molecular sieve GASPU psa nitrogen gas plant And Solution For Nitrogen Production Needs

Our Product Introduction

Basic Information

Product Specification

- Highlight: **molecular sieve psa nitrogen gas plant, psa nitrogen gas Production plant, gaspu psa nitrogen generation system**

Our Product Introduction

Product Description

PSA nitrogen generator GASPU

GASPU pressure swing adsorption PSA nitrogen generator is a device used for nitrogen production.

This equipment uses air as raw material and carbon molecular sieve as adsorbent. It applies the principle of pressure swing adsorption and utilizes the selective adsorption of oxygen and nitrogen by carbon molecular sieve to separate nitrogen and oxygen.

Carbon molecular sieves and zeolite molecular sieves are commonly used in the fields of nitrogen and oxygen production. The separation of oxygen and nitrogen by molecular sieves is mainly based on the different diffusion rates of these two gases on the surface of the molecular sieve. Carbon molecular sieve is a carbon based adsorbent that combines certain characteristics of activated carbon and molecular sieve. Carbon molecular sieves have a very small microporous composition, with pore sizes ranging from 0.3nm to 1nm. Smaller diameter gases (oxygen) diffuse faster and enter the solid phase of the molecular sieve more, allowing for the enrichment of nitrogen components in the gas phase. After a period of time, the adsorption of oxygen by the molecular sieve reaches equilibrium. Based on the different adsorption capacities of carbon molecular sieve for adsorbed gases at different pressures, the pressure is reduced to release the adsorption of oxygen by the carbon molecular sieve. This process is called regeneration. The pressure swing adsorption method usually uses two towers in parallel, alternating between pressurized adsorption and depressurization regeneration, to obtain a continuous nitrogen flow. PSA full name: Pressure Swing Adsorption. PSA is a new gas separation technology that has been rapidly developed abroad since the late 1960s and early 1970s. Its principle is to use the difference in adsorption performance of molecular sieves for different gas molecules to separate gas mixtures. It uses air as raw material and utilizes the selective adsorption performance of a high-performance and high selectivity solid adsorbent for nitrogen and oxygen to separate nitrogen and oxygen from the air.

The method of using air as raw material, carbon molecular sieve as adsorbent, and pressure swing adsorption principle to selectively adsorb oxygen and nitrogen by carbon molecular sieve to separate nitrogen and oxygen is commonly known as PSA nitrogen production. This method is a new nitrogen production technology that rapidly developed in the 1970s. Compared with traditional nitrogen production methods, it has the advantages of simple process flow, high degree of automation, fast gas production (15-30 minutes), low energy consumption, adjustable product purity within a large range according to user needs, convenient operation and maintenance, low operating costs, and strong device adaptability. Therefore, it is highly competitive in nitrogen production equipment below 1000Nm3/h and is increasingly popular among small and medium-sized nitrogen users. PSA nitrogen production has become the preferred method for small and medium-sized nitrogen users.

With the rapid development of industry, nitrogen has been widely used in fields such as chemical engineering, electronics, metallurgy, food, and machinery. China's demand for nitrogen is increasing at a rate of over 8% per year. The chemical properties of nitrogen are not active, and it exhibits great inertness in its normal state, making it difficult to undergo chemical reactions with other substances. Therefore, nitrogen is widely used as a protective gas and sealing gas in the metallurgical industry, electronic industry, and chemical industry. The purity requirement for protective gas is generally 99.99%, and some require high-purity nitrogen above 99.999%.

Pure nitrogen cannot be directly extracted from nature and is mainly obtained through air separation. Air separation methods include cryogenic method, pressure swing adsorption (PSA) method, and membrane separation method.

