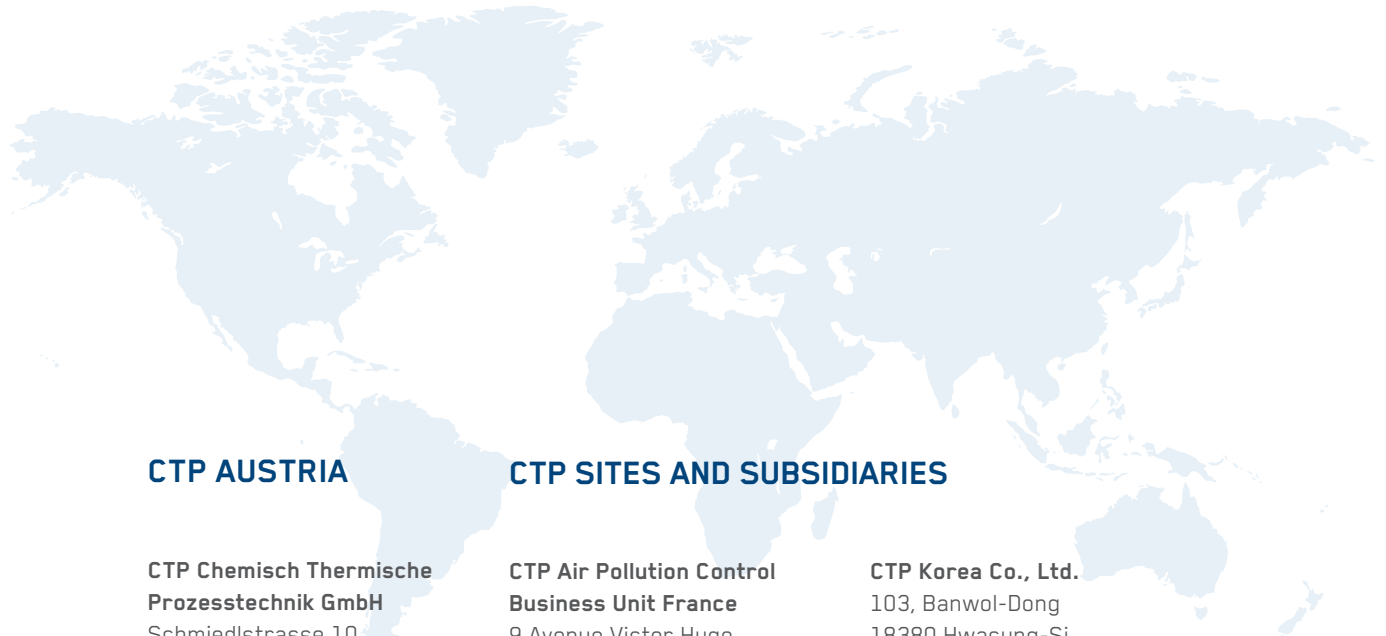




TECHNOLOGY IS IN THE AIR

PRODUCTS & TECHNOLOGIES



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We are here for you

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**Together with our
customers, we help
ensure a clean future**

-ctp-airpollutioncontrol



COMPANY PROFILE

CLEAN AIR. OUR TECHNOLOGIES EMBODY CLEAN AND EFFICIENT PROCESSES WORLDWIDE.

WHO WE ARE

CTP (Chemisch Thermische Prozesstechnik GmbH) is one of the world's leading companies in air pollution control for industrial applications.

CTP was founded in 1985 and since then, our engineers, chemists and researchers have been developing leading edge technologies to serve the individual needs of our customers worldwide, covering all industrial sectors. At CTP, we adhere to high quality standards maintained by qualified expertise.

WHAT WE DO

CTP can offer you emissions close to zero at a minimized total cost of ownership.

We provide integrated solutions from the emission source to the stack for the reduction of contaminants such as volatile organic compounds (VOC), NH₃ or NO_x.

OUR COMPANY'S ECOLOGICAL MISSION?

WE AIM TO CONVERT AIR POLLUTANTS INTO USABLE ENERGY.

WHERE WE WORK

With our headquarters in Austria, CTP has sales networks all over the world with locations and subsidiaries in France, Korea, China and the USA as well as partners in many other countries such as Australia, The Netherlands, Finland and South Africa.

