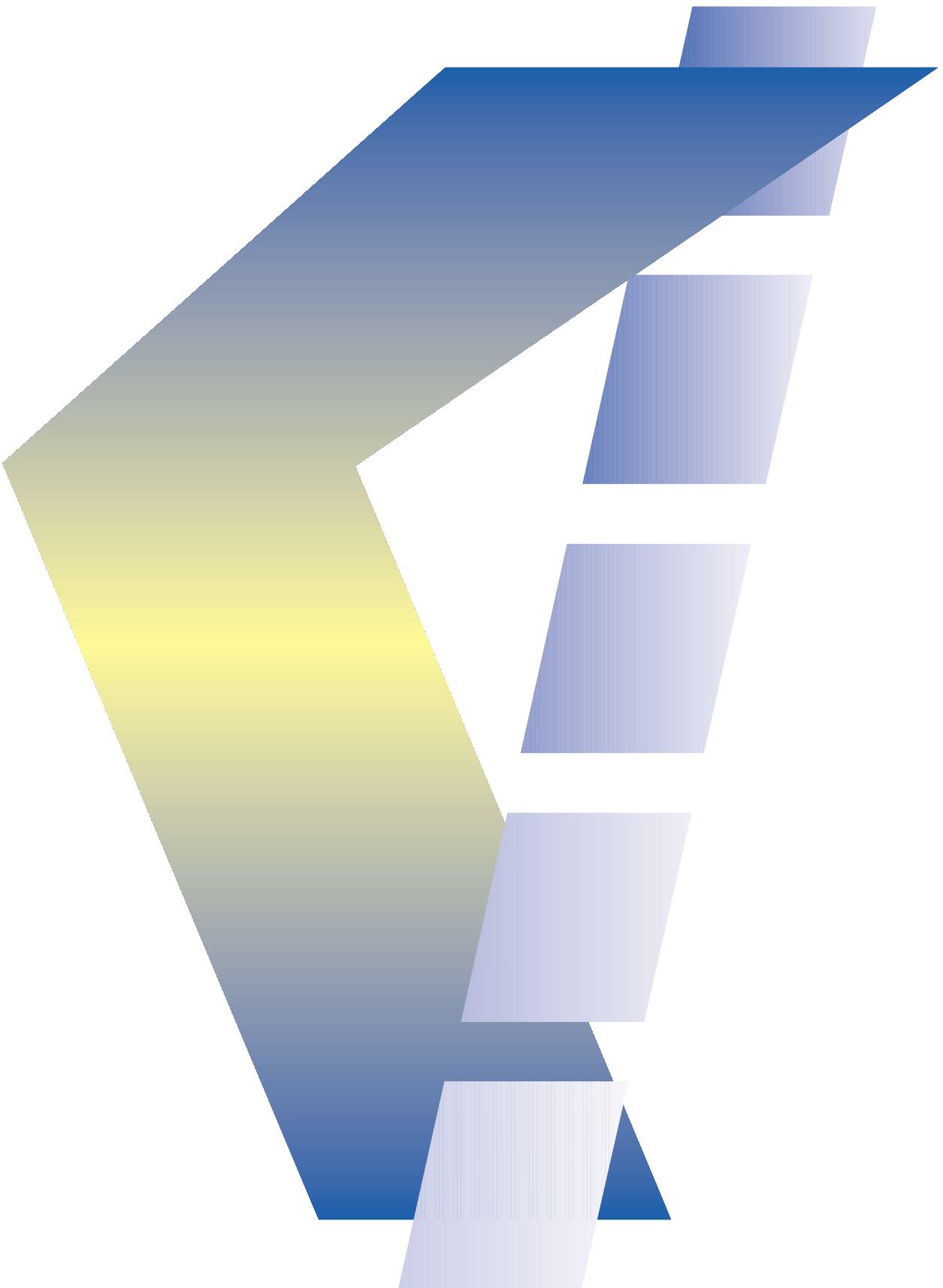
KAPARTA AG



Catalytic Gas Cleaning & Emissions Control

Catalytic exhaust gas treatment, a revolutionary environmental improvement

New clean air compliance regulations demand more severe emissions limits for toxic substances with optimum efficiency.

Emissions limits for combustion systems, electrical power generation as well as for production processes using oil, gas, wood, alternative fuels from waste and refuse in gen set engines, gas turbines and steam boilers have been significantly reduced.
Toxic gases, nitric oxides NO_x, carbon monoxide CO, hydrocarbons C_mH_n and dioxins/furans PCDD/PCDF can be efficiently removed with catalytic installations.

