

מחולל חמצן – Oxygen Generator



Other applications of O₂

- Cosmetic industry and revitalization centers
- Equipment for health institutions
 - Water bottling industries, Beverages/Refreshments/Beer Industries
- Fish-farms
 - Wherever high quality combustion process is used (e.g. Steel Industry)
- Pharmaceutical Industry
- Food Industry
- Diving centers (cylinders' filling)

CE 0653



PRESSURE SWING ADSORPTION TECHNOLOGY

The autonomous systems of O₂ production of

MO₂ CSS series are based on Pressure Swing Adsorption Technology (PSA), which is used for the separation of a gas from a mixture of gases under pressure. A result of this process is the production

of high purity O₂ (up to 99.5%).

Available types of O₂ generators – MO₂ CSS SERIES

| GENERATOR DEL | 2 | O ₂ PURITY | | Recommended volume | | Recommended @r Compressor | | | Recommended | | Recommended | |
|--------------------------|------|-----------------------|------|--------------------|--------|---------------------------|-------|------------|-------------|--------|-------------|-------|
| | | % Nm ³ /h | scfh | 0 | 1 | Lt | Type | Power (kw) | Lt | Volume | ACT Series | Dryer |
| MO ₂ CSS 1150 | 93±3 | 0.6 | 21 | 150 | KA2 | 2.2 | 150 | 3 | | | | |
| MO ₂ CSS 1250 | 93±3 | 1.2 | 42 | 150 | KA3 | 3.0 | 150 | 5 | | | | |
| MO ₂ CSS 1350 | 93±3 | 2.3 | 81 | 150 | KA4 | 4.0 | 150 | 8 | | | | |
| MO ₂ 2000 | 93±3 | 3.2 | 113 | 270 | KA5 | 5.5 | 270 | 12 | | | | |
| MO ₂ CSS 2150 | 93±3 | 4.5 | 159 | 270 | KA7 | 7.5 | 270 | 18 | | | | |
| MO ₂ 2155 | 93±3 | 7.0 | 247 | 270 | KSA11 | 11.0 | 270 | 30 | | | | |
| MO ₂ CSS 2205 | 93±3 | 9.3 | 328 | 500 | KSA11 | 11.0 | 500 | 30/40 | | | | |
| MO ₂ 2250 | 93±3 | 6.6 | 233 | 270 | KSA11 | 11.0 | 270 | 30 | | | | |
| MO ₂ CSS 2350 | 93±3 | 7.8 | 275 | 270 | KSA11 | 11.0 | 270 | 30 | | | | |
| MO ₂ 3000 | 93±3 | 11.0 | 388 | 500 | KSA15 | 15.0 | 500 | 40 | | | | |
| MO ₂ CSS 2275 | 93±3 | 12.5 | 441 | 500 | KSA15 | 15.0 | 500 | 40 | | | | |
| MO ₂ 3150 | 93±3 | 15.0 | 530 | 500 | KS18 | 18.5 | 500 | 55 | | | | |
| MO ₂ CSS 3250 | 93±3 | 18.0 | 636 | 1,000 | KS36 | 22.0 | 1,000 | 60 | | | | |
| MO ₂ 3350 | 93±3 | 21.0 | 742 | 1,000 | KS45 | 30.0 | 1,000 | 80 | | | | |
| MO ₂ CSS 2505 | 93±3 | 23.3 | 823 | 1,000 | KS45 | 30.0 | 1,000 | 80 | | | | |
| MO ₂ 3450 | 93±3 | 30.0 | 1059 | 1,500 | KS59 | 37.0 | 2,000 | 100 | | | | |
| MO ₂ CSS 3550 | 93±3 | 38.0 | 1342 | 1,500 | KS58 | 45.0 | 3,000 | 120 | | | | |
| MO ₂ 4505 | 93±3 | 42.0 | 1483 | 2,000 | KS97 | 55.0 | 4,000 | 140 | | | | |
| MO ₂ CSS 3650 | 93±3 | 45.0 | 1589 | 2,000 | KS97 | 55.0 | 4,000 | 160 | | | | |
| MO ₂ 3750 | 93±3 | 53.0 | 1872 | 2,000 | KS97 | 55.0 | 4,000 | 210 | | | | |
| MO ₂ CSS 3850 | 93±3 | 78.0 | 2755 | 3,000 | KS124 | 75.0 | 6,000 | 250 | | | | |
| MO ₂ 3950 | 93±3 | 84.0 | 2966 | 3,000 | KS158 | 90.0 | 6,000 | 300 | | | | |
| MO ₂ CSS 4050 | 93±3 | 90.0 | 3178 | 3,000 | KS158 | 90.0 | 6,000 | 300 | | | | |
| MO ₂ 4150 | 93±3 | 108.0 | 3814 | 4,000 | 2xKS97 | 110.0 | 8,000 | 360 | | | | |

