JFE Engineering Group
Standardkessel Baumgarte

RANGE OF PRODUCTS AND SERVICES

IDEAS FULL OF ENERGY!

As our energy resources grow ever scarcer, it is increasingly essential that we make more efficient use of our existing sources of energy – or find entirely new sources for thermal utilisation. That is why our expertise is in greater demand than ever before. In the following pages, you will find out how we transform ideas into energy.

Since December 2014 Standardkessel Baumgarte Group belongs to JFE Engineering Corporation. JFE Engineering Corporation, a subsidiary of JFE Holding Inc., is a market leader for "Grate Firing Systems" and "Gasifying and Direct Melting Furnace Systems". With more than 350 furnaces installed, JFE Engineering has its main experience in the Japanese market. With regard to biomass power plants, JFE Engineering is specialised in the construction of large sized power plants employing circulating fluidised bed boilers.

CONTENT

EXPERIENCE IS OUR BEST INVESTMENT.

INTELLIGENT SOLUTIONS FOR EVERY FACET OF YOUR ENERGY SUPPLY.

There are many ways in which different sources of energy can be transformed into heat, steam and electricity. At Standardkessel Baumgarte we not only know these ways – we also find new ones. Thanks to our more than 170 years of experience, we have incomparable process expertise, regardless of whether it concerns the supply of high-quality components, the implementation of complete complex systems, the provision of services as an EPCM contractor or the delivery of top-notch plant services. Even new energy concepts such as contracting are becoming increasingly attractive options for many customers.

It is therefore no surprise that energy supply companies, municipal governments, public utilities and industrial firms all rely on our know-how in these matters. That is because they know that experience is our best investment.

1 PUTTING RESIDUES TO WORK

ENERGY FROM WASTE

Fuel	Household and household-type industrial waste, production waste, used tyres, blast furnace gas, coke gas, liquid and gaseous industrial waste.
Performance range	Solid residues up to 140 MW_{th}, Steam parameters up to 500 °C - 100 bar Liquid and gaseous residues up to 550 MW_{th}, Steam parameters up to 570 °C - 170 bar.
Boiler technology	Steam generator operating in natural circulation with two or three vertically arranged radiation passes and a downstream convective pass. The first, second or third boiler pass are in empty pass construction and form the combustion and radiation area. The vertical or horizontal convective boiler pass is equipped with the superheater, evaporator and economiser convective heating surfaces. All convective heating surfaces can be cleaned with a rapper while in operation. Depending on the profile for requirement, boiler constructions with the installation of 3 or 4 passes can be applied. The temperature of the superheated steam is regulated by a multistage injection cooler between the heating surfaces of the superheater.
Combustion system	**Air-cooled or water-cooled pusher-type grate with ram feeder** Combustion that is highly resilient both thermally and mechanically with intelligent combustion control. The fuel is metered by a plunger feeder. Every grate zone can be controlled individually, including a multistage primary air distributor. The secondary air is injected via nozzle trays arranged in the first and rear wall of the furnace area. **Fluidised bed firing** The fuel is fed through openings of the evaporator side walls of the combustion chamber into the fluidised bed. The combustion air and the recirculated flue gas is injected into the fluidised bed and into the combustion chamber at different levels as secondary and tertiary air-injection. **Industrial combustion systems for liquid and gaseous fuels** Combustion technology for low-NO_x industrial and power station combustion systems. The selection and configuration of the burners is performed in accordance with the burner performance within the enclosing walls of the combustion chamber.
Fuel gas treatment	Reliable compliance with legal emission limits is ensured by a downstream flue gas cleaning system. Semi-dry or dry process versions are deployed. Calcium hydroxide $Ca(OH)_2$, calcium oxide CaO or $NaHCO_3$ are fed into the flue gas as additives for the absorption of the acidic gas components. As an alternative, wet processes may also be used. The separation of heavy metals and organic substances such as dioxins and furans is performed using adsorption with activated lignite coke or activated carbon. Fabric filters, electrostatic precipitators or cyclones are used to ensure the required particle separation. In particular, the preferred fabric filter not only guarantees minimal dust emissions, but also the lowest concentrations of pollutants in the clean gas thanks to the intensive absorption and adsorption processes in the filter cake. The removal of nitrogen from the flue gases can be performed using either an SNCR (selective non catalytic reduction) process or an SCR (selective catalytic reduction) process.

The thorough disposal of household waste and household-type industrial waste is still a current issue.

The shortage in global energy recources and the increasing concern about our environment requires that we direct our attention to this task by means of the most innovative plant technology.

As a result of the increasing worldwide production of consumer goods, the use of industrial production wastes as an alternative fuel source is also becoming an increasingly attractive option. Standardkessel Baumgarte supplies the necessary systems that will continue to allow for the practical and environmentally friendly utilisation of industrial wastes in future: for efficient energy generation.

Sources of Energy

REFUSE AND WASTE MATERIALS / HOUSEHOLD AND INDUSTRIAL WASTES





Sample Reference OOSTENDE, BELGIUM

The Task

To fulfil the task to design a waste to energy plant based on economic parameters with the highest possible efficiency, different plant capacities were examined in close cooperation with the client and the Belgian power supply company Electrawinds Biostoom N. V. The secured amount of fuel was a decisive factor for the maximum plant capacity.

The Solution

The optimum overall economic solution for the planned project was found using the basic planning of an already implemented boiler type with a relevant high capacity. In the presence of an average fuel throughput of around 17 t/h, the steam generator is capable of producing a volume of steam of approx. 80 t/h at a pressure of 42 bar and a temperature of 400 °C. The steam turbine is designed for full condensing operation. A steam amount up to 19.4 MW can be electrically generated. In close cooperation, Standardkessel Baumgarte accompanied the client's services throughout the entire project.

Scope of Supply

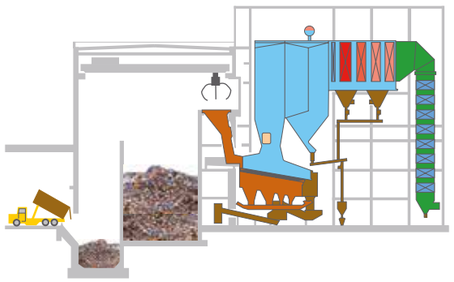
- Fuel Bunker Crane and Slag Conveying Unit
- Pusher Type Grate System incl. Ancillary Equipment
- Main Steam Generator with Fittings
- Flue Gas Treatment
- Refractory Lining and Thermal Insulation
- Induced Draught Fan and Steel Stack
- Heating Surface Cleaning Devices in Form of Spraying, Rapping and Soot Blower Systems
- Ignition and Auxiliary Firing with Fuel Storage and Conveyor Systems
- Boiler and Turbine House Steel Structure
- Steel Structure for Firing System and Boiler incl. Stairs and Platforms
- Water-Steam-Cycle with Turbine, Condenser, Steam Conversion
- Electro, Control, Measuring and Process Technology, Low Voltage Technology, Emergency Power Supply

Engineering Services

- Engineering incl. Approval and Official Engineering
- Installation and Commissioning
- Trial Run

Technical Project Information

Number of lines	1
Fuel	Domestic/Industrial refuse
Heating value (min. / max. / nom.)	11.0 / 18.0 / 15.0 MJ/kg
Fuel throughput (min. / max. / nom.)	12.6 / 21.0 / 16.8 t/h
Rated thermal input	70.0 MW
Steam capacity	80.3 t/h
Design pressure	54.0 bar g
Steam pressure	41.0 bar g
Steam temperature	402 °C
Feedwater temperature	130 °C
Fuel gas flow	135,000 m³ i. N./h
Exhaust gas temperature	180 °C
Operating approval	Vlarem II
Year of commissioning	2009



Example of a plant fired using household and household-type industrial waste

Sample Reference OULU, FINLAND

The Task

A waste-to-energy plant is to be built at the industrial location of the chemicals producer Kemira Oy in Oulu. This power plant shall ensure the supply of energy and heat to the City of Oulu and the chemicals company. The municipal energy supplier Oulun Energia Oy placed an order with Standardkessel Baumgarte for the supply of the complete combustion line and auxiliary systems. Operator of this plant will be the Laanilan Voima, an affiliated company of the Oulu Energia and Kemira Oy.

The Solution

The well-proven concept embracing a tailend boiler combined with a water cooled pusher-type grate was chosen for this power plant which is conceived according to the combined heat and power principle. However, this concept has been enlarged by an external superheater with a firing system to increase the turbine's efficiency.

Scope of Supply

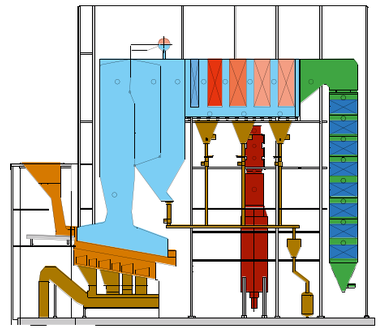
- Main-steam generator with ash removal facility and accessories
- External superheater with firing system (oil, control gas, constant gas)
- Heating-surface cleaning system as spraying system, rapping device and ball shot cleaning plants
- Water cooled pusher type grate system including auxiliary equipment
- Ignition and auxiliary firing system with accessories
- Slag conveying system
- Boiler house steel structure, supporting structure for the firing system and boiler including stairs and platforms
- Refractory lining and thermal insulation
- Feed water supply with tank and pumps
- Boiler instrumentation equipment
- SNCR / AGAM
- Air preheating
- Demineralised water preheating

Engineering Services

- Engineering incl. approval engineering
- Installation and commissioning
- Trial Run
- Documentation

Technical Project Information

Number of lines	1
Fuel	Household and industrial waste
Heating value (min. / max. / nom.)	8,0 / 15,0 / 10,5 MJ/kg
Fuel throughput (min. / max.)	11,5 / 16,4 Mg/h
Rated thermal input	52,4 MW
External superheater	5 MW
Steam capacity	58,7 Mg/h
Design pressure	102 bar (g)
Steam pressure	87 bar (g)
External superheater	83 bar (g)
Steam temperature	425 °C
External superheater	515 °C
Feedwater temperature	130 °C
Fuel gas flow	97.000 Nm³/h
Exhaust gas temperature	150 °C
Operating approval	EU Directive 2000/76/EC
Year of commissioning	2012



Example of a plant fired using household and household-type industrial waste





Sample Reference PLYMOUTH, GREAT BRITAIN

The Task

With the thermal waste-treatment-plant, now under full operation in Plymouth, the Mannheimer MVV Umwelt O&M achieves to supply power and heat obtained from municipal waste and industrial waste utilisation process to the neighbouring HM Naval Base. Standardkessel Baumgarte received the order to supply the complete firing and steam generator system. Owing to the specified space conditions a conception featuring a potential high efficiency of the combustion line had to be developed.

The Solution

The intended installation of the vertical economisers in two one behind the other situated boiler passes leads to a flexible boiler operation with low exhaust gas temperatures. This arrangement of the economiser enables a Sodium Bicarbonate injection between the economiser passes and results in a large residence and reaction time of the additive to achieve reduced emission values.

Scope of Supply

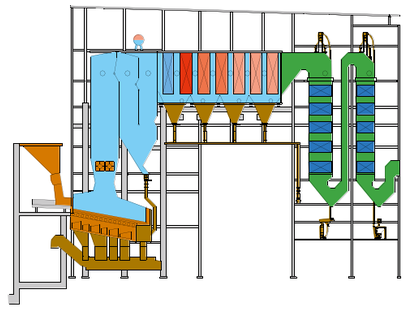
- Pusher- type grate system incl. secondary systems
- Main steam generator with valves and accessories
- Heating surface cleaning systems incl. spraying systems, rapping and ball shot cleaning plants
- Ignition and auxiliary burners
- Brick lining
- Insulation
- SNCR plant
- Slag discharge to slag bunker
- Boiler steel structure, supporting structure for firing system and boiler incl. stairs and platforms
- Refractory lining and thermal insulation
- Measuring boiler equipment
- Cranes for fuel and bottom ash

Engineering Services

- Engineering involving engineering required for Authorities and Approval
- Material Procurement
- Fabrication
- Transport
- Installation and Commissioning
- Trial Run / Performance Testing / Operating Staff Training

Technical Project Information

Number of lines	1
Fuel	Household and houshold-like industrial waste
Heating value (min. / max. / nom.)	7.5 / 12.0 / 9.5 MJ/kg
Fuel throughput (min. / max.)	20 / 32.8 Mg/h
Rated thermal input	82.1 MW
Steam capacity	104 Mg/h
Design pressure	83 bar (g)
Steam pressure	59 bar (g)
Steam temperature	420 °C
Feedwater temperature	135 °C
Fuel gas flow	200.000 Nm³/h
Exhaust gas temperature	160 – 170 °C
Operating approval	WID
Year of commissioning	2015



Example of a plant fired using household and household-type industrial waste





Sample Reference FRANKFURT, GERMANY

The Task

The waste incinerator technology developed by Standardkessel Baumgarte was applied not just when the new waste incineration plant Frankfurt Nordweststadt was built in 1964 but also when it was partly renewed in 1983. Already during the offer phase of the second part renewal, which was commissioned in 2004, the general contractor Lurgi Lentjes AG involved us intensively. The task was to develop a waste incineration plant designed for demanding steam parameters in consideration of the latest technologies. In addition, the very restricted space conditions had to be taken into consideration when developing the boiler concept and the increased performance.

