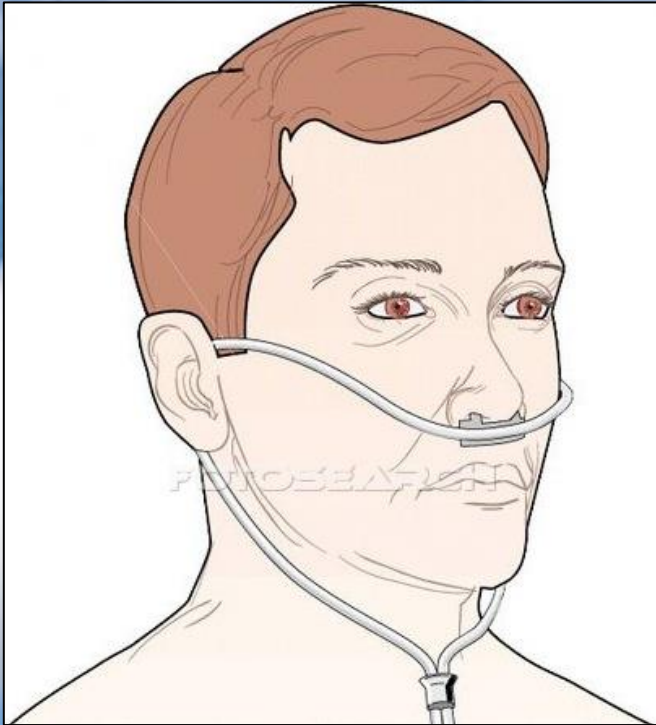
**Manual Oxygen Flow Control Device**



**Electronic Oxygen Flow Control Device**



# Standard Oxygen Nasal Cannulas & Masks





# Oxygen Delivery Systems

**Most Basic**

**“Continuous Flow”**

# Most Basic System - Continuous Flow

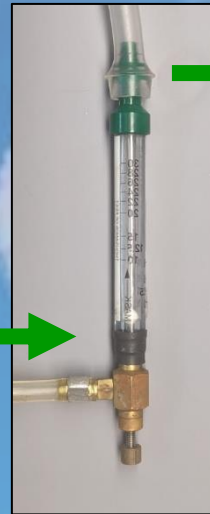
Oxygen  
Tank



Oxygen  
Regulator



Manual Oxygen  
Flow Control  
Device



Standard  
Cannula



**Continuous Flow Systems  
Uses the Greatest Oxygen Amount**

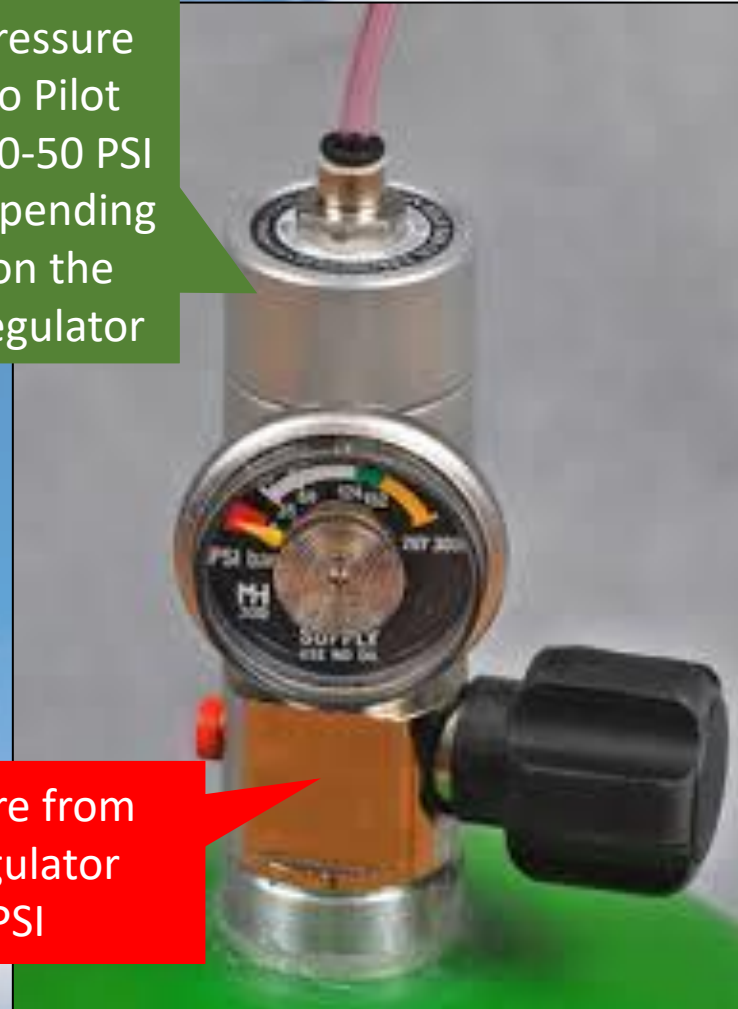
# Oxygen Regulators

Lowers the Pressure to Allow the Pilot's Safe Use



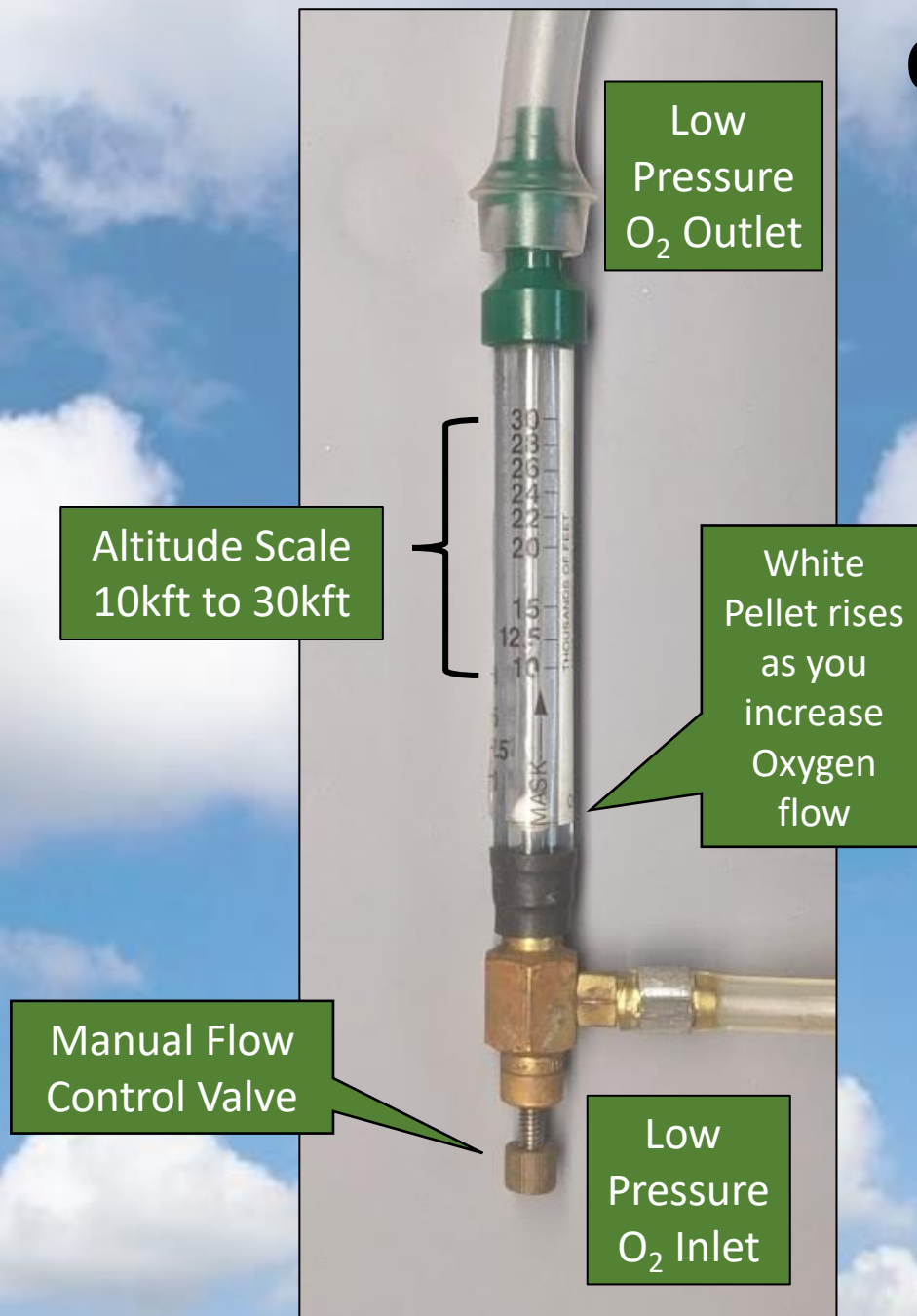
Low  
Pressure  
to Pilot  
~20-50 PSI  
Depending  
on the  
Regulator

