

Technical Proposal and Quotation

for SY® Nitrogen Generation System

Model: SYNT-25
(capacity 25m³/hr, purity $\geq 99.9\%$)



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1 Executive Summary

BEIJING SUNNY YOUNG TECHNOLOGY COMPANY LTD is pleased to offer Buyer this Quotation based upon our current understanding of your needs for supply of nitrogen at your factory.

BEIJING SUNNY YOUNG TECHNOLOGY COMPANY LTD will provide the service of design, fabrication, purchase and supply of all equipment as specified in SUNNY YOUNG 's scope of supply of this Quotation.

The gaseous nitrogen will be supplied by a reliable and efficient SUNNY YOUNG On-Site Pressure Swing Adsorption (PSA) System. SUNNY YOUNG's system performances are as follows: *(Note: All the “Nm³” used means one (1) cubic meter of gas measure at 0°C, 1atm)*

Design Ambient Condition: 5-45°C, 1atm, 80%RH, the Proposed Plants are as following:

- | | |
|--|---------------------------|
| • Total Nitrogen Production Capability | 25Nm³/h |
| • Nitrogen Purity | ≥99.9% |
| • Nitrogen Outlet Pressure | 8bar |

2.Introduction of BEIJING SUNNY YOUNG TECHNOLOGY CO.,LTD

SUNNY YOUNG Systems have a range of PSA nitrogen & oxygen generators, membrane nitrogen & oxygen generators, nitrogen purification systems etc, and are widely used in industries of petroleum, oil & gas, chemicals, electronics, metallurgy, coals, pharmaceuticals, aerospace, autos, glass, plastics, food, medical treatment, grain, etc. With years research in air separation technology and rich solution experiences in various industries, SUNNY YOUNG sticks to providing our clients with more reliable, more economical, more convenient professional gas solutions.

We have an experienced professional team always ready to be at your service. The sales engineers carefully analyze your specified requirements and offer suitable solutions for you. The after-sale service system guarantees swift response to your problems within 24 hours and their resolutions in the shortest time. SUNNY YOUNG is responsible for after-sales services to nitrogen/oxygen generators and other related equipment offered by us.

SUNNY YOUNG is dedicated to supplying with our customers with more reliable, more economical and more convenient air separation solutions and professional service.

COMPANY BUSINESS

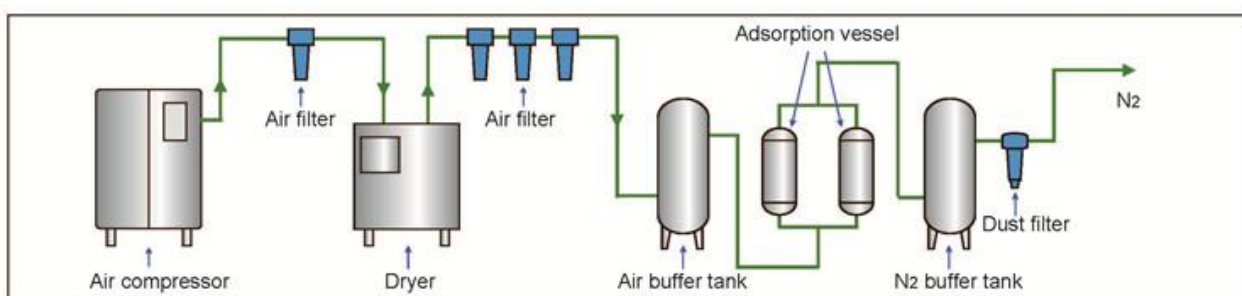
- PSA On-site N₂ generators
 - General purpose nitrogen generators
 - High purity nitrogen generators
- Membrane N₂ generators
- Nitrogen Purification Equipment
- PSA O₂ generators
 - Industrial oxygen generators
 - Medical oxygen generators
- Membrane O₂ generators
- Spare parts & Consumables of N₂/ O₂ generators
- Equipment selection and matching, technician training, installation and commissioning.

3. Description of PSA Nitrogen Generation System

SY® SYNT-25 nitrogen generation system produces 5Nm³/h nitrogen at purity above 99.9%. The system incorporates an Atlas Copco screw air compressor, JMEC refrigerated air dryer and filters, SunnyYoung nitrogen generator air buffer tank, nitrogen buffer tank, nitrogen booster.

