CTP-AIRPOLLUTIONCONTROL.COM

VOXCUBE

CTP-TECH OXIDATION

REGENERATIVE THERMAL OXIDATION
OF GASEOUS STREAMS

Maximum cleaning efficiency: CTP's 3-bed VOXcube

VOXCUBE

VOXCUBE 2,3,4,5: THE NEW RTO GENERATION

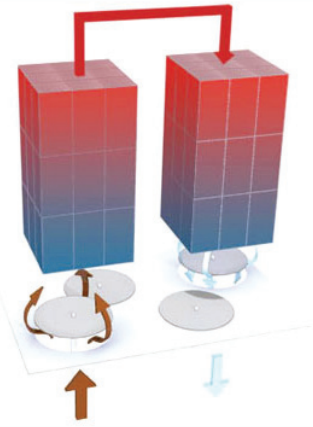
For maximum cleaning efficiency, the VOXcube should be your first choice. These units are built to be versatile and serve a wide variety of industrial needs. Modular and modern, the VOXcube is quick to install, inexpensive to run, and available with options for just about every need.

Every VOXcube comes with an array of standard features, and a wide variety of additional options is available to adapt the VOXcube to each customer's needs and requirements.

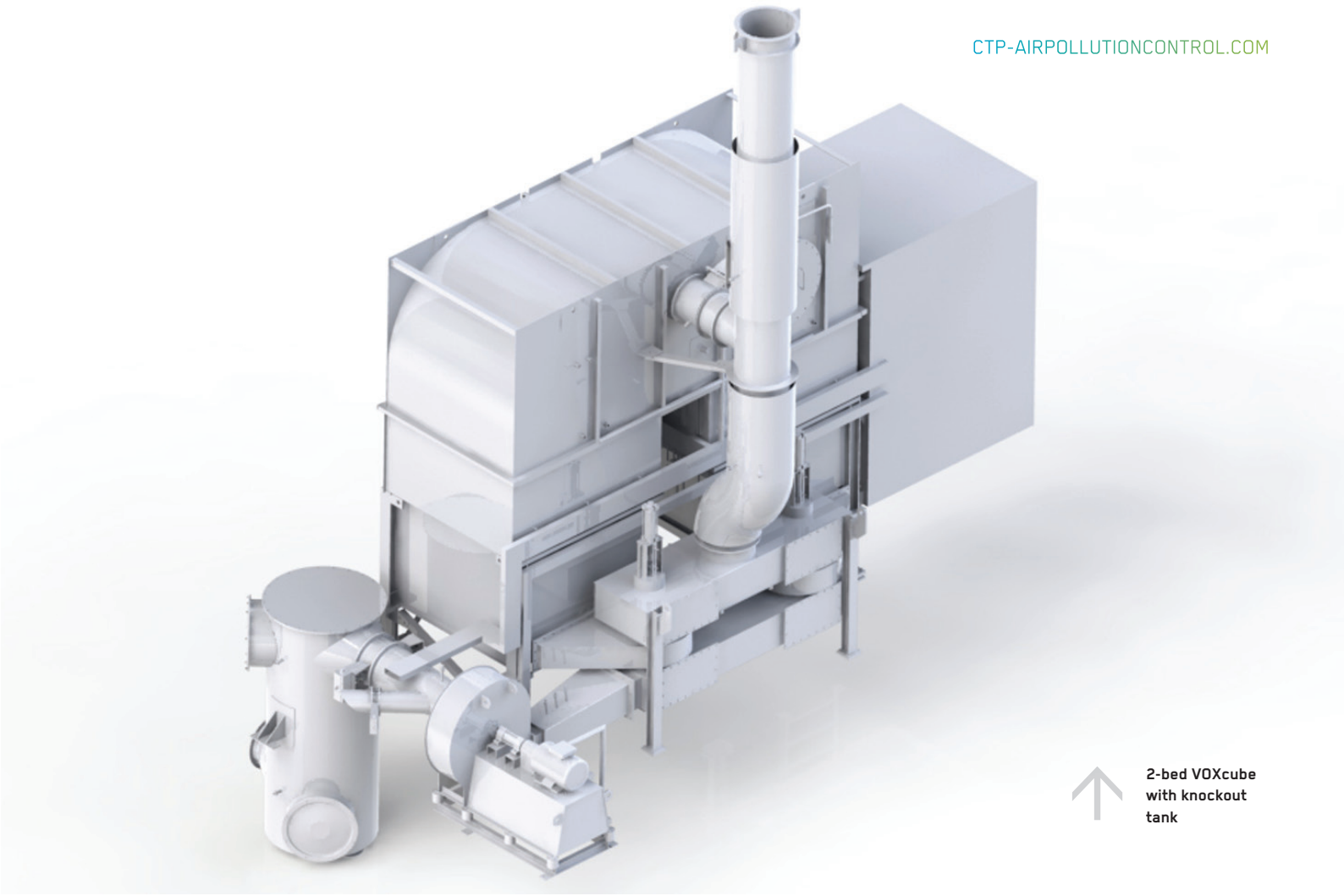
REGENERATIVE THERMAL OXIDATION (RTO)