High Pressure from  
Tank to Regulator  
~2000 PSI



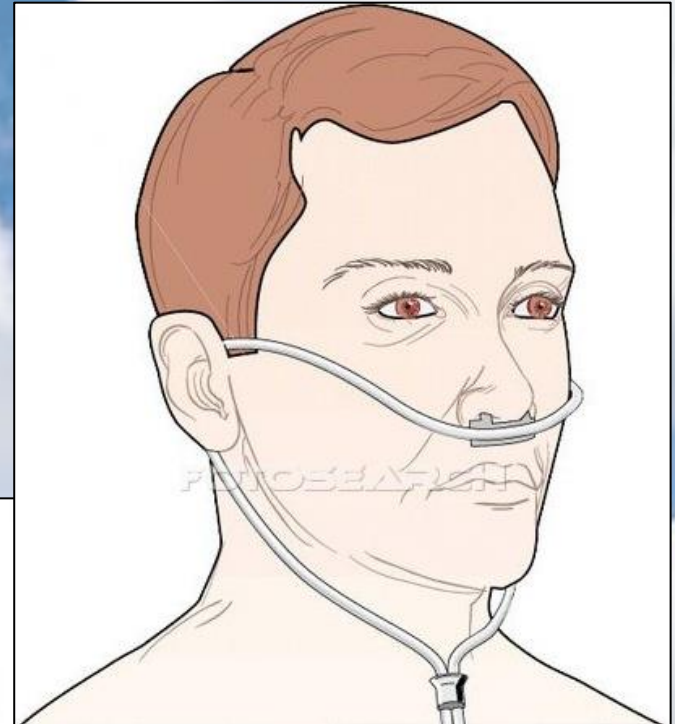


# Oxygen Flow Monitoring and Control Based on Altitude Simplest - Pellet Type



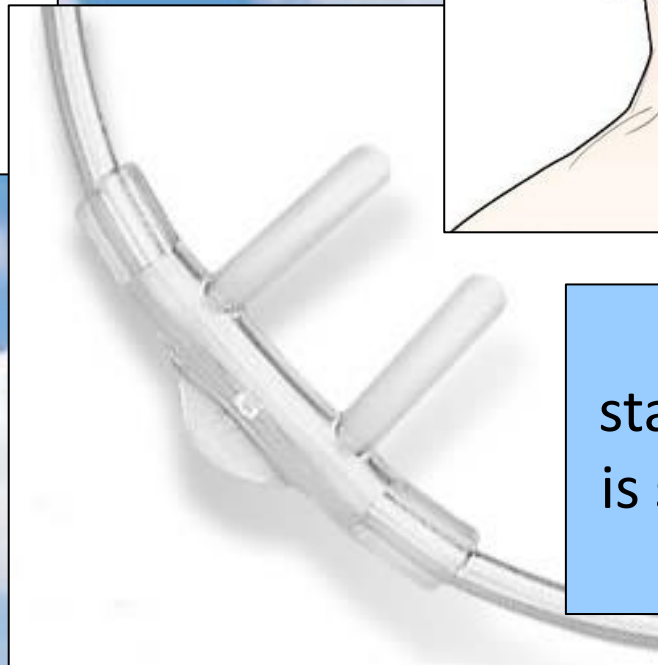


# Standard Oxygen Nasal Cannulas



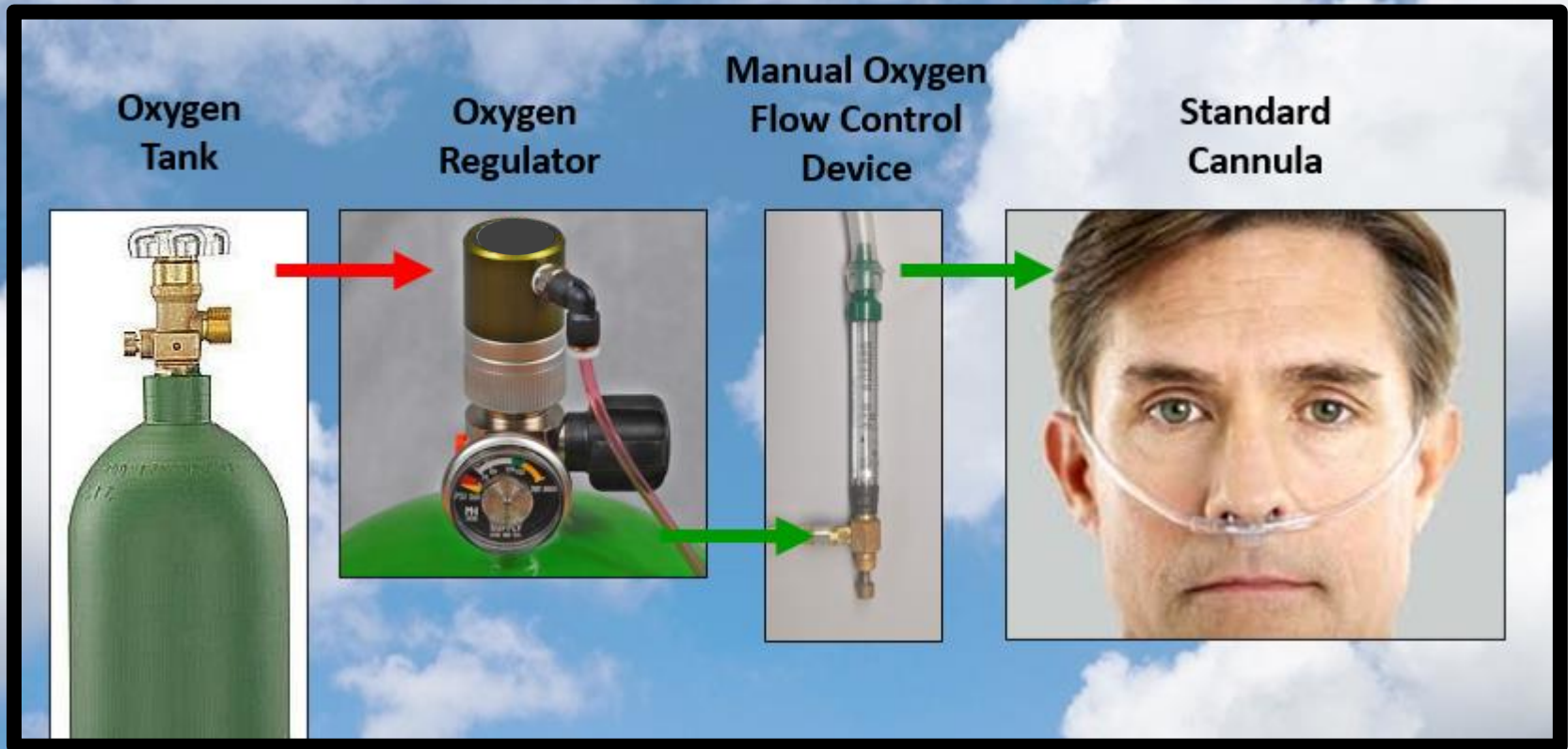
## **Wasteful!**

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”

