–weishaupt–

info

Information on ultra-low NO_x gas burners

Weishaupt 4LN-version gas burners (with flue gas recirculation)

WM-series, WKmono-series, and WK-series burners (700–23 000 kW)

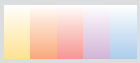
NO_x emission values for different gas burner versions

For many decades, the Weishaupt name has been a byword for low emissions, robust equipment, and reliable operation.

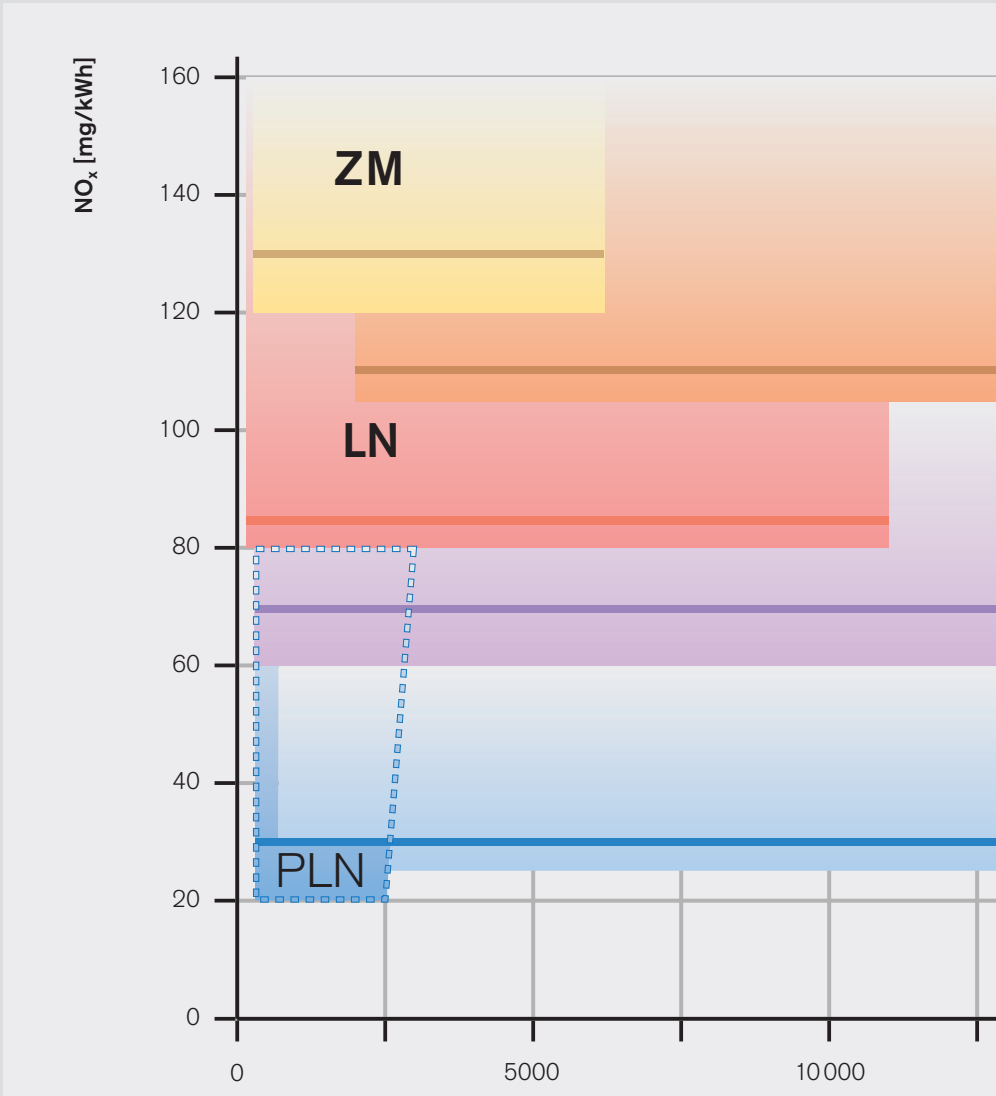
The graphic shows the output range of different gas mixing assemblies and the NO_x emissions they can achieve. The coloured lines mark the respective guaranteed NO_x emission values, subject to Weishaupt's constraints.

