

OXYMAT®

INSTRUCTION MANUAL

PSA OXYGEN GENERATOR

2-Column system

O10; O20; O40; O60; O70; O100; O190; O280; O430; O640;
O880; O1250; O1500

X-version

O880 X2; O1250 X2; O1500 X2



Manufacturer:
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WARNINGS AND IMPORTANT INFORMATION READ BEFORE USE!



Warning: OXYMAT PSA oxygen generator system is sold for use in industrial applications and for medical use. When PSA (pressure swing adsorption) generator is used for medical purpose it must be stated in declaration of conformity and refer to MDR 2017/745 EC (medical device regulation), Annex VII. & Annex V. (07/DK/1180). If you have ordered medical oxygen generator system, you must follow procedures for service and maintenance of *medical optional devices***. In case PSA oxygen generator is used for clinical purposes, it should be signed “exclusively for clinical investigations”.



Important: Upon receiving your OXYMAT PSA oxygen generator system, inspect the unit thoroughly for signs of damage. Any signs of damage, either external or internal, should be noted on the delivery receipt, and also reported immediately to both the Freight Company and OXYMAT. Contact OXYMAT at Tel +45 4879 7811 / Fax +45 4879 7813 or Tel +421 32 779 0123 / Fax +421 32 779 0125



Important: The owner of the Oxymat PSA oxygen generator system is responsible of keeping all the equipment in safe working order. Parts and units must be replaced if they are no longer in safe working condition. Installation of equipment and assembling to other equipment must be done in compliance with current local regulations and directions.



Important: The operator of the Oxymat PSA oxygen generator system must always use safe working methods in compliance with current local safety regulations and directions. In case of difference between directions in the manual and local regulations the strictest must be followed.



Important: For safety, installation and operating etc. of compressor, air dryer unit or other auxiliary equipment refer to the concerned manuals of the equipment.



Important: Authorized personnel is a person who has completed training and holds a valid Certificate of Service Training issued by OXYMAT. This person is authorized to act on behalf of the Oxymat service representative and can perform installation, commissioning and service activities.



Warning: Use only hoses and pipes of correct size and suitable for operating pressure and fluid. Never use hoses which are frayed, damaged or worn. Always use the correct type and size of connections. Make sure hoses are depressurized before disconnecting.



Warning: All tubes, hoses and piping used for oxygen must be compatible with oxygen and cleaned for oxygen service.



Warning: Lifting lugs on columns, if present, are only for handling of the columns if they are detached from the PSA generator unit. The PSA oxygen generator unit is not to be lifted by the lifting lugs on columns or by the pipes. The PSA oxygen generator must be lifted by the skid, with a suitable lifting device operated by a certified or trained operator. Take the necessary precautions to avoid units tipping over during handling. Anchor all parts to the concrete floor by means of anchor bolts or like.



Warning: Exhaust gas from the oxygen PSA oxygen generator contains only 8-21 % oxygen. Exhaust gas must be led by piping or ducts out of the room to outdoor atmospheric air.

Failure to do this may cause serious damage, injury or death. The room where the PSA generator is located must always be well ventilated.



Warning: Safety valve outlets from PSA and Product Tank must be connected by piping out of the room to safe area (outdoor atmospheric air). Failure to do so may cause serious damage, injury or death.



Warning: Make sure that your back-up/emergency oxygen supply is installed with an oxygen pressure regulator. The pressure must not exceed the design pressure stated in the Design Review Certificate. Check valves must be fitted at both oxygen delivery outlet from product tank and backup oxygen outlet.



Warning: Always vent oxygen to outdoor atmospheric air. While venting oxygen, make sure there is no smoking or open flame. Do not allow venting oxygen to come in contact with clothing or hydrocarbon materials.



Warning: Oxygen is a powerful oxidizing agent. It can cause fire or explosion. Observe strict cleanliness procedures when fabricating and connecting the oxygen piping. It is imperative that oxygen systems be properly cleaned and inspected to insure that no combustible materials remain in the connecting piping and fittings. Do not allow the free flow of oxygen from the oxygen PSA oxygen generator or from product tank.



Warning: The interior of the cabinet contains electrical parts that may produce electrical hazard if not handled properly. To prevent electrical shock, care must be taken when servicing this equipment. In general, electrical installation and servicing is to be performed by a qualified and licensed electrician only.



Warning: Do not attempt to open the inspection hatch or similar unless the unit cycle pressure gauge reads zero and the rubber hose from the filter elements is disconnected to release pressure. PSA oxygen generator columns can contain hazardous substances. Handle only with proper protective clothing, gloves and eyewear and according to local environment and work environment regulations. In general, mechanical and piping installation and servicing is to be performed by trained or authorized personnel only.



Caution: Improper behaviour as a result of inadequate qualification and knowledge can lead to substantial injury to person and property. Therefore don't allow any activities to be performed by other than appropriately qualified personnel.



Warning: Tanks must be depressurized and purged thorough with air to remove all oxygen before service or inspection. Always vent oxygen to outdoor atmospheric air. Make sure there is no smoking or open flame.



Warning: When servicing control valves only use lubricant suitable for oxygen service. Use Klüber Klubertemp 92-302 or similar. Never use oil, grease or other lubricant not designed for oxygen. Such lubricants can self-ignite or explode in contact with oxygen.



Warning: The compressor, air tank or other feed air supply and pressurized equipment must be fitted with adequate protective devices to protect against exceeding allowable limits of the concerned equipment e.g. safety relief valves. Feed air supply must be protected against exceeding the maximum allowable pressure for Oxymat PSA oxygen generators. The safety relief valves on PSA generator columns and product tank (if supplied) are solely for the protection of these components.



Caution: The following will cause damage not covered under the manufacturer's warranty. Feed air temperature T(O) above 40°C or below 5°C. Water, oil, rust, scale and/or other foreign objects carryover in the feed air due to damaged filter elements and/or plugged drains. The feed air quality must comply with specifications to ISO/EN 8573.1: 2010 class 1.4.1, unless otherwise stated.



Caution: OXYMAT prefilter 1µm and microfilter 0,01µm elements have been selected based upon their ability to function in severe operating conditions. Filters has to be chosen according Oxyomat recommendation, otherwise Oxyomat cannot guarantee product gas quality. Use prefilter and microfilter to reach feed air quality to comply with ISO specification 8573-1:2010 class 1.4.1.



Caution: The "oxygen compatible" lubricants Klüber Klubertemp 92-302 used in process valves is safe up to 60°C as mentioned on product sheet and MSDS (material safety data sheet) by manufacturer. In case of combustion, CO, Hydrocarbons and traces of fluorinated products will be released.



Caution: *** We recommend maintenance and greasing once a year on all other process valves.

*** see service check list



Warning: OXYMAT PSA oxygen generator cannot be disconnected from the power supply for the period longer than 6 month. It could cause PLC data loss. This period begins to count from the date of final operation test mentioned in Design Review Certificate. This type of certificate is always part of the delivery - unique for each serial number of PSA oxygen generator.



Warning: When handling active carbon, zeolite molecular sieve and carbon molecular sieve, ensure adequate ventilation, especially in confined areas.

Always use personal protective equipment.:

- Disposable filtering half mask Class FFP3 (EN149) or Half mask with a particle filter P3 (EN143).
 - Lightweight protective clothing, protective gloves and Safety glasses
- For detailed information refer to the MSDS of the molecular sieve.



Warning: Condensation Warning

- Important: Certain components of the device may become cold during operation. In environments with high humidity and low ambient temperature, this can lead to the condensation of moisture from the air.
- Precaution: The user is responsible for ensuring that the device is operated in conditions that prevent condensation. Do not use the device in environments where humidity or temperature levels may cause moisture to accumulate on or within the device.
- Note: Condensation may negatively affect device performance or safety. The manufacturer is not responsible for damage resulting from unsuitable environmental conditions.



Warning: If PSA ordered without product analysis, customer takes full responsibility if product purity out of specification.



Important: PSA Oxygen generator for medical use must be installed, tested, and commissioned according to EN ISO 7396-1:2016. Records shall be maintained, and parameters sent to OXYMAT – Slovakia, s.r.o. service@oxymat.com.



Important: Air compressor shall be connected to an emergency electrical supply.



Important: Air compressor shall not be used as source of medical air.

*** *see service check list*

Action in case of danger and accident:

- Store first-aid box and fire extinguishers close-at-hand
- Familiarise personnel with the inside emergency plan
- Emergency stop has to be activated
- Take first-aid measures in accordance with the inside emergency plan

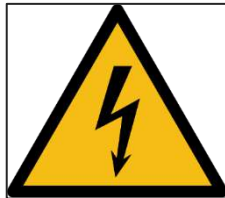
Pictograms and labels on equipment

Warning and caution labels



Label 1

Location: Right column vessel (upper part)



Label 2

Location: electrical cabinet
(Next to main switch)

Designation of pictographs

Label	pictographs	Designation
1		Warning – Oxidizing gas. Oxygen (Oxygen enriched air) inside, keep equipment in a well-ventilated area and gases away from combustible material.
		Warning: Asphyxiating atmosphere Nitrogen (Oxygen depleted air) inside Equipment must be placed in a well-ventilated area. Avoid inhalation of gases. Exhaust gases must lead outside
		Warning: Pressurized device, Lock out source and relieve pressure before servicing
		Warning: Tip over hazard. During manipulation and installation
		Refer to instruction manual/booklet instruction manual/booklet must be read
		Do not lift PSA generator unit by the by pipes.
2		Warning: Electricity.

Other labels

	Serial No label PSA Oxygen generator MEDICAL DEVICE <i>On skid plate</i>	Name and address of company, Production year, Type No., Operating pressure – bar(g) Operating temperature (°C), Maximum pressure - bar(g) Max/min temp. (°C), Test pressure - bar(g), Design control
	Serial No label PSA Oxygen generator PED directive label <i>On skid plate</i>	Name and address of company, Production year, Type No., Operating pressure – bar(g) Operating temperature (°C), Maximum pressure - bar(g) Max/min temp. (°C), Test pressure - bar(g), Design control
	Label on electrical cabinet Medical generator <i>Inside (upper) control panel</i>	Serial number / feeding / power supply / rated current / control supply / earthing system / degree of protection / type of cabinet / rated power
INLET – FEED AIR	<i>On piping near inlet</i>	Information label, INLET - FEED AIR: Connect to feed air supply.
OUTLET – OXYGEN	<i>On piping near oxygen outlet</i>	Information label, OUTLET – OXYGEN: On PSA generator: Connect this oxygen outlet to product tank inlet. On product tank: Connect this oxygen outlet to your consumption.

Symbol used in manual:



maintenance or control operation to be performed by adequate qualified personnel only

1 General information



Picture 1. Layout of OxyMAT generator system line

Main installation parts (pre-assembled):

A	Compressor	Accessory -if present in scope of supply
B	Air dryer	Accessory -if present in scope of supply
C	Filter Package	Accessory -if present in scope of supply
D	Coal tower	Accessory -if present in scope of supply
E	Air tank	Accessory -if present in scope of supply
F	Oxygen PSA generator c/w internal piping & electric cabinet – control system	Medical device
G	Product tank	Accessory -if present in scope of supply
H	High pressure compressor	Accessory -if present in scope of supply
I	Filling ramp/Backup	Accessory -if present in scope of supply

1.1 OxyMAT PSA oxygen generator system

This OxyMAT PSA oxygen generator is an on-site oxygen-generating machine. Coupled with your air compressor, refrigeration air dryer and filtration system (*), it takes air and separates the oxygen from other gasses. The separation is accomplished with an inert ceramic material (molecular sieve) that does not require replacement (when maintained and used according to this instruction manual). The process is completely regenerative which makes it reliable and virtually maintenance free. The delivery pressure can be set 0 to 6 bar(g) depending on version to meet the needs of your operation.

(*) *It is important to note that your compressor, refrigeration air dryer and filtration system is an integral part of your total operation. It should be maintained in accordance with the manuals received with the compressor, refrigeration air dryer and filtration system to ensure safe and clean air supply. An improperly maintained compressor, refrigeration air dryer or filtration system could affect the operation of your oxygen PSA generator. For use up to 24 hours a day, OXYMAT recommends high quality screw compressors only with external or internal refrigeration air dryers and proper sized filtration systems.*



Warning: OXYMAT PSA oxygen generator are sold for use in industrial applications only. Unless specifically modified by OXYMAT - Slovakia, these PSA oxygen generators must not be used for any respiratory medical application. If you have ordered the PSA oxygen generator modified for medical application you must follow procedures for service and maintenance of medical optional devices.

1.2 Product warranty

OXYMAT warrants all PSA oxygen generator to be free from defect in parts and workmanship for a period of one year duration, counting from the invoice date, or maximum 4000 operating hours of normal use and operation of the PSA oxygen generator. OXYMAT's obligations under this warranty are limited to the repair (all parts and labour free of charge, excluding filter elements) or to replacement of the purchase price for a similar unit. Each PSA oxygen generator for which a warranty claim is asserted shall, at the request of OXYMAT, be returned freight prepaid with proof of purchase date to the OXYMAT factory at the expense of the purchaser.

Any replacement parts shall be warranted as stated above for the unexpired portion of the original one-year warranty. If traveling on the customer site for repair, even under warranty, freight and travel will be charged to the customer. This warranty does not extend to any PSA oxygen generator or part if a defect or malfunction occurs from misuse (at OXYMAT sole determination), any feed air malfunctions¹, improper filter element maintenance², or external causes³. The feed air quality must comply with ISO specification 8573-1:2010 class 1.4.1. The warranty shall be null, void and inoperative if the PSA oxygen generator has been repaired or altered outside the OXYMAT factory without the express written authorization of OXYMAT. The foregoing warranty is in lieu of any other warranty, expressed or implied, in fact or in law including without limitation the warranty of merchantability or the warranty of fitness for a particular purpose. It is expressly understood that purchaser's sole and exclusive remedy for defect in parts is limited to enforcement of OXYMAT obligation as set forth above and OXYMAT shall not be liable to the purchaser or others for loss of use of the equipment or for other special, indirect, incidental or consequential damages.

Notwithstanding anything to the contrary herein, during the product warranty period as specified above, OXYMAT will return repaired PSA oxygen generator freight prepaid. After the product warranty period has expired, the customer is responsible for freight charges both ways. Said warranty shall extend and apply to the PSA generator only while the unit is owned and used exclusively by the original purchaser.

1.3 Limits of liability

OXYMAT shall not be liable for any special, indirect, incidental or consequential damages that result from the use or malfunction of the machine.

¹Air from your compressor must be less than 40°C before it reaches the PSA generator, T(O)-max. High feed air temperature will cause damage not covered under the OXYMAT Product Warranty.

²Replace the filter elements every six (6) months assuming a properly maintained air compressor. Failure to replace filter elements on schedule will result in a void OXYMAT Product Warranty.

³Locate the system in an indoor well-ventilated area that remains a temperature between 5°C and 45°C, T(S), to prevent damage not covered under the OXYMAT Product Warranty.

1.4 Conditions and procedure for returning the PSA oxygen generator for service

Follow the procedures below to return a PSA oxygen generator or component for service credit:
Contact OXYMAT. Before you call for service assistance, have the following information readily available:

- The Model number of the PSA generator
- The Serial number of the PSA generator
- The invoice date
- Hours of use

Be sure merchandise is packed for a safe return. OXYMAT is not responsible for damages that occur to the PSA generator or a component because of failure to follow this procedure is the sole responsibility of the customer. Item(s) must be returned freight prepaid.