- Purity according to ISO 10083, Oxygen 93 European Pharmacopoeia 7.1, USP Oxygen 93
 - Feed Air inlet pressure: 7–10 bar(g)
 - Feed Air minimum quality class 1.4.1 according to ISO 8573.1
 - Oxygen pressure: 6 bar(g) ±10%
 - Flow rate reference conditions acc to DIN 1343, (0°C, 1013mbar)

Due to a continuous policy of research and development, the manufacturer reserves the right to update and/or modify technical specifications without prior notice.

COMPLETED PROJECTS OF O₂ PRODUCTION IN GREECE UNTIL 2014

*Four more projects are under construction

| 2 | Place - Date of Installation | O ₂ Generator System |
|--|------------------------------|---|
| 1 Hospital | | |
| Agios Loukas, Nosileftiki SA (300 beds) | Thessaloniki, GR 9/2011 | MO ₂ CSS 3350 21 Nm ³ /h @ 93%±3% |
| 2 Agios Loukas, Nosileftiki SA (300 beds / 16 OPT) | Thessaloniki, GR 12/2011 | 2 MO CSS 3350 21 Nm ³ /h @ 93%±3% 2nd production line. Master/slave use |
| 3 General Clinic of Thessaloniki Euromedica Group (400 beds / 8 OPT) | Thessaloniki, GR 1/2012 | 2 MO CSS 3350 21 Nm ³ /h @ 93%±3% |
| 4 Athens Mediclinic (70 beds / 4 OPT) | Athens, GR 5/2012 | MO ₂ CSS 2350 7.8 Nm ³ /h @ 93%±3% |
| 5 Varvakio & Proio Syros General Hospital (100 beds / 6 OPT) | Syros, GR 6/2012 | 2 MO CSS 2350 7.8 Nm ³ /h @ 93%±3% |
| 6 Diaplati Rehabilitation Center (250 beds / 1 OPT) | Kalamata, GR 12/2012 | MO ₂ CSS 2250 6.6 Nm ³ /h @ 93%±3% |
| 7 Naxos General Hospital (30 beds / 3 OPT) | Naxos, GR 3/2013 | MO ₂ CSS 2250 6.6 Nm ³ /h @ 93%±3% |
| 8 Palladion Rehabilitation Center (330 beds / 2 OPT) | Tripoli, GR 4/2014 | MO ₂ CSS 2155 7.0 Nm ³ /h @ 93%±3% |
| 9 Kalamata General Hospital (300 beds / 10 OPT) | Kalamata, GR 9/2014 | MO ₂ CSS 3750 50 Nm ³ /h @ 93%±3% |
| 10 Kalamata General Hospital (300 beds / 10 OPT) | Kalamata, GR 9/2014 | 2 MO CSS 3750 50 Nm ³ /h @ 93%±3% 2nd production line. Master/slave use |



The oxygen Generator is a modern, alternative and effective solution for the supply of Oxygen for medical use which, by reclaiming top technology, offers many advantages in comparison with the traditional way of supplying oxygen (through liquid oxygen tanks or cylinders):

- **ECONOMY** Surveys have shown that by using an oxygen generator, the total cost can be reduced by 80%.
- **AUTONOMOUS** There is no need for continuous acquisition of liquid oxygen or cylinders.
- **SAFETY** The risk that arises from the continuous need for storage, transport and switching of the oxygen cylinders and the liquid oxygen tank is avoided.
- **FUNCTIONALITY** The oxygen Generators are fully automated, extremely easy to use and to maintain.
- **EXPANDABILITY** There is also the ability to expand the generator system in order to increase the supply of O₂.
- **LIFETIME** It has been calculated that the life span of an O₂ generator can reach twenty years, supposing that the planned maintenance program is being followed.

Taking into consideration all the above as well as the current prices of liquid oxygen and electrical power, it is clear that the oxygen generator is the best and most economical solution for the majority of the health institutions.

The full depreciation of the system is completed within a year from the first day of the investment.

