EXHAUST GAS PURIFICATION AND
ENERGY RECOVERY WITH SYSTEM

\[ C_mH_n + \left( \frac{m+n}{4} \right)O_2 \rightarrow mCO_2 + \frac{n}{2} H_2O + O \]
EXPERTISE AND FLEXIBILITY — RIGHT FROM THE VERY START

The effective purification of pollutants and the efficient energy recovery have shaped the consistent expansion of our range of services for decades. Thanks to the most up-to-date technology as well as members of staff with many years of experience, we implement innovative system technology which sets the standards in the field of exhaust gas purification. Whether it is thermal, regenerative or catalytic, the right choice of incineration technology is made as well as the systematic recovery of energy is carried out. This is based upon the intensive research which is carried out into the specific requirements of the customer.

Close contact with our customers is an important aspect of each project — from the construction stage right through to the assembly stage. The flexibility of the system construction method takes all spatial situations into consideration. The coated and highly efficient insulation guarantees resistance to weathering as well as low levels of energy loss regardless whether the system is intended to be built indoors or outdoors in winter-proof design. Once the system has been successfully commissioned, the availability of 24-hour service help as well as the replacement part warehouse will guarantee the reliability of the system technology.

EXPERTISE: The acquaintance of the individual situations at the location as well as the detailed analysis of all of the surrounding conditions will form the beginning of the teamwork. This complex method of operation guarantees that the tender is binding.

INDIVIDUAL: Based upon the system experience of many years, the construction of the customised system solution will take place with up-to-date CAD/CAM Technology. The digital order data accompanies each phase of construction and will be incorporated into the documentation.
INNOVATIVE SYSTEM TECHNOLOGY FOR THE CLEANEST AIR POSSIBLE

HIGH PERFORMANCE: The requirement for the ideal result is the perfect co-operation between qualified members of staff and innovative machine technology. The individual construction of the switchboard and the comprehensive quality inspection complement the production output.

RELIABLE: Customer satisfaction which comes as standard on the assembly and commissioning has taken place, the complex training regarding the system technology, expert service help as well as a quick response in the event of a breakdown guarantees a long term co-operation between ourselves and the customer.

The production of the individual system designs takes place in an area measuring over 3000 m².
The degree of innovation which is implemented thanks to targeted further development in the field of regenerative incineration technology is impressive. The residue-free exhaust gas purification of volatile organic compounds (VOC) is exceptionally good when it comes to dealing with complex tasks in the field of web offset printing, gravure printing and flexographic printing as well as with regards to painting and lamination processes amongst other tasks. The process is based upon a flameless oxidation process which takes place at a temperature of over 800°C. The optional flameless introduction of gas also creates a noticeable operational cost benefit in non-auto thermal operation. A compact housing normally contains three heat-exchanging chambers which are fitted with storage elements in the form of high-quality honeycomb bodies. Cold raw gases pass through the honeycomb body and in doing so almost heat up to the oxidation temperature. After the conversion of the pollutant has taken place in the incineration chamber located centrally above, the exhaust gas which is now purified reaches the next chamber and releases the heat onto the ceramic material. The effectiveness of the heat exchange of up to 97% achieves the highest level of economy and quickly reaches auto thermal operation.
**VARIABLE CONSTRUCTION:** The most varying of construction methods of the system can be implemented in order to adapt to the surrounding requirements. The "lying" horizontal construction method is distinguished by its area loads and low construction height, while the "standing" vertical construction method displays its value thanks to its low requirement of space. Furthermore the module construction method enables a simple adaptation to particular requirements, e.g. 2-chamber or 5-chamber system.

**HIGHEST LEVEL OF OPERATING SAFETY:** The core of the system is the valve technology which permanently guarantees a complete separation of raw and pure gases. Venjakob Umwelttechnik has begun its own in-house developments in this area in the form of flexible poppet valves which are pneumatically driven. The valves are extremely low maintenance, resistant to wear and tear and can be used in a wide range of temperatures.

**SYSTEM CHARACTERISTICS**
- Exhaust gas flow of between 5,000 and 75,000 m³/h
- Can be used with low to medium concentrations of pollutants
- Low level of primary energy usage thanks to a high degree of heat exchange effectiveness
- Excess energy can be used thanks to targeted energy recovery
- Incineration chamber temperature of > 800 °C
The classic technology for the purification of volatile organic compounds (VOC) is often directly integrated into the overall process with energy recovery systems. Therefore this is a significant component of complex production systems. The exhaust gas which is loaded with pollutants is pumped into the system via a centrifugal fan. The exhaust gas initially circulates around the integrated tube bundle heat exchanger in a cross current flow. In doing so this air heats itself up in an optimal manner. The pre-heated exhaust gas now arrives into the combustion chamber via the supporting burner.

The equipment which is installed in this area ensures that the exhaust gas is equally brought to the desired temperature level and that the required dwell temperature is observed in all operating conditions. The purified exhaust gas will then flow into the internal area of the tube bundle heat exchanger, releases the heat to a large extent onto the cold polluting air and can then be used as a pure gas in order to achieve the recovery of energy. The process makes allowances for ideal variable input parameters as well as changing requirements on secondary energy recovery.

TI – THERMAL INCINERATOR

The integrated thermal incinerator represents an individual solution of thermal incinerator technology which has been developed for well-known system manufacturers in the printing industry.
APPROVED SYSTEM TECHNOLOGY IN HIGH-GRADE QUALITY: Sophisticated construction characteristics such as the special compensator which has been developed in-house for the absorption of the heat exchanger expansion cannot be rivalled by anything else on the market. The incinerator and the heat exchanger are arranged in a tandem fashion so that all areas can be easily reached for maintenance purposes. The square construction design enables the adjustment of the fans or secondary heat exchangers on the thermal incinerator so that the required space is minimized at the location.