A further reduction in NO_x emissions of up to 35 % can be achieved if external flue gas recirculation (FGR) is combined with the appropriate mixing assembly.

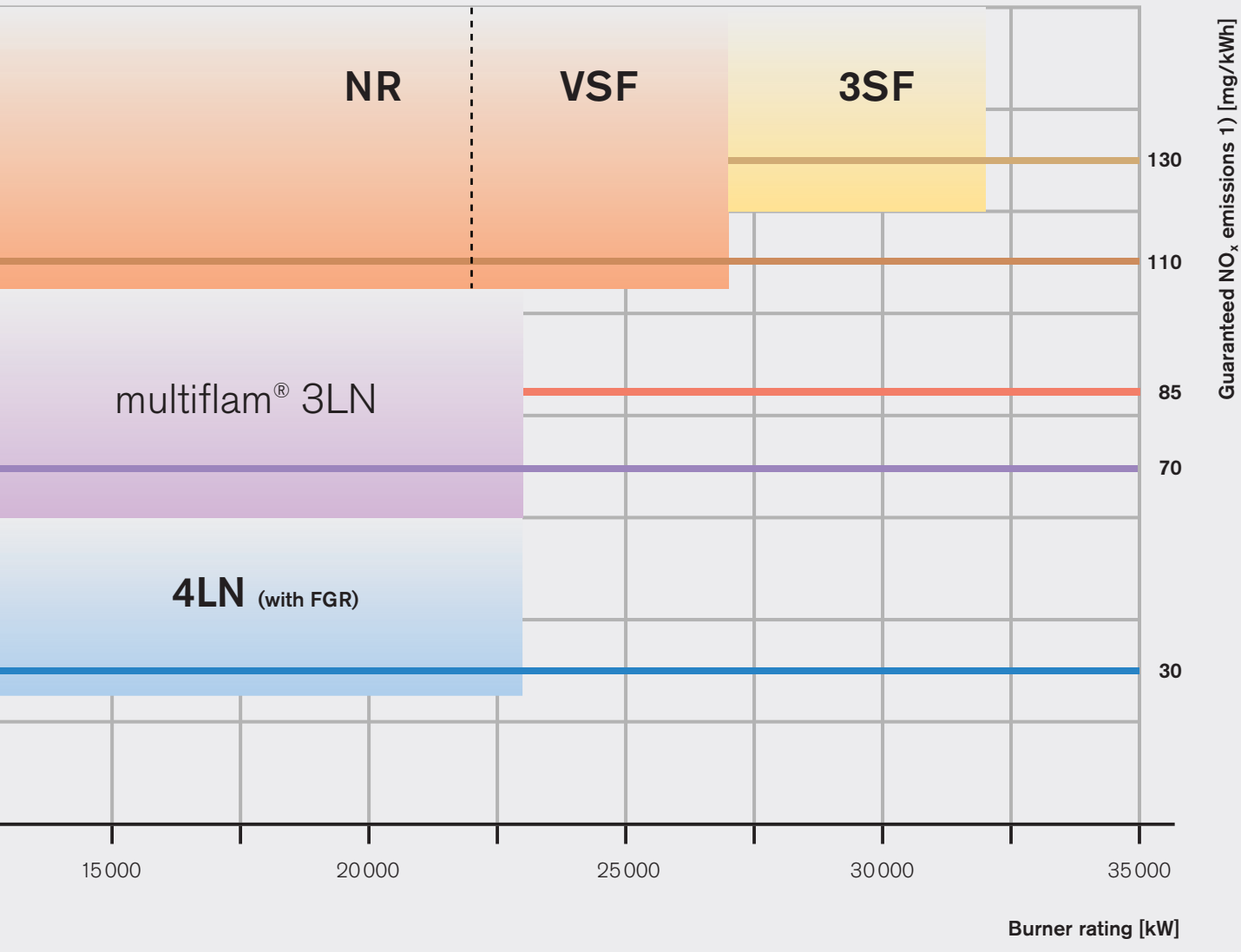
The low emissions achievable with 4LN-version burners, which include FGR as standard, is particularly noticeable. In the 700–23 000 kW range, NOx emissions of just 30 mg/kWh can be guaranteed with these natural-gas-firing burners.