Compressed air is purified through the air dryer and filters to a certain level for main generator to work with. Air buffer is incorporated for smooth supply of compressed air thus to reduce fluctuation of work demand for air compressor. The generator produces nitrogen with PSA (pressure swing adsorption) technology, which is a time proven nitrogen generation method. Nitrogen of desired purity at 99.9% is delivered to nitrogen buffer tank for smooth supply of product gas. Nitrogen in buffer tank is maintained at 7barg pressure. It is adjustable for your needs downstream through a pressure regulator valve.

Following is a general diagram of this process.

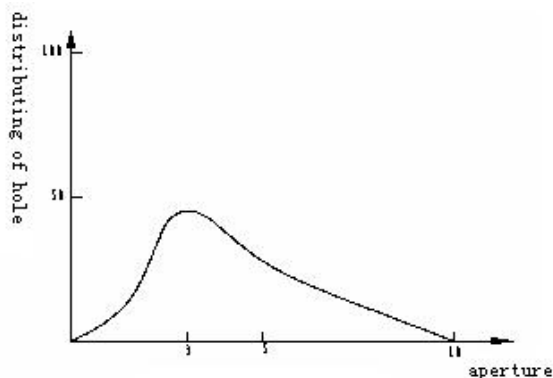


4. Working Principle

The adsorbent of nitrogen pressure swing adsorption (PSA) generator is CMS (carbon molecular sieve). It will adsorb oxygen from compression air, non-adsorb gaseous--Nitrogen is separated from air, becomes to production. The adsorbent will regenerate at depression. It consists from a special coal. Via grind into dust, oxidize, press to pellet, re-carbonization, and then fill the micro-holes, heat treat to produce the production. It is black. There are numerous micro-holes on outside and internal of the column adsorbent. The micro-holes will be scattered as illustration.

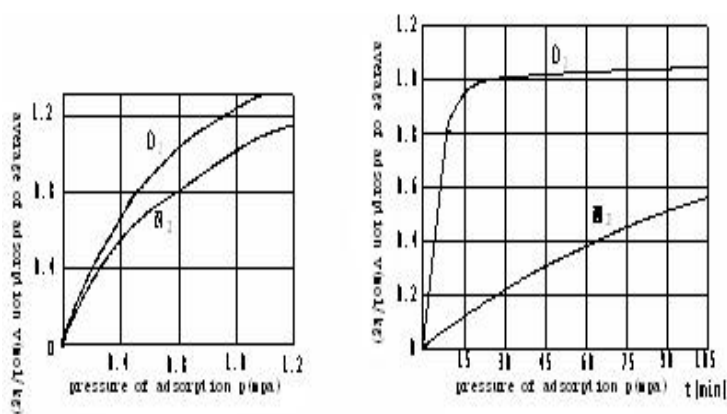
Adsorption and diffusion are the general principles behind the PSA system since each gas has a characteristic adsorption rate that is function of its ability to be adsorbed by a molecular sieve. The adsorption process can produce a range of gas purities from 95.0% to 99.9995% nitrogen plus inert.

It can be showed by the adsorption balance curve and adsorption development curve as statement that the capacity specification of CMS adsorbing to O_2 molecular and N_2 molecular.



From these two adsorption curves, we can understand that adsorption capacity of O_2 and N_2 increase together, while the adsorption pressure will increase. In short time, O_2 molecular is faster arrival at adsorption balance point than N_2 molecular cause their different diffuse.

The nitrogen PSA system bases on this characteristic of selectivity adsorption. Utilize double adsorption bed is elevated pressure to adsorb, and depress to regenerate. Then alternating continues produce high purity nitrogen gaseous.



5.Features

✓ **Reliability:**

- Over ten years' manufacturing& engineering experience, exported to over 40 countries and regions, thousands of machines running.
- Proven PSA technology, simple engineering design, few moving parts and international standardized manufacturing techniques ensure minimal maintenance and maximum reliability.
- Automatic start-stop, remote start-stop, unqualified nitrogen automatic venting, central control of the whole system.
- Operate under low working pressure, much less potential safety hazard.
- Simple engineering design philosophy, the least moving parts to reduce possible break down problems.
- High-efficient silencer.
- Turn-key solution, pre-commissioned before shipment.

