High Altitude Operations

At 18,000 air density is ½ @ sea level.

Hypoxia – lack of oxygen

Altitude	Time of useful consciousness
45,000 feet MSL	9 to 15 seconds
40,000 feet MSL	15 to 20 seconds
35,000 feet MSL	30 to 60 seconds
30,000 feet MSL	1 to 2 minutes
28,000 feet MSL	2½ to 3 minutes
25,000 feet MSL	3 to 5 minutes
22,000 feet MSL	5 to 10 minutes
20,000 feet MSL	30 minutes or more

How do we combat hypoxia?

- Supplemental O_2
- Pressurization

Decompression sickness

Regulations

91.211a Min O_2 Requirements

Cabin pressure (unpressurized)

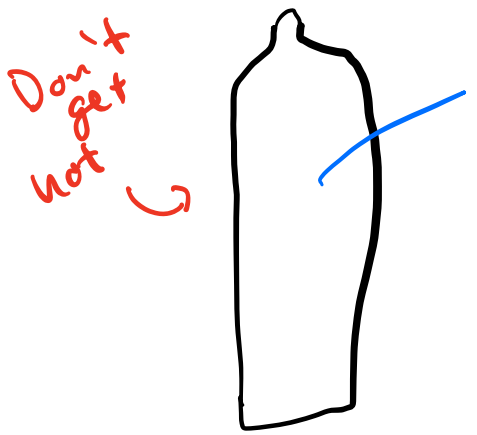
> 12,500	≤ 14,000	Min crew, Flight time > 30 min
> 14,000	≤ 15,000	Min crew, continuously
> 15,100		Min crew continuously + passengers provided

91.211b Pressurized aircraft

> FL250 10-min supply O_2 availble for all passengers.

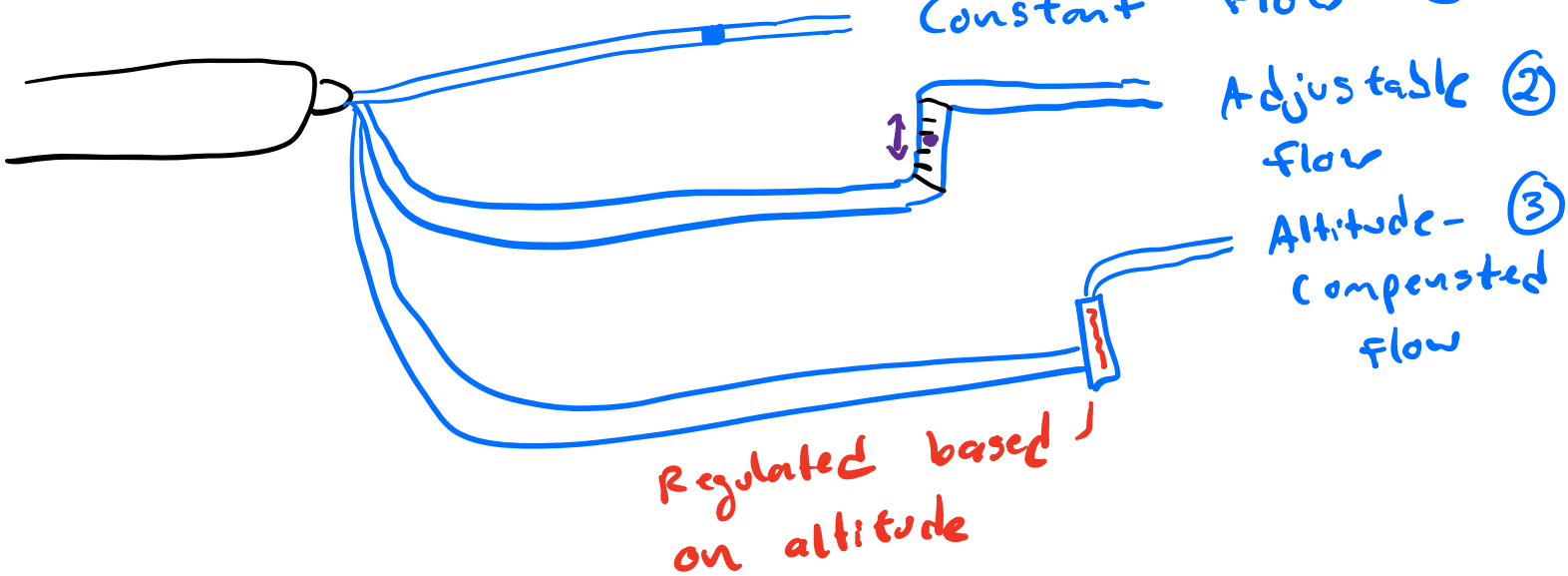
> FL350 1 pilot must wear O_2 mask, unless:
- Both pilots @ controls
- Both have quick donning masks (< 5 sec)

