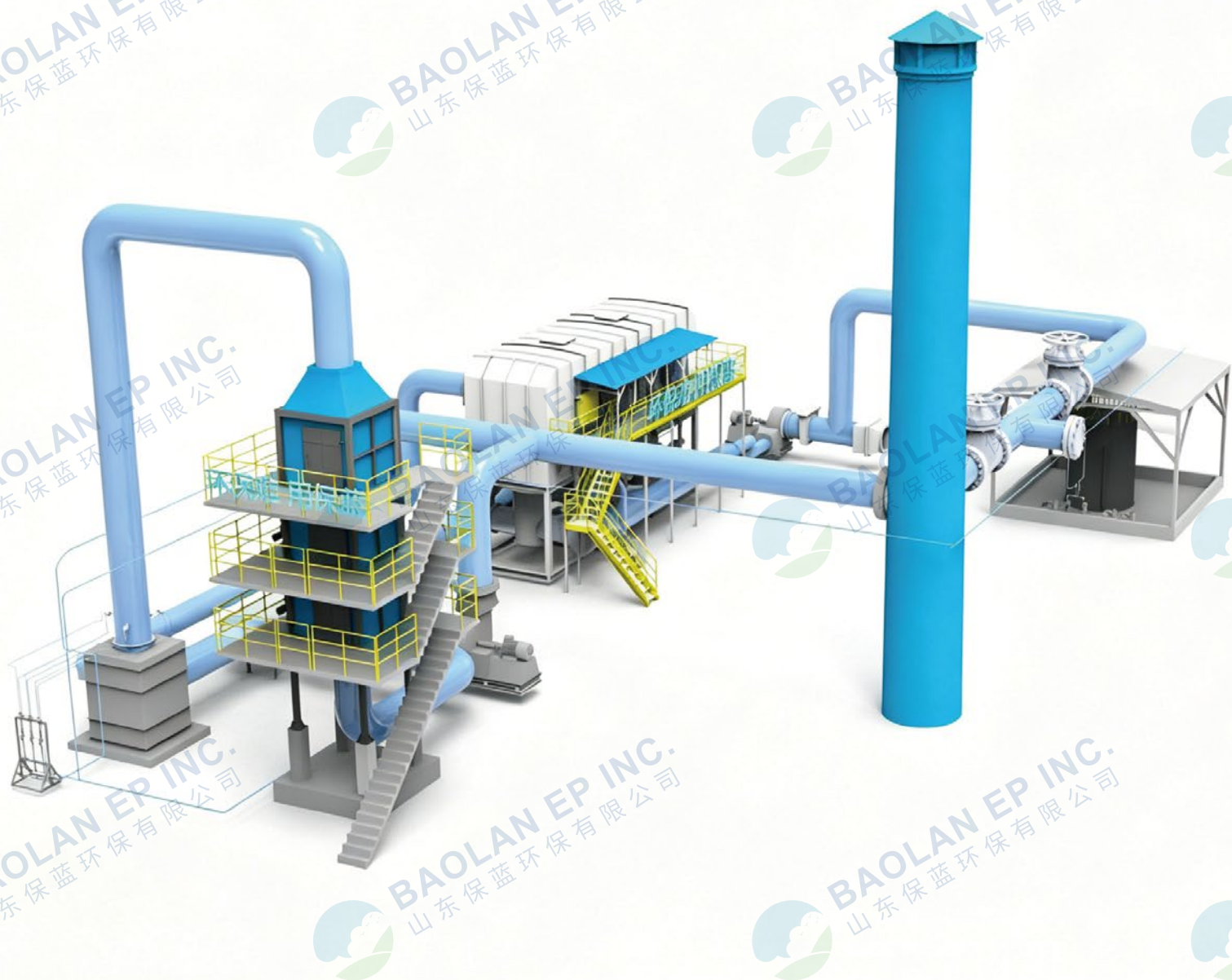


VOCs Solutions

Zeolite Adsorption | TO | RTO | CO | RCO | ETP



Zeolite Adsorption-Desorption

Adsorption System for VOCs

Overview

In industries such as printing, coating, and electronics manufacturing, the treatment of low-concentration volatile organic compounds (VOCs) exhaust gas has always been a challenge for environmental protection. Traditional single technologies (such as direct combustion or activated carbon adsorption) have problems including high energy consumption, high operating costs, poor safety, or secondary pollution. The combined process of zeolite adsorption concentration + catalytic combustion achieves efficient purification and resource utilization of low-concentration exhaust gas through the synergistic effect of "adsorption-desorption-combustion," becoming one of the mainstream solutions for industrial exhaust gas treatment today. It can be widely used in the following industries such as power, metallurgy, cement and chemistry, and so on.



Working Principle

First, enter the filter for pretreatment; use a dry filter to perform pretreatment filtration of particulate matter in the exhaust gas; The exhaust gas is sent into adsorption tanks A/B. When adsorption tank A approaches saturation, switch to adsorption tank B/C (adsorption tank A stops adsorbing). Use hot airflow to desorb and detach adsorption tank A. During desorption, the organic waste gas is concentrated, and the concentrated waste gas is sent to the catalytic combustion device to be decomposed into CO_2 and H_2O .

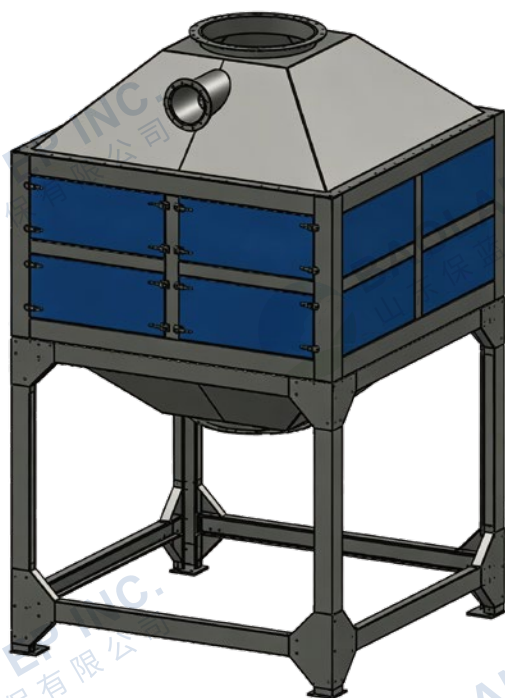
After desorption, adsorption tank A enters standby status. When adsorption tank B approaches saturation, the system switches back, while simultaneously desorbing adsorption tanks A/C, thus working in a cyclic manner.

Zeolite Adsorption-Desorption

Adsorption System for VOCs

Internal Structure

Dry Filter :Exhaust gas is introduced into the filter through the pipeline, passing through the filter cotton. The exhaust gas fully contacts the filter cotton, and the large molecular particles and dust it carries are intercepted by the filter cotton and adhere to it, removing dust particles larger than $5\mu\text{m}$ from the exhaust gas. Then the exhaust gas passes through the filter bag (G4-F5-F9-H10) for filtration, removing dust particles larger than $1\mu\text{m}$ from the exhaust gas.



