



# Fully automatic pressure trans-sorbent (PSA)

## Oxygen device

### System Process Description

The oxygen production system is composed of compressed air device, compressed air purification device, variable pressure adsorption oxygen making device, oxygen storage tank and other equipment.

#### I. Compressed air system

The compressed air system consists of screw compressor and air buffer tank providing the gas source required for variable pressure adsorption oxygen device. The system provides a stable output pressure and sufficient air volume. The air compressor with reliable operation, simple maintenance, low noise and no operation. The air buffer tank is mainly used as an air source, and plays a stable and storage role, in addition to collecting and excluding most oil-water condensate into the compressed air source. The buffer tank is equipped with pressure gauge, relief valve and drain outlet.

The exhaust capacity of the air compressor is slightly greater than the air consumption at the rated output of the nitrogen generator. Since the start and stop is controlled by the exhaust pressure, when the exhaust volume is greater than the gas consumption, the exhaust pressure rises and the air compressor stops; otherwise, the air compressor is started. Through such cycle start and stop, the air compressor exhaust volume suits the oxygen generator gas consumption requirements and meets the operation needs of the production line during changing conditions (lower than the rated output).



## II. Air purification system

The compressed air from the buffer tank first enters the C filter for coarse filtration, and then enters the frozen dryer to cool the compressed air, condensing the water vapor in the air, and condensing the liquid water with dust and oil discharge machine.

The cold dryer is preferably placed in the compressor room. Frozen dryer is used for the process, based on three reasons:

Maximum liquid load at intake of

1, rear T filter: 2000ppm w/w dew point  $<-12^{\circ}\text{C}$ , no freezing dryer, T filter is easy to fail;

2, winter outdoor temperature is low, the compressed air temperature decreases after the water precipitation, blocking the pipeline system, the pipeline system should be inclined and drained;

The 3, pipeline system is prone to corrosion and rust after the separation of water parts.

Post precision filter set of cold dryer consists of secondary filter. T main road filter and an efficient mist filter. Class T main filter precision is 1um, filter 1um and larger solid and liquid particles with residual oil content of 1ppm w/w. Class A high efficiency oil removal mist filter precision 0.01um filter 0.01um and larger solid state and liquid particles, 99.999+% oil mist; residual oil content is 0.001ppm w/w.

Compressed air quality reaches ISO8573.1 quality grade 1.



### III. Pressure-changing adsorption and oxygen production system

The PSA molecular sieve oxygen making device has two adsorption towers filled with molecular sieve, and the clean and dry compressed air enters the variable pressure adsorption oxygen making device and flows through the adsorption tower filled with molecular sieve (CMS). Compressed air flows through the adsorption tower from the bottom first to use the molecular sieve to absorb nitrogen and oxygen at different pressures. The components of nitrogen, water, carbon dioxide and so on are in the molecular sieve table.

Surface adsorption, the unabsorbed oxygen is collected at the exit into the product gas, the outflow from the upper end of the adsorption tower, into the buffer tank. After a period of time, the oxygen adsorbed by the molecular sieve in the adsorption tower is saturated and needs to be regenerated.

Regeneration is achieved by stopping the adsorption step and reducing the pressure of the adsorption tower. After the completed adsorption tower, under short mean pressure, the absorbed oxygen, water, carbon dioxide and other components are removed, and the regeneration process is completed.

The two adsorption towers alternate for adsorption and regeneration, thus producing product oxygen with steady flow and purity. The switching between the two absorbers is automatically completed by the programming valve controlled by the PLC. The performance of a variable pressure adsorption oxygen making device depends on the performance of the adsorbent, molecular sieve, process flow, equipment structure and electromagnetic pneumatic valve. The variable pressure adsorption oxygen making device produced by our company adopts PLC programmable controller produced by Mitsubishi of Japan, high quality molecular sieve and solenoid pneumatic valve produced by BURKET of Germany.

The adsorption forces of nitrogen and oxygen at different pressures are different, nitrogen, water and carbon dioxide are adsorbed on the surface of the molecular sieve, and the unabsorbed oxygen is collected into product gas at the outlet, flowing from the upper end of the adsorption tower and entering the buffer tank. After a period of time, the nitrogen adsorbed by the molecular sieve in the adsorption tower is saturated and regenerated.