CTP TECHNOLOGIES



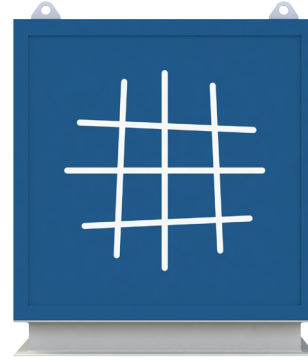
THERMAL SYSTEMS

Optimal abatement of all organic pollutants & multiple waste gas streams

In regenerative thermal oxidation systems (RTO) harmful compounds are oxidized without residue and the oxidation energy plus the heater energy is recovered by the ceramic heat exchanger and is further used in the process resulting into reduced auxiliary fuels requirements and lower operating costs.

In direct thermal oxidation systems (TO) several waste gas streams, liquid or gaseous, with concentrations from lean to explosive are injected directly in to the combustion chamber and oxidized.

The combustion chamber can be combined with a variety of other purification systems (e.g. scrubber unit, rotor, fixed bed adsorber, filter or a DeNO_x system). The purified gas can be directed to downstream heat recovery.



CATALYTIC SYSTEMS

Defined pollutant compositions in low or high concentrations

Waste gases are heated in the presence of special CTP oxidation catalysts which are responsible for the high cleaning efficiency and outstanding cost-effectiveness of the recuperative catalytic oxidation (CO).

Low reaction temperature achievable with catalysts and the outstanding thermal efficiency of the regenerative thermal oxidation (RTO) are the benefits of the regenerative catalytic oxidation (RCO).

Further CTP has developed recuperative as well as regenerative selective catalytic reduction system solutions (SCR). The SCR technology converts NO_x with a reduction agent to nitrogen and water in the presence of a catalyst. The chemical reaction is selective and this means oxides of nitrogen are preferentially reduced while unwanted side reactions are inhibited.



HYBRID SYSTEMS

Combined technologies in one system - for the best achievable solution

Regenerative thermal oxidation systems (RTO) in combination with direct thermal oxidation systems (TO) but also with selective non-catalytic reduction technology (SNCR) with injection of liquid or gaseous reduction agents into the waste gas as well as selective catalytic reduction (SCR), both for the reduction of NO_x.

Proven systems and longterm experience resulted into a new series of optimal solutions.



SORPTIVE SYSTEMS

Proven adsorption and absorption technologies

For treating large waste gas volumes with low contaminant concentrations as well as for concentration peaks or batch processing but also for the removal of inorganic components CTP relies on adsorption and absorption technologies.

For example rotary adsorbers are used to concentrate a large flow with low contaminant concentration to a much smaller, highly concentrated waste gas stream.

CTP's single or multiple fixed beds adsorb contaminant peaks and highly variable concentrations and then desorb them in a downstream oxidation system.

For the removal of inorganic components, contaminants such as acids (HCl, HF), sulfur dioxide (SO₂), organic pollutants (e.g. PCDD/DF) or heavy metals are accumulated on the sorbent which is removed efficiently in a downstream collector. Another possibility is the combination of a quench from where the cooled gas is directed to a scrubbing chamber in which the pollutants interact with the scrubbing solution.



CTP's air pollution control solutions have proven themselves in **a wide range of industries** – from electronic, chemical and petrochemical or pharmaceutical industries to the wood processing industry, panel production or to automotive and vehicle engineering. Different processes such as catalytic and thermal oxidation are used for VOC emission control, disposal of chlorinated hydrocarbons and odor removal.

We offer **highly complex individual and complete solution portfolios** from the analysis of your needs to the completion of your air purification project: **turnkey solutions** including all necessary intermediate steps such as engineering, piloting, design, manufacturing, installation, commissioning and accompanying support.