It is possible to remain well below the legally prescribed compliance limits for toxic substances with the use of catalytic equipment.
SCR (selective catalytic reduction) - catalytic technology is a revolutionary step forwards for medium and large sized installations. Once catalytic equipment has been installed, the toxic emissions levels can be reduced by 80-99.5%. The pollution levels will, hence, be 50-90% below the legal compliance limits.

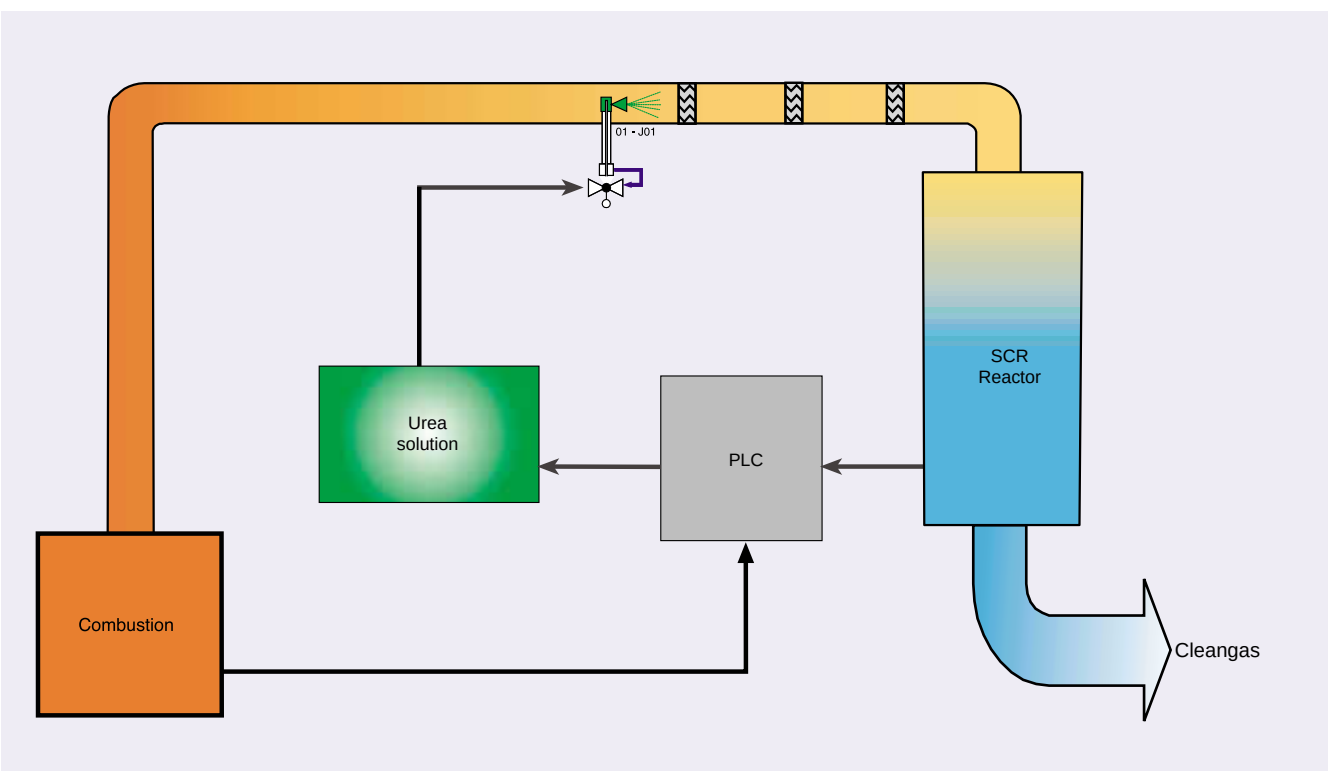
Selective honeycomb-monolith shaped elements

It has been proven that ceramic honeycomb monolith bricks best meet the prescribed conditions as they are highly selective (Selective Catalytic-Reduction), c.f. figure 4.