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**IV. Flow chart of pressure adsorption:**

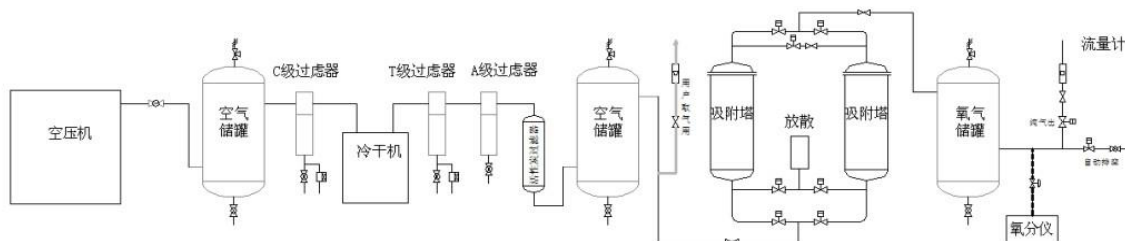







图 例:

-  截止阀
-  减压阀
-  球阀
-  电子自动排水器
-  止回阀



## Standards used for equipment manufacturing and inspection

1	GB150-1998.	Regulations for safety technical supervision of pressure vessels
2	GB150-1998.	Steel pressure vessel
3	GB150-89.	Standards for steel pressure vessels
4	GB150-89.	Relevant definitions of steel pressure vessels
5	GB191-90.	Figure display mark of packaging, storage and transportation
6	GB-4706.1-92.	General requirements for the safety of home and similar use appliances
7	GB699-88.	Technical conditions of high-quality carbon structural steel
8	GB711-65.	Carbon structural steel and low alloy structure hot rolled thick steel plate and steel strip
9	CB1225-76.	Weld rod inspection, packaging, and marking
10	GB6654-86.	Carbon steel and ordinary low alloy steel for pressure vessels
11	GB10893-89.	Specification and test for compressed air drying
12	GB/T13384-92.	General technical requirements for the packaging of mechanical and electrical products
13	GB/T13306-91.	Sigage
14	GB/T12243-91.	Spring direct-load-type relief valve
15	GB/T2624-93.	Flow measurement throttle device
16	GB/T4980-95.	Volume air compressor, determination of noise power level- - - - - - - - -engineering method
17	JB2536-95.	Pressure vessel, paint, packaging, and shipping
18	JB/T81-90-94.	Standard for steel pipe flange gaskets
19	JB4700-4707-92.	Pressure vessel flange standard
20	JB4730-94.	NDT for the pressure vessel
21	GB/T3277-91.	General compressed air quality grade
22	JB478-92.	Welding process evaluation of steel pressure vessel
23	HG20592-20635-97.	Steel pipe flanges, gaskets, fasteners
24	JB1614-83.	Mechanical performance inspection method of original pressure welding joint of boiler

**The unit has the advantages of energy saving, environmental protection, low energy consumption, stable operation and high oxygen yield rate; detailed as follows:**

## I. Control system

1, oxygen making system is fully automatic control, the whole process can be realized unattended. The twin tower adsorbs the main machine, works continuously 24 hours, the starting speed is fast, and can provide qualified oxygen in about half an hour.

2, oxygen purity, flow and pressure realizes online monitoring, showing accurate and reliable measurement, stable test data and no drift.

3, has reasonable structure, advanced process, safety and stability, low energy consumption; overall skid installation, small land area and portable installation.

4, special muffler with equipment noise of approximately 50dB (A).

The 5, device adds the fault self-diagnostic system.

All valve pipes of 6, oxygen system undergo explosion proof degreasing.

## II. Allocation

The 1, control valve adopts the special stainless steel pneumatic pipe valve for the oxygen generator. The control valve is opened once in dozens of seconds, and the service life of the whole control valve is opened by more than 2 million times. The solenoid valve adopts Taiwan ADB brand to ensure the long-term and stable operation of the equipment, has sensitive valve control, stable performance, and has a service life of more than 8 years under normal service conditions.

The 2, PLC programmer uses the German-imported Siemens brand. Automatic control is accurate and reliable, completes the automatic control of oxygen skid, and displays the operating parameters and status of inlet air flow, outlet oxygen flow, outlet oxygen flow, oxygen purity and outlet pressure of the oxygen system, and uploaded to the DCS system through RS485. Or PLC provides a RS485 serial communication interface communicating with the user DCS system, whose communication protocol is the MODBUS RTU protocol. Meanwhile, provide comprehensive fault alarm signal of oxygen making system, operation status signal (on / off amount) and accept remote stop control signal of user DCS system. Comprehensive fault alarm signal,



operation status signal, oxygen analyzer value and remote stop control signal are transmitted to the DCS system through hard wiring, and the signal type is dry contact signal with contact capacity: 220VAC, 2A.

3, uses the Dutch Jock brand electronic drainage device to realize the automatic drainage and sewage discharge of cold dryers and filters. Changing the instability of other automatic drainers, long service life, simple maintenance and operation without shutdown.

4, adopts OX8 molecular sieve imported from CECA, normally ensuring the service life of ten years,

### III. Suggestions

The air outlet of 1, air compressor is recommended to be outdoor to prevent excessive room temperature and affect the normal operation of equipment;  
The silencer outlet of the 2, oxygen making machine is recommended to be outdoor, to prevent excessive room nitrogen concentration, danger, and affect the performance of the oxygen making machine.

