Version：MISHA30 v4.3A
Date：20210524

MISHA30 OXYGEN PLANT

Technical Memorandum

MISHA30-93

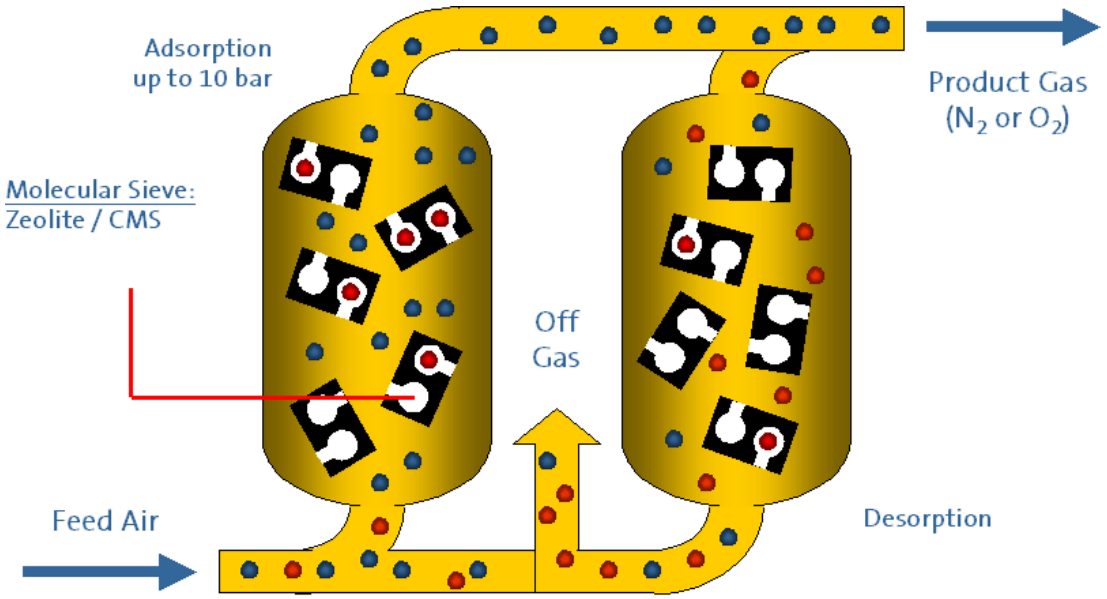
From ： SRAM & MRAM GROUP

Part 1: The Theory

The pressure swing adsorption (short for PSA) oxygen generator is a high-tech, energy-saving separation technology that directly produces Oxygen from the air at normal temperature. Using compressed air after a series of purification of water removal, oil removal and dust removal under pressure swing absorption.

Due to the kinetic effect, the diffusion rate of nitrogen on the Zeolite Molecular Sieve is significantly higher than that of Oxygen. When the adsorption does not reach equilibrium, the Oxygen molecular is enriched in the gas phase. Through PLC automatic control technology, continuous production of high-quality Oxygen gas is achieved.

The device has the advantages of compact, fully automatic operation, reliable operation, fast start and stop, low operating cost, convenient production and maintenance at normal temperature, and the purity and output of Oxygen can be appropriately customized. It is an efficient on-site oxygen generator and long lifespan up to 10 years.