Experience and expertise throughout the process

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VOXcube

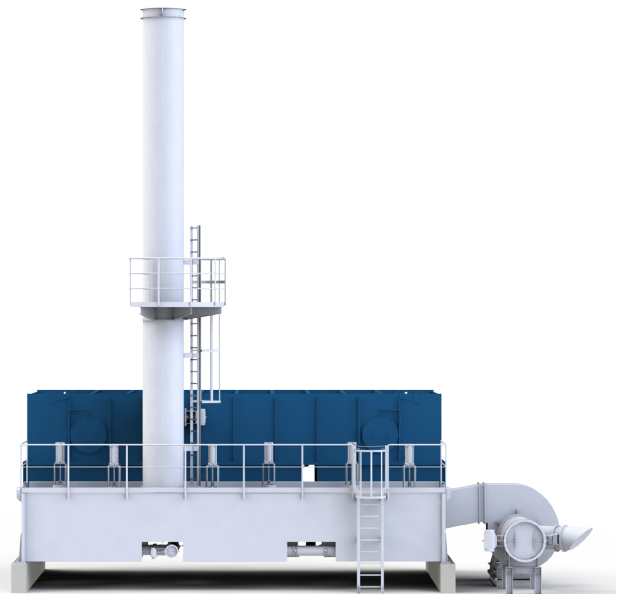
RTO

Maximum cleaning efficiency

High longevity

Very easy to maintain

Lowest energy consumption



The VOXcube purifies organic (VOC) and specific inorganic pollutants in the waste gas. The system is suitable for flow rates up to 125.000 Nm³/h, with a wide variety of concentrations and contaminants. For waste gas temperatures from -20°C up to +350°C.

FEATURES

- > **Maximum cleaning efficiency**
- > **Flexibility in the heat exchanger design**
 - High thermal efficiency
 - Low pressure drop (< 30 mbar)
- > **High safety standards**
 - Fail-safe programmable logic controller (PLC)
 - Selected sensors with safety integrity level (SIL) classification
- > **High availability**
 - Field proven advanced software
- > **Pre-assembled delivery**
- > **Excellent accessibility**
- > **High standardization**
- > **Automatic adjustment to variable operating conditions**
- > **Compact lightweight construction**
- > **Flexibility of inlet/outlet gas connections**

AVAILABLE OPTIONS

- > Multifuel burner
- > Gas and liquid injection
- > Electric heating
- > Hot bypass
- > Online bake-out
- > Integrated raw gas preheating
- > Special insulations and coatings
- > Heat recovery
- > Automatic cleaning
- > Lower explosion limit (LEL) safeguard
- > Residual oxygen control
- > Pressure peak reduction
- > Nitrous oxide purification
- > Double gaskets with block air
- > Preconcentration with adsorber
- > Smoothing bed
- > Prefilter
- > Aerosol filter
- > Pre- and post scrubber

AutoTherm

RTO

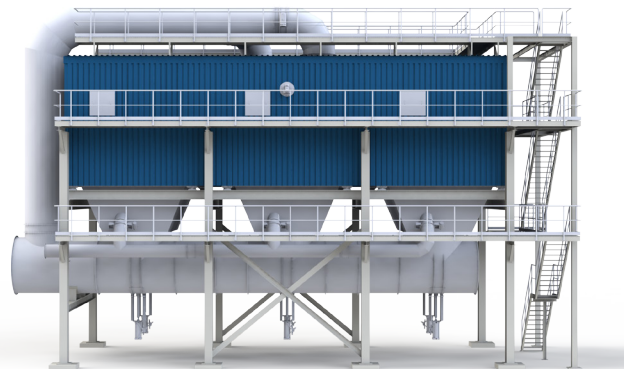
Highest flexibility and adaptability

Proven in the most complex applications

Extremely tight valves

Rugged design

Tailor-made



The perfect CTP solution for applications with particulate, sticky condensate or corrosive components in the waste gas but also for aerosol treatment by means of special 4- and 6-bed design. The AutoTherm is suitable for flow rates up to 420.000 Nm³/h, independent of the concentration and the nature of the contaminants. For waste gas temperatures from -20°C up to +400°C.