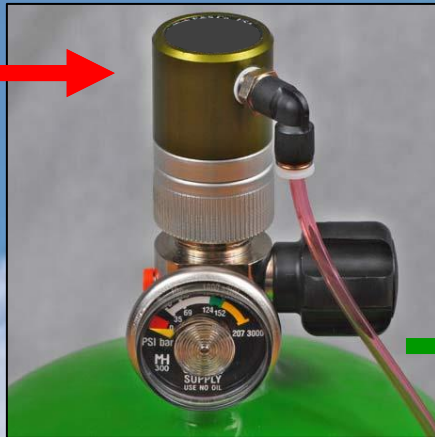


# Continuous Flow System - Oxygen Saving

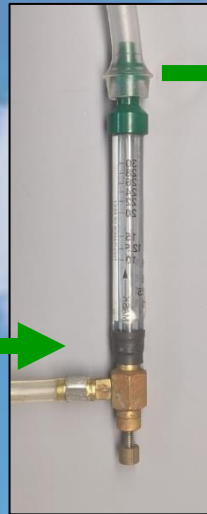
Oxygen  
Tank



Oxygen  
Regulator



Manual Oxygen  
flow control  
device



Oxygen Saving  
Nasal Cannula



**O<sub>2</sub> 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!

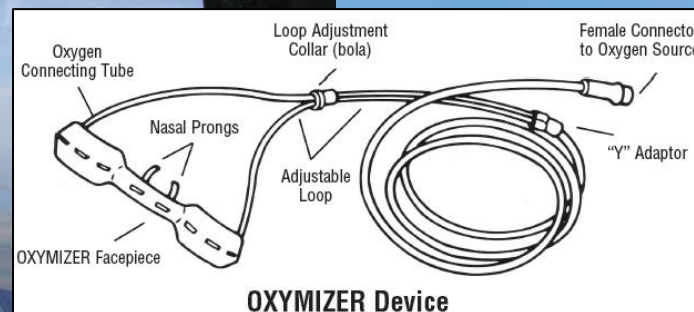
Saves ~50% of Oxygen

2 Year Lifespan

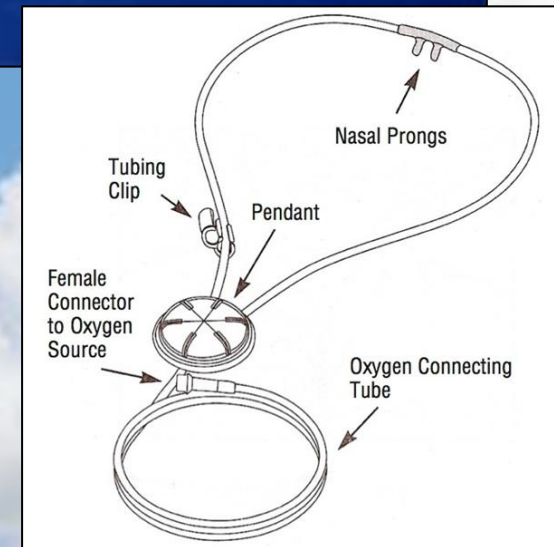
Pendant Style



Mustache Style



OXYMIZER Device

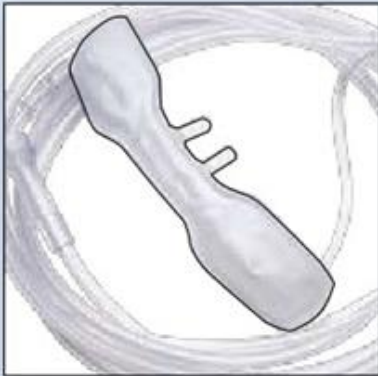


# Oxysaver® & Oxymizer® Nasal Cannulas



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

Standard  
Cannula  
10kft to 18kft  
MSL Scale

~50%  
Oxygen  
Savings

## Oxysaver Cannula

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

Oxysaver  
Cannula  
10kft to 18kft  
MSL Scale



# Oxysaver®

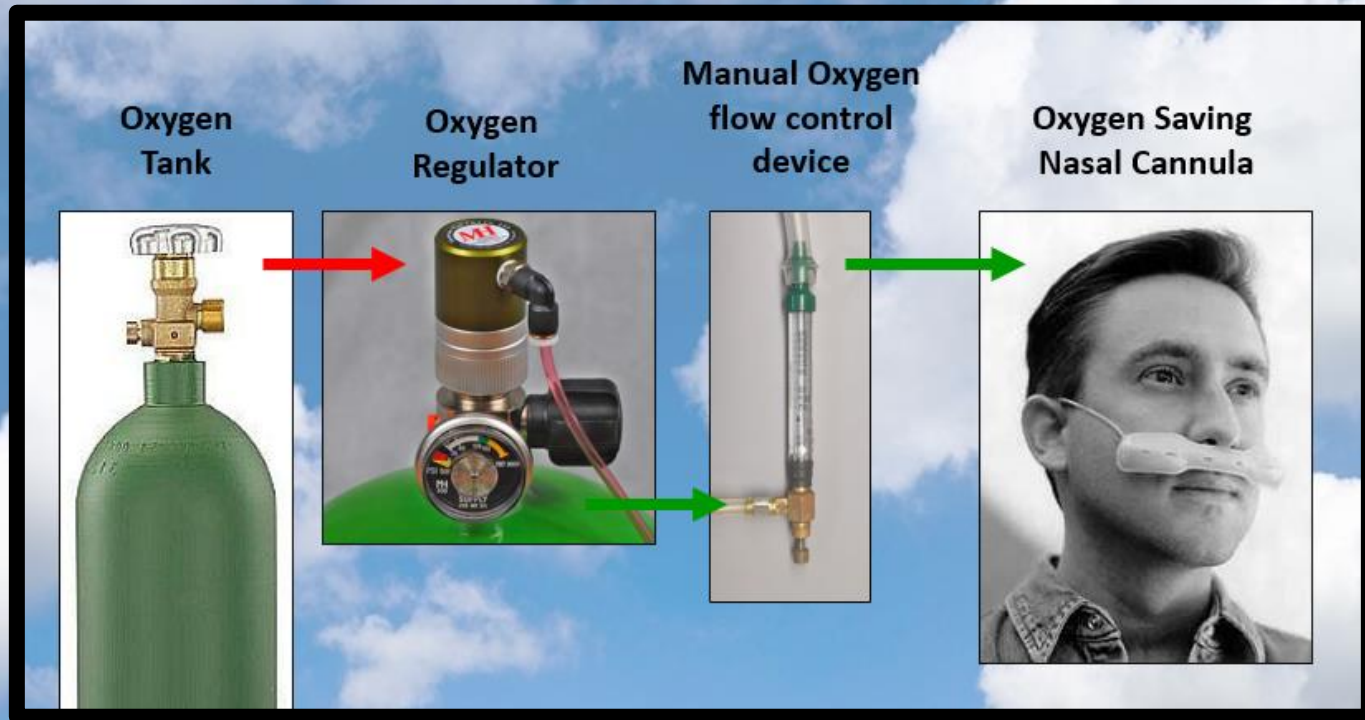
## Saves Oxygen by a Factor of x4

### 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<sub>2</sub>  
Flow Device



Standard  
Nasal Cannula

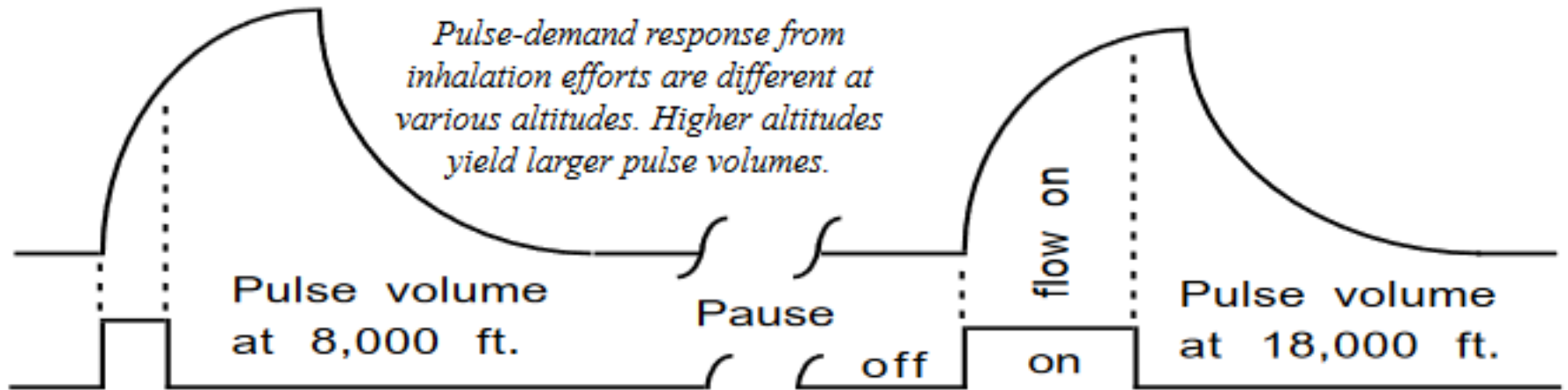


**Oxygen is only provided  
when you take a breath!**

**Automatically  
adjusts for altitude!**

**~95% O<sub>2</sub> Conservation!**

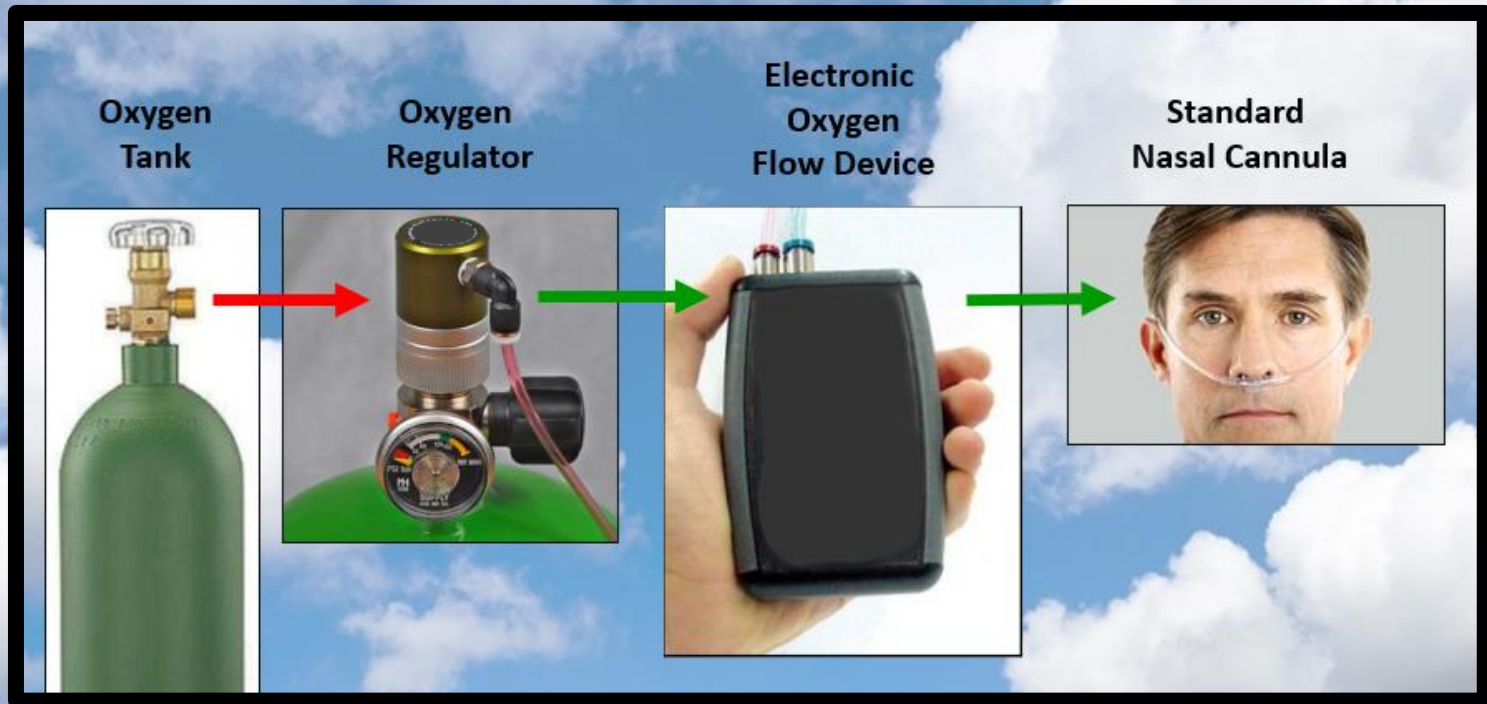
# Altitude Pulse Demand O<sub>2</sub> Flow Control (Electronic Type)



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

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

# Oxygen Delivery System – Pulse Control



## Pros

- Saves the Maximum O<sub>2</sub> (~95%)
- Automatic Altitude Adjustment
- Alarms given for issues
- Uses Standard Cannulas

## Cons

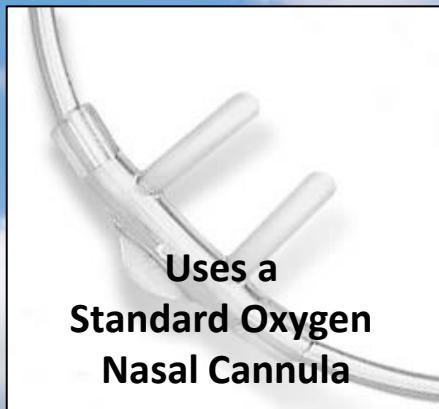
- Expensive
- Complex System
- Power Source Required



