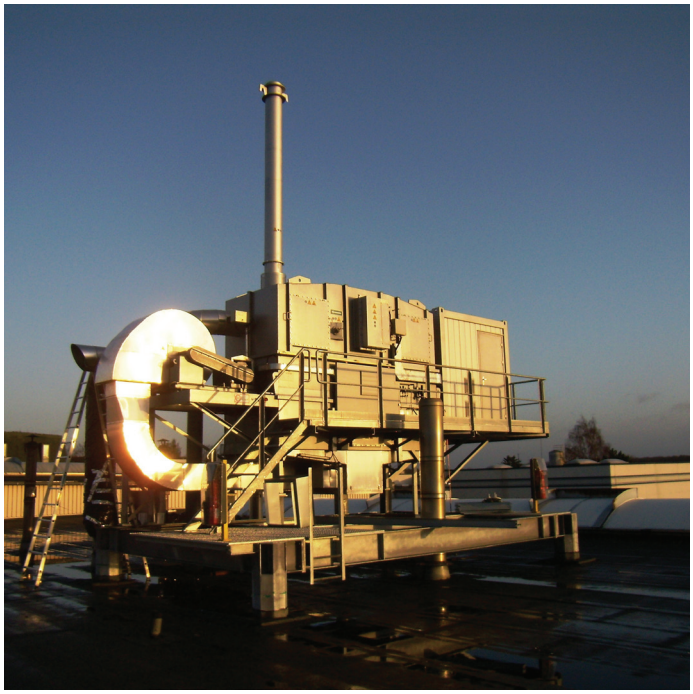
CTP-AIRPOLLUTIONCONTROL.COM

AUTOKAT



CTP-TECH OXIDATION

REGENERATIVE CATALYTIC OXIDATION
OF GASEOUS STREAMS

AUTOKAT

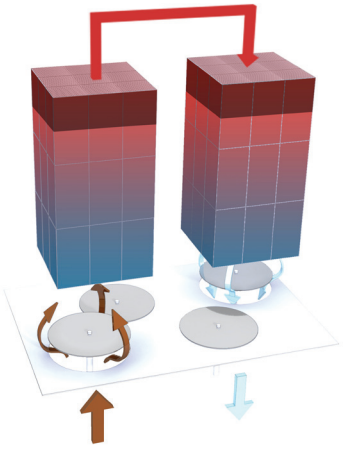
ECONOMICAL AIR POLLUTION CONTROL FOR LOW POLLUTANT CONCENTRATIONS

Thanks to CTP's unique honeycomb block technology, the AutoKAT achieves an optimal cleaning efficiency for gas streams already at temperatures between 200°C and 500°C. Even low concentrations of organic pollutants can be eliminated without using auxiliary energy. In addition, the AutoKAT can be operated at extremely low operating costs.

CTP's AutoKAT has been used successfully for a number of industrial applications such as in the chemical, pharmaceutical or paints and coatings industries. It is a trend-setting and highly economical solution compared to conventional regenerative thermal oxidation (RTO). However, it is necessary that no catalyst poisons are present in the raw gas or in its oxidation products.

REGENERATIVE CATALYTIC OXIDATION (RCO)

The AutoKAT Regenerative Catalytic Oxidizer combines the advantages of regenerative thermal oxidation with those of catalytic oxidation. A regenerative catalytic oxidation system consists of ceramic heat exchangers and CTP honeycomb catalysts where raw gas and clean gas alternately flow through and are connected by a shared combustion chamber. After entering the system, the contaminated raw gas is routed through a heat exchanger and continues into the combustion chamber. In this phase, the contaminated raw gas is heated by the energy stored in the ceramics. The contaminated raw gas passes through the CTP honeycomb catalyst and flows into the combustion chamber where it is heated to reaction temperature (T>200°C) by means of additional heating. The pollutants are oxidized at the catalyst's surface. The hot clean gas releases energy in the next heat exchanger and is cooled down to nearly the temperature of the raw gas. It is then exhausted via the stack.