FEATURES

- > **Maximum cleaning efficiency**
- > **Flexibility in the heat exchanger design**
 - High thermal efficiency
 - Low pressure drop (< 30 mbar)
- > **Flexible multi-bed design**
 - Adaptable for high flow rates
 - Customized for each application
 - Special 4- and 6-bed design with extra tower for frequent bake-out necessity
- > **Poppet valves with block air**
- > **High safety standards**
 - Fail-safe (PLC)
 - Selected sensors with SIL classification
- > **High availability**
 - Field proven advanced software
- > **Low operating costs**
- > **Automatic adjustment to variable operating conditions**
- > **Many fuel choices**

AVAILABLE OPTIONS

- > Multifuel burner
- > Gas and liquid injection
- > Electric heating
- > Hot and cold bypass
- > Online bake-out
- > Integrated raw gas preheating
- > Separate raw gas preheating
- > Heat recovery
- > Special insulations and coatings
- > Automatic cleaning
- > LEL safeguard
- > Residual oxygen control
- > Pressure peak reduction
- > Nitrous oxide purification
- > Double gaskets with block air
- > Preconcentration with adsorber
- > Smoothing bed
- > Prefilter
- > Aerosol filter
- > Pre- and post scrubber

MultiTherm

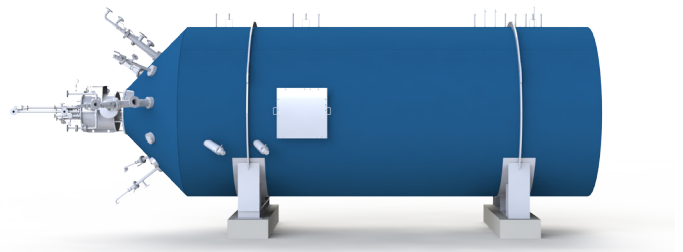
TO

Maximum destruction efficiency

Special burners (e.g. oxygen, LowNOx, solvents, tar)

Specially designed CTP nozzle for fuel injection

Universal applicability



For safe removal of highly contaminated, i.e. halogenous, waste gas streams and liquid waste as well as wastewaters, especially in the pharmaceutical, chemical and petrochemical industry.

CTP's MultiTherm is a combined process. It consists essentially of a thermal oxidation and one or more upstream or downstream processes fitted to the application. These could be heat recovery, wet scrubbing and DeNOx, among others. Our burner system has managed the simultaneous combustion of many highly variable waste streams.

FEATURES

- > **Maximum destruction efficiency**
- > **Efficient multifuel burners**
 - Modular design
 - Uniform flame shape
 - Turbulent flue gas recirculation
- > **Optimized fuel injection**
 - Optimized fuel distribution
 - Variable injection lances
 - Ultrasonic nozzles
 - Flashback free operation
- > **High safety standard**
 - Fail-safe PLC
 - Selected sensors with SIL classification
- > **High availability**
 - Adaptive control software for changing load conditions
 - Control concept optimized in operating costs
- > **Flexible combustion chamber design**

AVAILABLE OPTIONS

- > Safety technology (static dry or wet flame arrestors, dynamic flash-back protection)
- > Low heat-loss combustion chamber (multilayer insulation and recovery of heat-loss)
- > Selective Catalytic Reduction (SCR)
- > Selective Non-Catalytic Reduction (SNCR)
- > Heat recovery
- > Quench/Scrubber
- > Residual oxygen control

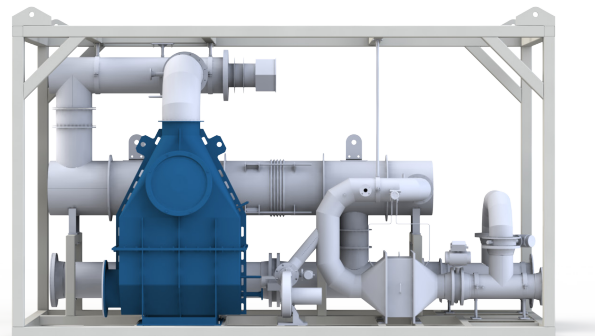
RecuKAT

Recuperative CO

Maximum cleaning efficiency

CTP's own high performance, custom-made „nobel-metal“ and „metal-oxide“ oxidation catalyst

Constant high performance – also for oxygen-poor gases



For high cleaning efficiency, the RecuKAT's attractive economic performance is due to the low reaction temperature of the CTP catalysts.

CTP can refer to more than 30 years of experience with catalysts in industrial applications. The RecuKAT is suitable for small to medium gas flows with low or high concentrations.