✓ **Economy:**

- Less unit cost than liquid nitrogen.
- Completely automatic, labor cost saved. No need to build a machine room specially, construction cost saved.
- Patented REFLUX high-efficiency control system.
- EES system (Energy Efficiency System) enables you to produce nitrogen as actual demand to lower operating cost.

✓ **Convenience:**

- Unattended operation controlled by PLC automatically. Optional touch-screen
- Touch screen controlling system (HMI) control, display and alarm system makes all the generation system operated by one touch. Touch screen controlling system(HMI) displays working parameters, reminds filter elements replacing and instructs trouble shooting. It enables remote control.
- Easy Installation: Skid mounted for easy installation and move.
- Longer Service-life: Exclusive bed containment system enables the service life of the machine to *ten years* under good operation condition.
- Minimal Maintenance: The generator has highly-reliable valves and no other moving parts. Filter elements are easily replaced.
- Optional Wi-Ctrl remote wireless monitoring system for long-distance monitoring, commissioning, and upgrading. SMS would be sent to engineers email box for reminder.

6 Characteristics & Performances of Main facilities

6.1 Main facilities of nitrogen generation system

1. Air compressor
2. Combined adsorption and refrigerated dryer
3. Compressed air filtration system
4. Nitrogen generator

6.2 Characteristics & Performances

Facilities	Manufacturer	Characteristics & Performances
Air compressor	Atlas Copco	World-famous top-rank brand. Screw style, variable speed drive to adjust nitrogen supply according to actual requirements. Remote monitor available. Reputable quality in the world. Local after-service is available in most countries.
Combined adsorption and refrigerated dryer	LUGong	Advanced Dry _u pack high efficient Heat Exchanger to reduce pressure loss of compressed air and refrigerant consumption.
Compressed air filtration system	ATS	Water separator and four stages' filtration to remove water, oil, dust in the air, with diameter of particles down to below 0.01μm, oil to 0.003ppm
Nitrogen generator	SUNNY YOUNG	It includes two adsorption vessels, air buffer tank and nitrogen buffer tank, Germany Burkert pneumatic valves/solenoid valves, Japan Siemens PLC. Efficient CMS enables service life up to 10 years.
Touch Screen control system	SUNNY YOUNG	Display and set operating parameters like purity, capacity etc, send alarm when they are beyond setting ones.

7 Specifications of Main Compositions

7.1 Air Compressor

ITEM	SPECIFICATION	REMARKS
Manufacturer		Atlas Copco
Model	G11	
Outlet Pressure	8.5 barg	Max installed pressure. Rated pressure 8bar.
Flow Capacity	1.6 m3/min	Normal standard
Noise Level	65dB(A)	Measured according to Pneurop/Cagi PN8NTC 2.2 Test Code.
Voltage Class	380v,50Hz,3Phase	
Power Rate	7kw/h	
Size	760*620*970mm	
Weight	410kg	

Cooled Way	Air cooled	Optional Water cooling
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7.2 Combined Refrigerated & Adsorption Dryer

Item	Specification	Remarks
Manufacturer	KeLeng	
Model	LG-20NC	High pressure type
Flow Capacity	2.6 Nm ³ /min	at 7barg, inlet temp 42°C, ambient temp
Max Working Pressure	1~10barg	
Max Inlet Temperature	80°C	Half of capacity compared to standard condition
Max Ambient	50°C	
Dew Point	≤-70°C	
Voltage Class	230v, 60Hz, 1Phase	
Power Rate	0.9 kw/h	
Cooling Method	Air Cooled	
Size	830×1300×1600mm	
Weight	220 kg	



7.3 Compressed Air Filtration System

Name	Model	Capacity (m3/min)	Accuracy	Oil Content	Remark
General Filter	P-0070	2.8	$\leq 3\mu\text{m}$	$\leq 5\text{PPM}$	ATS Italy
Dust Removal Filter	M-0070		$\leq 1\mu\text{m}$	$\leq 1\text{PPM}$	
High Efficiency Oil Removal Filter	H-0070		$\leq 0.01\mu\text{m}$	$\leq 0.01\text{PPM}$	
Active Carbon filter	C-0070		$\leq 0.01\mu\text{m}$	$\leq 0.003\text{PPM}$	ATS Italy