Adsorption Box:The internal zeolite of the adsorption box is designed in multiple layers, ensuring uniform and stable airflow distribution and good adsorption performance;

Using honeycomb activated carbon or molecular sieve, the empty tower wind speed is 0.8-1.5m/s, resulting in low resistance;

The equipment box is made of carbon steel material, with good surface anti-rust effect;

The adsorption device reserves maintenance manholes and is equipped with an operation platform. The platform, ladder, and guardrail facilitate equipment maintenance and material replacement, making it convenient to maintain and inspect the equipment and enhancing operational safety.

The box adopts a modular design, with molecular sieves independently installed for convenience and ease of maintenance.

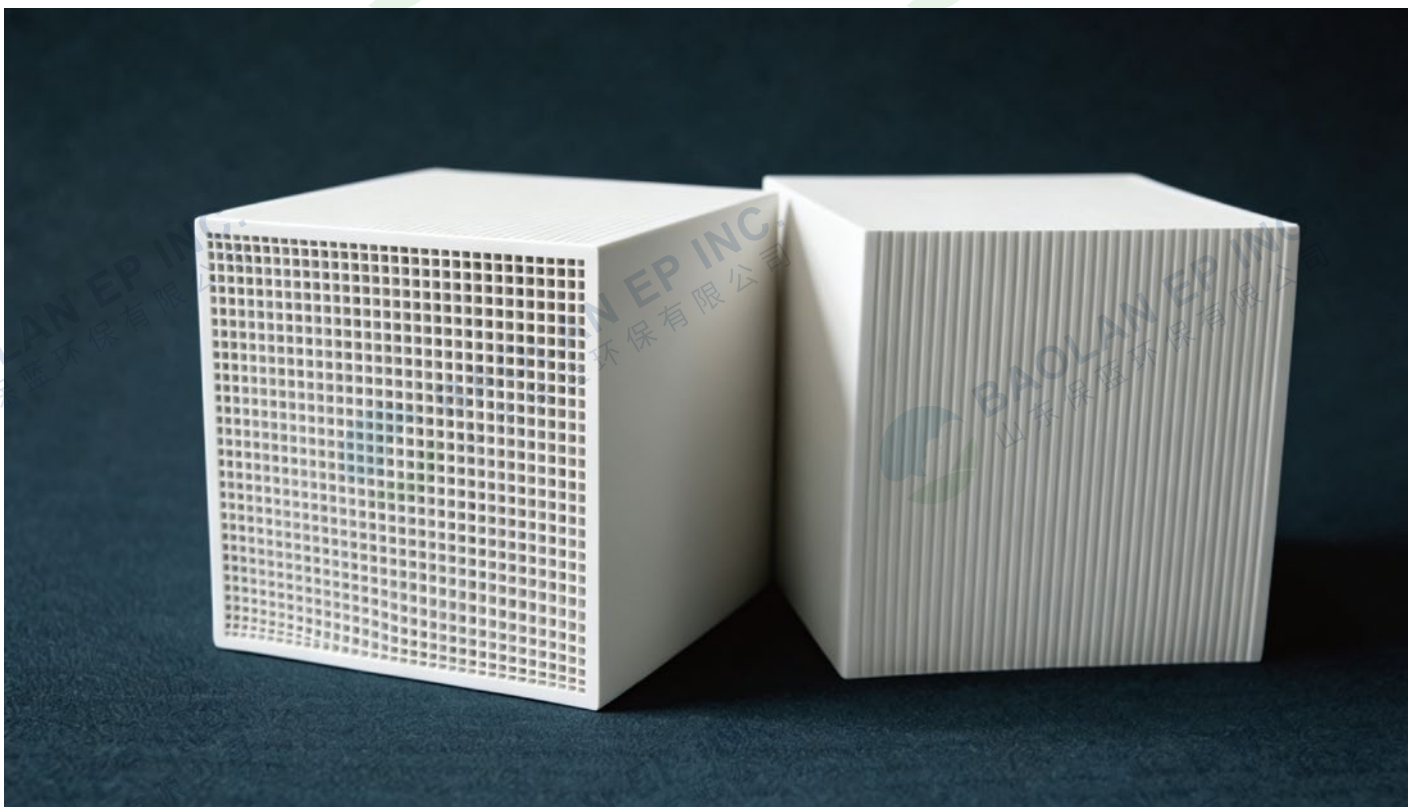
Zeolite Adsorption-Desorption

Adsorption System for VOCs

Internal Structure

Introduction to Adsorbent Materials:

1. The main material of honeycomb molecular sieve is natural zeolite, an inorganic microporous material composed of SiO_2 , Al_2O_3 , and alkali metals or alkaline earth metals;
2. It has uniform micropores, with pore sizes comparable to general molecular sizes, an internal pore volume accounting for 40-50% of the total volume, and a specific surface area of 300-1000 m^2/g ;
3. Due to the uniform pore size distribution, significant variations in structure and composition, it features high temperature resistance, non-flammability, good thermal stability, and hydrothermal stability.



Activated carbon adsorption and desorption can be adopted in certain scenarios.

Adsorption Principle:

1. Select adsorption according to the geometric size and shape of the molecule
Molecular sieves have a honeycomb structure, with cavity diameters generally between 0.6~1.5nm, pore sizes about 0.3~1nm, and uniformly arranged channels within the crystal. The uniform pore size and the regular framework structure of the molecular sieve determine its shape-selective adsorption.
2. Select adsorption according to the polarity, unsaturation, and polarizability of the molecule
Due to differences in polarity, unsaturation, and polarizability of the adsorbate molecules, their interaction strength with the molecular sieve and diffusion rate inside the molecular sieve vary. Since zeolite molecular sieves themselves are polar substances with a strong internal electrostatic field, molecules with stronger polarity or easier polarization are more easily adsorbed.

Desorption Principle :

The desorption uses hot air as the desorption medium, and this hot airflow comes entirely from the residual heat after catalytic combustion within the system. The concentrated organic waste gas after desorption enters the catalytic combustor for purification treatment, requiring no additional energy, greatly reducing operating costs. For the same treatment volume, it is about 1/20 of the direct catalytic combustion method and 1/10 of the molecular sieve adsorption.