FEATURES

- > **Maximum cleaning efficiency**
- > **CTP's high performance bulk catalysts treating:**
 - a wide variety of hydrocarbons
 - methane and short-chain alkanes
 - halogenated hydrocarbons, nitrogen containing hydrocarbons
 - carbon monoxide
 - ammonia
- > **Effective shell tube heat exchanger (>75%)**
- > **Cleaning of gases with low oxygen content (residual oxygen content <0.2% vol.)**
- > **High availability**
 - Weatherproof installation of instrumentation and heating system
 - Field proven advanced software
- > **No NOx is formed when oxidizing ammonia (NH₃)**
- > **Cleaning of oxygen-poor gases**

- > **Available for low and high pressure processes up to >25 bar**
- > **CO₂ polishing**
- > **Horizontal and vertical configuration**
- > **Small footprint**

AVAILABLE OPTIONS

- > Selective pre-separation of sulfur compounds
- > Coarse and deep desulfurisation
- > Combination oxidation-catalyst and De-NOx or N₂O catalyst resp. dioxin catalyst
- > Combination with scrubber for SO_x or HCl, HBr
- > Electric heating or gas burner
- > Hot bypass
- > Heat recovery
- > Multi-layer catalyst
- > Horizontal or vertical configuration
- > LEL safeguard
- > Residual oxygen content control
- > External energy recovery

AutoKAT

Regenerative CO

Highest thermal efficiency

Constant high cleaning efficiency
 – also for oxygen-poor gases

Extremely energy-saving

Easy access to catalyst modules

Very compact system: low footprint



The AutoKAT combines the advantages of regenerative thermal oxidation with those of catalytic oxidation. The AutoKAT is a very cost-effective alternative for well understood waste streams. Existing RTO systems can be upgraded to an AutoKAT.

FEATURES

- > **Maximum cleaning efficiency**
- > **CTP's own high performance honeycomb catalysts treating:**
 - a wide variety of hydrocarbons
 - carbon monoxide
 - ammonia
- > **CTP's honeycomb ceramic heat exchanger**
 - Very high thermal efficiency
 - Very low operating costs
- > **Cleaning of gases with low oxygen content (residual oxygen content <0.5% vol.)**
- > **Extremely low autothermal point of <math><500 \text{ mg/Nm}_3</math>**
- > **High availability**
 - Weatherproof installation of instrumentation and heating system
 - Field proven advanced software
- > **Pre-assembled delivery**

- > **Excellent accessibility**
- > **High standardization**
- > **Oxidation without formation of NOx (e.g. removal of ammonia-NH₃)**
- > **Flexibility of left or right inlet/outlet connections**

AVAILABLE OPTIONS

- > Electric heating or gas burner
- > Hot bypass
- > Raw gas preheating
- > Automatic cleaning
- > LEL safeguard
- > Residual oxygen control
- > Pressure peak reduction

RecuNOx

Recuperative SCR

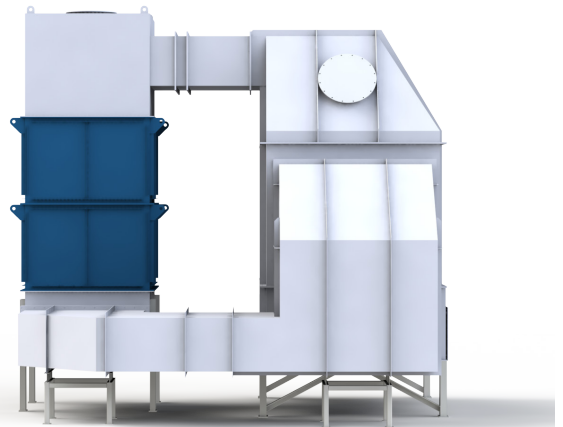
Maximum cleaning efficiency

Low operating costs

Optimal injection and distribution of the reduction agent

For low dust applications

Small footprint



CTP's SCR systems are used in industrial processes with a wide variety of gas volumes and NOx concentrations. These systems are also suitable for increased particulate content.