Supplemental Oxygen



Always use aviation Oxygen.
- No welder's or medical O_2

Continuous-Flow Style (Most common)
- Good up to 25,000'



O_2 Masks

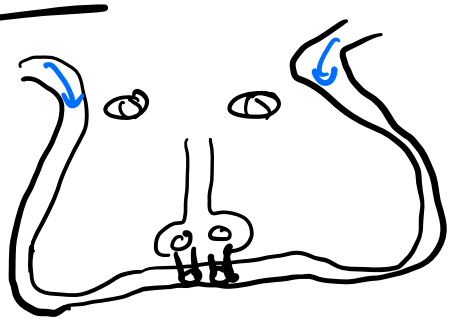
"Oronasal rebreather"

Most efficient

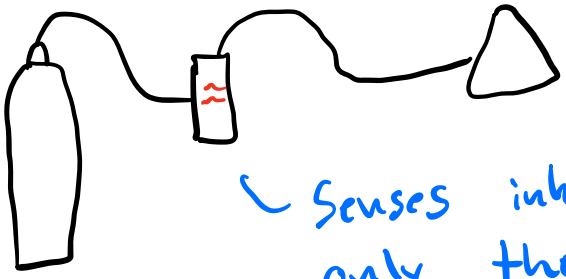
Nose/Mouth Mask

Rebreather bag (allow re-use of exhaled O_2)

Cannula



Electrical Pulse-Demand



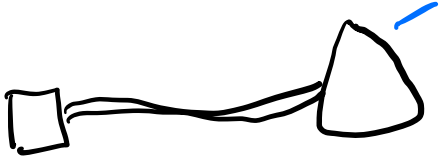
Senses inhalation and delivers O_2 only then.

Less wasted gas when exhaling

50-80% less O_2 wasted

Higher Altitude Systems

Diluter-Demand



Only supplies O_2 when inhaling

Good to 40,000'

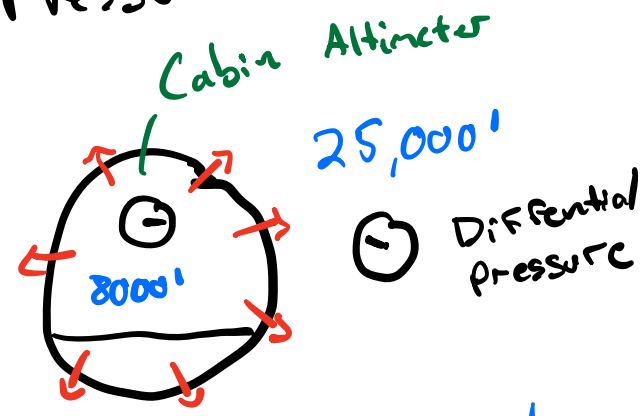
Pressure-Demand

- Sinilar to above, but pressurizes O_2 above 34,000'
- Some are certified for >40,000'

