
Atlas Copco
WEBINAR : Oxygen Concentrator
PART 1 & Part 2

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This is Atlas Copco
Customers in 180 countries
37 000 employees in 70+ countries
Established in 1873 Stockholm, Sweden
Turnover of nearly 95 BSEK / 9 BEUR
Operating margin of 22.2%
Atlas Copco

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To Be First in Mind – First in Choice,
by Delivering Superior Customer Solutions, Globally

Customer First

We add value to the customer's operations with our superior solutions. We understand the customer KPI's, innovate for performance, produce, sell and service with a customer focused culture with highly efficient processes and excellent operations. We exceed customer expectations in all aspects of the customer journey.

Our People Grow

Our passionate people thrive in our open, collaborative work environment to bring out their best. Hired for attitude, trained to competence, incentivized to perform, motivated through leadership and aligned through a clear mission and objectives. Within a culture of innovation, teamwork, interaction, demonstrated accountability and commitment, our colleagues grow sustainably.

Trusted Globally

We will be market leaders globally, embracing our ambition to double our business in both our segments. The synergies, following our market leadership, reflect in common processes and products with local customizations that will deliver overall efficiency and customer excellence.

Innovative Performance

We have efficient and speedy innovation processes that target transformational improvements for our customers. Beyond compliance or standards, focused on performance, total cost and design for life. We develop global solutions platforms with local customizations. We extend our offer for increased customer share.

Support For Life

We accelerate our growth in service. We offer peace of mind and improved efficiency to our customers, one stop shop for related services, improve our resilience as an organization and stay close to our customers in all aspects of their operations. Therefore we are First in Mind – First in Choice for all their aftermarket needs.

Efficiency Delivered

Our processes and operations across all disciplines are tuned to exceed customer expectations, reduce cost and increase agility. We standardize for cost leadership and differentiate smartly for local needs. We embrace digitalization to improve the customer journey and improve our internal processes.

Home of Industrial Ideas

Atlas Copco

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Atlas Copco Group

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Take-Aways

Part 1
Required Quality of medical Oxygen
How to produce Oxygen on-site
What Compliance needs to **International** standard or **Local** Standard

Part 2
Product Overview of OxyPlant
Feature and Benefit to produce Oxygen on-site

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Generators vs Concentrators

These are Oxygen Generators

We are focusing on

OXYGEN CONCENTRATION

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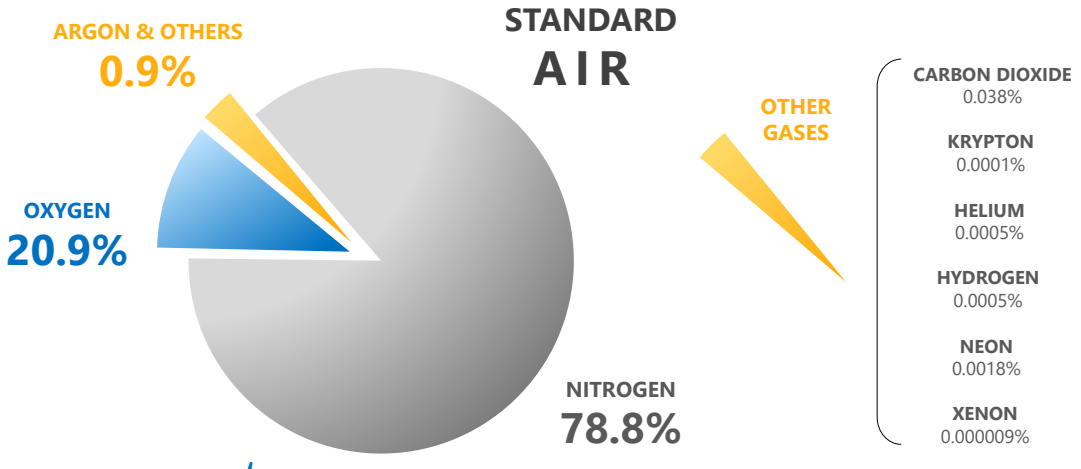
Where Does Oxygen Come From?



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Quality needs for Medical ?

Permenkes No 4 Tahun 2016 Bab I ; Pasal 1 – Point 4

We also had,

KEMENKES RI AKL 20403914521 ; expired by 31 Dec 2023

Concentrators and Standards

The pharmacopeias define the purity of the gas.

	Oxygen	Oxygen 93
Assay (O_2)	≥99%	90-96%
Balance	na	argon (≈5%) and nitrogen
	Store in cylinders or pressurized storage tanks.	Produced by molecular sieve process. Store in cylinders or low pressure tanks.
Odor	none	none
CO_2	0.03%	0.03%
CO	0.001%	0.001%

USP Is used for comparison here

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Oxygen OFF-site

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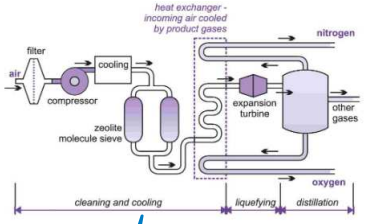
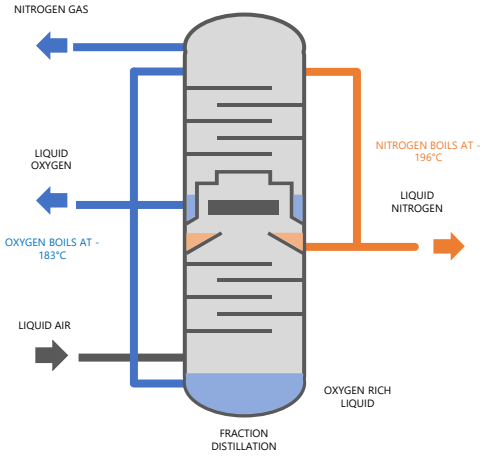
Concentrating Oxygen By Liquefication





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Getting Oxygen to Hospitals

Liquid, in Containers

Gas, in Cylinders

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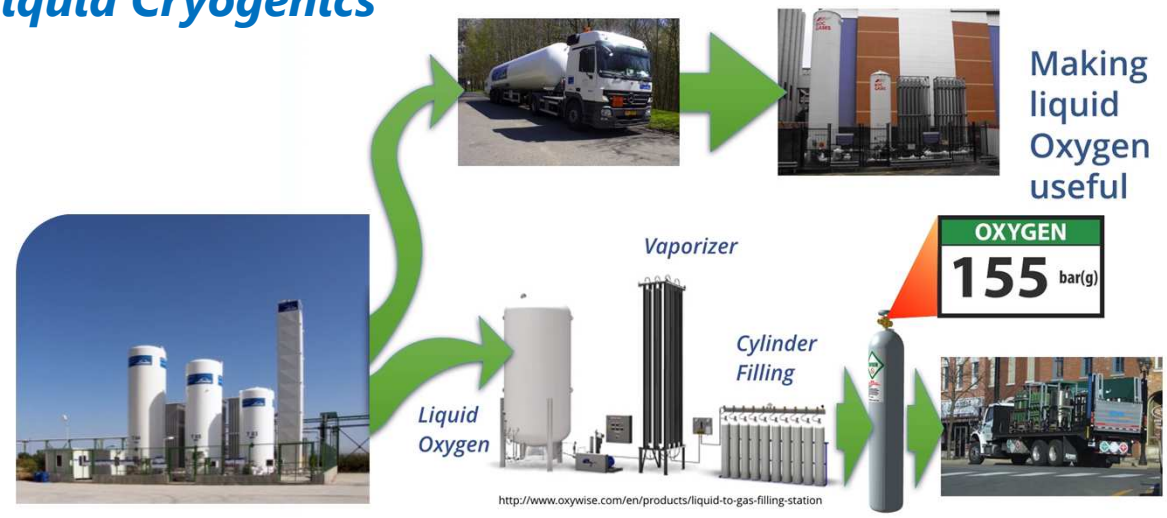
Liquid Cryogenics