7.4 Nitrogen Generator

Nitrogen Generator SYNT-25		
Item	Specification	Remark
Nitrogen Capacity	25Nm ³ /h	Normal/Standard Condition
Nitrogen Purity	$\geq 99.9\%$	
Nitrogen Delivery Pressure	1~8barg	Adjustable 1-8bar.
Power Consumption	0.2kW	230V, 50Hz Single Phase
Oil Content	$\leq 0.008\text{PPm}$	Normal pressure
Particles Size	$\leq 1\mu\text{m}$	
Pressure Dew Point	$\leq -45^{\circ}\text{C}$	
Dimension	1300×1100×1600 mm	4Towers , estimated
Design Working Conditions		
Air Temperature	5~45°C	
Relative humidity	85%	
Dust Content In The Air	$\leq 20\text{mg/m}^3$	
H ₂ S、SO ₂ Content In The Air	$\leq 5\text{ppm}$	

CO ₂ Content In The Air	≤250ppm	
CnHm Content In The Air	≤20ppm	
Acidic Gases		Less than stimulus content and without erosive gases
Location	Indoor/Outdoor	
Ventilation	Good	



8.Scope of Supply(Including, but not limited)

NO	ITEM	MODEL	QTY	MANUFACTURER
1	Nitrogen Generator	SYNT-25	1	Sunny Young
	Adsorption Vessel		2	Sunny Young
	Air Buffer Tank		1	Sunny Young
	Nitrogen Buffer Tank		1	Sunny Young
	Carbon Molecular Sieve			Sunny Young
	Pneumatic-Controlled Valves		8	SMC , Japan
	Solenoid Valves		6	SMC , Japan
	Control Unit/PLC		1	Siemens, Japan
	CMS Filling System		2	Sunny Young
	Air distribution system		2	Germany
	Online Nitrogen Analyzer	P860-5N	1	Chang'ai, China

	Digital Flow Meter		1	SMC, Japan
	Online Pressure Gauge		2	Sunny Young Partner
	Residual Gas Silencer		1	Sunny Young
	Touch Screen controlling system		1	Siemens, Sunny Young
2	Air compressor		1	Atlas
3	Refrigerated Dryer		1	LuGong
4	Adsorption Dryer		1	Sunny Young
5	Compressed Air Filtration System		5	ATS
6	Pipeline and Flanges for connection		1	Sunny Young
7	Complete Set Of All Technical Drawings in English.		1	Sunny Young
8	Operational Manual and Technical Brochure in English		1	Sunny Young

*The main nitrogen generator is skid mounted and needs no foundation as well as other related equipment. Drains for water should be prepared.

*Power supply: 230v,50Hz,3phase and 230v, 50Hz,1phase.

ITEM	Power Rating(kw/hour)	Power Supply
Air compressor G11	11	230v,50Hz 3Phase
Combined Refrigerated & Adsorption Dryer LG-015AG	0.9	230v,50Hz 1Phase
Air filters	N/A	N/A
Nitrogen generator SYNT-5	0.2	230v,50Hz 1Phase
Total	12.1	

***Required Working Conditions**

-Location of Machine: intended for use indoors.

-Feed Air and Ambient Air Quality: to preserve the effectiveness and extend the working life of the Nitrogen Generator, all precautions should be taken to insure that Oil-free, Clean, Dry air is provided to it.

Dust content: $\leq 20\text{mg/m}^3$

CO₂ content: $\leq 250\text{ppm}$

C₂H₂ content: ≤0.5ppm

CnHm content: ≤20ppm

The air should not have stimulus content or erosive gases.

-Changing the inlet air filters. The unit should be located in a well-ventilated area. The room should be free of toxic gases and high concentration of hydrocarbons, especially carbon monoxide. Furthermore, to the degree possible, oily and humid areas should be avoided as installation sites.

9. Standards

List of Main Standards and Regulations of Practice			
Code	Item	Relevant Standard	Note
1	Pressure vessel	GB150-1998	
		JB/T4701-2000	
		JB755-85/16Mn	
		GB/T1591-1994/16Mn	
		GB/T709-1988	
		GB985-88	
		GB986-88	
		JB/T4709-92	
2	Valve	DIN17440/ 1.4408	
		AISI SS316/SS304	
		ASTM A351 CF8M	
		AATCC127-2003	
		ASTM.E96-2000	
		GB1220-1992/00Gr17Ni14Mo2	
3	Piping and Fitting	GB/T1220-1992/00Gr17Ni14Mo2	
		GB8163-1999/ 20#	
4	Flange	GB1220-1992/00Gr17Ni14Mo2	
		GB/T 9112~9124-2000	
5	Rolled-steel	GB/T699-1999 /16Mn	
		GB/T707-1998	
		GB/T9787-1998	
6	Wiring	GB3836-2000	
		GB/T3783-1994	
		GB/T4942.2-1994	
		GB9332-88	

