CTP-AIRPOLLUTIONCONTROL.COM

AUTOTHERM

CTP-TECH OXIDATION

REGENERATIVE THERMAL OXIDATION
OF GASEOUS STREAMS

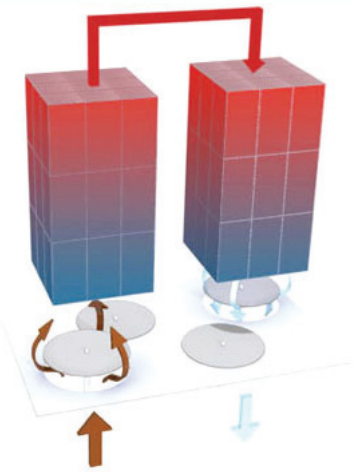
CTP AutoTherm for a bio-mechanical waste treatment plant

AUTOTHERM

PROVEN TECHNOLOGY FOR HIGH VOLUME FLOW RATES AND DIFFICULT GAS STREAM REQUIREMENTS

The flexible option of the AutoTherm regenerative thermal oxidation system is ideal for the most difficult gas streams with high flow rates (up to 300,000 Nm³/h). Apart from the 5-bed standard design, this system is easily adaptable and thus also available as 6- or 7-bed system.

The AutoTherm system is well suited for organic pollutants with high solids content and also for sticky substances, with waste gas temperatures up to 400°C.



Regenerative Thermal Oxidation (RTO)

REGENERATIVE THERMAL OXIDATION (RTO)

At the heart of the AutoTherm regenerative thermal oxidation system is the flow through ceramic heat exchange media. In the heat exchangers, raw gas and clean gas periodically reverse direction. The heat exchangers are connected by a shared combustion chamber. After entering the system, the contaminated raw gas is routed through one heat exchanger toward the combustion chamber. In this phase, the contaminated raw gas is heated by the stored energy in the ceramics. In the combustion chamber, the organic pollutants are destroyed at a temperature selected based on the pollutants being treated, but generally around 800°C.

The hot clean gas leaving the combustion chamber releases the energy in the ceramics of a different heat exchanger. In this process, the gas is cooled down to nearly the temperature of the raw gas and is exhausted via the stack. The combustion chamber is equpipped with a start-up heater which can also be used to add energy during times when only lightly polluted streams are being treated, otherwise the RTO usually operates with no additional heat required.

UNIQUE ADVANTAGES OF THE CTP SYSTEM

OUTSTANDING PERFORMANCE

- Maximum cleaning efficiency (> 99.8 %)
- Very high thermal efficiency (> 97 %)
- Low pressure drop
- Low operating costs (low energy consumption and therefore high economic efficiency)

SAFE AND RELIABLE OPERATION

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

FUNCTIONAL DESIGN

- Flexible and expandable multi-bed system
- Easy integration with other options (DeNOx, heat recovery, cold bypass, hot bypass)
- Suitable for high volume flow rates
- Customized for every application

HIGH-END TECHNOLOGY

- Efficient heat exchangers with CTP's honeycomb ceramics
- Zero leakage poppet valves with seal gas purge option
- Free choice of the additional fuel
- Optional electric heating
- Weatherproof instrumentation and heating system

THE SYSTEM

The AutoTherm is custom designed to meet the customer's requirements. The system in its basic design consists of:

- **Main fan with Variable Frequency Drive (VFD)**
- **Main valves with inlet and outlet manifolds**
- **Reactor (chamber with heat exchangers)**
- **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 AutoTherm for positive pressure systems, or after for negative pressure systems. A specified amount of waste gas is fed into the AutoTherm where it is safely and economically purified.

Both the raw gas duct and the clean gas duct are situated under the reactor. The heat exchanger towers are connected to the raw gas and clean gas ducts, which are opened and closed by the **MAIN VALVES** (poppet valves).

The heat exchangers 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 outgoing gas. In the combustion chamber, the pollutants are oxidized and, in the case of VOC, converted to water vapor and carbon dioxide.