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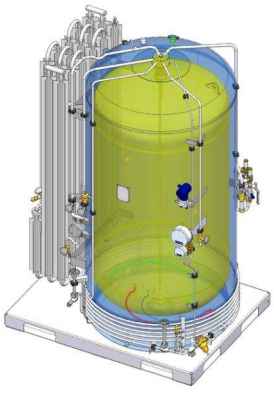
Liquid Cryogenics



Source: https://airliquide-expertisecenter.com/cryogenic-gases/

Normal Evaporative Rate

The degree of product loss from a cryogenic liquid container due to heat leak into the container as designed. The NER is checked by measuring the amount of product loss over a specified time and serves to confirm whether the insulation is still good or not

Source: http://hiq.linde-gas.com/en/glossary/n/normal_evaporation_rate/index.html

Use it or Lose it!

Cryogenic liquid Oxygen boils at **-183 °C**

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Medical Gas Main Rule

Always Supply the patient !!

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Oxygen Off-Site / Liquid or Cylinder

The tyranny of **DISTANCE**

Transport is the greatest challenge in Oxygen supply

- Liquid – losses increase over long distances
- Liquids and Cylinders – they are both heavy and difficult to transport
- Cylinders – they are at very high pressure and must be handled with care

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Oxygen Off-Site / Liquid or Cylinder

The burdens of **HANDLING**

Cylinders do not contain very much gas

- It is not realistic to supply a larger facility using them (too much handling)
- Cylinders cost money to rent (a hidden cost)
- The hospital must pay for them if they are lost or stolen

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Oxygen ON-site

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Pharmacopeia Medicinal Drug

93 OXYGEN

O2-93 can be obtained onsite from ambient air by means of pressure swing adsorption through molecular sieves in oxygen concentrators

Produced onsite into their pipeline system, rather than oxygen obtained from gas manufacturers

Component	Standard		
	EurPh Oxygen 93	USP Oxygen 93	Laboratory Assay from a BeaconMedæs PSA Module[1]
Oxygen v/v%	93 ±3%	> 90% < 96%	90 - 95%
Carbon Monoxide	5 ppm	5 ppm	0.11 ppm
Carbon Dioxide	300 ppm	300 ppm	0.82 ppm
Water	67 ppm	-	3.8 ppm

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Oxygen On-Site

Indications for Oxygen **ON-SITE**

Risk Assessment

- Transport requires good infrastructure – it can be interrupted by many events
- The supplier must be operating. Along with other problems, strikes, labor unrest etc. can interrupt supply
- Road accidents, ship sinking; all can prevent supply
- Where there is a strong risk of supply interruption – seismic, tsunami, volcanic activity, severe weather, unstable areas (unrest)
- Where Oxygen is not available – remote islands, undeveloped areas
- Land or space – challenging to put VIE storage tanks
- Where the price of Oxygen is expensive
- Emergency preparedness

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Oxygen On-Site

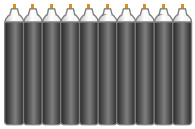
Supply Sources from **OXYGEN CONCENTRATORS**

HTM02-01 or NFPA99

- Remember: 2 or more Supply Sources = Central Supply System
- Cascade system – Always Supply the Patient!

Oxygen Supply Source A

Oxygen Supply Source B



Oxygen Reserve Supply (Manifold System)

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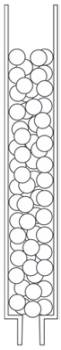
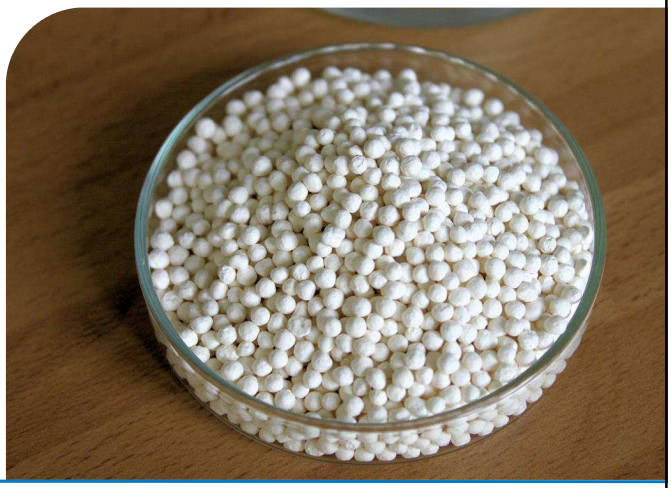
Science of Oxygen Concentration

Basic Science of **ZEOLITES**

- Separation by relative affinity – the same technique used in liquid or gas chromatography
- Materials selected are very porous structure, naturally entraps gas molecules
- Usually made of carbon or aluminum oxide
- Formed into a shape for maximum to the gas mixture (bead or hollow cylinder)





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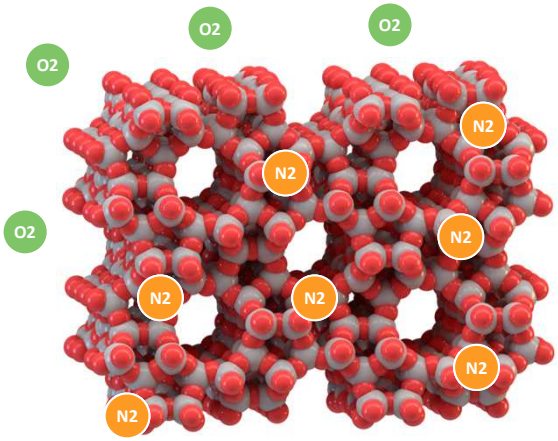
Science of Oxygen Concentration

Basic Science of **ZEOLITES**

- In concentrators, we use a molecular sieve material like Zeolite, which has a microporous structure to capture small molecules
- Holds Nitrogen back and lets Oxygen through (includes minute molecules of Argon)



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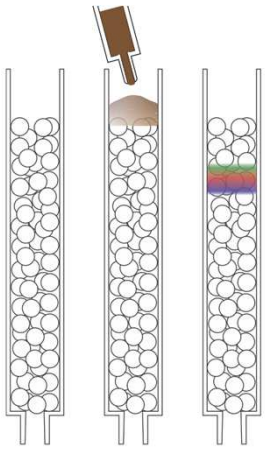
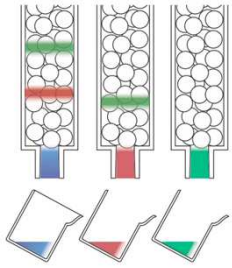
Science of Oxygen Concentration



- As the mixture flows through the column, some elements move faster, others slower based on how 'sticky' the column is for that element
- Depending on our **TIMING**, as each element reaches the outlet, it can be separately drawn off



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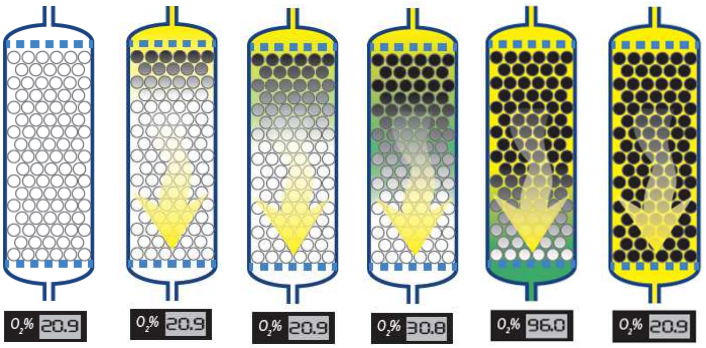
Science of Oxygen Concentration