# Altitude Pulse Demand O<sub>2</sub> Flow Control

## Mountain High System

<https://www.mhoxxygen.com>



Uses a  
Standard Oxygen  
Nasal Cannula



# Altitude Pulse Demand O<sub>2</sub> Flow Control

## Mountain High System

Single Place  
EDS Model O<sub>2</sub>D<sub>1</sub>

Two Place  
EDS Model O<sub>2</sub>D<sub>2</sub>

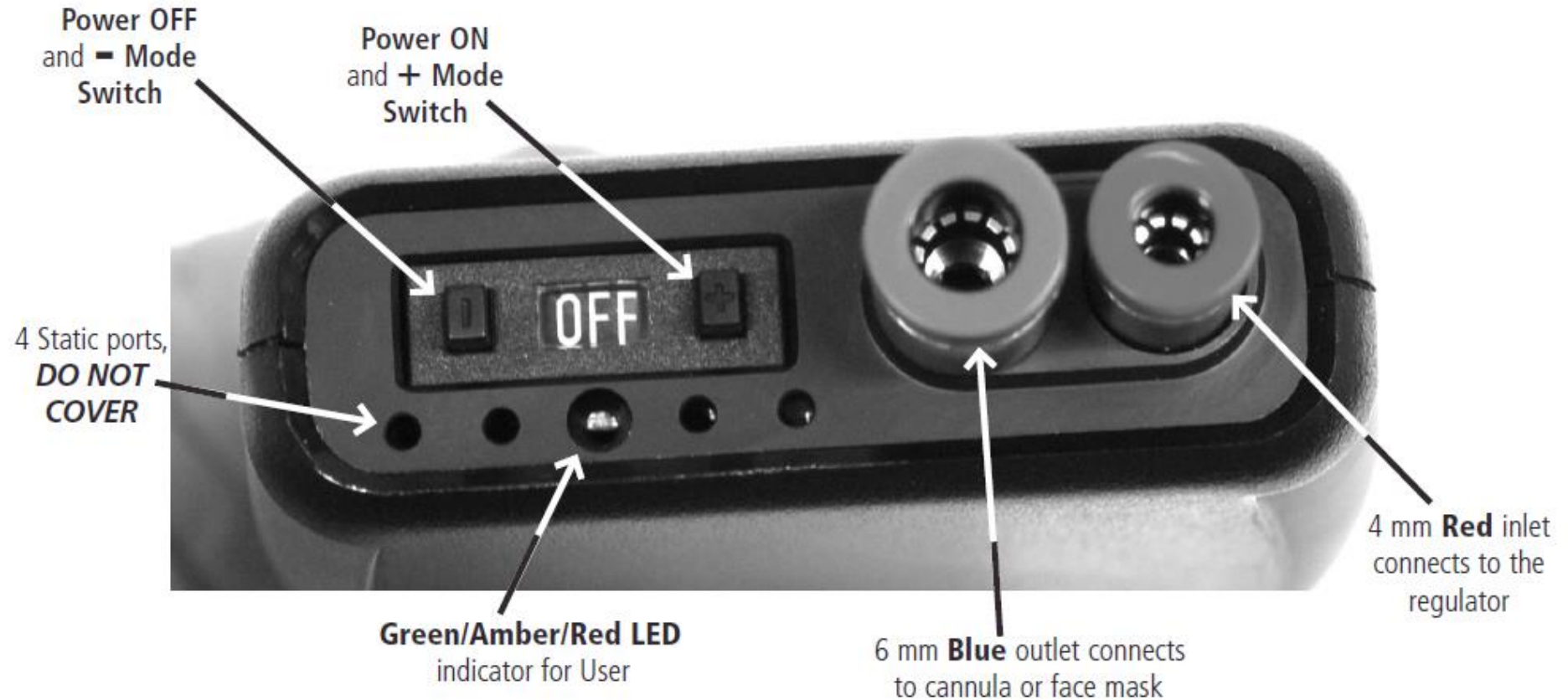


Second Generation



# Altitude Pulse Demand O<sub>2</sub> Flow Control

## Mountain High - 1st Generation

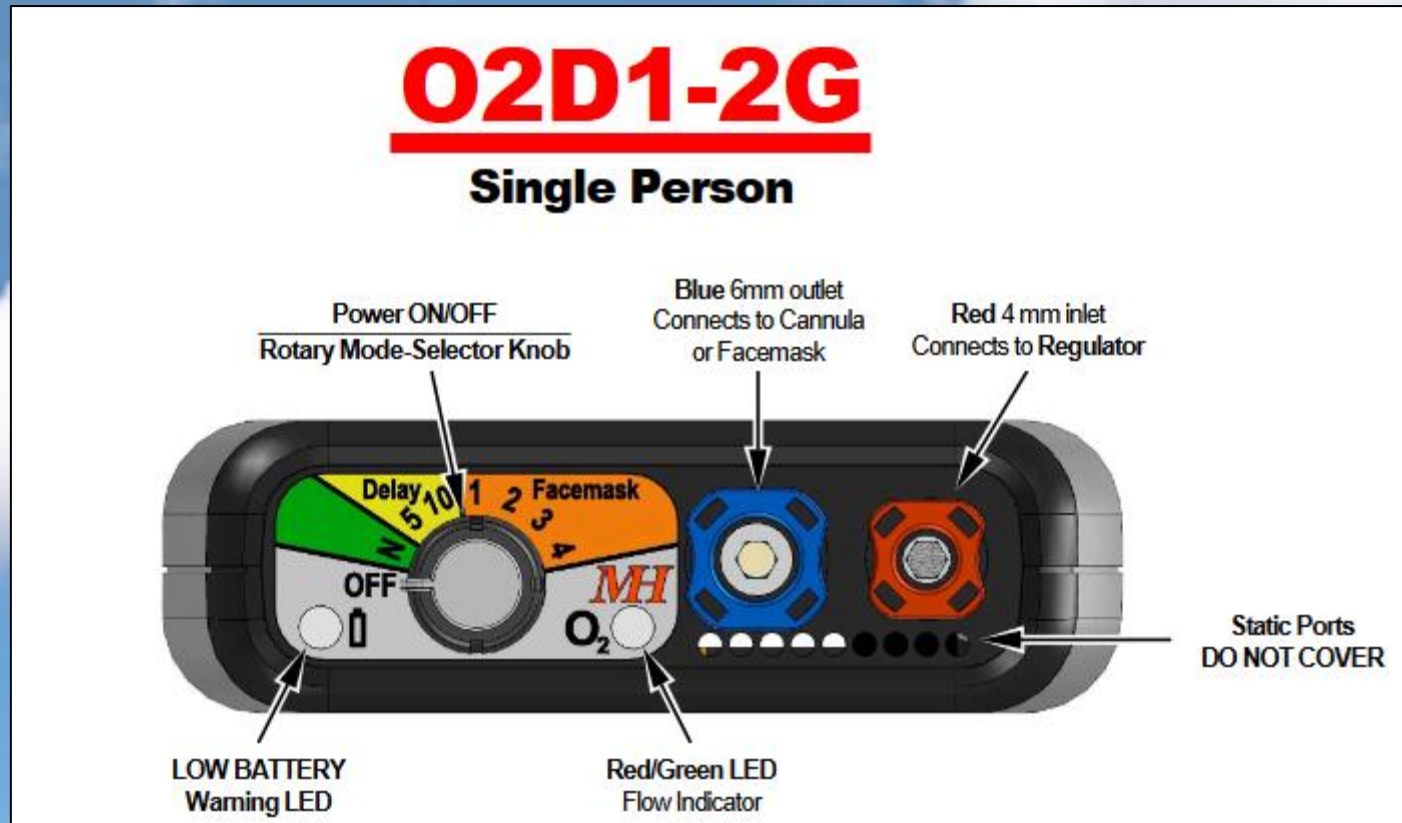


**Audible Alarms: Flow-Fault, Apnea & Tachypnea Sensing**



# Altitude Pulse Demand O<sub>2</sub> Flow Control

## Mountain High – 2nd Generation



**Audible Alarms: Flow-Fault, Apnea & Tachypnea Sensing**

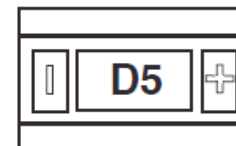
I start oxygen as soon as I am in the glider to help my "flat lander" acclima-tion.

# Altitude Pulse Demand O<sub>2</sub> 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.

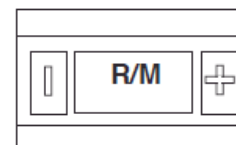


**Flow start:** All altitudes **Use with:** Cannula or face mask  
**Flow amount:** **Altitude Compensating?:** Yes  
Enriched: F5 =Standard+5,000 ft  
F10=Standard+10,000 ft  
F15=Standard+15,000 ft.  
F20=Standard+20,000 ft.