The Solution

Development of a boiler concept designed as a two-pass system with furnace area followed by a radiation area in vertical construction and a downstream horizontal pass with the installation of convective heating surfaces. Through this concept an increased plant performance by around 35% could be realised by maintaining the existing space conditions. So as to protect the superheaters from corrosion in the presence of main steam temperatures normally unusual in waste incineration plants, the heating surface tubes were cladded with the high-grade Inconel material. The plant was renewed in two construction stages, i. e. two lines were revamped in one stage with the other two in full operation.

Scope of Supply

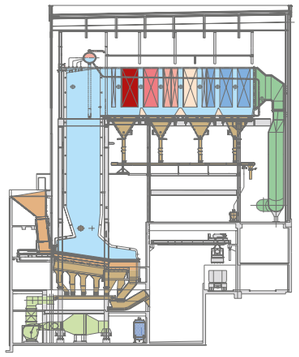
- Main Steam Generator with Fittings
- Heating Surface Cleaning Plant as Mechanical Rapping Device
- Heating Surface and Furnace Area Cladding
- Steel Structure with Stairs and Platforms
- Thermal and Sound Insulation
- Refractory Lining

Engineering Services

- Engineering incl. Approval and Official Engineering
- Installation incl. Provision of Lifting Devices
- Commissioning and Trial Run

Technical Project Information

Number of lines	4
Fuel	Household waste, household-type industrial waste
Heating value (min. / max. / nom.)	8.0 / 14.0 / 11.0 MJ/kg
Fuel throughput each (min. / max. / nom.)	12.0 / 22.0 / 20.0 t/h
Rated thermal input each	62.8 MW
Steam capacity each	67.2 t/h
Design pressure	80.0 bar g
Steam pressure	59.0 bar g
Steam temperature	500 °C
Feedwater temperature	130 °C
Fuel gas flow each	122,500 m³ i. N./h
Exhaust gas temperature	220 – 240 °C
Operating approval	17. BImSchV
Year of commissioning	2006 / 2008



Example of a plant fired using household and household-type industrial waste

Sources of Energy

REFUSE AND WASTE MATERIALS / REFUSE-DERIVED FUELS




Sample Reference BERNBURG, GERMANY

The Task

To ensure the supply of energy to the Solvay Company in Bernburg, a second mainstay for energy supply had to be created. The EAB Company, a subsidiary of the waste management and recycling specialist Tönsmeier and the pharmaceutical enterprise Solvay planned the installation of a waste-to-energy power plant. On the basis of their powerful references with their conception of identical boiler plants, the Standardkessel Baumgarte Group was able to obtain the order to install three combustion lines with equal performance rating on a turnkey contract basis.

The Solution

The well proven technical conception was supplied from one hand source by Standardkessel Baumgarte Group. The delivery included, but was not limited to, the furnace area situated above a water-cooled pusher type grate, two vertical radiation passes, and a vertical economiser was selected for these waste-to-energy combustion lines. The overall scope of order encompasses the fuel supply, feed-water system, instrumentation and control engineering, building services engineering, the flue-gas treatment system and the stack.

Scope of Supply

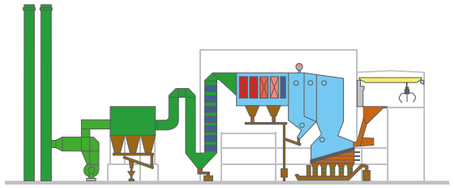
- Steam Generator with Valves and Accessories
- Heating Surface Cleaning System as Spray-Water System, Rapping and Sootblowing Device
- Pusher-Type Grate System including Auxiliary Aggregates
- Ignition and Auxiliary Firing Systems with Fuel Tanks and Conveying Systems
- Fuel Bunker Crane and Slag Conveying Plant
- Boiler and Machine Hall Steel Structure, Supporting Structure for the Firing System and Boiler including Stairs and Platforms
- Refractory Lining and Heat Insulation
- Flue-Gas Cleaning Plant, Forced Draft Fan and Steel Stack
- Metrological Boiler Equipment and Building Services Engineering
- Instrumentation, Control and Low-Voltage Engineering
- Emergency Power

Engineering Services

- Engineering incl. Approval and Official Engineering
- Installation and Commissioning
- Trial Run

Technical Project Information

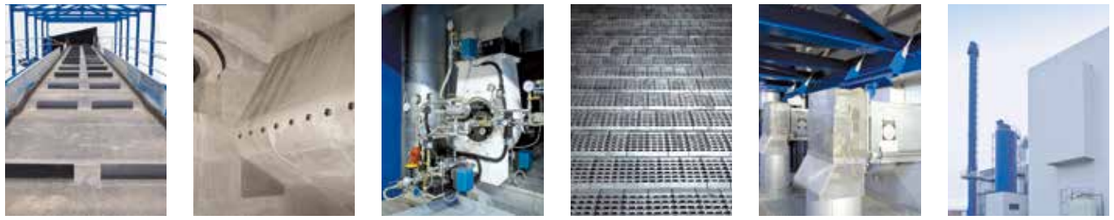
Number of lines	3
Fuel	Domestic/Industrial waste
Heating value (min. / max. / nom.)	10.5 / 18.0 / 15.0 MJ/kg
Fuel throughput (min. / max. / nom.)	11.3 / 21.0 / 16.8 t/h
Rated thermal Input	70.0 MW
Steam capacity	80.0 t/h
Design pressure	55.0 bar g
Steam pressure	41.0 bar g
Steam temperature	410 °C
Feedwater temperature	130 °C
Fuel gas flow	136,000 m³ i. N./h
Exhaust gas temperature	180 °C
Operating approval	17. BImSchV
Year of commissioning	2010



Example of a plant fired using household and household-type industrial waste

Sources of Energy

SOLID INDUSTRIAL RESIDUES



Sample Reference POLGAR, HUNGARY

The Task

In Hungary, the company TECHCON Környezetvédelmi és Energetikai Szolgáltató Kft disposes used tyres and production residues from the production of tyres. The accumulating residues, such as car tyres, truck tyres and tyres of heavy agricultural machines shall be disposed of by thermal means and the inherent energy shall be converted into electricity. The accumulating residual substances as a result of incineration as well as flue-gas cleaning, are either to be treated to obtain valuable substances or to be sent to landfills.

The Solution

TECHCON Környezetvédelmi és Energetikai Szolgáltató Kft placed an order with a Hungarian general contractor for the supply of a power plant on a turnkey basis. The order for the thermal part, consisting essentially of the fuel conveying system, the steam generator with grate stoker and flue gas cleaning, was secured by Standardkessel Baumgarte. The tyre handling equipment separates and transports the whole tyres from the storage area to the feed device for the firing system. The core of the plant is built up of the underfeed stoker and the vertically arranged natural circulation boiler which generates the superheated steam for feeding into the connected steam turbine. The flue gases are freed of all pollutants in a flue gas cleaning plant, based on the dry sorption process, and are discharged into the atmosphere via a stack after cleaning.

Scope of Supply

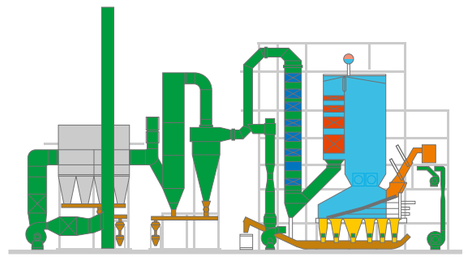
- Tyre Handling System
- Firing System
- Steam Generator
- Flue-Gas Cleaning System
- Ancillary Plants
- Structural Steelwork, Stairs and Platforms

Engineering Services

- Engineering incl. Licensing Engineering and Engineering for Official Permits
- Assembly and Commissioning
- Trial Run

Technical Project Information

Number of lines	1
Fuel	Used tyres
Low heating value (min. / max. / nom.)	28.0 / 36.0 / 31.4 MJ/kg
Fuel throughput per line (min. / max. / nom.)	2.5 / 3.5 / 2.9 t/h
Rated thermal input	25.3 MW
Electrical power output	5.6 MW
Steam capacity	27.4 t/h
Steam temperature	503 °C
Steam pressure	80 bar g
Feedwater temperature	130 °C
Rated fuel gas flow (nom.)	55,000 m³ i. N./h
Fuel gas temperature	220 °C
Operating approval	17. BImSchV
Year of commissioning	2011



Example of a plant fired using solid industrial materials

Sources of Energy

LIQUID AND GASEOUS INDUSTRIAL RESIDUES




Sample Reference WESSELING, GERMANY

The Task

Shell Deutschland Oil GmbH operates a power plant at the Wesseling location for supplying the adjacent refinery with electricity and process steam. To fulfil the new environmental guidelines, two old boilers have been set out of operation and the installation of two new boilers has been planned. Standardkessel Baumgarte was entrusted with the task of constructing the new boilers No. 7 and No. 8 in order to secure the energy supply to the refinery and to dispose the production residues. It was particularly important for Shell to meet its energy requirements from its own production residues in order to save primary fuels.

The Solution

The new boiler No. 7 is mounted on the existing foundations of an old boiler house. The flue gas desulphurisation plant was already provided by the customer for boiler No. 6 and designed for a later extension. Within the scope of the construction of the new building, the new boiler was connected to the existing flue gas desulphurisation plant. The new boiler is designed in vertical construction and operates in natural circulation. The burner system is arranged in the front wall of the boiler's combustion chamber.

Scope of Supply

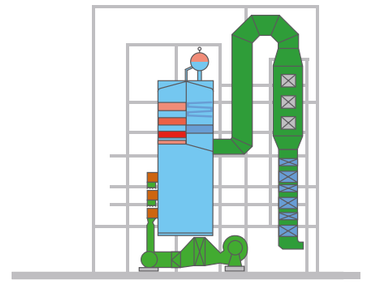
- Steam Generator
- Firing System for Liquid and Gaseous Fuels
- Air and Flue Gas Ducts
- SCR System, Electrostatic Precipitator
- Piping
- Electrical and Instrumentation and Control Components
- Structural Steelwork, Stairs and Platforms

Engineering Services

- Engineering and Obtaining Approvals / Licences incl. Liaising with Authorities
- Delivery, Erection and Commissioning
- Trial Operation

Technical Project Information

Fuel	Heavy fuel oil, Production residues (gaseous), Production residues (liquid)
Heating value (nom.)	39.53 MJ/kg
Fuel throughput rate (max.)	14 t/h
Thermal capacity of firing system (max.)	168 MW
Steam capacity	200 t/h
Steam temperature	520 °C
Approved working pressure	138 bar
Feed water temperature	145 °C
Waste gas temperature	165 °C
Operating licence	17. BImSchV / SVTI
Year of commissioning	2012



Example K7

COKE OVEN GAS / BLAST FURNACE GAS




Sample Reference SALZGITTER, GERMANY

The Task

The steam generator plant covers a part of the supply of electricity and heat for the steel production process of SZFG. Special demands concerning the technical solution were made on high availability, the high quality standard, low emission values and high efficiency with low station service of the plant. The steam generator is integrated into the newly constructed power plant.

The Solution

The steam generators were designed as radiant boilers of a 2-pass type of construction and arranged suspended in the structural steelwork of the boiler. The firing system is designed as a frontal firing system with a total of 6 burners. In order to reduce the NOx emissions, a flue gas recirculation system has been provided. The boiler generates superheated steam and is equipped with a reheater. By means of a heat displacement system involving combustion air, flue gas, feedwater and blast furnace gas / converter gas, optimum operation is achieved with low emission values and a high efficiency.

Scope of Supply

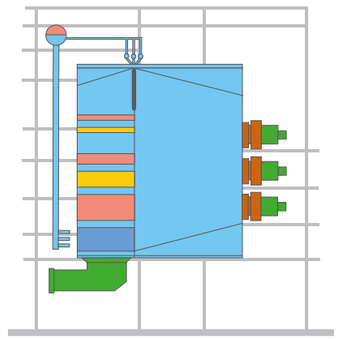
- Blast Furnace Gas / Converter Gas Fan Station
- Heat Displacement System
- Combustion Air System incl. Air Preheating
- Steam Generators
- Structural Steelwork, Stairs and Platforms
- Waste Gas System as far as the existing stack

Engineering Services

- Engineering
- Erection and Commissioning
- Trial Operation

Technical Project Information

Fuel	Furnace gas / Converter gas
Calorific value	3.436 MJ/Nm³
Rated thermal input	250 MW
Fuel	Coke Oven Gas
Calorific value	17.24 MJ/Nm³
Rated thermal input	180 MW
Fuel	Natural gas
Rated thermal input	180 MW
Fuel	Fuel Oil EL
Rated thermal input	150 MW
Rated thermal input (total)	298 MW
Steaming capacity HP / RH	340 / 320 t/h
Steam temperature HP / RH	568 / 563 °C
Steam pressure HP / RH	168 / 45 bar
Feedwater temperature	255 °C
Flue gas volume flow	451,000 m³ i.N./h
Exhaust gas temperature	130 °C
Operating licence	13. BImSchV
Year of commissioning	2010



Example of a blast furnace gas fired plant

2 A MATURE TECHNOLOGY

ENERGY FROM BIOMASS

Fuel

Matured wood, waste wood, fresh wood, forest waste, tree prunings, peat, bark
Other bio-fuels such as e. g. rice husks, olive pressing residues, etc.

Performance range

Pusher type grate up to 100 MW_{th}
Travelling grate system up to 140 MW_{th}
Fluidised bed firing system up to 100 MW_{th}
Dust burner up to 60 MW_{th}
Steam parameters up to 525 °C - 100 bar

Boiler technology

Multi-pass steam generator with natural circulation in vertical construction. The first boiler passes are radiation passes, the following passes are equipped with superheater, evaporator and economiser bundles. All convective heating surfaces can be cleaned by soot blowers during operation. The steam temperature is controlled by injection coolers between the superheater sections.