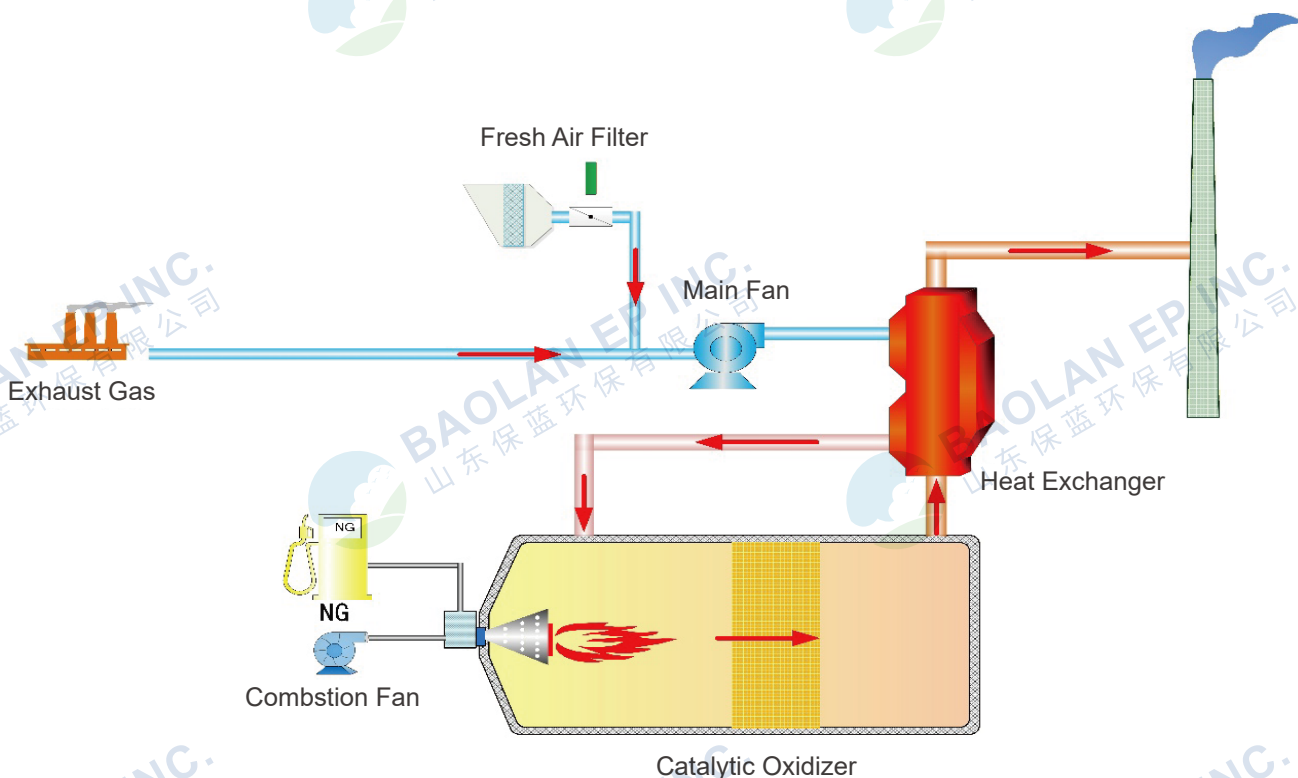
Zeolite Adsorption-Desorption

Adsorption System for VOCs

Internal Structure

Principle of Catalytic Combustion Technology:

1. The exhaust gas enters the heat exchanger under the action of the main fan, and the gas is heated.
2. The exhaust gas enters the catalytic bed. If the temperature after heat exchange does not reach the catalytic temperature, electric heating or a burner is used to heat the exhaust gas until it reaches the catalytic temperature, then it enters the catalyst.
3. Under the action of the catalyst, the organic substances in the exhaust gas are oxidized and decomposed, purified into carbon dioxide and water, and release heat; the released heat enters the hot side of the heat exchanger to heat the exhaust gas.
4. The purified exhaust gas is discharged in compliance with standards.



Catalysts are the core of catalytic combustion methods. A good catalyst must have characteristics such as high catalytic activity, good thermal stability, high strength, and long service life.

1. High activity. The activity of the catalyst directly affects the chemical conversion rate of catalytic combustion. The conversion rate is not only related to the activity of the catalytic active material itself but also directly related to the physical shape of the catalytic carrier. Therefore, when selecting suitable catalytic active materials, the physical shape of the catalytic carrier must also be considered to ensure the catalyst has high activity and achieves the purpose of catalytic combustion purification.
2. Good thermal stability. Since the temperature of the exhaust gas changes at any time, if the catalyst cannot adapt to temperature changes within a certain range, the performance of the catalyst will decline, and the purification efficiency will decrease. Therefore, the catalyst must be able to adapt to temperature changes within a certain range.
3. High strength. During the catalytic combustion process, the catalyst is often subjected to factors such as high temperature, vibration, and airflow, causing the catalyst to crack and wear. Cracking and wear will reduce the catalyst's activity, increase the pressure drop in the catalyst bed, and affect the purification effect.
4. Long service life. Catalytic active materials are generally quite expensive, so when designing and selecting catalysts, catalysts with longer service lives should be used as much as possible.

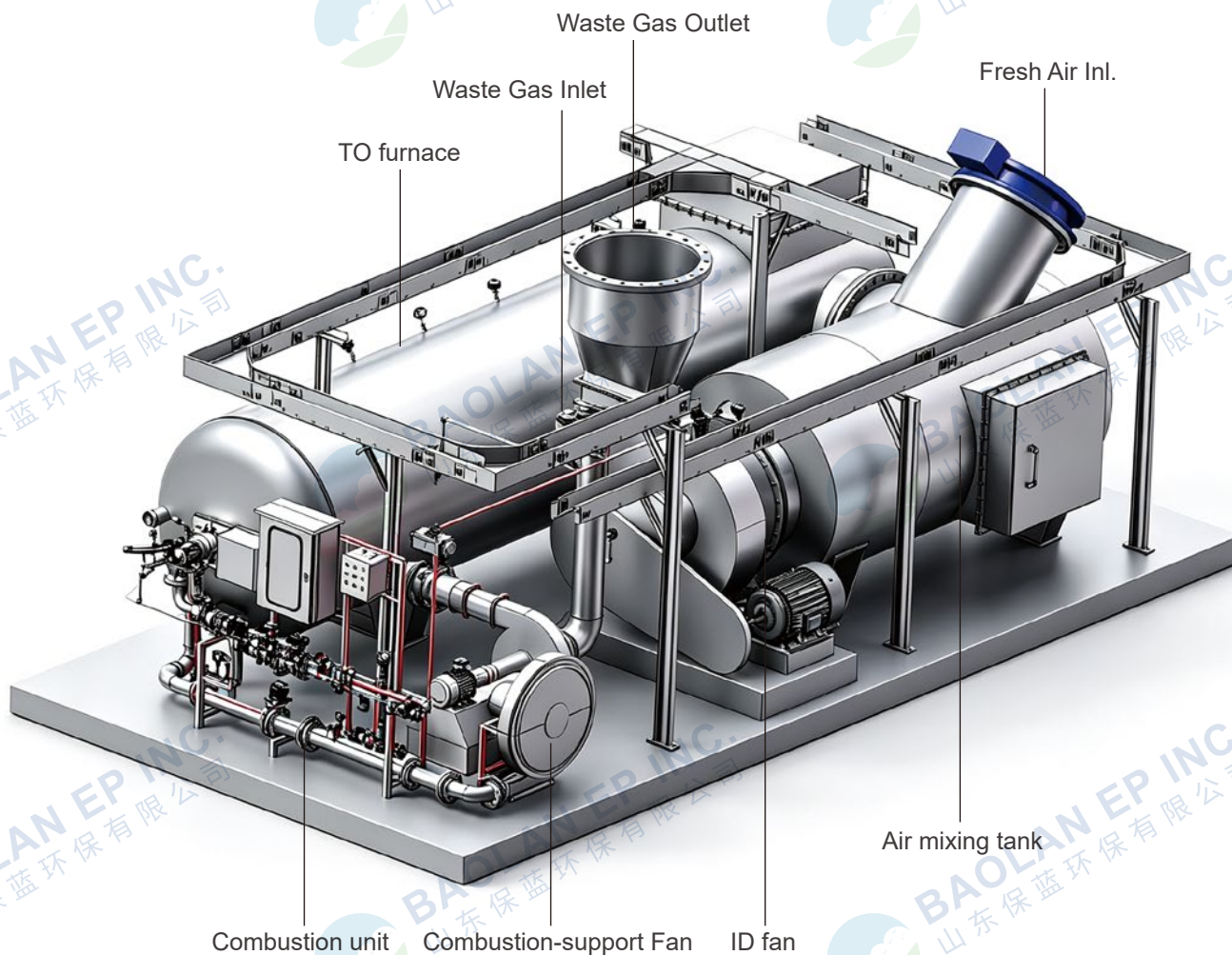
Catalytic combustion technology can achieve over 95% removal efficiency of VOCs at relatively low temperatures (300-500 °C), with complete reaction producing CO_2 and H_2O . It is one of the most energy-saving and efficient waste gas treatment technologies. With the help of catalysts, organic waste gases can undergo flameless combustion at lower ignition temperatures, oxidizing and decomposing into CO_2 and H_2O while releasing a large amount of heat.

