Hoval

FACTBOOK

Hoval PowerBloc EGC

Power plants for heat and electricity.

Efficient | Variable | Reliable

Hoval | Responsibility for Energy and Environment

Electricity, essential for our life

Generate it yourself!

Electricity has become an integral part of our daily lives. Nowadays, electricity also powers bicycles and cars more and more often. Electricity is produced centrally in power plants, very often still with nuclear energy or from fossil fuels. Transmission losses occur on the way to the consumer. A changeover is underway, but it takes time. In Europe, renewable energies such as solar, wind, water and biomass are being increasingly promoted in order to significantly reduce greenhouse gas emissions.

Be part of this change and save money in the process. Do you heat your building? Use energy highly efficiently and generate your electricity at the same time instead of buying it at a high price. As decentralised units, a combined heat and power plant produces heat and electricity at the same time in your home. Away from large power stations with their high losses.

With a Hoval combined heat and power plant, you become your own energy supplier.

Contents

Hoval cogeneration system
Welcome to PowerBloc EGC.

Combined heat and power (CHP) plants provide not only electricity but also heat for heating buildings and domestic hot water. They are therefore also referred to as cogeneration plants. They are mostly operated at the location where heat is consumed. The higher total efficiency compared with the conventional combination of a local heating system and a central power station results from the fact that the wate heat from the generation of electricity are used directly where they arise. For this reason, they are suitable for cutting primary energy requirements and reducing CO_2 emissions.

CHP plants are available in different sizes and are classified according to their electrical output.

with condensing technology

PowerBloc EG (12 - 20)

Natural gas
biogas, liquid gas

PowerBloc EGC (50)

Natural gas

without condensing technology*

PowerBloc EG (40 - 530)

Natural gas
biogas

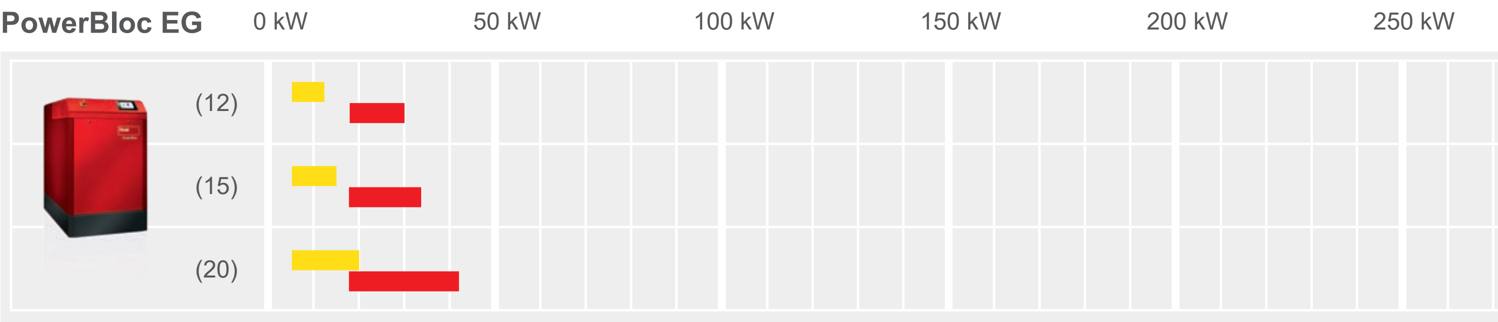
PowerBloc EG NOx (210 - 530)

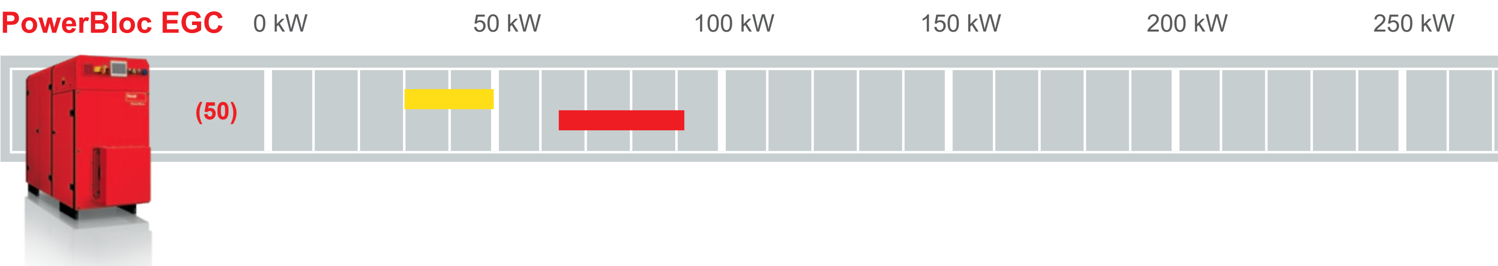
Natural gas - reduced NOx emissions

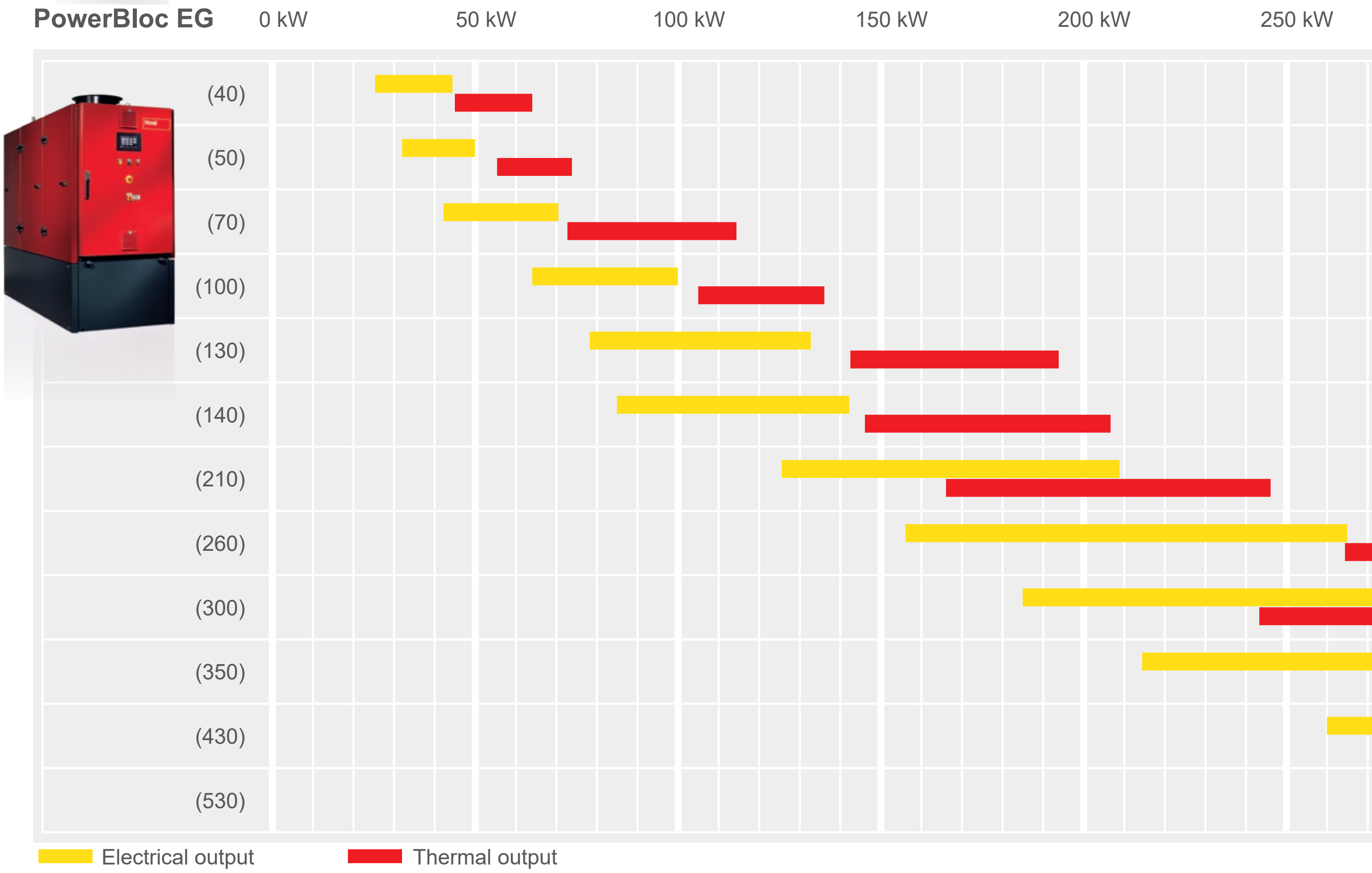
* Available as an option

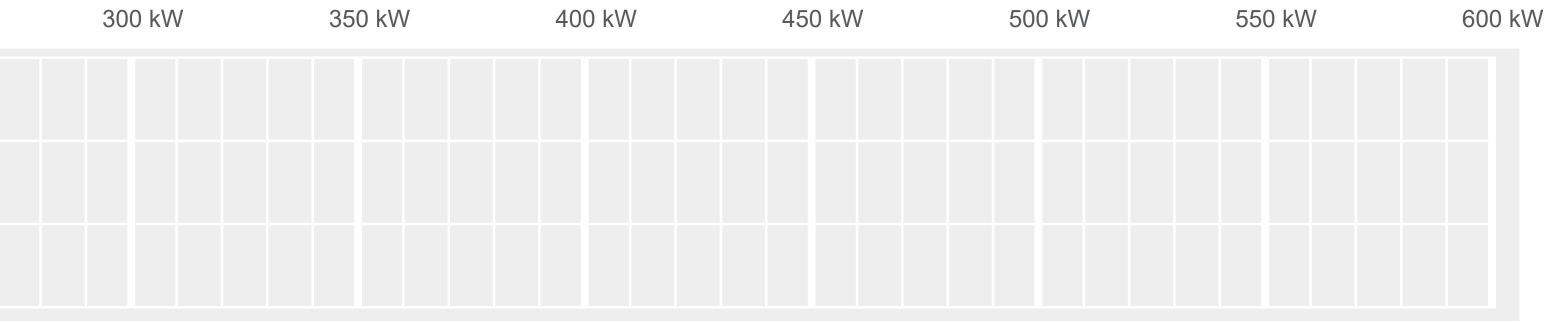
Hoval PowerBloc

A comparison of the outputs.