It is recommended for 3, air source air compressor for control of oxygen equipment to prevent the vibration of air compressor and facilitate maintenance and maintenance.

4, In order to prevent the failure of oxygen analyzer after long-term use and inaccurate oxygen purity affects the process requirements, the oxygen analyzer proposes to install two and two monitored at the same time.

## Chapter III, 10Nm<sup>3</sup>/ h oxygen production system technical parameters

### I. Compressed air system

1, air compressor:

According to the equipment requirements, one screw air compressor produced by Atlas.		
1	Treatment air volume:	3.0m. <sup>3</sup> / min.
2	Working pressure:	0.8M pa.
3	Power supply:	18KW.
4	Noise:	≤ 74bd (A)
5	Supply voltage:	380V.
6	Overall dimensions:	850 * 790 * 1260mm.
7	Equipment Weight:	364KG.



### 2, air storage tank:

(Including accessory safety valve, pressure gauges and data)

1	Volume:	0.3m. <sup>3</sup>
2	Media:	Air is
3	Working pressure:	0.8M Pa.
4	Tube specification:	Φ 500 * 1730mm.



### II. Compressed air purification system



1, Class C main road filter: after air compressor or before freezing dryer  
Solid state particles above 3um, the minimum residual oil content are only 5ppm.

According to the equipment requirements, Class C filter adopts 1 E 9-24 type filter produced by Hankson		
1	Treatment air volume:	3.0 m3/min.
2	Number of filter element:	One only
3	Maximum service temperature:	65°C
4	Working pressure:	0.6-1.0Mpa.
5	With an automatic electronic drain	1 / 2 " 16bar 220V.



## 2, Cold-drying dryer:

The cold dryer adopts one high-temperature frozen dryer produced by the company.		
1	Treatment air volume:	2.8m. <sup>3</sup> / min.
2	Power supply:	0.5HP.
3	Power supply:	220V.
4	Overall dimensions:	400*700*780
5	Interface pipe diameter:	DN25.
6	Weight:	65kg.



3, Class T filter: can filter liquid and solid particles up to 1um to a minimum residual oil of 0.5ppm.

According to the equipment requirements, Class T filter adopts 1 E 7-24 type filter produced by Hankson		
1	Treatment air volume:	3.0m3/min.
2	Number of filter element:	One only
3	Maximum service temperature:	65°C
4	Working pressure:	0.6-1.0Mpa.
5	With an automatic electronic drain	1 / 2 " 16bar 220V.



4, A filter: also known as super-efficient oil removal filter, used for freezing dryer, can filter liquid and solid particles less to 0.01um, reaching the minimum residual oil content of only 0.001ppm.

According to the equipment requirements, Class A filter adopts 1 E 5-24 type filter produced by Hankson		
1	Treatment air volume:	3.0 m3/min.
2	Number of filter element:	One only
3	Maximum service temperature:	65°C
4	Working pressure:	0.6-1.0Mpa.
5	With an automatic electronic drain	1 / 2 " 16bar 220V.



5, Active Carbon Oil mist Filter (Class H): Oil mist and hydrocarbons filtered up to 0.01um, up to

The minimum residual oil content is only 0.003ppm.

According to the equipment requirements, the activated carbon filter adopts 1 H-24 type activated carbon filter produced by the company

1	Treatment air volume:	3.0 m3/min.	
2	Number of active carbon	75kg.	

6. Dryer:

One heat-free regenerative adsorption dryer.

1	Treatment air volume:	2.8m. <sup>3</sup> / min.	
2	Power supply:	220V.	
3	Overall dimensions:	600 * 350 * 1720mm.	
4	Interface pipe diameter:	DN20.	
5	Weight:	90kg.	

**III. Automatic pressure changing adsorption oxygen making device (all valves and pipelines undergo explosion-proof degreasing treatment)**

**11, HDF O 93-12 Oxygen Machine:**

1	Oxygen yield quantity:	12Nm. <sup>3</sup> / h.
2	Compressed air consumption:	2.4Nm. <sup>3</sup> / min.
3	Oxygen purity:	93%±2%
4	Oxygen outlet pressure:	0.5Mpa.
5	Power supply:	220V, 50Hz.
6	Overall skid bar	1200 * 1600 * 1800mm.
	Overall dimensions:	
7	Weight:	1200Kg.
8	Power supply:	1KW.
9	Normal pressure dew point of nitrogen gas:	≤-45℃
10	Operation mode;	Fully automatic
11	Discharge discharge method:	Fully automatic
12	Installation environment:	Skid-mounted room (with no foundation installation)
13	Defat method:	Chemical detergent