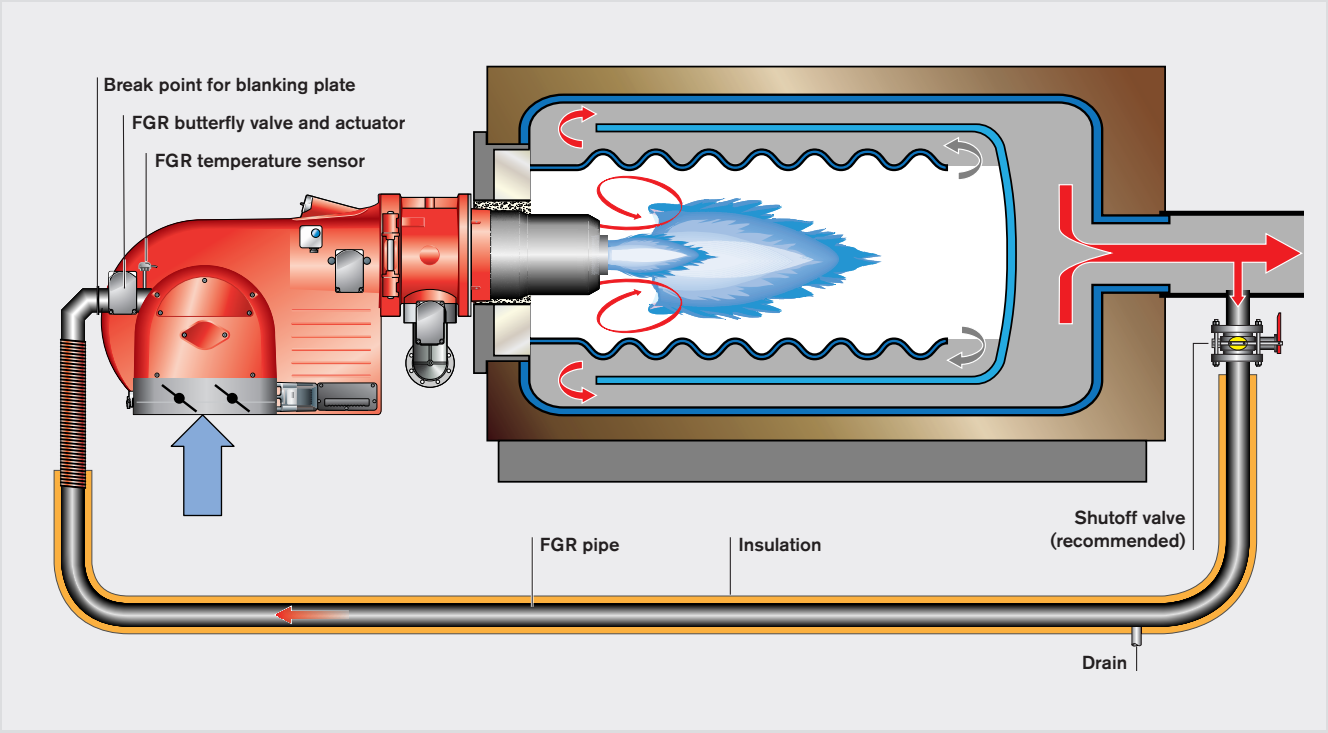
NO_x values with the combustion of natural gas dependent on system parameters [1].



[1] The values are for the stated burner versions on three-pass combustion chambers with heating medium temperatures ≤ 110 °C and combustion air temperatures < 40 °C. Weishaupt constraints based on the requirements of EN 676.


NR
VSF
3SF
multiflam® 3LN
4LN (with FGR)
130
110
85
70
30
Guaranteed NO_x emissions 1) [mg/kWh]
15 000
20 000
25 000
30 000
35 000
Burner rating [kW]

The 4LN flue gas recirculation principle



General arrangement of a flue gas recirculation system with a WM-series burner

Weishaupt 4LN-version gas burners are an innovative further development of patented multiflam® technology combined with flue gas recirculation.

At the heart of this further development of larger multiflam® burners lies a swirl body in the secondary air area and a longer flame on the primary diffuser.

In combination with flue gas recirculation, the swirl body generates an intensive mixing of the fuel, air, and recirculated flue gas. The primary flame, which is adapted for high flue gas recirculation rates, ensures the flame remains stable at all stages of operation.

How does FGR work?