TO

Thermal Oxidizer for VOCs

Overview

Direct-fired incineration technology TO (Thermal Oxidizer, abbreviated as TO) utilizes the heat generated by the combustion of auxiliary fuels (such as natural gas, diesel, gas, liquefied gas, etc.) to raise the temperature of combustible organic waste gases to the reaction temperature (680-760°C), thereby causing oxidative decomposition and purifying the waste gas. The high-temperature gas produced by decomposition can be used for heat recovery through devices such as heat exchangers or boilers, or it can be directly discharged.



Working Principle

After the exhaust gas enters the TO direct-fired incinerator, the burner heats up and raises the temperature, the exhaust gas is heated to an oxidation temperature above 760°C, and the organic matter in the exhaust gas is oxidized and decomposed into carbon dioxide and water, releasing heat; the purified high-temperature gas enters the rear heat exchanger or waste heat boiler for heat recovery, and is finally discharged through the chimney under the action of the fan to meet the emission standards.

TO

Thermal Oxidizer for VOCs

Internal Structure

TO Direct-Fired Incinerator:

Direct-fired waste gas incinerators are key equipment in organic waste gas incineration treatment systems. The design principle of waste incinerators is to ensure that the waste is completely burned in the furnace at the specified incineration temperature and with sufficient residence time.



Burner:

The burner, as the heart of the incineration process, mainly consists of the burner body, flame stabilization device, air distributor, ignition gas gun, main gas gun, explosion-proof high-energy ignition device, flame detection equipment, etc.

The most notable feature of our high-efficiency burner is that the swirling mixed airflow forms a low-pressure zone in the center of the combustion chamber. This low-pressure zone draws part of the flue gas back into the combustion chamber, prolonging the residence time of a large amount of fuel in the chamber and ensuring more complete combustion. The thorough mixing of fuel and air accelerates the combustion reaction rate, thereby shortening the flame length. The intense mixing of fuel and air in the combustion chamber and the resulting stable flame root prevent flame instability and incomplete combustion issues when the burner efficiently burns various fuels. This circulating vortex flow pattern maximizes the mixing and combustion of fuel and air.

The burner adopts a two-stage ignition method: the ignition gun lights the ignition gas gun, which then ignites the main gas gun. It features a compact structure, stable combustion, a high turndown ratio, and low noise. The flame exhibits excellent spreadability, complete combustion, and easy control. The high-efficiency burner's central air supply is equipped with a flame stabilization shield, creating a recirculation zone to stabilize the flame shape and further promote thorough mixing of air and fuel. The burner is equipped with a viewing port to observe the flame combustion status. The air inlet is configured with an automatic or manual air damper.