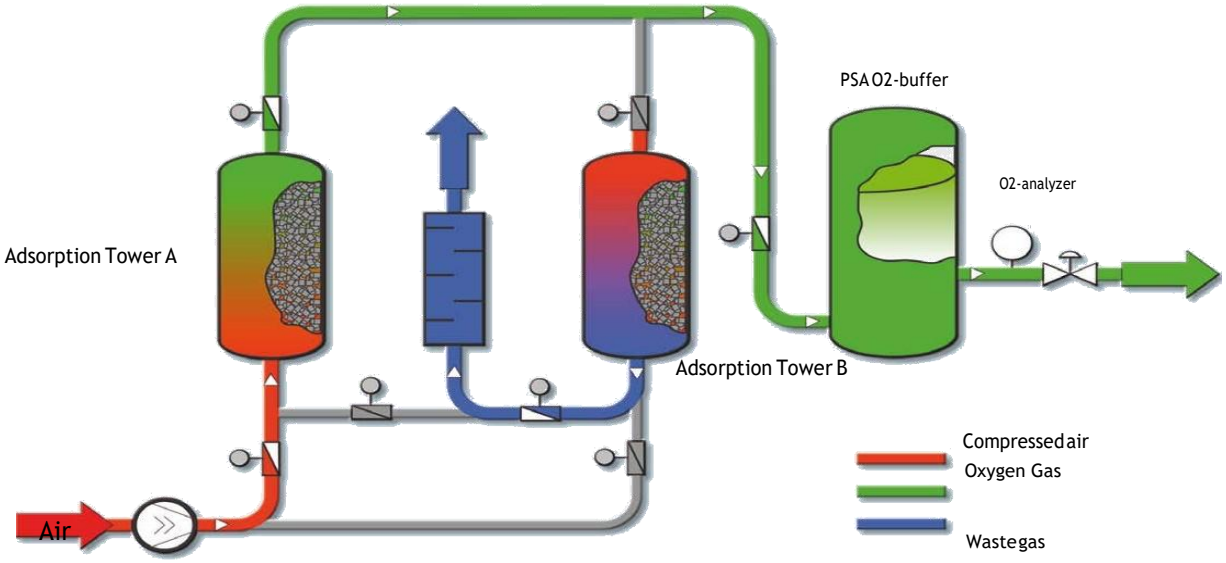


The separation of N2 and O2 from air takes place in an adsorption vessel filled with Zeolite molecular sieve.

-Different diffusion of N2 molecules get into the pore structure of the Zeolite molecular sieve than O2.
-Different capacity of N2 molecules get into the pore structure of the Zeolite molecular sieve at different pressure.

Part 2: The Process

2.1 Principle Of Process



There are two alternately process cycle for PSA Oxygen Generator:

–Pressurization/adsorption

–Depressurization/ desorption

Compressed air alternately pressurises each of two identical adsorber towers. Beginning at a point in the cycle where one adsorber tower (A) is being pressurised and the other adsorber tower(B) is undergoing depressurisation, the description of the PSA process cycle is as follows:

As compressed air enters adsorber tower A, moisture, nitrogen, and carbon dioxide are adsorbed. After operating pressure is reached, oxygen product flows from adsorber bed A into a oxygen product receiver prior to entering the product piping. Simultaneously, adsorber tower B is depressurised to atmospheric pressure.

Upon completion of oxygen production from adsorber tower A, an equalisation step occurs. Adsorber tower B (atmospheric pressure) is pressurised to an intermediate pressure as the gas remaining in adsorber bed A (at operating pressure) flows into adsorber tower B. During this step, air is not consumed nor is product gas generated. Therefore a oxygen receiver is applied to allow for a constant flow, purity and pressure of the oxygen product throughout the PSA cycle.

Adsorber tower A then undergoes depressurisation and the nitrogen enriched waste gas is vented to theatmosphere. Depressurisation permits the release of nitrogen, carbon dioxide, and water vapor previously adsorbed during oxygen production from adsorber tower A. At the same time, adsorber tower B is brought to operating pressure, and begins its oxygen production portion of the cycle.

Following oxygen production, adsorber tower B undergoes equalisation and subsequent depressurisation. The cycle continues at the point where adsorber tower A undergoes pressurisation and adsorber tower B is depressurised.

2.2 Working Status Process

Step 1: Air Compressed System

The nitrogen content in the air is about 78%. This system uses an air compressor to collect air raw materials.
Then the compressed air will be stored in the air receiver.

Step 2: Air Purification System

After the compressed air passes through the Refrigerated Air Dryer, the gas enters the Refrigerated dryer to drop down the atmospheric dew point of the compressed air down to 2-10°C, remove a large amount of air moisture, and then primary filtration for the first to remove the oil, water, and dust, then pass through intermediate filtration . The filter removes oil and water so that the oil content is less than or equal to 0.01ppm, and the dust content is less than or equal to 0.01μm; then goes through the activated carbon filter to remove acid, alkali and other harmful gases and micro-oil mist to make the oil content less than or equal to 0.003ppm, and finally go through precision filtration and Dust filtration to get a clean air source.

Step 3: PSA Oxygen Generator

The clean compressed air enters the air buffer tank of the oxygen generator and then enters the two pressure swing adsorption separation towers filled with adsorbent (zeolite molecular sieve, composite bed structure). Compressed air enters from the bottom end of the adsorption tower. After the gas flow is diffused through a special multi-layer stainless steel air diffuser, it evenly enters the adsorption tower for oxygen and nitrogen adsorption and separation. Then oxygen flows out from the outlet end, and a small amount of oxygen enters the regeneration tower to blow the adsorbent to remove the adsorbed impurity components (mainly nitrogen) back to the atmosphere. The two adsorption towers are operated alternately and cyclically, continuously feeding raw material air and continuously producing oxygen.