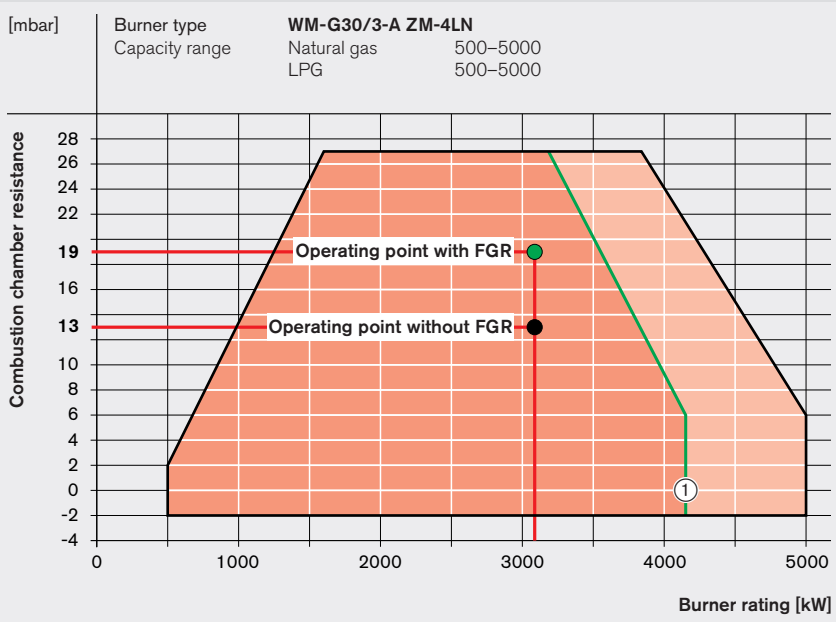
Flue gas recirculation has a particular effect on the formation of thermal NO_x by reducing the oxygen concentration in each cubic metre of air. This results in increased air flow speed, which reduces the dwell time of the combustion gases in the hot reaction zone and lowers the flame temperature.

Burner executions with FGR

Version	WM-G	WKmono-G	WKG
ZM(H)	x	–	o
ZM(H)-NR	o	o	o
ZM(H)-LN	o	–	o
ZM(H)-3LN	x	o	o
ZM(H)-4LN	●	●	●
ZM(H)-VSF	–	–	o
ZM(H)-3SF	–	–	o

● **Standard**
o **Optional**
x Not available
– No burner range

Capacity reduction with flue gas recirculation



① Additional capacity reduction with FGR for a specified NO_x level of 30 mg/kWh (individually determined)

Example:
Calculation for an installation with the following specifications:

NO_x limit value	30 mg/kWh
Burner rating	3070 kW
Resistance	13 mbar
Installation altitude	0 m asl
Fuel – natural gas E	10.35 kWh/Nm^3
FGR takeoff point	
▪ Flue gas pressure	0 mbar
▪ Flue gas temperature	160 °C

Weishaupt's standard parameters for calculating the reduction in burner capacity:

▪ Combustion chamber type	3-pass / through-pass
▪ FGR pipe length	2.5 x combustion chamber length
▪ Number of FGR pipe bends	5
▪ Flue gas pressure	0 mbar
▪ Additional internal fittings	none

The capacity of a monobloc burner equipped with flue gas recirculation is reduced because the combustion air fan is drawing both air and flue gas. The greater air mass flow for any given rating, which leads to an increase in the combustion chamber resistance, also has to be taken into account.