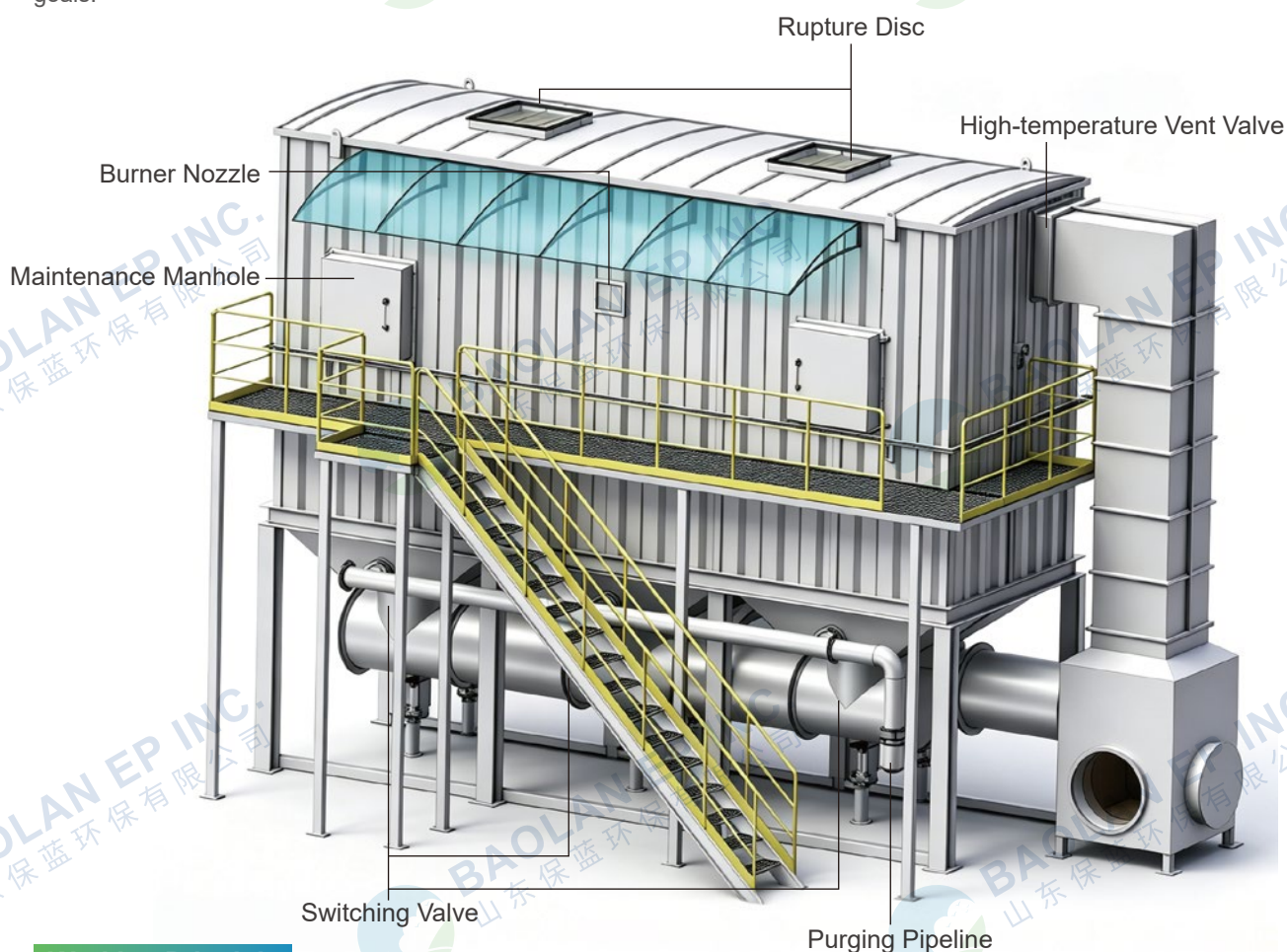


RTO

Regenerative Thermal Oxidizer for VOCs

Overview

The Regenerative Thermal Oxidation (RTO) technology heats organic waste gases to above 760°C, causing the volatile organic compounds (VOCs) in the waste gases to oxidize and decompose into CO₂ and H₂O in the combustion chamber, achieving a purification efficiency of up to 99%. The high-temperature gases generated by oxidation flow through a specially made ceramic regenerator, heating the ceramic body and "storing heat". In the next process, the waste gases pass through the already "heat-stored" ceramic, transferring the heat of the ceramic to the waste gases. The organic waste gases pass through the ceramic as a heat exchanger carrier, undergoing repeated heat exchange, thereby saving fuel consumption for heating the waste gases, reducing operating costs, and achieving a heat recovery efficiency of up to 95%. Under medium to high concentration conditions, RTO can export waste heat, which can be utilized in the form of steam, hot air, or hot water, achieving economic benefits while meeting environmental protection goals.



Working Principle

The high-temperature purified flue gas flows through another cold heat storage bed, transferring heat to the ceramic media for heat recovery, then the low-temperature clean gas is discharged. Through regular switching of intake and exhaust valves, each heat storage chamber alternately undertakes preheating waste gas and recovering flue gas heat, realizing high-efficiency heat recycling. The heat recovery efficiency can reach over 95%, and the VOC removal efficiency is higher than 99%. When the waste gas has high organic concentration, the self-generated combustion heat can maintain the reaction temperature without continuous fuel supply, significantly cutting operating costs.

RTO

Regenerative Thermal Oxidizer for VOCs

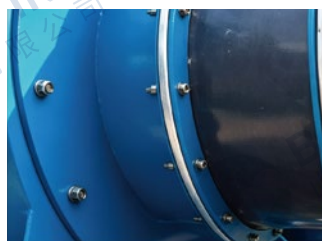
Internal Structure

Insulation cotton:The RTO box adopts high-alumina aluminum silicate fiber insulation modules with a maximum insulation thickness of 300mm, providing superior insulation performance compared to ordinary aluminum or high-purity fiber cotton.

The insulation products selected for this project feature low thermal conductivity and good thermal stability; they are easy and quick to install, with anchoring parts installed internally for good safety; they have high compressive strength and long service life; they exhibit excellent resistance to thermal flow scouring and high mechanical strength. Due to the fiber components being in a compressed state, after the furnace lining is installed, the fiber components expand, leaving no gaps between the furnace linings, thus improving the thermal insulation performance of the fiber lining.



Fan system:The exhaust fan adopts fire-resistant designs such as copper-inlaid suction inlets or cast aluminum impellers, enhancing the safety of the system's equipment in flammable and explosive environments. All fans operate at specified flow rates and operating temperatures and are equipped with: flexible connections, shock pads, and maintenance holes.



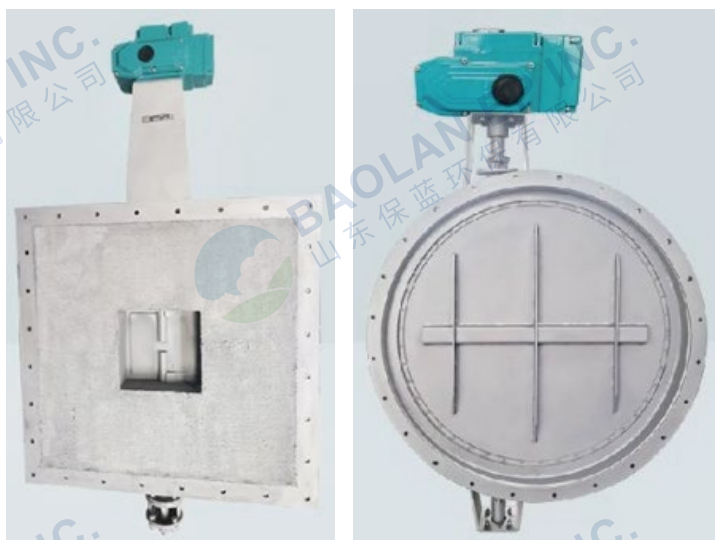
RTO switching valve system:All RTO switching valves utilize high-quality poppet valves. The selected poppet valves feature high precision, minimal leakage ($\leq 1\%$), long lifespan (up to 500,000 cycles), rapid opening and closing ($\leq 1s$), and reliable operation.

RTO

Regenerative Thermal Oxidizer for VOCs

Internal Structure

Insulation cotton: High-temperature valves are equipped with pneumatic/electric actuators according to the on-site operating conditions. The valves are adjusted through analog signals and automatically controlled by a PLC control system, ensuring reliable operation. Due to the high operating temperature of the environment where the high-temperature valves are located, the valves are designed with aluminum silicate fiber insulation modules or temperature-resistant coatings for insulation, with an insulation thickness of $\geq 200\text{mm}$. The valve plates of the equipment valves are made of 310S material to ensure sufficient temperature resistance of the valves and meet the long-term operation requirements of the equipment.



Bursting disc: In abnormal conditions, if RTO or the fan experiences an abnormality leading to a sharp increase in pressure, the explosion venting disc will automatically vent to reduce damage to system equipment. According to HG/T20570.3 "Setting and Selection of Bursting Discs", an explosion venting disc device is also installed on the RTO furnace body. The pressure relief safety device, consisting of an explosion venting disc and a holder, will actuate immediately when the pressure difference between the two sides of the explosion venting disc reaches a predetermined value at a predetermined temperature, releasing the pressure medium.