Regenerative Catalytic Oxidation (RCO)

UNIQUE ADVANTAGES OF THE CTP SYSTEM

OUTSTANDING PERFORMANCE

- Maximum cleaning efficiency of CH_4, VOC, NH_3, CO, H_2 (> 98.5%)
- Very high thermal efficiency (> 95%)
- No formation of secondary products (NOx, dioxin)
- Low pressure drop
- Low operating costs (low energy consumption and therefore high economic efficiency)
- Extremely low autothermal point

FUNCTIONAL DESIGN

- Compact lightweight construction
- Flexibility of inlet/outlet gas connections
- Simple foundation (only two supports necessary)
- Excellent accessibility for easy inspection and maintenance

SAFE AND RELIABLE OPERATION

- Fail-safe Programmable Logic Controller (PLC)
- Field-proven advanced software
- Sensors with Safety Integrity Level (SIL) classification
- Most spare parts in stock
- On-site and online support

SHORT PERIOD OF INSTALLATION AND COMMISSIONING

- Pre-assembled delivery for fast, easy installation
- Complete wiring and testing at manufacturing plant assures trouble free start-up

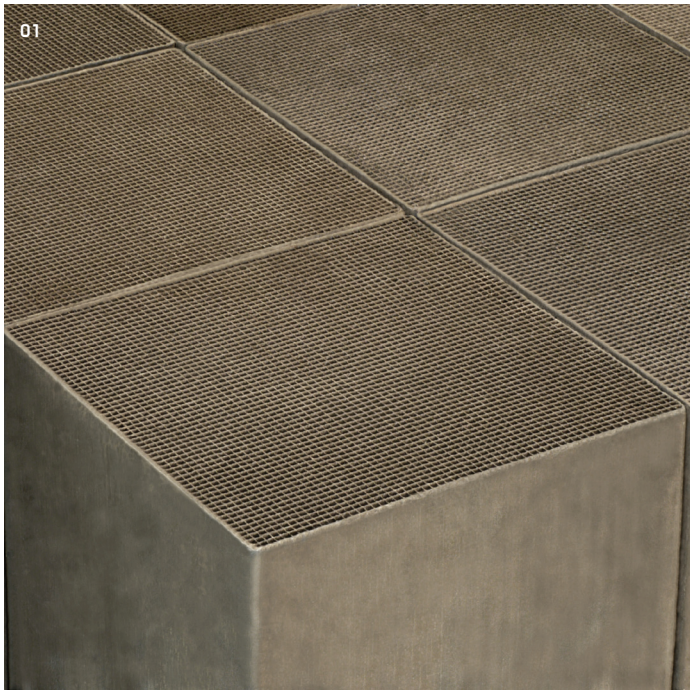
HIGH-END TECHNOLOGY

- Efficient heat exchangers with CTP's honeycomb ceramics
- Customized CTP high performance catalysts with high longevity
- Various fuel choices for the additional heating (gas, electricity)
- Operation at lowest oxygen content (residual oxygen control)
- Weatherproof instrumentation and heating system

THE SYSTEM

The AutoKAT series includes 2- and 4-bed systems which are available in defined configurations based on the flow rate. The system in its basic design consists of:

- **Main fan with Variable Frequency Drive (VFD)**
- **Valve box**
- **Reactor**
- **CTP honeycomb catalyst**
- **Stack**
- **Sensor package**
- **Control and power distribution panels**
- **Fully automated control system**

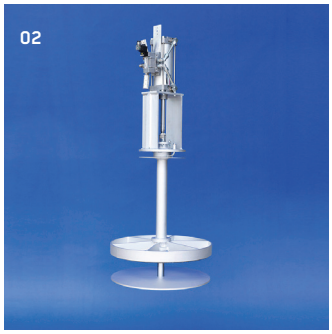


The **MAIN FAN** is continuously controlled by a VFD, and can be positioned before the AutoKAT for positive pressure systems, or after for negative pressure systems. A specified amount of waste gas is fed into the AutoKAT where it is safely and economically eliminated.

The **VALVE BOX** consists of a raw gas duct, a pure gas duct and the valve bodies, which connect to the heat exchangers. There, the poppet valves are situated. Through their switching operation, raw gas and clean gas reverse paths through the valves and heat exchangers.

The heat exchangers, catalyst and the combustion chamber are referred to as the **REACTOR**. The heat exchangers function as a heat storage and minimize the system's demand for energy, due to their ability to store the energy of the exhaust gas. On the catalyst's surface, the pollutants are oxidized and, in the case of VOC, converted to water vapor and carbon dioxide.

The cleaned gas leaves the AutoKAT through the **STACK**, which is situated directly atop the valve box when the AutoKAT is a positive pressure system.