Combustion system

Pusher type grate system
Fuel-loading is done by a feeding ram under the fuel feeding chute. The primary air is introduced under the grate system. The different air zones can be controlled independently from each other. The nozzles for the secondary air injection are located at the front and rear boiler walls above the combustion chamber.

Travelling grate
Fuel-loading is done by a spreader stoker system. The primary air is introduced under the grate system. The different air zones can be controlled independently from each other. The nozzles for the secondary air injection are located at the front and rear boiler walls above the combustion chamber.

Fluidised bed firing
The fuel is fed through openings of the evaporator side walls of the combustion chamber into the fluidised bed. The combustion air and the recirculated flue gas is injected into the fluidised bed and into the combustion chamber at different levels as secondary and tertiary air-injection.

Dust Burner
In addition to the a.m. firing systems it is also possible to burn wood dust respectively granules via special dust bruner or injection systems. These burners resp. injection systems are installed into the side walls of the steam generator or in a seperate combustion chamber, depending on the capacity of the additional combustion system. The flue gases are mixed inside the common convective area downstream the combustion chamber. For higher capacities this system can also be designed as a mono-system for the combustion of dust only.

Flue gas treatment

Cyclone system, bag house filter respectivly electrostatic precipitators are used for dust reduction. Following the emission requirements a flue gas conditioning system can also be foreseen in semi-dry or dry process. Calcium hydroxide $Ca(OH)_2$, calcium oxide CaO or $NaHCO_3$ are fed into the flue gas as additives for the absorption of the acidic gas components. As an alternative, wet processes may also be used. The removal of nitrogen from the flue gases can be performed using either an SNCR (selective non catalytic reduction) process or an SCR (selective catalytic reduction) process.

High costs for primary energy sources such as oil and natural gas and, most notably, environmental concerns, have created a real boom in the environmentally-friendly generation of energy from biomass.

Wood has been used to generate heat and energy since time immemorial, yet this environmentally friendly energy source has been growing ever more important since the introduction of the German Renewable Energy Act (EEG). This is true not only in Germany and Europe, but around the globe. In addition to wood, all other biogenic energy sources are in demand for environmentally friendly, CO_2-neutral energy generation. Standardkessel Baumgarte offers a wide array of applications with which to meet your needs.

Sources of Energy

WOOD / WASTE WOOD






Sample Reference EBERSWALDE, GERMANY

The Task

At the Eberswalde location a new biomass-fired power plant (BMPP) had to be constructed in the harbour area. The task of the BMPP is to supply the surrounding households with electricity. Moreover, the co-generation of process steam for supplying the surrounding business enterprises/production plants is planned. As fuel for the BMPP, only fresh wood is used, in accordance with the Biomass Ordinance. The order for implementation was placed with Standardkessel Baumgarte in July 2005.

The Solution

The delivery of the fuel is carried out by means of trucks. The fuel is taken from the receiving station to a roofed-over outdoor storage area where it is put into intermediate storage. From the open air storage area, the fuel is conveyed by means of moving floors and conveyor belts to the boiler area. The thermal part consists of grate stoker, steam generator and flue-gas cleaning system. The firing of the fuel is carried out via a three-compartment underfeed stoker. The steam generator is designed as a water-tube boiler in the vertical type of construction with natural circulation. In order to achieve optimum efficiency, there is an integral reheat stage. Flue-gas cleaning is carried out in a dry process by means of fabric filters. The electric energy generated in the turbine/generator is fed into the public grid.

Scope of Supply

Turn-Key Biomass Power Station consisting of:

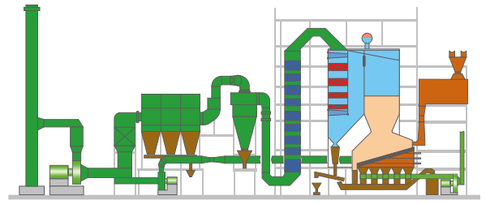
- Fuel Feed System
- Firing System / Boiler / Flue-Gas Cleaning System
- Water / Steam Circuit with Reheat
- Steam Turbine / Generator/ Cooling Tower / Cooling Circuits
- Chemical Water Treatment
- Electrical Instrumentation and Control System
- Auxiliary Plant Units

Engineering Services

- Engineering incl. Licensing Engineering and Engineering for Official Permits
- Assembly and Commissioning
- Trial Run

Technical Project Information

Number of lines	1
Fuel	Wood
Low heating value (min. / max. / nom.)	8.5 / 12.0 / 10.4 MJ/kg
Fuel throughput (min. / max. / nom.)	11.0 / 24.0 / 22.0 t/h
Rated thermal input	65 MW
Electrical power output	20 MW
Steam capacity HP / RH	68 / 68 t/h
Steam temperature HP / RH	482 / 472 °C
Steam pressure HP / RH	82 / 19 bar g
Feedwater temperature	105 °C
Rated flue gas volume	135,000 m³ i. N./h
Fuel gas temperature	170 °C
Operating approval	13. BImSchV
Year of commissioning	2006



Example of a wood-fired plant





Sample Reference BEC TWENCE, NETHERLANDS

The Task

On the basis of the Dutch Act for the Promotion of Renewable Energies' (MEP), the company Twence planned the construction of a biomass-fired power station at the location of the waste from waste plant in Hengelo. In the new biomass-fired power plant, the percentage of waste wood obtained from the waste flows was to be converted into electricity in an environmentally friendly and efficient way and to be fed into the public grid. The order for the construction of the biomass-fired power plant was placed with Standardkessel Baumgarte in October 2005.

The Solution

The waste wood extracted from the waste flows is delivered and stored in a warehouse. A multistage conveying device conveys the fuel to the boiler. At the same time, metal and oversize material are separated. The thermal part of the plant consists of a multi-lane underfeed stoker, a 4-pass vertical boiler with natural water circulation and a downstream flue-gas purification unit. The flue gas purification unit works on the principle of dry sorption and additionally includes an SCR system for the reduction of the nitrogen oxides. The superheated steam generated in the boiler flows to the turbine/generator unit and produces electric current that is fed into the public grid.

Scope of Supply

Biomass Power Station consisting of:

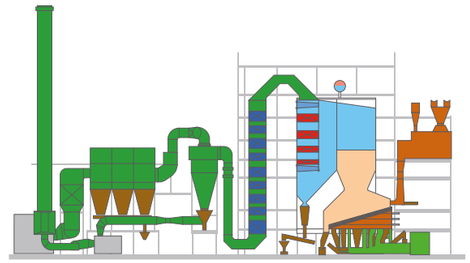
- Civil Works
- Fuel Transportation System
- Grate System
- Steam Generator
- Flue Gas Treatment Plant
- Water-Steam Cycle
- Electrical Instrumentation and Control System
- Auxiliary Equipment

Engineering Services

- Engineering incl. Licensing Engineering and Engineering for Official Permits
- Assembly and Commissioning
- Trial Run

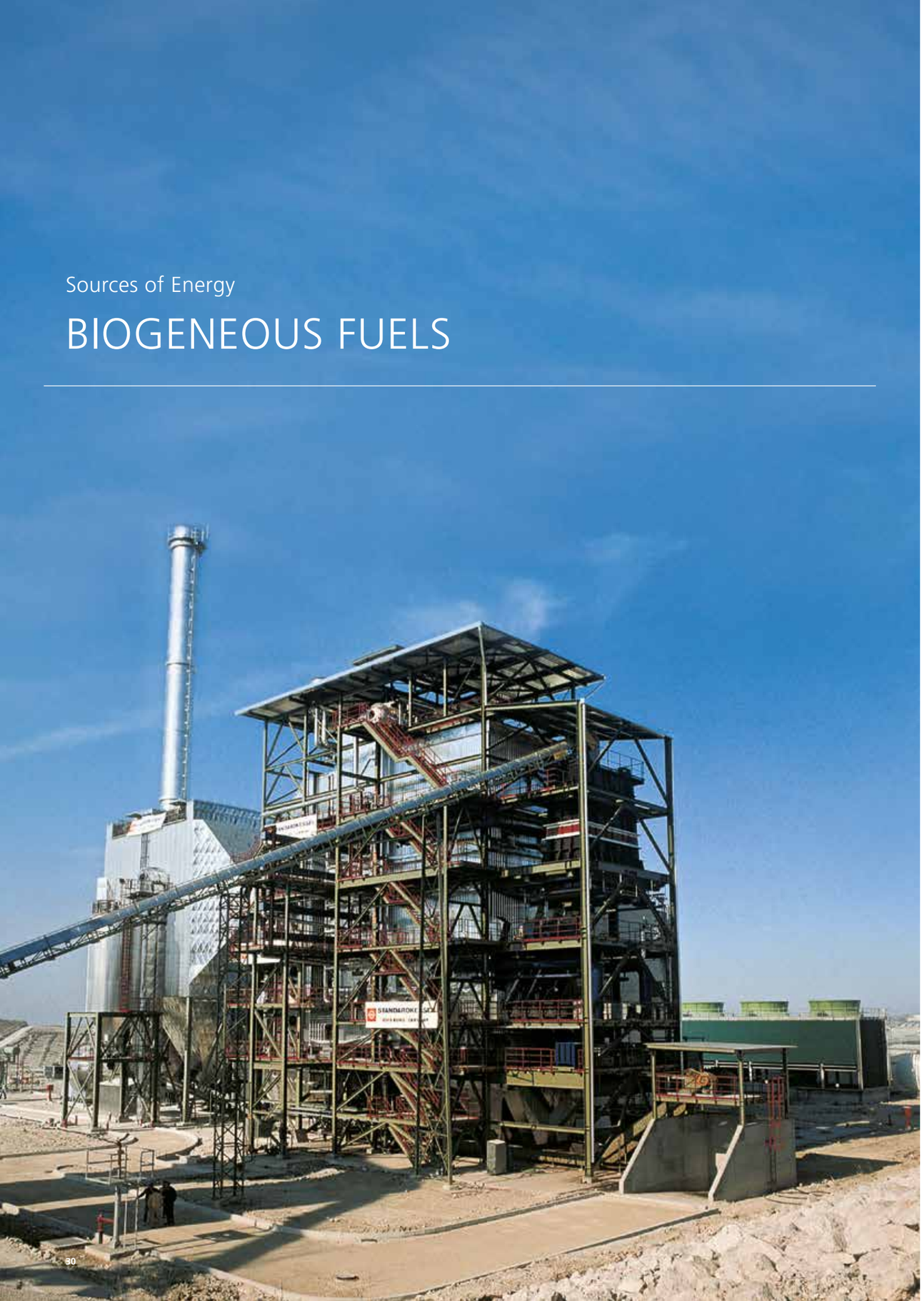
Technical Project Information

Fuel	Waste wood (A1 – A4)
Low heating value (min. / max. / nom.)	10 / 16 / 13.4 MJ/kg
Fuel throughput (min. / max. / nom.)	10.3 / 22.5 / 19.0 t/h
Rated thermal input	73 MW
Electrical power output	20 MW
Steam capacity	80 t/h
Steam temperature	465 °C
Steam pressure	68 bar g
Design pressure	79 bar g
Feed water temperature	130 °C
Rated flue gas volume	111,500 m³ i. N./h
Fuel gas temperature	170 °C
Operating approval	BVA
Year of commissioning	2007



Example of a wood-fired plant

BIOGENEOUS FUELS



Sample Reference BAENA, SPAIN

The Task

EL Oleicola El Tejar in Baena, Andalucia, is one of the largest olive oil producers in Spain. Until now, olive waste generated during the production process was disposed of on large waste disposal sites. However, since Spanish legislation encourages the utilisation of regenerative energies, using olive waste for generating electricity in a biomass power plant was found to be advantageous.

The Solution

Standardkessel Baumgarte has developed the first European biomass power plant capable of using "alperujo"-olive waste generated during the extraction of olive oil in a centrifugation process – as fuel. In December 1998, the contract for development and turn-key construction was concluded between Agroenergetica de Baena S.L. and Standardkessel Baumgarte. The start-up, successful performance test run and approval took place in February, 2002 – faultlessy and in compliance with all contractually agreed-upon guarantees. Spanish and European legal requirements were not only fulfilled, but in terms of emissions, even surpassed in many cases. The maximum electrical output is 25 MW.