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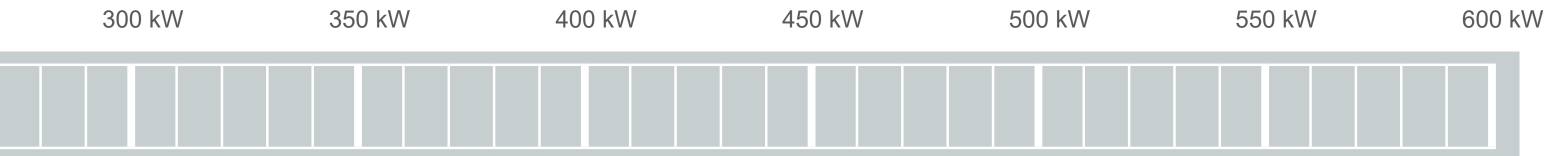
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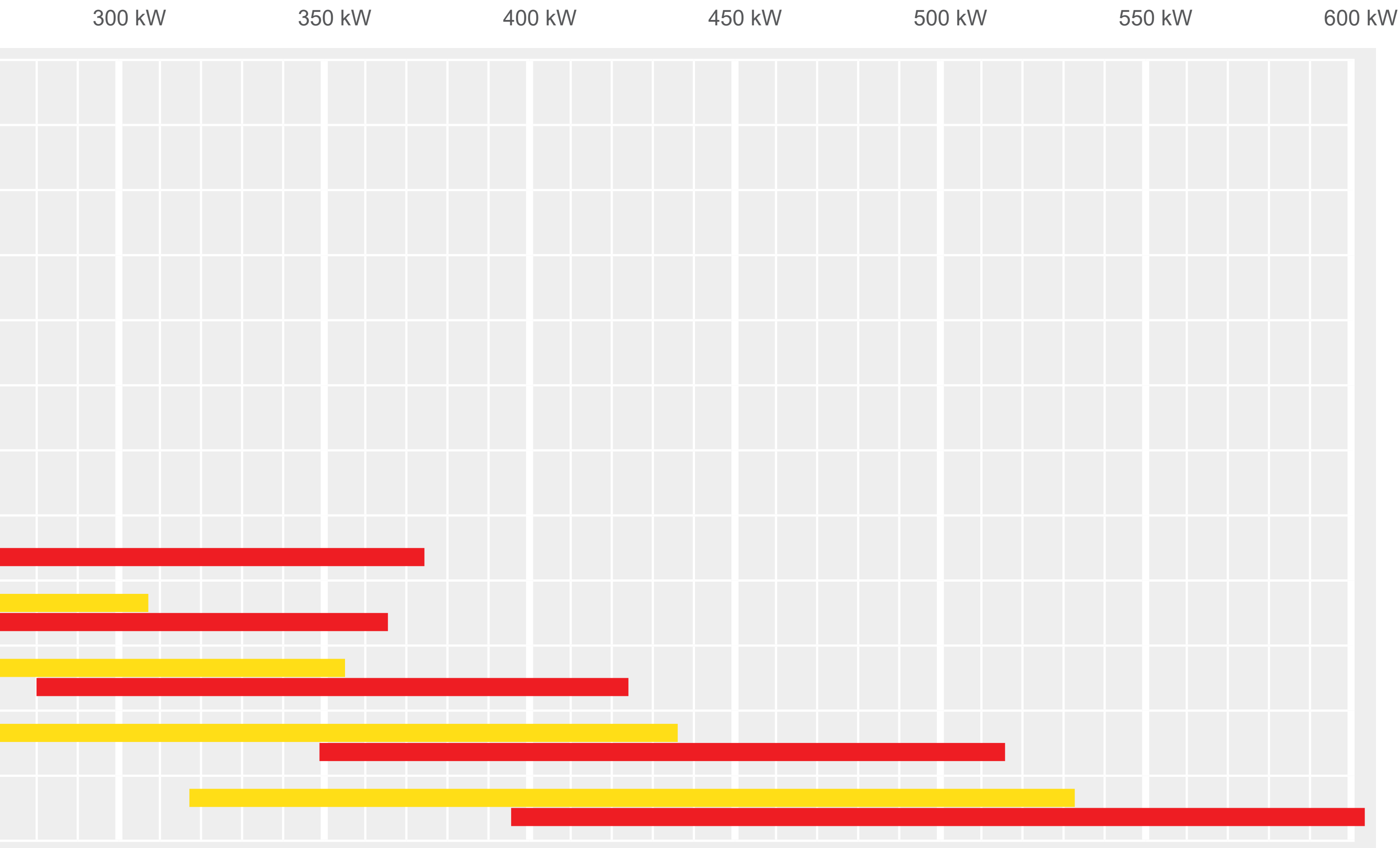
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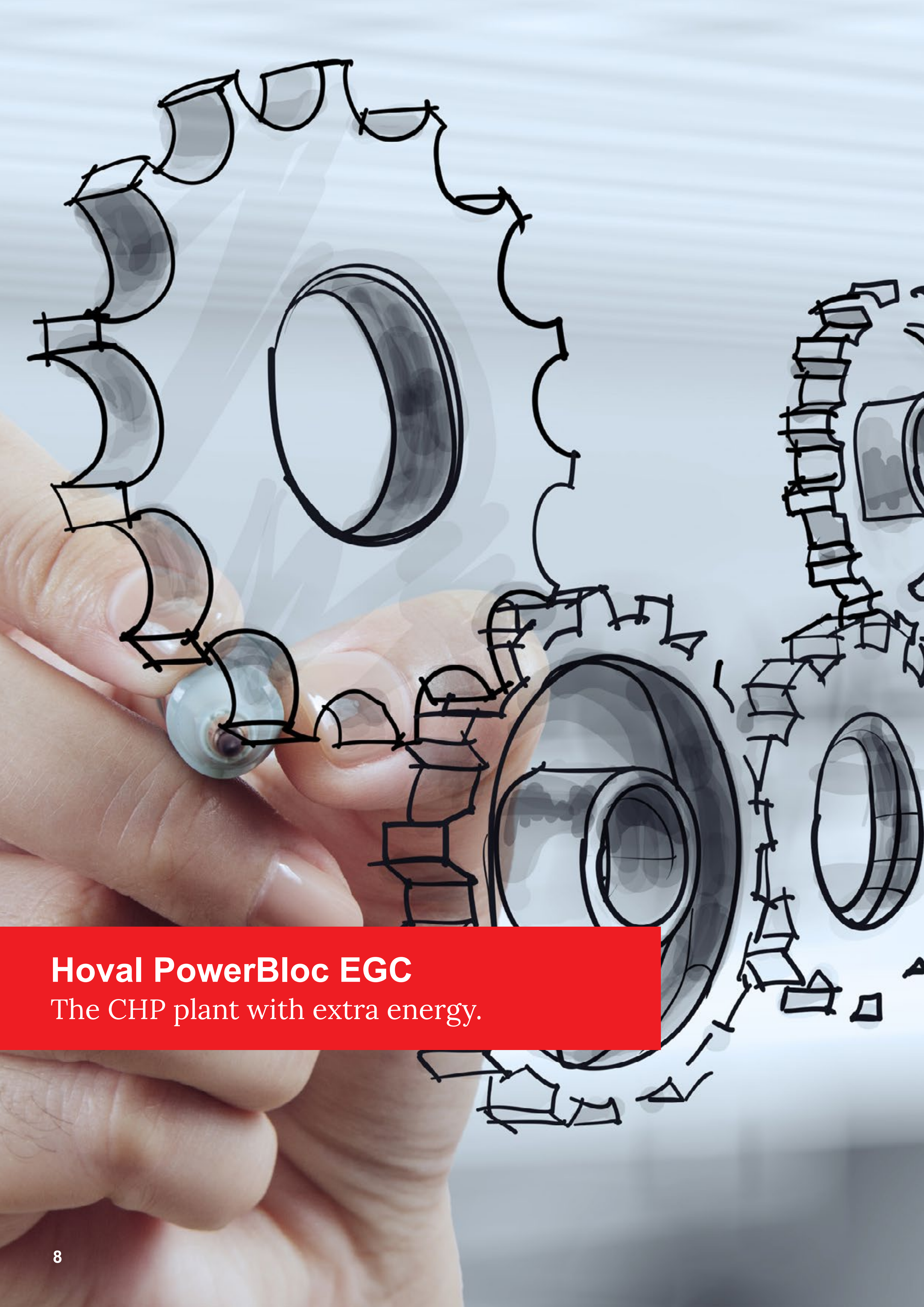


Hoval PowerBloc EGC

The CHP plant with extra energy.

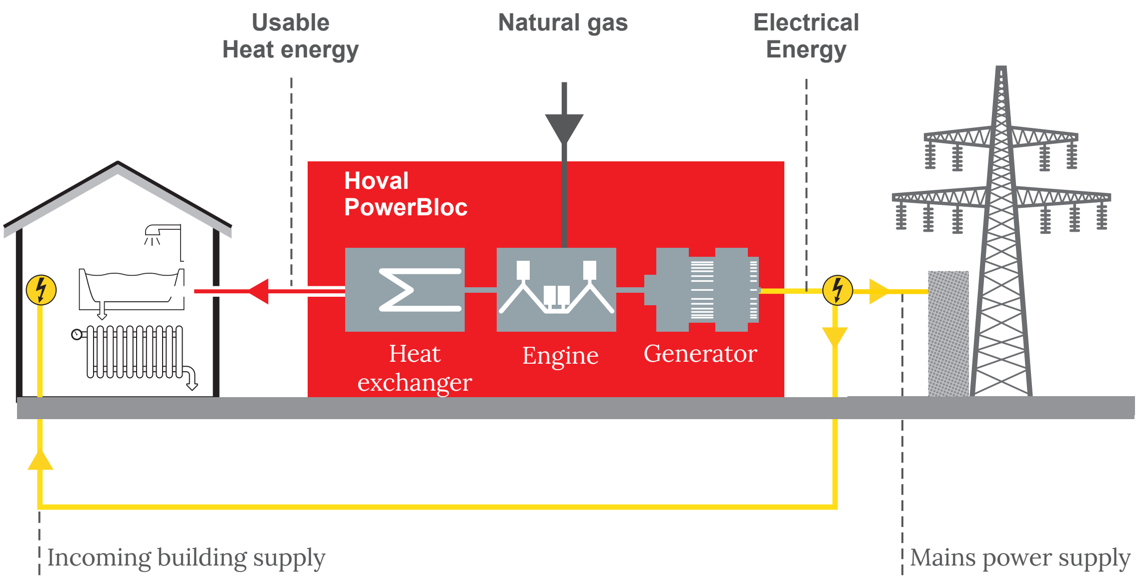
From cogeneration to CHP plant
Principle and application.

Cogeneration can be realised with a wide variety of technologies. The fundamental principle is decentralised utilisation of the (simultaneously) generated electrical power and heat. The combustion engine (e.g. engine, gas turbine) drives a generator and thus supplies the consumer load with electrical current. Gas turbines are used in particular in industrial applications, to supply low-temperature process heat (up to 500 °C), while engine plants are predominantly used to provide room heating.

A combined heat and power unit (CHP) uses the principle of cogeneration in a modular device. Thus, there is a real powerhouse concealed within the simple exterior of the PowerBloc EGC (50) combined heat and power plant. This chiefly consists of an engine that drives a generator.

The waste heat and the energy contained in the exhaust gas are removed via heat exchangers. This heat is used for heating the heating water and process water or is distributed to individual consumers via a heating network. The special feature of the PowerBloc EGC (50) is the efficient heat recovery from the exhaust gas with condensing effect. This means that it uses primary energy even more efficiently than many of its counterparts.

The electricity produced is used in the plant's own building. Excess electricity can be fed into the public utility grid. Arrangements for the feedback of electricity into the grid must be clarified in good time.



Hoval PowerBloc EGC
Heat and power with extra.

Combined heat and power (CHP) plants take advantage of cogeneration technology. From fossil fuels or biogenic gases, they simultaneously produce electrical and thermal energy directly where it is needed. In this way, a CHP plant utilises the energy involved particularly efficiently, and thus makes a valuable contribution to climate protection.

Added value for your benefit:
- Saves primary energy
- Utilisation of condensing technology integrated
- Reduces emissions
- Long service life
- Complete, ready-to-connect solution

Compact combined heat and power plant uses natural gas to generate heat and power, with condensing technology, output adaptation 60 - 100%.

Range of applications: blocks of flats, housing estates, hotels, restaurants, schools, swimming pools, health centres, commerce, industry – for new buildings and renovations.

Efficient

Combined heat and power (CHP) plants take advantage of cogeneration to generate both electricity and heat. The electricity produced is used in the plant's own building or fed into the public utility grid. This waste heat is used for heating water, for instance, or as process heat for industrial operations. This means that a CHP plant is significantly more efficient than systems without heat extraction.

By making better use of resources, the Hoval PowerBloc achieves a very high degree of primary energy utilisation, up to 95%, depending on the size of the plant, thus saving energy. Using resources wisely also means significantly reducing pollutants and carbon dioxide emissions.

A natural gas-operated PowerBloc produces almost 60% less CO_2 than would be the case with separate power and heat generation using hard coal and EL heating oil. Conventional power plants which generate electricity, such as large-scale gas-fired power stations, only achieve a primary energy efficiency of 30 to 50% compared to this. With them, a large part of the energy is lost as waste heat.

Variable

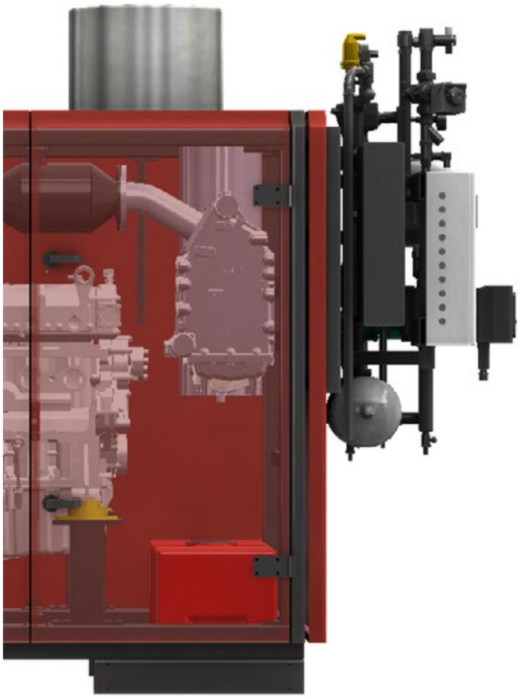
Depending on the requirements with regard to NOx and CO emissions, three different variants of 3-way catalytic converters are already available for selection when ordering the PowerBloc EGC. The selected catalytic converter is already installed and fully insulated in the CHP plant supplied.

For the reduction of sound emissions, Hoval offers further suitable silencers as accessories in addition to the built-in exhaust gas silencer.

Reliable

The PowerBloc is crammed full of proven technology. The central component is a robust, durable industrial gas-powered engine from MAN, but all the other parts are also designed to provide a long service life and stable operation.

Depending on the demand profile and with a good design, the owner of the system produces most of its electricity itself and thus achieves independence from the electricity grid.



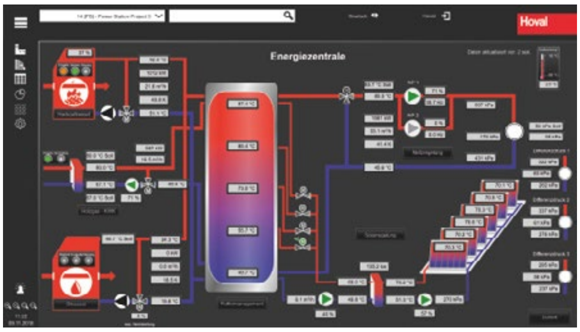
Condensing technology for extra efficiency

With return temperatures below approx. 50 °C, it is often sensible both in terms of cost effectiveness and energy use also to use the residual heat contained in the exhaust gas. For this purpose, a condensing heat exchanger is integrated in the return of the CHP plant which cools the exhaust gas below the dew point and transfers the resulting heat of condensation to the heating water.