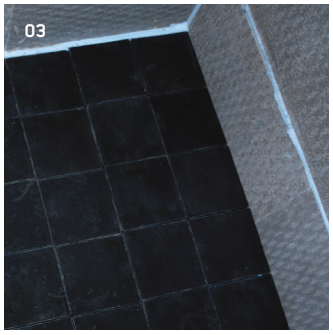


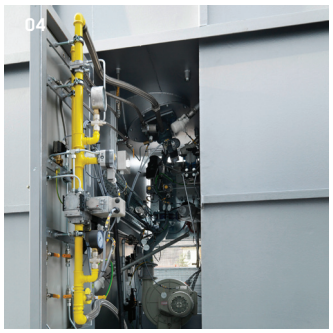
01 CTP honeycomb catalyst
02 Poppet valve
03 CTP high performance catalyst
04 Burner system
05 Efficient heat exchanger

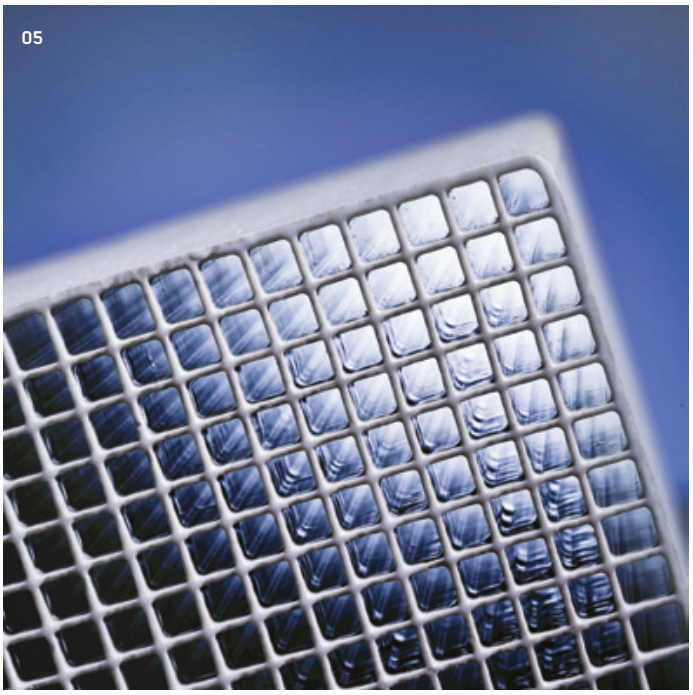
Our extensive **SENSOR PACKAGE** is capable of measuring all necessary process variables such as temperature, pressure, differential pressure and flow.

An enclosure is located next to the reactor that contains the **CONTROL AND POWER DISTRIBUTION PANELS**. These provide a **FULLY AUTOMATED CONTROL SYSTEM** that includes a PLC and operator interface. CTP's standard program, which has been refined over many years, enables an adjustment of the system to diverse process conditions and customers' specifications.

THE KEY COMPONENTS







DUAL-SEALING POPPET VALVES

As an integrated part of the valve box, CTP's poppet valves are specifically designed for 2- and 4-bed systems as well as for gaseous media. Being robust, reliable and leakage-free, they guarantee high cleaning efficiency as well as fast opening and closing.

CTP HIGH PERFORMANCE CATALYST

The CTP high performance honeycomb catalyst is characterized by its excellent performance in converting organic hydrocarbons as well as hydrogen, carbon monoxide or ammonia. The catalyst is separately designed for each application and thus offering the ideal customer-specific solution for the respective waste gas problem. Available as metal oxide or platinum catalyst, it still performs excellently even with low oxygen content. Raw gases containing NH_3 are oxidized without NOx formation.

BURNER SYSTEM

The standardized burner system for different gaseous fuels consists of the burner, the gas and air supply system as well as the burner air fan. All components are safely installed in a protected area, i.e. the machinery space. Optionally, energy can be supplied by an electrical heating unit.

CERAMICS

The ceramic heat exchanger elements have great advantage over conventional ceramic saddles. They enable high heat recovery and at the same time a minimal pressure drop. CTP's heat exchanger elements are especially resistant to chemical, thermal and mechanical influences due to the usage of high quality materials, which are especially selected and manufactured for the intended use. The defined linear flow accompanied by the monolithic honeycomb structure prevents particle deposition and obstruction.

ADDITIONAL OPTIONS

RAW GAS PREHEATING

Condensing substances do not only reduce the cleaning efficiency, but can cause deposits that may lead to corrosion. In order to protect the system from condensing substances, and extend its cleaning efficiency and useful life, the raw gas can be preheated before it enters into the system. For reduction of radiant losses, all preheat systems are equipped with external insulation.

PREHEAT OPTIONS:

- Preheating burner system
- Preheating with hot gas from the combustion chamber
- Recuperative heat exchangers (e.g. shell and tube type)

INTEGRATED STACK

As a special option of the AutoKAT with a forced draft fan, CTP offers an integrated stack which is up to 12 meters in height and arranged directly on top of the valve box. Thus the system's footprint can be minimized. The measurement points in the stack are easily accessible via a platform and access ladder.