Scope of Supply

Turn-key Biomass Power Plant, specifically:

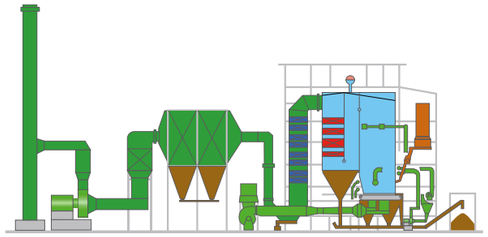
- Civil Works
- Fuel Storage and Supply, including Diesel Oil Stock as Ignition and Fuel
- Steam Boiler with Grate Firing
- Flue Gas Purification
- Steam Turbine
- Water Treatment / Waste Water Treatment
- Cooling and Condensation System
- Required Systems such as Water/Steam Cycle, Pressurized Air System, Fire-Fighting System
- Control System, Electrical and Lightning Equipment

Engineering Services

- Engineering incl. Permit and Authority Engineering
- Erection
- Commissioning

Technical Project Information

Number of Lines	1
Fuel	Olive waste
Low Heating Value (min. / max. / nom.)	9.2 / 15.1 / 10.1 MJ/kg
Fuel throughput (min. / max. / nom.)	25.0 / 41.0 / 37.4 t/h
Rated thermal input	105 MW
Electrical power output	25 MW
Steam capacity	110 t/h
Steam temperature	455 °C
Steam pressure	78 bar g
Feed water temperature	105 °C
Rated flue gas volume	161,890 m³ i. N./h
Fuel gas temperature	160 °C
Operating approval	EU Requirements
Year of commissioning	2002



Example of a plant fired using the residue left after pressing olives

3 A HOT TOPIC

HEAT RECOVERY

Heat source	Gas turbine exhaust gas
Performance Range	Heat input up to 550 MW_{th} Steam capacity up to 600 t/h Steam parameters up to 570 °C - 170 bar
Auxiliary fuels	Coke oven gas, blast furnace gas, natural gas, light oil, production exhaust gases
Boiler technology	Steam generators with natural circulation in horizontal or vertical one or multi-pass construction with different pressure stages. Either designed as heat recovery boiler or equipped with auxiliary firing also suited for fresh air operation and "flying takeover" between fresh air operation mode and gas turbine operation mode. The superheat steam temperature control is carried out by means of an injection cooler between the superheater heating surfaces.
Combustion system	Industrial combustion systems as duct burners in the gas turbine exhaust duct or as in-duct burner in the combustion chamber of the boiler plant respectively or in conventional burners with an external exhaust gas feed.
Flue gas treatment	The removal of nitrogen from the flue gases can be performed using either an SNCR (selective non catalytic reduction) process or an SCR (selective catalytic reduction) process.

In many industrial production processes, the energy consumption ratio is continuously rising. No surprise then, that "efficiency boosting" is increasingly becoming the focus of production process design.

The heat recovery steam generator (HRSG) downstream a gas turbine is of decisive importance for ensuring the efficient utilisation of the energy from the gas and steam turbine process. It utilises the turbine exhaust to generate steam, and is usually also equipped with an additional firing system in order to increase the overall efficiency of the system. In addition, HRSGs that have been designed for the "flying takeover" also deliver high operational reliability and availability. These boiler systems can be operated in both GT exhaust gas and fresh air modes. The system switches between operating modes automatically without any adverse effect on the steam turbine operation.

Sources of Energy

GT PROCESS





Sample Reference LINDEN, GERMANY

The Task

The heat recovery steam generator (HRSG) is fitted into an existing boiler house in which a coal-fired boiler was previously installed. Then, together with the existing No. 1 waste heat boiler, a common steam range will be used which feeds to a new steam turbine having a reheating system. The turbine is intended to be operated in efficient variable pressure operation, so the boiler and the steam lines will be designed in such a way that in the event of the failure of No. 1 waste heat boiler the new boiler can produce its full capacity even at half the pressure. For the most flexible use possible, in particular with widely varying load requirements, the boiler is designed for fast start-up. Due to the long delivery time of the steam turbine, for economic reasons it is planned to start bypass operation already during the erection phase.

The Solution

In order to meet these requirements, Standardkessel Baumgarte is supplying a vertically arranged natural circulation boiler with an additional condensate heat exchanger which also feeds the district heat supply system. Besides the HP and the MP parts, the boiler is also provided with a reheater to optimize efficiency. The steam generator is constructed as a suspended boiler and designed in such a way that the existing steel supporting structure of the old coal-fired boiler can continue to be used. For the generation of peak current with waste heat operation, the plant is equipped with a flue gas bypass for 100% flue gas flow. The waste gases from No. 2 waste heat boiler and/or bypass flow into a joint stack.

Scope of Supply

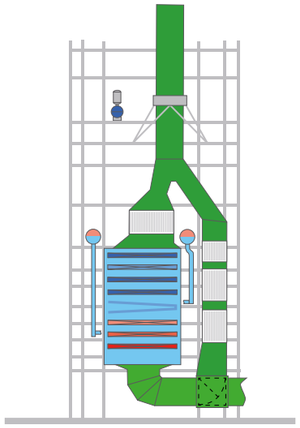
- 3-Pressure HRSG with Condensate Heat Exchanger
- Flue Gas-Bypass Duct incl. Dampers
- Supplementary Steel Structure, Stairs and Walkways
- Auxiliary Equipment

Engineering Services

- Approval Engineering
- Planning and Execution Engineering
- Assembly
- Commissioning

Technical Project Information

Energy source	GT-exhaust gas
Type of gas turbine	GE 6 FA
Fuel for auxiliary firing	–
Electrical power output GT	77 MW
GT-flue gas flow	215 kg/s
GT-exhaust gas temperature	590 °C
Steam capacity HRSG	
HP / RH / MP / LP	93 / 104.6 / 12.8 / 11 t/h
Steam Temperature	
HP / RH / MP / LP	540 / 544 / 351 / 240 °C
Design Pressure	
HP / RH / MP / LP	98.1 / 29 / 31 / 5.2 bar
HRSG-exit gas temperature	80 °C
Year of commissioning	2011



Example of a HRSG





Sample Reference VAREL, GERMANY

The Task

The increased production capacity owing to the installation of an additional paper machine also required a performance boost on the part of the power center. The demands on energy supply within a paper and cardboard company – high electric capacity paired with high steam consumption – had to be taken into consideration where an enlargement of the plant by means of a new steam generator was concerned. In addition, the requirements for high dynamic load following capabilities (load changes up to 1 MW/s) had to be met and the boiler's part load performance at 100% turbine output was to be optimised. The concept of a combined heat and power plant was again to be realized by using the patented CHPP SYSTEM HUTTER which had been patented by the company Friedrich Hutter GmbH.

The Solution

A natural circulation boiler with generous internal piping and supply lines was to be conceived in order to meet the targets. This led to a stable internal circulation as well as to the maintenance of the required dynamics. A process steam cooler was implemented in the flow-oriented turbine exhaust duct – totally in line with demands of the patented system.

Scope of Supply

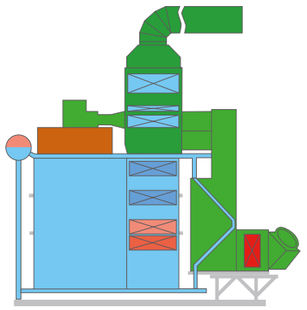
- Steam Generator with Valves
- External process steam cooler in the exhaust Gas Duct
- Ripped-Tube Economiser
- Refractory Lining of Burner Muffles
- Boiler Feedwater System
- Feedwater Tank

Engineering Services

- Engineering
- Installation and Commissioning
- Trial Run

Technical Project Information

Number of lines	1
Fuel	Natural gas H
Heating value	31.66 MJ/m³ i.N.
Fuel throughput	6,078 m³ i.N./h
Rated thermal input	53.46 MW
Combustion air	Gas turbine exhaust gas as oxygen carrier
GT-exhaust gas temperature	556 °C
GT-exhaust gas volume flow (wet)	41.76 kg/s
Steam capacity	90 t/h
Design pressure	105 bar g
Steam pressure	89 bar g
Steam temperature	480 °C
Feed water temperature	105 °C
Exhaust gas temperature	135 °C
Design code	TRD-DIN / EN
Year of commissioning	2007



Example of a boiler plant

Sample Reference PLATTLING, GERMANY

The Task

Kraftwerk Plattling GmbH, a subsidiary of E.ON Energy Projects, constructed at the location of the paper mill of the Myllykoski Group in Plattling, a CHP power plant as a combined gas and steam turbine plant. The power plant is intended to ensure that the adjoining paper mill is supplied with process steam as well as with electric energy by means of cogeneration. Standardkessel Baumgarte was given the task of constructing the heat recovery boiler for fully automatic and economical continuous operation at high efficiency and availability, with at the same time maximum reliability of the steam supply being achieved.

The Solution

In order to solve the problem Standardkessel Baumgarte is supplying a heat recovery boiler of horizontal construction. The heat recovery boiler in the power plant in Plattling is operated downstream of a GE 6FA gas turbine with an approx. 60 MW auxiliary firing system and a cooled combustion chamber. At full load, the HRB reaches a steaming capacity of 201 t/h at a steam pressure of 92 bar and a steam temperature of 532 °C. The gas and steam turbines together generate up to 110 MW of electricity, the process steam being taken off at a low stage from the pass-out condensation turbine. Besides the heat recovery boiler, Standardkessel Baumgarte is supplying the associated steelwork, the flue gas duct between the gas turbine and the heat recovery boiler, the silencer and the stack as well as the field instrumentation and the complete burner control system.

Scope of Supply

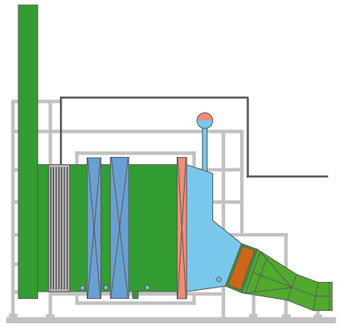
- Single-Pressure HRSG with Condensate Heat Exchanger
- Auxiliary Gas Firing System
- Structural Steelwork, Stairs and Platforms
- Ancillary Plants
- Stack
- Silencer

Engineering Services

- Work of Obtaining Approvals / Licences
- Planning and Design Engineering
- Erection
- Commissioning

Technical Project Information

Energy source	Natural gas
Gas turbine type	GE 6 FA
Additional tuel	Natural gas
Electrical output of GT	77 MW
GT-Exhaust gas flow rate	214.5 kg/s
GT-Exhaust gas temperature	592 °C
HRB steaming capacity	201 t/h
Steam temperature	532 °C
Approved working pressure	108 bar
HRB waste gas temperature	110 °C
Year of commissioning	2010



Example of a boiler plant

Sources of Energy

WASTE HEAT FROM INDUSTRIAL PROCESSES

Sample Reference GROVEHURST, GREAT BRITAIN

The Task

So as to reduce environmental impact caused by land-filling and land-spreading of the produced waste-paper sludges from the paper making process at Kemsley and Sittingbourne site, a new combustion plant was planned to be built. The energy company E.ON UK commissioned the companies Lurgi Envirotherm GmbH and Lurgi UK with the installation of a fluidised bed combustion plant containing a waste-heat steam generator situated next to the existing power plant at Kemsley Paper Mill. During the early conceptual design phase, Standardkessel Baumgarte was already involved in the preparation of a concept tailored to build a waste-heat recovery system.

The Solution

The experience gained from supplied and operative waste-heat recovery systems in comparable applications was the basis of the boiler to be engineered. When the flue gases leave the combustion chamber, they are directly conveyed to the main-steam generator in vertical design with the installation of evaporator walls, superheater and evaporator heating surfaces. The economiser heating surfaces are located in the second flue-gas pass made form sheet-metal casing. So as to provide cleaning of the heating surfaces, both passes are equipped with a steel shot cleaning system and also offers the option to retrofit a soot-blower system.

Scope of Supply

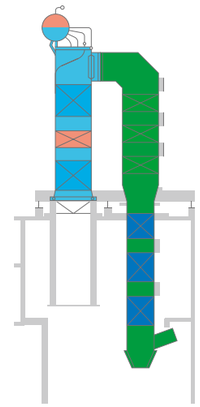
- Main-Steam Generator with Shut-Off and Control Devices
- Boiler Supporting Structure including Stairs and Platforms
- Steam Air Preheater
- Interconnecting Piping
- Cleaning System as Steel Shot Cleaning Plant
- Boiler Feed-Water Pumps with Fittings
- Blow-Down Tank and Sampling Station
- Metrological Boiler Equipment

Engineering Services

- Approval and Official Engineering
- Detail-Engineering and Technical Handling
- Erection, Commissioning and Trial Run

Technical Project Information

Number of lines	1
Fuel	Waste heat from sludge combustion
Flue gas flow (moisture)	79,400 m³ i. N./h
Quantity of flue gas heat	33.75 MW
Flue gas temperature	860 – 1000 °C
Steam capacity	38.8 t/h
Steam pressure	26.5 bar g
Steam temperature	345 °C
Feed water temperature	105 °C
Exhaust gas temperature	160 – 180 °C
Air rate	45,000 m³ i. N./h.
Air temperature inlet / outlet	25 / 220 °C
Operating approval	BS / EN
Year of commissioning	2002



Example of a plant fired using the heat recovered from industrial processes





Sample Reference DUNKIRK, FRANCE

The Task

Gaz de France placed an order with Alstom Power as the general contractor for the construction of a combined gas and steam turbine plant in the French city of Dunkirk. Within the scope of the project, Standardkessel Baumgarte was entrusted with the task of developing a solution for the power station mode of operation of the gas and steam process using a fuel/electricity management system. The two combined gas and steam turbine power plant lines are to generate, at full load, 2 x 400 MWel.

The Solution

The power plant mode of operation of the combined gas and steam turbine process with a fuel/electricity management system, which is unique world-wide, was made possible by the special design of Standardkessel Baumgarte special heat recovery steam generator. Unlike the otherwise usual mode of operation of combined cycle gas and steam turbine plants, in the case of this power plant, the major share of the electricity is generated by the steam turbines. The gas turbines are switched on and off fully automatically each day. For the unusual new mode of operation, a special heat recovery steam generator had to be developed. The smooth change-over between gas turbine and fresh air operation with the fuels coke-oven gas and blast-furnace gas requires a flexibly responding boiler with change-over devices which are not only based on the company's many years of design experience, but as regards their size and number are unique throughout the world. The boiler plant is designed in a suspended vertical type of construction and is arranged in natural circulation. The burners are of staggered opposed arrangement as a so-called 'combed' opposed firing system. The delivery time for the engineering, manufacturing, and erection of both boilers was 26 months.