1.5 Intended purpose (PSA oxygen generators as medical device)

Intended purpose: Oxygen (93 per cent) production

Definition:

Content: 90,0 % V/V to 96,0 % V/V of O₂, the remainder mainly consisting of argon and nitrogen.

Full monograph is described in European Pharmacopoeia 10.0 Monograph Oxygen (93 per Cent) 04/2011:2455.

1.6 Vigilance System for OXYMAT® PSA Oxygen Generator used as a Medical Device

Distributors, customers, and end-customers are obliged under the European Union law for medical devices - Medical Device Regulation EU 2017/745 - to follow rules for vigilance reporting.

Customers and end-customers (e.g. healthcare institutions), contracting business partners (e.g. distributors), and authorized personnel carrying out service activities shall contact ACG Air & Gas Solutions SK s.r.o. and OXYMAT A/S when they receive any complaint about OXYMAT® PSA Oxygen Generator or any report about an incident associated with the medical device. This information shall be emailed at vigilance@oxymat.com and/or departmental contact email (Service, Sales, other). The UDI code and serial number of OXYMAT® PSA Oxygen Generator should be included for traceability.

A 'complaint' is defined in EN ISO 13485:2016 and can be described as a written, electronic or oral communication that alleges deficiencies related to the identity, quality, durability, reliability, usability, safety or performance of a device, or related to a service that affects the performance of such devices, irrespective of the source of this information.

The following information shall be considered for reporting:

1. Is the information related to an issue with the device?
2. Is the issue with the device one of the following:
 - A malfunction or deterioration in its characteristics or performance,
 - A use-error due to ergonomic features,

- An inadequacy in the information supplied by OXYMAT,
- An undesirable side-effect to a person from the use of OXYMAT® PSA Oxygen Generator,

When a complaint is raised, the manufacturer performs assessment whether the complaint classifies as an incident and whether a causal relationship between the incident and the medical device can be established or that such causal relationship is reasonably possible.

Incidents are classified according to the MDR (EU) 2017/745.

Under Article 2 (64), the '**incident**' means any malfunction or deterioration in the characteristics or performance of a device made available on the market, including use-error due to ergonomic features, as well as any inadequacy in the information supplied by the manufacturer and any undesirable side-effect.

Under Article 2 (65), the '**serious incident**' means any incident that directly or indirectly led, might have led or might lead to any of the following:

- (a) the death of a patient, user, or other person,
- (b) the temporary or permanent serious deterioration of a patient's, user's or other person's state of health,
- (c) a serious public health threat.

When the complaint is confirmed to be an incident or a serious incident, the manufacturer initiates vigilance process, following an internal procedure based on the MDR (EU) 2017/745, Chapter VII, Section 2 Vigilance, Articles 87-92.

1.7 PSA Oxygen Generator lifetime

PSA Oxygen generator lifetime is 2 million cycles for each column vessel or 10 years (whichever comes first).

Vessels lifetime:

Column vessels are designed for 2 millions cycles.

PSA oxygen generator life time with short cycle times (Cycle time 30 sec. Equalization 10 sec.) and operation 24/7 is app. 4.5 years.

PSA oxygen generator life time with long cycle times (Cycle time 106 sec. Equalization 30 sec.) and operation 24/7 is app. 15 years.

2 Product specifications

PSA oxygen generators are designed for indoor applications, temperature requirements in a range 5-45°C.

Performance in Nm³/hour measured at 20° C (± 5 %), 1013 mbar.

Sm³ – Standard cubic meter – reference conditions to 15°C, 981 mbar

Nm³ – Normal cubic meter – reference conditions to 20° C, 1013 mbar

Product Dew point ~ -50°C PDP (Dewpoint at Line Pressure)

! Important: All necessary information is stated in portfolio, related Order Confirmation and Oxymat web page.

Density of O ₂ and air		
	[Nm ³]	[Sm ³]
Density [kg/m ³]	by 20°C	by 15°C
O ₂ [kg/m ³]	1,330	1,310
Air [kg/m ³]	1,204	1,186

Table 1. Density of O₂ and air

Conversion from m³/hr. to kg/hr.:

Flow (m³/hr.) * Density (kg/m³) = Flow (kg/hr.)

Conversion from kg/hr. to m³/hr.:

Flow (kg/hr.) / Density (kg/m³) = Flow (m³/hr.)

bar(g) – gauge pressure

bar(a) – absolute pressure

bar(g) = bar(a) + atmospheric pressure (1,01325 bar)

Feed air

- Compressed feed air supply must be less than 40°C before it reaches the PSA generator.
- Pressure dew point of feed air ≤ +3°C.
- The feed air quality must comply with ISO specification 8573-1:2010 class 1.4.1.

NOTE:

The PSA oxygen generators are designed to operate at a peak cycle pressure of 4.0 to 7.0 bar(g) and deliver 90-95% oxygen when supplied with a minimum feed air pressure of 6.0 bar(g). An increase of the cycle pressure to more than stated in the Design Review Certificate results in higher feed air consumption and lower generation efficiency.

The PSA oxygen generators can run higher peak cycle pressure, but only after special modification from OXYMAT.

For operation at lower cycle pressures and/or higher flow rates, modifications are required. Please contact your OXYMAT representative for assistance.

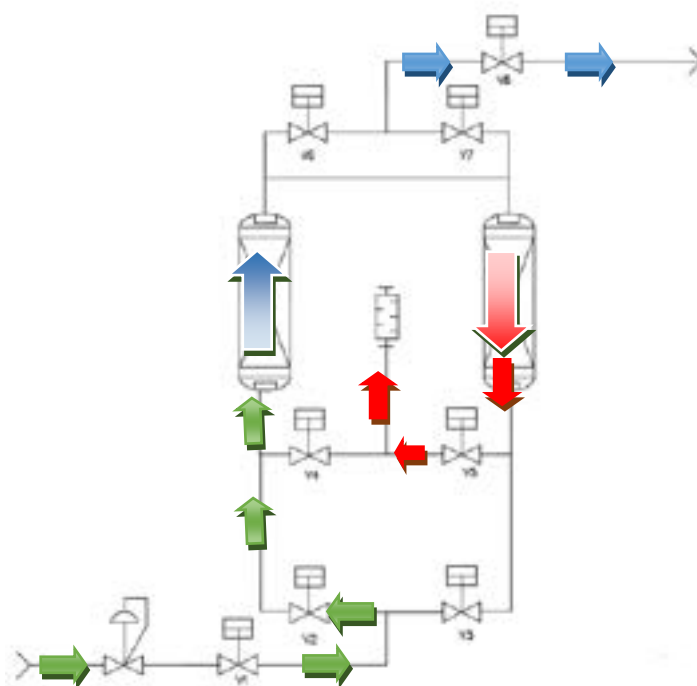
3 PSA oxygen generator system parts and controls

3.1 Basic process flow description of PSA oxygen generator system

The OXYMAT PSA Oxygen generator system 10,0 bar version is designed to accept compressed feed air at 6.0 – 8.5 bar(g) into its filter assembly. The incoming compressed air must be filtered through an air-conditioning system consisting of water drain filter, refrigeration air dryer, pre- and micro filtration units. All filtration units must be equipped with automatic drain valves for removing water and oil. The pre-filter (if present) and micro filter removes condensed water and oil, dirt, scale, etc., and the coalescing filter removes oil vapour (oil aerosols).

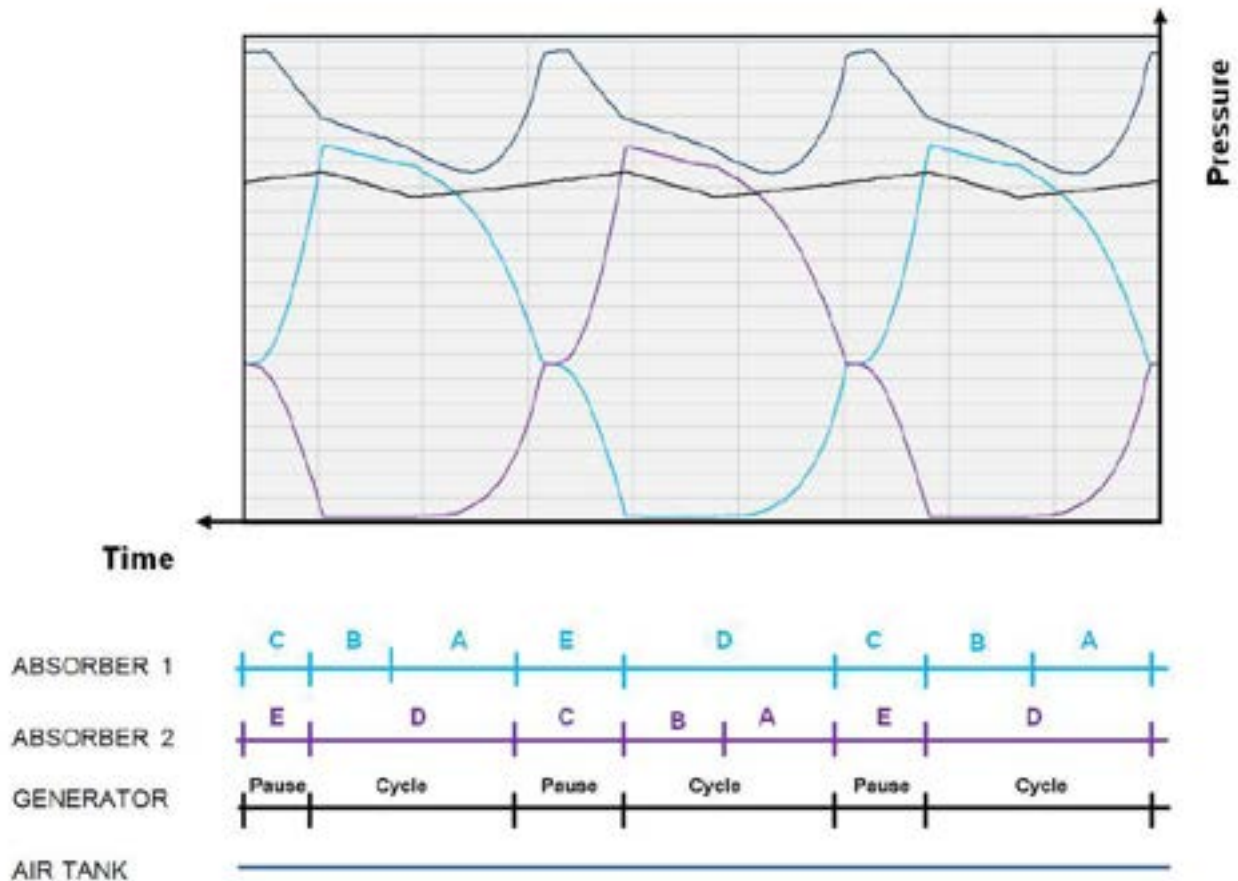
The normal flow of air through the PSA oxygen generator is shown in picture 2 below. After exiting the filter, the compressed feed air is regulated down to 4.0 – 8.5 bar(g) and then directed by pneumatic activated valves into one of two adsorber columns containing molecular sieve. Molecular sieve has the unique property that it physically attracts or adsorbs nitrogen from the air, leaving the oxygen to pass through to the product tank, and can when saturated with nitrogen be regained to clean sieve again by purging with oxygen under lower pressure conditions.

The PSA oxygen generator consist of two or three adsorber columns working in alternate operation, e.g., the processes always run in antiphase to one another in such way, that one adsorber column with cleaned sieve delivers oxygen while the other adsorber column regenerates saturated sieve. After a certain pre-set period, the processes shifts, so that the first adsorber column now regenerates saturated sieve, while the second is delivering oxygen through a cleaned sieve. The oxygen from the adsorber column is stored in the product tank. From the product tank the oxygen is regulated to 0 - 6.0 bar(g), depending upon model and the consumer's specific working pressure. See picture 3 next page for more detailed information on the working process.



Picture 2. Flow - schematic unit of OXYMAT – 2-Column oxygen PSA generator

2-Column PSA oxygen generator



Picture 3. Schematic Pressure/Time diagram of Oxymat PSA generator oxygen 2C

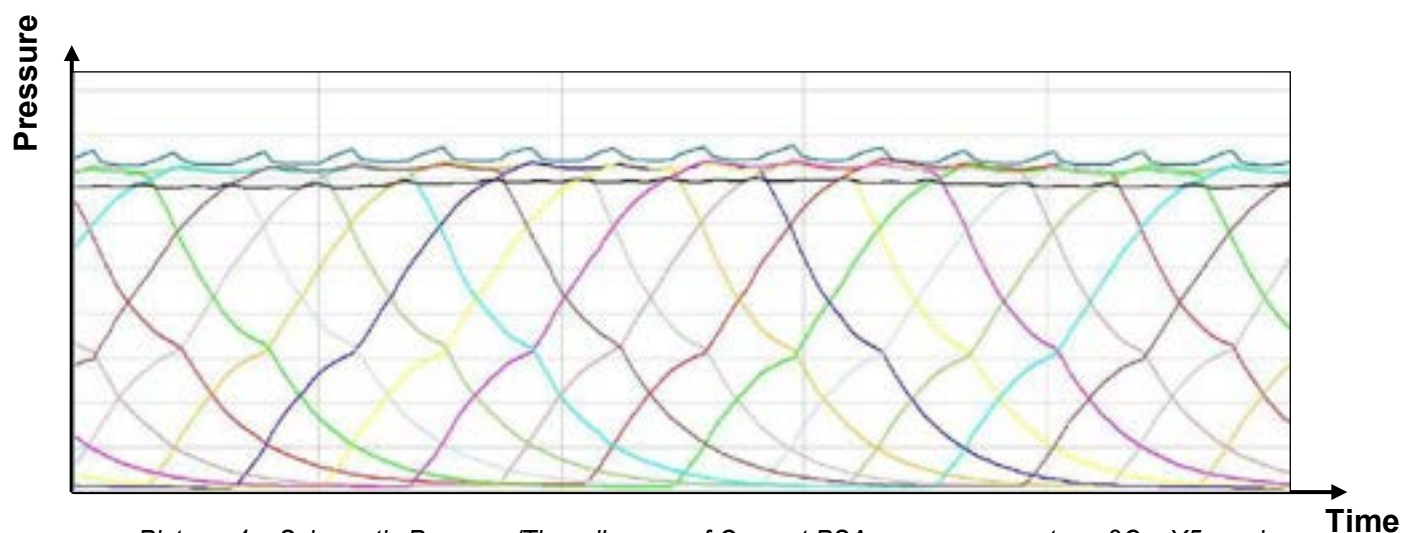
The pressure drop ΔP on the accumulated oxygen delivery must not exceed 0.5 bar(g).

