

Waste gas and process gas scrubbing systems

High-tech and compact solutions



Waste gas scrubbing systems

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Acting as a general contractor, we offer turn-key units for waste gas cleaning systems from basic engineering to process commissioning to the customer.

Waste gas, high contaminated with pollutants, is produced during the incineration of waste from chemical processes. These combustion gases often contain high concentrations of gaseous inorganic chemicals.



Waste gas scrubber 1,500 Nm³/h

Problem definition – problem solution

Typical pollutants are elemental halogens such as Cl₂, Br₂, I₂, hydrogen halogens (HCl, HBr, HI) and sulphur compounds such as SO₂, SO₃, H₂S. In addition, particles and aerosols are often discharged. High temperatures along with varying compositions of corrosive and abrasive contaminants place high demands on waste gas cleaning systems.

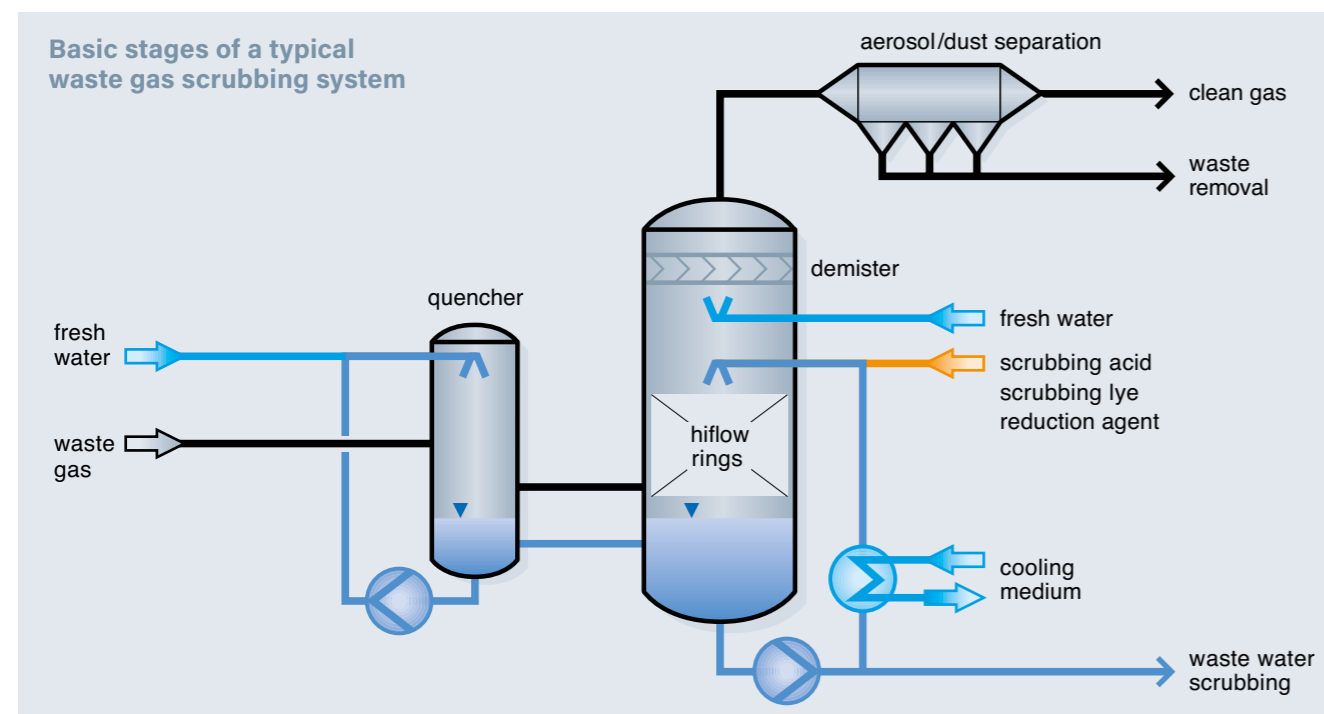
As a result of high concentrations of pollutants, multi-stage, wet-type waste gas scrubbing systems are used to comply with low emission limit requirements. In most cases these plants consist of a particle separation process, a quench stage, one or several scrubbers as well as an aerosol separator.