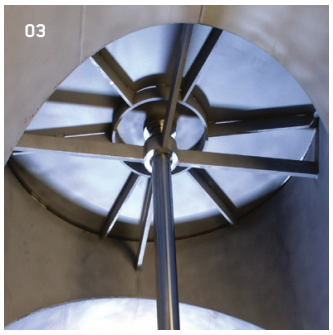
The cleaned gas leaves the AutoTherm through the clean gas duct and the **STACK**.

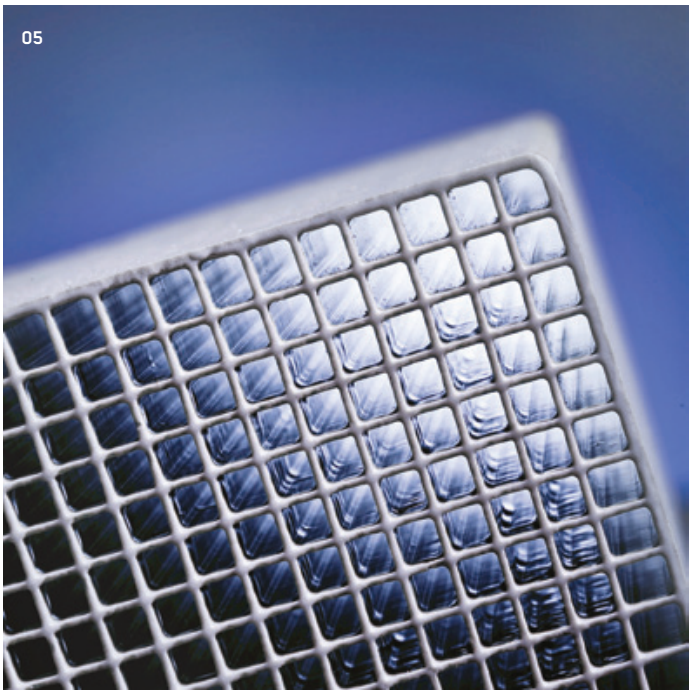
01 Stack
02 Main fan
03 Poppet valve
04 Burner
05 Efficient heat exchanger

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

The **CONTROL AND POWER DISTRIBUTION PANELS**, which can be positioned freely, 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 automatic adjustment of the system to diverse process conditions and customers' specifications.

THE KEY COMPONENTS





CTP-TECH OXIDATION

POPPET VALVES

CTP's poppet valves are especially designed for RTO applications and gaseous flows. They are robust, reliable and available in zero-leak designs. They are available as single-sealing poppet valves with or without sealing air depending on the customer requirements.

BURNER SYSTEM

The standardized burner system for different gaseous fuels consists of the burner, gas and air system, as well as the combustion air fan. All components are safely installed in a protected area.
The system may also be operated with liquid and gaseous fuels by using a multifuel burner. If no fuels are available, the combustion chamber can be heated electrically.
For higher fuel economy, it is recommended that a direct fuel injection system be installed along with the burner system. Fuel consumption and NOx generation can be further minimized with this option.

INTERNAL INSULATION

The multi-layered insulation design protects the external walls of the reactor from high combustion chamber temperatures and, at the same time, minimizes the radiant losses of the system. The internal insulation is designed for temperatures up to 1,000 °C and is also available as solid refractory lining if additional insulation is desired.

CERAMICS

CTP uses traditional ceramic block packing in contrast to random packing to provide maximum heat recovery with low 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. Linear flow of gas through media helps prevent particle deposition and subsequent obstruction.

ADDITIONAL OPTIONS

2-bed AutoTherm in the chemical industry

RAW GAS PREHEATING

Condensing substances do not only reduce the cleaning efficiency of the RTO, but can cause deposits that may lead to corrosion. In order to protect the system from condensing substances, and extend its 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)

CORROSION PROTECTION

Special coatings with high anti-corrosion properties allow operation of the systems with condensing gases at temperatures below the water and acid dew points. In addition to the corrosion protection, the systems can be equipped with an external insulation to further protect against corrosion.

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 AutoTherm to treat a much larger variety of inlet concentrations.