Indicative table of O₂ generator system suitability depending on the size (number of beds) of the facility (~A m³/h average with peak max 40% then ~B m³/h). For the calculation of the most suitable model, the following equation should be used: Total minimum capacity of generator (LPM) = m number of nursery beds × 0,75LPM + n number of special beds (ICU OPT etc) × 10LPM

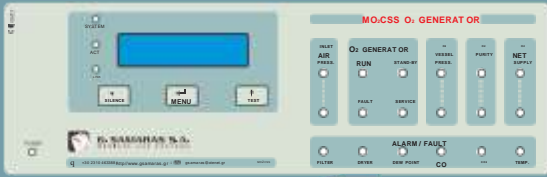
| | Nursing Institution Information | Consumption - & exit average & peak* (A-estimation) | Main for 93%-93% Number O ₂ pressure >5 bar (B) | Source of Generators | Machinery beds | Total Weight (kg) | height (meters) | Min level (meters) | Notes |
|----------------------------|--|---|--|---|----------------|-------------------|-----------------|--------------------|--|
| External nursing clinic: 5 | 1 Medical Center- Peripheral clinic Nursing beds: 5 Intensive Care-CCU-ICU: 0 Surgery: 1, Recovery: 1 | 1,3m ³ /h | 2,3m ³ /h | One generator with one source to supply air according to the table | 2×2 | 7,5 | <500 | 2×2 | The use of Scroll compressor is recommended in order to avoid maintenance services. The produced air can also be used for the creation of vacuum by using OXYVAC-UUM machines. (Venturi effect) |
| Surge | 2 Medical Center - Small Hospital Nursing Beds: 20 Intensive Care-CCU-ICU: 2 Surgery: 2, Recovery: 2 External clinics: 5 | 2,5-8m ³ /h | 4,5m ³ /h | One generator with one source to supply air according to the table | 2×5 | 10 | <1.000 | 4×4×2 | It is possible to use only one pattern of source of air, which is also going to be connected with the network of breathing air (if there are enough machines) or with one independent compressor and it will work in parallel with the gas cylinder system 2×5+3 like 4 sources. |
| External clinics: 20 | 3 Small Hospital Nursing Beds: <100 Intensive Care ICU: 5 Surgery: 4 recovery: 4 | 2-16m ³ /h | 15,4m ³ /h | Two generators running in parallel with two sources of air | 2×15 | 67 | 4500 | 5×5×3,2 | The double generators pattern is being chosen. |
| 4 | 4 Medium Hospital Nursing beds: 250 Intensive Care ICU: 12 Surgery: 12, Recovery: 8 External clinics: 30 | 20-30m ³ /h | 25m ³ /h | Two generators running in parallel with two sources of air | 2×20 | 90 | 7000 | 7×7×3,2 | The double generators pattern is being chosen. |
| External clinics: 35 | 5 Big Hospital Nursing Beds: <400 Intensive Care ICU: 14 Surgery: 12, Recovery: 8 | 30-45m ³ /h | 45m ³ /h | Two or more generators running in parallel with at least 3 sources of air (2 working, one for reserves) | 2×25 | 250 | 15000 | 8×8×3,8 | The system will have at least two generators which will cover 100% of the hospitals' demand and three compressors with each one covering 100% of the demand for reserves with the possibility to opt for: 1) one tank, 2) one system composed of one high pressure O ₂ compressor which will fill a series of 2× n*16 cylinder packs (n=number of cylinder packs in order to be sufficient for each side to cover at least one day of demand, for example for >700 beds, n=10). |
| 6 | 6 Big Hospital Nursing beds: 700 Intensive Care ICU: 22 Surgery: 20, Recovery: 10 External clinics: 35 | 45-66m ³ /h | 66m ³ /h | Two or more generators running in parallel with at least 3 sources of air (2 working, one for reserves) | 2×30 | 280 | 16000 | 8×8×3,8 | |
| one for reserves) | 7 Very Big Hospital Nursing Beds: 900 Intensive Care ICU-CCU: 30 Surgery: 20, Recovery: 10 | 65-90m ³ /h | 92m ³ /h | Two or more generators running in parallel with at least 3 sources of air (2 working, one for reserves) | 2×30 | 560 | 16000 | 14×14 | 4. These systems will not close the cylinder series, which will remain operational as reserves, running independently from the other systems. |

*Average consumption and peak have a difference of ~30% (As peak moments are being defined the days of shifts and the working hours of operational theaters. It should be noted that the average consumption differs from one hospital to another in accordance with the usage of it (university-general-gynecologic-for rehabilitation-oncologic), its site (in a large city or an island for example) and whether it is private or public (higher fluctuations). Thus, the information on this table is indicative and every clinic or hospital needs a custom study. Also it should be noted that the age of the existing facilities affect the average consumption. It has been observed that in old not well-maintained public hospitals 20% of the consumption was due to leaks and an other 20% was down to neglectful usage of the facilities from the nursing staff.