1. Introduction to Process Flow

After passing through an air filter to remove dust and mechanical impurities, the air enters the air compressor and is compressed to the required pressure. After strict oil, water, and dust removal purification treatment, clean compressed air is output to ensure the service life of the molecular sieve in the adsorption tower. There are two adsorption towers equipped with carbon molecular sieves. When one tower is working, the other tower is depressurized for desorption. Clean air enters the working adsorption tower, and oxygen, carbon dioxide, and water are adsorbed by molecular sieves. The gas flowing to the outlet end is nitrogen and trace amounts of argon and oxygen. The other tower (desorption tower) separates the adsorbed oxygen, carbon dioxide, and water from the micropores of the molecular sieve and releases them into the atmosphere. In this way, the two towers take turns to complete nitrogen oxygen separation and continuously output nitrogen gas. The purity of nitrogen produced by pressure swing adsorption is 95% -99.999%. If higher purity nitrogen is needed, nitrogen purification equipment needs to be added. 95% -99.99% of the nitrogen output from the pressure swing adsorption nitrogen generator enters the nitrogen purification equipment, and an appropriate amount of hydrogen is added through a flow meter. In the deoxygenation tower of the purification equipment, hydrogen and trace oxygen in the nitrogen undergo catalytic reaction to remove oxygen. Then, they are cooled by a water condenser, dehydrated by a steam water separator, and deeply dried by a dryer (two adsorption drying towers are alternately used: one adsorption drying dehydration and the other heating desorption drainage) to obtain high-purity nitrogen gas, with a purity of 99.9999%

Cryogenic nitrogen production

1. Typical process flow of cryogenic nitrogen production:

The entire process consists of air compression and purification, air separation, and liquid nitrogen vaporization.

Air compression and purification

After passing through an air filter to remove dust and mechanical impurities, the air enters an air compressor, compressed to the required pressure, and then sent to an air cooler to lower the air temperature. Then enter the air drying purifier to remove moisture, carbon dioxide, acetylene, and other hydrocarbons from the air.

Air separation:

The purified air enters the main heat exchanger in the air separation tower and is cooled to saturation temperature by the reflux gas (product nitrogen, exhaust gas). It is then sent to the bottom of the distillation tower, where nitrogen is obtained at the top of the tower. The liquid air is then throttled and sent to the condensing evaporator for evaporation. At the same time, a

portion of the nitrogen sent by the distillation tower is condensed. A portion of the condensed liquid nitrogen is used as the reflux liquid of the distillation tower, while the other portion is used as liquid nitrogen product and discharged from the air separation tower.

The exhaust gas from the condenser evaporator is reheated to about 130K by the main heat exchanger and enters the expansion machine for expansion and cooling to provide cooling for the air separation tower. A portion of the expanded gas is used for the regeneration and blowing of molecular sieves, and then discharged into the atmosphere through a muffler.

Liquid nitrogen vaporization

The liquid nitrogen from the air separation tower is stored in a liquid nitrogen storage tank. When the air separation equipment is under maintenance, the liquid nitrogen in the storage tank enters the vaporizer and is heated before being sent into the product nitrogen pipeline.

Cryogenic nitrogen production can produce nitrogen gas with a purity of ≥ 99.999%.

Technical and economic comparison

Technical and economic comparison between cryogenic nitrogen production and pressure swing adsorption nitrogen production

1. Process comparison

From the above discussion, it can be found that the pressure swing adsorption nitrogen production process is simple, with a small number of equipment, mainly consisting of air compressors, air dryers, adsorption nitrogen generators, and gas storage tanks. The cryogenic nitrogen production process is complex with a large number of equipment, including air compressors, air coolers, air purification dryers, heat exchangers, expanders, and precision flow towers.

Nitrogen generator

2. Comparison of product types and purity

Cryogenic nitrogen production can not only produce nitrogen but also produce liquid nitrogen, meeting the process requirements for liquid nitrogen. It can also be stored in liquid nitrogen storage tanks. When there is a nitrogen interruption load or minor maintenance of the air separation equipment, the liquid nitrogen in the storage tank enters the vaporizer and is heated before being sent into the product nitrogen pipeline to meet the nitrogen demand of the process equipment. The operating cycle of cryogenic nitrogen production (referring to the interval between two large heating cycles) is generally more than 1 year, therefore, cryogenic nitrogen production generally does not consider backup. However, pressure swing adsorption nitrogen production can only produce nitrogen gas without backup means, and a single set of equipment cannot guarantee continuous long-term operation.

Cryogenic nitrogen production can produce nitrogen gas with a purity of ≥ 99.999%. The purity of nitrogen is limited by factors such as nitrogen load, number of trays, tray efficiency, and oxygen purity in the liquid air, and the adjustment range is very small. Therefore, for a set of cryogenic nitrogen production equipment, the product purity is basically certain and difficult to adjust. The purity of nitrogen produced by pressure swing adsorption is generally within the range of 95% -99.999%. If higher purity nitrogen is needed, nitrogen purification equipment needs to be added. The purity of nitrogen is only affected by the nitrogen load of the product. Under other constant conditions, the higher the nitrogen discharge, the lower the purity of nitrogen; Conversely, the higher it is. Therefore, for a set of pressure swing adsorption nitrogen production equipment, as long as the load is allowed, the product purity can be adjusted freely between 90-99.999%.