At the heart of the VOXcube 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.



Regenerative Thermal Oxidation (RTO)



2-bed VOXcube with knockout tank

UNIQUE ADVANTAGES OF THE CTP SYSTEM

OUTSTANDING PERFORMANCE

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

FUNCTIONAL DESIGN

- Compact lightweight construction
- Flexibility of inlet/outlet gas connections
- Simple foundation (only 2 supports necessary)
- Excellent accessibility for easy inspection and maintenance
- Simple integration with other systems (NOx removal, pre-filtration, scrubbing, heat recovery)

SAFE AND RELIABLE OPERATION

- Fail-safe Programmable Logic Controller (PLC)
- Field-proven advanced software
- Sensors with Safety Integrity Level (SIL) classification
- Online bake-out or wash-out options
- 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
- Zero-leak poppet valves
- Optional electric heating
- Weatherproof instrumentation and heating system
- Optional upstream and downstream stages for difficult waste streams

THE SYSTEM

The VOXcube system includes 2-, 3-, 4-, or 5-bed systems which are available in defined configurations based on the flow rate. The main components are:

- **Main fan with Variable Frequency Drive (VFD)**
- **Valve box**
- **Reactor**
- **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 theVOXcube for positive pressure systems, or after for negative pressure systems. Standard units can accept raw gas up to 350˚C. Higher temperatures may require special handling and materials.

The **VALVE BOX** consists of a raw gas duct, a pure gas duct and the valve bodies, which connect to the heat exchangers.

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

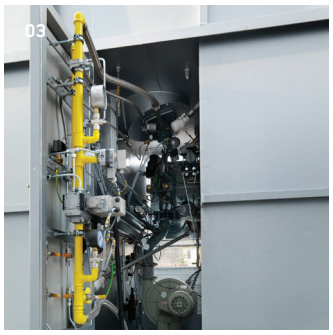
The cleaned gas leaves the VOXcube through the **STACK**, which can be mounted directly on the valve box if the main fan is on the pressure side.

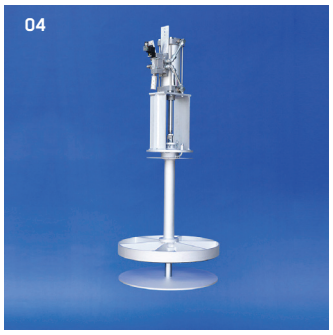
01 VOXcube reactor
02 VOXcube valve box
03 Burner system
04 Self-supporting poppet valve
05 Efficient heat exchanger