DIFFICULT TASKS: A case for the thermal incinerator. Where other technology reaches its limits, the thermal incinerator from Venjakob Umwelttechnik remains completely reliable. This particularly applies when handling exhaust gas which contains particles or silicone and with regards to highly variable operating conditions. The combination with energy recovery systems which are adjusted to the requirements leads to a high level of economy. Innovative product development has shaped this robust type of system for over 30 years.

SYstem characteristics:
- Exhaust gas flow of between 1,000 and 40,000 m³/h
- Can be used with high or unknown amounts of pollutant concentration
- Robust construction design, simple to operate
- High level of energy potential for secondary energy recovery
- Incineration chamber temperature of > 750 °C
The CTO from Venjakob Umwelttechnik displays its value particularly whilst dealing with small special tasks. Similar to the thermal incineration system, the exhaust gas which is to be purified is initially pumped into a recuperating heat exchanger in order to be optimally pre-heated. Now auxiliary energy in the form of natural gas/propane gas or electrical energy will be applied should it be required in order to reach the necessary reaction temperature. The catalyzer quickly reduces the temperature which is required to convert the pollutant in comparison to pure thermal type systems. During the conversion phase, no attrition of the catalyzer occurs which means that the material can be used over a period of many years. The reaction enthalpy which becomes free – as is the case with all thermal systems – will be used in order to support the pre-warming of the exhaust gas so that the usage of auxiliary energy is significantly reduced. Due to the fact that the catalyzer will lose some of its activity due to particular pollutants (e.g. silicone and heavy metals), it is important that this matter is to be individually agreed upon during the planning phase according to the given composition of the pollutant.

**System Characteristics**

- Exhaust gas flow of between 1,000 and 15,000 m³/h
- Can be used with low to medium amounts of concentrations of pollutants
- Low level of primary energy usage thanks to low temperatures
- An economic alternative for the purification of organic pollutants
- Reaction temperature of > 280 °C

**EFFECTIVE:** Thanks to the co-operation with well-known catalyzer manufacturers, it is guaranteed that the best solution will always be offered. The selection of the catalyzer will take place individually after the requirement analysis has been completed. From noble metal catalyzers in pellet, honeycomb or foil form, or a mixed oxide catalyzer in bulk material form, the multitude of choice cannot fail to impress. The aim of the construction is to optimise the installation into the complete system whilst taking fluidic aspects into consideration.
BIOLOGICAL: Venjakob Umwelttechnik has made it a priority to innovatively and bravely promote new developments which are in excess of approved technologies. The biological purification of weak VOC-loaded exhaust gas represents an interesting challenge. Pilot systems with realistic conditions are providing significant experience in order to permanently ensure high levels of requirements which are placed upon the operating reliability and economy of the machine.
Exhaust gas purification does not have to be a loss making business! The thorough planning and the early inclusion of our energy recovery systems in a process contribute to making a profit from investments made towards environmental protection. The remaining gases / excess energy which are contained in the pure gases from the Venjakob exhaust gas purification systems offer a large amount of potential in many tasks, which systematically and effectively support the actual production process, the heating of the building or other areas where energy is required. Energy recovery as an ecologically and economically sensible measure for the saving of primary energy offers a flexible multitude of solutions. The planning, construction as well as production is carried out in an individually coordinated manner depending on the respective circumstances whether it is an individual system for thermal oil, warm and heating water, warm air, steam or combined as a downstream system solution of exhaust gas purification system. Naturally our heat exchanger systems can also be combined with systems which have been produced by other manufacturers.

ENERGY RECOVERY WITH THE SYSTEM

Exhaust gas flow of between 1,000 and 40,000 m³/h
Heat exchanger for the heating of water, steam, air, exhaust gas and thermal oil
Can be used in all temperatures up to more than 800 °C
Reduction of operating costs concerning the process and building heating
Low level of pressure loss and high resistance to corrosion

INDIVIDUAL: A smooth tube or a ribbed tube heat exchanger? A boiler tube or a water tube tank? For use in low temperatures or with hot gases? These questions just show how the requirements vary in reality. Venjakob Umwelttechnik expertly plans a customised solution with the highest level of economy as well as long durability due to the robust construction of the heat exchanger.
CUSTOMER SATISFACTION IS OUR DAILY CHALLENGE

EXAMPLES OF CUSTOMERS:

AS Création Tapeten, Gummersbach
Baumann-Druck, Kulmbach
GGP Media, Pößneck
Heyne & Penke Verpackungen, Dassel
Honeywell Bremsbelag, Glinde
Koenig & Bauer, Würzburg
Linden, Lüdenscheid
Mondi Inncoat, Raubling
VSM, Hannover

REFERENCES

We work towards the target with a high level of commitment and dedication. We respond to the trust placed in us with individual system solutions as well as excellent service help. The satisfaction of our partners enable the consistent and innovative growth of our Company.
Venjakob Umwelttechnik belongs to the Venjakob Company Group which has been an internationally recognised and worldwide operative system manufacturer of innovative surface technology for over 40 years. The conception of individual system solutions, the optimisation of production processes as well as the development of innovative system technology is carried out based upon the experience accumulated over many years as well as the profound expertise of our members of staff. Individuality, close contact with our partners in the most varying of fields as well as conceptual thinking and actions shape the daily operations at our Company.

SURFACE SKILLS WITH THE SYSTEM

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