FEATURES

- > **Maximum cleaning efficiency**
- > **Effective shell tube heat exchanger (>75%)**
- > **Minimal ammonia slip by accurate and fast control unit**
- > **Injection with special nozzles**
- > **High availability**
 - Weatherproof installation of instrumentation and heating system
 - Field proven advanced software
- > **Low reaction temperature**
- > **Residue-free reduction of the pollutants to N₂ and H₂O**
- > **Robust catalyst resistant to the effects of poisons and dust**

AVAILABLE OPTIONS

- > Choice of reduction agent (ammonia, urea, cyanuric acid)
- > Electric heating or gas burner
- > High temperature particle filter
- > Heat recovery
- > Horizontal and vertical configuration

AutoNOx

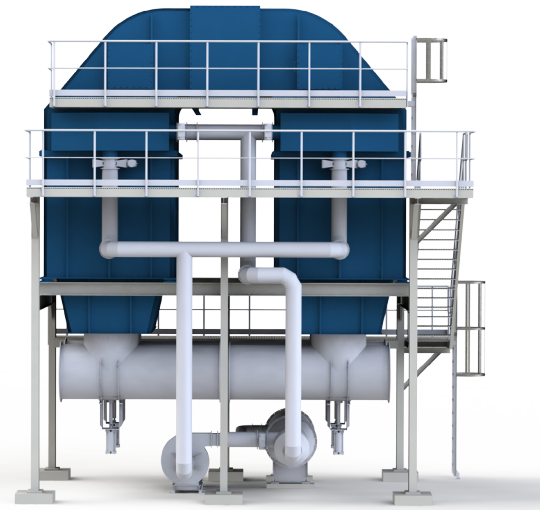
Regenerative SCR

Innovative SCR concept

Highest thermal efficiency

Highest flexibility

Possibility for extension



The perfect CTP solution for the reduction of NOx. A special feature about the CTP AutoNOx is the fact that it can be adapted to meet a wide variety of special customer requirements.

FEATURES

- > **Highest NOx cleaning efficiency**
- > **Very low heat-requirement due to the high thermal efficiency**
- > **Low operating costs**
- > **Exactly designed for specific application**
- > **High availability**
 - Weatherproof installation of instrumentation and heating system
 - Field proven advanced software

AVAILABLE OPTIONS

- > Electric heating
- > Integrated raw-gas pre-heating
- > Heat recovery

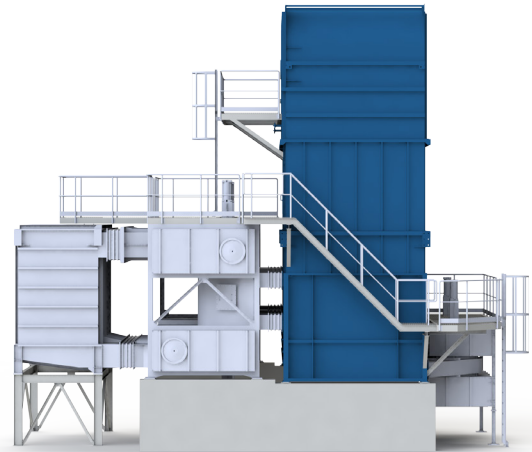
RTO-i-SCR

RTO + SCR

Highest flexibility and possibility for extension

Combined VOC, CO, N₂O and NOx treatment

Highly effective SCR catalyst operated at optimum temperature



The perfect CTP-solution for a combined cleaning of organic pollutants (RTO) and nitrogen oxides (SCR) at high efficiencies. The RTO-i-SCR is suitable for flow rates up to 300.000 Nm³/h at raw gas temperatures up to +200°C

FEATURES

- > **Highest VOC cleaning efficiency**
- > **Highest NOx cleaning efficiency**
- > **Flexibility in the heat-exchanger design, adapted to the optimum operating range of the SCR catalyst:**
 - High thermal efficiency
 - Low pressure-loss (20 to 50 mbar)
- > **Low operating costs**
- > **Specifically designed for the respective application**
- > **High availability**
 - Weatherproof installation of instrumentation and heating system
 - Field proven advanced software
- > **Free choice of the auxiliary fuel (possible restrictions regarding the SCR-catalyst)**
- > **Free choice of the reducing agent**

AVAILABLE OPTIONS

- > Multifuel burner
- > Gas- or liquid injection
- > Electric heating
- > Bake-out
- > Integrated raw gas preheating
- > Integrated washing device
- > Special insulations and coatings
- > SNCR

VOCNOxTherm

RTO + SNCR

All-in-one simultaneous abatement of VOC and NOx

Existing CTP RTO systems can be equipped with NOx control

Specially designed injection lances and distribution system



The VOCNOxTherm system combines low operating costs and excellent cleaning efficiency of an RTO with the NOx reduction of an SNCR. In several applications the VOCNOxTherm eliminates the need for an additional and complete SCR system.