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	Pressure	Capacity				10,000 FL			15,000 FL			20,000 FL			25,000 FL			
Number	PSI	Cu. Ft. /Liters	Diameter	Length	Weight	*MH4	*MH3	*EDS	*MH4	*MH3	*EDS	*MH4	*MH3	*EDS	*MH4	*EDS	*MH4	*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.

calculated with cannula and N, D5, D10 mode.

calculated 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

Source: [https://www.mhoxxygen.com/2016/wp-content/uploads/Cyl-Dimensions-Chart-6\\_17-md.pdf.pdf](https://www.mhoxxygen.com/2016/wp-content/uploads/Cyl-Dimensions-Chart-6_17-md.pdf.pdf)

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



Toll Free: 800-468-8185  
 Telephone: 541-548-7500  
 Fax: 541-923-4141  
 sales@mhoxxygen.com  
 www.MHoxxygen.com

Redmond OR 97756-7537



# Altitude Pulse Demand O<sub>2</sub> 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<sub>2</sub> 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

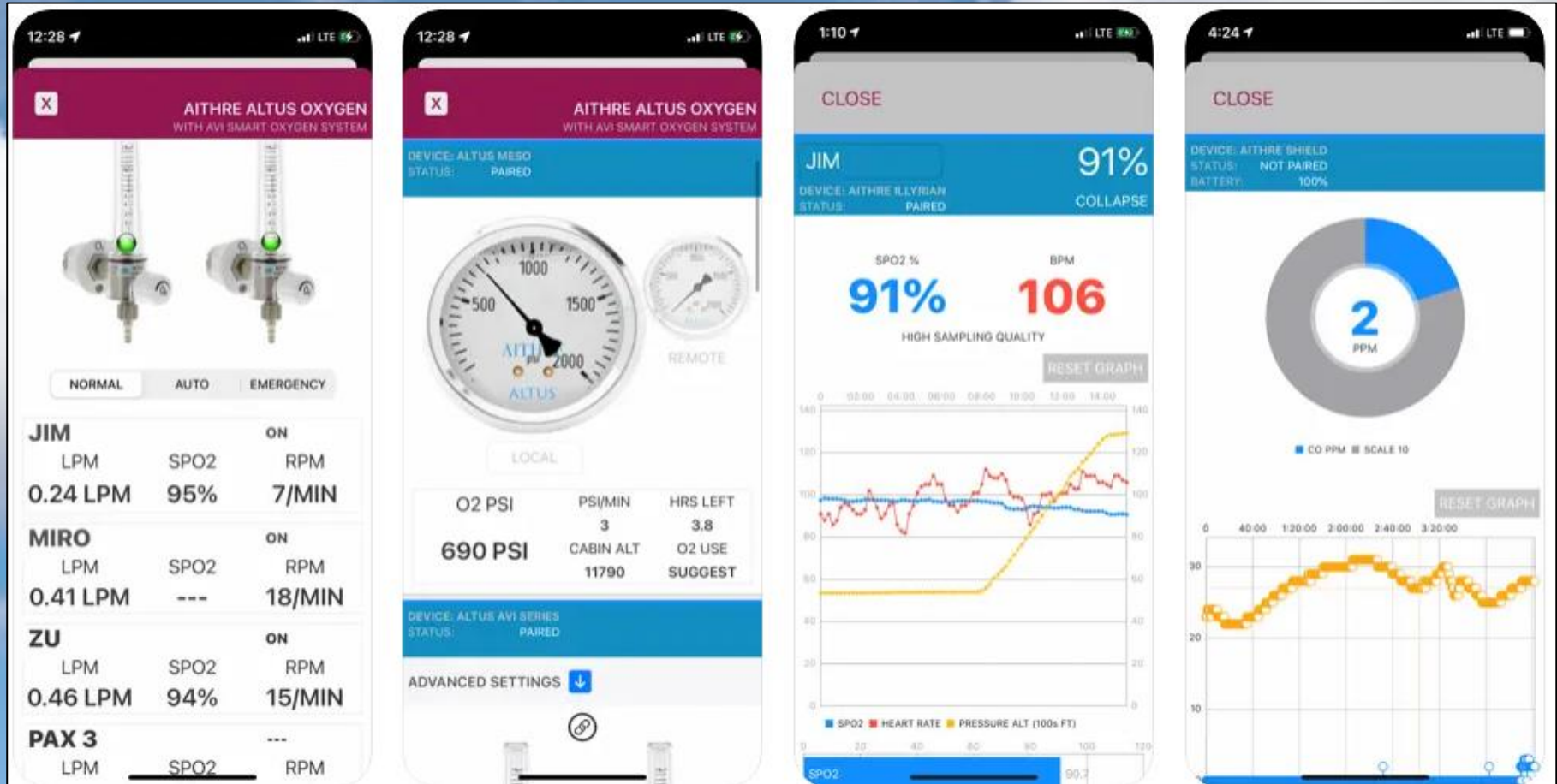
Push-button and cannula placards make your panel sharp.





# Altitude Pulse Demand O<sub>2</sub> Flow Control

## Aithre AVI - iPhone Application





# Altitude Pulse Demand O<sub>2</sub> Flow Control

## Aithre Instrument Panel Equipment



# Altitude Pulse Demand O<sub>2</sub> Flow Control



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

- **Cost\*:** \$1093 (single place)
- **Pros**
  - Alarms
  - iPhone App Integration
  - Bluetooth
  - Optional Equipment
    - Panel O<sub>2</sub> Switch
    - Oximeter Input
    - Cabin CO Sensor
- **Cons**
  - Less compact shape
  - Externally Powered (12Vdc)
  - Requires Aithre Regulator

\*With manufacturer's regulator & 47 liter oxygen tank

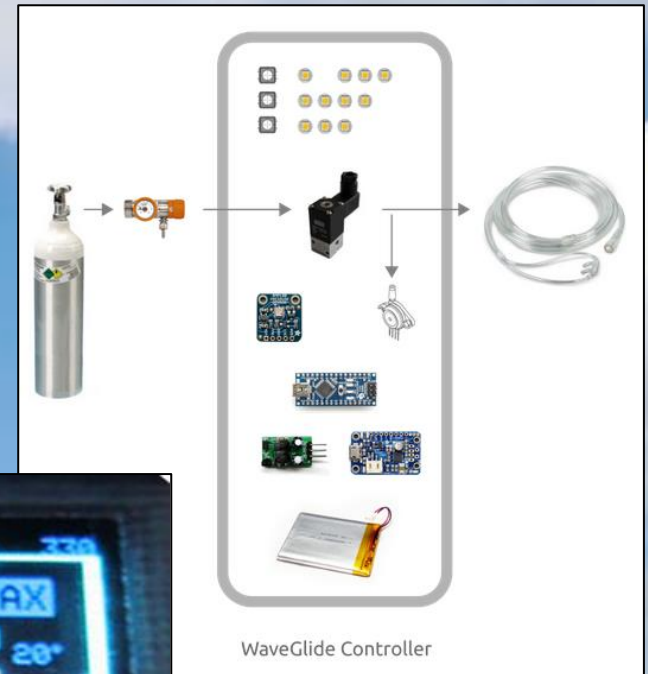
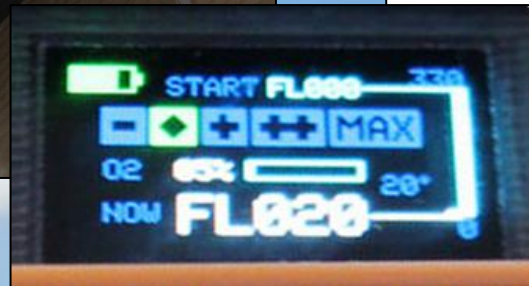


# Altitude Pulse Demand O<sub>2</sub> Flow Control

**Build Your Own Pulse System?????**

<http://nortd.github.io/WaveGlide>

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





# Oxygen Equipment Resources

- **New Equipment**

- <http://mhxygen.com>
- <http://aithreaviation.com>
- <http://craggyaero.com>
- <https://cumulus-soaring.com>
- <http://wingsandwheels.com>
- <http://aircraftspruce.com>

- **Used**

- <https://www.mhxygen.com/closeout-refurbished/>
- <http://glidersource.com>

- **Repair and Testing**

- <https://www.mhxygen.com/technical-services/>
- <http://aithreaviation.com>

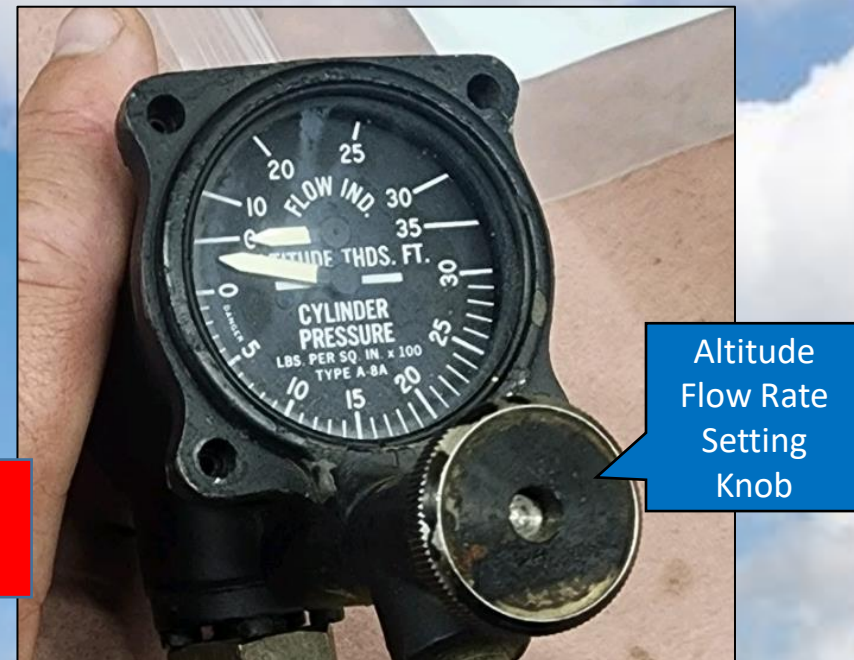
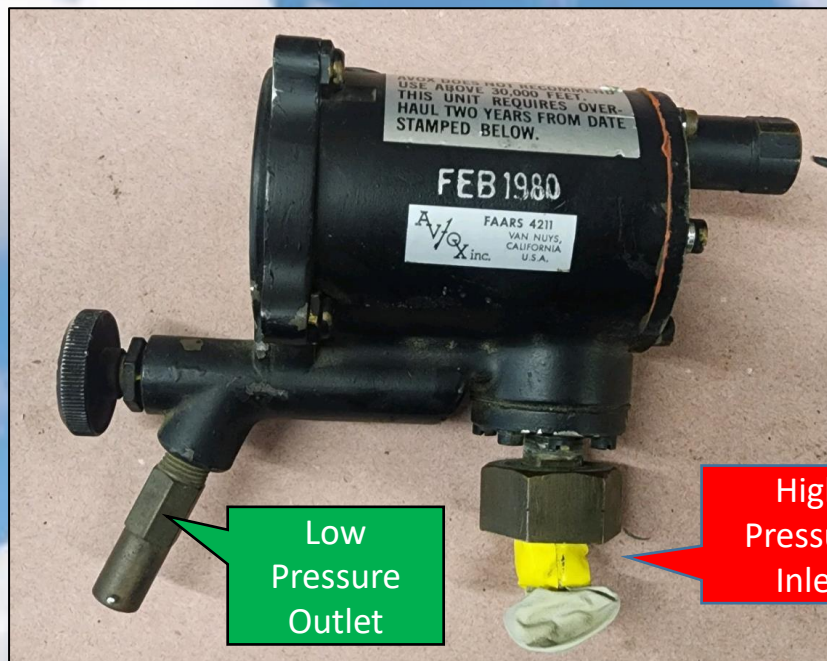
# Additional Oxygen System Information

# CRITICAL Equipment - Oxygen Regulators

## A 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 for the aircraft's current altitude set by the large black knob.