Normal process sequence:

- A: Pressurization
- B: Oxygen delivery
- C: Pressure equalization - decreasing pressure
- D: Exhaust (Pressure drop causes nitrogen release from sieve)
- E: Pressure equalization - increasing pressure

X-version PSA oxygen generator

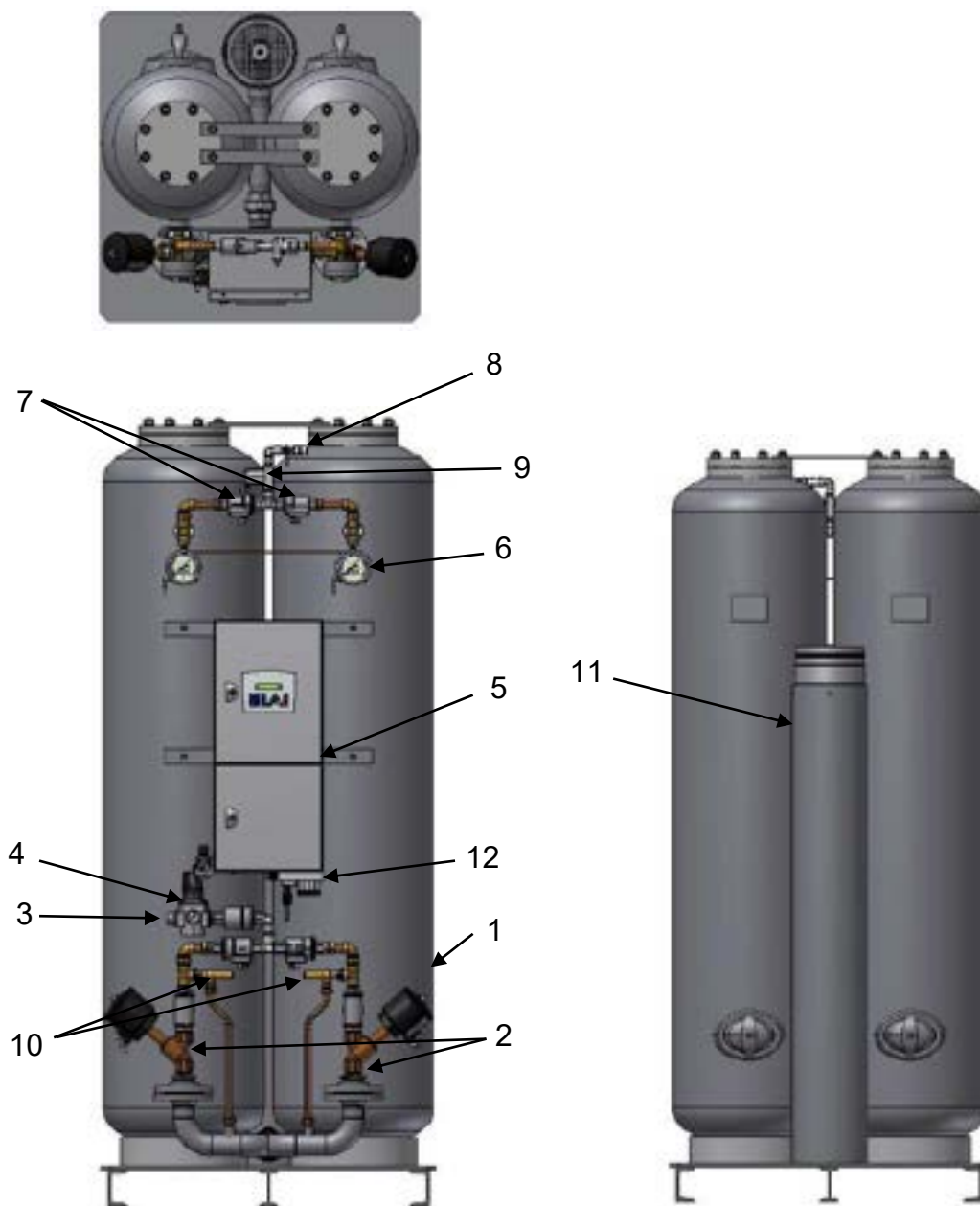
- X-version PSA oxygen generator system consists of X-number of single PSA oxygen generators working in a counter phase. Total cycle time of single PSA generator is divided by the number of PSA generators and cycling of each unit is shifted in time proportionally.



Picture 4. Schematic Pressure/Time diagram of Oxymat PSA oxygen generators 2C – X5 version

3.2 PSA oxygen generator parts description

3.2.1 PSA oxygen generator parts, 2-Column system



Picture 5. PSA oxygen generator parts

1. Adsorber column 2. Angle seated valves for cycle operation 3. Feed air inlet
4. Feed air pressure regulator 5. Cabinet containing electrical parts e.g. the PLC
6. Cycle pressure gauge 7. Axial valves for equalization / delivery of oxygen 8. Outlet to product tank
9. Axial valve for delivery of oxygen 10. Safety relief valves 11. Exhaust pipe 12. Valve block

1. Adsorber column

Adsorber columns contain molecular sieve that adsorbs nitrogen and concentrates oxygen from air.

2. Axial valve for cycle operation.

Angle seat valve for cycle operation.



These valves are controlling the pressurization and blow down sequences on the adsorber columns.

3. Feed air inlet

Feed air from air supply system is connected to this point.

4. Feed air pressure regulator (without or with filter)



The feed air pressure regulator controls the inlet air pressure to 4.0 – 8.5 bar(g), and is set by the OXYMAT factory. Changing of factory set pressure can affect and harm the production capacity. The factory set pressure is stated in our Design Review Certificate.

5. Cabinet

The cabinet contains all sensors, PLC, HMI and electrical parts.

6. Cycle pressure gauge



It indicates adsorber column pressure during the PSA generator cycles. The gauge is able to read from 0 to 16 bar (g). Peak cycle pressure is 4 to 7 bar(g) unless specially modified by OXYMAT to another pressure.

7. Axial valves for delivery of oxygen to product tank, Angle seat valve for delivery



These valves open for a period of when the adsorber column is pressurized to deliver oxygen to the product tank for use.

8. Outlet to product tank



Product tank and PSA generator are connected to this point. It is important to use the hose or pipe delivered from Oxymat, as the internal dimension is an integrated part of the system.

9. Axial valve for equalization of pressure, Angle seat valve for equalization of pressure



After pressurization cycle on one of the adsorber columns, the equalization valve will open for a period and pressure equalization between the adsorber columns will take place.

10. Safety relief valves



These valves ensure that the pressure in column does not exceed the design pressure.

11. Exhaust pipe - supersilencer

Blow processed waste gases.



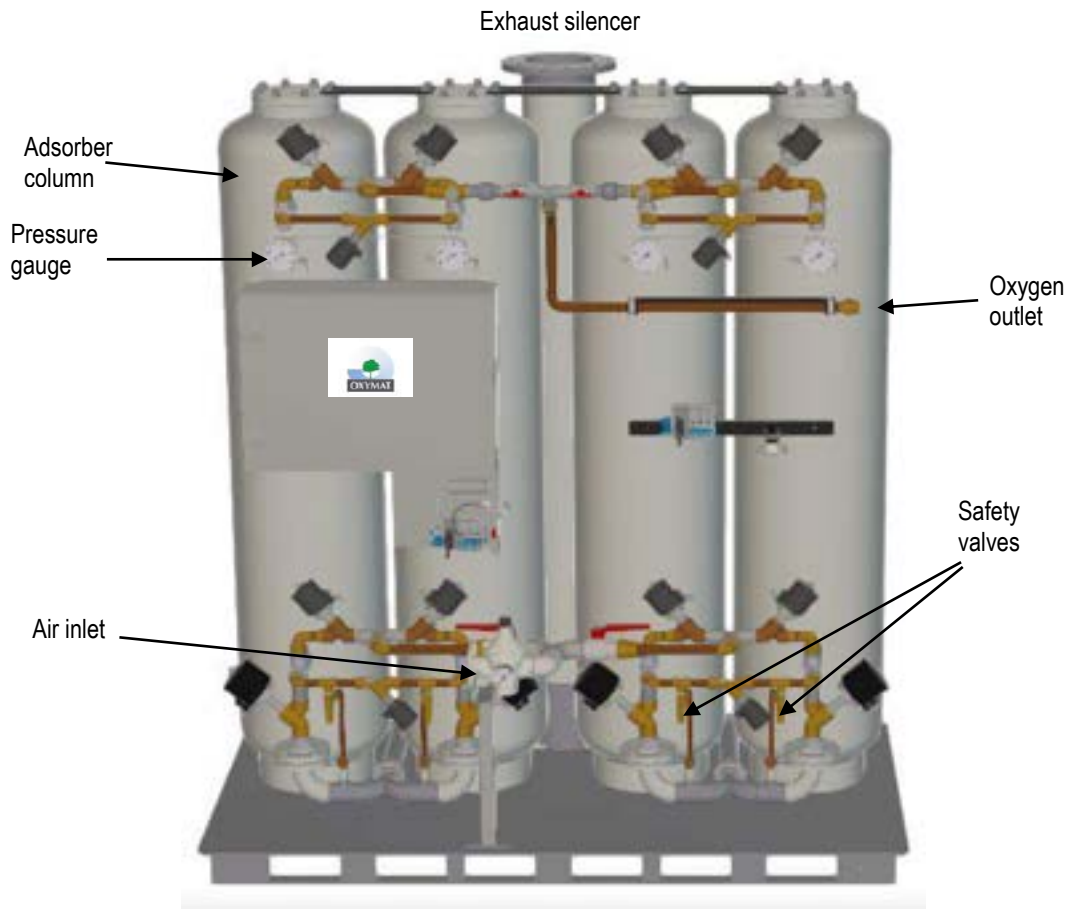
12. Valve block

The valve block contains all solenoid valves, that via the PLC controls the pilot air supplied to the process valves, drain and purge control valves.



3.2.2 PSA oxygen generator parts, X2 version system

X-version consists of X2 PSA oxygen generators connected into one inlet air one outlet oxygen controlled by Control cabinet.



Picture 6. X2-version PSA oxygen generator parts

Function of each component is similar to the functions of the components in a 2-Column PSA oxygen generator.

3.3 Coal tower parts description

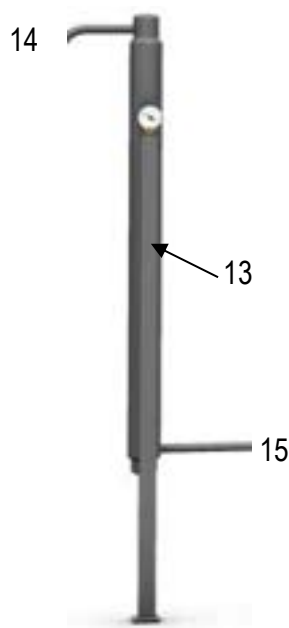
Air from compressor, air dryer cleaned with filters enters the coal tower through the top and leaves through the bottom.

13. Coal tower – Tower filled with active coal

14. Inlet coal tower connection

15. Outlet coal tower connection

If PSA oxygen generator is for medical purposes – coal tower with micro filter has to be used to comply with MDR.



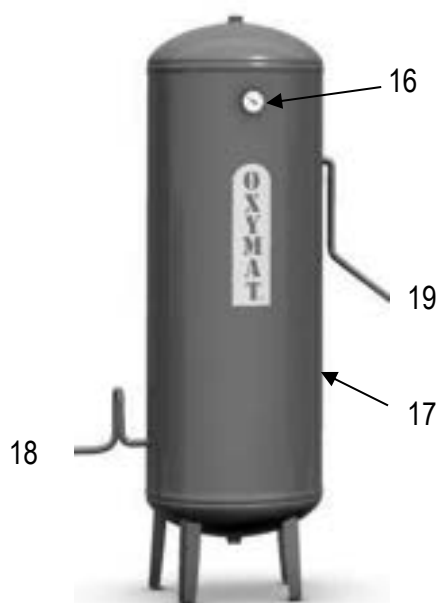
Picture 7. Coal tower parts

13. Coal tower **14.** Inlet connection **15.** Outlet connection

3.4 Air tank parts description

Air from coal tower enters the air tank through the bottom of the air tank and leaves through the top.

- 16. Pressure gauge**
This should under normal condition read between 4.0 – 16.0 bar(g), depending on version
- 17. Air tank**
This stores the air for oxygen PSA generator. The air tank provides stable flow for process.
- 18. Inlet air tank connection**
- 19. Outlet air tank connection**



Picture 8. Air tank parts

16. Pressure gauge **17.** Air tank **18.** Inlet connection **19.** Outlet connection

3.5 Product tank parts description

20. Product tank

This stores the oxygen produced by the oxygen PSA oxygen generator. The product tank provides stable flow and purity of oxygen.

21. Safety relief valve assembly with pressure outlet

Safety relief valve prevents excessive pressure from building up should a malfunction occur.

Pressure outlet on tee branch below the valve shall via the supplied hose be connected to the pressure transmitter on the control panel.

22. Inlet product tank connection

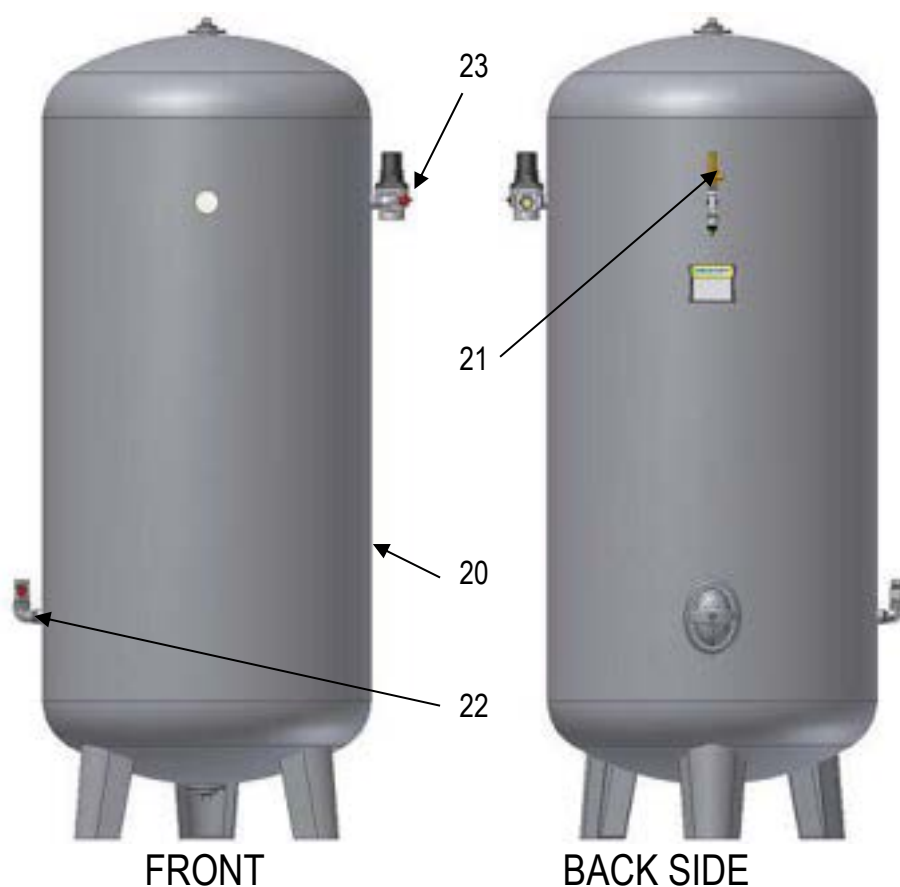
The PSA oxygen generator is normally connected to the product tank at the bottom through ball valve.