Scope of Supply

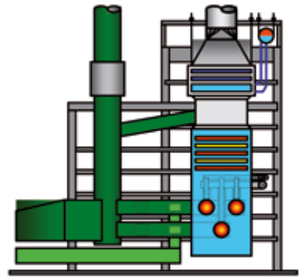
- Boiler Plant
- Firing System for:
  Coke Oven Gas, Blast Furnace Gas, Natural Gas
- Flue Gas Ducts incl. Flaps and Dampers
- Stack
- Auxiliary Equipment

Engineering Services

- Engineering
- Assembly
- Commissioning

Technical Project Information

Energy source	GT exhaust gas
Fuel for auxiliary firing	Coke oven gas, Blast furnace gas Natural gas
Electrical power output GT	2 x 160 MW
Electrical power output ST	2 x 240 MW
Steam capacity HP / RH	535 / 530 t/h
Steam temperature HP / RH	566 / 566 °C
Steam pressure HP / RH	144 / 31 bar g
Feed water temperature	105 °C
Nominal waste gas flow	536 kg/s
GT-Waste gas temperature	527 °C
RTO Aux. firing system	345 MW
FG Temp boiler outlet	120 °C
Year of commissioning	2004



Example of a plant fired using the heat recovered from industrial processes

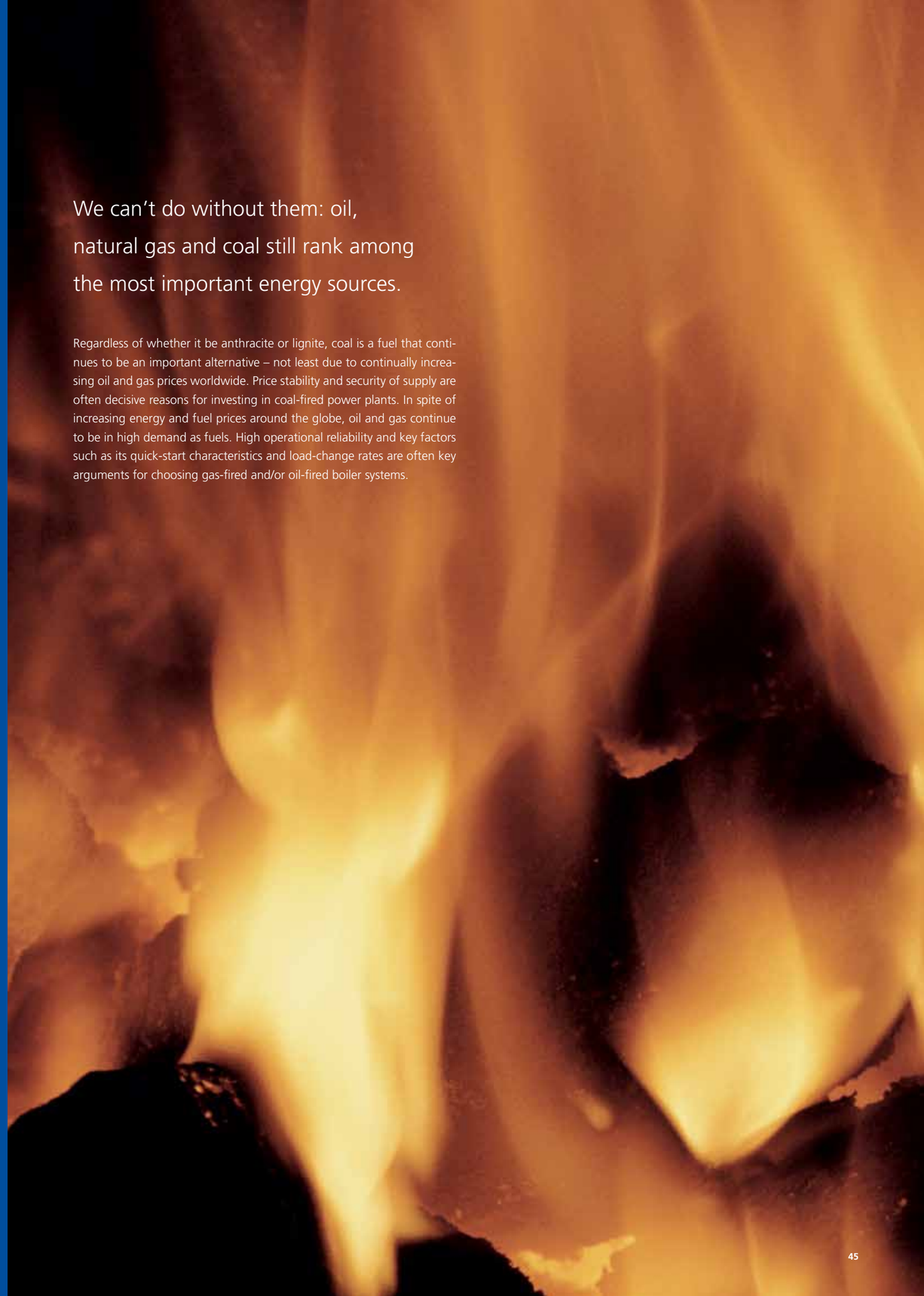
4 ALL FIRED UP

ENERGY FROM PRIMARY FUELS

Fuel	Coal and lignite briquette, coal dust, natural gas or fuel oil
Performance range	Travelling grate firing system up to 140 MW_{th}, Steam parameters up to 540 °C - 140 bar Dust firing system up to 300 MW_{th} , Steam parameters up to 540 °C - 140 bar Gas and oil firing system up to 550 MW_{th}, Steam parameters up to 570 °C - 170 bar
Boiler technology	This natural circulation steam generator boasts a compact structure and is largely prefabricated in the workshop. As a natural circulation two-drum boiler, prefabricated as a modular system. Steam generators with natural circulation with several boiler passes being vertically arranged. The first boiler pass is formed as open pass and is divided into furnace and radiation chamber. Superheater, evaporator and economiser convection heating surfaces are installed in all further boiler passes. All convection heating surfaces can be cleaned during operation with soot blowers. The superheated steam temperature control is carried out by means of an injection cooler between the superheater heating surfaces.
Combustion system	**Hard coal, lignite** Travelling grate firing with hopper feed and fuel bed controller. The primary air is fed underneath the grate - divided into several separately controllable zones. The secondary air injection is carried out via nozzle rows in the front and rear wall of the furnace. **Coal dust** Low NO_x industrial/powerstation firing systems are used for coal dust. The burners are arranged depending on the capacity in the surrounding walls of the combustion chamber. **Gas, oil** Low NO_x industrial/powerstation firing systems as single-fuel system or as combined burner for gas and oil.
Fuel gas treatment	Semi-dry or dry process versions are deployed. Calcium hydroxide $Ca(OH)_2$, calcium oxide CaO or $NaHCO_3$ are fed into the flue gas as additives for the absorption of the acidic gas components. As an alternative, wet processes may also be used. The separation of heavy metals and organic substances such as dioxins and furans is performed using adsorption with activated lignite coke or activated carbon. Fabric filters, electrostatic precipitators or cyclones are used to ensure the required particle separation. The removal of nitrogen from the flue gases can be performed using either an SNCR (selective non catalytic reduction) process or an SCR (selective catalytic reduction) process.

We can’t do without them: oil, natural gas and coal still rank among the most important energy sources.

Regardless of whether it be anthracite or lignite, coal is a fuel that continues to be an important alternative – not least due to continually increasing oil and gas prices worldwide. Price stability and security of supply are often decisive reasons for investing in coal-fired power plants. In spite of increasing energy and fuel prices around the globe, oil and gas continue to be in high demand as fuels. High operational reliability and key factors such as its quick-start characteristics and load-change rates are often key arguments for choosing gas-fired and/or oil-fired boiler systems.



Sources of Energy

COAL





Sample Reference JÜLICH, GERMANY

The Task

At Pfeifer & Langen's location in Jülich, the company operates its own power plant for the energy supply. As the existing plants were no longer able to meet the power requirements of the sugar mill and in addition had become very maintenance and repair-intensive, the decision was taken to modernize the CHP plant. With the new plant a long-term, sustainable and, from a business management point of view, optimum energy supply was to be achieved by means of low fuel costs as well as the reduction of personnel and operating costs. Moreover, the new CHP plant was required to show, besides a high degree of reliability and availability, a future-orientated technical conception.

The Solution

To expand the plant's own energy supply, Standardkessel Baumgarte received the order from the Jülich works of Pfeifer & Langen for the supply of a steam generator including a flue gas cleaning system arranged downstream. The natural circulation boiler is equipped with a travelling grate stoker firing system and designed for the combustion of bituminous coal, lignite briquettes and fuel oil. In accordance with the CHP principle, the superheated steam is initially used for electricity generation and then as process steam. The plant went into operation in September and already supplied the energy for the sugar beet campaign in the autumn of 2004.

Scope of Supply

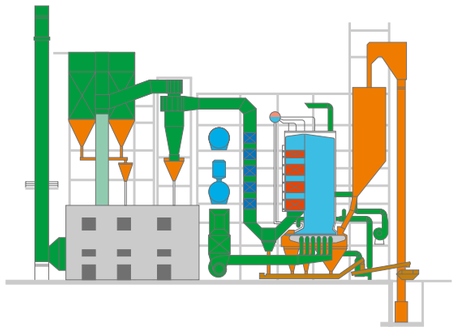
- Coal Handling System, incl. Bunker
- Traveling Grate System
- Combustion Air System
- Steam Generator
- Steel Structure
- Cyclone
- Bag House Filter
- Flue Gas Conditioning System
- Slag and Ash Handling System

Engineering Services

- Engineering and Supply
- Erection and Commissioning
- Putting in to Operation

Technical Project Information

Number of lines	1
Fuel	Lignite briquettes
Low heating value	19.8 MJ/kg
Fuel throughput	21.8 t/h
Fuel	Bituminous coal
Low heating value	28.6 MJ/kg
Fuel throughput	15.1 t/h
Thermal input	120 MW
Steam capacity	130 t/h
Steam temperature	520 °C
Steam pressure	109 bar g
Feed water temperature	110 °C
Rated flue gas volume (nom.)	168,500 m^3 i.N./h.
Flue gas throughput	150 °C
Operating approval	13. BImSchV
Year of commissioning	2004



Example of a coal-fired plant

Sources of Energy

GAS AND OIL




Sample Reference TRINIDAD, TRINIDAD AND TOBAGO

The Task

To ensure the generation of steam in the world's largest methanol plant, the PROMAN Gesellschaft für der Projekt-management mbH commissioned Standardkessel Baumgarte with the planning and delivery of a natural gas-fired packaged boiler system. The specific requirement was to ensure the continuous operation of the plant during the first three years. After five years of successful plant operation, Standardkessel Baumgarte was awarded the contract to supply a second boiler unit as part of the intended expansion of production capacities. In addition to natural gas, the three burners shall be capable of burning the fusel oil resulting from the production process. In all other aspects the equip-ment on orderremained almost unchanged.

The Solution

So as to comply with the set conditions, the packaged steam generator was to be conceived as a single-drum boiler. In particular, the steam drum and the evaporator system together with the headers and distributors were calculated to match the requirement. Apart from the boiler pressure part itself, the major parts of the equipment component were largely designed for redundancy. So, e. g. the combustion air fan was equipped with two independent drives, i. e. electro motor and turbine drive. The control fittings were equipped with quick-acting drives.

Scope of Supply

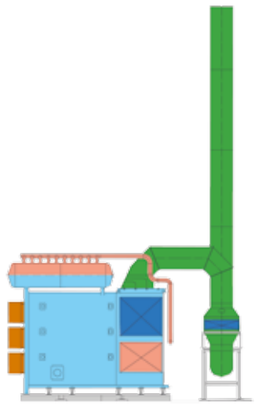
- Main-Steam Generator with Fittings
- Natural-Gas Firing Plant with Combustion Air System
- Steam Turbine Drive for Combustion Air Fan
- Steel Structure for Stairs and Platforms
- Economiser
- Flue-Gas Ducts
- Thermal Insulation
- Chimney

Engineering Services

- Engineering
- Supervision for Erection
- Commissioning

Technical Project Information

Number of lines	1
Fuel	Natural gas / Fusel oil
Heating value	35.9 MJ/m³ i.N.
Fuel troughput	11.525 m³ i.N./h.
Rated thermal input	B1: 115.0 MW B2: 114.0 MW
Steam capacity	147.5 t/h
Design pressure	34.0 bar g
Steam pressure	28.5 bar g
Main-steam temperature	341 °C
Feed water temperature	109 °C
Exhaust-gas temperature	200 °C
Design regulation	TRD-DIN / EN
Year of commissioning	B1: 2004 B2: 2011



Example of a gas- and oil-fired plant

5 PROCESS TECHNOLOGY

SOLUTIONS ALL AROUND WASTE GAS, EXHAUST AIR AND FLUE GAS CLEANING

Condensation

With a high pollutant and/or solvent concentration in the waste gas, consideration is given primarily to recovering the pollutants or solvents as valuable substances in order to save raw materials, energy and costs.
A tried and proven process is that of condensation. Depending on requirements and the particular application it is used for emission reduction, recovery and waste gas conditioning as an independent or multistage measure e.g. in combination with a fine cleaning system arranged downstream.
Condensation is a thermal separation process in which the waste gas stream containing pollutants and/or solvents cools down to a temperature below the dew point of the compounds. The condensate forming is collected directly in a utilisable form. Depending on the demands made on the condensate, the product recovered can be fed back directly into the process. This is particularly advantageous in the case of applications in such areas of use as coating plants, circulating gas dryers, fixed-bed drying, film coating, chemical and pharmaceutical process engineering, tank farms, gas displacement and respiratory gas. Here, direct condensation is specifically used.