RVT Process Equipment offers high-tech and economical solutions to meet these requirements.



Assembly of a SO₂-scrubber for 60,000 Nm³/h

Acting as a general contractor we are offering turnkey units for waste gas cleaning systems starting with basic engineering and ending with the commissioning to the customer.



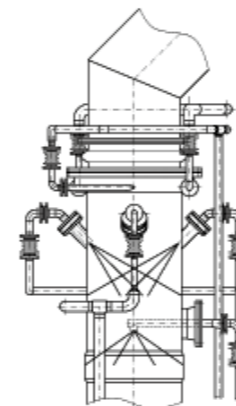
Quench stage

The hot waste gases leaving the combustion chamber with temperatures up to 1,300 °C are directly carried to the quench stage, where the gas cooling takes place by direct heat exchange down to saturation temperature of the gas. This gas cooling is realized by evaporation of quench water. Due to the special process conditions this treatment demands for a highly sophisticated design engineering:

Cooling down the hot gases must be ensured in any case to prevent damaging the downstream equipment by hot gases. This has to be ensured even in case of a power blackout.

A further issue is the transition area between the dry and hot gas zone and the water distribution area of the quench. A careful selection of suitable materials as well as a perfect design layout of the transition are necessary. Back-flow of the liquid which may cause salt deposits must be prevented and a uniform surface irrigation of the apparatus with cooling liquid must be ensured.

Depending on the real process conditions there are different quench designs available, e.g. jet sprays, spray nozzles, pipe or venturi configurations. Jet spray quenches made of corrosion-proof GRP and wear-resistant nozzles of SiSiC are the most favored design.



Example of a jet-spray quench

Due to the special design of cooling water distribution it is possible to operate these quenches in processes with temperatures up to 1,300 °C.

Jet-spray quenches are insensitive to load changes of the process gas and have a good performance in dust separation due to the high relative velocity.

Reducing the gas temperature by quenching enables the use of inexpensive plastics and compound materials for the following process steps.

Pollutant absorption

Saturated vapor enters the absorption stage of the plant, often a column equipped with random tower packing.

The raw gas flows through the column from the bottom in upward direction, while the liquid scrubbing agent flows countercurrently to the gas. Chemicals can be added to the scrubbing liquid to improve the absorption of contaminants, if necessary.

Column internals, made at our own factory are core components to ensure an efficient operation of the column. Hiflow® rings are used as random tower packing in most of the cases. The open lattice structure of this packing makes it extremely insensitive against any fouling. Further features of the Hiflow® rings are the low weight, the high mechanical stability, flexible loading capacity and the low pressure drop reduces the electric energy demand.

Separation of droplets and aerosols

In order to reduce the entrainment of droplets and mists the scrubbed gas passes a mist eliminator. Wire mesh or vane-type mist eliminators cause coalescence of liquid particles that can either be separated in films or droplets.

Our mist eliminator systems can be flushed completely on demand in order to prevent encrustations.



Wet working electrostatic precipitator for separation of dust and aerosols

Systems for process gas treatment

Gas cooling and scrubbing

Gas cooling / heat recovery

RVT provides systems for waste gas and process gas cooling based on direct heat exchange.

Hot gas is cooled down to saturation temperature directly contacting with circulating liquid upon the wetted surface of tower packing. Therefore heat energy is exchanged from the gaseous to the liquid medium and can be utilized in heat exchangers for heating purposes. Furthermore this process causes dehumidification of the gas.

This way of heat recovery by direct heat exchange takes place simultaneously with an absorption process in many plants. RVT is mainly using columns working with a counter-current system for this process. These columns are either equipped with random tower packing or with structured packing, especially designed for this application and featuring large specific surfaces for heat and mass transfer.

Production of steam, hot water or thermal oil is another facility for waste heat recovery. This is realized by using heat exchangers e.g. waste heat boiler.



Cooling column with 3 heat exchangers in the foreground to utilize waste heat energy in a district heating system

Gas scrubbing and recovery of recyclable wastes

Besides waste gas scrubbing systems we offer scrubbing systems for the separation of inorganic and water-soluble organic substances from process gases or waste gases.