23. Outlet product tank connection

On the top of the product tank is connected outlet for the consumption through a ball valve and a regulator. In case of PSA oxygen generator for medical use, particle filter and bacterial sterile filter have to be placed downstream of regulator.

Spare parts

Spare parts are delivered according to customer request mentioned in OC.



Picture 9. Product tank parts

20. Product tank 21. Safety relief valve assembly with pressure outlet

22 Inlet port with ball valve 23 Outlet port with reduction valve

3.6 Connections

3.6.1 Coal tower connections

Air from compressor, air dryer cleaned with filters enters the coal tower through the top and leaves through the bottom.

Connections to/from coal tower							
Model type	Volume [l]	Connection [DN]		Model type	Volume [l]	Connection [DN]	
		Inlet	Outlet			Inlet	Outlet
C010	10	20	20	C020	20	20	20
C040	40	25	25	C090	90	50	50
		40	40			40	40
C150	150	50	50	C320	320	50	50
C470	470	90	90	C750	750	100	100
C1000	1000	150	150	C1500	1500	150	150

Table 2. Air inlet connections to and from coal tower

3.6.2 Air tank connections

Air from coal tower enters the air tank through the bottom of the air tank and leaves through the top.

Connections to / from air tank							
Model type	Volume [l]	Connection [DN]		Model type	Volume [l]	Connection [DN]	
		Inlet	Outlet			Inlet	Outlet
AT090	90	20	20	AT150	150	20	20
AT320	320	20	20	AT470	470	20	20
		25	25			25	25
						40	40
AT750	750	40	40	AT1000	1000	20	20
						25	25
						40	40
						50	50
						90	90
						100	100
AT1500	1500	40	40	AT2000	2000	40	40
		50	50				
		90	90				
		100	100				
		150	150				
AT3000	3000	50	50				
		50	40				

Table 3. Air inlet connections to and from air tank

3.6.3 PSA oxygen generator connections

From pressure outlet on product tank to oxygen pressure sensor

Size of nylon tube, connecting product tank pressure outlet and pressure sensor on PSA oxygen generator control cabinet, depends on PSA oxygen generator model type.

Air inlet / oxygen outlet connections

Air from air tank enters PSA oxygen generator through the bottom pipe set of PSA oxygen generator and oxygen leaves through the top pipe set of PSA oxygen generator.

Air inlet connection / oxygen outlet connection 2-columns							
Model type	Volume [l]	Connection [“]		Model type	Volume [l]	Connection [“]	
		Inlet	Outlet (note)			Inlet	Outlet (note)
O10	10	DN20	10/12 (a)	O20	20	DN20	10/12 (a)
O40	40	DN20	10/12 (a)	O60	60	DN20	10/12 (a)
O70	70	DN20	DN10 (a)	O100	100	DN20	DN10 (a)
O190	190	DN25	DN10 (a)	O280	280	DN25	DN15 (b)
O430	430	DN25	DN20 (c)	O640	640	DN40	DN20 (d)
O880	880	DN40	DN25 (d)	O1250	1250	DN40	DN25 (d)
O1500	1500	DN40	DN25 (d)				

Table 4. Air inlet connection to PSA oxygen generator and oxygen outlet from PSA generator - 2-Column

Air inlet connection / oxygen outlet connection X-versions					
Model type	Connection [DN]		Model type	Connection [DN]	
	Inlet	Outlet (note)		Inlet	Outlet (note)
O880 X2	DN50	DN40	O1250 X2	DN50	DN40
O1500 X2	DN50	DN40			

Table 5. Air inlet connection to PSA oxygen generator and oxygen outlet from PSA generator – X-version

Connection size may vary with flow and purity.

The feed air quality must comply with ISO specification 8573-1:2010 class 1.4.1.

NOTES (Connection from PSA oxygen generator outlet to product tank inlet):

- For connection: supplied 10/12 ID/OD plastic tube to be used.
- For connection: supplied 13/15 ID/OD plastic tube to be used.
- For connection: use 20/22 ID/OD pipes of max 6 meters length, and material in Cu or AISI 314L, cleaned for oxygen service.
- For connection: use 25/28 ID/OD pipes of max 6 meters length, and material in Cu or AISI 314L, cleaned for oxygen service.
- For connection: use 32/35 ID/OD pipes of max 6 meters length, and material in Cu or AISI 314L, cleaned

for oxygen service.

- f) For connection: use 39/42 ID/OD pipes of max 6 meters length, and material in Cu or AISI 314L, cleaned for oxygen service.
- g) For connection: use 50/54 ID/OD pipes of max 6 meters length, and material in Cu or AISI 314L, cleaned for oxygen service.
- h) For connection: use DN65 pipes of max 6 meters length, and material in Cu or AISI 314L, cleaned for oxygen service.
- i) For connection: use DN80 pipes of max 6 meters length, and material in Cu or AISI 314L, cleaned for oxygen service.

3.6.4 Product tank connections

Oxygen from the PSA oxygen generator enters the product tank through the bottom, then oxygen leaves product tank on top and continues to consumption (distance less than 5 meters).

Product tank connection					
Model type	Connection [“]		Model type	Connection [“]	
	Inlet	Outlet		Inlet	Outlet
PT090	15	10	PT150	15	10
		8			
PT320	20	15	PT470	15	15
	15				
PT750	20	20	PT1000	25	25
	25	25		40	40
PT1500	20	20	PT2000	25	25
	25	25			
PT3000	40	40			

Table 6. Connections to / from product tank



Warning: All tubes, hoses and piping must be compatible with oxygen and cleaned for oxygen service.

Sizes of air tank and product tank according model type of PSA generator			
Model type	PSA generator column size [l]	Air tank [l]	Product tank [l]
O10	10	30	30
O20	20	60	60
O40	40	90 / 150	90
O60	60	150	90 / 150
O70	70	320	150
O100	100	500	320
O190	190	750	320 / 500
O280	280	750 / 100	500
O430	430	1000 / 1500	750 / 1000
O640	640	1500	750 / 1000
O880	880	1500 / 2000	1000 / 1500
O1250	1250	2000 / 3000	2000 / 3000
O1500	1500	3000	3000
O880 X2	880	1500	1500
O1250 X2	1250	1500	1500
O1500 X2	1500	1500	1500

Table 7. Minimum sizes of air and product tank

3.7 Control system

27. Power/OFF

Switch for turning the power supply ON or OFF. This is placed on the side of the cabinet.

28. Touch screen



Finger operated Touch Screen – see instruction manual for touch screen control system in attached CD or USB flash drive.

29. Display control



See instruction manual for display control system in attached CD or USB flash drive.

30. Emergency stop button (optional)

In case of emergency you can manually stop PSA generator.



Picture 10. Control panel – IntelliControl Siemens, Display Control Panel DCP0 – DCP2

27. Power/OFF 28. Touch screen 29. Display control 30. Emergency stop button



*Picture 11. Control panel - Display Control Panel DCP1 – DCP2+
27. Power/OFF 29. Display control*



For further detailed information – see related HMI manual and wiring diagram.

4 Installation



Important: PSA Oxygen generator for medical use must be installed, tested, and commissioned according to EN ISO 7396-1:2016. Records shall be maintained, and parameters sent to OXYMAT – Slovakia, s.r.o. service@oxymat.com.

4.1 Electromagnetic compatibility declaration

Medical equipment needs special precautions regarding electromagnetic compatibility (EMC) and needs to be installed and put into service according to the EMC information provided below.

Guidance and manufacturer's declaration - electromagnetic emissions		
Pursuant to IEC 60601-1-2:2015/A1:2021 - Medical electrical equipment - Part 1-2: General requirements for basic safety and essential performance - Collateral Standard: Electromagnetic disturbances		
The equipment is intended for use in the electromagnetic environment specified below. The customer or the user of the equipment should assure that it is used in such an environment.		
Emissions test	Compliance	Electromagnetic environment - guidance
RF emissions CISPR 11	Group 1	The product use RF energy only for its internal function. Therefore, its RF emissions are very low and not likely to cause any interference in nearby electronic equipment The equipment is suitable for use in all establishments, including domestic establishments and those directly connected to the public low voltage power supply network that supplies buildings used for domestic purposes.
RF emissions CISPR 11	Class B	
Harmonic emissions IEC 61000-3-2	Class A	
Voltage fluctuations/ flicker emissions IEC 61000-3-3	Complies	

Table 8. Guidance and manufacturer's declaration - electromagnetic emissions.

Guidance and manufacturer's declaration – electromagnetic immunity			
Pursuant to IEC 60601-1-2:2015/A1:2021 - Medical electrical equipment - Part 1-2: General requirements for basic safety and essential performance - Collateral Standard: Electromagnetic disturbances			
The equipment is intended for use in the electromagnetic environment specified below. The customer or the user of the equipment should assure that it is used in such an environment.			
Immunity test	IEC 60601-1-2 test level	Compliance level	Electromagnetic environment - guidance
Electrostatic discharge (ESD) IEC 61000-4-2	±8 kV contact ±15 kV air	±8 kV contact ±15 kV air	Floor should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30 %
Electrical fast transient/bursts IEC 61000-4-4	± 2 kV for input Power ports	± 2 kV for input Power ports	Mains power quality should be that of a typical commercial and/or hospital environment
Surge IEC61000-4-5	±0,5, ± 1 kV differential mode ± 2 kV common mode	±0,5, ±1 kV L-N ±2 kV L-PE; N-PE Applied to mains connection	Mains power quality should be that of a typical commercial and/or hospital environment
Power frequency (50/60 Hz) IEC 61000-4-8	30 A/m	30 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment
Voltage dips, short interruption, and voltage variations on power supply	U _T >95%, 0,5 cycle (at 0, 45, 90, 135, 180, 225, 270 and 315°) U _T >95%, 1 cycle, at 0	U _T >95%, 0,5 cycle (at 0, 45, 90, 135, 180, 225, 270 and 315°) U _T >95%, 1 cycle, at 0	Mains power quality should be that of a typical commercial and/or hospital environment

input lines IEC 60601-4-11	$U_T=30\%$, 25(50Hz)/30(60Hz) cycles at 0 $U_T>95\%$, 250(50Hz)/300(60Hz) cycles at 0	$U_T=30\%$, 25(50Hz)/30(60Hz) cycles at 0 $U_T>95\%$, 250(50Hz)/300(60Hz) cycles at 0	
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80 MHz	3 Vrms	Portable and mobile RF communications equipment should be used no closer to any part of the equipment, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. Recommended separation distance $d=1,2\sqrt{P}$ $d=1,2\sqrt{P}$, 80 MHz to 800 MHz $d=2,3\sqrt{P}$, 800 MHz to 2,7 GHz where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in metres (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey ^a , should be less than the compliance level in each frequency range ^b . Interference may occur in the vicinity of equipment marked with the following symbol 
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2,7 GHz	3 V/m 80 MHz to 2,7 GHz	
Proximity fields from RF wireless communications equipment IEC 61000-4-3	9 to 28 V/m 15 specific frequencies (380 to 5800 MHz)		
NOTE 1 At 80 MHz and 800 MHz, the higher frequency range applies. NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people			
^a Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the equipment is used exceeds the applicable RF compliance level above, the equipment should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the equipment. ^b Over the frequency range 150 kHz to 80 kHz, field strengths should be less than 3 V/m.			

Table 9. Guidance and manufacturer's declaration - electromagnetic immunity.

4.2 Unpacking

You have received the Oxymat PSA oxygen generator, and the Instruction manual needed for proper installation of the unit. The product tank (if supplied) is shipped separately.

Place and unpack the shipment at the pre-determined location with a hard plane and level surface, and check if the delivery is complete according to shipment and delivery lists. If any packages or parts are missing, notify the Freight Company and Oxymat at once. **The manufacturer is not liable in losses caused during shipment.**



Warning: Lifting lugs on tanks / columns, if present, are only for handling of the tanks / columns if they are detached from the PSA oxygen generator or by the pipes. The PSA unit is not to be lifted by the lifting lugs on columns. The PSA oxygen generator must be lifted by the skid, with a suitable lifting device operated by a certified or trained operator. Take the necessary precautions to avoid units tipping over during handling.

The PSA oxygen generator columns must be pressurized to protect the molecular sieves from ambient moisture.



Important: Upon receiving your Oxymat PSA oxygen generator, inspect the unit thoroughly for signs of damage. Any signs of damage, either external or internal, should be noted on the delivery receipt, and also reported immediately to both the Freight Company and Oxymat. Contact Oxymat at Tel +45 4879 7811 / Fax +45 4879 7813 or Tel +421 32 779 0123 / Fax +421 32 779 0125. *The manufacturer is not liable in damage caused during shipment.*

4.3 Pre-installation instructions

It is necessary to consider the location, space available, air supply, and power supply prior to installing your Oxymat PSA oxygen generator.



Important: For safe installation and operation etc. of compressor, air dryer or other equipment refer to manuals concerned for the equipment.



Important: Air compressor air intake must be free of damaging contaminants such as:

- dust, fine sand, fibres ...
- chemically instable gases and vapours (ammonia, chlorine, hydrogen sulphide etc.)
- Increased level CO and/or CO₂,

Recommendation: PSA Oxygen generator system should be installed in sound insulated room.



Warning: Oxygen is a powerful oxidizing agent. It can cause fire or explosion. Observe strict cleanliness procedures when fabricating and connecting the oxygen piping. It is imperative that PSA oxygen systems be properly cleaned and inspected to ensure that no combustible materials remain in the connecting piping and fittings. Do not allow the free flow of oxygen from the PSA oxygen generator or from product tank.

4.3.1 Location

The PSA oxygen generator must be located in a well-ventilated indoor area which remains **above 5°C and below 45°C T(S)**. Operating the PSA generator in an area below 5°C or above 45°C, **could cause damage not covered under the manufacturer's warranty.**



Warning: Condensation Warning

- **Important:** Certain components of the device may become cold during operation. In environments with high humidity and low ambient temperature, this can lead to the condensation of moisture from the air.
- **Precaution:** The user is responsible for ensuring that the device is operated in conditions that prevent condensation. Do not use the device in environments where humidity or temperature levels may cause moisture to accumulate on or within the device.
- **Note:** Condensation may negatively affect device performance or safety. The manufacturer is not responsible for damage resulting from unsuitable environmental conditions.

Physical PSA oxygen generator characteristics (space requirements) for 2-Column system:

Physical PSA oxygen generator characteristics							
Model type	Floor space [cm x cm]	Height [cm]	Load [kg]	Model type	Floor space [cm x cm]	Height [cm]	Load [kg]
2-Column							
O10	55x45	145	155	O20	65x50	147	180
O40	65x50	145	200	O60	50x65	195	255
O70	58x65	192	336	O100	65x75	188	402
O190	78x80	204	647	O280	93x93	220	879
O430	115x115	222	1245	O640	134x125	232	1747
O880	153x135	240	2452	O1250	183x140	242	2985
O1500	140x183	284	3384				
X-version							
O880 X2	165x270	240	4940	O1250 X2	195x280	242	6000
O1500 X2	195x280	284	6800				

Table 10. PSA Oxygen Generator characteristics.

* Total weight of the X-version system excludes frame weight for frame built solutions. Add 2700kg for 20ft, 1800kg for 15ft and 1400kg for 10ft frame construction.