HOT BYPASS

If high concentrations of organic compounds result in excess heating of the combustion chamber, a hot bypass will open and part of the hot gas is vented directly from the combustion chamber bypassing the heat exchanger. This allows the AutoKAT to treat a much larger variety of inlet concentrations.

WASHING-OUT

Organic dust or aerosols may cause deposits on the ceramic heat exchangers resulting in rising pressure drop and a decrease in cleaning efficiency. While heat exchanger elements enable the cleaning of polluted heat exchanger beds, inorganic deposits can be removed from the CTP heat exchanger beds by water washing.

MATERIALS

The AutoKAT system can be manufactured in a range of different materials depending on the customer's needs. Standard materials are S235 (ST-37), 1.4301 and 1.4571.

LEL SAFEGUARD AND SYSTEM BYPASS

If equipped with an LEL (Lower Explosive Limit) monitor, the AutoKAT can protect itself against high inlet concentrations engaging a bypass system.

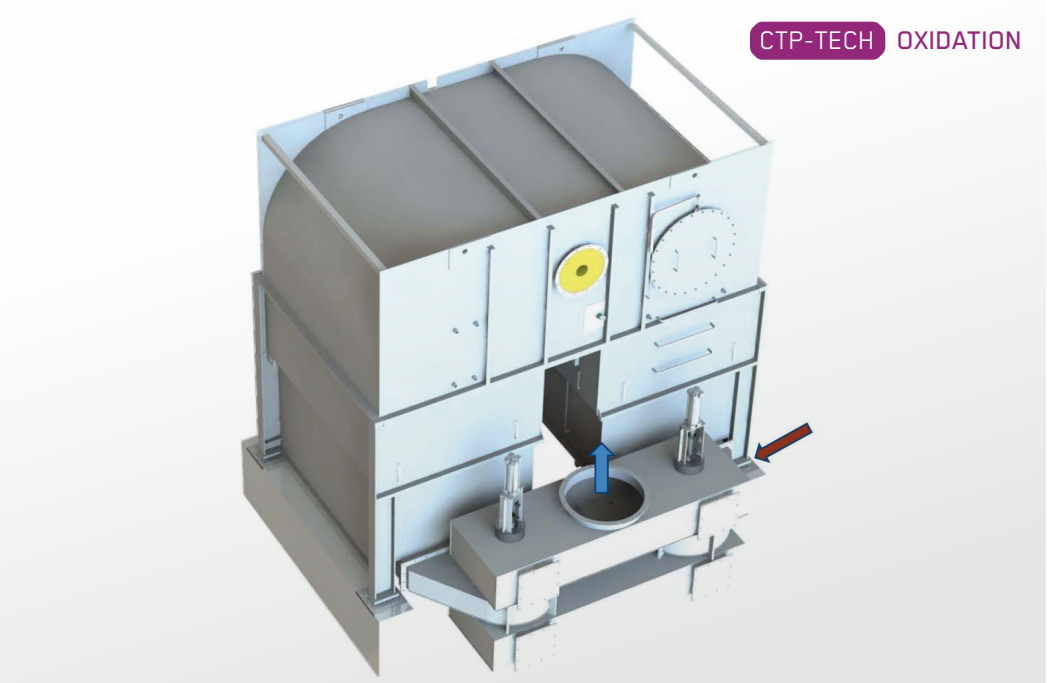
RESIDUAL OXYGEN CONTROL

Low oxygen waste streams can be processed by adding an oxygen control loop with small amounts of excess oxygen.

MINIMIZING OF PRESSURE PEAKS

For processes that are especially sensitive to pressure fluctuations, optional equipment can be added to make pressure changes almost undetectable.

AUTOKAT



2-bed AutoKAT

The extent of the flow defines which AutoKAT model is suitable. Each type is available for a defined flow in a variety of configurations:

SERIES

Type	Min. nominal flow [Nm³/h]	Max. nominal flow [Nm³/h]	Number of models
AutoKAT 2 series	3,200	57,600	16
AutoKAT 4 series	46,800	124,800	11

MINIMIZE THE OPERATING COSTS OF YOUR RTO!

Due to the consistent size of the CTP honeycombs, conventional heat exchanger elements of an existing RTO can be retrofitted with customized catalyst elements. CTP analyzes your process, assesses various options to optimize it and helps to minimize costs.

CTP-AIRPOLLUTIONCONTROL.COM

CTP Chemisch Thermische Prozesstechnik GmbH
Schmiedlstrasse 10, 8042 Graz, Austria
Phone: +43 316 4101-0, Fax: +43 316 4101-80
office@ctp.at, www.ctp-airpollutioncontrol.com