FEATURES

- > High VOC cleaning efficiency
- > CTP's honeycomb ceramic heat exchangers
- > Very high thermal efficiency
- > Low pressure drop (<30 mbar)
- > NOx reduction up to 60%
- > High availability
 - Weatherproof installation of instrumentation and heating system
 - Field proven advanced software
- > Possible retrofitting of an existing CTP RTO system for NOx removal
- > High dust tolerance

AVAILABLE OPTIONS

- > Free choice of the reduction agent (ammonia, urea)
- > Gas and liquid injection
- > Electric heating
- > Hot and cold bypass
- > Online bake-out
- > Integrated as well as separate raw gas preheating
- > Heat recovery
- > Automatic cleaning

Hybrid RTO

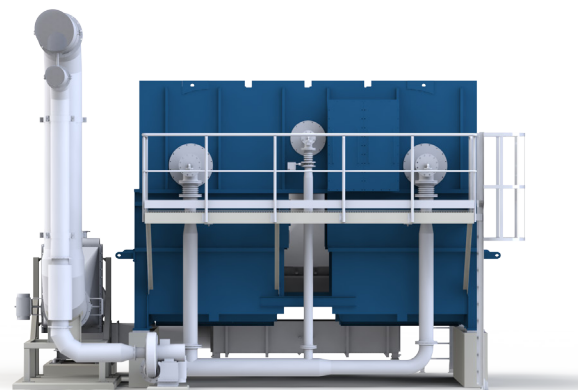
RTO + TO

Injection of high caloric raw gas and/or liquids

Higher cleaning efficiency due to direct injection

Flexible and energy-efficient operation adapted to injection

Highest flexibility and possibility for extension



The Hybrid-RTO combines the advantages of the RTO technology with the direct thermal oxidation (TO). It is the perfect CTP-solution for combined cleaning of low laden organic waste gas flows and high caloric off gas and/or liquids even without LEL protection. The Hybrid-RTO is especially suitable for small flows at concentrations \rightarrow LEL, which occur continuously or discontinuously. Design of the raw gas injection is possible in ATEX.

FEATURES

- > **Highest cleaning efficiency even for 2-bed design by direct injection**
- > **Flexible combination of exhaust gas injection and liquid injection by means of the well-known CTP heating systems**
- > **Flexibility in the heat-exchanger design:**
 - High thermal efficiency
 - Low pressure drop (17 to 29 mbar)
- > **Low operating costs**
- > **Specifically designed for the respective application**
- > **High availability**
 - Weatherproof installation of instrumentation and heating system
 - Field proven advanced software

AVAILABLE OPTIONS

- > Multifuel burner
- > Gas- or liquid injection
- > Electric heating
- > Bake-out
- > Integrated raw gas preheating
- > Integrated washing device
- > Special insulations and coatings
- > Heat recovery

RotorSorbTherm

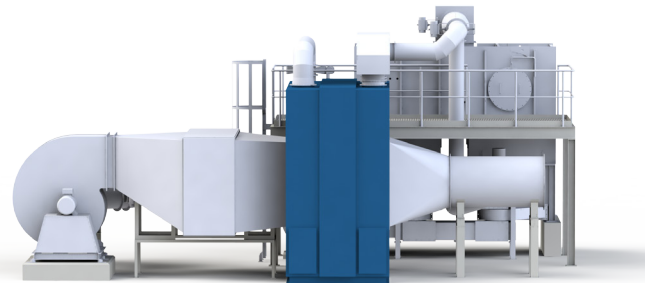
Rotary adsorber

Very high cleaning efficiency

Patented recirculation of the desorption gas (high concentration factor of up to 1:20)

No pressure peaks

Low investment and operating costs



CTP's solution for continuous control of lean waste streams at room temperature. The RotorSorb achieves an optimal cleaning efficiency of organic pollutants, and low operating costs.