Physical product tank characteristics (space requirements):

Product tank sizes			
Model type	Volume [l] / Diameter [mm]	Model type	Volume [l] / Diameter [mm]
PT090	90 / 300	PT150	150 / 400
PT320	320 / 500	PT470	470 / 600
PT750	750 / 750	PT1000	1000 / 863
PT1500	1500 / 863	PT2000	2000 / 1100
PT3000	3000 / 1280		

Table 11. Size of product tank. Please, consult Oxymat for further details.

Exhaust pipe connections in mm:

Exhaust pipe connections			
Model type	Diameter Ø [mm]	Model type	Diameter Ø [mm]
2 column			
O10	150	O20	150
O40	150	O60	150
O70	150	O100	150
O190	150	O280	200
O430	200	O640	200
O880	250	O1250	250
O1500	250		

Table 12. Exhaust pipe connections

4.3.2 Air supply (Feed air)

Air from your compressor or feed air supply must be less than 40°C, T(O)-max, before it reaches the PSA oxygen generator. High feed air (operating) temperature will reduce the performance of the PSA oxygen generator and will cause damage not covered under the manufacturer's warranty. Low feed air (operating) temperatures may cause freezing of components and damage not covered under the manufacturer's warranty.

 **Warning:** The compressor, product tank or other feed air supply and pressurized equipment must be fitted with adequate protective devices to protect against exceeding allowable limits of the concerned equipment e.g. safety relief valves. Feed air supply must be protected against exceeding the maximum allowable pressure P(S) for Oxymat PSA oxygen generators. The safety relief valves on PSA generator columns and product tank (if supplied) are solely for the protection of these components.

The feed air quality must comply with ISO specification 8573-1:2010 class 1.4.1., e.g. maximum number of particles per m³ is as following:

class	Maximum number of the particles per m ³				Moisture	Residual Oil
	Particle size, d [µm]				Max. pressure dew point (PDP) [°C]	Max. concentration [mg/ m ³]
	d ≤ 0,1	0,1 < d ≤ 0,5	0,5 < d ≤ 1,0	1,0 < d ≤ 5,0		
0	As specified by the equipment, user or supplier and more stringent than class1					
1	Not specified	≤ 20 000	≤ 400	≤ 10	- 70	0,01
2	Not specified	≤ 400 000	≤ 6 000	≤ 100	- 40	0,1
3	Not specified	Not specified	≤ 90 000	≤ 1 000	- 20	1
4	Not specified	Not specified	Not specified	≤ 10 000	+ 3	5
5	Not specified	Not specified	Not specified	≤ 100 000	+ 7	> 5

Table 13. Feed air quality

Dew point +3°C & residual water content max. 6 g/m³ and residual oil content max. 0,01 mg/m³.

 **Warning:** Use only hoses and pipes of correct size and suitable for operating pressure and fluid. Never use hoses, which are frayed, damaged or worn. Always use the correct type and size of connections. Make sure hoses are depressurized before disconnecting.

 **Warning:** All tubes, hoses and piping used for oxygen must be compatible with oxygen and cleaned for oxygen service.

The connections of hoses, if used must be done with high quality connection systems, e.g. a clamp system or compression end fittings depending on the type of hose applied.

It is not recommended to use ordinary hose clips.



Important: All hoses and piping must be routed out of harm's way and secured to prevent accidental pulling of hoses piping or connections.

The hose/piping used to bring air from the compressor to the air tank and from the air tank to the PSA oxygen generator should be dimensioned to supply the needed feed air flow at a pressure between 6,0 - 8,5 bar(g). The dimensions must at least be:

Minimum dimensions on feed air hoses/pipes			
Model type	Dimensions [DN]	Model type	Dimensions [DN]
2 column			
O10	20	O20	20
O40	20	O60	20
O70	20	O100	20
O190	25	O280	25
O430	40	O640	40
O880	40	O1250	40
O1500	40		
X version			
O880 X2	DN50	O1250 X2	DN50
O1500 X2	DN50		

Table 14. Air inlet connections

Connection size may vary with flow and purity.

With a properly dimensioned hose/piping, the feed air pressure must not be less than pressure specified by Oxymat. The use of an improperly size of hose/piping will result in reduced oxygen generating capacity.

It is recommended to have a shut off valve installed where the air inlet hose/piping is connected to the compressed air supply or if present on the air tank to facilitate safe depressurization of the hose/piping before removal of connections.

4.3.3 Power supply



Warning: The interior of the cabinet contains electrical parts that may produce electrical hazard if not handled properly. To prevent electrical shock, care must be taken when servicing this equipment. In general, electrical installation and servicing is to be performed by a qualified and licensed electrician only.

1. 110-240V, 50-60Hz, single phase,
Proper voltage must be provided to the PSA generator at all times.
type of network - TNC or TNS or TNC-S (Refer to page 11, label on el. Cabinet)
Maximum fuse on power supply 10A
Improper voltage will cause damage not covered under the manufacturer's warranty. To protect your PLC on the PSA generator Oxymat recommend the use of electrical filters.
Please refer to CE plate inside PSA control system.
2. Power should be supplied to the unit from **a grounded electrical outlet with a 3-prong plug**. It is recommended to use a circuit that will not be accidentally turned off, as this will cause the PSA unit to stop cycling. If power is off and the PSA unit is being used, the product tank will depressurize.
3. In order to prevent production stop and purity drop in case of electric power failure, a UPS (power backup) is recommended as an option.

4.4 Installation

Unpacking and handling in general:

On receipt of the aggregate, check that the individual parts correspond with those listed on the delivery note.

The packaging serves to protect the machine until it is installed and protect it from transportation damage, corrosion and other damage. Therefore, do not disturb packaging and remove it right before installation. When unloading, check immediately for possible damage to all parts, such as dents, scratches, corrosion, torn electric cables, bent pipes, or the like. In case of defects or damage, the carrier and supplier shall be informed immediately.

The aggregate shall only be lifted according to suppliers instructions, and in case of compressor/air dryer delivery, special care must be taken to the instructions noted in the compressor suppliers manual. In order to avoid squeezing of instruments, piping, etc., use a suitable lifting device.



Warning: The PSA oxygen generator columns must be pressurized to protect the sieves from ambient moisture.

Placement of aggregate:

Place all the main parts in their final positions. Make sure that sufficient space between parts is available for maintenance and inspection. Up-line the parts to proper horizontal and vertical positions and anchor all parts to the concrete floor by means of anchor bolts or like.



Warning: Exhaust gas from the PSA oxygen generator contains only 8-21 % oxygen. Exhaust gas must be piped out of the room to outside. Failure to do this may risk in serious damage or death. The room must always be well ventilated

- OPTIONAL - For on-line back up or product tank needs, we recommend that backup oxygen is connected directly on the oxygen outlet string (through a check valve), and that the pressure on the backup oxygen is approximately 0.3 kg/cm² below the regulator setting on the oxygen PSA generator.



Warning: Make sure that your back-up/emergency oxygen supply is installed with an oxygen pressure regulator the pressure must be set according to pressure levels stated in Design Review Certificate.



Very important: Check all connections for leaks using an oxygen compatible leak detecting solution.



Make all the installations and note the cautions mentioned above.

Configuration: New or existing - compressor, air dryer, coal tower with oil mist adsorber, air tank; new oxygen PSA oxygen generator; new or existing product tank, high pressure compressor

- 1.1 For the compressor installation – follow the instructions in the compressor manual – **read this manual before installation!!!**
- 1.2 Connect air hose/pipe from compressor outlet to air dryer inlet
- 1.3 Connect air hose/pipe from air dryer outlet via the pre-filter and the micro-filter (new or existing) to the inlet port at the top of the coal tower.
- 1.4 Connect the coal tower (oil mist adsorber) equipped with a second micro-filter to the inlet of air tank. The coal tower inlet is placed on top of the tower, and the outlet is placed at the bottom of the tower.
 - If the delivery includes a separate air tank, the coal tower is placed between the air dryer and air tank.

- If the air tank is an integrated part of the compressor, the coal tower location is after the air tank, and the auto drain valve is in this case placed on the side of the air tank instead of the bottom of the tank

- 1.5 Connect air hose/pipe from bottom of coal tower to inlet valve of the air tank.
- 1.6 Connect air hose/pipe from an upper port on air tank to inlet of PSA generator.
- 1.7 Connect product hose/pipe from PSA generator outlet valve on top of generator to the product tank bottom valve
- 1.8 Also connect your oxygen application/consumption to the pressure regulator on top of the product tank. In case of medical device - after product tank and pressure regulator is placed particle filter and bacterial sterile filter
- 1.9 High pressure compressor, connect oxygen hose/pipe from product tank to high pressure compressor. **Always check type of connection to high pressure compressor before installation.**

Installation connections between supplied parts and existing equipment follow sizing instructions.

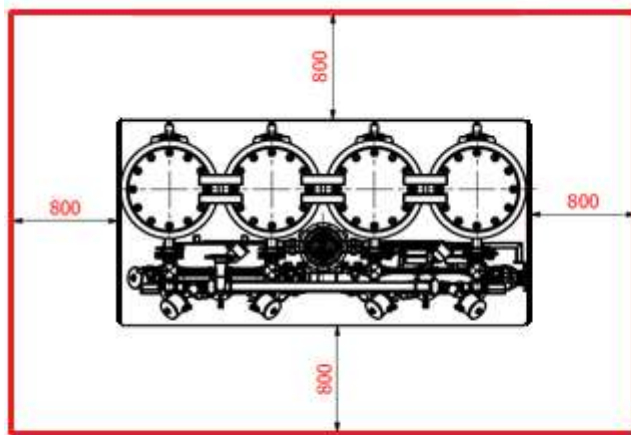


Important: Oxymat recommend installing one way valve after product tank.

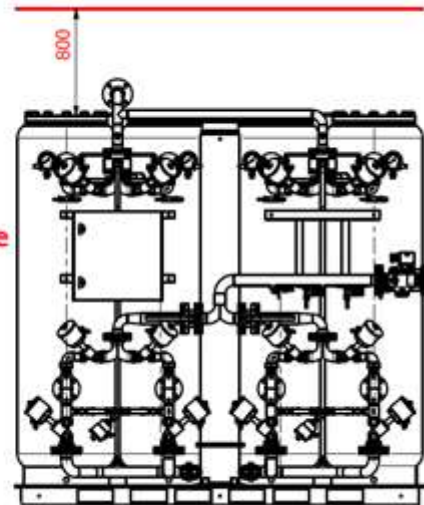
One way valve installed after product tank may reduce risk of system (generator) damage, in case of back flow from equipment installed applications down stream of product tank.

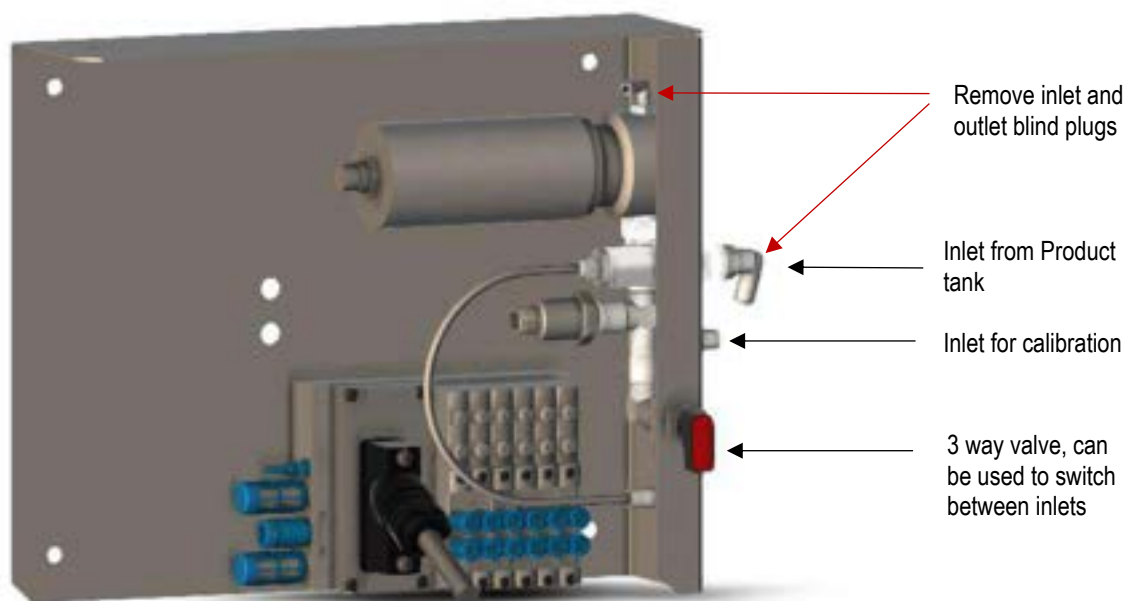


Important: Keep at least 800mm maintenance space from each side of PSA.

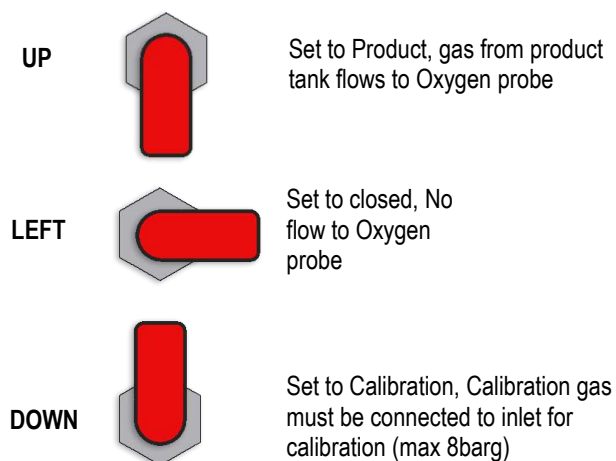


Maintenance Area



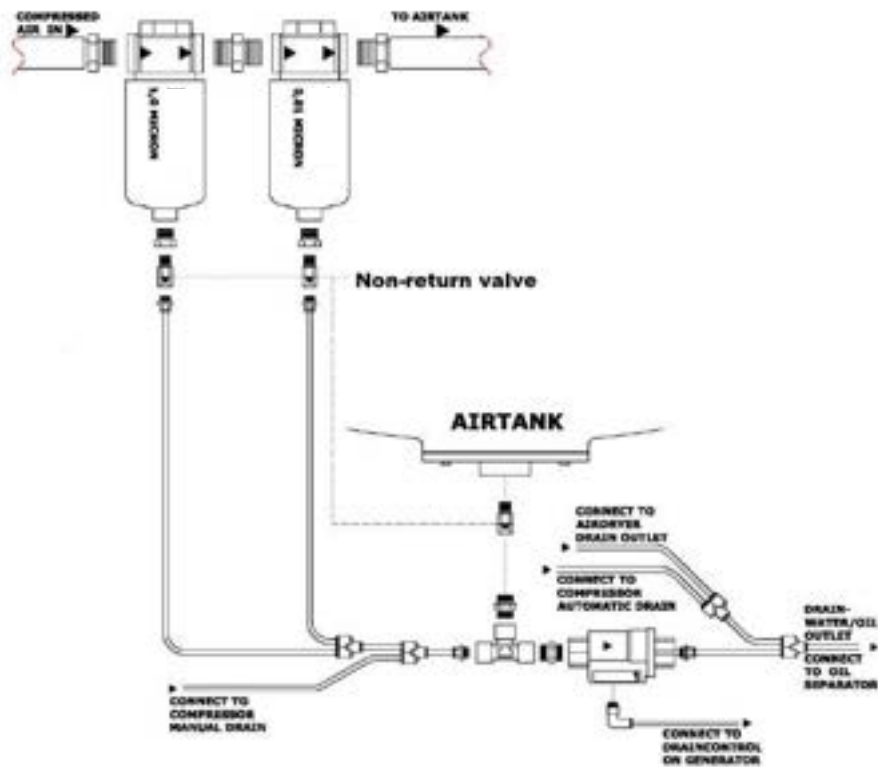


3 way valve switch positions:

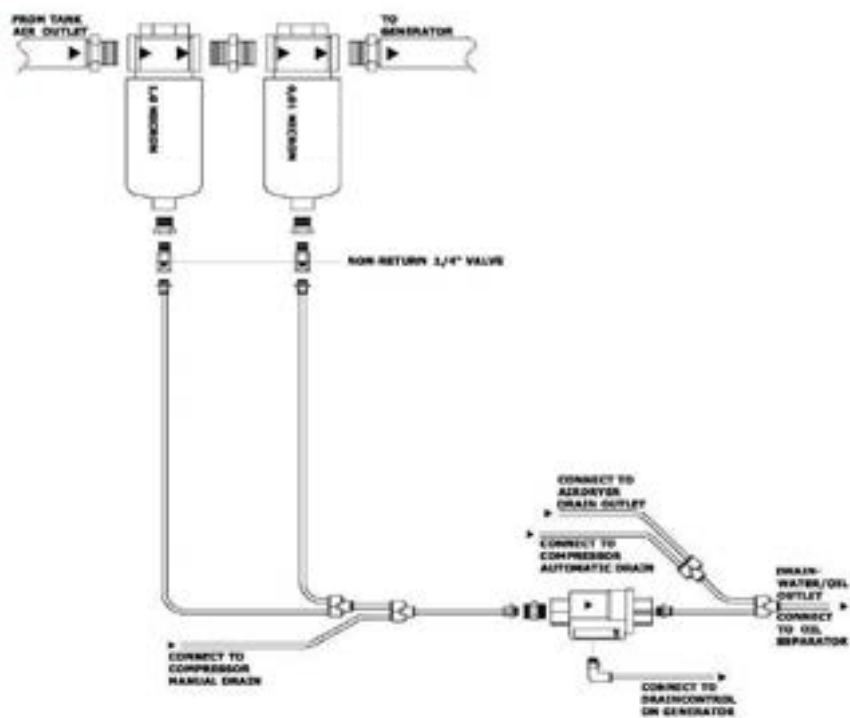


Picture 12. Oxygen Monitor

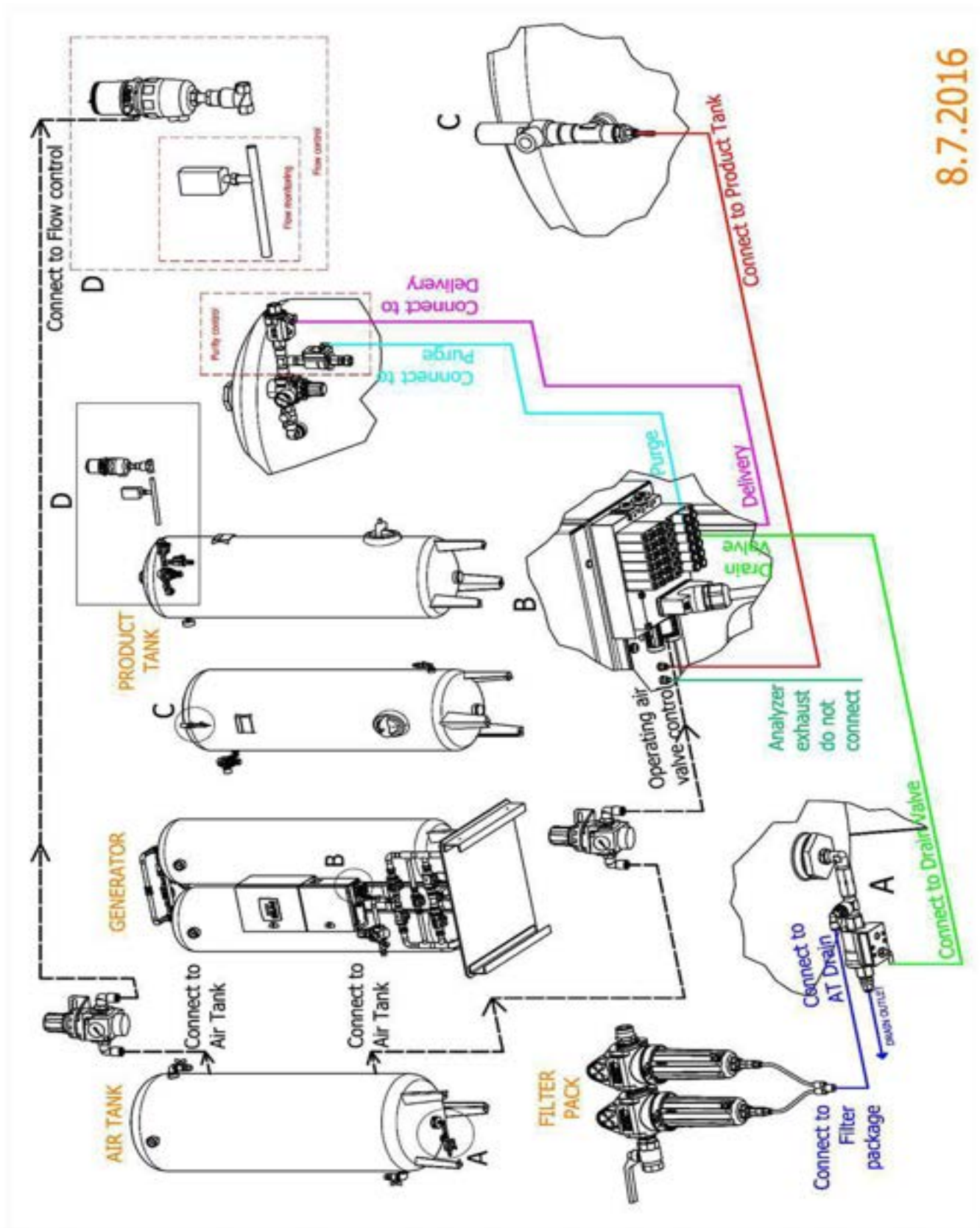
Optional drain system might be available.



Picture 13. Drain system – separate air tank



Picture 14. Drain system – compressor mounted air tank



Picture 15. Instruments hose connection



Instruments hose connection – for more information follow wiring diagram.

5 Operation



5.1 Initial start-up procedure

To start the PSA oxygen generator for the first time, follow the steps below:

1. Remove transport brackets at the air dryer (if present).
2. Turn on the power supply to the air dryer (if present).
3. Allow the refrigeration air dryer temperature to stabilize at the pre-set value $+3^{\circ}\text{C}$
4. Remove transport brackets at the compressor (if present).
5. Turn on the power supply to the compressor (if present).
6. Make sure, that all shut off valves between the plant items are open
7. Let the compressor keep running and observe that the compressor shifts to unloaded operation, when the compressor pressure has reached the pressure stop set point.
8. Carefully and gentle open for feed air supply to the PSA generator.
9. Turn on the electric power supply to the PSA generator.
10. Start PSA generator by pressing START button (IntelliControl) or by pressing manual on/off button (DCP controller only). Refer to control system manual.
11. *Ensure that the drain system works properly* by checking, that air vents from the drain water outlet for about 3 second every 5 minutes.
12. Be aware that air and condensate might be exhausted automatically from compressor and air dryer during start up – this is not a malfunction.
13. Safety valves check according to chapter 6.12
14. Shut off the oxygen application/consumption and *prepare for Leak test*:
 - a. Let the plant run in manual mode, until the product tank pressure reaches a minimum of 5 bar.
 - b. Stop PSA generator, and the PSA generator will stop after a little while, when the actual operation cycle is completed.
 - c. Shut off the feed air supply.
 - d. Check if 3 way valve on Oxygen monitor is set to CLOSED position (See picture 12.)
 - e. Read and note the pressure P1 in product tank, column 1, column 2, and air tank.
 - f. Let the plant stand still (rest) and isolated in pressurized condition for an hour.
 - g. After an hour read and note the pressure P2 in product tank, column 1, column 2, column 3 (if available) and feed air tank.
 - h. Then determine an eventually pressure drop as the difference between P1 and P2 for each component.
 - i. For identification of leaks, use appropriate leaktest fluid on the joints.
 - j. *The Leak test is right, if the pressure drops after one hour pressurized isolation is less than 0.1 bar(g). In case of leaks they must not cause more than 0.1 bar(g) pressure drop per hour.*
15. To obtain the design purity in product tank purge the tank with oxygen as follows:
 - a. Check that oxygen consumption is closed off.
 - b. Open up for flow from feed air supply/compressor.
 - c. Start the feed air supply/compressor.
 - d. Start the PSA oxygen generator and let it run for about 15 minutes.
 - e. Set 3 way valve on Oxygen monitor to PRODUCT position (See picture 12.)
 - f. Check that pressure in product tank reaches the value stated in Design Review Certificate.
 - g. Open for oxygen consumption. Adjust flow to approximately to 50 % of design flow (refer to Design Review Certificate).

- h. Let the generator run in manual mode until design purity is reached. Duration 0.5 - 8 hours depending on purity and capacity.
 - i. When design purity is reached close off oxygen consumption switch PSA generator to auto mode and let the PSA oxygen generator run until it stops automatic. This should occur within 10 minutes. If the generator does not stop as described refer to section for pressure set point procedure.
16. At the end of this period, observe the feed air pressure gauge and the cycle pressure gauge on the PSA generator for at least 5 complete cycles, to make sure that the PSA oxygen generator starts and stops within the allowable limits, as follows:
- a. **Observe that the feed air pressure should be no less than stated by manufacturer.**
 - b. **Observe that the peak cycle pressure should not increase above stated by manufacturer (Design Review Certificate).**
17. Now *the plant is ready for normal operation.*



Important: If the system is equipped with purge system – purity control (optional), the system will automatically ensure a proper ventilation of the system.



Important: When the generator is being started up for the first time, or after a long shut-down period, it is possible that the product tank is contaminated by ambient air. Before the PSA oxygen generator can supply oxygen of design purity, any gas in the product tank must be purged out.



Warning: Always exhaust oxygen to the outside atmospheric air. While exhausting oxygen, make sure there is no smoke, spark or open flame nearby. Do not allow exhausted oxygen to come in contact with clothing or hydrocarbon materials.

Product purity (O₂) – indicate the purity in the product tank. The purity is controlled by purity alarm. If the purity level drops below the alarm settings, an alarm is executed. If the purity level drops below the purity stop settings, then the PSA unit will perform a controlled stop.

Product gas quality – please consider, that Oxymat is choosing most suitable filters to reach required product gas quality. If filters are not supplied by Oxymat, choose filters according Oxymat recommendation, otherwise Oxymat cannot guarantee product gas quality.

5.2 Operation

The PSA oxygen generator can operates in auto mode (Manual mode available for DCP control) or can be in stand-by mode. Service mode is available for service personnel only, protected by password.



Refer to touch screen control manual.

5.3 Normal start-up

- Turn on the air dryer power supply (if present)
- Allow the refrigeration air dryer temperature to stabilize at the pre-set value +3°C
- Turn on the compressor power supply (if present), or open for the central compressed feed air supply
- Observe that the feed air pressure is above the minimum pressure requirements.
- Turn on the power supply to the oxygen PSA generator
- Start PSA generator
- Observe that the drains are working
- Observe that the peak cycle pressure do not exceed the value stated Design Review Certificate
- After a while observe that the PSA generator automatically stops, when the product tank pressure reaches pressure set point stop stated by manufacturer in Design Review Certificate
- Further observe that the PSA generator automatically re-starts after about 0.5 pressure drop unless stated otherwise by manufacturer. If the PSA generator does not start or stop like this see section for pressure set point procedure and adjustment

5.4 Shut-down

1 Turn of oxygen application/consumption

Close off central oxygen application/consumption. This will insure that the product tank is full the next day even if oxygen discharge valve is left open.

Ensure that the mode selector switch is in the AUTO position and wait until the PSA generator stops cycling. This allows the product tank to fill completely with oxygen for immediate use required. It also allows the unit to shut down at the proper point in the cycle.

NOTE: Failure to wait or immediate or accidental stop of operation during a cycle will result in temporary lower oxygen purity during subsequent use.

2 Turn off Power

- Stop PSA
- Turn off the compressor power switch (if present)
- Turn off the air dryer power switch (if present)
- Turn off the PSA generator power switch

5.5 Extended shut-down

To shut down the Oxymat PSA oxygen generator for 24 hours or longer, complete all steps in Section 5.3 – Shutdown. In addition perform the following:

Fully close all manual valves to isolate the oxygen in the product tank, to prevent the loss of pressure in the product tank, in order to enable a normal start-up. Turn off all electric powers, e.g. on compressor, air dryer and PSA oxygen generator.

Keep columns pressurized and sealed to protect contained molecular sieve against ambient moisture.

If PSA oxygen generator is fitted with purity monitoring probe, close the 3-way valve on probe inlet.

Storage conditions refer to chapter 9.

5.6 Start-up after an extended shut-down

After an extended shutdown or an unexpected shutdown, such as an electric power failure, you must purge the product tank of any low purity oxygen before the oxygen PSA oxygen generator can supply oxygen within the purity specifications.

To purge the product tank, follow step 15 in section – Initial start-up procedure.



Important: If the system is equipped with purity control and valve kit (optional addons), then control system will automatically ensure a pre-set purity.

6 Maintenance



Warning: The interior of the cabinet contains electrical parts that may produce electrical hazard if not handled properly. To prevent electrical shock, care must be taken when servicing this equipment. In general, electrical installation and servicing is to be performed by a qualified and licensed electrician only.

Monitoring the operation of the unit on a regular schedule is the best way to insure a long life for your Oxymat PSA oxygen generator. External and internal inspection of tanks/columns and other pressurized equipment must be carried out according to local regulations.



Refer to the concerned manuals of the equipment for service instructions.



For medical devices refer to chapter 6.14.

6.1 Daily inspection

- Every day observe the operation of the PSA oxygen generator system
- Check purity and product consumption and if applicable CO, CO₂ and dew point level.
- Verify that the temperature displayed on the refrigeration air dryer is +3°C. If the air tank is assembled with DEW POINT transmitter check the real dew point value.
- Make sure that the automatic drain system and air tank drain system is functioning properly (press DRAIN test button in PSA controller menu to check this function)

Observe that the filter drain port and air tank drain port is not clogged. Air should discharge from these ports for 3 seconds every 3 to 7 minutes (it depends from actual time settings) when the PSA generator is cycling.

Clogging of the drain systems will cause water/oil carry-over into the adsorber columns and will cause severe damage to the molecular sieve which is not covered under the manufacturer's warranty.