Exclusively from Hoval

HovalSupervisor

Hoval offers software for visualising, monitoring and recording data and for optimising energy production systems and district heating networks in real time: HovalSupervisor. Ask your Hoval consultant!



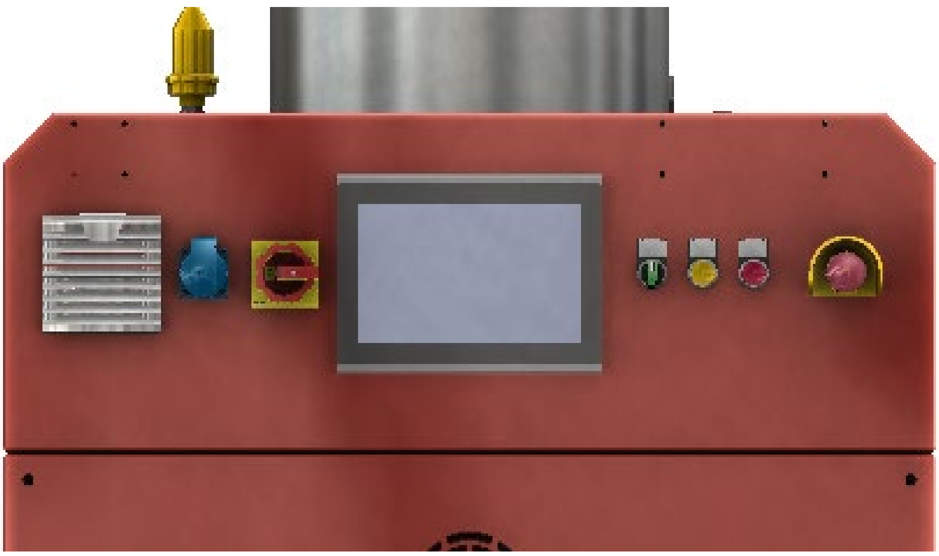
Unit control system

The module control system is designed to allow fully automatic operation without supervision. It performs all control, regulation and monitoring functions.
Its basic functions are:

- Engine control
- Engine monitoring
- Mains and generator monitoring
- Control of the exhaust purification system
- Fault message / remote data transmission
- Emergency shutdown

The control panel is located horizontally above the generator and opens via hinged doors. The cable introduction is from above.

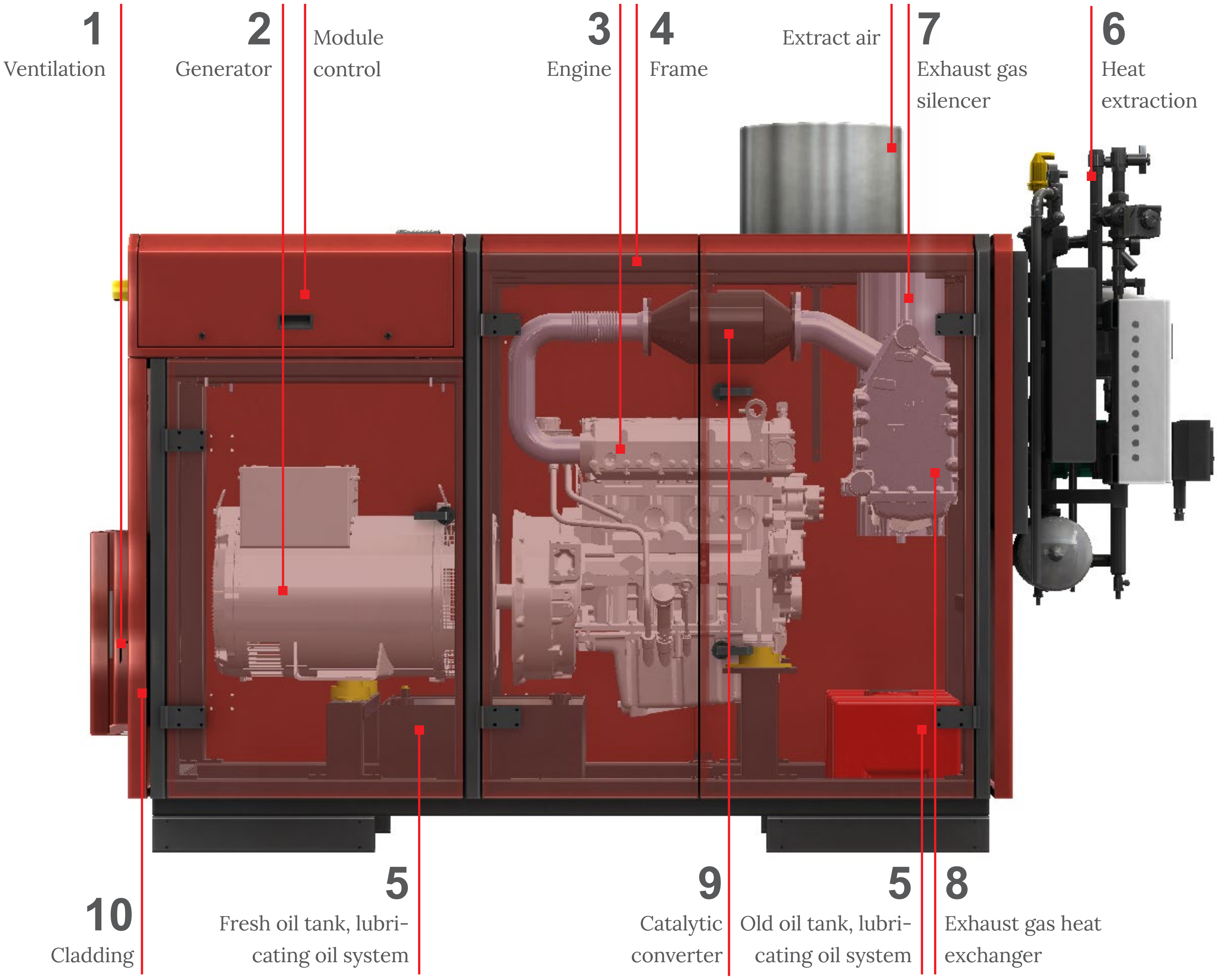
The CHP plant unit control system with generator coupling field (power section) consists of a complete modular system of acquisition and control modules, as well as a computer module for the control and regulation of the CHP system. The central processor assembly is a user-programmable PLC. The CHP plant control system realises full potential separation between the grid-generator unit and the PLC processing level. There are special signal processing assemblies for grid and generator signals upstream of the control processor for this purpose. Here, faults are filtered out, phase condition and amplitude of current and voltage signals from the grid and generator evaluated and prepared for further processing in the processor assembly.



Structure of the PowerBloc EGC (50)

Where is what?

◀ View from right

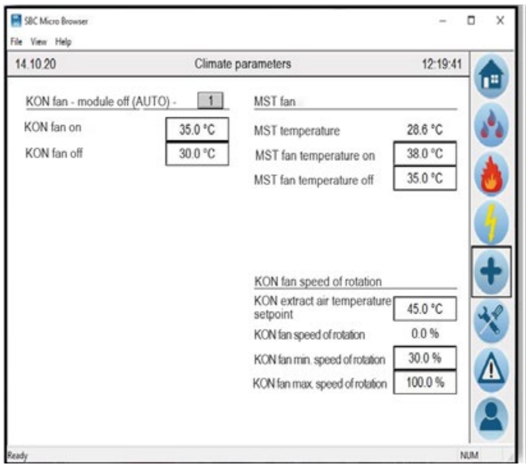


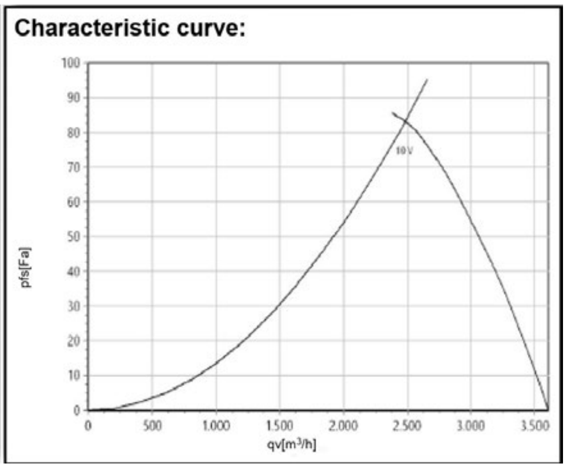
The PowerBloc EGC uses natural gas as fuel. Inside it, a gas SI engine drives a generator that produces 3-phase alternating current with a frequency of 50 Hz and a voltage of 400 V. The heat is extracted by integrated heat exchangers. Furthermore, the CHP plant is equipped with a gas control line, start device as well as an exhaust system with corresponding devices for low-emission operation. All connections such as the heating, exhaust gas, fuel supply and condensate discharge connections are routed out of the module. The aggregate is of compact design and mounted on a basic frame.

Hoval PowerBloc EGC
Components in detail.

1 Ventilation

The air is supplied via a controlled fan in the front panel. The supply air fan is covered by a supply air sound insulation hood, which also serves as protection against contact. The fan is switched on or off via two switching thresholds. The speed is controlled on the basis of the extract air temperature, which is set to 45 °C as standard. Due to the variable fan control and reduced heat radiation in the unit, the power consumption of the CHP plant is reduced by an average of 30 % compared to the standard PowerBloc EG (50), to approx. 1 kW.





► Standard ventilation structure, see chapter "PowerBloc EGC (50) and accessories"

2 Generator

Electricity is generated by a synchronous generator. This type of generator requires a synchronisation device for mains parallel operation and is therefore more complex than asynchronous generators. However, it does offer the possibility of emergency power supply operation. The voltage and the frequency can be maintained at a constant level via the regulator. This means the synchronous generator operates with cos phi regulation. Compared to an asynchronous generator, it does not require a compensation system.

3 Engine with engine cooling circuit

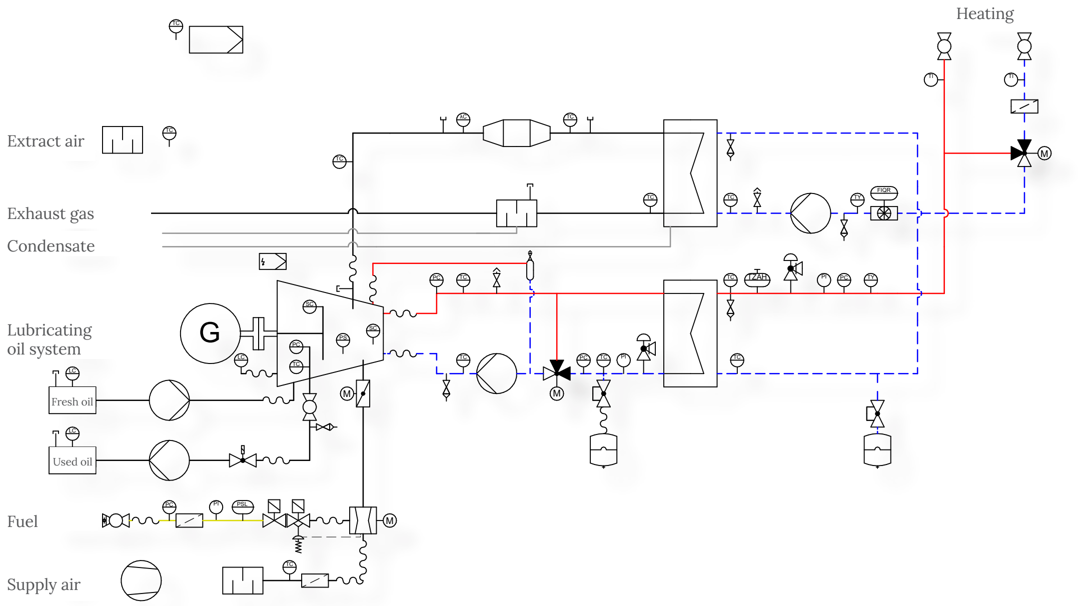
The engine is a gas SI engine. The engine emits heat which is absorbed from the lubricating oil, the engine cooling water and the exhaust gas in the so-called "inner cooling circuit" and transferred to the heating system via heat exchangers.

Engine cooling circuit

A 3-way valve for controlling the engine inlet temperature is located in the engine cooling circuit. This achieves faster heating of the engine in the start phase.

The heat extraction return flows first through the condensing heat exchanger and then through the heat exchanger of the engine cooling circuit. This cools the exhaust gas down as deeply as possible and uses the condensing effect.

The heat extraction unit is equipped without a non-return flap as standard. If parallel operation of several generators is planned, a non-return flap must be provided on site.



4 Framework construction

The aggregate is of compact design and mounted on a basic frame. This basic frame consists of a torsion-free steel construction which accommodates the engine, generator and heat exchangers and is painted in RAL 9005 (deep black).

Both the engine and generator are elastically mounted on the machine frame.
The basic frame itself must be mounted with elastic elements, vibration-free, on the on-site foundations.