This is a moving process, once you stop, all the molecules are going to mix again and you cannot get the Oxygen

1. Pressure vessel packed with zeolite
2. We start flowing air through the vessel. The zeolite retains the nitrogen preferentially
3. As nitrogen is retained, the air becomes "Oxygen enriched"
4. More nitrogen is retained, the Oxygen concentration rises
5. "Oxygen enriched air" with high Oxygen concentration elutes from the column
6. The zeolite has retained all the nitrogen it can hold. The Oxygen concentration at the outlet falls back to 20.9%

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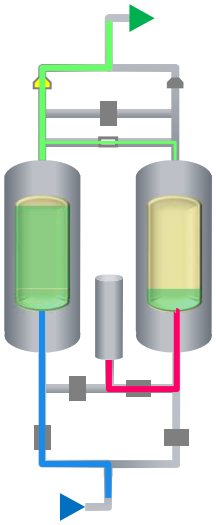
Science of Oxygen Concentration

Basic Science of **CONTINUOUS FLOW**

- Two sieve beds and control valves
- Programmed timing for each cycle with the correct pre-requisite parameters



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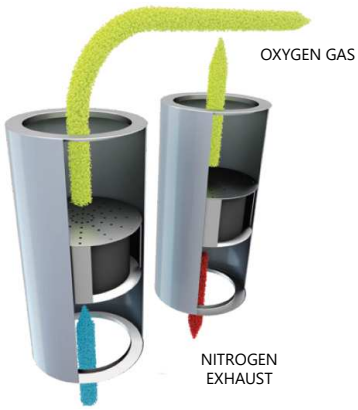
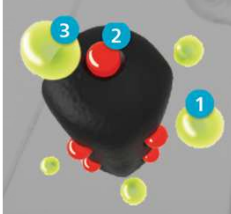
Pressure Swing Adsorption



PSA

PSA technology to isolate Oxygen molecules from other molecules in compressed air. Nitrogen and other gases are adsorbed. The result is virtually 93 to 95 percent Oxygen at the outlet of the concentrator.



1. ADSORBENT (ZEOLITE)
2. NITROGEN & OTHER GAS MOLECULES
3. OXYGEN MOLECULES

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On-Site Oxygen Concentrator

OGP-MED

OXYGEN CONCENTRATOR

Medical oxygen is an irreplaceable component for many basic medical procedures and treatments, and an invaluable supplement to many other treatments. It is one of the drugs medical facilities cannot be without

O2-93

COMPLIANT WITH OXYGEN STANDARDS

The OGP MED Generators can produce oxygen compliant with the United States Pharmacopeia (USP) monograph for Oxygen 93 or the European Pharmacopeia (EurPh) monograph for Oxygen 93

PSA

PRESSURE SWING ADSORPTION

Removes other gases to achieve Oxygen purity up to 95%

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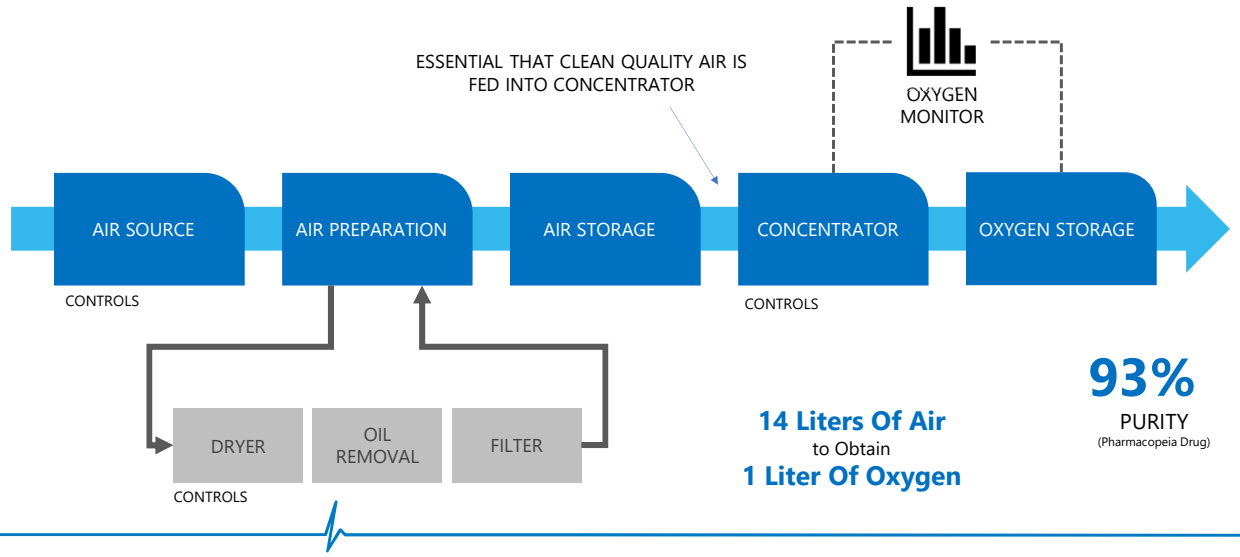
Constructing A Concentrator Supply Source



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What does it look like in real life

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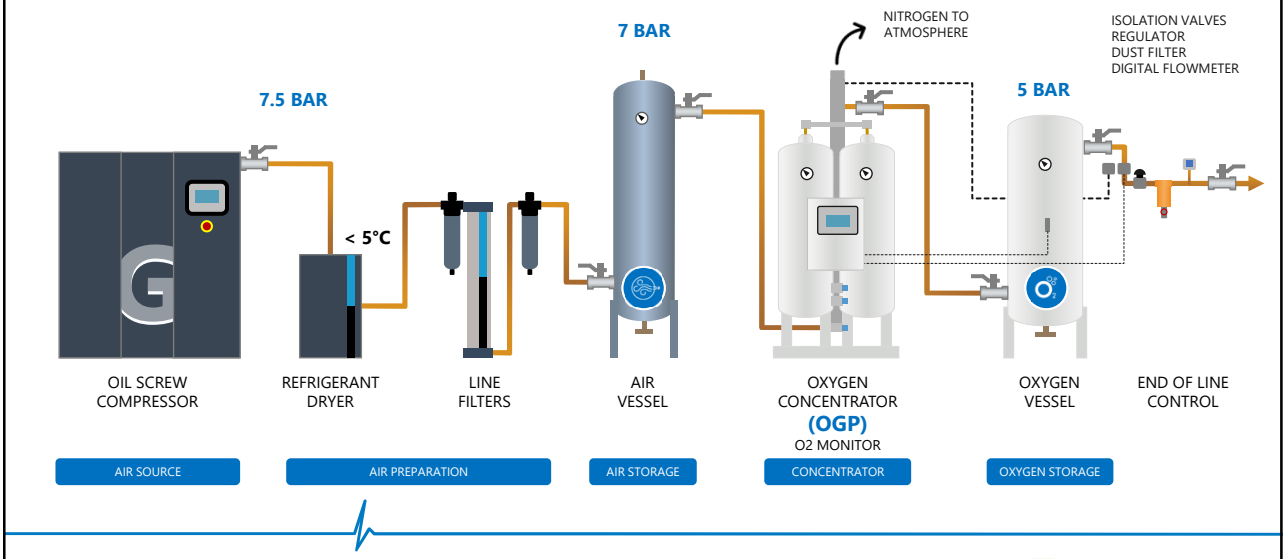
BeaconMedaes Oxyplant (Single Train)