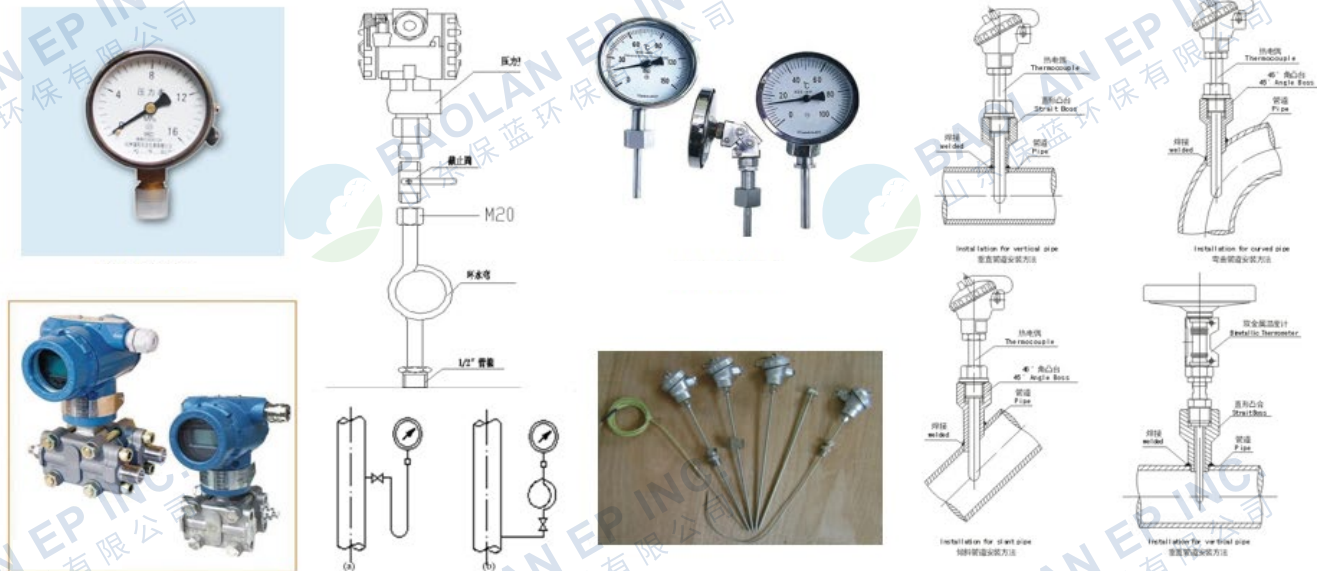


RTO

Regenerative Thermal Oxidizer for VOCs

Internal Structure

Instrumentation system



Burner: The burner adopts a low-pressure proportional regulating gas burner, which can achieve continuous proportional regulation with a regulation range of 30:1. The fuel is natural gas, ignited at high pressure, and can adapt to various situations. The combustion system includes a combustion air fan, a high-pressure ignition transformer, a proportional regulating valve, a UV flame detector, etc. The proportional regulating valve can adjust its opening according to the temperature changes required by the furnace, saving fuel. The fuel and combustion air change synchronously, ensuring stable combustion. The fuel supply pipeline system includes a pressure regulating valve, an automatic fuel shut-off valve, and high and low pressure switches. When the gas pressure is low, the automatic fuel shut-off valve cuts off the fuel, and the burner stops working - this is the low-pressure protection function. If the gas pipeline is blocked, causing the pressure to exceed the limit, the fuel will be automatically shut off, and the burner will stop working - this is the high-pressure protection function.

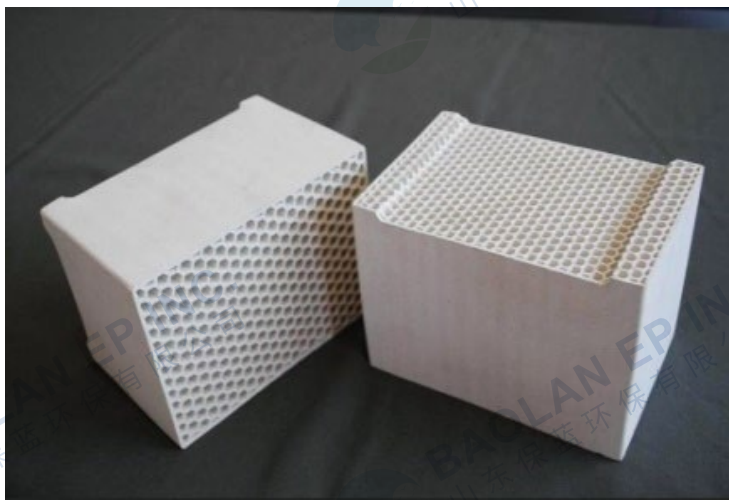


RTO

Regenerative Thermal Oxidizer for VOCs

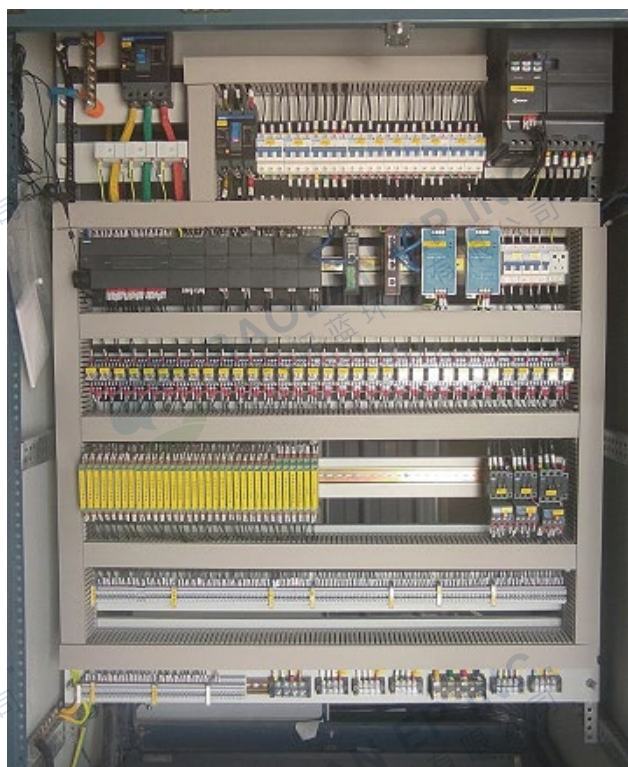
Internal Structure

Regenerative body: The regenerator, also known as the regenerative filler, is an important component of the RTO device. It acts as a heat exchanger, specifically a regenerative heat exchanger. Its function is as follows: when cold exhaust gas passes through the hot regenerator, the regenerator releases the stored heat, heating the exhaust gas to the required preheating temperature while the regenerator itself is cooled (cold cycle). The preheated gas then enters the combustion chamber, and after reaction, the hot purified gas passes through the cold regenerator, where the regenerator absorbs the heat from the purified gas, cooling the gas while the regenerator itself is heated (hot cycle).



Electronic control system: The waste gas treatment control system takes PLC as the core controller, equipped with HMI touch screen and local operation boxes. It realizes real-time monitoring of equipment operating status, graphic display of technological processes, real-time display of key operating parameters and fault alarm information, as well as automatic interlock protection for safe operation.