7	Welding	GB985-88	
		GB986-88	
8	Coating Systems	GB 6745-86	
		GB 6748-86	
		JC / T500—1992	
		GB 9761	
		GB6748 – 86	
9	Packing	GB/T13384	

Note: ASME standard is also available.

10.Functional Specification:

- 1、The system adopts the one-click start way, Air compressor、Refrigerated Air Dryer、Adsorption dryer、Nitrogen Generator will start to work following the program one by one.
- 2、The Nitrogen generator equipped with unqualified nitrogen gas warning-alarm and automatic vent out , then it can make sure that all nitrogen that goes into the pipeline is good quality.
- 3、The Nitrogen generator equipped with colorful touch screen from Siemens Germany , it can display the running condition , purity, pressure, and nitrogen rate of flow of whole system on-line; And it can also remind the maintenance time , record the trouble alarm, download the operating data.

Optional features	Instruction
OCSS(A key to start and stop)	Smart a key to start – stop
AESS (AUTO VENT PORT)System	(Automatically vent the unqualified oxygen)
HMI(Touch Screen Controlling System)	All operating data of oxygen generator will be displayed in the touch screen via the PLC, and touch screen can control the whole system
IAS(Interlock alarm)	When one part of system is faulty alarm, the whole system will shut down interlocking
ABS(Automatic sewage system)	The water and oil in the equipment will be exhaust automatically
EES(Energy Efficiency Systems)	According to different supply amount of gas, controlling the starting and stoping and frequency of systems.
REFLUX(Components control system)	Reduce Compressed air consumption, reduce energy consumption.
SOPRD(Gas pressure regulating device)	Controlling the pressure of gas by the regulating device.
OSS(Backup oxygen system)	When a power outage, system failure, regular maintenance, Providing oxygen still.
Wi-Ctrl(Remote wireless monitoring system)	When the device alarm, the information will be sent automatically to the remote data center and the mail box of local equipment

	maintenance engineer, it can be settled timely in remote and local.
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11 Warranty

It is responsible for SUNNY YOUNG to analyse, answer breakdowns for users all through the working life of SUNNY YOUNG machines.

The period of warranty on the goods under the Scope of supply is 18 months since the completion day of installation and commissioning or 24 months after shipment, whichever occurs first. Upkeep borne in maintenance period shall be borne by SUNNY YOUNG. And upkeep beyond guarantee period or demand for on-site commissioning within or beyond guarantee period are offered with paid service.

For auxiliary facilities including Air compressor, dryer, limited maintenance are offered according to warranty policies of relevant suppliers. Maintenance service can be done by local maintenance site&distributor.

For dryer and filters, warranty period are the same with SUNNY YOUNG generators.

Filter elements are not guaranteed.

12. Itemized prices

Item	Model	Manufacturer	Quantity (set)	Unit price (USD)	Prices (USD)
Air compressor	G11	Atlas	1	\$5100	\$5100
Combined Refrigerated & Adsorption Dryer	LG-20NC	<u>KELENG</u>	1	\$1340	\$1340
Compressed Air Filtration System	4Stages	ATS	4	\$900	\$900
PSA Nitrogen generator	SYNT-25	Sunny Young	1	\$14310	\$14310
HMI(Touch Screen Controlling System) <i>(optional)</i>	7' inch	Siemens& Sunny Young	1	\$700	\$700
AESS (AUTO VENT PORT)System		Sunny Young	1	\$700	free
Total					\$22350

Remark:The quotation doesn't include On-site service fee

-Total Price based on scope of supply above: **USD22350.00 FOB**

-Air/nitrogen buffer tanks could be purchased locally near worksite for saving transportation cost.

Payment term, Delivery&Packing

-Payment Term:50% advance payment and balance before shipment, or 100% irrevocable and confirmed Letter of Credit.

-Delivery time: 40 days on receiving payment.

-Packing: Wooden boxes.

Andrew Hsu

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