6.2 Weekly inspection

The weekly inspection of the PSA oxygen generator system consists of a daily inspection point, plus:

- Check oil level and operating temperature on the air compressor
- Check function of refrigeration dryer
- Check filter elements placed after the refrigeration dryer, pressure differential gauges on the filter elements must not be in red area at any time of operation.
- Air compressor maintenance (clean procedure of air/oil after-cooler)
- Air dryer maintenance (clean procedure of cooler)
- Check settings for pressure reduction valves (refer to chapter 7.2)

After-cooler clean procedure

- With an air jet (max. 2 bar) blowing from inside towards outside clean the cooler of air dryer and air compressor
- Repeat this operation blowing in the opposite way

!!! Be careful not to damage the aluminium fins of the cooling package.

6.3 Biannual PM – or every 4 000 working hours

The half-year Preventive Maintenance of the PSA oxygen generator system consists of:

- Service of air compressor according to manufacturer's manual (filters and oil replacement, etc...)
- Service of air dryer according to manufacturer's manual (drain and strainer cleaning, etc...)
- Replacement of pre-filter 1µm and micro filter element 0,01µm, see chapter 6.9
- Gas analyser maintenance according to manufacturer's manual - calibrate if necessary
- Safety valves maintenance according to chapter 6.12

6.4 Annually PM – or every 8 000 working hours

The Annual PM of the oxygen generator system consists from the points of half-year PM, plus:

- Air package maintenance according to manufacturer's manual (filters, oil replacement, oil separator etc...)
- Safety valves maintenance according to chapter 6.12
- Coal tower maintenance- replacement of active coal, oil indicator and micro-filter, see chapter 6.8
- Air tank - Inspection of drain system; each non-return valve has to be cleaned and checked for damage (replace if needed); axial drain valve has to be cleaned and re-greased – replace if needed
- PSA oxygen generator - whole system has to be inspected for function, damage, leakage (solenoid valve block, hose/pipe connection, all axial valves etc...); process valves has to be cleaned and re-greased (Klüber Klubertemp 92-302 or similar grease has to be used for O₂ applications); inspection of strainer, nylon filter replacement and; inspection of the status of molecular sieve - replacement of 2" O-ring/lid gasket
- Product tank – 1µm dust filter element or OMED upgrade filter elements (sterile and particle filter) have to be replaced, see chapter 6.9
- Fan filter cleaning or replacement – if present
- Gas analyser maintenance according to manufacturer's manual, replacement of inline filter.

6.5 Two years maintenance – or every 16 000 working hours

The 2 years PM consists from the points of annual PM, plus:

- Replacement of top brass filters (1" DN25 connection)
- Replacement of fan/cooler in control cabinet - if present

6.6 Three years maintenance – or every 24 000 working hours

The 3 years PM consists from the points of annual and 2 years PM, plus:

- Replacement of HDM solenoid valve block
- Replacement of main inlet pressure regulator
- Process valve replacement

6.7 Four years maintenance – or every 32 000 working hours

Same as 2 years. Refer to chapter 6.5

6.8 Five years PM – or every 40 000 working hours

The 5 years PM consists from the points of annual PM, plus:

- Molecular sieve replacement is recommended
- Internal inspection of process columns
- Top brass filter replacement (1" DN25 connection)

6.9 Filter element replacement

The expected lifetime of the pre-filter elements is 6 months or 4.000 working hours with proper maintenance of air compressor.

The expected lifetime of the micro filter elements is 6 months or 4.000 working hours with proper maintenance of air compressor and pre-filters.

It is recommended to replace active coal in coal tower annually. At the very latest – when the oil indicator mounted on coal tower turns red.

Improper compressed air quality could affect the operation of your PSA oxygen generator. The filter element(s) supplied with each unit have been selected by manufacturer based upon the units feed air requirements.



Caution: The following can cause damage not covered under the manufacturer's warranty:

- Feed air (operating) temperature T(O) above 40°C or below 5°C.
- Water, oil, rust, scale and/or other foreign objects carryover in the feed air can damage filter elements and/or plugged drains.



Warning: OXYMAT prefilter 1µm and microfilter 0,01µm elements have been selected based upon their ability to function in severe operating conditions. Filters has to be chosen according Oxymat recommendation, otherwise Oxymat cannot guarantee product gas quality. Use prefilter and microfilter to reach feed air quality to comply with ISO specification 8573-1:2010 class 1.4.1.



Warning: Do not attempt to remove the filter bowls unless the units cycle pressure gauge reads zero and the rubber hose from the filter elements is disconnected slowly to release pressure.

Note that the first filter from the air inlet port is the pre-filter and the second filter is the micro filter.

Filter element replacement

1. Close off feed air supply to PSA oxygen generator.
2. Carefully disconnect the 4/6 mm drain tube the bottom of the filter to depressurize.
3. Turn the filter element counter clockwise and remove the element.
4. Remove check valve form old filter element and install the check valve on the new filter element.
5. Install new filter element with check valve.
6. Reconnect tube to the check valve at the bottom of the filter element.
7. Perform a leak test.

Coal tower annual maintenance

1. Stop Oxymat PSA oxygen generator and air compressor
2. Close the manual ball valves behind the air dryer and front of the air tank
3. Depressurize unit (open safety relief valve slightly)
4. Disconnect hose/piping connection from the coal tower
5. Remove top filter coupling unit (turn it counter clockwise)
6. Use a suitable vacuum cleaner and suck out all the active coal
7. Perform a coal tower maintenance
8. Use a suitable funnel and fill the coal tower with new active coal (leave approx. 15-20cm free space on top of the tower)
9. Refit the top filter coupling unit applying a new sealing
10. Refit hose/piping connection
11. Close manual ball valve on the bottom of tower and remove micro filter element
12. Pressurize the tower from top to approx. 5 bar and after pressure is reached, totally discharge tower through manual bottom ball valve
13. Repeat this procedure until the coal dust is completely blown out from the tower
14. Install new filter element and replace oil indicator
15. Perform a leak test

6.10 Tank / column maintenance



Warning: Tanks must be depressurized and purged thorough with air to remove all gasses before service or inspection. Always vent oxygen to outdoor atmospheric air.
Make sure there is no smoking or open flame.



External and internal inspection of tanks / columns and other pressurized equipment must be carried out according to local regulations.

If molecular sieve is going to be replaced inspect columns for corrosion or other damage. Replace if needed. Refer to sieve material safety data sheet for handling and safety instructions of sieve.

Product tank should be inspected internal every 4 years or according to local regulations.

6.11 Valve maintenance

All valves should be inspected, cleaned all VIP / axial valves have to be lubricated within period of 12 months or after 8.000 operating hours. Important notice:

Valve cleaning and lubrication

1. Stop the PSA oxygen generator.
2. Close off feed air supply to PSA oxygen generator.
3. Close and disconnect product tank.
4. Depressurize the columns by opening safety valves.
5. **NOTE! The columns must never be left unpressurized more than 2 hours.**
6. Carefully disconnect and remove the upper and lower pipe set.
7. Seal the inlets of the columns by using tape to avoid any contamination of column content by the moist.
8. Disassemble the pipe sets and disassemble the valves.
9. Remove all the particles, dirt, residual grease etc. from inside the valve.
10. Clean and lubricate the valve (Klüber Klubertemp 92-302 or similar grease has to be used for oxygen applications).
11. Reinstall the valve as well as the pipe sets.
12. Perform a leak test.

6.12 Safety valves maintenance

Always wear personal protection of hearing, hands, eyes etc.

To make sure that the safety valves continue to operate in good working condition, these must be periodically tested. To do this, open the valve manually using the opening nut or lever; this test must be done while keeping the protected appliance at a pressure between 80 and 90% of the valve calibration pressure. The valve must open cleanly, and release an abundant amount of fluid, and must then close fully once the lever has been released or the nut tightened. The operation must be short and performed just once. The interval depends on the conditions of the installation (probability of the valve becoming fouled with dirt).

Test the start-up of the plant and then follow the provisions of rule and / or law of the country of installation

The average life of the safety valves, in the specific operating conditions they have been designed for, is 24-36 months for valves with elastomer seal seats, and 36-48 months for valves with metal or PTFE seal seats. At the end of this period, replacement or an external visual check must be performed to make sure that the valves are in good condition (no serious oxidation - erosion and with the slits/discharge connections free of blockages). If there is no evident oxidation, erosion, fouling and/or damage due to external causes, the average life is extended by the same period as described above.

6.13 Service check list

When performing the stated monitoring/maintenance, it will be necessary to follow and use the Service check list shown on next page.



Warning: When servicing control valves use only lubricant suitable for oxygen service. Use Klüber Klubertemp 92-302 or similar.

Never use oil, grease or other lubricant not designed for oxygen. Such lubricants can self-ignite or explode in contact with oxygen.

Type: _____		Installation	every 4 000 hours	every 8 000 hours	every 16 000 hours	every 24 000 hours	every 32 000 hours	every 40 000 hours
Series no: _____								
1	Check/Service of air compressor according to manufacturer's manual	x	x	x	x	x	x	x
2	Check/ service of air dryer according to manufacturer's manual	x	x	x	x	x	x	x
3	Check of pressure in air tank, column tanks and product tank	x	x	x	x	x	x	x
4	Check of cycle time and cycle interval	x	x	x	x	x	x	x
5	Check of product purity reading	x	x	x	x	x	x	x
6	Check of product consumption (flow)	x	x	x	x	x	x	x
7	Check of drain system	x	x	x	x	x	x	x
8	Service of drain system - valve replacement if required			x	x	x	x	x
9	Replacement of particle filters (pre-filter and micro-filter)		x	x	x	x	x	x
10	Replacement of micro-filter after coalescing tower			x	x	x	x	x
11	Replacement of active carbon and oil indicator			x	x	x	x	x
12	Replacement of micro filter and sterile filter/bacterial filter			x	x	x	x	x
13	Inspection of pressure regulators		x	x	x		x	x
14	Replacement of pressure regulators					x		
15	Replacement of Nylon filter at pressure regulator (if applicable)			x	x		x	x
16	Cleaning of strainer (if applicable)		x	x	x	x	x	x
17	Cleaning and inspection of axial valves			x	x		x	x
18	Replacement of process valves (axial and angle-seated valves)					x		
19	Check level and status of molecular sieve		x	x	x	x	x	
20	Replacement of molecular sieve recommended / on demand							x
21	Leak test	x	x	x	x	x	x	x
22	Check of safety valves	x	x	x	x	x	x	x
23	Replacement of upper/top brass filters				x		x	x
24	Replacement of bottom brass filters (together with molecular sieve)							x
25	Check of pressure gauges / manometers	x	x	x	x	x	x	x
26	Check of pipe and hose connections, cables, plugs etc.	x	x	x	x	x	x	x
27	Check of solenoid valve block for proper function and leakage	x	x	x	x		x	x
28	Replacement of solenoid valve block					x		
29	Check of O2 gas analyser / Calibrate if required	x	x	x	x		x	x
30	Replacement of O2 gas analyser					x		
31	Replacement of in-line filter (nylon filter for inlet to gas analyzer)		x	x	x	x	x	x
32	Control of product consumption / O2 delivery to end-user app.	x	x	x	x	x	x	x
33	Fan filter replacement		x	x	x	x	x	x
34	Measurement of residual gas impurities- required for medical applications only	x		x	x	x	x	x
Remarks:								

Table 15. Service check list

6.14 Medical maintenance

After each maintenance attendance/action is required to perform measurement of gas impurities in product oxygen.

Refer to table below to see max allowable volume concentration of gas impurities

Measured impurities content:			
impurity		measured value	maximum allowed value*
Carbon dioxide	CO ₂	ppm	300 ppm
Carbon monoxide	CO	ppm	5 ppm
Nitrogen monoxide & Nitrogen dioxide	NO+NO ₂	ppm	2 ppm
Sulfur dioxide	SO ₂	ppm	1 ppm
Oil	OIL	mg/m ³	0.1 mg/m ³
Dew point	°Ctpd/ppm	ppm	67 ppm
*Impurities tolerance according to European Pharmacopoeia			

Table 16. Impurities tolerance for medical oxygen.

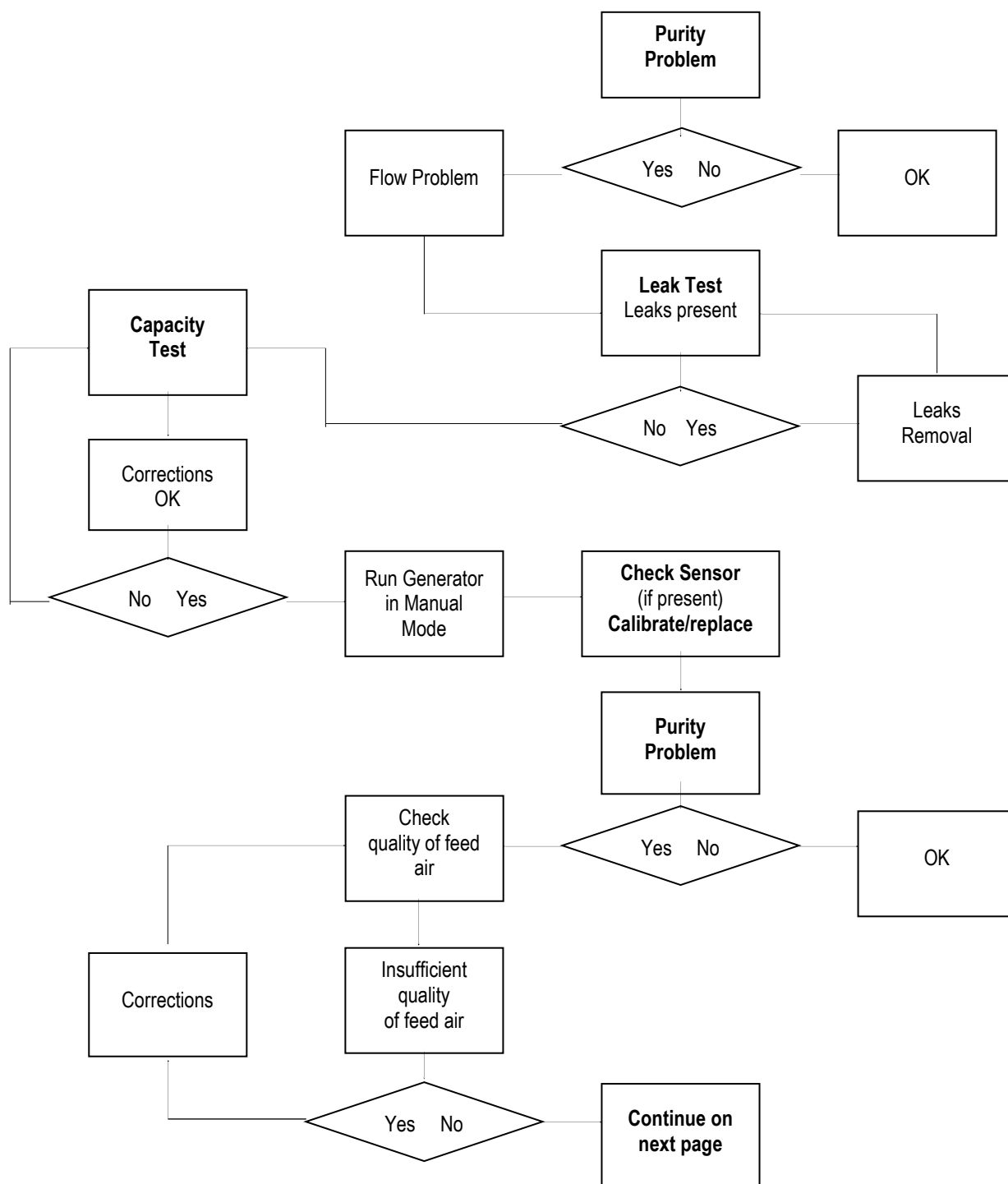
Use of Dräger gas detection tubes is recommended for measuring impurities.