5 Lubricating oil system

Fresh oil system

The CHP plant has an automatic lubricating oil supply with internal fresh oil tank and level indicator. The 100-litre fresh oil tank is located under the generator and is designed for 3000 operating hours. A pump in the oil flow line to the engine oil sump is activated via a level sensor.

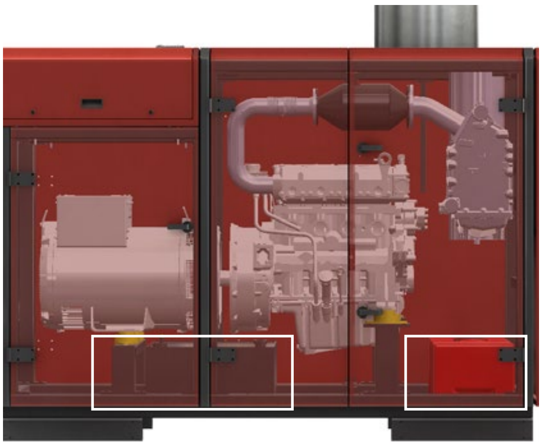
Used oil system

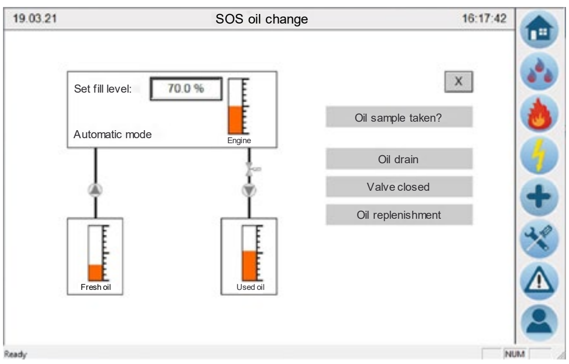
In this plant, fresh or used oil is conveyed by a pump. The oil level sensor is located directly on the engine in order to be able to detect the oil level in the engine with little delay.

In the software, an oil change can be carried out via fresh and used oil pumps.

The used oil is pumped into the used oil tank (safety shut-off at max. filling level). The tank is located under the condensing exchanger and internal modular silencer. It holds 55 litres and the accumulating used oil for 3000 operating hours. The used oil must be emptied during maintenance W4.

The fresh oil is filled up to the set quantity (here 70%) after the oil replenishment is activated.

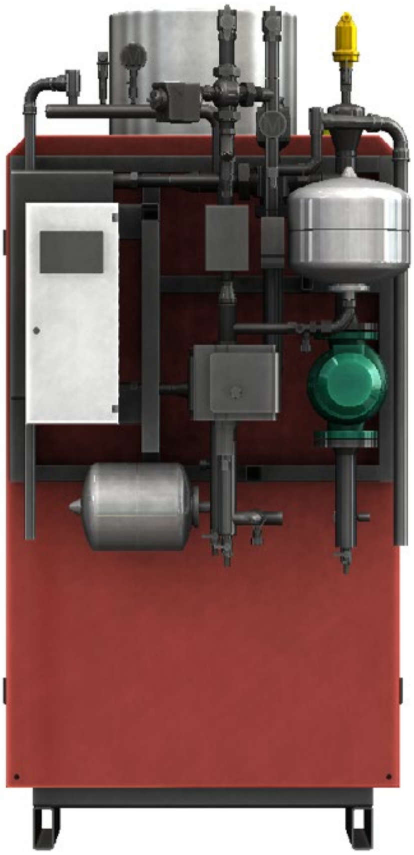




6 Heat extraction

The heat extraction unit has a space-optimised design and is mounted on a removable frame on the rear wall of the CHP plant. It has its own control box and is connected to the module control cabinet by means of a bus line and power supply.

The heat extraction is only available in pressure level PN 6 and is equipped with a 3.0 bar safety valve as standard. The standard operating temperature is 80 °C in the flow. At 60 °C in the return (no condensing effect), the flow temperature can rise to 85 °C. At a flow temperature of 87 °C and a return temperature of 65 °C, there is a safety stop.



Rear view

Exhaust system

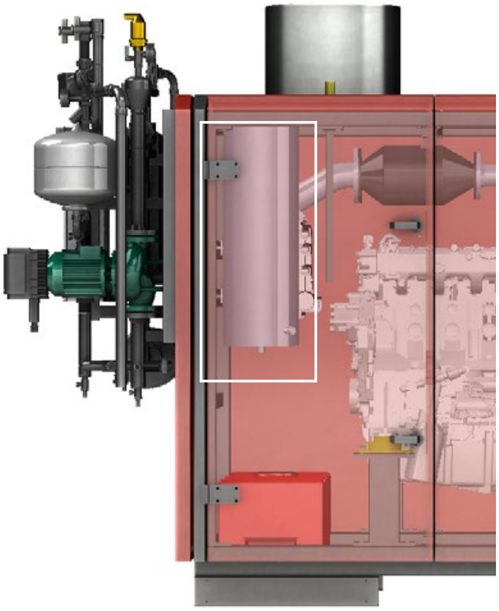
The internal exhaust system is equipped with:

- Three-way catalytic converter
- Exhaust gas heat exchanger
- Unit silencer

7 Unit silencer

The PowerBloc EGC (50) has an integrated stainless steel exhaust gas silencer. This achieves a reduction of the cumulative sound pressure level at a distance of 10 m from the exhaust gas outlet of approx. 15 dB(A), which corresponds to a residual cumulative sound level of approx. 59 dB(A) at 10 m.

Resonance silencers (RSDs) or absorption silencers (ASDs) can be used to further reduce exhaust gas sound levels. The selection depends on the residual sound pressure level to be maintained at the place of immission or on the reduction of a certain frequency. It is possible to connect several silencers in series, provided that the maximum permissible exhaust gas back pressure of the entire exhaust system is observed.

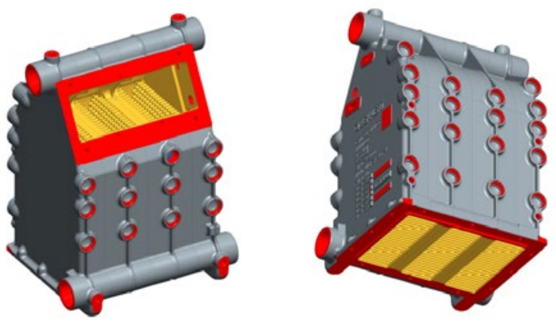


View from the left

► External exhaust gas silencer, see chapter "PowerBloc EGC (50) and accessories"

8 Exhaust gas heat exchanger

The CHP plant has a condensing exhaust gas heat exchanger made of cast aluminium and a cast aluminium sump. The condensate discharge is led from the module silencer to the rear out of the sound insulation cladding.



Condensate from the exhaust gas heat exchanger

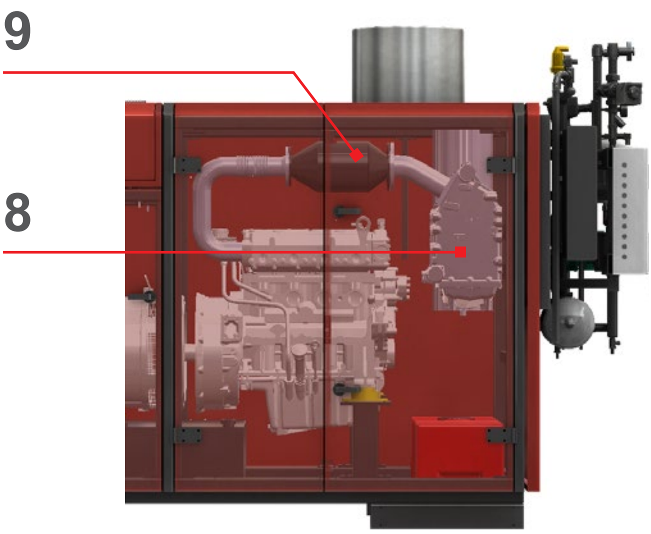
In condensing mode (return temperature 35 °C), up to 15 litres of condensate per hour are produced at full load. The condensate line is routed from the module silencer to the rear out of the sound insulation cladding. It is protected by the client against escaping exhaust gas by means of a siphon or condensate ball. In accordance with local regulations, the condensate must be treated by means of a neutralisation unit.

Operation and cleaning

In standard operation at 35 °C return temperature, the desired condensate precipitation takes place in the exhaust gas heat exchanger. This condensation has a corresponding self-cleaning effect on the exchanger surface. If the CHP plant is often not operated in the condensing range, the exchanger surfaces will consequently become clogged over the operating time.

In normal operation, the temperature difference between heat extraction return and exhaust gas temperature after the exhaust gas heat exchanger is less than 20 K. With increasing dirt build-up on the exchanger surfaces, the temperature difference increases and the heat extraction decreases. If 30 K is exceeded, the exchanger surfaces should be cleaned to increase efficiency. For this purpose, the thermal insulation and exhaust gas connection between the catalytic converter and the exhaust gas heat exchanger is removed. This gives access to the internal exchanger surfaces. The condensate drain is separated from the neutralisation unit and fed into a collection tank.

The exchanger surfaces can then be cleaned from above with steam. The water with the dissolved dirt is drained off via the condensate drain, collected in the container and disposed of. Then reinstall the exhaust gas connection (use new exhaust gas seals and screws) and reconnect the condensate drain to the neutralisation unit. During a test run, the exhaust gas section must be checked for leaks and finally the thermal insulation must be reattached.



View from right

9 Catalytic converter

Three different versions of the three-way catalytic converter can be installed to reduce emissions.

Emissions value with 5% residual oxygen

Nitrogen oxide (NOx):	Carbon monoxide (CO):
< 20 mg/m³	< 100 mg/m³
< 50 mg/m³	< 100 mg/m³
< 250 mg/m³	< 300 mg/m³

10 Cladding

The sound insulation cladding (50 mm) is equipped with side doors over the entire height of the CHP plant. This improves service accessibility to all installed components. Colour sound insulation cladding RAL 3000 (red)

Condensing technology

Condensation is the difference.

Hoval PowerBloc EGC

What is condensing technology for?

Utilisation of condensing technology

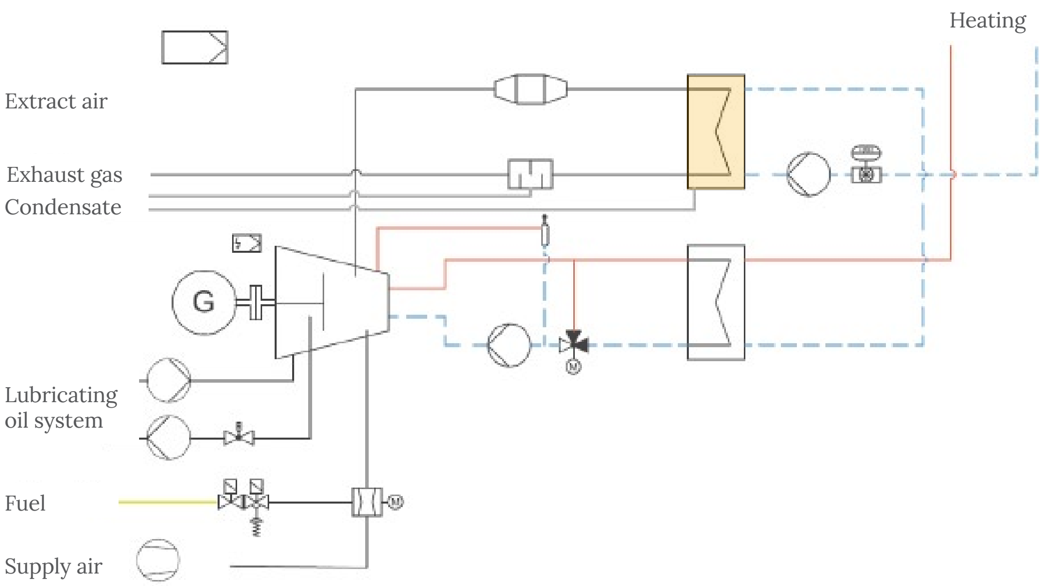
When gases and most other fuels are burned, water vapour is produced among other things. If this vapour is cooled below the dew point, the water condenses and energy is released. This energy cannot be used in conventional heating technology because the condensate produced causes the heat exchangers to corrode.
Condensing boilers are equipped with condensate-resistant heat exchangers.
With these devices, the exhaust gas can be cooled below the dew point at low heating water temperatures; this is known as using the calorific value through condensing technology.

CHP plant with condensing technology

Increasing fuel efficiency by means of combined heat and power (CHP) is primarily about tapping a previously neglected exergy potential. However, if we really want to make optimal use of the fuel, we must also consistently use another option: the full gross calorific value, i.e. in addition to the heat released directly during combustion, also what is referred to as the latent heat in the exhaust gas.
The latent heat in the exhaust gas is only released when it cools down to below the dew point of water vapour. This amounts to 11% of the lower net calorific value for natural gas, 6% for heating oil and approx. 8% for pellets. The water vapour contained in the exhaust gas condenses out and condensation heat is generated.

