

EXHAUST GAS PURIFICATION STATIONARY ENGINES

combikat™



***hug*engineering.**
A FAURECIA COMPANY

DRIVING DOWN EMISSIONS: NO_x, CO, NMHC, PM, NH₃

HUG COMBIKAT™: COMPREHENSIVE AFTER-TREATMENT FROM THE TECHNOLOGY LEADER

In stationary engine installations, Hug Engineering was the pioneer in the introduction of urea as an SCR reducing agent for exhaust gas aftertreatment and is the major global source-of-supply of emissions abatement units for large spark and compression ignition engines. Applications range from standard installations to the ultra-low NO_x reduction systems required in carbon dioxide (CO₂) fertilization plants for greenhouses, or to reach high purification of the exhaust gas emitted by engines installed in non-attainment areas in the USA.

Hug systems overall capabilities include the simultaneous elimination of NO_x, NH₃, CO, Particulate Matter (PM) and volatile organic compounds (VOC).

Drawing on know-how from more than 30 years in the design, development, manufacture and application of selective catalytic reduction systems, oxidation units and particulate filters for large engines, Hug Engineering has developed combikat™, a flexible, modular after-treatment technology capable of reducing the major types of exhaust pollutants to legislation compliant levels.

POWER PLANTS & COGENERATION FACILITIES

Hug has supplied SCR, oxidation units and particulate filters to a wide spectrum of electrical power generation, cogeneration and tri-generation plants in a broad range of energy supply contexts:

- utility, municipal, IPP and industrial process
- base-load, load-following and standby (incl. black start)
- grid stability and merchant power (peaking and mid-merit)
- vital support for greenhouse
- district heating for communities
- cooling facilities for data centers
- civil applications such as CHP in hospitals and universities

VERSATILE AND INCLUSIVE

combikat™ targets stationary engine power systems such as power and cogeneration plants in a power range from 200 kW to 40 MW. It is designed to minimize emissions from diesel, gas and dual-fuel engines burning a full range of liquid and gaseous fuels:

Fossil fuels

- distillates (e.g. Diesel, MGO, MDO)
- heavy residual oils (HFO)
- natural gas incl. well-head, associated and flare gases
- process streams (e.g. tail gas, coke oven vents and low-BTU fuels)

Renewables

- bio-fuels including biogas or vegetable oils (exhaust, refined and crude)
- syngas from the gasification processes of different biomasses

In this way, Hug Engineering's combikat™ emissions reduction system enables operators of large engines to comply with the strictest clean air legislation applicable, while also contributing to international environmental commitments such as greenhouse gas reduction.

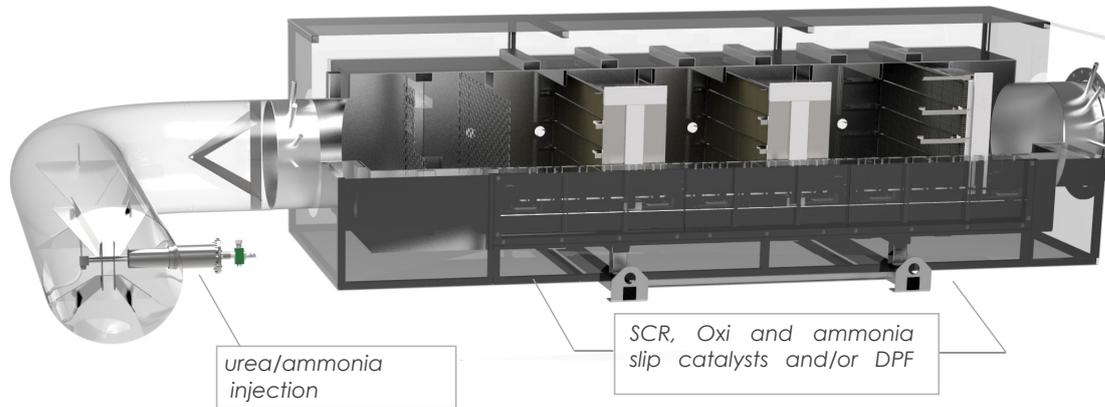
MODULAR AND CONFIGURABLE

Following the proven Hug philosophy, combikat™ consists of modular SCR and oxidation catalysts, combined with optional particulate filter cassettes, configured by Hug's engineers to meet the emissions regulations in force and the customer's own specifications. The total system is packaged in robust, easily transportable, acoustically and thermally insulated casings, ready for quick installation on site.