Catalysis

The catalytic process lends itself to waste gas, exhaust air and flue gas cleaning. The pollutants are converted by oxidation or reduction, if necessary with the use of an additive. Catalytic processes are usually characterised by lower reaction temperatures than in the case of comparable thermal processes. This permits more efficient process control with a considerably reduced energy input. The catalytic process is exothermic. Depending on the case of use and the level of pollutant loading, the heat is recovered via recuperation or regeneration. For the respective specific application – for the initiation of and support for the reaction – various stable and highly active catalysts are used. The pollutants are converted on the surface of the catalyst with a further chemical element or a compound.
This element or compound is either present or has to be added. With the use of tried and proven catalysts, reliable adherence to the statutory emission values is ensured.

Combined processes

When considering individual emission reduction measures, it is to be taken into account that waste gas streams can often no longer be cleaned in an ecologically meaningful manner by means of a single-stage cleaning process. With regard to the constituents and their concentration in the waste gas, mostly further process stages arranged upstream and/or downstream, which are to be regarded as supplements, are to be used. It is likely that official requirements will demand a combination of processes as a solution.

Now as ever, environmental protection is a big, topical subject for Standardkessel Baumgarte. In this connection an important objective is to develop sustainable concepts for the reduction and avoidance of pollutants. Here Standardkessel Baumgarte provides a wide range of sustainable solutions in the form of product-integrated environmental protection.

With integrated and customised concepts, a high level of protection is to be achieved for the environment, resources are to be handled sparingly and emissions are to be avoided, reduced or changed into a usable form. The legislator therefore demands that a cleaning unit be arranged downstream of the production area or of other emission sources.

Standardkessel Baumgarte provides various processes for emission reduction and elimination. With the single-stage or multistage processes and process technologies for waste gas, exhaust air and flue gas cleaning, with the meeting of our high quality standards, the emission limit values required can be complied with and accompanied by optimum energy utilisation and high availability.

CONDENSATION SPRAY COOLER

Direct Condensation of Solvent in a Liquid Jet

The Task

In the production of free-flowing granules, solvents (VOC) are released during their drying. The emission of the solvent concentration is to be reduced and to be put into a form that can be utilised. With a product-integrated concept, the solvent used is to be recovered with a high degree of purity by means of suitable measures and to be recycled by means of being returned to the process. The technical rules, especially of explosion protection, must be mandatorily observed.

The Solution

To minimise the investment costs, the dryer is operated in a closed circuit (circulating air). To reduce emissions and to recover solvent, provision is made for feeding merely a small part of the main flow via a condenser system. The separation of the solvent and the cleaning of the part flow are carried out by means of direct condensing in a spray cooler in the refrigerated solvent jet. The circulated solvent jet drives the spray cooler and feeds the part flow through the condenser system due to the ejector effect. The part flow cools down to the condensing temperature and the solvent is condensed. Through the recovery, the solvent is removed from the process and can be reused directly. The solvent-reduced flow is passed back into the main flow.

Scope of Supply

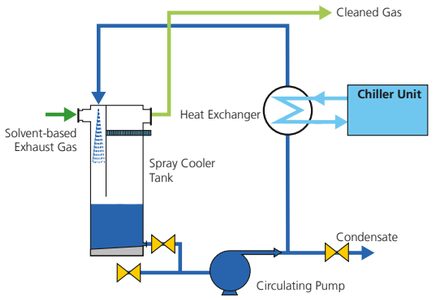
- Liquid storage tank with ejector tower, self-priming
- Circulation pump including piping system
- Heat exchanger for indirect cooling of the liquid circuit
- Cooling unit
- Instrumentation and system control

Engineering Services

- Engineering
- Production and delivery
- Erection, commissioning and service

Technical Project Information

Waste gas flow rate	300 kg/h
Waste gas temperature at inlet	120 °C
Condensation temperature	–15 °C
Condensation capacity	20 kW
Liquid circulation flow rate	16,000 kg/h
Service pressure	Atmospheric
Recovery rate based on the incoming load	>90%
Mode of operation	Continuous



Direct condensation in refrigerated solvent jet




CONDENSATION BATH COOLER

Direct Condensation of Solvent in a Liquid Bath

The Task

For high pollutant and/or solvent concentrations in the waste gas from a production plant, a suitable separation process is to be used for the separation of the solvents and/or the pollutants. As a function of the emitting process and depending on the production step, the waste gas is laden with solvents, plasticisers, fuels and propellants, oils, aromatic compounds or paraffin. The solvents are to be recovered as a recyclable material. For further use, the solvents are to be available directly in a liquid form.

The Solution

To recover and separate the solvents, direct condensation in a liquid storage cooler is provided for as a thermal separation process. In this case it is a bubble column in which the evaporator package built into a tank cools down the liquid in the tank. The liquid corresponds as a rule to the composition of the condensate from the waste gas stream. The waste gas stream to be condensed is fed into the tank via a perforated plate and, as a bubble column, it is conveyed through the liquid storage tank with the help of a fan. The waste gas containing solvent cools in the bubble column to the temperature set in the storage vessel below the dew point of the compounds. The condensate forming is collected directly in the liquid. The liquid storage vessel cooler is kept constantly at the condensation temperature selected. The solvent concentration at the outlet from the system corresponds to the saturation concentration of the solvent used.

Advantages of the System

- Low tendency to ice over, no misting
- Plasticisers/paraffins contained in the waste gas are largely dissolved and are separated
- No deposits at all are build up
- The liquid storage vessel cooler constantly cleans itself
- Heat exchange takes place directly and with optimum efficiency

Scope of Supply

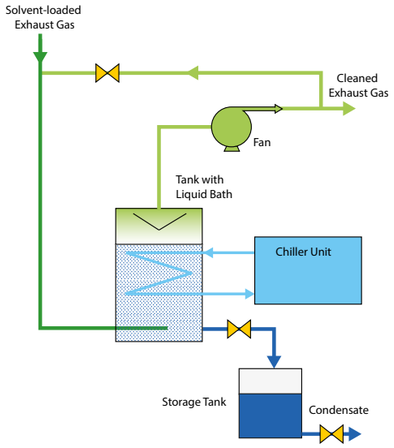
- Condensing equipment including fan for waste gas conveying
- Evaporator package for cooling the liquid storage vessel
- Cooling unit
- Instrumentation and equipment control system

Engineering Services

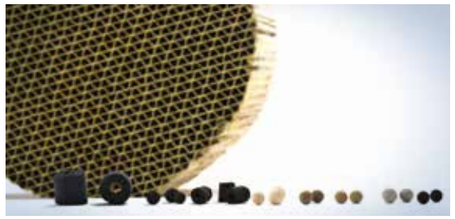
- Engineering
- Production and delivery
- Erection, commissioning and service

Technical Project Information

Throughput rate	20 to 1,700 Nm³/h
Waste gas temperature at inlet	0 °C to 80 °C
Condensation temperature	10 °C to –45 °C
Service pressure	0.85 to 10 bars
Condensation power	Up to 70 kW
Mode of operation	Continuous/discontinuous
Solvent concentration	0 to 100% solvent saturation (fluid)
Control range, volume flow rate	0 to design volume flow rate (0–100%)



Direct condensation of solvent in a refrigerated liquid bath



CATALYTIC OXIDATION (CatOx) with recuperative Heat Recovery

The Task

In a chemical/pharmaceutical production plant, exhaust air containing pollutants that contain volatile organic compounds (VOCs) is emitted. Due to the operational mode of the production plant markedly fluctuating, exhaust air quantities and different VOC concentrations are released. At a low oxidation temperature the exhaust air is to be cleaned according to the emission limit values set out by the German Air Pollution Control Regulations (TA-Luft) before it is discharged into the ambient air.

The Solution

For safe and environmentally friendly removal of the volatile organic compounds (VOC), a catalytic exhaust air cleaning plant is used. The plant is able to respond both to the fluctuating exhaust gas quantities and to the different concentrations. As a result of the use of the catalyst, the oxidation temperature – adapted as required – for the conversion of the organic compounds is lowered in comparison with thermal oxidation. Catalytic reaction is exothermic and releases thermal energy during catalytic oxidation. With the use of a highly efficient heat exchanger, auto-thermal operation becomes possible due to heat recovery already taking place at low VOC concentrations. Recuperative heat recovery takes place in order to ensure reliable separation of exhaust air and clean air.

Scope of Supply

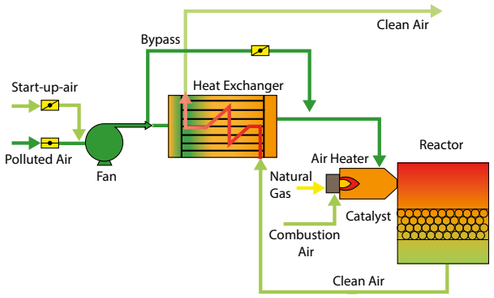
- Fan for conveying the exhaust air stream
- Reactor with catalyst material
- Heat exchangers for recuperative preheating of the exhaust air stream
- Heating equipment designed as burners
- Instrumentation and plant control system

Engineering Services

- Engineering
- Production and delivery
- Erection, commissioning and service

Technical Project Information

Exhaust air volume flow rate	5,000 Nm^3/h
Exhaust air temperature	30 °C
Pollutant concentration (VOC)	2–10 g/Nm^3
Clean gas value	<20 mg/Nm^3 VOC
Auto-thermal operation from VOC concentration of	3 g/Nm^3
Installed burner output	200 kW
Service pressure	Atmospheric
Operating mode	Continuous



Catalytic exhaust air cleaning plant with recuperative heat recovery

CATALYTIC OXIDATION (RCO) with regenerative Heat Recovery

The Task

Granule storage containers emit, due to subsequent evaporation, exhaust air containing pollutants and low hydrocarbon concentrations. The exhaust air is to be cleaned at a low oxidation temperature according to the emission limit values set out by the German Air Pollution Control Regulations (TA-Luft), before it is discharged into the ambient air. To minimise the demand for secondary fuel, auto-thermal operation is to be achieved at low initial concentrations.

The Solution

For reliable and environmentally friendly removal of the hydrocarbons a catalytic exhaust air cleaning plant with regenerative heat recovery (RCO) is used. Due to the use of the catalyst, the oxidation temperature for the conversion of the organic compounds – adapted as required – is lowered in comparison with thermal oxidation. The catalytic reaction is exothermic and releases thermal energy during oxidation. Through the use of the highly efficient regenerative heat recovery, auto-thermal plant operation is possible without auxiliary heating already at very low pollutant concentrations.

Scope of Supply

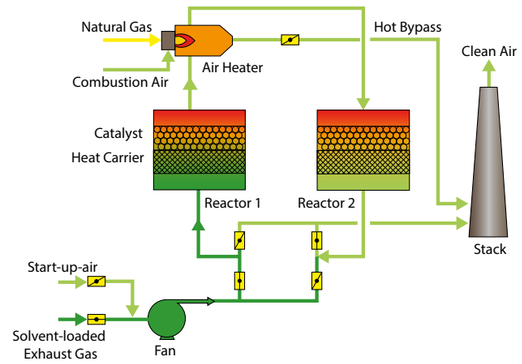
- Fan to convey the exhaust air stream
- Two-bed reactor, with catalyst and heat transfer material per bed
- Heating system installed between the beds
- Instrumentation and plant control system

Engineering Services

- Engineering
- Production and delivery
- Erection, commissioning and service

Technical Project Information

Exhaust air volume flow rate	10,000 Nm³/h
Exhaust air temperature	30 °C
Pollutant concentration (hydrocarbon)	0–2 g/Nm³
Clean air value	<20 mg/Nm³ org C
Auto-thermal operation from a hydrocarbon concentration of	0,7 g/Nm³
Heating system	Gas-fired burner
Installed burner output	250 kW
Service pressure	Atmospheric
Mode of operation	Continuous



Catalytic exhaust air cleaning system with regenerative heat recovery




SELECTIVE CATALYTIC REDUCTION (SCR) with recuperative Heat Recovery

The Task

In a combustion plant, nitric oxides (NO_x) are obtained during the combustion process at high temperatures due to oxidation of the nitrogen in the combustion air and oxidation of the nitric oxide bound in the fuel and the liquid residue. The required NO_x emission limitation cannot be achieved by means of primary operating measures, so that a suitable secondary measure for emission reduction has to be applied. Due to the high NO_x flue gas concentration, an NO_x reduction degree of at least 95% is necessary to limit the emissions to the applicable clean gas value.

The Solution

With reference to the stipulation of the high denitrification capacity the SCR process (catalytic flue gas denitrification) is to be applied. The nitric oxides react in an oxidising atmosphere in the presence of ammonia (NH_3) to form molecular nitrogen and water. For that purpose the reductant (NH_4OH) is injected into the flue gas duct before the catalyst and homogeneously distributed. Catalytic materials reduce the activation energy of the chemical reaction so that the NO_x reduction can, due to the presence of the catalyst, take place at low temperatures. The SCR catalyst is installed at the end of the flue gas cleaning chain as a high-temperature variant. The advantage of this is the simultaneous separation of dioxins and furans.