\* The “Feb 1980” date is the last time the unit was tested.



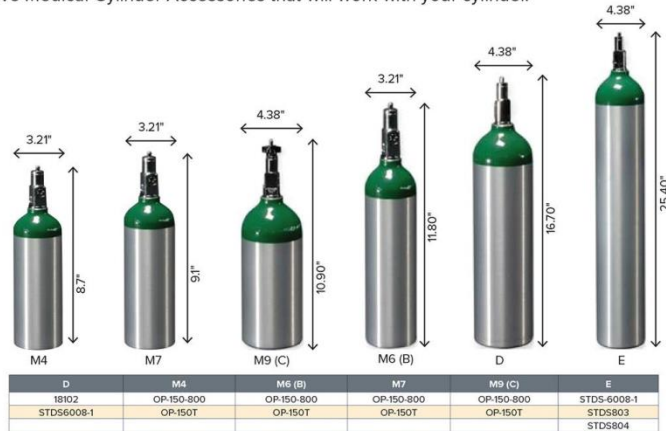
# Oxygen Tanks & Valves

# Oxygen Tanks – Many Different Sizes

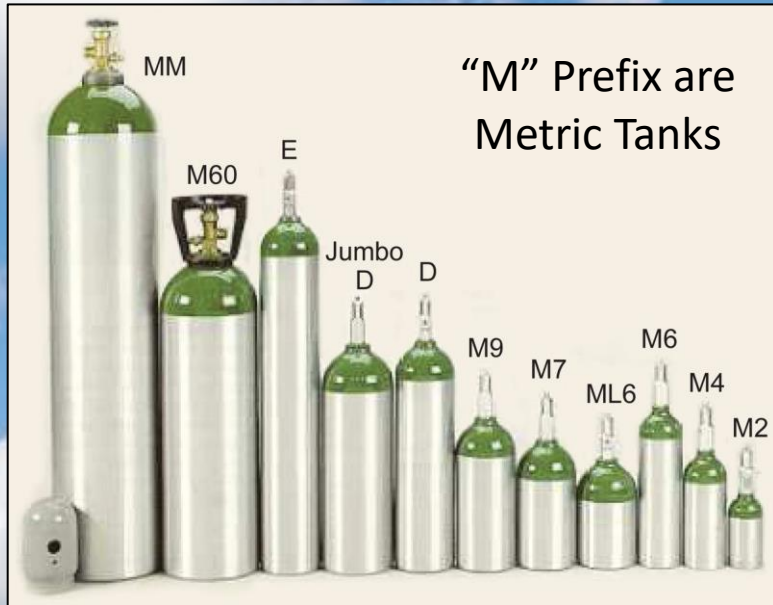
## CYLINDER SIZING GUIDE

www.drivemedical.com

The guide below can be used to determine the size of the cylinder you have and the Drive Medical Cylinder Accessories that will work with your cylinder.



MODEL NUMBERS FOR CORRELATING DRIVE MEDICAL CYLINDERS



# Oxygen Tanks – Construction Types

## Steel

Lifespan Unlimited\*  
Test every 5 years\*



## Aluminum

Lifespan Unlimited\*  
Test every 5 years\*



## Carbon Fiber

Lifespan 15 years\*  
Test every 5 years\*



\* Per AeroOx Web Site

**Get Yours Tested Before Next Flying Season!**



# US Steel Oxygen Tank Markings



## DOT (ICC\*) Specification “3AA2015”

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

### More Details

- ❖ [https://www.mhoxygen.com/2016/wp-content/uploads/Oxygen\\_Cylinder\\_Markings.pdf](https://www.mhoxygen.com/2016/wp-content/uploads/Oxygen_Cylinder_Markings.pdf)
- ❖ [http://www.esabna.com/euweb/oxy\\_handbook/589oxy3\\_10.htm](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 Testing Date(s)

← Examples Shown at left

7 57 = July 1957

3 84 = March 1984

12 94 = Dec 1994

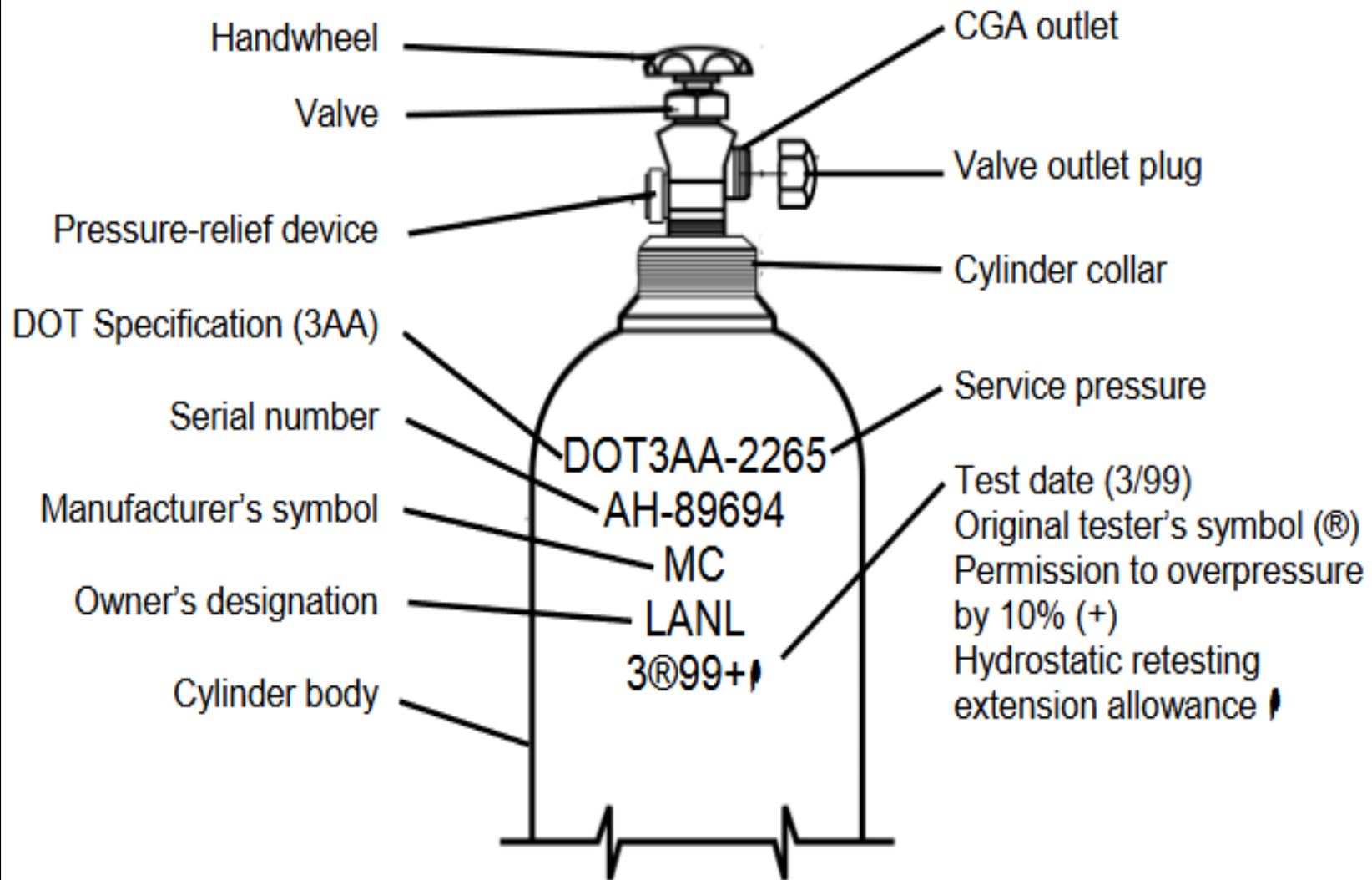
10 00 = Oct 2000

The “+” symbol following the year indicates that the cylinder’s maximum service pressure can be 10% above 2015 PSI → 2216.5 PSI

The numbers, letters and/or symbols between the month and the date identifies the inspector who did the hydrostatic testing



# US Steel Oxygen Tank Details





# Basic Parts of an Oxygen System

**NOTE:** There are many types of Oxygen Tank valves.  
This presentation will deal primarily 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