**2, oxygen storage tank: (including accessories)**

1	Volume:	0.3m. <sup>3</sup>
2	Media:	Oxygen
3	Working pressure:	0.8M Pa.
4	Tube specification:	Φ 550 * 1766mm.




**3, medical grade oxygen stainless steel filter, dedicated for the food and pharmaceutical industries.**

According to the equipment requirements, the oxygen sterilization filter adopts 1 HDE-16 type filter

1	Treatment air volume:	1m <sup>3</sup> /min.	
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**IV. Supercharger**

According to the equipment requirements, the air station adopts one full oil-free oxygen supercharger produced by Anshan Libang brand

1	Flow rate	12m. <sup>3</sup> / h.	
2	Import pressure:	0.4Mpa.	
3	Export pressure:	15.0MPa.	
4	Working medium:	Oxygen	
5	Pressure	150bar.	

**Filling table (2 head)**



## Chapter IV Scope of Supply

### Equipment part:

S/n o.	Name	Model and specification	Quantity	The Supplier
<b>1, compressed air system</b>				
1)	<b>Air compressor</b>	LU18-8.	One set	Liu Fuda
<b>2, air purification system</b>				
(1)	<b>Air purification unit</b>			
	Main road filter	XF9-24.	One only	Hankson
	Cold-dryer	HD 0020.	One set	Suzhou Evergrande
	Dryer	HDX 0020.	One set	Suzhou Evergrande
	Micro-oil filter	XF7-24.	One only	Hankson
	Ultra-efficient filter	XF5-24.	One only	Hankson
	Automatic drain unit (external)	OPT-A.	3-Only	Hankson
	Active carbon filter	H-24.	One only	Hankson
	Air buffer tank	0.3m. <sup>3</sup> / 0.8MPa.	One only	Professional pressure vessel plant



3, PSA oxygen-making system				
(1)	PSA oxygen gen	HDFQ93-12.	One set	DingLong
	Adsorbent	---	2-Only	Professional pressure vessel plant
	A molecular oxygen sieve	---	Several are	Domestic molecular sieve
	Muffler	HDJ-12.	One only	Suzhou Evergrande purification
	Pilot solenoid valve	4V210-08.	Eight items	Yadk, Taiwan
	Pneumatic valve	Type 2000	Eight items	Special stainless steel valve for oxygen generator
	Stop valve	---	One set	Dedicated purpose
	Flow-flow meter	2-20N m. <sup>3</sup> / h.	One set	Changzhou Double Ring Thermal Instrument Factory
	Electric control box	---	One only	Integrated with the host
	Oxygen meter	Special inlet probe	One set	Shanghai Changai
	The PLC program controller	S7-200, CPU224.	One set	Siemens, Germany
	Sample gas pressure relief valve	---	2-Only	Yadke, Inc
	Pressure gauge	---	Four only	Shanghai
	Touch-screen	At 7 inches	One set	Suzhou Evergrande purification
	Piping, bracket, and base	---	One set	Evergrande Purification Company
	Storage tank	0.3m. <sup>3</sup> / 0.8MPa.	One only	Professional pressure vessel plant
	Medical grade stainless steel sterilization filter	HDE-16.	One only	ZhongSu Evergrande
	Oxygen supercharger	WWZ-12/4-150.	One set	Anshan bang
	Filling table	HDF-2.	One set	ZhongSu Evergrande
	Three-phase current regulator	SBW-80kw.	One set	Shanghai Shengquan





### **Design and technical documents:**

- 1) General drawing of equipment layout
- 2) Complete set of equipment operation instructions and safety manual
- 3) National test certificates for various pressure vessels

### **III. Service scope:**

- 1) Responsible for the commissioning and linkage operation of the gas equipment
- 2) Participate in the commissioning assessment and completion acceptance of the Buyer's equipment
- 3) After the assessment and acceptance, solve the production problems at the site regularly or irregularly according to the request of the Buyer
- 4) Technical training for the operation and maintenance personnel of Party A

### **IV. Service replacement life of equipment and parts:**

1. Change time of pipe filter element- - - -6 months or pressure gauge pointer refers to the red area;
- 2, precision filter element replacement time- - - - -6 months or differential pressure gauge pointer refers to the red area;
3. Replacement time of superfine filter element- - - - -6 months or differential pressure gauge pointer refers to the red area;
4. Active carbon replacement time- - - - -6 months;
5. Solenoid valve replacement time- - - -3-5 years
- 6, sensor replacement time- - - - -about 2-3 years or purity stability;
7. Replacement time of pneumatic valve seals- - - - -3-5 years or use of more than 3 million years
- 8, oxygen molecular sieve replacement time- - - - -8-10 years (normal use)