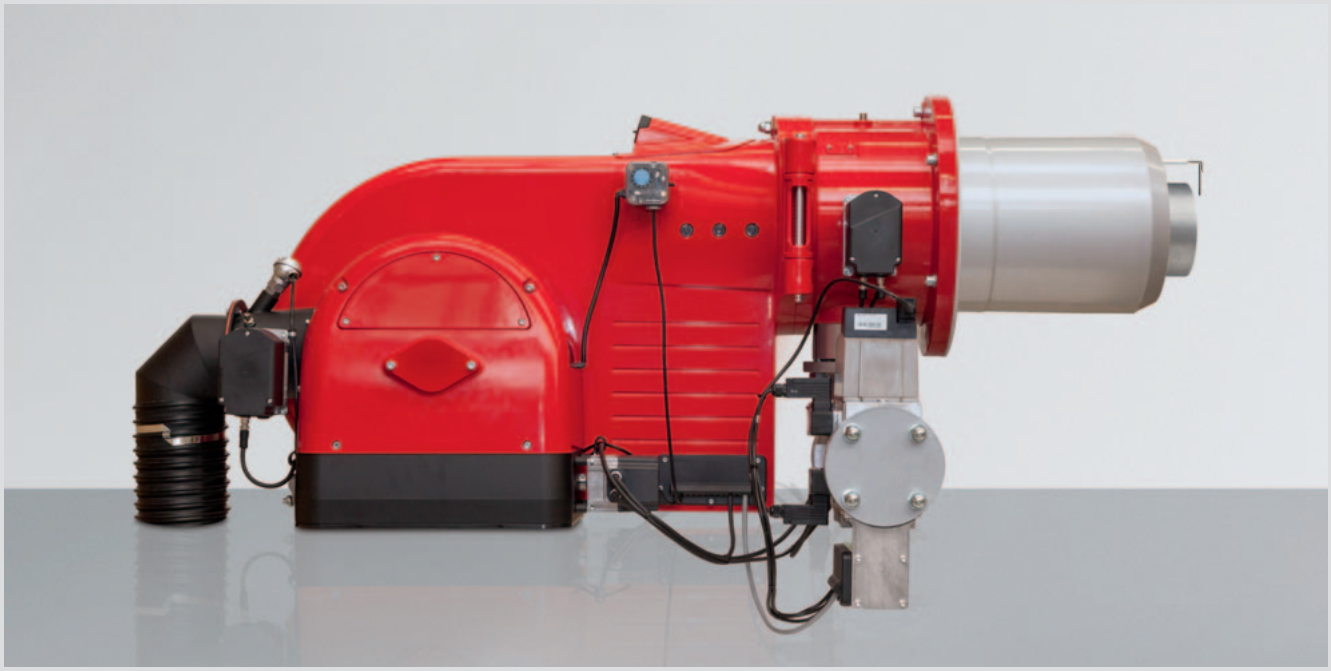
The extent to which the capacity will be reduced and the combustion chamber resistance will be increased has to be determined individually for every installation.

The example shows a calculation of the reduction in capacity and the increase in combustion chamber resistance for a specified NO_x level of 30 mg/kWh.

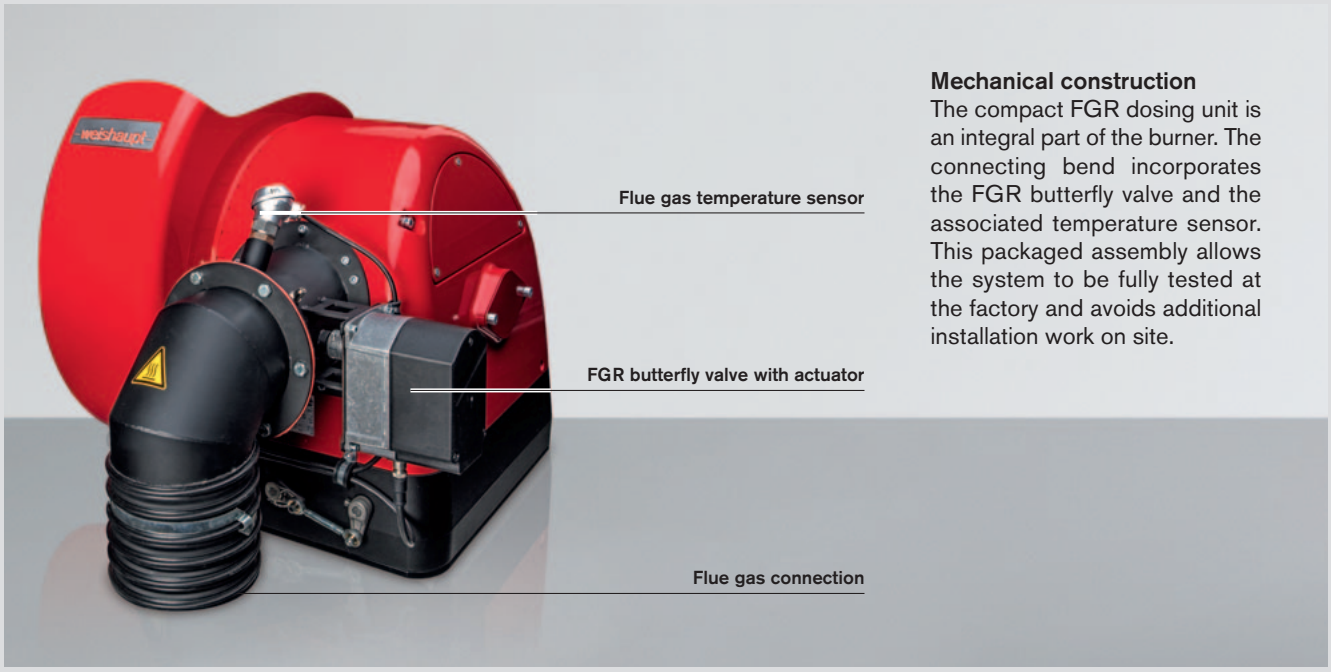
Capacity graphs for gas burners certified in accordance with EN 676.

