

**The roll out and implementation of PSA Oxygen Plants at
identified hospitals in South Africa**

PSA-OXYGEN PLANT SPECIFICATION

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Rev 01

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1 INTRODUCTION

This document outlines the technical specifications for the design, supply, installation, testing, and commissioning of containerized Pressure Swing Adsorption (PSA) oxygen generation systems. These systems are intended to provide medical-grade oxygen (93% \pm 3%) at specified flow rates to designated hospitals in KwaZulu-Natal, Northern Cape, North-West, Limpopo, Mpumalanga, Free State, Eastern Cape and Gauteng Provinces South Africa. All installations must comply with applicable international and South African standards and regulatory requirements.

2 SCOPE OF WORK

Each hospital site is to be provided with a fully operational, plug-and-play PSA oxygen generation system, containerized and capable of independent operation. The scope includes:

- Detailed design
- Manufacturing and factory testing
- Supply and delivery to site
- Installation, connection to hospital reticulation system
- Commissioning, user training, and handover
- Spare parts provision and documentation

3 PSA SYSTEM PERFORMANCE REQUIREMENTS

- **Oxygen Output Purity:** 93% \pm 3%
- **Output Pressure:** Minimum 4.1 bar (gauge)
- **Flow Rate:** As per hospital demand (e.g. 25 Nm³/h, 30 Nm³/h, 35 Nm³/h)
- **Continuous Operation:** 24/7, capable of handling local site conditions
- **Ambient Operating Conditions:** 5°C to 40°C, 15-95% relative humidity
- **Altitude Design Criteria:** The altitude varies from one hospital to the other due to their geographical location, the PSA components selection for each hospital will be derated in accordance with the altitude. The outcome of using various altitudes when designing the PSA plant will be to obtain the high purity of oxygen (93% \pm 3%) as 93/42/EEC or FDA certificate per the regulations and standards

Table1: Schedule of Altitude per province details

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Province	Altitude
Limpopo	1400m
Mpumalanga	1275m
Northern Cape	2156m
Northwest	1805m
Eastern Cape	670m
Free State	1385m
Kwazulu Natal	518m
Gauteng	1753m

4 PSA SYSTEM COMPONENTS

4.1 PSA Oxygen Generator

- Twin-tower molecular sieve system
- Interconnecting pipework with pressure relief and non-return valves
- Off-spec oxygen purge system

4.2 Medical Air Compressor and Treatment

- Oil-flooded rotary screw air compressor (sized per flow rate and site altitude)
- Refrigerated air dryer (dew point $\leq 3^{\circ}\text{C}$ at nominal flow)
- Filtration: moisture separator, coalescing pre-filter (0.1 μm), activated carbon filter
- Final bacterial filter at product oxygen outlet

4.3 Oxygen Booster Compressor

- Oil-free oxygen booster compressor for cylinder filling
- Delivery pressure: 150 bar

4.4 Oxygen Storage and Backup System

- Oxygen receiver tank (min. 1500 litres), complete with isolation valves and bypass
- Cylinder manifold for 2x10 BS-type and 2 pin-index connections
- Auto-changeover system between PSA plant and cylinder backup

4.5 Monitoring and Control

- Digital oxygen control panel (7"-10" touch screen)
- Online remote monitoring with 24/7 access
- Oxygen purity analyzer with low-purity alarm and volt-free contacts
- Plant status monitoring and logging
- Master alarm panel with audible/visual alerts, 6-hour battery backup

4.6 Containerized Housing

- ISO-standard container (20ft or 40ft depending on plant size)
- Rockwool insulation (25mm) to ASTM C177
- Perforated aluminium internal cladding
- Aluminium checker plate flooring
- 2x 12000 BTU inverter split AC units
- Electrical DB board, socket outlets, LED lighting
- Compressor intake/exhaust ducting

4.7 Electrical Works

- Power supply: 400 V, 50 Hz, 3-phase
- Main power distribution board with protection
- Voltage stabilizer (min. 60 kVA)
- Weatherproof isolators per equipment type
- Earthing and bonding to container and equipment
- All wiring in compliance with SANS 10142-1

4.8 Interconnection and Reticulation

- Medical grade copper piping (BS EN 13348, brazed joints)
- Connection to hospital manifold or reticulation within 25m of container
- Pressure regulating valves and gauges as required

4.9 Standards and Compliance

- WHO Oxygen Technical Specifications

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- Global Fund PSA Oxygen Guidelines
- ISO 7396-1 (Medical Gas Pipeline Systems)
- ISO 13485 (Medical Device QMS)
- CE marking or US FDA device approval
- South African Standards:
 - SANS 7396-1/2
 - SANS 347 (Pressure Equipment)
 - SANS 10142-1 (Electrical Installations)
- SAHPRA medical device establishment license and product registration

5 DOCUMENTATION AND TRAINING

- Operating and maintenance manuals (5x printed + 1x digital copy)
- Electrical and pipeline compliance certificates (CoC)
- As-built drawings (electrical, process, layout)
- On-site training for hospital technical staff (min. 1 full-day session)

6 SPARE PARTS AND WARRANTY

- 3-year recommended spare parts kit (including all filters and seals)
- Minimum 1-year comprehensive warranty on equipment and installation
- Optional service contract proposal (separate line item)

7 SITE PREPARATION AND RESPONSIBILITIES

- Supplier to:
 - Level concrete slab (as per layout)
 - Electrical cable terminated at external isolator
 - Adequate access for offloading containers
- Supplier to:
 - Anchor and install container
 - Perform final electrical and mechanical connections

- Test and commission complete system

8 TESTING AND COMMISSIONING

- Functional test of PSA system
- Oxygen purity verification (using calibrated analyzer)
- Pressure and flow verification
- Alarm system test
- Leak and safety test for pipeline
- Commissioning report to be signed off by end-user