Pulse Oximeters

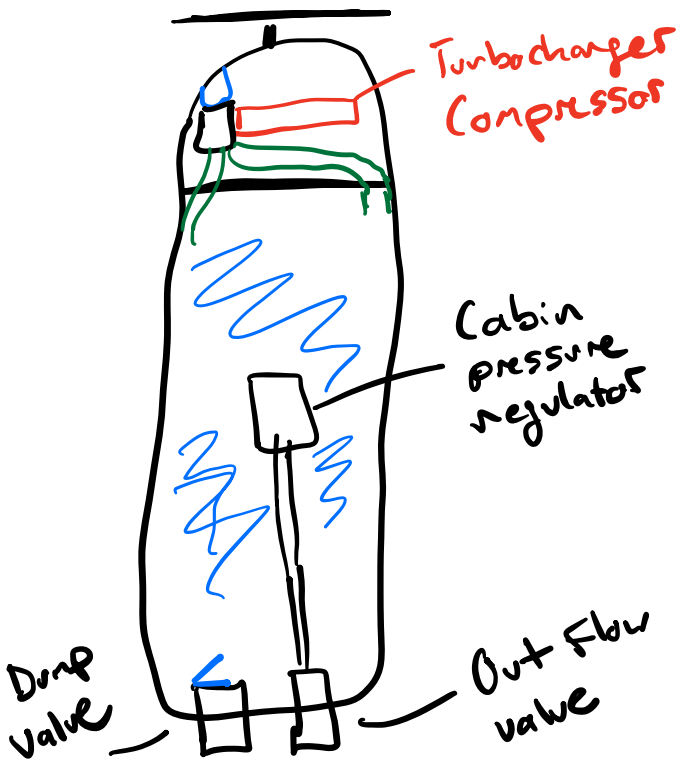
>90 is good

Pressurization



1. Airtightness, hold pressure (imperfect)
2. Compressed air delivery
3. Controller to regulate the pressure
4. Safety dump valve (smoke)

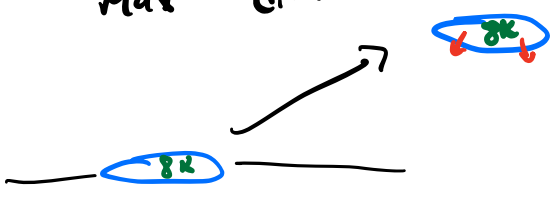
Generally pressurized 6500 - 8500' Cabin altitude



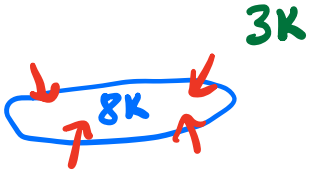
Regulator open/closes outflow valve to:

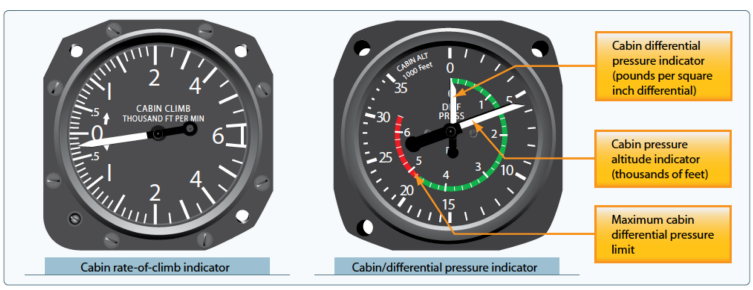
→ Maintain selected cabin pressure

→ Prevent from exceeding max differential pressure



→ Vacuum relief lets air outside in, prevent higher pressure outside





Decompression

1. Slow decompression: < 10 sec
2. Rapid decompression: Lungs decompress faster than the cabin.
3. Explosive decompression: Cabin decompresses faster than lungs can (0.2 - 0.5 sec)
   - Lung damage
   - Hypoxia, LOC
   - Decompression sickness
   - Noisy
   - Foggy
   - Debris