The supporting data processing software supports data reception, dynamic display, remote transmission and long-term storage. An independent emergency shutdown circuit is configured. It will immediately stop relevant equipment when faults, over-temperature, gas leakage and other dangerous conditions occur, preventing safety hazards and guaranteeing stable and compliant operation of the whole waste gas purification system.



Rotary RTO

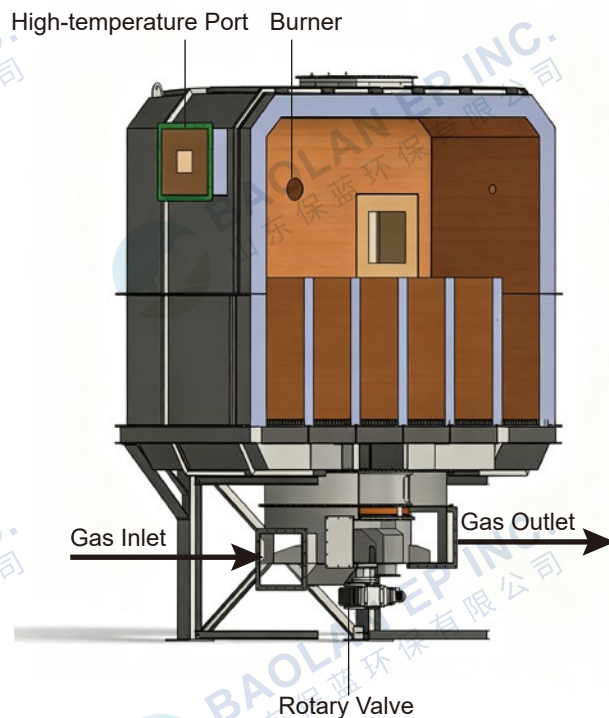
Regenerative Thermal Oxidizer for VOCs

Overview

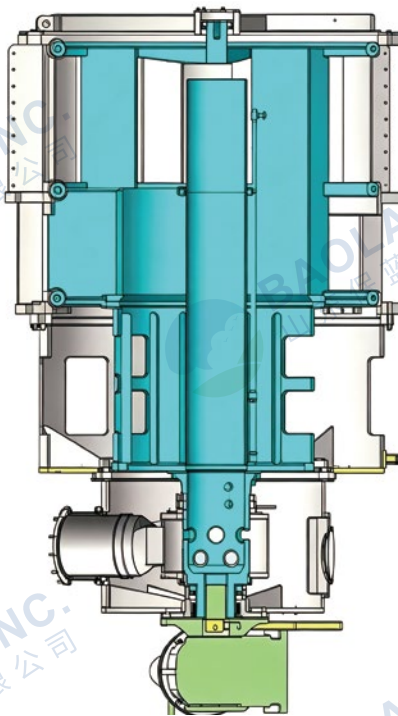
Rotary RTO, short for Rotary Regenerative Thermal Oxidizer, is a high-efficiency regenerative incineration equipment for volatile organic compounds (VOCs) waste gas treatment.

Different from the traditional three-chamber RTO with switching valves, the rotary RTO adopts an integrated rotary distribution valve to continuously switch the air flow direction inside the furnace. The ceramic honeycomb regenerator inside the equipment stores and recovers heat generated by the oxidative combustion of waste gas, which greatly reduces the auxiliary heating energy consumption.

Polluted waste gas enters the regenerator for preheating, then flows into the combustion chamber for high-temperature oxidation decomposition at 760–850°C, converting organic pollutants into harmless carbon dioxide and water vapor. The purified high-temperature flue gas passes through another group of regenerators to release heat, realizing cyclic heat recovery.



Internal Structure



Rotary valve: The rotary valve is a key component of the rotary RTO, and its structural composition is closely related to the rotary RTO furnace body. During design, comprehensive consideration should be given from the perspective of furnace body usage. The medium enters from one half of the rotor and exits from the other half, with a purge zone and a dead zone separating the two halves to prevent air leakage. As the rotor rotates, the medium is distributed to some ceramic sectors of the RTO and discharges the processed gas medium from other sectors. This process is repeated in a continuous cycle.

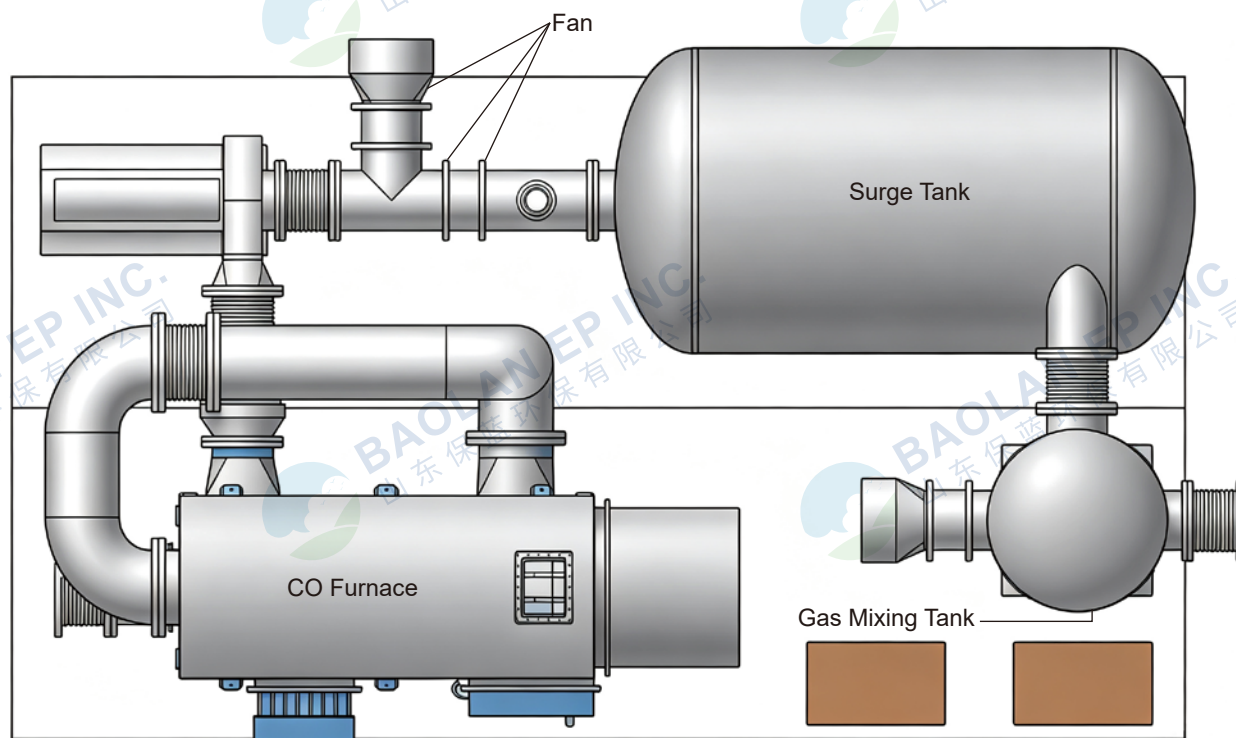
The rotary valve operates continuously and smoothly, with low rotational speed and minimal pressure fluctuation at the medium outlet. The rotor adopts a segmented connection, allowing for disassembly without having to remove the entire equipment. The sealing ring and air knife are embedded on the rotor, greatly facilitating replacement and maintenance.