FEATURES

- > Very high cleaning efficiency (up to 98%)
- > Highest concentration factors by recycled desorption air (recirculation)
- > Lowest operating costs in combination with RTO
- > Autothermal operation above 220 mg/Nm³ possible
- > Low pressure drop (5 to 8 mbar)
- > Recovery of excess energy for preheating of desorption air
- > Regenerative rotary concentrators for high boilers (bake-out-capable or washable)
- > Possible combination with all oxidation systems

AVAILABLE OPTIONS

- > Different zeolites in one wheel
- > Mixing chamber for energy optimized desorption
- > Aerosol precipitator
- > Dust collector
- > Rotor wheel washing device
- > LEL safeguard

WetSorbTherm

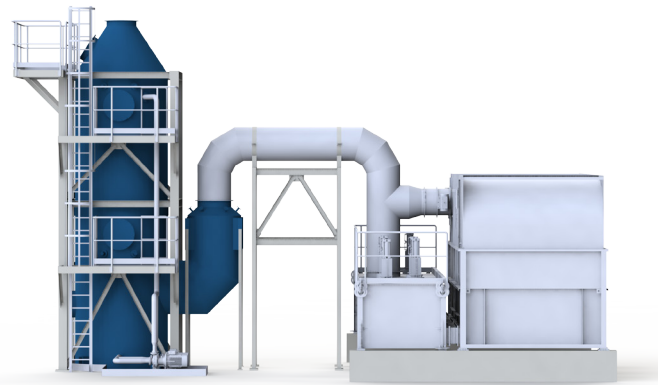
Wet absorber

Maximum cleaning efficiency

High safety standard

High availability

Low maintenance costs



After the oxidation of for example halogenated hydrocarbons, the corresponding hydrogen halides and elemental halogens emerge. Inorganic pollutants are efficiently removed from the waste gas by wet gas purification.

The combination of exhaust gas cooling (quench) and waste gas purification (scrubber) is ideal for use after a conventional APC system.

FEATURES

- > **Maximum cleaning efficiency (>99.5%)**
- > **High safety standard**
 - Fail-safe PLC
 - Selected sensors with SIL classification
- > **High availability**
 - Redundant pump system
 - Field proven advanced software
- > **Selective separation of inorganic substances (HCl, Cl₂, HBr, BR₂, HF, SO_x)**
- > **Flexible injection systems for necessary chemicals (supply pipe, lance and nozzles, storage tanks)**
- > **High standardization**
- > **Adaptations for existing, on-site chemical**

AVAILABLE OPTIONS

- > Multiple sensor package for liquid analysis
- > Make up water conditioning unit
- > Different materials for scrubber (polypropylene, pp reinforced with glass-fibre, reinforced plastic or stainless steel)
- > Access platforms
- > Plume prevention

VOXsorbTherm

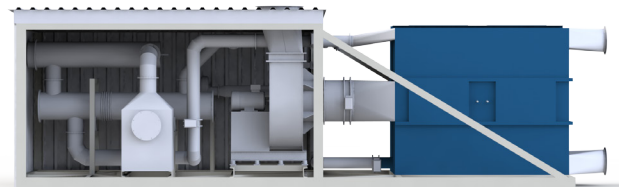
Fixed bed adsorber

Especially for discontinuous waste gas streams

Energy efficient

Small footprint

Quick installation



The VOXsorbTherm system has been developed especially for lean VOC concentration (<math><200 \text{ mgVOC/Nm}^3</math>) and periodically occurring waste gas streams. The system is regenerated in place by an accompanying oxidation system.

FEATURES

- > **Highest cleaning efficiency during adsorption for large flow rates (>98%)**
- > **Maximum cleaning efficiency during desorption for small flow rates (>99.5%)**
- > **Low operating costs during adsorption and regeneration**
 - Small pressure drop during adsorption
 - Low energy consuming design of desorption process
- > **Compact design**
- > **Pre-assembled for delivery**
- > **Use of different adsorbents**

AVAILABLE OPTIONS

- > Continuous adsorption possible with multiple adsorption modules
- > Residual oxygen control during desorption
- > Based on all oxidation systems

THERE IS EXPERIENCE IN THE AIR ...





01



02



05



06



09

- 01 VOXcube
- 02 AutoTherm
- 03 RTO-i-SCR
- 04 AutoNOx
- 05 Hybrid RTO + SCR unit
- 06 VOCNOxTherm
- 07 RotorSorbTherm
- 08 WetSorbTherm
- 09 Catalytic Oxidation + SCR

FOR THE CLEAN



THAT WE BREATHE



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