The first catalyst reduces the nitric oxides NO_x using vanadium pentoxide V_2O_5. It comprises of honeycomb bricks with a fine cell density which are either coated with V_2O_5 or has V_2O_5 bonded in the ceramic mass. The noxious components in the exhaust gas are transformed almost completely into water vapour (H_2O), nitrogen (N_2) and carbon dioxide (CO_2) through a process of reduction and oxidation. These products of reaction then leave the stack as clean gases, in other words as natural components of the atmosphere.
A similar vanadium pentoxide based catalyst destroys the highly toxic dioxins and furans by means of oxidation. The chlorine is separated from these hydrocarbons and is oxidised to hydrochloric acid HCl. This method of destruction means that no new dioxins can be formed and no dangerous residues can be produced.

The third honeycomb catalyst made of clay and coated with precious metals, transforms the unreacted hydrocarbons (C_mH_n) and toxic carbon monoxide (CO) into carbon dioxide (CO_2) and water vapour (H_2O).

The overall efficiency of installations in steam boilers and power generation units with thermal co-



Proven and custom-made with guarantee for success

generation cycles, can be considerably improved using heat exchangers downstream of the catalytic reactors to extract residual waste heat from the clean gas stream.

Proven and custom-built installations with a guarantee of success

The SCR catalytic process of Kaparta AG operates according to an incredibly simple principle. An exact quantity of urea dissolved in water is sprayed into the combustion gases which are at a temperature of ca. 400 °C. The urea solution and hot gases are then homogeneously mixed in inline static mixers before being fed to the catalytic reactor housing. Here, the toxic gases are almost completely transformed in the catalyst bed.

Catalytic reactor housing and equipment parts as standard components

Our reactor housings are built using standardized sizes and parts depending on the contaminants to be treated. All units are delivered, complete with automatic urea spray nozzle system, tank for reagent solution preparation and storage, electrical control unit, urea metering pump control system, and the catalytic reactor housing shop fitted with catalyst. Our compact units fit into even the smallest of spaces (minimum foot print design).

Industry-suitable dimensions of the catalyst honeycomb bricks

In power stations, catalytsts have very large dimensions, are extremely heavy and made up of large elements. Our honeycombs are single elements with typical dimensions of 15 x 15 x 30 cm. Their weight is ca. 5 kg and are very easy and flexible to use in industrial applications. The particular type of catalyst we use has been rigorously tested over several years on real industrial exhaust gas applications resulting in a reliable and industrial proven design concept. We are continuously perfecting and optimising our designs to produce the following set of economically optimised system elements for our installations.

Urea, an environmentally neutral, user-friendly, and cost-effective reagent

Urea, in contrast to hazardous ammonia, allows complete trouble - free storage. It represents no hazard to the operator. The injection of water dissolved urea solution with our units is free of any problems. Urea is inexpensive, environmentally friendly, and dissolves easily in water. It is supplied in the form of 2 mm (1/16”) Ø white granulate material. Urea is mainly used in industry as fertiliser, animal feed additive and also as a deicing agent at airports.

Reliability of components

The instrumentation and control requirements of the SCR process is fully supervised and controlled by an onboard PLC (programmable logic control) unit. PLC technology has been developed and tested over the years such that it is sufficient to control the rate of urea injection using a fuel supply modulation signal or another suitable control parameter from process.Without further intervention in the process, this method of control gives excellent results in NOx reduction. This simple control loop philosophy minimises the unit’s susceptibility to failure.

Customer-optimised designs and manufacture

All unit designs are prepared by our design office. After the fabrication of the individual system components is complete, works tests are carried out. Our design department is equipped with modern CAD systems, enabling us to quickly address our customers’ needs. The stainless steel reactors, mixers and miscellaneous system components are welded and pre-assembled in our own fabrication shops.

Kaparta AG designs and produces turnkey exhaust gas and exhaust air treatment systems for furnaces and production applications. Kaparta AG is also able to test different catalyst formulations in real exhaust gas streams as well as using synthetic gas mixtures to verify the catalysts suitability for an application. We leave nothing to chance and test all our components before shipping.

No waste disposal problems of unwanted residue, no special waste

The catalytic transformation of raw exhaust gases into clean exhaust leaves no environmentally hazardous waste residue behind requiring disposal as special waste. Spent catalyst elements can be returned to the manufacturing company where they are ground, filtered and reused as raw material for new catalysts.

Very low retro fit costs and shutdown times for existing installations

The SCR catalytic technology is best suited to treat existing production processes. There is no need to exchange the burners or

Development, engineering, project management, design work and manufacturing

boilers. Only small modifications to the boiler may be necessary. From experience, we know that service and shutdown times are usually minimal.