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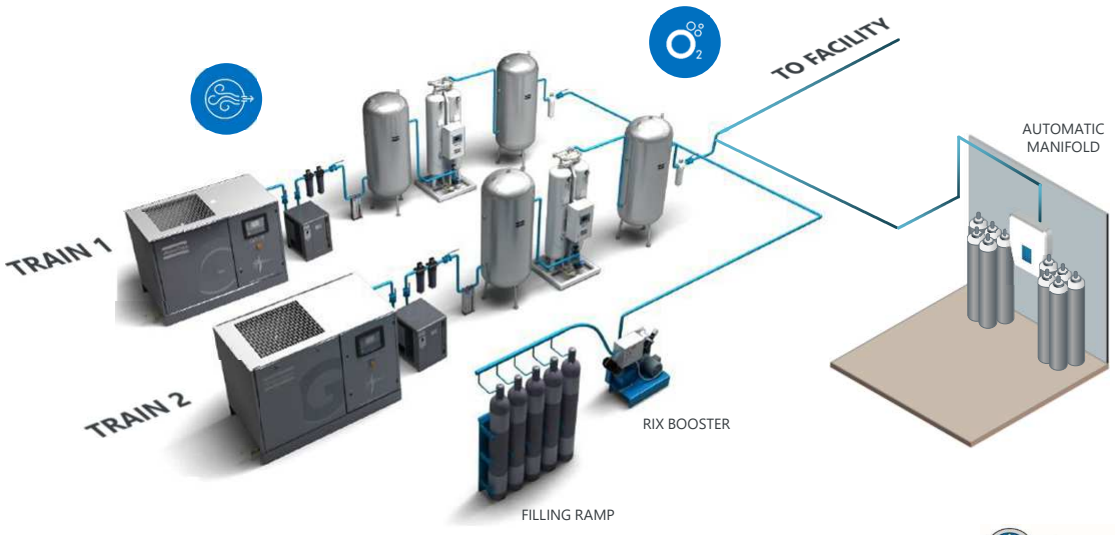
Cascade Design: Oxygen-93 Production



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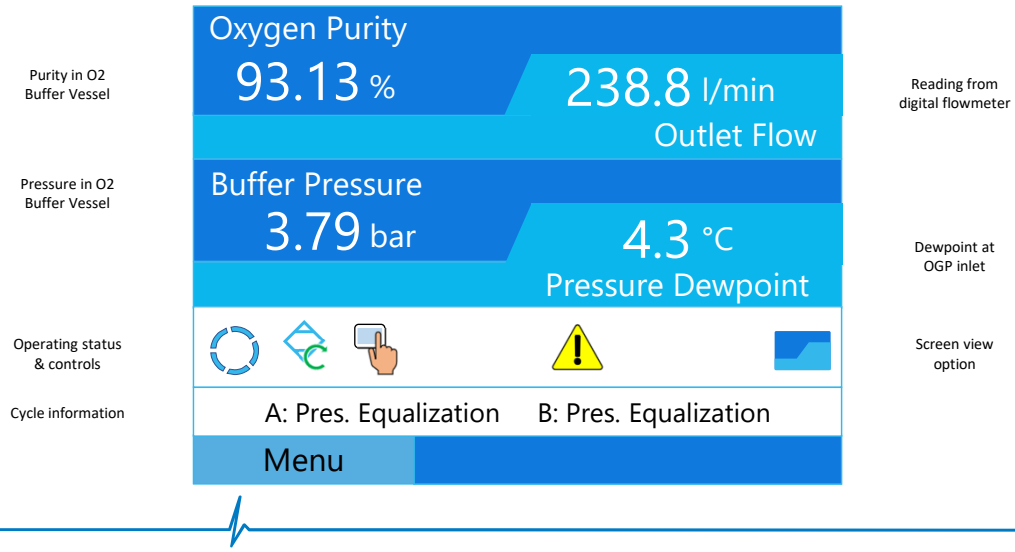
OGP Controller Screen



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OXYPLANT

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OXYPLANT

02

AIR DRYER

OGP MED

AIR DRYER 02

- Atlas Copco FX refrigerant dryer
- Self regulating pressure
- Reach 3 °C PDP at 45 °C with nominal flow

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OXYPLANT

03

FILTRATION

OGP MED

FILTRATION 03

- 3-stage filters: UD+, QDT, PDp+
- UD+: Oil aerosol, wet dust
- QDT: Oil vapor
- PDp+: Fine dry dust
- ISO 8573-1 air quality preparation for concentrator

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OXYPLANT

04

AIR VESSEL

OGP MED

AIR VESSEL 04

- Steel construction
- Adequately sized to feed concentrator
- Protected by a safety pressure relief valve
- Zero loss electronic drain valve
- Pressure gauge

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OXYPLANT

05

Concentrator

OGP MED

CONCENTRATOR 05

- Outlet Oxygen purity at 93% +/- 3%
- Pressure swing adsorption (PSA)
- Contain zeolite for N2 adsorption
- Purity monitoring
- Pneumatic valve controls
- Flow monitoring (l/m)

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OXYPLANT

06

Oxygen Vessel

OGP MED

OXYGEN VESSEL 06

- Steel construction
- Adequately sized to ensure O2 pressure during nominal operation
- Protected by a safety pressure relief valve
- Pressure gauge

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OXYPLANT

07

Regulation

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REGULATION 07

- Isolation valve
- Line regulator
- Dust filter approved for Oxygen
- Digital flowmeter

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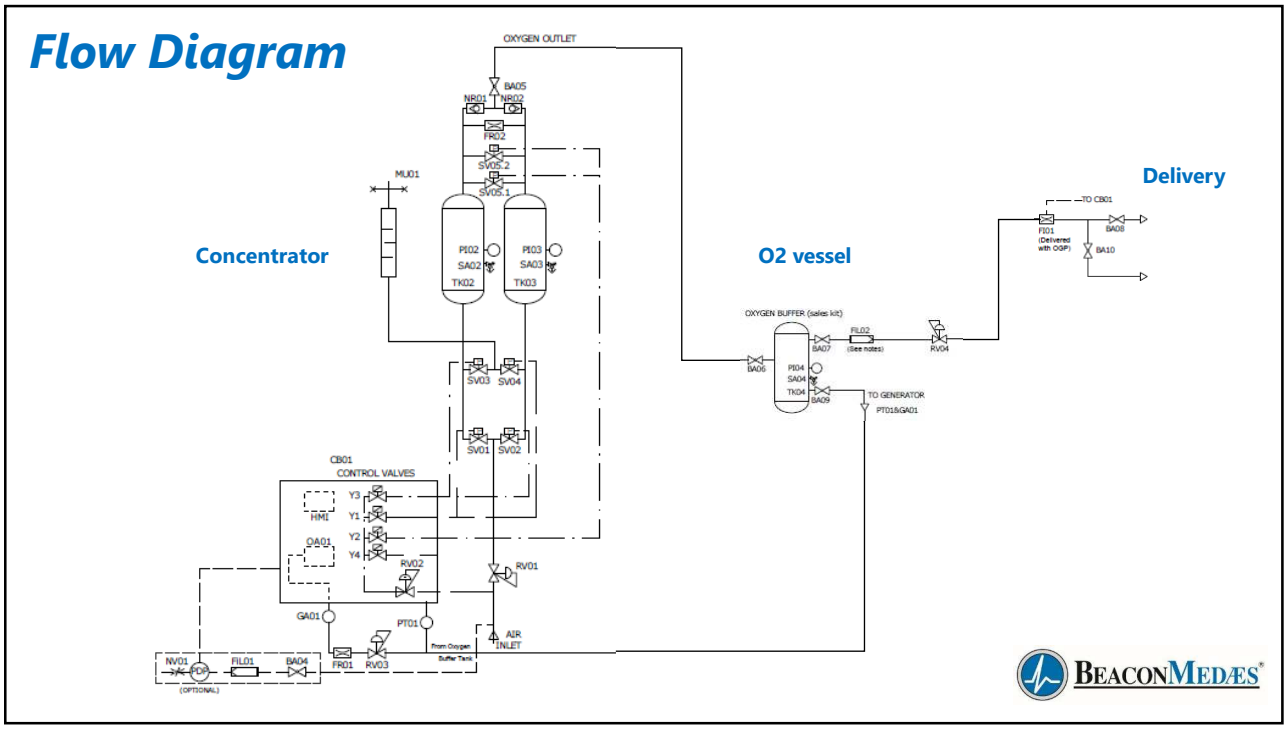
Flow Diagram