**The power is the total power of the machinery and does not refer to the machines that operate at the moment for the production (out of the three sources one is enough to satisfy the demand and cyclical transitions are being performed.

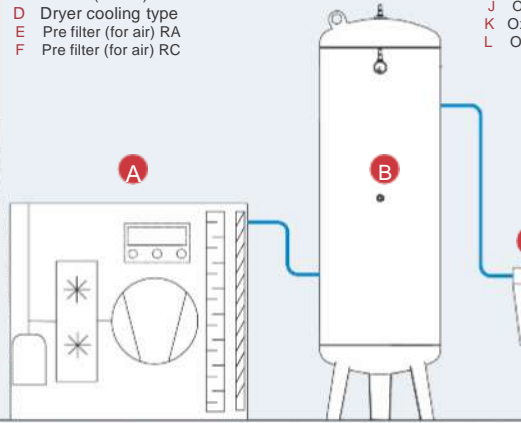
***The ratios are indicative and special caring takes place for the connection of the network with the existing gas network of air, O₂, data or electricity, etc. Also an extra plan is needed for the housing of the equipment (power boards, remote management as well as copper network, electricity mains, machinery facilities, air connection and disposal ducts) which will be placed in the generator housing.

OXYGEN GENERATOR CONTROL PANEL



TYPICAL LAYOUT OF O₂ PRODUCTION SYSTEM

- A Air compressor
- B Compressed air vessel
- C Pre filter (for air) RB
- D Dryer cooling type
- E Pre filter (for air) RA
- F Pre filter (for air) RC



PRODUCT HIGHLIGHTS:

- LCD screen, 3 buttons for navigation, 18 LEDs for visual indication, audible signaling
- Analyzer, with long life zirconia sensor, supplied as standard
 - Automatic restart (on electrical power failure)
 - Automatic purity recover procedure, if purity falls below a limit (user programmable, code protected)
 - Automatic shutdown
- Automatic recover on any fault condition (if the fault condition doesn't exist yet)
- Three operation modes: FIX, AUTO, AUTO ECO (ECO mode is an automatic mode with lower air consumption, providing standard O₂ purity 93%±3)

Automatic O₂ generator start up / purity built up (no user action required, the only action needed is to START the O₂ generator, all automatically implemented). Useful function at first installation and during services

- Smart algorithm included for O₂ purity protection function (on inlet air pressure over/under range)
- O₂ purity measurement with instant value and min/max value records (available as standard)
- O₂ flow measurements with instant value (Nm³/h), min, max and total volume counter
- O₂ Dew point measurement
- Inlet, O₂ product and outlet pressure measurement

Option of installation in a pre-fabricated housing of special specifications



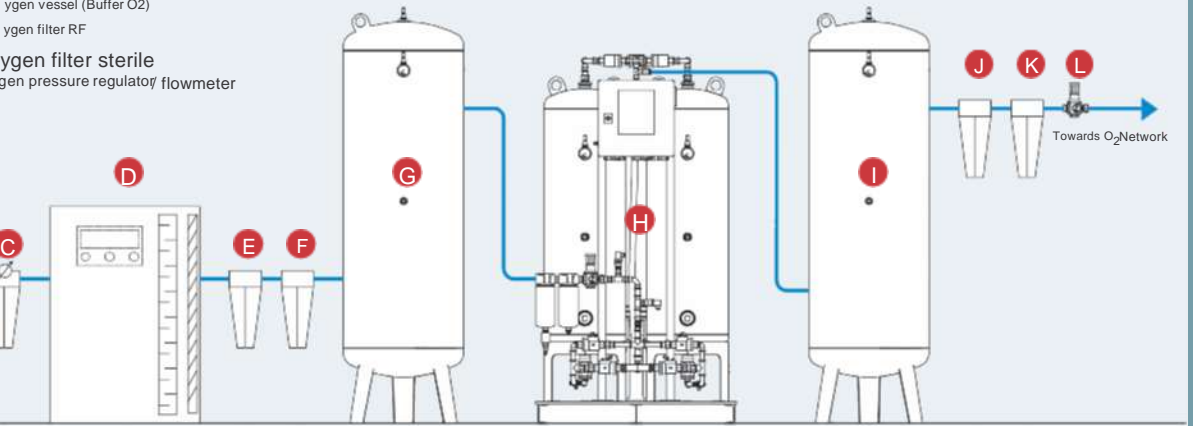
Option of filling the cylinders using a booster (pneumatic / electrical).