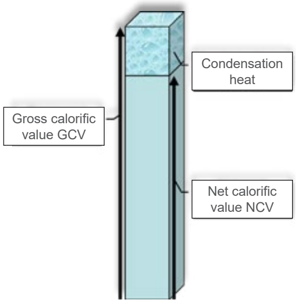
Use of condensing technology to improve efficiency

With particularly low return temperatures (below approx. 45/50 °C), it is often sensible both in terms of cost effectiveness and energy use also to use the residual heat contained in the exhaust gas.
For this purpose, a condensing exchanger is integrated which cools the exhaust gas (or in the case of a CHP plant return, the exhaust gas) below the dew point and transfers the resulting condensation heat to the heating water.
The additional heat yield is up to approx. 15% of the regular thermal output of the CHP plant and can increase the overall efficiency by several percentage points. In addition to the return temperatures and the exhaust gas back pressure, the space requirement must also be taken into account for downstream exhaust gas heat exchangers.



Gross calorific value

The gross calorific value GCV (or upper heating value Ho) is a measure of the specific thermal energy contained in a substance per unit of measurement. The gross calorific value of a fuel indicates the amount of heat released during combustion and subsequent cooling of the combustion gases to 25 °C and their condensation.



Net calorific value

The net calorific value NCV (formerly lower heating value Hu) is the maximum amount of heat that can be used during combustion, at which condensation of the water vapour contained in the exhaust gas does not occur, related to the amount of fuel used. The net calorific value is therefore the measure of the specific usable heat quantity without condensation heat, depending on the unit of measurement.

Example for performance data
Related to gross calorific value

Performance data		PowerBloc EG (12)	PowerBloc EG (15)	PowerBloc EG (20)
Pel.	kW	5 - 12	5 - 15	5 - 20
Pth.	kW	21 - 28	21 - 33	21 - 40
Qn.	kW	25 - 43	25 - 51	25 - 63
η (el.)	%	28	29	32
η (th.)	%	65	65	64
η (total)	%	93	94	96

Related to net calorific value

Performance data		PowerBloc EG (12)	PowerBloc EG (15)	PowerBloc EG (20)
Pel.	kW	5 - 12	5 - 15	5 - 20
Pth.	kW	18 - 30	18 - 34	18 - 42
Qn.	kW	24 - 40	24 - 48	24 - 60
η (el.)	%	30	32	33.3
η (th.)	%	72	70	70
η (total)	%	102	102	103.3

Net calorific value/gross calorific value conversion factors

According to German EnEV

Fuel	Gross calorific value > net calorific value	Net calorific value > gross calorific value
Heating oil	0.943	1.06
Natural gas	0.901	1.11
Liquid gas	0.917	1.09

The gross calorific value takes into account both the energy required to heat the combustion air and the exhaust gases and the heat of evaporation or condensation of liquids, especially water.
In contrast to the gross calorific value, the net calorific value refers to the amount of heat that is released during combustion and subsequent cooling to the initial temperature of the combustible mixture, in which case the combustion water is still present in the form of vapour.
The net calorific value of water-rich fuels is therefore significantly lower than their gross calorific value by the amount of the enthalpy of evaporation of the water vapour present.

Condensate-resistant heat exchangers are used for the technical energy utilisation of the gross calorific value, i.e. the energy content of the fuel used or of waste gases from production containing water vapour. Examples of materials are stainless steel, glass, plastics, etc.
Condensing boilers also use the condensation heat (= latent heat) of the water vapour (and to a lesser extent other vapours) contained in the exhaust gas to provide heat, unlike conventional boilers, which lose about 11% of latent heat (= condensation heat) when burning gas and about 6% when burning EL fuel oil.

Liquid fuels (at 25 °C)

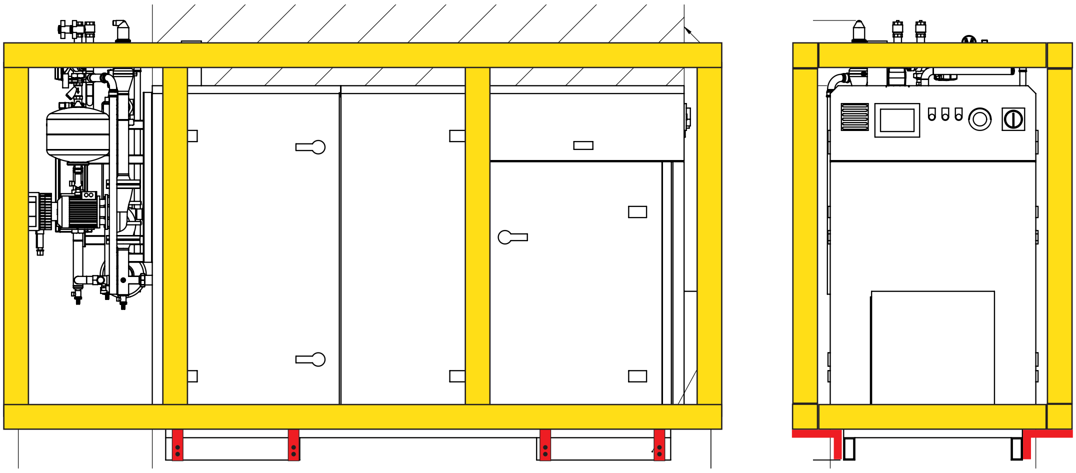
Fuel	Gross calorific value (MJ/kg)	Net calorific value (MJ/kg)	Net calorific value (kWh/kg)	Density (kg/dm^3)
Petrol	42.7 - 44.2	40.1 - 41.8	11.1 - 11.6	0.720 - 0.775
Ethanol	29.7	26.8	7.4	0.7894
Methanol	22.7	19.9	5.5	0.7869
Heating oil	45.4	42.6	11.8	0.820 - 0.845
Heating oil S	41.5	39.5	11.0	0.96 - 0.99

Gaseous fuels (at 25 °C)

Fuel	Gross calorific value (MJ/kg)	Net calorific value (MJ/kg)	Gross calorific value (MJ/m^3)	Net calorific value (MJ/m^3)	Net calorific value (kWh/m^3)
Hydrogen	141,800	119,972	12,745	10,783	2,995
Carbon monoxide	10,103	10,103	12,633	12,633	3,509
Natural gas	36 - 50	32 - 45	35 - 46	31 - 41	8.6 - 11.4
Methane	55,498	50,013	39,819	35,883	9,968
Propane	50,345	46,354	101,242	93,215	25,893

Technical details

Dimensions and more.



Packaging

A frame construction made of wooden sections is used as transport protection. For easy assembly, this is attached to the base frame via steel brackets (red) in holes already provided. Support from the wooden frame to the upper area of the CHP plant is provided by means of a pressure-resistant packing material against the exposed steel frame, to which the doors of the sound insulation cladding are attached.
A lift truck or forklift truck should be driven under the CHP plant for transport, and the plant lifted at the steel frame without putting any load on the wooden frame.

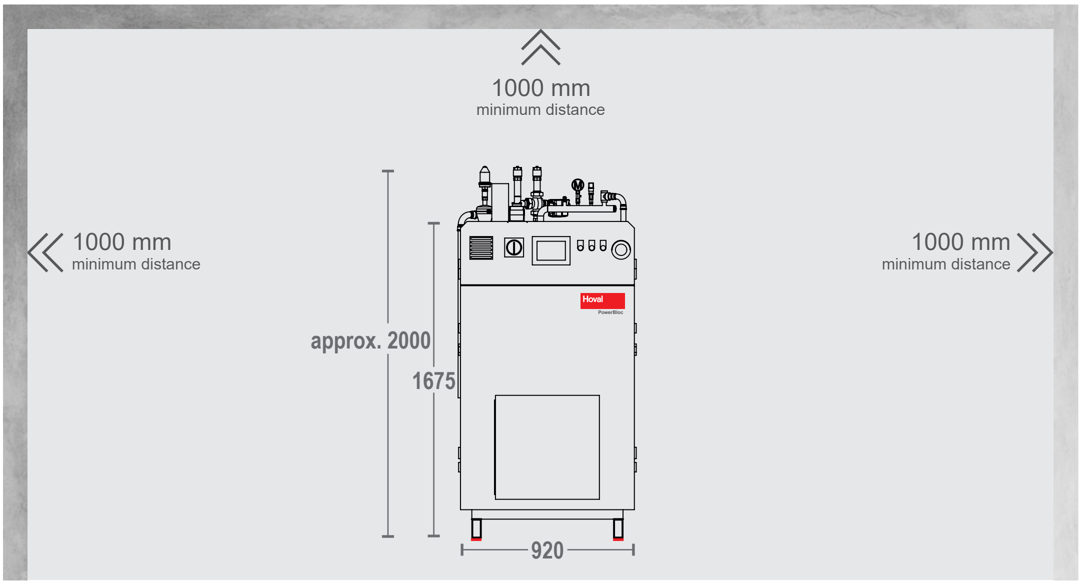
Frame and transport

The plant stands on legs made of 100*50 mm rectangular steel tubing and can be moved by means of a long lift truck for 2.5 tonnes. Alternatively, two lift trucks (1x short front and 1x long rear) can be used simultaneously.

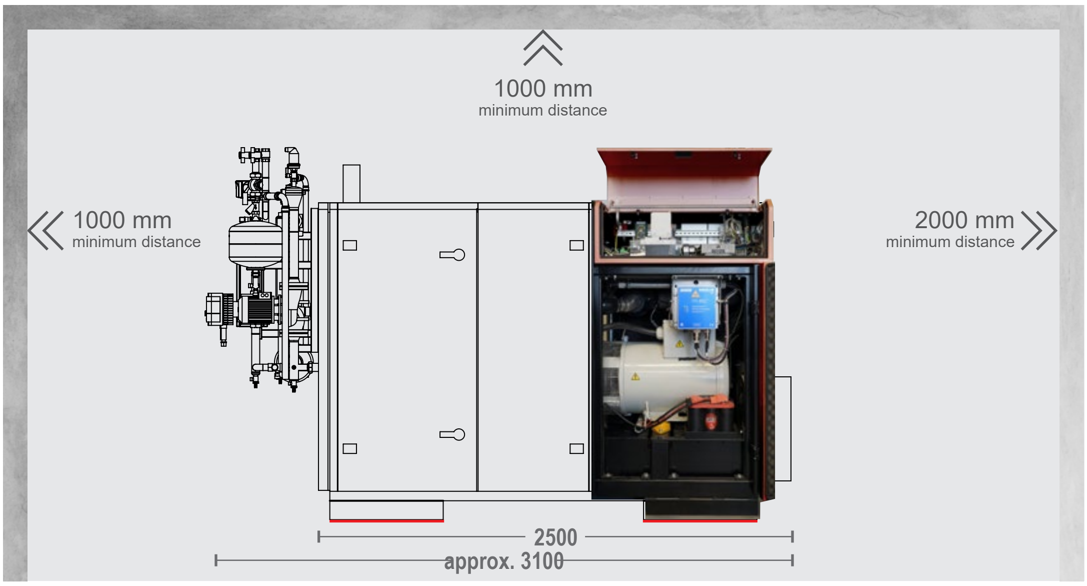
Care must be taken to ensure that the CHP plant is lifted evenly centred over the centre of gravity without any risk of tipping over. It is generally important to ensure that the surrounding frame is load-bearing. The welded sheet metal sump serves as a collection trough for the operating medium in the event of a malfunction and must not be subjected to any load from either below or above.

Hoval PowerBloc EGC
Technical data.