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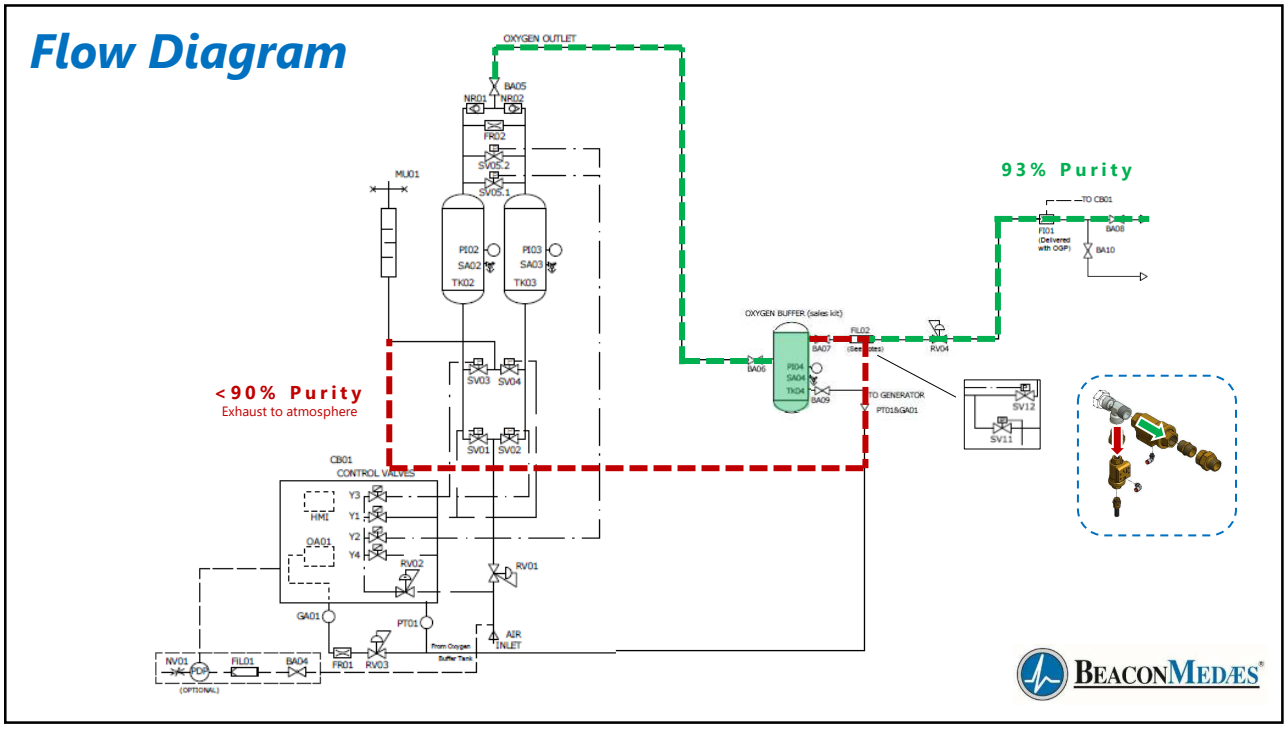
Flow Diagram



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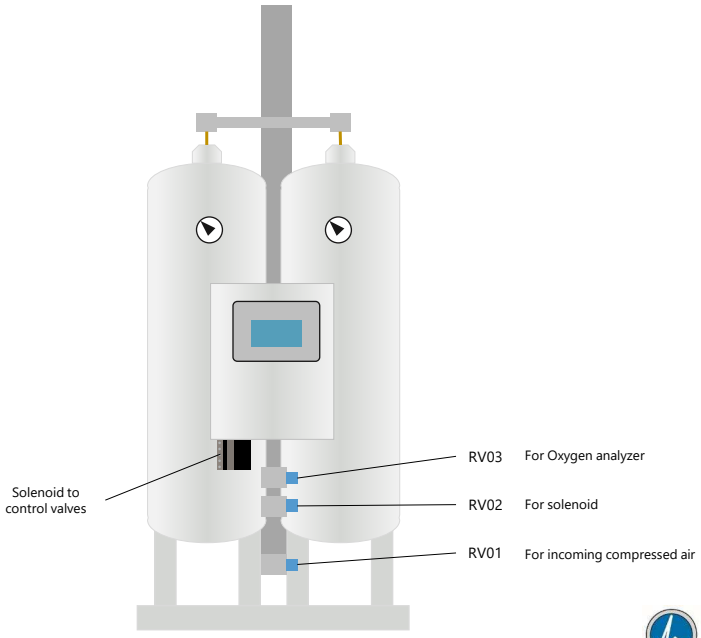
OGP



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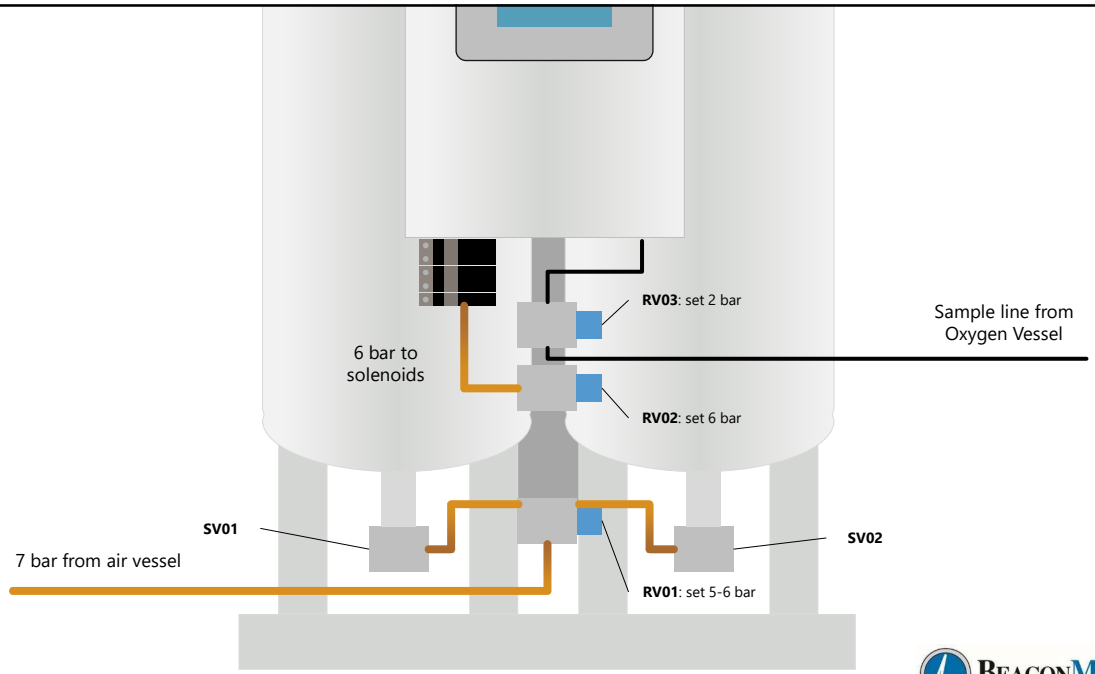

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Which Plant Size?