CO

Catalytic Oxidizers for VOCs

Overview

Our company's CO furnace integrates design, manufacturing, installation, and commissioning. The BL-CO series products are advanced equipment in the fields of environmental protection and energy recovery, with internationally leading levels. Over the years, through practical applications and continuous optimization in numerous industrial projects, the product structure has become increasingly rational, with strong operational stability and high processing efficiency, capable of meeting various strict environmental protection and energy efficiency standards. The BL-CO furnace can be widely applied in industries such as chemicals, coking, pharmaceuticals, spraying, and printing, achieving efficient and safe treatment of VOCs and carbon monoxide, as well as energy recovery and utilization.



Working Principle

Catalytic Oxidation (CO) is an advanced gas purification technology. Its core principle is to utilize a catalyst to efficiently oxidize volatile organic compounds (VOCs) and other combustible pollutants in waste gas with oxygen at lower operating temperatures, completely decomposing them into harmless carbon dioxide (CO_2) and water (H_2O), while releasing heat.

Internal Structure

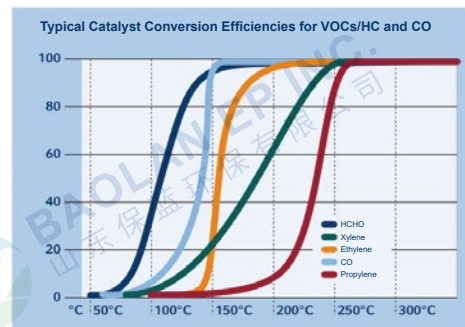
Catalyst:

A catalyst is a substance that can alter the rate of a chemical reaction without altering its own chemical properties before and after the reaction. Catalysts are typically composed of catalytically active materials and catalytic carriers. Catalytically active materials are generally metals or metal oxides. Precious metal catalysts mainly include platinum, palladium, and ruthenium, while common metal catalysts mainly include copper, chromium, nickel, vanadium, manganese, iron, cobalt, and their oxides. Catalytic carriers are porous materials whose main function is to provide the active materials with a large surface area. Catalysts with ceramic carriers are generally based on silicon-aluminum oxides, and their structures can be either flaky-granular or honeycomb-like. Typically, a thin layer of α -alumina, only 0.13mm thick, is coated on the ceramic structure. The active metal catalysts such as platinum and palladium are deposited or dispersed in a microcrystalline state within the porous alumina thin layer, and a mold drawer that is easy to assemble and disassemble is made.

CO

Catalytic Oxidizers for VOCs

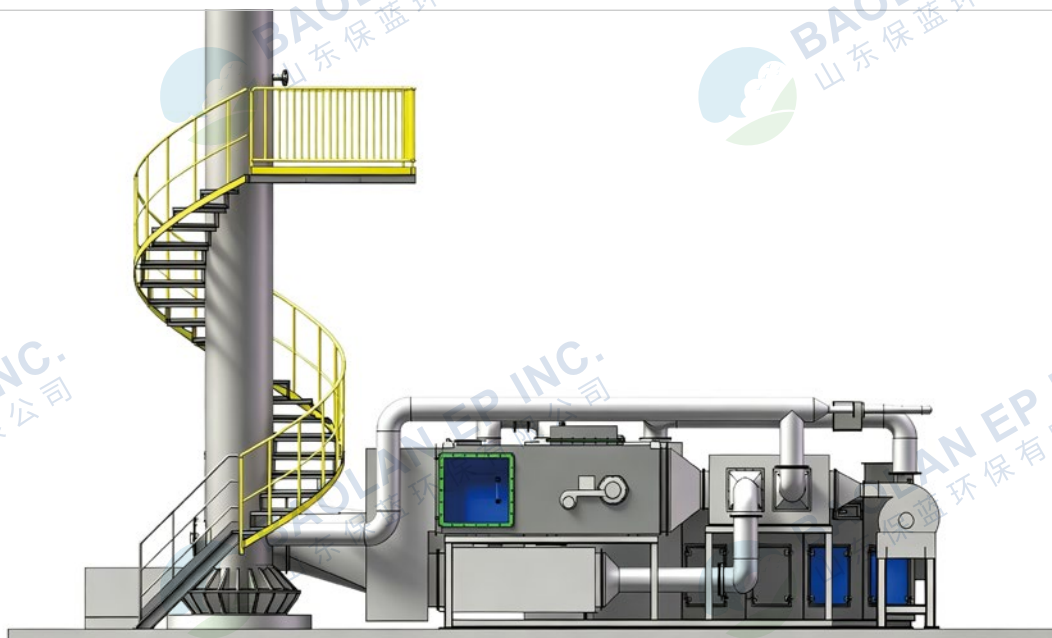
Internal Structure



Catalytic combustion device: Generally, fixed bed catalytic reactors are used. The design of the reactor is carried out according to specifications, and it should be easy to operate, maintain, and facilitate the loading and unloading of catalysts. In the process design of catalytic combustion, specific conditions should be considered. For cases with a large gas volume, a component-based flow design should be adopted, that is, the preheater and reactor are installed independently and connected by pipelines.

Catalysts are the core of catalytic combustion methods. A good catalyst must have characteristics such as high catalytic activity, good thermal stability, high strength, and long service life.

1. High activity. The activity of the catalyst directly affects the chemical conversion rate of catalytic combustion. The conversion rate is not only related to the activity of the catalytic active material itself but also directly related to the physical shape of the catalytic carrier. Therefore, when selecting suitable catalytic active materials, the physical shape of the catalytic carrier must also be considered to ensure the catalyst has high activity and achieves the purpose of catalytic combustion purification.
2. Good thermal stability. Since the temperature of the exhaust gas changes at any time, if the catalyst cannot adapt to temperature changes within a certain range, the performance of the catalyst will decline, and the purification efficiency will decrease. Therefore, the catalyst must be able to adapt to temperature changes within a certain range.
3. High strength. During the catalytic combustion process, the catalyst is often subjected to factors such as high temperature, vibration, and airflow, causing the catalyst to crack and wear. Cracking and wear will reduce the catalyst's activity, increase the pressure drop in the catalyst bed, and affect the purification effect.
4. Long service life. Catalytic active materials are generally quite expensive, so when designing and selecting catalysts, catalysts with longer service lives should be used as much as possible.





Environ. trouble? Baolan trustable!

Andrew Yu

Add: No. 199, Changguo East Road, Fengshui Town, Zibo EDZ, Shandong, China

Phone: +86 135 8959 1050 Web: www.baolanep.com Email: andrew@baolanep.com



WhatsApp



WeChat



Telegram