Front view



View from the left



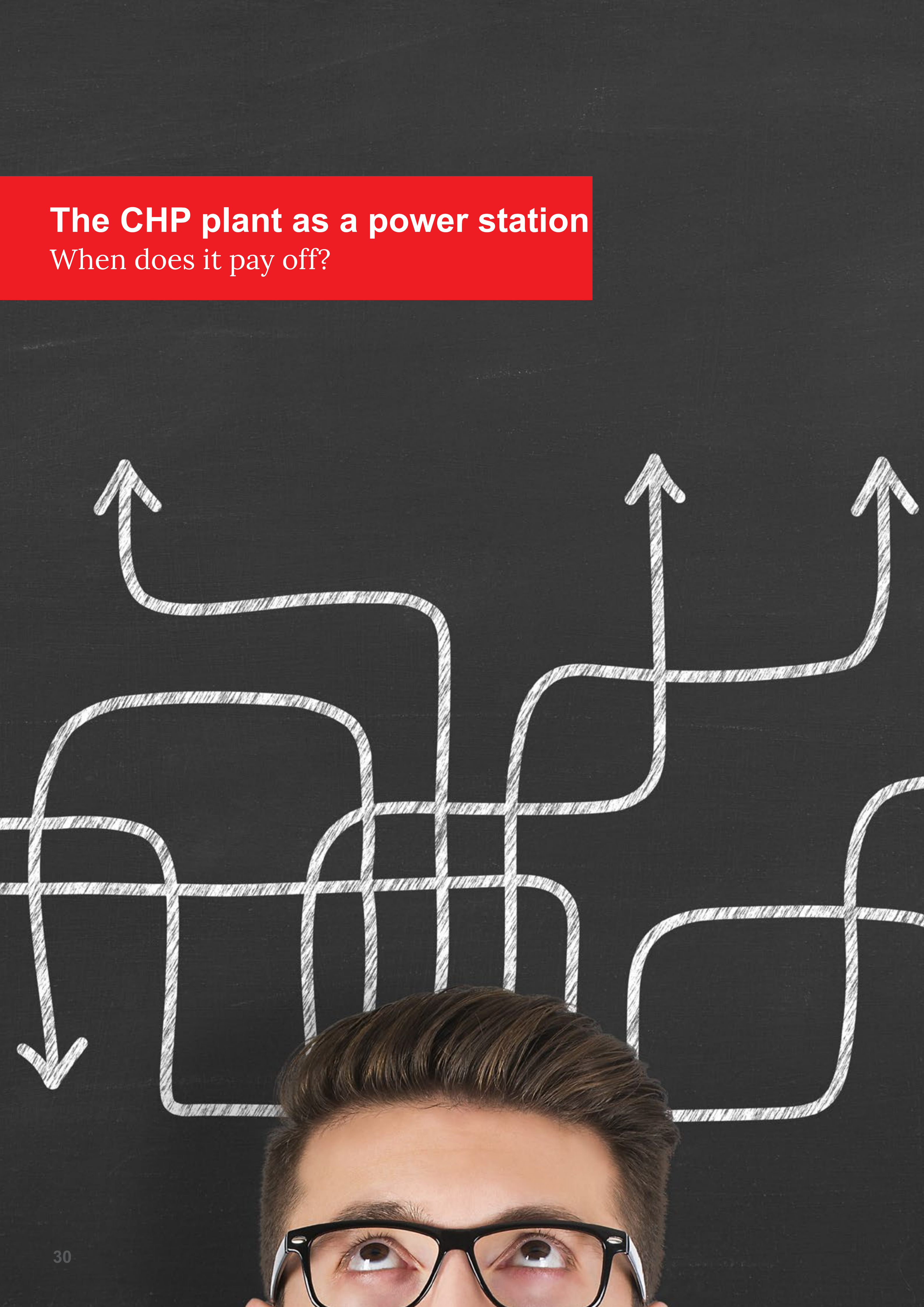
Load		100 %	80 %	60 %
Electrical output	kW	50	40	30
Thermal output at 35 °C RT	kW	91	75	64
Fuel input	kW	146	121	97
Electrical efficiency Hi	%	34.3	33.0	30.9
Thermal efficiency Hi at 35 °C RT	%	62.3	62.0	66.0
Total efficiency Hi at 35 °C RT	%	96.6	95.0	96.9
Current coefficient		0.55	0.53	0.47

Exhaust gas emissions (at 5% O2) mg/Nm³ CO < 300 / NOx < 250 / HCHO < 5

Set-up and foundation

In the standard case, the Sylomer strips supplied provide vibration and structure-borne sound decoupling from the installation site. For increased requirements for structure-borne sound decoupling, vibration dampers can be used, which are to be secured against slipping under the supporting frame. In sound-sensitive locations, the CHP plant must be installed on a foundation that is decoupled from the building.

The CHP plant as a power station
When does it pay off?



Deployment possibilities

Combined heat and power plants are suitable for decentralised energy supply of both new and renovated buildings.

- Medium-sized and large residential buildings
- Housing estates
- Retirement and care homes
- Hospitals
- Schools, sports halls, swimming baths
- Industrial and commercial buildings
- Data processing centres and office buildings

Specially designed for low-temperature applications

- Energy network with condensing boiler for peak coverage
- Local heating networks with low temperature level return 35-50 °C and flow 65-80 °C
- Office buildings, care homes and industry with underfloor heating
- Process heat applications with a high temperature difference e.g. between return 35 °C and flow 80 °C (25 - 45 K).
- Project-specific with additional extract air heat utilisation to further increase efficiency

Notes

When converting to a CHP plant, it is usually possible to continue using the existing installations after making just a few minor modifications. The temperature level of the heat consumers and the CHP plant must be co-ordinated.
The simultaneous generation of energy (in the form of both electricity and heat) by a CHP plant must be noted. Summertime operation must be taken into consideration during configuration.

Dimensioning aid

Assessment based on fuel consumption

- The amount of fuel consumed per year offers an initial indication of the optimum size
- Property with centralised water heating
- Selection example:

With an annual gas consumption of 120,000 m³, the optimum CHP module will have an electrical output of approx. 45 kW

	Fuel requirement Annually [m³/a]	Boiler output [kW]	Power generation Annually [kWh/a]	Optimum CHP plant output [kWel]
1	60,000	270	120,000	20
2	80,000	360	150,000	25
3	100,000	450	200,000	40
▶ 4	120,000	540	240,000	45
5	140,000	630	280,000	45
6	160,000	720	320,000	50
7	180,000	810	360,000	63
8	200,000	900	400,000	70
9	220,000	1000	440,000	70
10	240,000	1080	480,000	90
11	260,000	1180	520,000	104
12	280,000	1270	560,000	104
13	300,000	1350	600,000	104
14	350,000	1590	700,000	140
15	400,000	1800	800,000	140
16	500,000	2250	1,000,000	140

The distribution of output over several small units means:

+ Good power adjustment (high number of operating hours, economical in partial load operation)
+ High availability in the event of failure of an aggregate or during maintenance work.
- Relatively high investment costs
- Higher maintenance and installation effort

Supplying power with one large unit means:

- Usually insufficient power adjustment in partial load operation
- No availability in the event of failure
+ Lower investment costs
+ Lower maintenance and installation effort

Design

The design, i.e. the determination of the size of a CHP plant, starts with the demand structure of the building in question with regard to thermal and electrical energy. There are thus basically two ways of determining the size of a CHP plant:

- According to the level and structure of the heat demand
- According to the level and structure of the electric power consumption

Heat demand

The fuels used in the CHP plant are utilised to the maximum possible extent if the thermal output of the CHP plant is designed according to the level and structure of the heat demand of a building. The CHP plant only runs when heat is required. The simultaneously generated electricity is used in the building, sold or fed into the public grid. Only in these cases can the CHP achieve the technically possible overall efficiency.

Power demand

Establishing the dimensions according to the electrical power is carried out on an individual basis. It is useful in cases where there is a high electrical power requirement that is more expensive to pay for and where the heat generated at the same time can also be used.

Typical buildings	Thermal CHP plant output relative to the max. heat demand
Retirement homes, hospitals, clinics, Swimming pools	30 – 40 %
Hotels	20 – 30 %
Schools with sports halls, Restaurant/catering establishment	10 – 15 %
Administrative buildings (with cooling)	10% (up to 40%)
Multiple dwelling units	15 – 30 %

Fuel requirement instead of heat demand

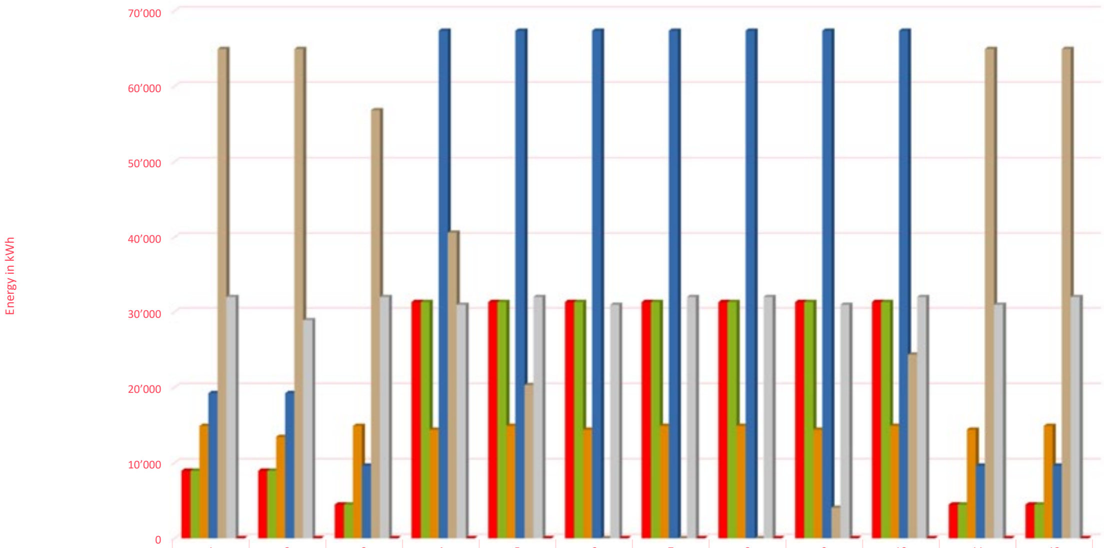
If the maximum heat demand is not available, the maximum fuel demand can be used. However, this must be multiplied by the degree of utilisation of the heat provided, in order to arrive at the maximum heat demand.

Operating time and structure

Apart from the size of a planned CHP plant, its operating time and thus the amount of heat and electricity supplied is also of interest. Only then can an economic efficiency forecast be made. Once the operating time of the CHP plant has been determined, the structure of the electric power consumption has to be compared with the electricity production of the CHP plant. Only then can the energy balance for heat and electricity be established.

For the profitability analysis, the annual shares of substituted and fed-in CHP electricity and the remaining electricity consumption must be determined. It is therefore important to know how much electricity is purchased at what times.

Energy distribution



	1	2	3	4	5	6	7	8	9	10	11	12
Electrical (production)	8'943	8'943	4'471	31'334	31'334	31'334	31'334	31'334	31'334	31'334	4'471	4'471
Electrical energy consumption	8'943	8'943	4'471	31'334	31'334	31'334	31'334	31'334	31'334	31'334	4'471	4'471
Capacity CHP plant el.	14'880	13'440	14'880	14'400	14'880	14'400	14'880	14'880	14'400	14'880	14'400	14'880
Thermal (production)	19'227	19'227	9'612	67'368	67'368	67'368	67'368	67'368	67'368	67'368	9'612	9'612
Heat energy consumption	64'923	64'923	56'808	40'577	20'289	0	0	0	4'058	24'346	64'923	64'923
Capacity CHP plant th.	31'992	28'896	31'992	30'960	31'992	30'960	31'992	31'992	30'960	31'992	30'960	31'992
Yield PV - plant el.	0	0	0	0	0	0	0	0	0	0	0	0

Months

Conclusion

A CHP is plant is "a heating system that earns its money". It generates heat while at the same time supplying electricity that can be used by the producer itself or fed into the public grid, so it makes doubly effective use of the fuel used.

However, whether a CHP plant pays off in the long term is strongly determined by whether the selected CHP plant fits as closely as possible to the energy needs of a building and its use. How quickly a CHP plant pays for itself largely depends on how well it is dimensioned to meet demand. On the one hand, a CHP plant should of course cover a significant part of the energy demand, but on the other hand it should not be oversized so as not to require unnecessarily high acquisition costs and to avoid unproductive downtimes.

Hoval SystemCalculator

The decision on a major investment is usually based on reliable data. Which energy source should be used? What are the requirements in everyday operation?

Enter your consumption data in the Hoval SystemCalculator software and put together your desired plant. The result you receive is an economic statement about the plant and an ecological assessment.
The cost effectiveness of various system combinations can be compared by means of variant management. Both the system price and an economic assessment over the system's service life are taken into account. Direct energy and cost comparisons of different energy systems.

Added value for your benefit:

- Cost effectiveness reliably calculated
- Profit and loss calculation
- Unique variant management
- Ecological evaluation

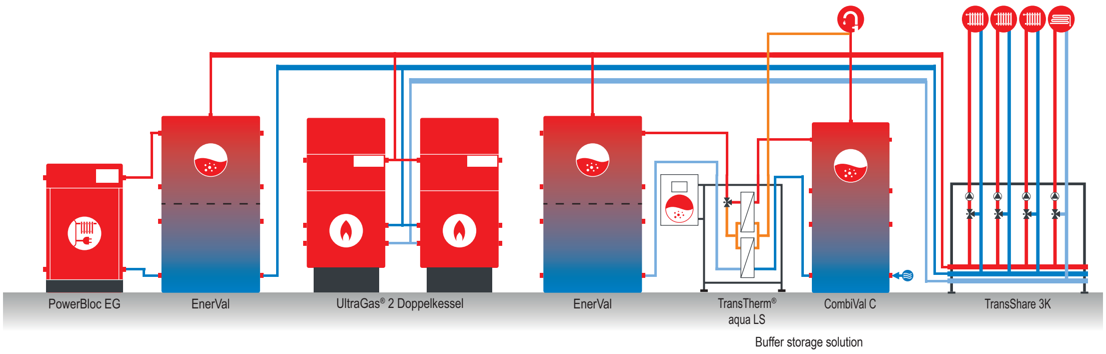
PowerBloc EGC in the system

Planning as a guarantee of success.

Reliable system for electricity and heat with high hygiene standard for hot water.