Determine What Flow is Required

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Oxygen Diversified Flow Calculation Sample

Department	Design flow for each terminal unit (L/min)	Diversified flow Q (L/min)
In-patient accommodation (ward units):		
Single 4-bed rooms and treatment room	10	$Q_{ac} = 10 + [(n-1)6/4]$
Ward block/department	10	$Q_d = Q_{ac}[1 + (n/W - 1)/2]$
Accident & emergency:		
Resuscitation room, per trolley space	100	$Q = 100 + [(n-1)6/4]$
Major treatment/plaster room, per trolley space	10	$Q = 10 + [(n-1)6/4]$
Post-anaesthesia recovery, per trolley space	10	$Q = 10 + [(n-1)6/8]$
Treatment room/cubicle	10	$Q = 10 + [(n-1)6/10]$
Operating:		
Anaesthetic rooms	100	Q = no addition made
Operating rooms	100	$Q = 100 + (nT-1)10$
Post-anaesthesia recovery		$Q = 10 + (n-1)6$
Maternity:		
LDRP rooms:		
Mother	10	$Q = 10 + [(n-1)6/4]$
Baby	10	$Q = 10 + [(n-1)3/2]$
Operating suites:		
Anaesthetist	100	$Q = 100 + (nS-1)6$
Paediatrician	10	$Q = 10 + (n-1)3$
Post-anaesthesia recovery	10	$Q = 10 + [(n-1)3/4]$
In-patient accommodation:		
Single/multi-bed wards	10	$Q = 10 + [(n-1)6/6]$
Nursery, per cot space	10	$Q = 10 + [(n-1)3/2]$
Special care baby unit	10	$Q = 10 + (n-1)6$
Radiological:	100	$Q = 10 + [(n-1)6/3]$
All anaesthetic and procedures rooms		
Critical care areas	10	$Q = 10 + [(n-1)6]3/4$
Coronary care unit (CCU)	10	$Q = 10 + [(n-1)6]3/4$
High-dependency unit (HDU)	10	$Q = 10 + [(n-1)6]3/4$
Renal	10	$Q = 10 + [(n-1)6/4]$
CPAP ventilation	75	$Q = 75n \times 75\%$
Adult mental illness accommodation:		
Electro-convulsive therapy (ECT) room	10	$Q = 10 + [(n-1)6/4]$
Post-anaesthesia, per bed space	10	$Q = 10 + [(n-1)6/4]$
Adult acute day care accommodation:		
Treatment rooms	10	$Q = 10 + [(n-1)6/4]$
Post-anaesthesia recovery per bed space	10	$Q = 10 + [(n-1)6/4]$
Day patient accommodation (as "In-patient accommodation")		As "In-patient accommodation"
Oral surgery/orthodontic:		
Consulting rooms, type 1	10	$Q = 10 + [(n-1)6/2]$
Consulting rooms, types 2 & 3	10	$Q = 10 + [(n-1)6/3]$
Recovery room, per bed space	10	$Q = 10 + [(n-1)6/6]$
Out-patient:		
Treatment rooms	10	$Q = 10 + [(n-1)6/4]$
Equipment service rooms, sterile services etc	100	Residual capacity will be adequate without an additional allowance

Reference: HTM02-01 Table 13, page 26

For a hospital with 5 Operating Theatres, 10 ICU bays, 10 A&E (Resus), 20 in-patient beds, the diversified flow for Oxygen is as the following:

Area	Beds/Bays	Formula Table 13	O2 D/Flow (l/m)	O2 Outlets
OT	5	Q = 100+(nT-1)10	140	10
ICU	10	Q = 10+[(n-1)6]3/4	51	40
A&E (Resus)	10	Q = 100+[(n-1)6/4]	114	20
Wards	20	Qw = 10+[(n-1)6/4]	39	20
Total			**344**	

From the diversified flow calculation, total flow at 344 l/m of Oxygen is required, hence checking the specification sheet, the recommended Oxyplant size with correction factor of 0.91 at 30 °C is **Oxyplant 29**

Oxyplant 29 = 450 l/m * 0.91 = **409.5 l/m**

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Refer Specification Sheet

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Specification Sheet

Oxyplant - 50 Hz

Model	Part No	Capacity* (lpm)	Capacity* (cfm)	Compressor	Dryer	UD+ Filter	QDT Filter	PDp+ Filter	Air Receiver	Generator	Oxygen buffer tank
Oxyplant 4	8102341600	54	2.0	GA5P-7,5 CE	FX6 (A5)	UD25+	QDT20	PDp20+	250 L 11 BAR	OGP4 MED	150L
Oxyplant 6	8102341601	90	3.1	GA7P-7,5 CE	FX7 (A6)	UD45+	QDT45	PDp35+	250 L 11 BAR	OGP6 MED	150L
Oxyplant 8	8102341602	120	4.3	GA11P-7,5 CE	FX9 (E7.5)				250 L		380L
Oxyplant 10	8102341603	144	5.0	GA11+P A 7,5 APB	FX10 (E8)						500L
Oxyplant 14	8102341604	222	7.8	GA15+P A 7,5 APB	FX11 (E9)						500L
Oxyplant 18	8102341605	300	10.5	GA18+P A 7,5 APB	FX12 (E10)						500L
Oxyplant 20	8102341606	318	11.2	GA22+P A 7,5 APB	FX15 (A13)						1000L
Oxyplant 29	8102341608	450	16.0	GA30+P A 7,5 APB	FX16 (A14)						1000L
Oxyplant 45	8102341610	702	24.7	GA45+P A 7,5 APB	FX18 (E16)	UD180+	QDT185	PDp170+	11 BAR	OGP45 MED	1500L
Oxyplant 55	8102341611	852	30.1	GA55P A 7,5 APB	FX18 (E16)	UD220+	QDT245	PDp210+	2000 L 11 BAR	OGP55 MED	2000L
Oxyplant 65	8102341612	1,050	37.2	GA75P A 7,5 APB	FX19,5 (A17,5)	UD310+	QDT310	PDp310+	2000 L 11 BAR	OGP65 MED	2000L
Oxyplant 84	8102341613	1,302	46.0	GA90P A 7,5 APB	FX20 (A18)	UD310+	QDT310	PDp310+	2000 L 11 BAR	OGP84 MED	2000L

Flow Factoring At Different Temperatures

Temperature (°C)	Temperature (°F)	Correction factor
10	50	1.00
15	59	1.00
20	68	1.00
25	77	0.98
30	86	0.91
35	95	0.82
40	104	0.74
45	113	0.60

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Can the Oxyplant Fit?