CUSTOMIZED TURNKEY SOLUTIONS

COMBIKAT™ CONVERTER



COMPREHENSIVE AND PRE-TESTED

Hug Engineering aims to deliver complete emissions abatement systems for large engines which are immediately ready-to-use, thus minimizing expensive on-site activities and accelerating commissioning and start-up. A vital contribution to this capability is Hug's longstanding specialization in the development and manufacturing of standardized and pre-commissioned control systems for aftertreatment units, including open and closed-loop dosing of urea/ammonia for SCR systems. The closed-loop systems are based on a proprietary, built-in emissions measuring system, also available in versions for high-sulfur fuels such as HFO, syngas and biogas.



ADVANCED TECHNOLOGY

Hug's best-in-class technology is based on significant annual investments in R&D and extensive field experience in the science of ultra-low NO_x emissions. As a result, we can guarantee emissions simultaneously lower than 3 ppm* for oxides of nitrogen (NO_x) and 1 ppm* for ammonia (NH₃) from gas engines, and up to 97 % reductions in particulate matter (PM) and NO_x from diesel engines. (* at 15% O₂).

QUALITY FOR PERFORMANCE

As a developer, designer, producer, packager and installer of both standard and tailor-made emissions reduction systems for a full spectrum of large engine applications on land and sea, Hug maintains comprehensive in-house R&D, manufacturing, application and plant engineering capabilities. In this way, Hug secures the maximum quality control over its entire product supply chain, hence always ensuring optimum performance from the installed systems.

TECHNOLOGY AND PRODUCTION

On the technology side, Hug maintains its technical leadership via multiple applied engineering functions covering chemistry, materials science for catalysts and substrates, automation for advanced controls, bi-phase fluid dynamics and structural mechanics. Likewise, as well as the design, engineering and production of complete emissions reduction systems like combikat™, Hug ensures its manufacturing quality by maintaining in-house capabilities in critical areas.

This policy dictates the manufacture of key components such as unconventional catalytic elements and process controllers at Hug's works in Switzerland, and the capability to execute basic and detailed engineering from the company's own resources. This ranges from the leanest licensor package to complete design and manufacturing of the whole emissions reduction system on a turn-key basis. Complementing this in-house manufacturing philosophy is procurement of basic constituents from qualified sub-contractors under the implementation of the strictest quality assurance procedures.

HUG EMISSION REDUCTION: Competence, Technology and Experience

FROM CONSULTATION TO COMMISSIONING AND SERVICE

Hug Engineering's offering covers everything from component supply to full turn-key contracts with full after-sales support.

Hug's customer engagement starts with close consultation to determine the correct solutions in terms of commercial viability and regulatory compliance, including accurate assessments and optimization of the entire life cycle performance of Hug products.

In line with the agreed scope-of-supply, following manufacture of the emissions reduction systems, Hug offers execution of all on-site activities by Hug's own highly qualified and experienced personnel – from pre-erection inspections to site supervision, commissioning and long-term supply of spares and service. Accordingly, after-market activities include management of operating and capital spare parts inventories in accordance with the operator's specific needs.

ABOUT HUG

With over 30 years of experience with stationary, mobile and marine applications, Hug Engineering has a unique level of know-how in the reduction of emissions.

This success is based on intensive, targeted R&D and a wide and flexible scope of supply in advanced emissions reduction systems – from standardized modules to customized systems, based on the customers' specifications and applicable legislation, and supplied and installed according to their individual preferences.

According to the application-specific configuration, the Hug combikat™ system is capable of significantly reducing pollutant exhaust gas constituents:

TECHNOLOGY / PRODUCTS

- selective catalytic reduction (SCR)
- particulate filter
- oxidation catalyst

EMISSIONS

- oxides of nitrogen (NO_x)
- particulate matter (PM)
- unburnt hydrocarbons (HC)
- carbon monoxide (CO)
- overall volatile organic compounds (VOC)
- formaldehyde ethylenenon and methane hydrocarbons (NMHC)
- ammonia slip (NH₃)

EMISSIONS RESULTS:

NO _x	< 2.3 ppm*
PM	> 97 %
NMHC	> 90 %
CO	> 99 %
NH ₃	< 1 ppm*

* at 15% O₂

combikat™

Exhaust Gas Purification Systems for Stationary Engines

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