COLD BYPASS

By using a cold bypass, raw gas is routed directly to the combustion chamber bypassing the heat exchanger. The combination of a hot bypass and a cold bypass is used for high concentrations of organic compounds.

CTP AutoTherm in the cement industry

BAKE-OUT

Organic dust or aerosols may cause deposits on the ceramic heat exchangers resulting in rising pressure drop and a decrease in overall operating efficiency. In order to clean the heat exchanger and restore the original characteristics of the system, a simple bake-out is usually all that is necessary. Deposits removed during bake-out are processed through the combustion chamber, where any unburned hydrocarbons are destroyed, resulting in smokeless operation.

WASHING-OUT

Deposits on the heat exchanger beds can increase the system's pressure drop and cause a decrease in operation efficiency. Inorganic deposits can often be removed from the CTP heat exchanger beds by water washing. Some AutoTherm models can even be washed while the unit remains online.

MATERIALS

The AutoTherm 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 AutoTherm can protect itself against high inlet concentrations engaging a bypass or dilution system.

HEAT RECOVERY

Additional heat recovery is available in some cases by adding an additional heat exchanger in the exhaust of the RTO to provide energy for the customer's use.

RESIDUAL OXYGEN CONTROL

Low oxygen waste streams can be processed by adding an oxygen control loop to introduce a controlled amount of dilution air.

MINIMIZING OF PRESSURE PEAKS

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

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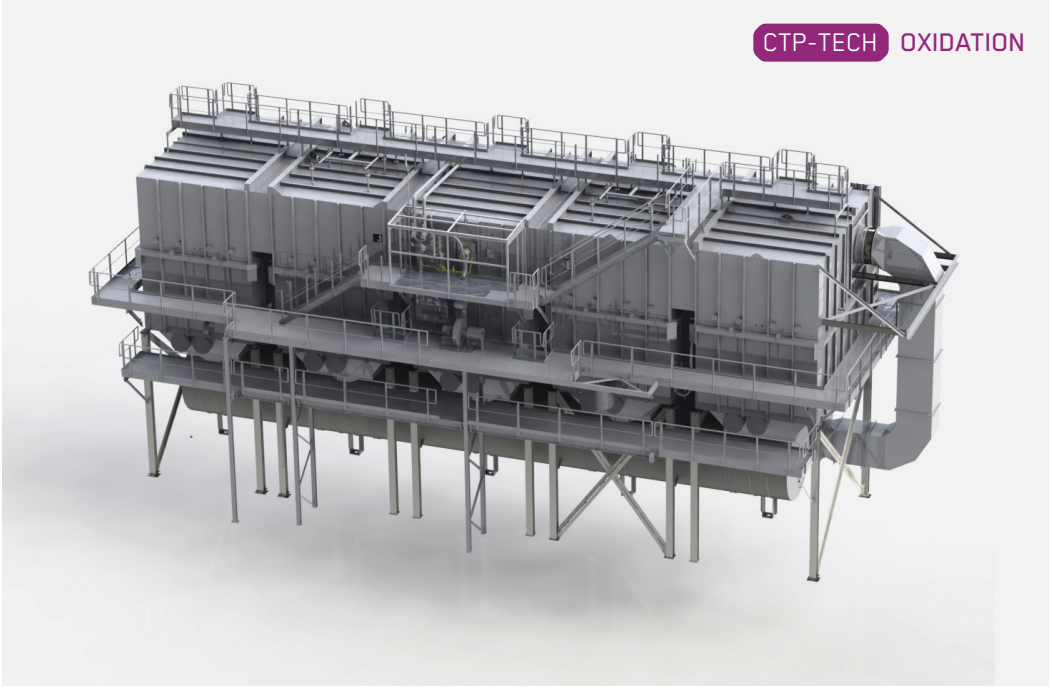

SPECIFICATION

Type	Min. nominal flow [Nm³/h]	Max. nominal flow [Nm³/h]
AutoTherm 5 series	105,600	300,000

CTP-AIRPOLLUTIONCONTROL.COM

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