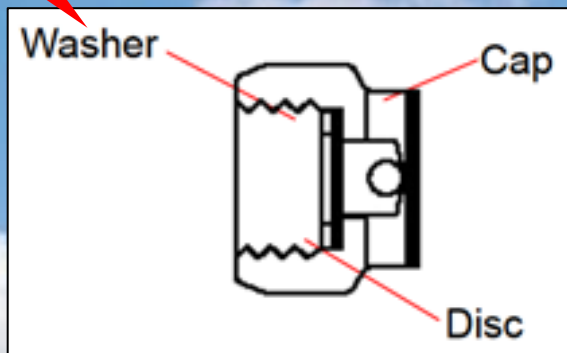
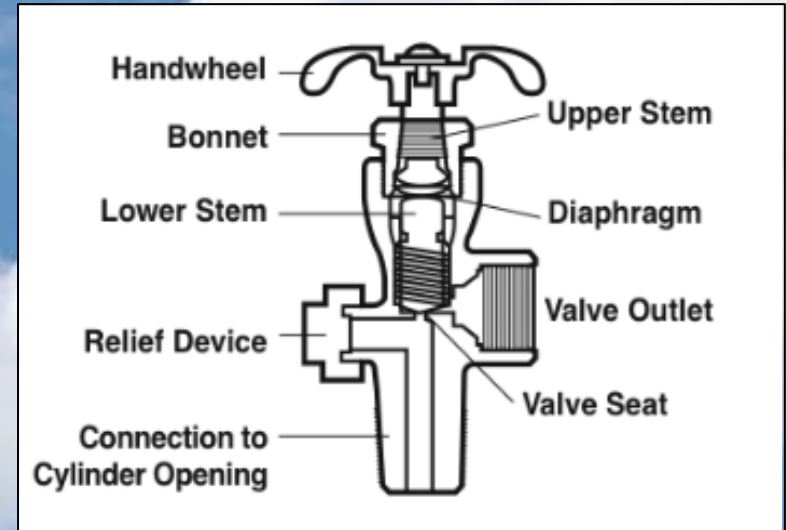
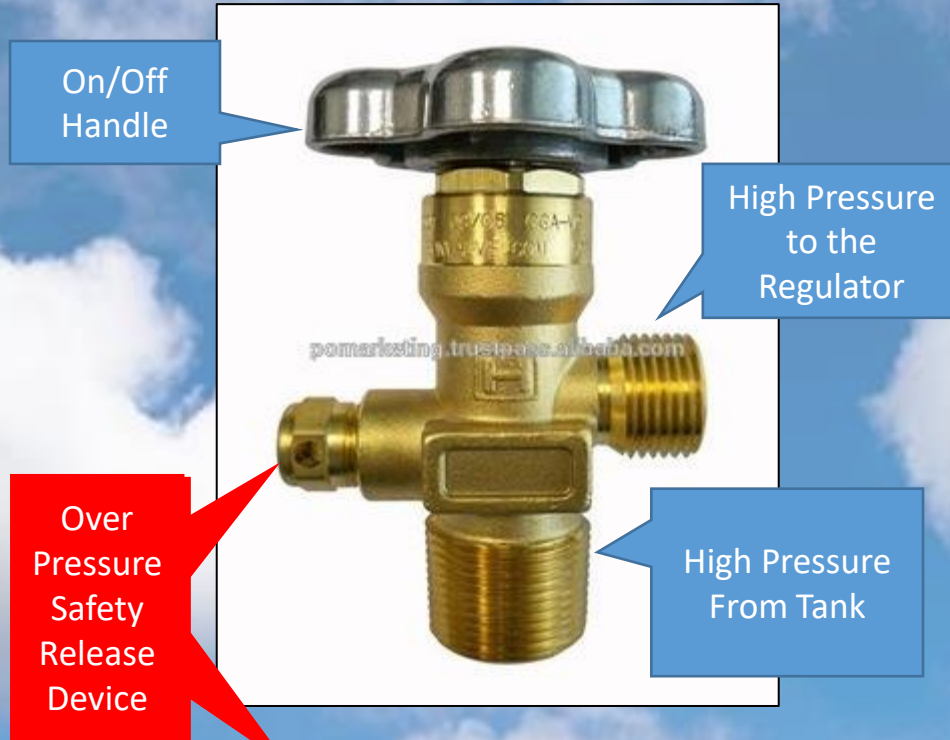
## DIN477-9

Common Metric



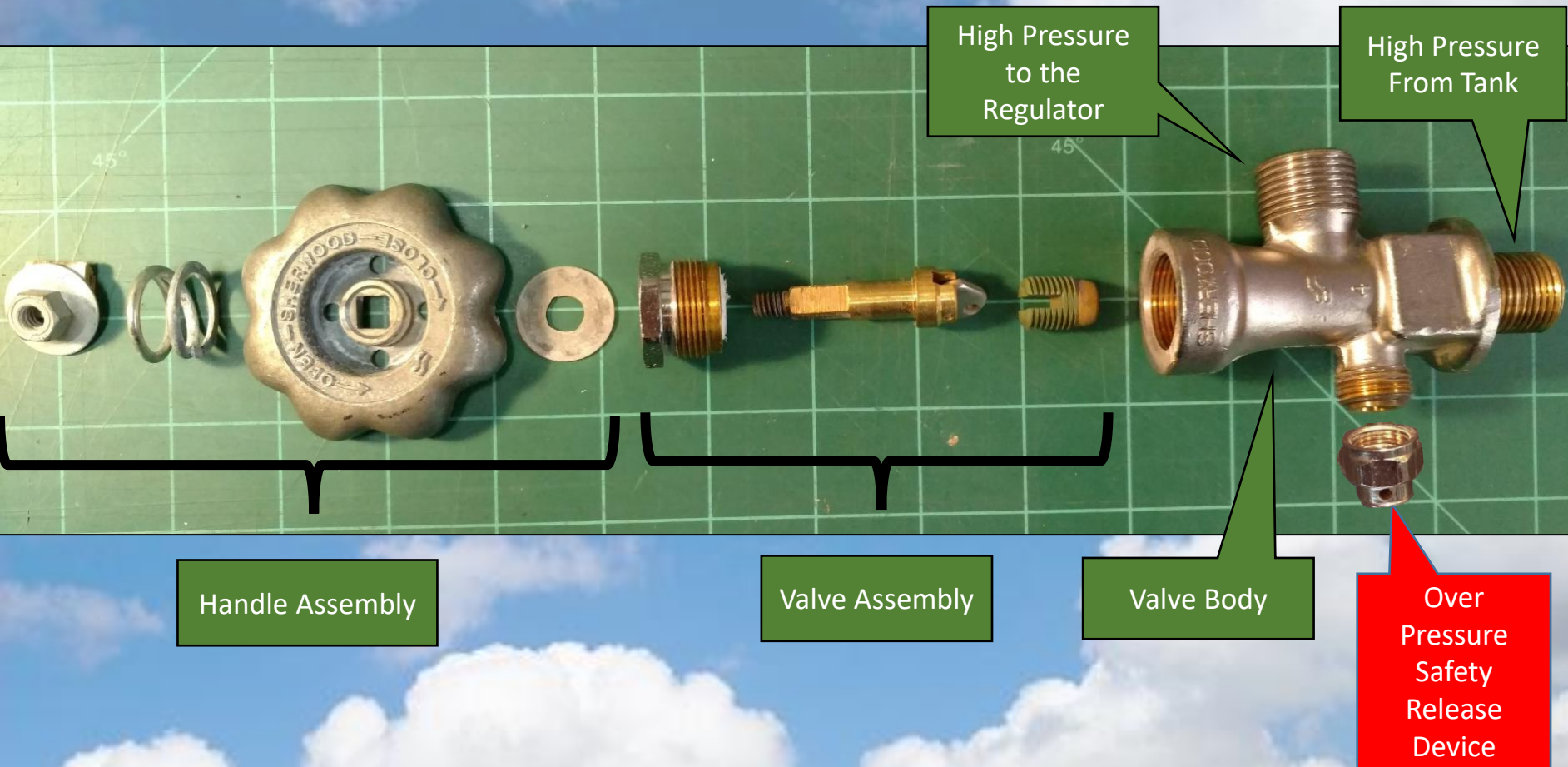
Mountain High  
can supply regulators  
and adapters  
for these metric valves

# Commonly Used CGA-540 Valve Assembly





# Commonly Used CGA-540 Valve - Disassembled

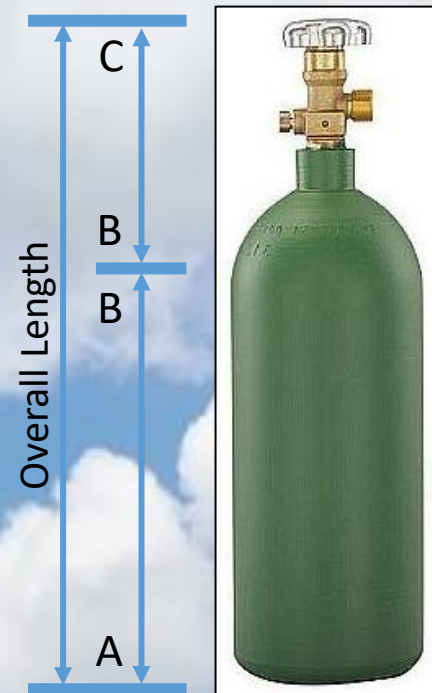


# Oxygen Tanks – Searching for the Right Size

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.

Try these steps and ideas to locate a tank.

- ❑ The easiest way to determine the correct size bottle is by locating an owner of your same model of glider and ask them to measure their tank using the ideas shown below. If not, then use the following steps;
- ❑ Determining the overall length of the bottle you will need.
  - Measure the depth of your glider's oxygen tank sleeve. This represents the part of the bottle from A to B shown at right.
  - Then add something for the distance from B to C (~8" with a CGA-540 valve) to estimate the overall length of A to C.
- ❑ Determining the thickest diameter of the bottle that will fit.
  - Generally, this is by measuring the I.D. of your O<sub>2</sub> tank sleeve. Note: that many non-US glider sleeves are made to fit 100mm (~4") metric O<sub>2</sub> bottles.
  - The easy way to directly measure a bottle is by using a tailor's cloth tape (not a common metal tape measure) or wrapping a piece of paper around the bottle (mark and then measure).
- ❑ Armed with the length and diameter 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 same steps as shown above.