Check Plantroom Size

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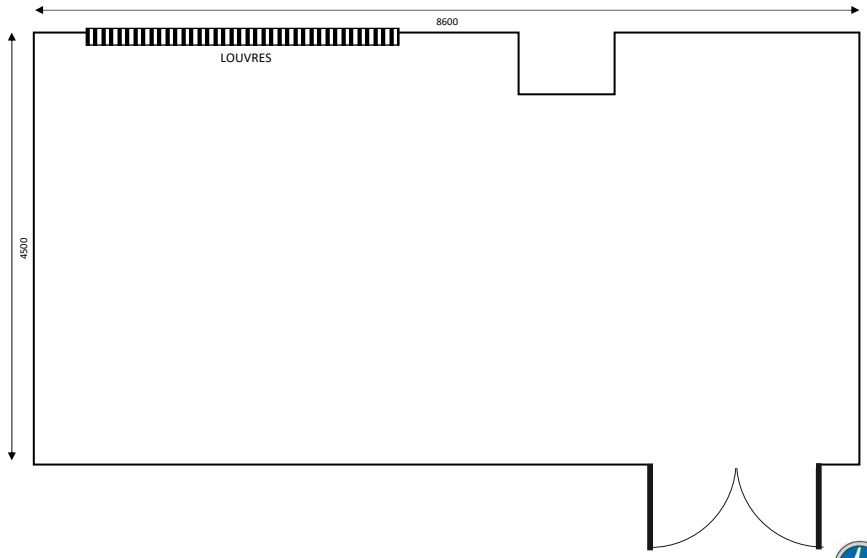
Can the Oxyplant Fit In This Room?



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Can the Oxyplant Fit?

Refer All Equipment Dimensions

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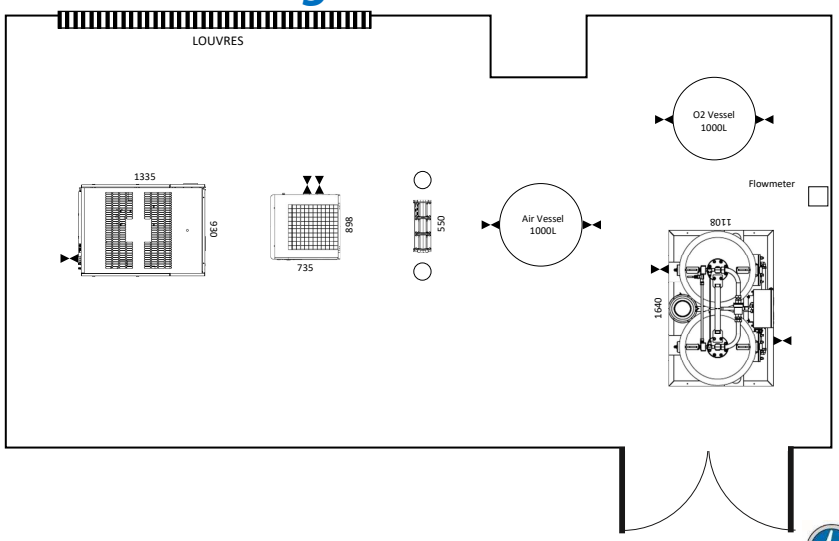
Measure & Arrange Placement
Is This The Best Arrangement?



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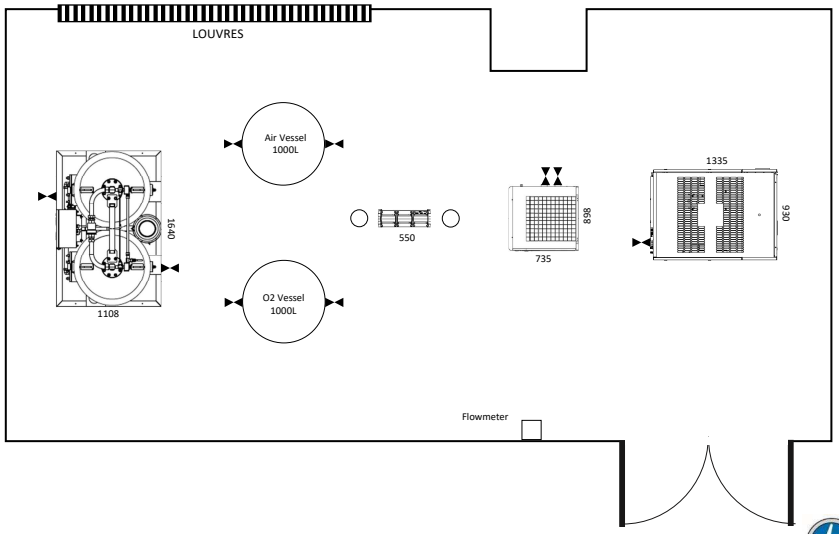
Design As If You Are the Owner



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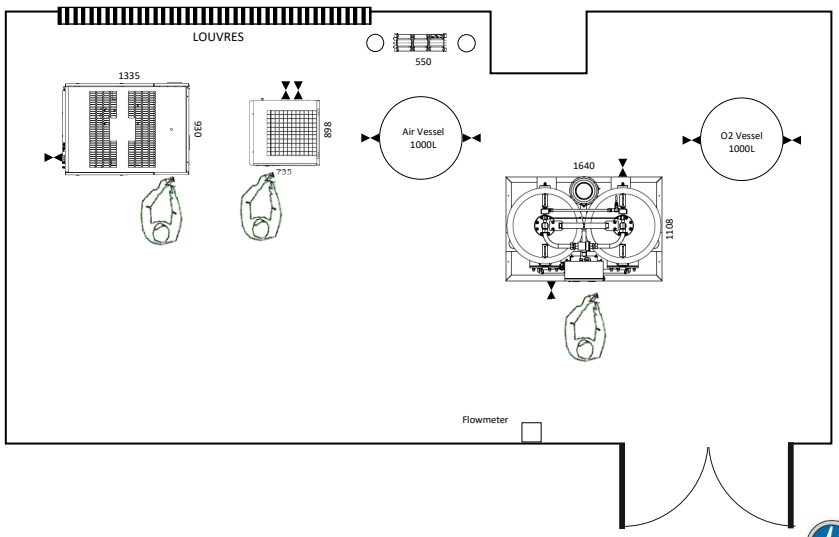
Always Consider Ergonomics & Aesthetics