For further information about UltraGas® 2, see UltraGas® 2 Factbook

A combined heat and power plant meets up to 70% of the base heat requirement. The simultaneously generated electricity can be used in the building or fed into the public grid.
The additional heat required is generated by a gas condensing boiler. If a double boiler system is installed for this purpose, the heat can be provided even more efficiently and even more attuned to demand. Even in the event of a heat generator failure, the heat supply is ensured. The fresh water is heated to the desired temperature via a storage tank charging system and made available for a demand of relatively large quantities of water in a domestic water storage tank.



Careful planning and clear concepts are a precondition for designing a CHP plant and its efficiency.

CHP plant in the system

On the heat side, the CHP plant is operated in parallel with a boiler. Both heat generators are connected to the heating system, domestic hot water heating or other heat consumers such as a swimming pool.

Depending on the consumption profile of the building, the use of a heating water buffer storage tank can make sense in order to enable the longest possible and uninterrupted operating times of the CHP plant.

On the electricity side, the first priority is to cover the building's own consumption. If there is no longer a consumer there, the electricity is fed into the public grid and billed.

Configuration for heat-regulated CHP plants

This is based on the annual load curve of the **heat requirement**. This shows how for many hours a year a specific heat output is required. The daily load curve of electricity demand is calculated in order to estimate the simultaneous power and heat demand.

Rule of thumb for economic operation: the CHP plant should cover approx. 10 to 20% of the total energy demand and should reach at least 3500 operating hours at full capacity per year. The residual heat demand is covered with peak load boilers in bivalent operation.

Operating modes

Heat-regulated

In a heat-regulated CHP plant, the output is regulated according to the local heat demand. Depending on the demand, individual aggregates are connected or disconnected through regulation of the heat output.
In configurations with only one aggregate, the power output of this aggregate is curbed accordingly. As far as possible, the electrical power generated by such plants is used on site; the surplus power is fed into the public grid and billed accordingly.

Current-regulated

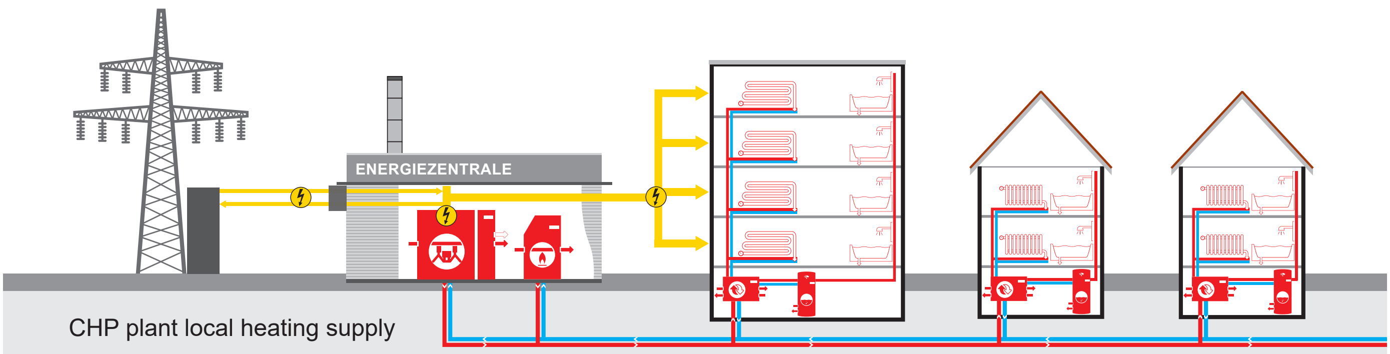
In the case of a current-regulated CHP plant, the power output is regulated according to the power requirement. The heat which cannot be used during this period is buffered in a buffer storage tank or emitted into the surrounding area as waste heat, although this reduces the efficiency. This operating mode is often found in island grids, that is, in electricity networks separate from the public grid.

Grid-regulated operation

If the output level is specified by a central unit for multiple systems, this is referred to as a grid-regulated CHP plant. The central unit optimises the scheduling of the decentralised units across the system based on economic constraints such as common gas and residual electricity procurement contracts. As in current-regulated operation, a storage medium must be incorporated in the system to allow for a time lag between heat generation and load.

Combined operating mode

In the combined operating mode, the unit is selected when both the heat demand and the electrical energy requirement are sufficiently high. The lower demand is taken as the maximum output value, ensuring that both energy types (heat and power) are used. The use of a buffer storage tank is recommended here, in order to achieve a longer unit operating time when electrical power is required and in order to avoid high cycle rates.



Hydraulics
The operating mode for integration into the power supply must be clarified.
Precise co-ordination between consumers and generator as well as between the individual heat generators, allowing for long operating times and a high number of operating hours at full capacity, is a major factor influencing cost effectiveness.

Buffer storage tank
Depending on the plant concept, a buffer storage tank may be required for hydraulic integration. However, heat extraction by means of a buffer storage tank is recommended. The storage tank volume must be selected in accordance with the engine operating time. The engine operating time should be at least one hour.

Gas connection
Hoval must be consulted without fail with regard to the exact gas quality required for operation with one CHP plant.
A shut-off valve must be installed upstream of every CHP plant. Should local regulations or conditions require it, an approved gas filter must be installed in the gas supply line, between gas valve and CHP plant, to prevent malfunctions caused by dirt particles in the gas.

Imbalanced load from the power system (parallel mains operation/emergency power supply)
According to the applicable guidelines, the loads of the building electrical system must be evenly distributed over all external phases of the electrical circuit. If this is not done, an imbalanced load occurs between the phases, which means that the outer conductors are loaded differently by the local consumers.

If a CHP plant is connected to this system, it measures the currents of each phase. This means imbalanced loads are also detected and monitored. The imbalanced load (differential current) is not allowed to exceed 15% in order to protect the generator. Greater load imbalances can overheat the generator, leading to automatic deactivation by a safety stop of the CHP plant (triggering time 10 s if the differential current is exceeded by more than 15%).

If imbalanced loads are detected in the local power system, the building system must be checked and the loads causing the imbalance must be connected to the power system in such a way that the imbalanced loading of the phases is avoided.

Partial load operation
For partial load operation, the following should be considered:
Load profile - conditions/limitations
- > 60% of nominal load:
  Generally, no limitations.
- > 30% and < 60% of nominal load:
  Max. 300 h/a, thereof max. 5 h at a time.
  Determination of oil lifetime on the basis of oil analyses (in accordance with operating manual/TUC 13.036).A reduced oil lifetime must be expected.
- < 30% of nominal load
  To be avoided in general. Possible for a short time (max. 5 minutes).

At low load profiles < 30%, there is an increased condensate accumulation in the oil system. This accelerates the ageing of the oil. To ensure complete combustion and avoid deposits in the combustion chamber, the ignition system control must be adapted according to the load profile. It must be ensured that the emissions in accordance with the country-specific atmospheric pollution prevention regulations are complied with at each load point. Please consider this in your maintenance schedule.
After each partial load phase < 60%, the engine must be operated at nominal load (100%) for at least 1 h.

PowerBloc EGC and more

Accessories and connections.

Hoval accessories
from the price list

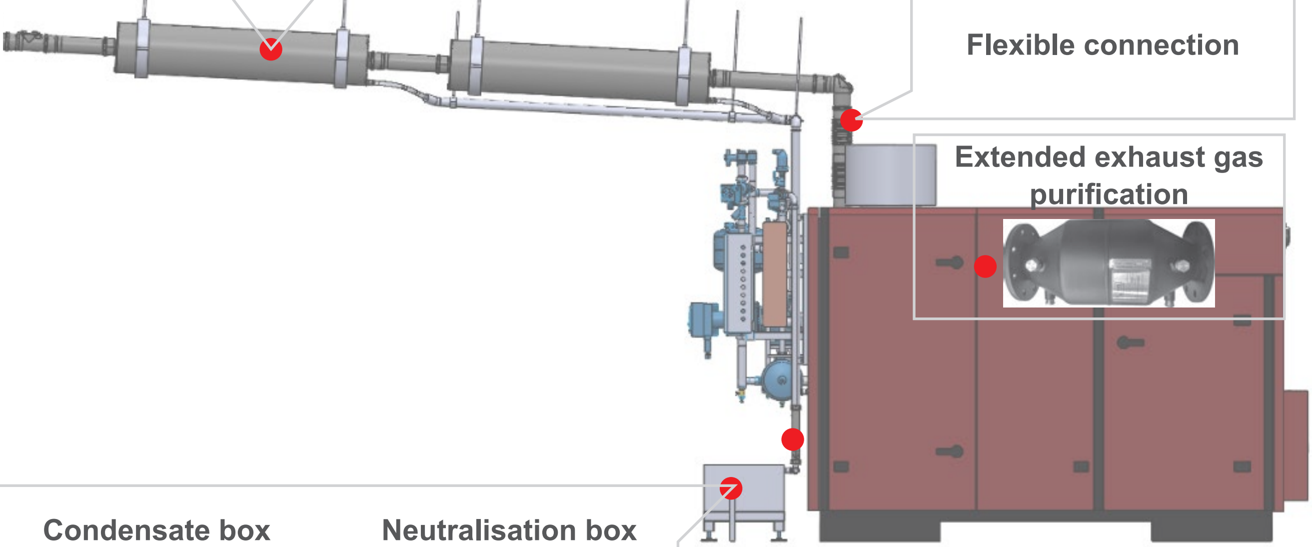
Silencer

Fastening set for silencer

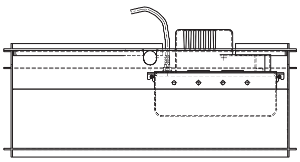
Siphon for silencer

Flexible connection

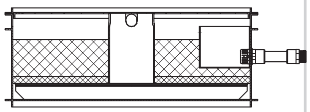
Extended exhaust gas purification



Condensate box



Neutralisation box



Neutralisation granulate

Condensate ball float

Safety devices

Smoke detector

Gas warning system

Oil/water warning device

Warning signal horn and light

Supply air, exhaust gas and noise
What and how.

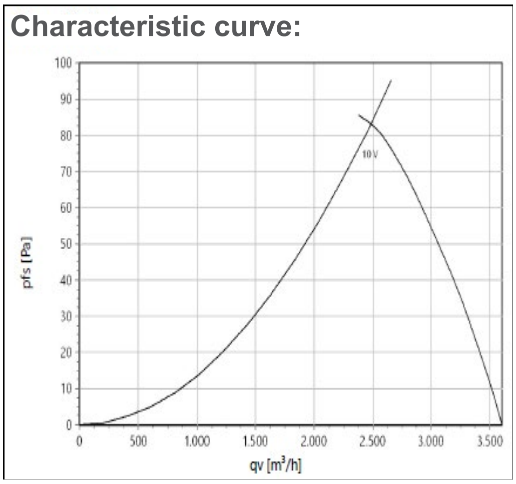
Supply air
The combustion air supply must be guaranteed. Ensure that the air intake cannot be closed or blocked.

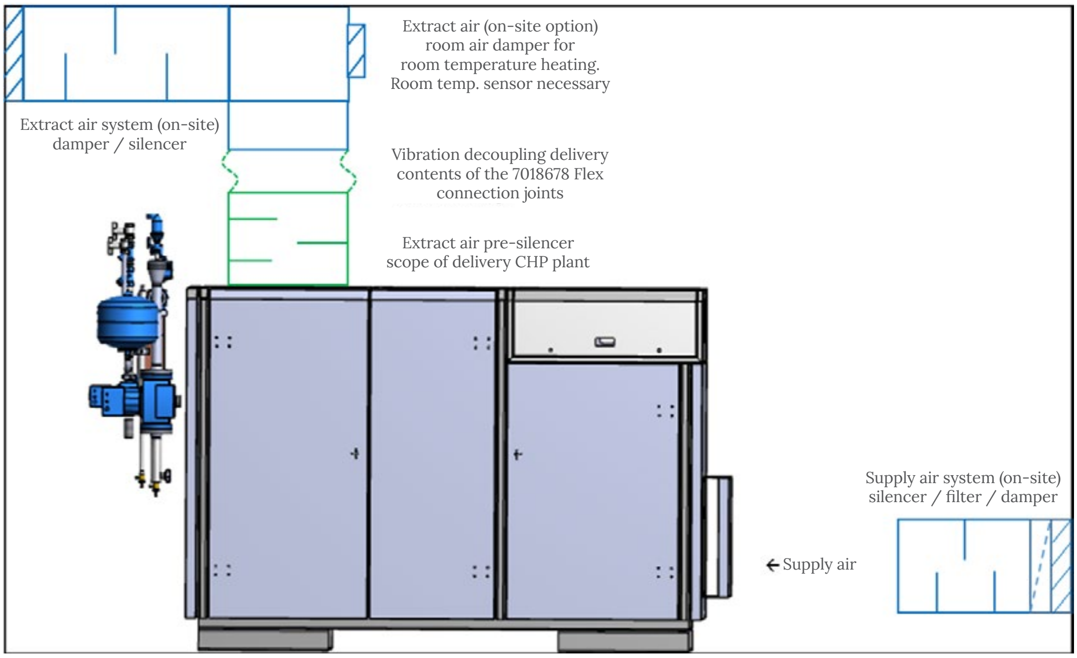
Standard ventilation structure
Air pressure CHP fan is sufficient for the external ventilation system of:

- Supply air damper with filter and silencer
- Via extract air duct with extract air silencer
- And exhaust air damper

Observe fan characteristic curve!