The oxygen from the oxygen generator enters the oxygen buffer tank and is filtered by the dust filter to obtain the oxygen product.

The finished product then stored in a buffer tank.

Step 4: Oil Free O2 Booster

Due to the characteristic of the absorbent of the Zeolite Molecular Sieve, the outlet pressure will be only no more than 0.4Mpa, the high pressure oil-free booster is needed to boost the oxygen gas up to 10bar or 200bar to fill the cylinders based on the customers' need.

2.3 Characteristic of the System

Run Automatically

- Control By Programmable Logic Controller (PLC)
- Control the inlet compressed gas in and out automatically
- Monitor and alarm the abnormal working status
- Display parameter values

Operating The System

- Plug and play
- One-press On/ Off
- One-press Start/ Stop

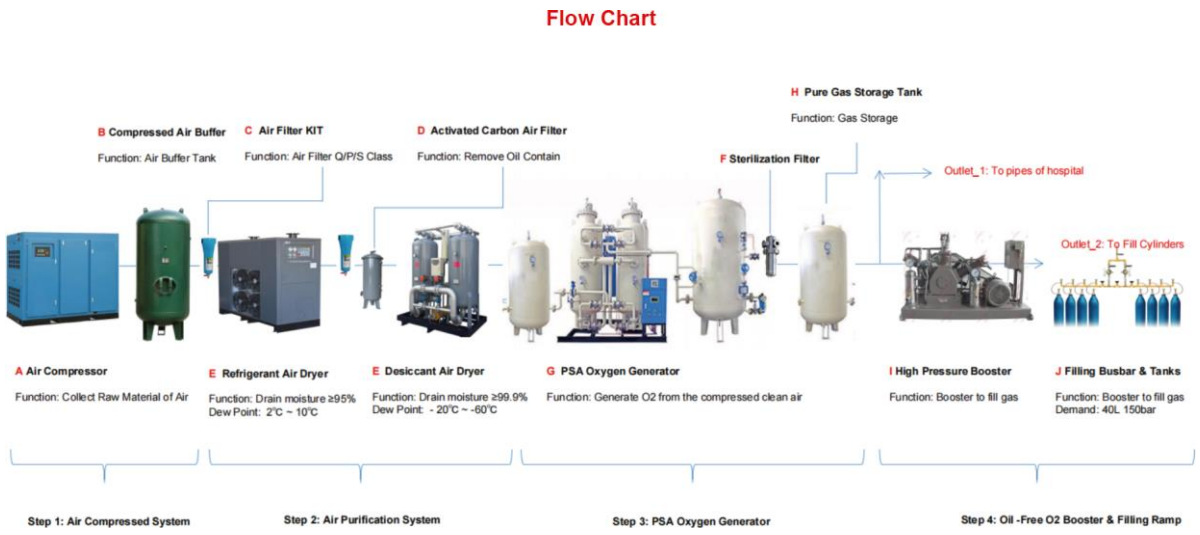
Long Lifespan

- Advanced absorber structure
- Reliable and smart program design
- Vortex honeycomb type gas distribution structure
- Blizzard-type CMS filling strengthen the gas flow
- Components from high-end supply chain