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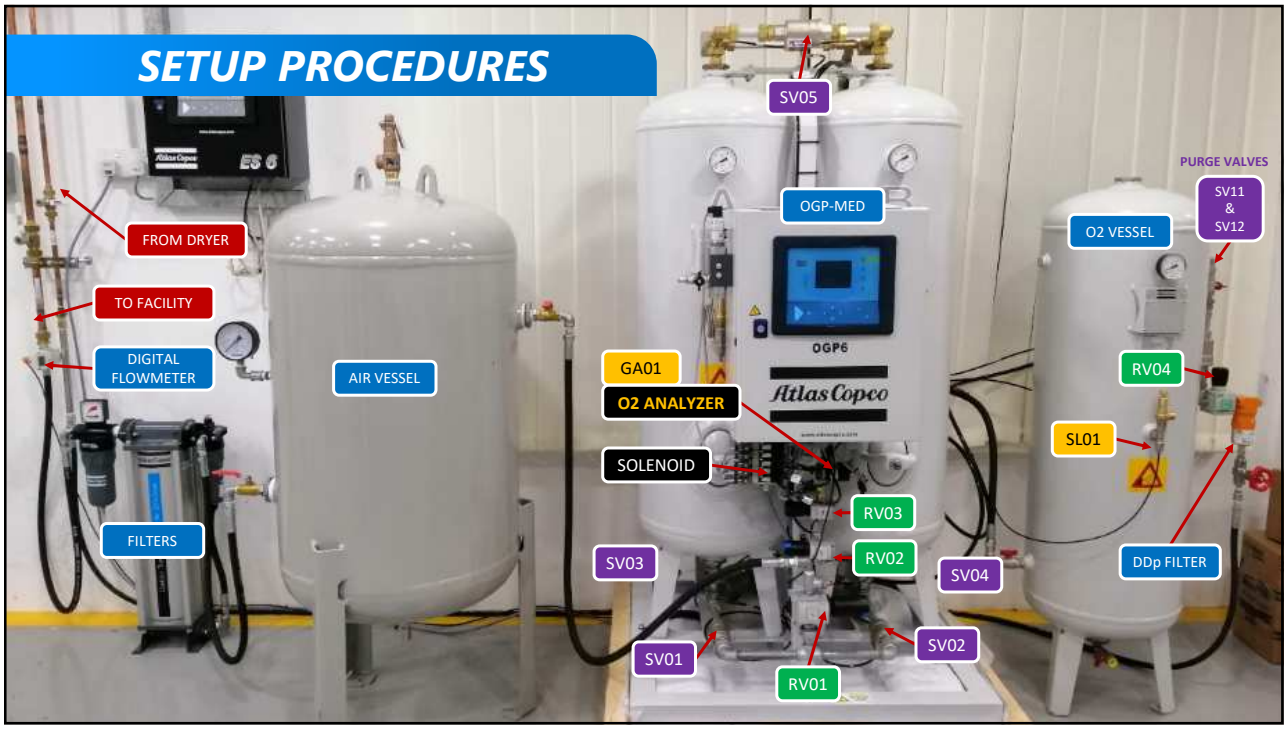
SETUP PROCEDURES
SV05
PURGE VALVES
SV11 & SV12
OGP-MED
O2 VESSEL
FROM DRYER
TO FACILITY
DIGITAL FLOWMETER
AIR VESSEL
GA01
O2 ANALYZER
SOLENOID
OGP6
Atlas Copco
RV04
SL01
RV03
FILTERS
SV03
RV02
SV04
DDp FILTER
SV01
RV01
SV02

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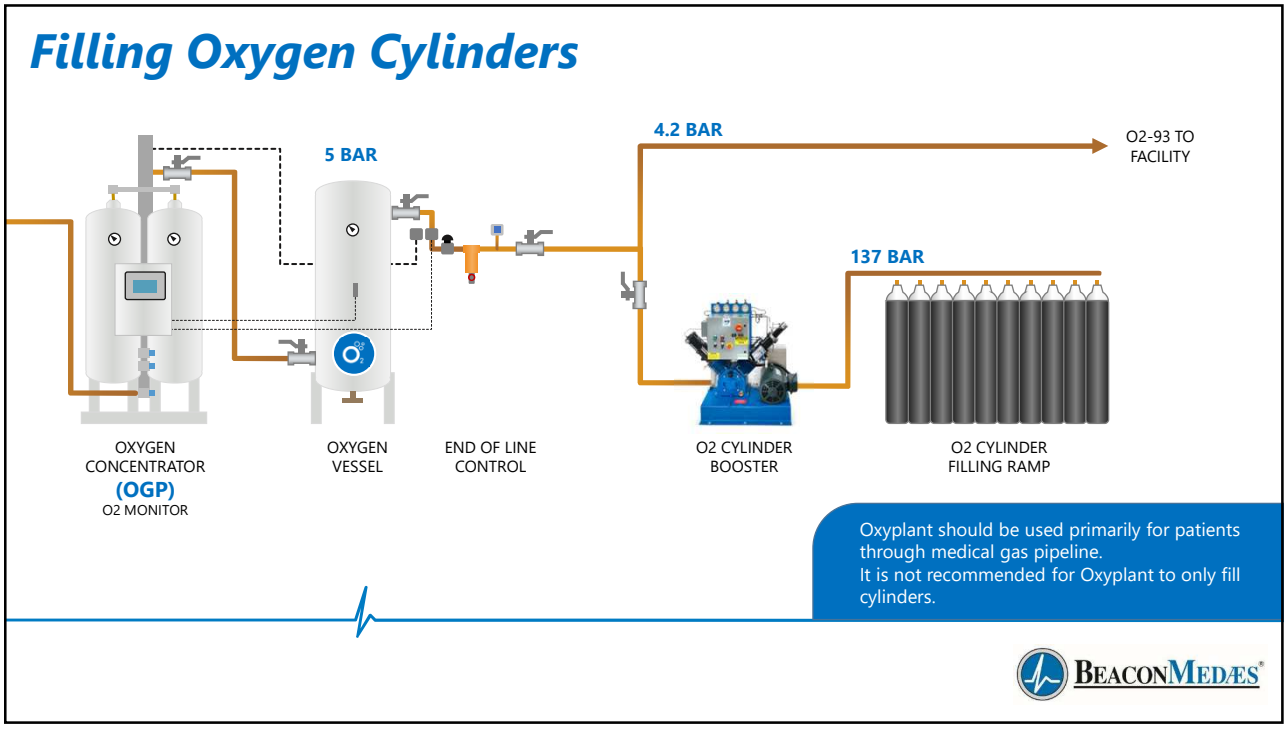
Filling Oxygen Cylinders
5 BAR
4.2 BAR
O2-93 TO FACILITY
137 BAR
OXYGEN CONCENTRATOR
(OGP)
O2 MONITOR
OXYGEN VESSEL
END OF LINE CONTROL
O2 CYLINDER BOOSTER
O2 CYLINDER FILLING RAMP
Oxyplant should be used primarily for patients through medical gas pipeline.
It is not recommended for Oxyplant to only fill cylinders.
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Things To Remember

Concentrators are not ideal for every application, but there are specific applications where they are a useful solution

Success with a concentrator is all about the quality of the feed air

There are many elements to making a concentrator central supply system work correctly beside the concentrator itself

Monitoring of the oxygen concentration is critical and the monitors require maintenance attention

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Why OxyPlant ??

- RELIABLE. Processed from Free Air
- (Based on installed base experience) Operating Cost Reduction / Operating Expenditure lower minimum 20% from Monthly Cost
- (Based on installed base experience) Investment Cost / Capital Expenditure will be profitable within 2 years (Dedicated for Indonesia)
- Fully under Atlas Copco Service Monitoring during period of contract agreement. Nationwide Cover for all over Indonesia
- Usage Efficiency will easily monitor and maintain

OPEX LOWER 20%
CAPEX 2 YEARS PROFIT

Atlas Copco

SERVICE ENERGY EFFICIENCY

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THANK YOU FOR JOIN

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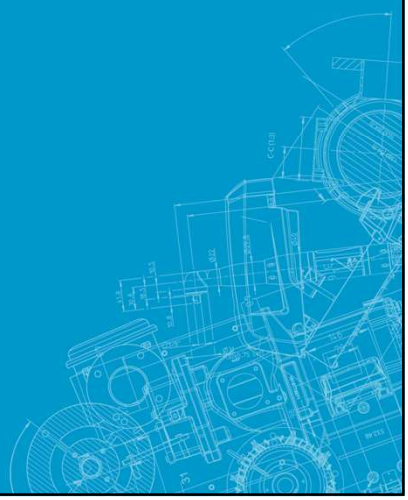
Atlas Copco

Home of Industrial Ideas



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