3. Comparison of operational control

The cryogenic method is carried out at extremely low temperatures, and there must be a pre cooling start-up process before the equipment is put into normal operation. The start-up time is generally not less than 12 hours from the start of the expander to the required nitrogen purity; Before the equipment enters major maintenance, there must be a period of heating and thawing, usually 24 hours. Therefore, the cryogenic nitrogen production equipment should not start and stop frequently, and should operate continuously for a long time. When starting the pressure swing adsorption method, just press the button and within 30 minutes, qualified nitrogen products can be obtained. If high-purity nitrogen is needed, it can be purified by a nitrogen purification device in about 30 minutes to obtain 99.99% -99.9999% high-purity nitrogen. Just press the button to stop the machine. Therefore, pressure swing adsorption nitrogen production is particularly suitable for intermittent operation.

Deep cooling nitrogen production generally adopts advanced DCS (or PLC) computer control technology to achieve integrated control of central control, machine side, and on-site, which can effectively monitor the production process of the entire equipment. Pressure swing adsorption nitrogen production adopts intelligent fully automatic control, and nitrogen production can be carried out with just a button, without the need for dedicated personnel to manage.

purpose

The specialized nitrogen generator for the oil and gas industry is suitable for nitrogen protection, transportation, coverage, replacement, emergency rescue, maintenance, nitrogen injection and oil recovery in mainland oil and gas extraction, coastal and deep-sea oil and gas extraction. It has the characteristics of high safety, strong adaptability, and continuous production.

The specialized nitrogen generator for the chemical industry is suitable for the processing of petrochemical, coal chemical, salt chemical, natural gas chemical, fine chemical, new materials and their derivative chemical products. Nitrogen is mainly used for covering, blowing, replacing, cleaning, pressure conveying, chemical reaction agitation, chemical fiber production protection, nitrogen filling protection and other fields.

The specialized nitrogen fertilizer machine for the metallurgical industry is suitable for fields such as heat treatment, bright annealing, protective heating, powder metallurgy, copper and aluminum processing, magnetic material sintering, precious metal processing, and bearing production. It has the characteristics of high purity, continuous production, and some processes

require nitrogen to contain a certain amount of hydrogen to increase brightness.

The specialized nitrogen generator for the coal mining industry is suitable for fire prevention and extinguishing, gas and gas dilution, and other fields in coal mining. It has three specifications: ground fixed, ground mobile, and underground mobile, fully meeting the nitrogen demand under different working conditions.

The specialized nitrogen generator for the rubber tire industry is suitable for nitrogen protection and molding during the vulcanization process of rubber and tire production. Especially in the production of all steel radial tires, the new process of nitrogen vulcanization has gradually replaced the steam vulcanization process. It has the characteristics of high nitrogen purity, continuous production, and high nitrogen pressure.

The specialized nitrogen generator for the food industry is suitable for green storage of grain, nitrogen filling packaging of food, preservation of vegetables, sealing (canning) and storage of alcoholic beverages, etc.

Explosion proof nitrogen generators are suitable for places with explosion-proof requirements such as chemical, petroleum and natural gas industries.

The specialized nitrogen generator for the pharmaceutical industry is mainly used in fields such as drug production, storage, packaging, and packaging.

The electronic industry specific nitrogen generator is suitable for semiconductor production packaging, electronic component production, LED, LCD liquid crystal display, lithium battery production and other fields. The nitrogen generator has the characteristics of high purity, small size, low noise, and low energy consumption.

Container type nitrogen generators are suitable for petroleum, natural gas, chemical, and other related fields, and have the characteristics of strong adaptability and mobile operation.

Vehicle mounted mobile nitrogen generation vehicles are suitable for fields such as oil and gas extraction, pipeline blowing, replacement, emergency rescue, dilution of flammable gases and liquids in the oil and gas industry. They are divided into low-pressure, medium pressure, and high-pressure series, and have the characteristics of strong mobility and mobile operation.

Automobile tire nitrogen filling machine, mainly used for nitrogen filling of automobile tires in 4S stores and repair shops, can extend the service life of tires, reduce noise and fuel consumption.

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