We routinely provide solutions for treating waste streams containing HCl, HF, HBr, Cl₂, NH₃, and SO₂. We also offer processes which recover organic compounds including alcohols, aldehydes, ketones, and others. We can also provide special absorption solutions for the use of organic scrubbing agents upon request.

Process control optimization enables high concentration product solution recovery for reuse.

Acid and alkaline gas components are usually separated via chemical scrubbing. Scrubbing of highly concentrated hydrogen chloride is one of our specialties.

Using our knowledge of thermodynamics, we are able to recover HCl.

For the separation of SO₂/SO₃ we offer a multi-stage process that produces sulphuric acid.



Bypass-plant for recovery of hydrochloric acid from flue gas.



Single-stage waste gas scrubber behind a regenerative oxidizer of a chemical plant, 50,000 Nm³/h

Nitric oxide reduction

Nitric oxide reduction is performed by selective catalytic reduction process (SCR process). Ammonia or a solution of urea is being injected into the raw gas and the transformation of nitric oxides to elemental nitrogen and water takes place upon the surface of the catalyst.

RVT can either provide the full plant or any of the individual components including reactor housings, catalyst honeycombs, agent injection devices, and chemical storage tanks.



Assembly of a catalytic converter equipped with catalytic ceramic honeycombs



Equipment for injection of ammonia



Waste gas cleaning plant with hot gas quench, SCR-reactor and multi-stage absorption, 20,000 Nm³/h



Mobile multi-purpose test plant

In some cases it is useful to carry out test runs on customer's site under the real process conditions and gas quality to get more information how to design a plant.

For this application, we offer a mobile test unit housed within a 40 ft. container. The design of our testing unit enables its use for the testing of gas quenching, multi-stage absorption as well as desorption processes. The plant is controlled by an integrated system.

Economic solutions From one single source

Even under complicated system requirements, RVT Process equipment offers complete, economical, compact, high-tech, field-proven solutions.

We specialize in the treatment of highly contaminated waste gases with temperatures up to 1,300 °C.

In addition to the removal of acidic and alkaline pollutants (SO₂, HCl, HBr, HF or NH₃) we have experience in the separation of elementary halogens such as chlorine and bromine. Very often these combinations can only be effectively absorbed with a particular process management including the addition of suitable auxiliary chemicals.



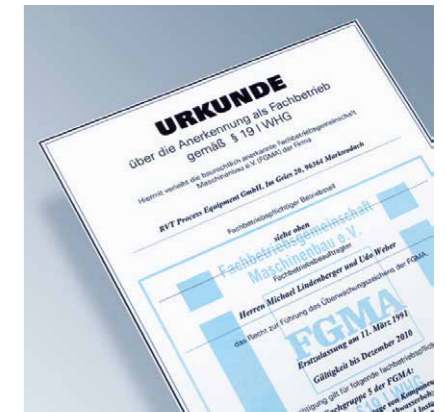
Redundant waste gas scrubber in a chemical plant for 2,000 Nm³/h

Our experience for your problem definition

- Complete solutions in high-tech and compact design
- Product application engineering and realisation from one source
- High separation levels
- Low gas-side pressure loss and low energy requirement
- Flexible loading capacities and low partial load sensitivity
- Particularly suitable for very hot, corrosive waste gases containing solids
- Use of materials which are extremely low from corrosion and wear aspects
- Insensitive to fouling and proven reliability in practice
- Minimum servicing and maintenance
- Fully automatic plant operation

We require the following details in order to prepare a quotation for your specific scenario:

- Waste gas volume
- Water content
- Composition / substances contained
- Temperature
- Pressure
- Required outlet gas concentrations
- Particular requirements



We are a certified and approved specialised company according to § 19 of the Water Resources Management Act (WHG).

RVT Process Equipment has been certified according to ISO 9001 since 1996, and according to ISO 14001 since 2010.

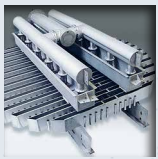
The way to RVT Process Equipment



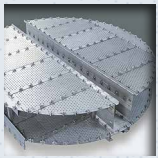
Tower packings for mass and heat transfer



Structured packings for mass and heat transfer



Column internals



Mass transfer trays



Biological carrier media



Turn-key units for waste gas scrubbing



Ammonia recovery processes



Combustion plants for the disposal of exhaust air, waste gases and liquid media



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