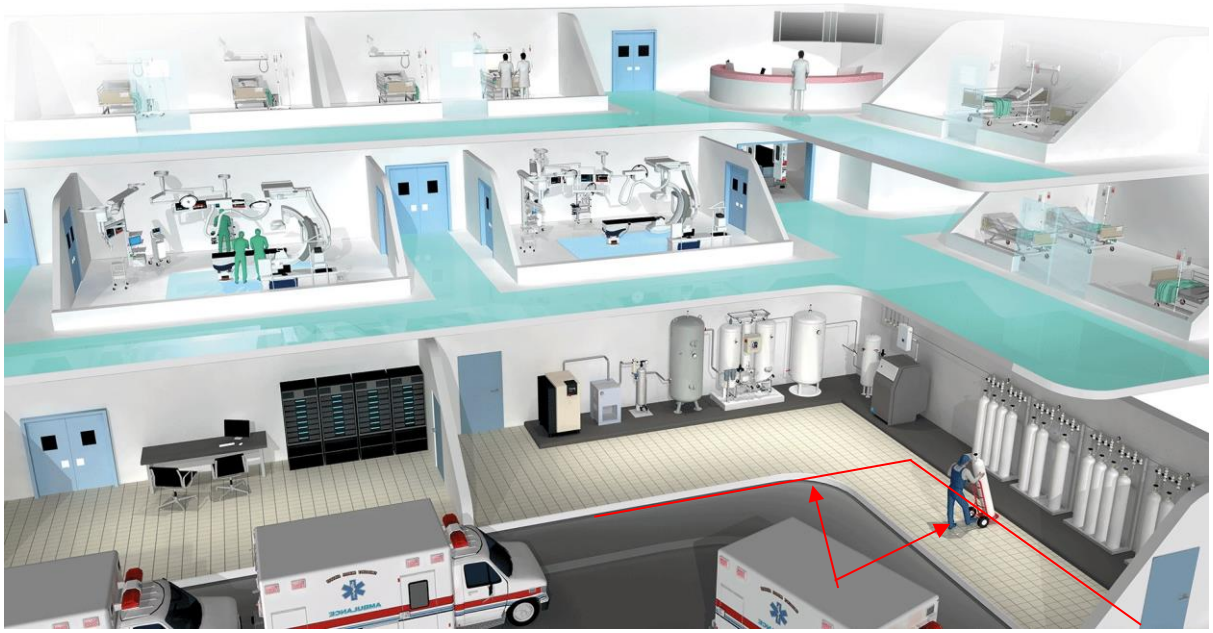
Installation Site

- Due to the severe ambient conditions and in order to protect the PSA unit from driving rain and direct sunlight, it is strongly recommended to install the PSA unit in a closed shelter, at least a roof covering the valve skid and the compressor shall be supplied.

2.4 System Overview

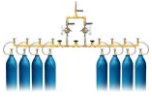


2.5 System Application



Part 3 The List

3.1 Items of All Parts

No.	System	Name	Qty	
1	Air Compressed	Air Compressor	1 unit	
		Air Receiver	1 unit	
2	Air Purification	Refrigerated Air Dryer	1 unit	
		Q Primary filtration	1 unit	
		P Precision filtration	1 unit	
		S Precision filtration	1 unit	
		Electronic Drainer	3 units	
		CH Activated Carbon Filter	1 unit	
		Sterilization Filter	1 unit	
		Desiccant Air Dryer	1 unit	
3	O2 Generation	Compressed Air Buffer	1 unit	
		PSA O2 Generator	1 unit	
		O2 Gas Buffer Tank	1 unit	
		O2 Storage Tank	1 unit	
4	O2 Booster	Oil-free O2 Booster	1 unit	
		Filling Ramp	1 set	
5	Accessories	Pipes and Valves	1 set	

3.2 Parts of Air Compressed System

No.	Model	Brand	Specification	Mark
1	HD-55	MISHA	**Air Compressor** - Rated /Max Pressure:0.80Mpa - Flow Rate: 9.2Nm³/min - Installation Power: 55KW - Pipe Size:R1 - Voltage: 415V 50Hz - Weight:1120KG - Size: 1800*1250*1670	
2	CG1.0/0.8	MISHA	**Air Receiver Tank** - Design Pressure: 0.80Mpa - Design Temperature: 150℃ - Volume: 1.0m³	

3.3 Parts of Air Purification System3.3.1 Refrigerated Air Dryer & Desiccant Air Dryer

No.	Model	Brand	Specification	Mark
1	MISHA -75AS	MISHA	**Refrigerant Air Dryer** - Comp Air Pmax: 10 bar - Flow Rate: 10.5Nm³/min - Tmax: 55℃ - Dew Point: 2-10 ℃ - Voltage: 415V 50Hz - Power: 3KW - Pipe Size:65mm - Size: 1350*700*1220mm - Weight: 227KG	
2	MISHA -75XFW	MISHA	- Comp Air Pmax: 10.5 bar - Flow Rate: 10.8Nm³/min - Tmax: 55℃ - Dew Point: -20 ~ -60 ℃ - Voltage: 415V 50Hz - Power: 60W - Pipe Size: 40mm - Size: 1150*700*2250mm - Weight: 480KG	