Efficiency and performance of the Kaparta AG catalyst process

The catalytic NO_x control elements we use are sized typically to have a gas hourly space velocity GHSV = 60,000 h^{-1}; the oxidation honeycombs are sized to a gas hourly space velocity of up to as much as GHSV = 1,000,000 h^{-1}. Large power stations usually use plate catalysts which operate with a space velocity of GSHV = 6,000 h^{-1}. As our units have space velocities more than 10 times higher we are able to offer more compact and cost-effective systems.

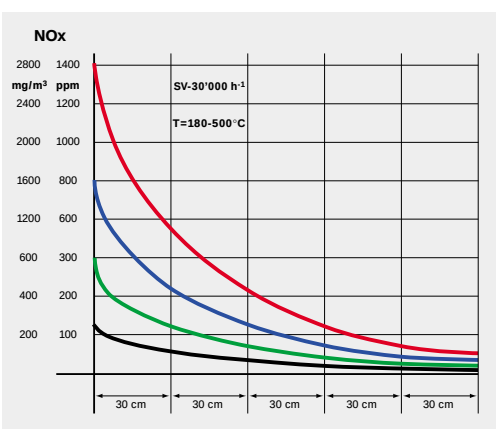


Figure 1: De-NO_x stage – reduction stage

$DeNO_x$ stage - reduction stage

Degree of emissions attenuation ranges from 90 – 98.5% (c.f. figure 1).

De-Dioxin/furan oxidation stage

The catalyst assembly is similar to that of the $DeNO_x$-stage (c.f. figure 2).

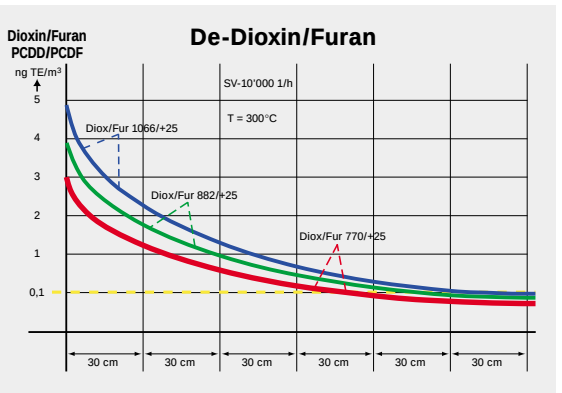


Figure 2: The De-dioxin/furan oxidation stage

The CO oxidation stage and the C_mH_n oxidation stage

The performance of these catalysts is exceptionally high. The destruction level for carbon monoxide ranges from 95 - 99.5%, and ca. 85 - 92% for hydrocarbons C_mH_n. For ethylene, C_2H_4, the emission level can be reduced below the detection level (c.f. figure 3).

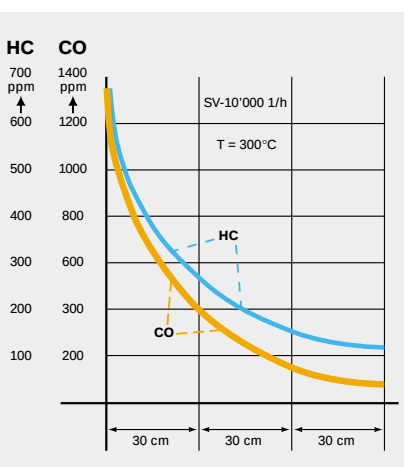


Figure 3: The De-CO oxidation stage and the De-C_mH_n oxidation stage

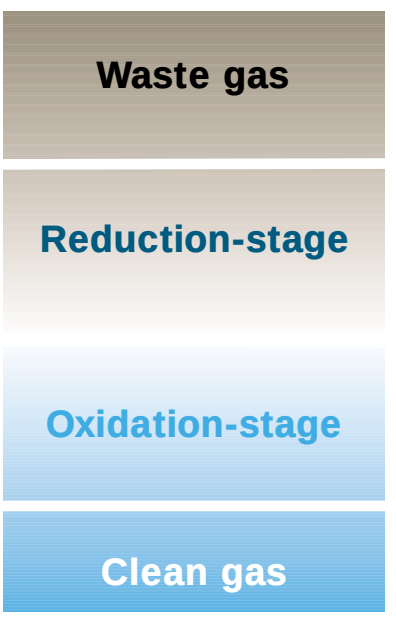


Figure 4: SCR system (Selective Catalytic Reduction)

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