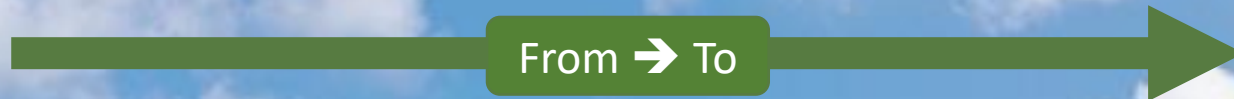
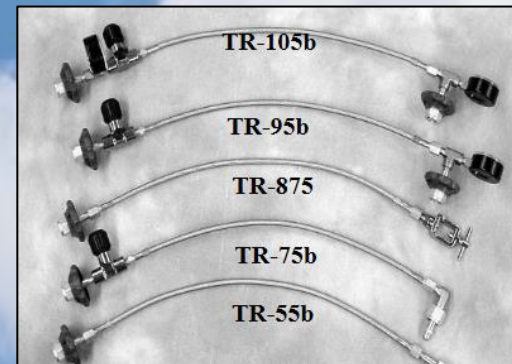


# Refilling Oxygen Bottles at a Gliderport



# Typical Refilling (Trans-Filling) at a Gliderport

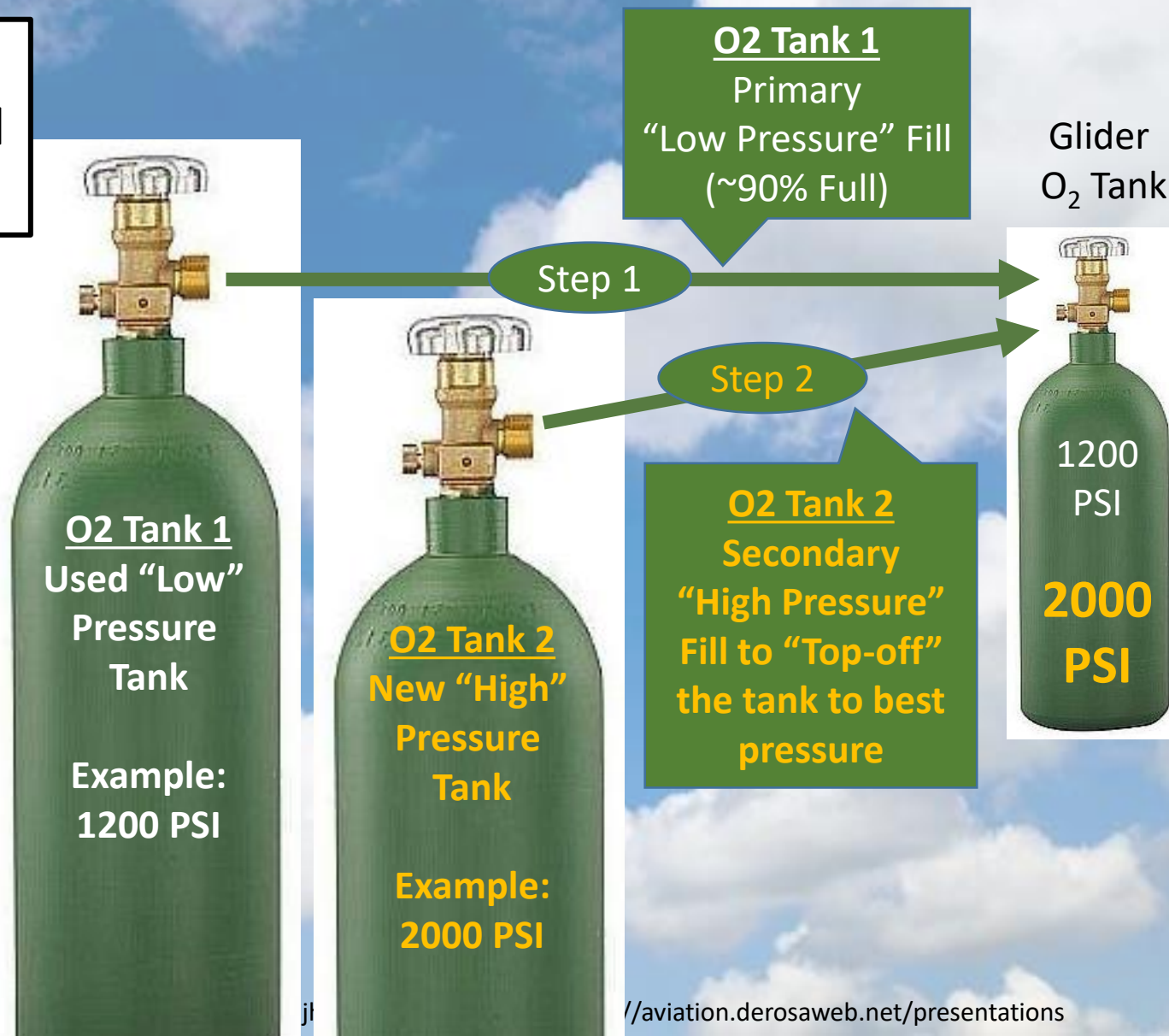
## Trans-Filling Oxygen Bottles, Carts, Hoses, Valves and Adapters



Courtesy of [http://www.craggyaero.com/mh\\_transfillers.htm](http://www.craggyaero.com/mh_transfillers.htm)

# Typical Refilling (Trans-Filling) at a Gliderport

Two Large  
Commercial  
O<sub>2</sub> Tanks

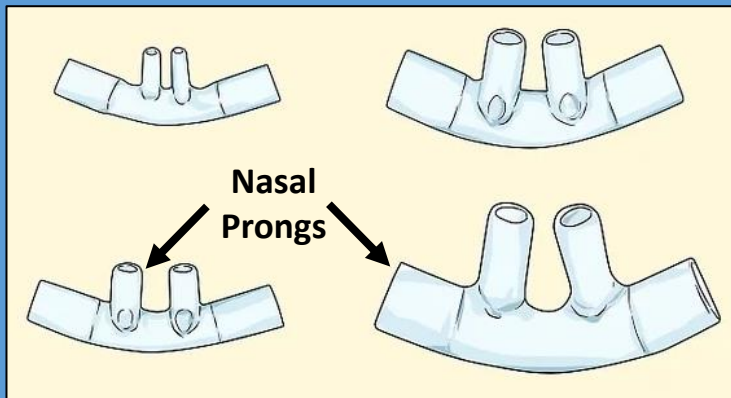


# Proper Use of a Nasal Cannula



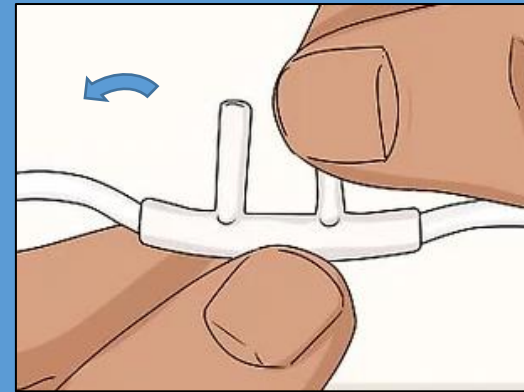
# How to Use a Nasal Cannula

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 here provides them better oxygen flow.

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

# Oximeters



# Oximeter Fingertip O<sub>2</sub> 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<sub>2</sub> Level Testing

Alarm Monitoring and Date Logging

**SORRY - OLED Type – Shade Use Only**



More Expensive ~\$150

**Get One & Use It During Flight!**

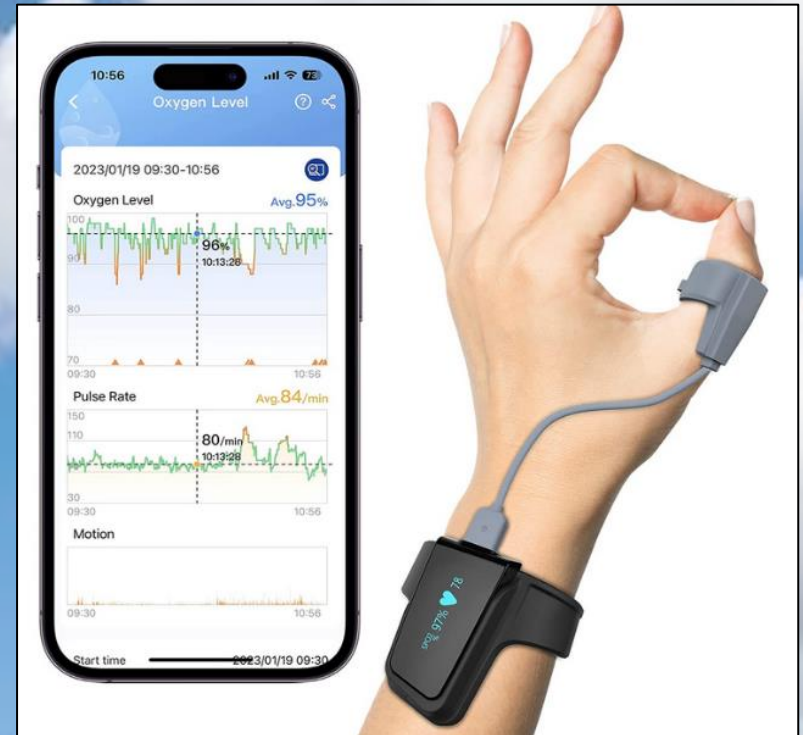
# Oximeter Fingertip O<sub>2</sub> Level Testing

Alarm Monitoring and Date Logging

**SORRY - OLED Type – Shade Use Only**



More Expensive ~\$200+



**Get One & Use It During Flight!**



# Watch Type O<sub>2</sub> 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

# High Altitude Oxygen Masks

Commonly used above 18,000ft  
Often during wave flight





# Connectors Between Regulator & Flow Monitoring Device

## Oxygen Connector Chart



Manual Altitude  
Flow Control Valves  
(on all types)

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

# The Future?

## Portable Concentrators of Free Oxygen



# 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

- **Manufacturers**
  - Mountain High – [Aviation Oxygen Products](#)
  - Aerox/SkyOx - [Aviation Oxygen Systems](#)
  - Aithre - [aithreaviation.com](http://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](mailto:jhderosa@yahoo.com)