3.3.2 Air Filter KIT

Item	Model	Flow Rate	Pressure	Oil Contain	Particles	Mark
Primary filtration	MISHA -090Q	10.8Nm³/min	1.0Mpa	≤5 ppm	≤5 Micron	With Drainer
Precision filtration	MISHA -090P	10.8Nm³/min	1.0Mpa	≤0.1 ppm	≤0.1 Micron	With Drainer
Precision filtration	MISHA -090S	10.8Nm³/min	1.0Mpa	≤0.01 ppm	≤0.01 Micron	With Drainer
Activated Carbon Filter	MISHA -090CH	10.8Nm³/min	1.0Mpa	≤0.001ppm	N/A	
Dust Filtration	MISHA -015D	1.3Nm³/min	1.0Mpa			
Sterilization Filter	MISHA -015SUS	1.3Nm³/min	1.0Mpa			

3.4 Parts of PSA Oxygen Generator

3.4.1 MISHA30-93 Working Status

No.	STATUS	UNIT	VALUE	MARK
1	INTAKE COM-PRESSED AIR	Air Consumption	7.0Nm³/min	
2		Inlet Air Pressure	0.6Mpa	
3		Inlet Air Moisture	≤5%	
4		Inlet Air Particle	≤0.01ppm	
5		Inlet Oil Contain	≤0.003ppm	
6		Inlet Pipe Size	DN40	
7	Discharge O2	Flow Rate	≥30Nm³/h	
8		Discharge Purity	≥ 93%±3%	
9		Outlet Pressure	0.4Mpa	
10		Outlet Pipe Size	DN25	
11	Electricity	Voltage	220V 50Hz	
12		Install Power	0.6KW	
13	Installation Site	N/A	Indoor or outdoor with shelter	

3.4.2 MISHA030-93 Configuration

No.	ITEM	Part Number	QTY	MEASURING	MARK
1	Adsorption Tower	MISHA -30T	2	UNIT	
2	Zeolite Molecular Sieve	13X HP	Default	KG	
3	Muffler	MISHA -500X	1	UNIT	
4	O2 Analyzer	P950	1	UNIT	
5	PLC	Default	1	KIT	
7	Pneumatic angle valve	DN30 DN15	12	UNIT	
8	Electromagnetic valve	4V210-08	12	UNIT	
9	Sealing Device	MISHA -30J	2	UNIT	
10	N2 Flow Meter	LZB	1	UNIT	
13	Piping & Valve	MISHA -500G	1	KIT	
14	Skid-mounted	MISHA -500D	1	UNIT	
15	Compressed Air Tank	Default	1	UNIT	
16	O2 Buffer Tank	Default	1	UNIT	

3.5 Parts of Boost System

3.5.1 Parts Oil-free O2 Booster

No.	Model	Brand	Specification	Mark
1			Oil-free Booster - Flow Rate: 30Nm³/min - Installation Power: 18.5KW - Inlet Pressure: 0.4~0.5Mpa - Outlet Pressure: 15.0Mpa - Cooling Type: Fan Type - Medium Gas: Oxygen Gas - Inlet Temperature: ≤35℃ - Size:1350*1000*1100 - Weight:450KG	

Part 4 The Requirement Standard

4.1 Requirement of The System

No.	ITEM	Requirements	RESUALT	Mark
1	System Performance	O2 Flow Rate ≥30Nm³/h O2 Purity ≥93%±3% O2 Pressure 0.4Mpa (Oxygen Generator) O2 Pressure 15Mpa (O2 Booster)	PASSED	
2	Checking For Acceptance	1) Video & Picture For The System Testing Result. 2) On-site Checking If Available.	PASSED	

4.1 Checking for Acceptance

1. The supplier shall conduct accurate and comprehensive tests on the quality, specifications, performance, quantity and weight of the goods before shipment, and issue relevant certificates or certificates that the goods meet the requirements of the contract.

2. The two parties shall determine and confirm the product quality assurance parameters, by offering the video and picture to show all the corresponding parameters required or what the buyer want to check.

Part 5 The Power Consumption

No.	ITEM	INSTALL POWER	VOLTAGE	MARK
1	AIR COMPRESSOR	55KW	415V/ 50Hz	
2	REFRIGERATED AIR DRYER	3KW	415V 50Hz	
3	DESICCANT AIR DRYER	60W	415V 50z	
4	OXYGEN GENERATOR	0.5KW	220V 50Hz	
5	OIL-FREE O2 BOOSTER	18.5KW	415V/ 50Hz	
	TOTAL	≈77KW	N/A	

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