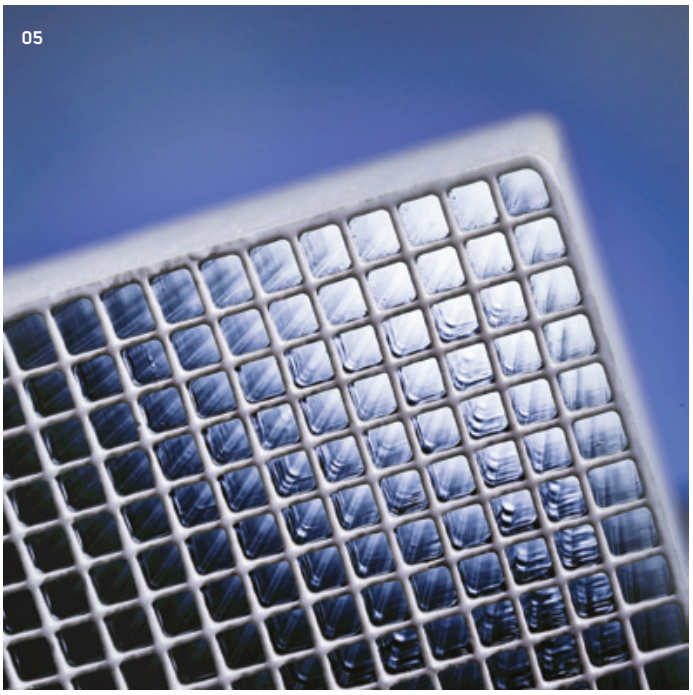
Our extensive **SENSOR PACKAGE** is capable of measuring all necessary process variables such as temperature, pressure, differential pressure and flow.

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 automatic adjustment of the system to diverse process conditions and customers' specifications.

THE KEY COMPONENTS







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 (gas or liquid) be installed along with the burner system. Fuel consumption and NOx generation can be further minimized with this option.

POPPET VALVES

CTP's poppet valves are an integrated part of the VOXcube valve box. They are robust, reliable and available in zero-leak designs. They are available as dual-sealing and single-sealing poppet valves depending on the VOXcube model.