Scope of Supply

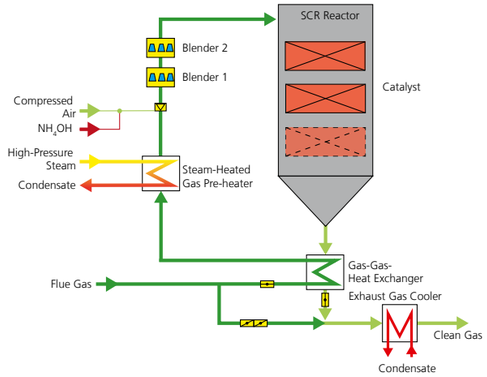
- Tail end SCR with heat transfer system
- Instrumentation and plant control system

Engineering Services

- Engineering
- Production and delivery
- Erection, commissioning and service

Technical Project Information

Exhaust air volume flow rate	150,000 Nm³/h
Flue gas temperature	155 °C
Pollutant concentration (NO_x)	1,000 mg/Nm³
Clean gas value	<70 mg/Nm³ VOC
SCR service temperature	250 °C
Service pressure	Atmospheric
Mode of operation	Continuous



Tail end SCR with heat transfer system and steam/ gas pre-heater

COMBINED PROCESS Two-stage Condensation

The Task

Wrapped in a paper coating, plant solvents are vaporised in an inert atmosphere in a gas-tight dryer. The plant works at a drying temperature of 120°C. The heated-up air is blown via a primary gas circuit onto the paper web to be dried. At the inlet and the outlet of the dryer, air locks are installed which largely prevent the ingress of air. The primary circulating gas flow inside the dryer – with the help of the fans – leads the heat of evaporation to the paper web to be dried. The solvent concentration in the primary circuit is to be reduced to the equilibrium necessary and admissible for the drying process while the solvent is being recovered. The dryer exhaust gas contains, besides solvents, traces of phenolic resins and dust.

The Solution

To reduce the solvent concentration, the solvent-laden waste gas is extracted by suction via a fan in a secondary circuit. The exhaust gas is pre-cooled in a spray cooler operating with circulating solvent which is cooled in a condensation system. Here, a part of the contamination is bound and a part of the phenolic resin is dissolved. In the condensation system, the gas is reduced to the necessary equilibrium concentration to then be fed back to the dryer. The phenolic resin particles entrained in the circulating gas flow of the dryer (which have already partly been cracked) and the dust, make special demands on the condensation system. The special type of construction of direct low-temperature condensation is unrestrictedly suitable for these problems. The recovered solvent is separated from the dust in the separator.

Scope of Supply

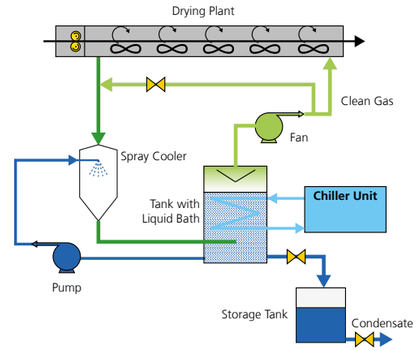
- Spray cooler with circulation pump
- Condensation equipment with integrated evaporator package
- Indirect cooling of the liquid circulation
- Cooling unit
- Instrumentation and plant control system

Engineering Services

- Engineering
- Production and delivery
- Erection, commissioning and service

Technical Project Information

Waste gas volume flow rate	600 Nm^3/h
Waste gas temperature at inlet	120 °C
Solvent concentration	Up to 250 g/Nm^3
Condensation temperature	–10 °C
Condensation power	65 kW
Condensate flow rate	120 kg/h
Concentration at the outlet of the condenser system	38 g/Nm^3
Circulation dryer	4,500 kg/h
Service pressure	Atmospheric
Mode of operation	Continuous



Direct condensation in a liquid bath – with a spray cooler arranged upstream – in a closed system

COMBINED PROCESS Condensation with Catalytic Oxidation

The Task

In a chemical multipurpose plant, a waste gas laden with hydrocarbons is emitted at different volume flow rates and time intervals from various sources. The waste gas is to be cleaned using an economically flexible process before it is discharged into the ambient air. In order to save raw materials, energy and costs, the solvents are to be largely recovered as valuable resources and to achieve the applicable emission limit values, to be treated in a further process stage at a low oxidation temperature.

The Solution

Cleaning is carried out in two process steps. The first stage is direct condensation of solvents in a liquid bath. By means of condensation, a residual concentration remaining almost constant is achieved. The concentration achieved corresponds to the saturation conditions of the solvent used and/or of the composition of the bath. Concentration peaks are thus reduced. This remaining residual concentration is cleaned to the applicable emission limit values in a second cleaning stage designed as a catalytic exhaust air cleaning system with a recuperative heat recovery system.

Scope of Supply

- Low-temperature condensation
  - Condensation unit including fan for waste gas conveying
  - Evaporator package for cooling the liquid bath
  - Cooling unit
- Catalytic oxidation
  - Fan for conveying the exhaust air stream
  - Reactor with catalyst material
  - Heat exchanger for recuperative preheating of the exhaust air stream
  - Heating device designed as burner
- Instrumentation and plant control system

Engineering Services

- Engineering
- Production and delivery
- Erection, commissioning and service

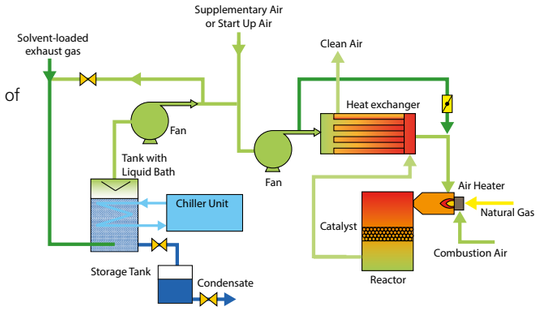
Technical Project Information

Condensation

Waste gas volume flow rate	800 Nm³/h
Solvent concentration	Up to 150 g/Nm³
Condensation temperature	–25 °C
Condensate flow rate	0 bis 70 kg/h
Concentration at the outlet from the condenser system	8 g/Nm³

Oxidation (CatOx)

Volume flow rate	1,600 Nm³/h
Concentration at inlet	8 g/Nm³
Clean gas value	<20 mg/Nm³ VOC
Auto-thermal operation, from a VOC concentration of	8 g/Nm³
Installed heating capacity	90 kW
Service pressure	Atmospheric
Mode of operation	Continuous



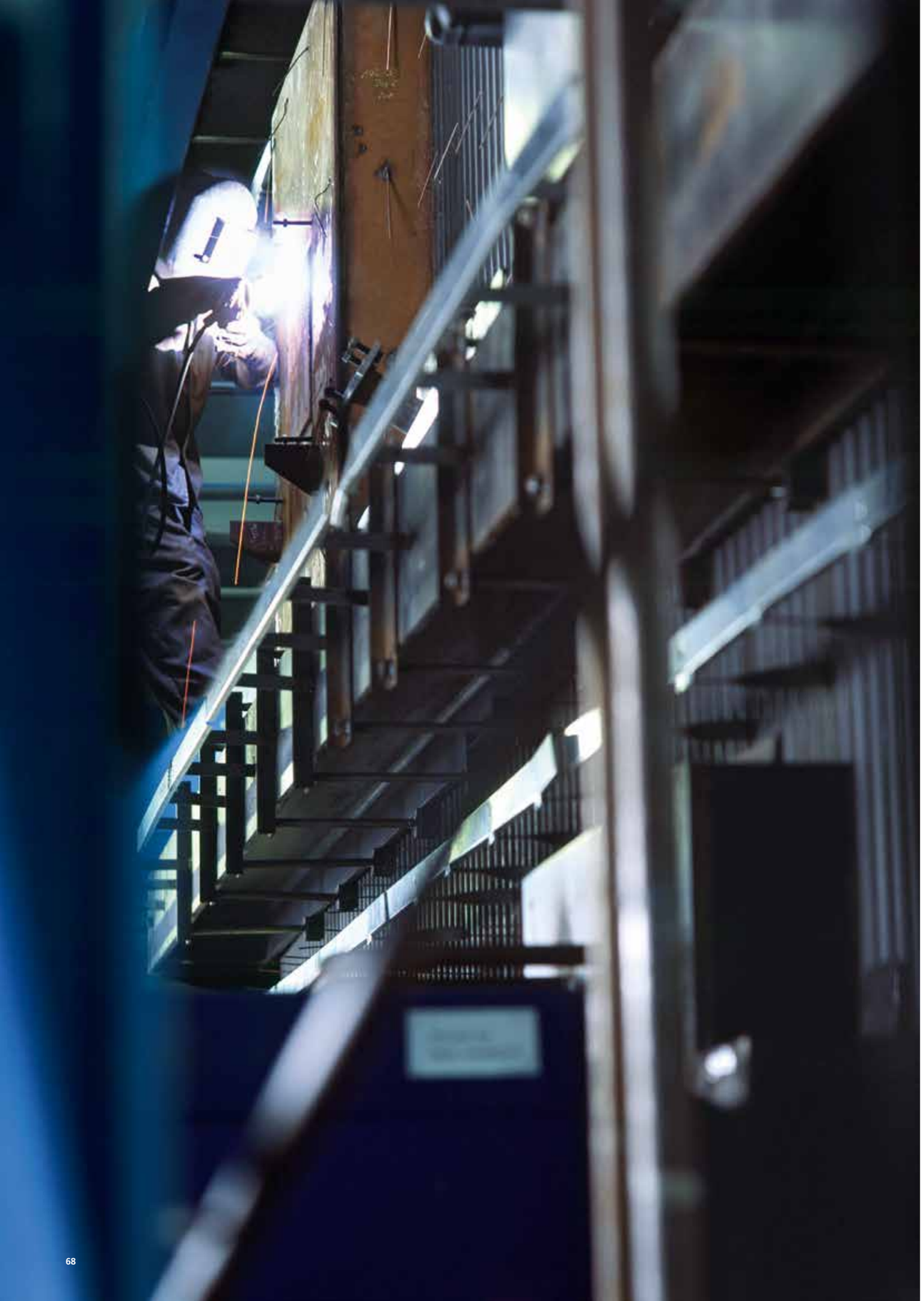
Direct condensation of solvent in a refrigerated liquid bath with catalytic oxidation arranged downstream

6

SERVICE O.K.
EVERYTHING O.K.

PLANT SERVICES FROM A TO Z

When investing in a system, it is not just the right concept and subsequent implementation that are important. Service is also an important consideration. That is because an efficient system depends on smooth operation, and that is where the wide range of services provided by Standardkessel Baumgarte Service is able to help.



OUR SERVICE KNOWS NO LIMITS. NOT EVEN FOR SYSTEMS CONSTRUCTED BY THIRD PARTIES.

An overview of our plant services.

Engineering
Task definition, check and evaluation of measurements and protocols, recommendations and proposals of measures, planning and engineering, execution of engineering works, quality control

Modernisation
Definition of actual plant situation, definition of modernisation works, execution of modernisation works

Optimisation
Conceptual design and realisation of: increase of availability, efficiency, reduction of emission values, operation costs, etc.

Maintenance
Yearly power plant maintenance works, repairs, optimisation of components, spare part management

Erection
Planning of erection, erection works and erection supervision, assembling of components and turn key plants, quality controls, erection management

Commissioning
Functional check and settings of components, over all functional tests, performance checks and tests of components, preparations of test run, execution of test run including performance tests

Operation
Power plant operation

7

PIONEERS

INNOVATIVE TECHNOLOGIES

We believe that being a leading provider in the field of power plant construction means offering you solutions that are always state-of-the-art. That is why we invest in research and development year in and year out – with impressive results, as you will see over the following pages.

New, innovative and highly efficient:

THICK NICKEL PLATING

An essential element of an economically operating boiler plant is a smooth and reliable operation, without failures and expensive time-consuming maintenance measures. As a leading supplier of plants for the combustion of disposals we are also the front-runner in the development of new corrosive protection procedures, one of which is the thick nickel plating process which is exclusively licensed to Standardkessel Baumgarte.

Corrosion – the natural enemy of every plant

Wherever flue gases with high temperatures come in contact with membrane walls and convection heating surfaces, corrosion can be formed. The consequences: a reduced life-time of the components so that a plant standstill to replace the damaged components can no longer be avoided. A problem, which in particular crops up in plants for the combustion of disposals such as household waste, house-hold-type industrial waste, refused-derived fuels and also in biomass combustion plants.

Application of thick nickel plating

The new innovative process of corrosion protection offered by Standardkessel Baumgarte is suitable for heating surfaces with tube wall temperatures of max. 400 °C, such as:

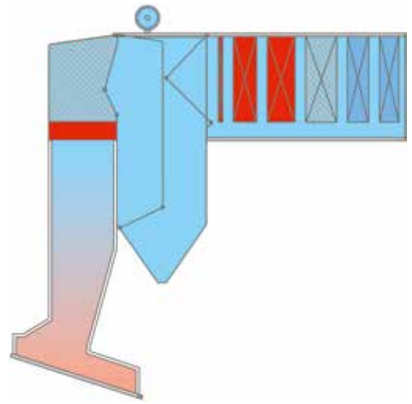
- Membrane Walls
- Convection Evaporator
- Superheater
- Components in Energy-Generating Plants prone to Corrosion and Fouling

The solution: thick nickel plating offered by Standardkessel Baumgarte

The process of thick nickel plating offers effective protection from corrosion. This is an innovative procedure in which the components requiring protection are immersed in an electro-plating bath made from 100% nickel.

The advantages are obvious:

- The non-porous surfaces produced in the electroplating process protect the components from attacks by aggressive flue gases.
- The surface properties reduce the tendency for combustion residue to accumulate.
- Even large components and relatively complex forms can be effectively protected at little cost.
- The 100% nickel is applied using a low tension tech-nique, ensuring good adhesion.
- Unlike conventional processes, thick nickel plating does not mix with the base of the components.