STANDARDS / REGULATIONS OF CONFORMITY

- ISO 10083:26 Oxygen concentrator supply systems for use with medical gas pipeline systems
- EN ISO 7396-1:2007 Medical gas pipeline systems Part 1: Pipeline systems for compressed medical gases and vacuum
- European Pharmacopoeia 7.1 monograph 4/2011:2455, OXYGEN (93%)
- HTM 02-01
- Directive 93/42/EEC, class IIb
- National Pharmacopoeia Organization (in Greek: ΕΟΦ) 22288/28.3.2011



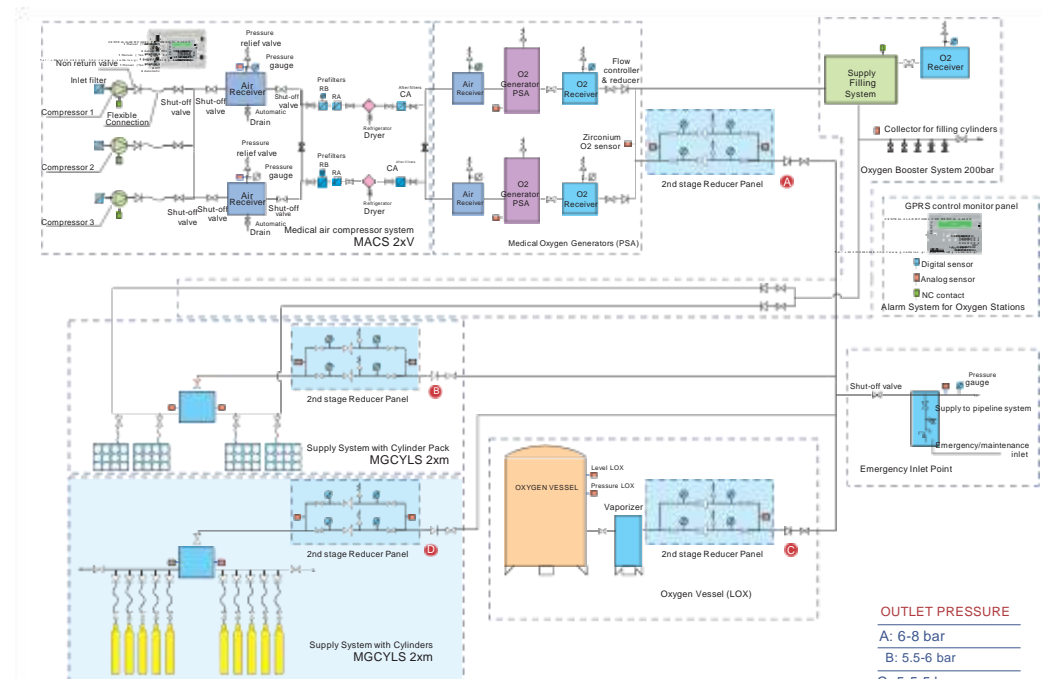
compressed air vessel (Buffer)
 Oxygen generator
 Oxygen vessel (Buffer O2)
 Oxygen filter RF
 Oxygen filter sterile
 Oxygen pressure regulator/ flowmeter



- Two temperature sensors
- Run and service timers
- Internal storage up to 200 records for any alarm/event with time/date stamp, unlimited if our report software used (a pc needed)
- User friendly WEB interface, using RJ45 port (Ethernet) and any internet browser for on line monitoring and code protected configuration. Multiple users supported.
- Inlet filters monitoring
 - Alarm signal (dry contacts C/NC/NO) available for any BMS system connection
- Master / Slave supported
- Remote control (start/stop) digital inputs

- MODBUS TCP/IP communication protocol
- CO/CO₂ sensors (available as an option)
- Remote monitoring SCADA based software (available as an option)
- Remote monitoring panel , remote device with repeater function (available as an option)
- Controller redundancy (available as option)
- GSM/GPRS module for SMS alerts
- 4.3" TFT Touch Screen

Future options:



OUTLET PRESSURE

A: 6-8 bar

B: 5.5-6 bar

C: 5-5.5 bar

D: 4.5-5 bar

Typical layout of Oxygen center with the use of an Oxygen generator of PSA technology