Supply air from the atmosphere





Ventilation structure external fan

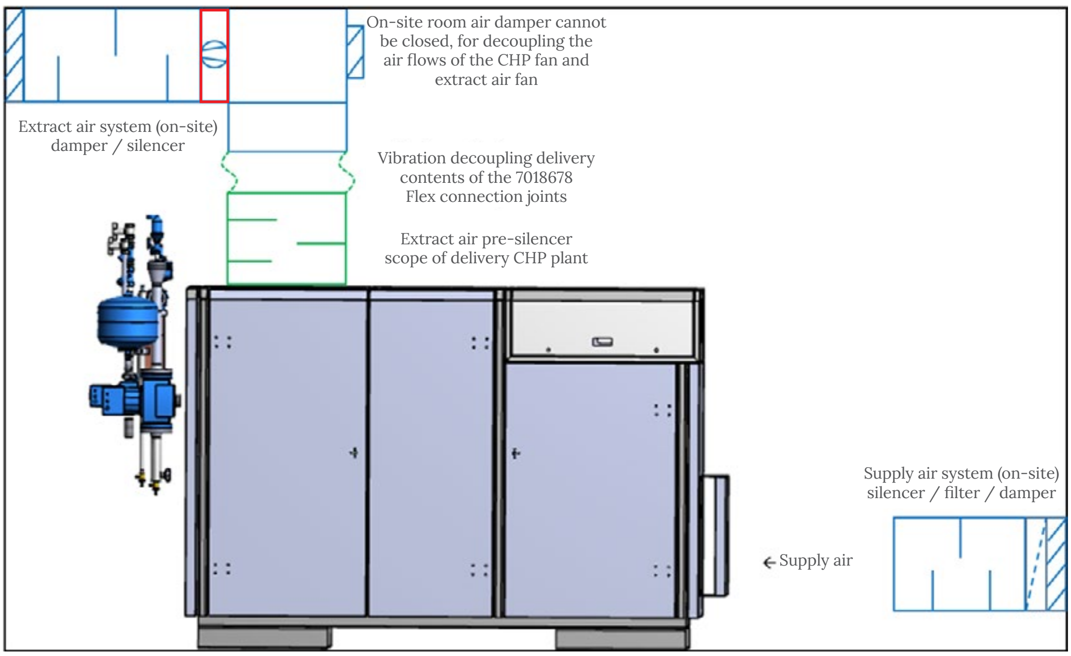
Air pressure CHP fan is not sufficient for the external ventilation system

If the external ventilation system of supply air damper with filter and supply air silencer via extract air duct with extract air silencer and exhaust air damper has a higher pressure drop than the internal fan can overcome, a controlled external fan must be used.

In this case, the CHP fan only overcomes the internal CHP pressure drop and that of the supplied extract air pre-silencer. Thus, there is a supply air intake from the room and an extract air inflow into the room.

It is not permitted for a closed air duct system to be built in which the CHP fan and the external extract air fan are connected in series. The fans would influence one another, which must be avoided.

If a connected extract air system is to be set up, a permanently open ventilation damper to the room must be installed. The damper must provide sufficient free surface area so that the controlled air flow rate of the CHP fan is not influenced by the external fan.



Exhaust system

The exhaust gas must be routed through a tested and approved exhaust gas line. Exhaust gas lines must be gas-tight, condensate-proof and overpressure-tight.

Resonance silencer

The term "resonant silencer" stands for different design principles that share the common feature of a spring, usually in the form of a volume of air, being excited to resonance in conjunction with an acoustic mass. The acoustic mass can be either a plate closing the air space (plate resonator) or a resonating air mass (perforated plate resonator, Helmholtz resonator).

In the range of the resonance frequency, energy is extracted from the sound field. This effect is chiefly limited to low frequencies and to a specific frequency, but can be effective over a wider frequency range by connecting differently tuned resonators in series and/ or additional damping with absorber material. Resonant silencers are often combined with absorption silencers.

Silencer type		RSD 113
Length of silencer body	mm	1300
Useful length	mm	1378
Total length	mm	1438
Outside diameter	mm	250
Exhaust gas inlet	mm	80
Exhaust gas outlet	mm	80
Total weight	kg	7.5
Coefficient of resistance		0.1

Insertion attenuation DE in the individual third octave frequencies F

F [HZ]	25	31.5	40	50	63	80	100	125	160	200	250	315	400
DE dB(A)	8	11	13	16	20	21	16	9	4	13	14	5	14

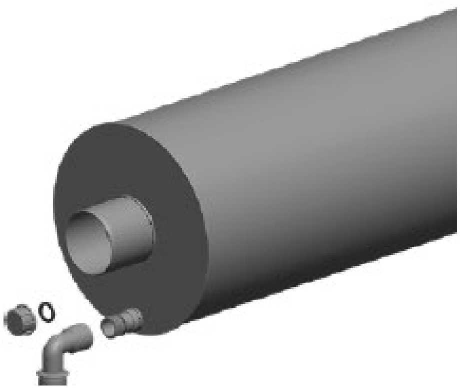
F [HZ]	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000
DE dB(A)	6	6	5	5	6	7	6	5	4	4	3	3	3

Absorption silencer

The vibrations of the air molecules caused by the sound are slowed down in the porous absorption material (often mineral wool). This is how the sound energy is ultimately converted into heat energy. Silencers that operate according to the pure absorption principle have excellent attenuation values at medium and high frequencies.

Absorption silencers are ineffective for low frequencies, as the absorber layers would have to be very thick in order to absorb those frequencies, which would result in very voluminous silencers.

Silencer type		ASD 112
Length of silencer body	mm	1250
Useful length	mm	1336
Total length	mm	1396
Outside diameter	mm	250
Exhaust gas inlet	mm	80
Exhaust gas outlet	mm	80
Total weight	kg	9.5
Coefficient of resistance		0.2



Insertion attenuation DE in the individual third octave frequencies F

F [HZ]	25	31.5	40	50	63	80	100	125	160	200	250	315	400
DE dB(A)	1	1	2	4	6	10	16	23	33	45	45	45	45

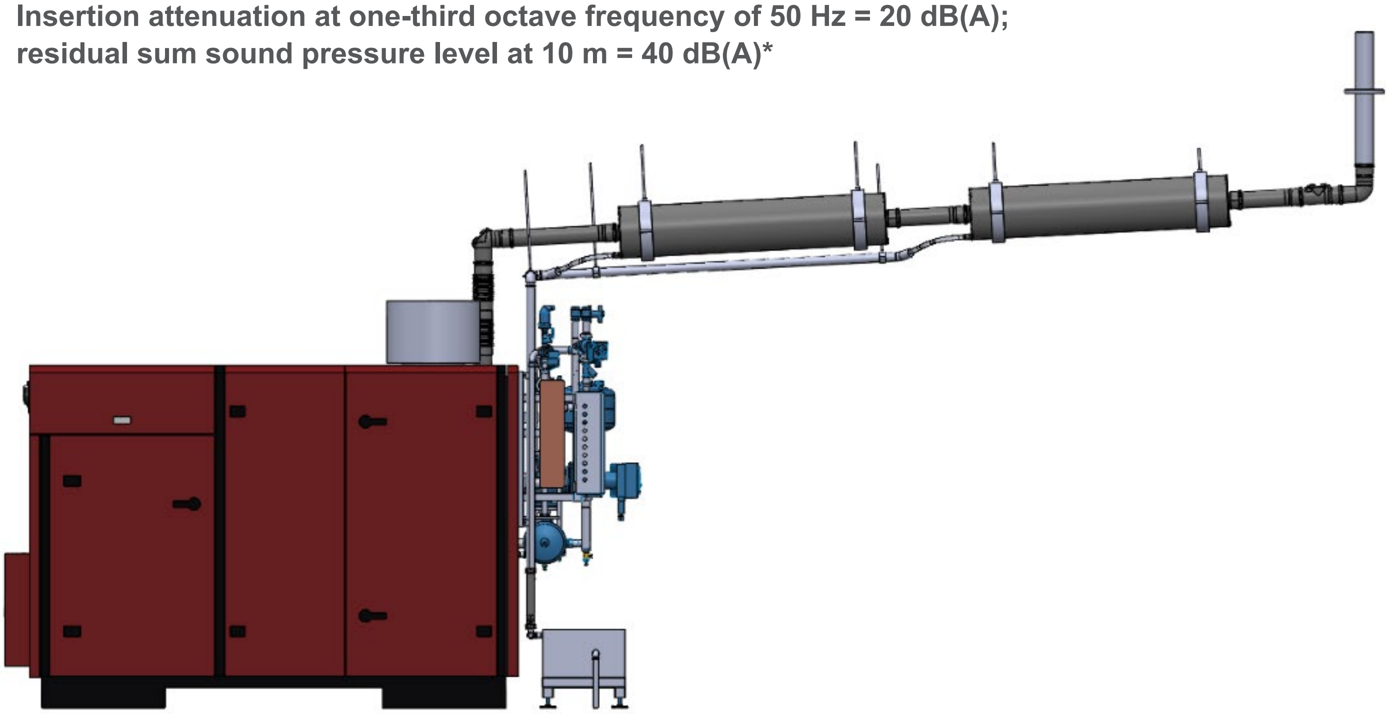
F [HZ]	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000
DE dB(A)	45	45	45	45	45	45	45	45	45	45	45	45	45

Application of exhaust gas silencers

The silencers must be installed in accordance with the manufacturer's instructions. For this purpose, a mounting set was provided as an accessory, which includes sound insulation dowels and sound insulation fasteners. In the horizontal installation position, each silencer must be equipped with a siphon.

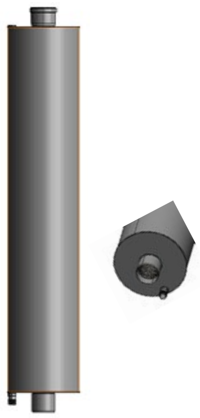
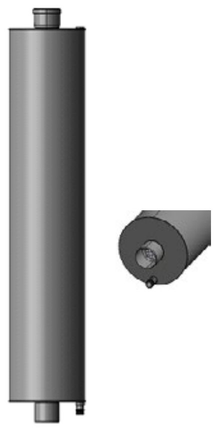
The exhaust silencers made of PP are designed for a max. temperature of 120 °C (TS=120). In standard operation (return temperature 35 °C), the exhaust gas temperature is below 60 °C. With increasing contamination of the exhaust gas heat exchanger or higher return temperatures (max. 60 °C), the exhaust gas temperature at the module outlet increases accordingly. To protect a PP exhaust system used on site, a safety stop of the CHP plant takes place at 120 °C exhaust gas temperature.

Insertion attenuation at one-third octave frequency of 50 Hz = 20 dB(A); residual sum sound pressure level at 10 m = 40 dB(A)*



* Tolerance +/-3 dB(A)

Installation overview with damping of resonance and absorption silencer

Resonance silencer RSD 113		Absorption silencer ASD 112		Resonance RSD 113 + absorption silencer ASD 112	
					
Insertion attenuation at tertiary frequency of 50 Hz = **16 dB(A)** Residual sum sound pressure level at 10 m		Insertion attenuation at tertiary frequency of 50 Hz = **4 dB(A)** Residual sum sound pressure level at 10 m		Insertion attenuation at tertiary frequency of 50 Hz = **20 dB(A)** Residual sum sound pressure level at 10 m	
43 dB(A)*		**55 dB(A)***		**40 dB(A)***	
Piece	**Designation**	**Piece**	**Designation**	**Piece**	**Designation**
1	Resonance silencer RSD 113	1	Absorption silencer ASD 112	1	Resonance silencer RSD 113
1	Siphon with integrated check ball	1	Siphon with integrated check ball	1	Absorption silencer ASD 112
1	Attachment set D250	1	Attachment set D250	2	Attachment set D250
				2	Siphon with integrated check ball

* Tolerance +/-3 dB(A)

Condensate drain

A permit for discharge of the exhaust gas condensate into the sewage system must be obtained from the relevant authority. Without neutralisation, condensate discharge is generally only permitted if the waste water pipes and the sewage system are made from plastic or ceramic material. If the sewage pipes are made from cement-bonded materials, intermitted discharge (without neutralisation) may be permitted for power levels up to 200 kW.

Hoval quality.
You can count on us.

Hoval

As a specialist in heating and climate technology, Hoval is your experienced partner for system solutions. For example, you can heat water with the sun's energy and your rooms with oil, gas, wood or a heat pump. Hoval ties together the various technologies and also integrates room ventilation into the system. So you can save energy while looking after the environment and your costs – and still enjoy the same level of comfort.

Hoval is one of the leading international companies for indoor climate solutions. More than 75 years of experience continuously motivate us to design innovative system solutions. We manufacture complete systems for heating, cooling and ventilation to more than 50 countries.

We take our responsibility for the environment seriously. Energy efficiency is at the heart of the heating and ventilation systems we design and develop.

Responsibility for energy and environment

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2021 - 06 | Subject to modifications

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