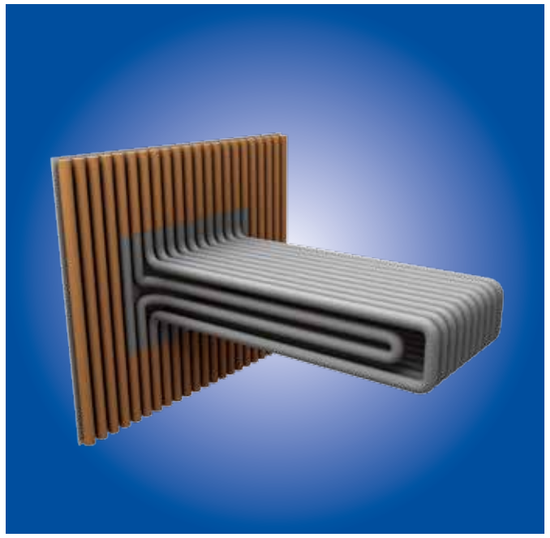


Exemplary areas of a waste incinerator in tailend construction where thick nickel plating can be applied:

- High or increased potential of corrosion in the red and red-hatched areas.
- In other areas contacted by flue gas the application depends on the degree of damage by corrosion.

System for optimal afterburning

TETRATUBE



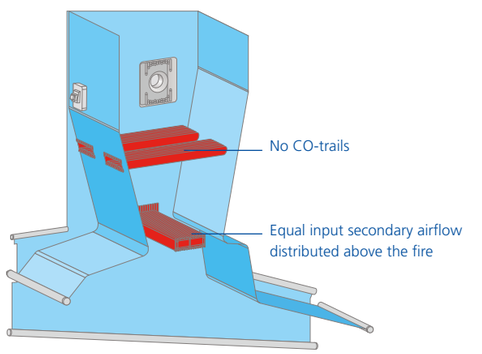
With Tetratube, Standardkessel Baumgarte offers a solution that can increase the service life of your plant.

The Task

Fuels occur in a very wide range of different qualities. Residues and in some cases biomasses fall into the lower end of this scale and this can be clearly seen during combustion in modern plants. In these plants, secondary air is usually injected at the front and rear walls of the furnace. While this is a proven solution, even such established methods can be improved by engineers. With large firing chamber dimensions, for example, the airflow may not penetrate deeply enough or generate sufficient mixing of the flue gas with the combustion air. As a result, CO peaks occur which lead to corrosion in the boilers. This corrosion reduces the lifespan of vital boiler parts and results in high maintenance costs and long down times.

The Solution

With the patented TetraTube Standardkessel Baumgarte offers an innovative solution for optimum afterburning. It doesn't inject the secondary airflow from the side but delivers it to where it will be most effective: in to the top of the furnace. Constricting the boiler's cross section produces a kind of nozzle effect that causes the flue gases to mix perfectly with the injected secondary air. A second TetraTube, turned 90° and located approx. 2 m above the first, enhances the effect. At the most constricted point of the cross-section, the mixed gases reach peak speeds of 30 m/s. These conditions are perfect for preventing peaks in CO and ensuring continuous afterburning. The system is also perfectly suited to injecting NOx reducing agents. The modified version is fitted in the furnace's corresponding temperature zone.

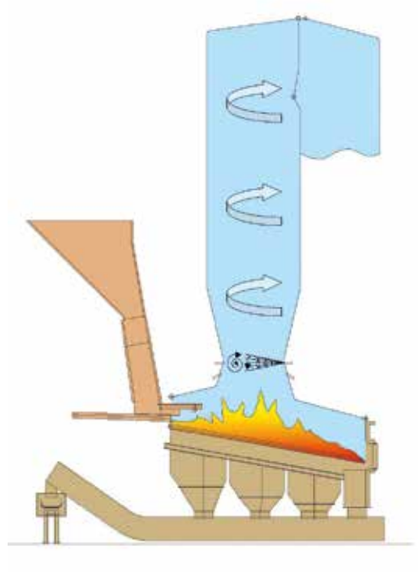


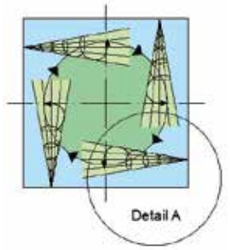
New plant equipment with TetraTube

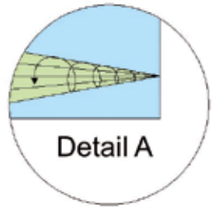
A patented system for secondary airflow in the afterburner chamber.

TANGENTIAL AIR INJECTION

The key prerequisite for good post-combustion is an optimum mixture of the flue gas with the combustion air. Ensuring that the unburned constituents of the flue gas are completely combusted requires oxygen, extensive expertise and the correct process technology. With the patented tangential air injection process, we are able to deliver the oxygen directly to the carbon monoxide.







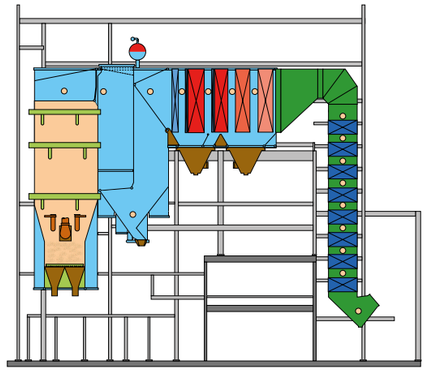
The advantages of this air injection are:

- Improved Emissions Values
- Optimised Flue Gas Mixture
- Harmonisation of the Flue Gas Temperature throughout the entire Firing Chamber Cross-Section
- Controlling the Afterburning and Temperature Distribution
- Reduction in Excess Air and Lower Flue Gas Volume
- Reduced NH_3 Consumption
- Reduction in the Susceptibility to Corrosion

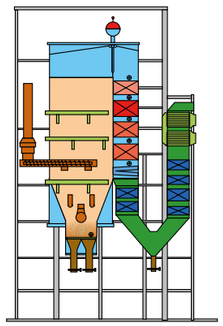
The perfect addition to our grate technologies

FLUIDISED BED FIRING SYSTEM

In order to be able to offer solutions for fuels that could not be used with existing grate technologies, we have expanded our product range and readopted a fluidised bed firing system. The fluidised bed firing system is primarily utilised with waste materials and biomass.



Fluidised bed technology for the combustion of industrial waste



Fluidised bed technology for the combustion of biomass

Functional principle of Fluidised Bed Technology

Our fluidised bed technology is based on the principle of a stationary fluidised bed in which the fluidised bed is integrated into the steam generator. The side walls of the first boiler pass, integrated into the natural circulation, at the same time form the containing walls of the fluidised bed combustion chamber. The fuel is introduced into the fluidised bed by feed chutes via these side walls. The constant fluidisation of the fluidised bed, over the entire load range with low gasification temperature, is achieved by the injection of air and recirculated flue gas via an open nozzle plate. Above the fluidised bed follows the staged post combustion of the gasification products in the freeboard. Through the several rows of nozzles the secondary air and recirculated flue gas are introduced temperature-regulated. If required several nozzle levels can be started and stopped for regulation of the combustion conditions. The steam generator is a classic vertical multi-pass natural circulation boiler and consists of an optional radiation pass, a super-heater pass as well as an economiser pass and an air-heater pass. Ash discharge from the fluidised bed is carried out below the nozzle plate, hence facilitating the removal of impurities and assures a continuous plant operation.

Main characteristics of Fluidised Bed Technology:

- High Efficiency
- Fouling Tolerant
- Low Corrosion Tendency
- Co-combustion of liquid, pasty and solid fuels, possible in a broad mix ratio and a large range of heating values
- Low Emissions
- Equal temperature profile along the length of the furnace due to temperature controlled injection of secondary air and recirculated flue gas into the fluidised bed combustion and the freeboard
- High Availability
- Good mixing of oxygen and flue gas due to optimized-nozzle geometry and air control
- Large thermal load range due to load-dependet activation and deactivation of nozzle levels
- Intensive mixing relation of fuel, fluidisation material plus combustion air in fluidised bed and thereby excellent mass and heat transfer with good ignition and high fuel burnout
- Operation with low excess air volumes and low exhaust gas losses

Design features of Standardkessel Baumgarte Fluidised Bed Technology:

- Open nozzle plate with a wide and open cross section and bottom nozzles, insensitive versus impurities
- Fluidised bed firing system integrated into water-tube, natural circulation steam generators of horizontal or vertical type of construction
- Membrane walls lined with refractory material
- No moving components in the furnace

Parameters of the fluidised bed technology:

Fuels	Biomasses, sludges, RDFs, pasty waste, etc.
Heating values	4–30 MJ/kg
Grain sizes	Total edge lengths <ca. 200 mm–300 mm
Output parameters	25–100 MWth 5–30 MWel
Steam parameters	up to 525 °C up to 100 bar up to 115 t/h
Emissions	CO <5 mg/Nm³
NOx without SNCR	<150 mg/Nm³
with SNCR	<50 mg/Nm³

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WHAT OUR CUSTOMERS SAY

CUSTOMER REFERENCES

Every project is different, yet they all share one thing in common: our passion for intelligent engineering. It is something that is also demonstrated by our many satisfied customers. That is why we have asked some of them about their experiences with Standardkessel Baumgarte. Here is what they told us.

CUSTOMER REFERENCES

PLANNED, BUILT AND APPROVED

**RWE Technology GmbH,
Essen, Germany**

»With regard to building the new upstream gas turbines, we decided to award contracts on a lot-by-lot basis. Since we did not have the available capacities required to implement the project ourselves, we were looking for an expert partner who could realise the modernisation of the power plant without acting as a supplier at the same time. Standardkessel Baumgarte was just the right choice for us.

Under the general management of RWE Technology, the job involved the basic engineering, process technology design, preparation of the tender documents, support in selecting and acquiring the individual sub-contractors as well as technical project support all the way through to the initial commissioning. This type of project management and implementation pays off for us. Standardkessel Baumgarte did everything in line with our specifications – to the complete satisfaction of RWE.«

Dr. Michael Fübi
Member of the Management Board, RWE Technology GmbH

**Tönsmeier Dienstleistung GmbH & Co. KG,
Bernburg, Germany**

»Innovative technologies are needed – especially these days – in order to guarantee us a supply of energy which is dependable, cost-efficient and also sustainable. In Standardkessel Baumgarte we have found the perfect ally which is able to apply the full force of its expertise precisely in our field. In 2007 we commissioned the company to erect a substitute fuel combined heat and power station for us. The idea was to set up three combustion lines of equal output. The experts at Standardkessel Baumgarte quickly drew up a solution tailored to our needs and handed it over to us completed, within budget and on schedule, in October 2010. Now we are supplying Solvay Chemical Plant not only with its electricity and heat requirements, but also with the steam it needs. The power plant is designed for a furnace thermal capacity of 210 MW at a steam output of 240 t/h. The fuel throughput is 450,000 t/a. The planning, execution and final outcome of the project were all entirely to our satisfaction. Standardkessel Baumgarte is a specialist ally which guarantees us tailor-made energy solutions.«

Dr. Jürgen Balg
Spokesman for Group Management, Tönsmeier Dienstleistung GmbH & Co. KG

CUSTOMER REFERENCES

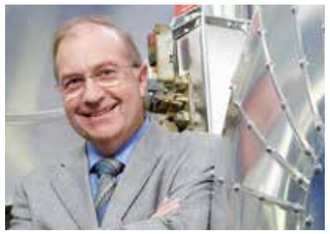
TOP MARKS

**Deutsches Zentrum für Luft- und Raumfahrt e. V.,
Cologne, Germany**

»Conventional gas and steam power plants will continue to maintain a large share in the comprehensive energy supply in the future as well. Under these circumstances, it will become increasingly important to compensate for the output fluctuations of renewable energy sources. Managing and handling these quick load changes puts great demands on the combustion systems. To test and further develop these systems under realistic conditions, the existing test facility at the DLR in Cologne, Germany, has been expanded. Standardkessel Baumgarte Service developed, manufactured and installed the air preheater for the facility. Since October 2011, the world's most state-of-the-art and high-performance air preheater has been supplying valuable research data for the trial operation of combustion chambers. The natural gas-fired combustion chamber heats up the compressed air at 41 bar to a temperature of 730°C. Standardkessel Baumgarte Service increased the previous throughput rate of 30 kg/s to 70 kg/s. When selecting a supplier for the air preheater for the DLR, it was important to find a partner capable of meeting the complex requirements in an efficient and independent manner. Standardkessel Baumgarte Service has just the know-how it takes.«

Christian Fleing, Dipl.-Ing. (Graduate Engineer)
Head of Combustion Test Department, Deutsches Zentrum für Luft- und Raumfahrt e. V.

**Papier- und Kartonfabrik Varel GmbH & Co. KG,
Varel, Germany**



»In 2006, we awarded Standardkessel Baumgarte the contract to supply our factory with Boiler 8 (output level 95 t/h, steam/95 bar). After just 11 months, the steam generator went into operation as a combined heat and power installation with two upstream gas turbines (6.3 MWel each). Since its commissioning, the plant has run flawlessly and we are completely satisfied. In addition to the price-performance ratio, Standardkessel Baumgarte expertise, reliability, flexibility and personal commitment were crucial factors that won us over.

The success of the new boiler once again affirms the trusting and excellent cooperation between Papier- und Kartonfabrik Varel and Standardkessel Baumgarte.«

Horst Büsing
Managing Director, Papier- und Kartonfabrik Varel GmbH & Co. KG

COUNT ON US TO FIND THE ENERGY MANAGEMENT IDEAS YOU NEED. PROVIDED, OF COURSE, THAT YOU FIND US FIRST.

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