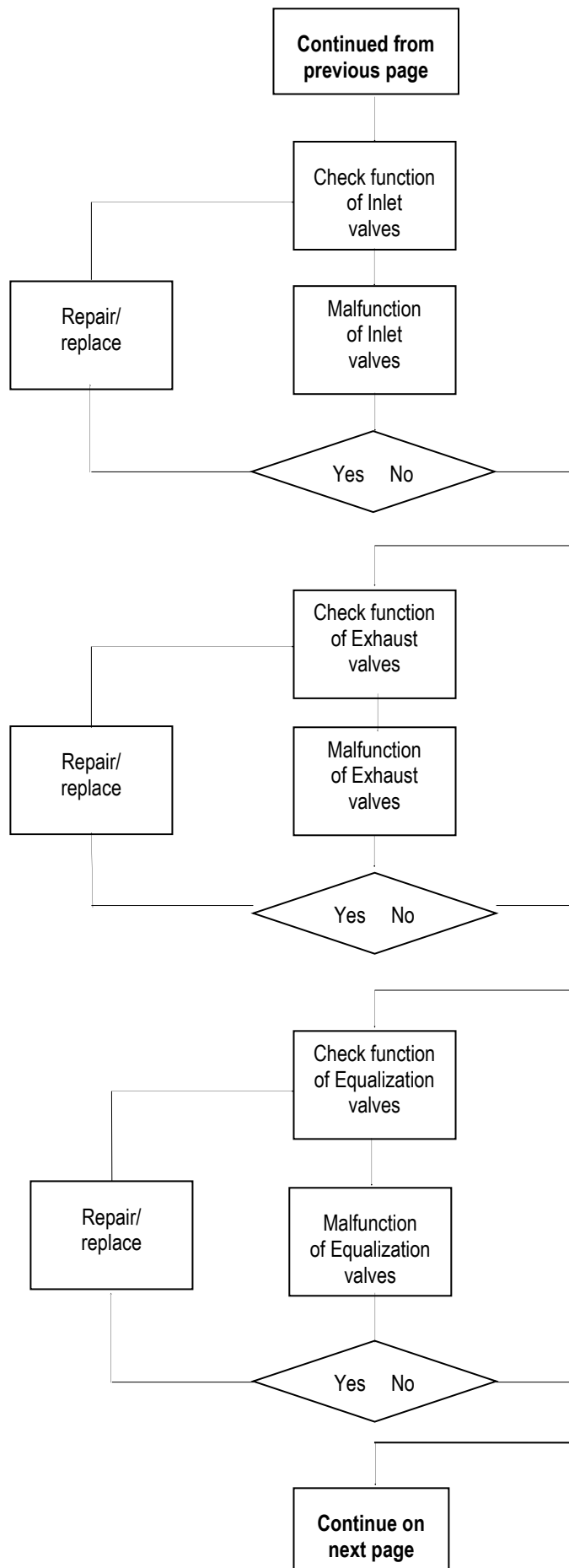
Other methods may be used, provided they offer sufficient accuracy and comply with the required detection limits.

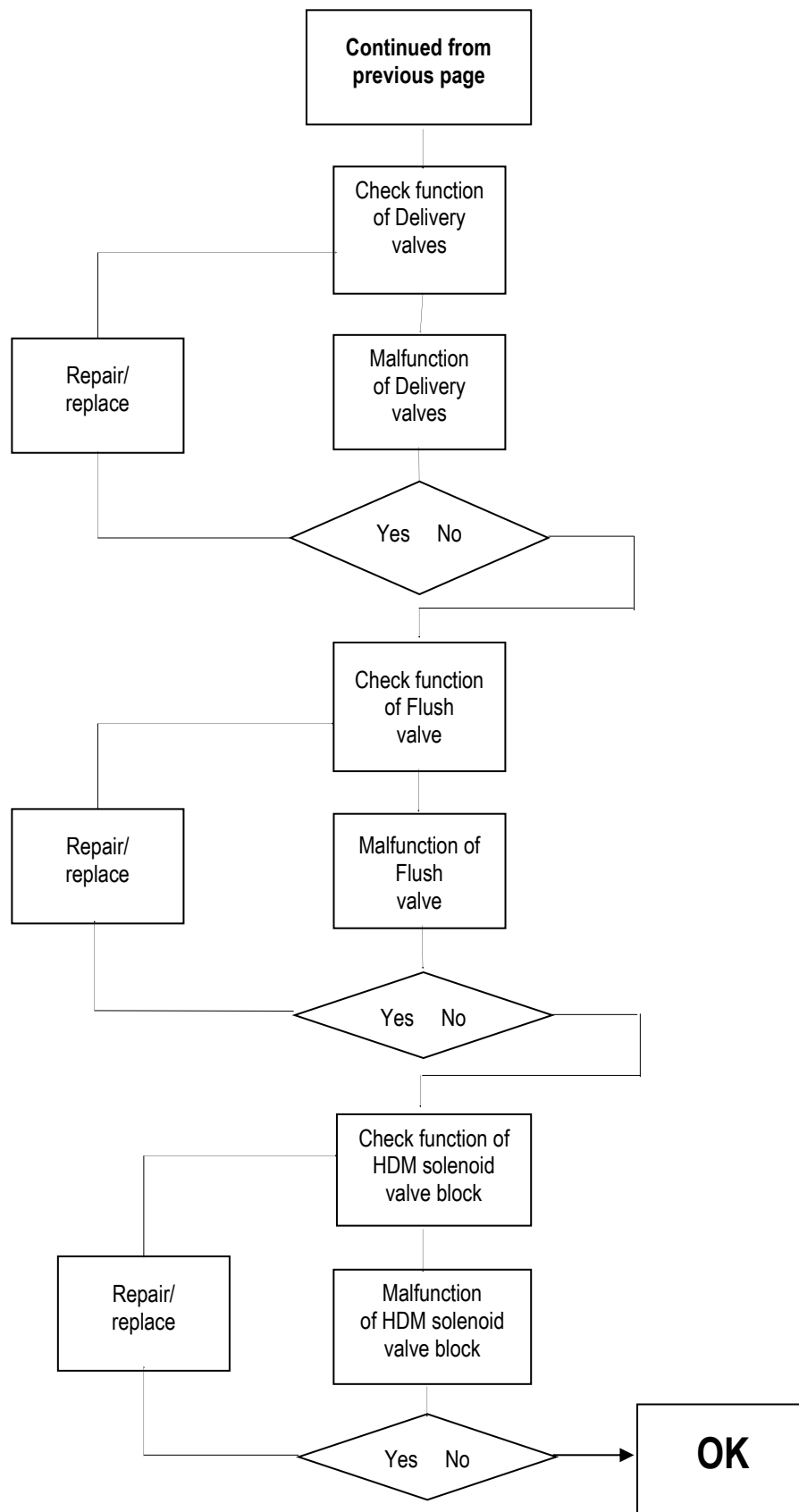
7 Troubleshooting



Most common operation failure is insufficient oxygen purity due to inadequate flow rate (capacity) caused by too heavy leakage or other capacity problems. If a purity problem occurs, it is strongly recommended at once to uncover these eventually problems before any other initiative are taken – so follow the Route Diagram shown below:







Picture 16. Route diagram / Purity problem solving

7.1 Leak test procedure

1. Shut off the oxygen application/consumption.
2. Let the plant run, until the product tank pressure reaches a minimum of 5 bar.
3. Turn the mode selector switch to stand-by/off, and the PSA generator will stop after a little while, when the actual operation cycle is completed.
4. Shut off the feed air supply.
5. If coal tower is installed, close of oil indication tube. If fitted with purity monitoring probe close of the pressure reduction valve on probe inlet.
6. Read and note the pressure P1 in product tank, column 1, column 2, column 3 if present and feed air tank.
7. Let the plant stand still (rest) and isolated in pressurized condition for an hour.
8. After an hour read and note the pressure P2 in product tank, column 1, column 2, column 3 if present and feed air tank.
9. Then determine an eventually pressure drop as the difference between P1 and P2 for each component.
10. *The Leak test is right, if the pressure drop after one hour pressurized isolation is less than 0.1 bar. In case of leaks they must not cause more than 0.1 bar pressure drop per hour.*
11. If closed open for coal tower oil indication tube and reset the pressure reduction valve on probe inlet 1.0 bar.

7.2 Pressure regulator adjustment procedure

1. Unlock lock on adjustment knob.
2. To increase pressure turn clockwise.
3. To decrease pressure turn counter clockwise.
4. Make small adjustments and let system cycle through one cycle before making another adjustment.
5. If readings are still incorrect, make another adjustment until you are within manufacturer's specifications stated in Design Review Certificate.

7.3 Consumption test procedure

1. Close the shut off valve between the PSA oxygen generator and the product tank.
2. Read and note the pressure in the product tank – called the starting pressure: P1 (bar).
3. Rapidly open the shut off valve between the product tank and the oxygen application/consumption and rapidly close it again after exactly one minute. This will achieve the real and exact consumption for a one minute period.
4. Now read and note the final pressure P2 (bar).
5. Determine the capacity by using the formula: $(P1 - P2) \times (\text{Volume of product tank in litres}) = \text{capacity in litres per minute}$. Check the result with the stated capacity in the Design Review Certificate.

7.4 Pressure set point procedure

The pressure in the product tank controls start and stop of PSA generator in auto mode.

1. Determination of the product tank peak pressure P1:
 - a. Start PSA oxygen generator.
 - b. Shut off oxygen consumption.
 - c. Let the generator run for 10 minutes or more.
 - d. Read and note the maximum product tank pressure during this period. This is the peak pressure P1.
2. Calculating stop set point pressure and restart hysteresis set point:
 - e. Calculate the stop set point pressure P2 by subtracting 0.05 bar from peak pressure P1. $P2 = P1 - 0.05$.
 - f. The hysteresis set point (normal value 0.5 bar) controls when the generator restarts.

Example: Measured peak pressure P1: 6.50 bar

Stop set point pressure $P2 = P1 - 0.05 = 6.50 - 0.05 = 6.45$ bar

With hysteresis set to 0.5 bar the PSA generator will restart when the pressure in product tank has decreased 0.5 bar. Restart at $= P2 - 0.50 = 6.45 - 0.50 = 5.95$ bar

How this start and stop process is adjusted and controlled depends on PSA oxygen generator control system type.

The above mentioned product tank pressures must be read out and adjusted according to system.

For PSA oxygen generators equipped with touch screen control system refer to the separate control system manuals in attached CD or USB flash drive.

7.5 Probe check and calibration

Oxymat oxygen PSA oxygen generators with control system have a probe for monitoring the purity of produced oxygen.

Procedure for checking the probe depends on the type of probe fitted.

See probe type on information label inside control panel.

If present the probe module is placed below the main control cabinet.

Zirconium probe:



Important:

- Do not touch the sensor's cell.
- Do not blow cold air or gas onto the sensor when it is warm.
- Make sure that inlet pressure to sensor is set according to manufacture instruction manual.
- Do not bend or tear the twisted steel pipe.
- The measuring gas must be pure and dry. Use a filter on the ingoing gas if needed.



For further detailed information – see separate Control system manual and Sensor manual as separate file.



For detailed information regarding the O₂, CO, and CO₂ probes—including specifications, handling, maintenance, and calibration, please refer to the respective sensor manuals provided by the manufacturer.

7.6 Purging procedure

To obtain the design purity in product tank purge the tank with oxygen as follows:

1. Check that oxygen consumption is closed off.
2. Open up for flow from feed air supply/compressor.
3. Start the feed air supply/compressor.
4. Start the PSA oxygen generator and let it run for about 15 minutes.
5. Check that pressure in product tank reaches the value stated in Design Review Certificate.
6. Open for oxygen consumption. Adjust flow to approximately to 50 % of design flow (refer to Design Review Certificate).
7. Let the PSA oxygen generator run until design purity is reached. Duration 0.5 - 8 hours depending on purity and capacity.
8. When design purity is reached close off oxygen consumption and let the PSA oxygen generator run until it stops automatic. This should occur within 10 minutes. If the PSA generator does not stop as described refer to section for pressure set point procedure.



Important: If the system is equipped with purity control and valve kit (optional addons), then control system will automatically ensure a pre-set purity.

8 Disposal



8.1 Dismounting

By the time when the equipment is no longer in use - dismount as follows:

- Disconnect, remove and collect all wires into a wire scrap pile
- Dismount, remove and collect all electronics into an electronics scrap pile
- Disconnect, remove and collect all hoses and other plastics into a plastic scrap pile
- Empty adsorber columns from the molecular sieve, and fill it into bags.
- Dismount all pipes and sort all metal parts into steel or copper scrap piles.
- Collect all organic, flammable materials into a separate scrap pile.

Dispose the different categories of waste in a via designated collection facilities appointed by the government or local authorities according to local regulations. Correct disposal and recycling will help preventing potential negative consequences to the environment and human health.

8.2 Molecular sieve

The molecular sieve is a nontoxic organic material, which can be disposed along with the rest of sorted scrap. However the disposal must be done according to national and local laws and rules.



Refer to material safety data sheet for correct handling of molecular sieve and proper personal protection.

9 Preservation, storage



Important: When the PSA oxygen generator package must be stored in a warehouse following principles must be followed:

1. Maintain a storage temperature of 3 - 45 °C
2. Store the machine in a dry, frost-proof and dust-free room
3. Keep PSA columns pressurized at minimum 0.5bar (g) to protect contained molecular sieve against ambient moisture.
4. Protect generator from ambient conditions as a direct sunlight, rain and lighting.



Important: Failure to follow these principles can lead to damage of supplied goods.

1. Moisture can lead to corrosion
2. Frost can damage the machine
3. Prevent ingress of moisture and formation of condensation.

List of shortcuts

OXYMAT	manufacturer of medical device, Oxymat-Slovakia s.r.o.
PSA	pressure swing adsorption
OMED	medical upgrade kit
DRC	Final summary certificate resp. test report (summary of product, factory settings and performance)
MDR	medical device regulation 2017/745 EC (successor of MDD 93/42/EC directive)
2C	2-column PSA oxygen generator
MSDS	material safety data sheet
T(O)	operating temperature
T(S)	max. allowable temperature
PLC	programmable logic controller
HMI	human-machine interface
OC	order confirmation
ID/OD	inside diameter/outside diameter
P(S)	max. allowable pressure

Conversion table [DN] – [inch]	
DN10	$\frac{3}{8}$ "
DN15	$\frac{1}{2}$ "
DN20	$\frac{3}{4}$ "
DN25	1"
DN32	1 $\frac{1}{4}$ "
DN40	1 $\frac{1}{2}$ "
DN50	2"
DN65	2 $\frac{1}{2}$ "
DN80	3"
DN90	3 $\frac{1}{2}$ "
DN100	4"
DN125	5"
DN150	6"

Table 26. Conversion table of dimensions DN – inch

Conversion from bar to Pascal:

1bar = 10⁵ Pa

Manufacturer:

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