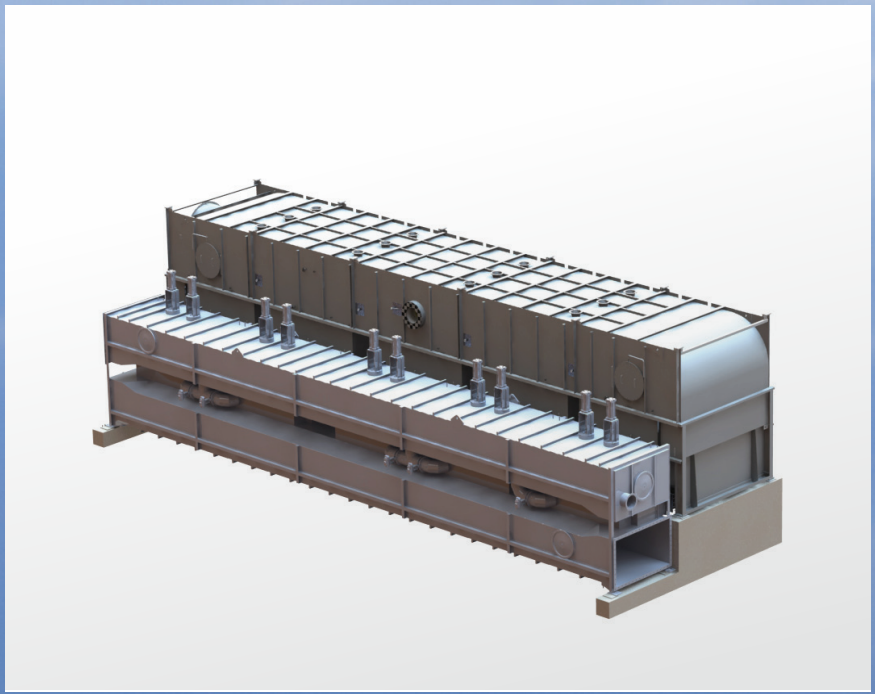
INTERNAL INSULATION

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



5-bed VOXcube

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

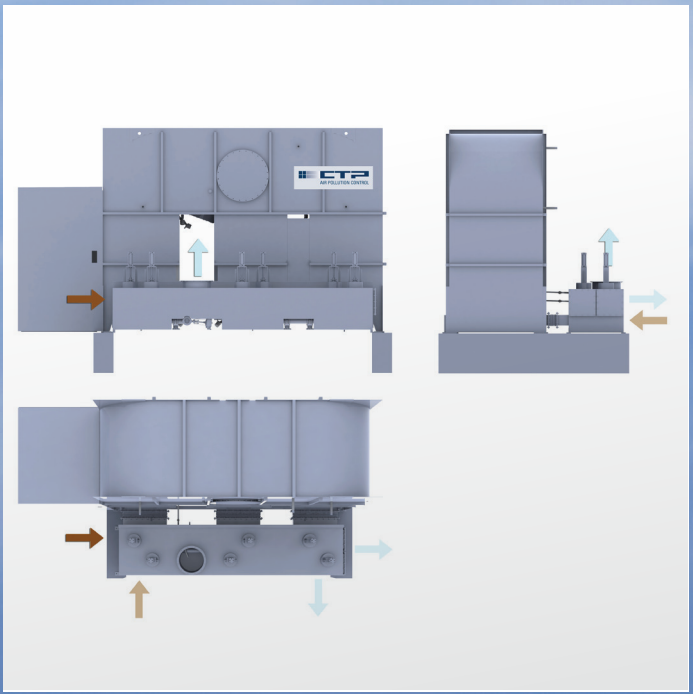
Special coatings with high anti-corrosion properties allow operation of the systems with condensing gases at temperatures below the water and acid dew points. In addition to the corrosion protection, the systems can be equipped with an external insulation to further protect against corrosion.

INTEGRATED STACK

As a special option of the VOXcube 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. This makes the footprint of CTP's system very small. The test parts 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 VOXcube to treat a much larger variety of inlet concentrations.



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 VOXcube models can even be washed while the unit remains online.

MATERIALS

The VOXcube 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.

FLEXIBLE CONNECTION

A flexible connection for raw gas and clean gas is possible.

LEL SAFEGUARD AND SYSTEM BYPASS

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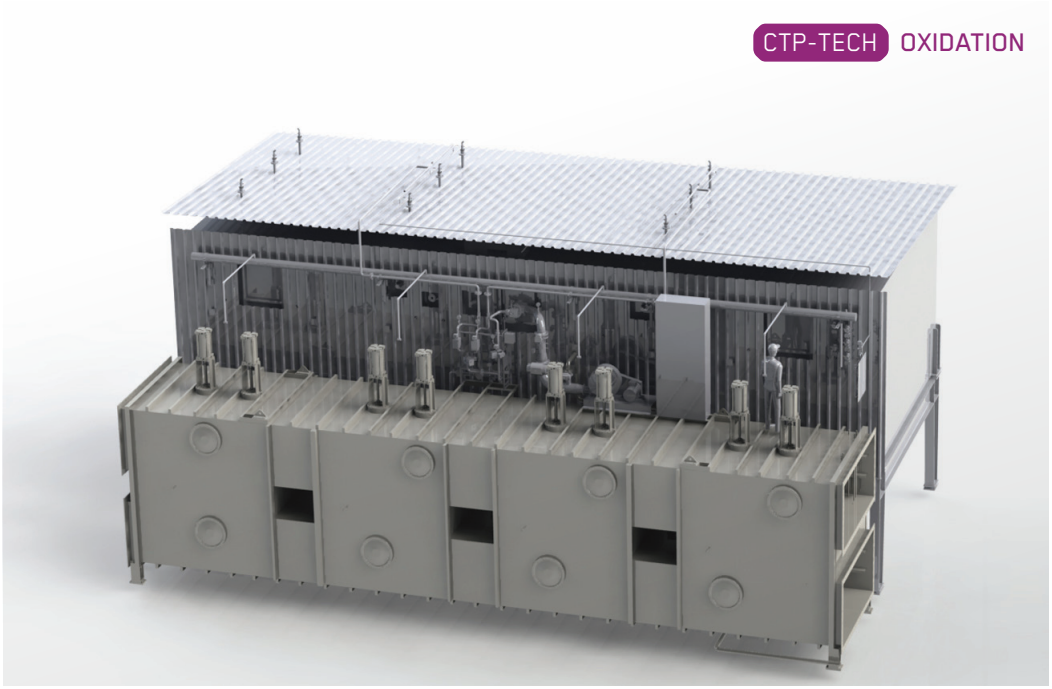

4-bed VOXcube

The extent of the flow defines which VOXcube 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
VOXcube 2 series	3,200	57,600	16
VOXcube 3 series	3,200	57,600	16
VOXcube 4 series	46,800	124,800	11
VOXcube 5 series	46,800	124,800	11

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