Stated ratings are based on an air temperature of 20 °C and an installation at sea level. For installations at higher altitudes, a reduction in capacity of 1 % per 100 m above sea level should be taken into account.

4LN-version monarch® burners WM-G20 to WM-G50



WM-G30/3-A ZM-4LN monarch® gas burner

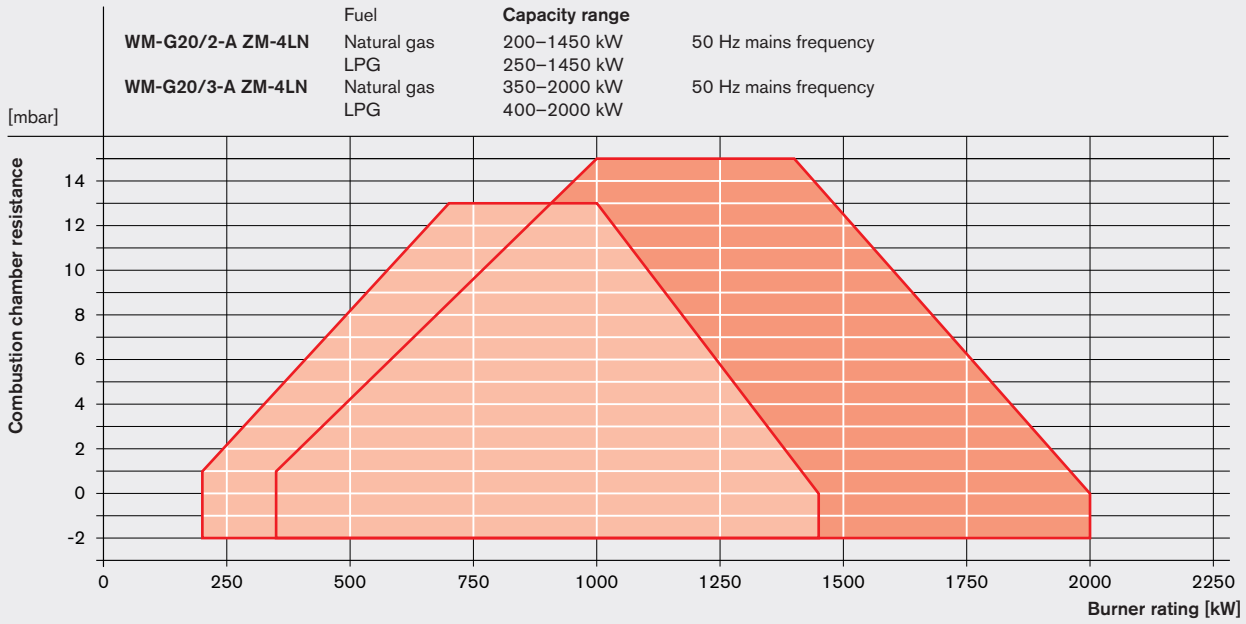


Mechanical construction
The compact FGR dosing unit is an integral part of the burner. The connecting bend incorporates the FGR butterfly valve and the associated temperature sensor. This packaged assembly allows the system to be fully tested at the factory and avoids additional installation work on site.

Air inlet housing with factory-pre-assembled flue gas recirculation components

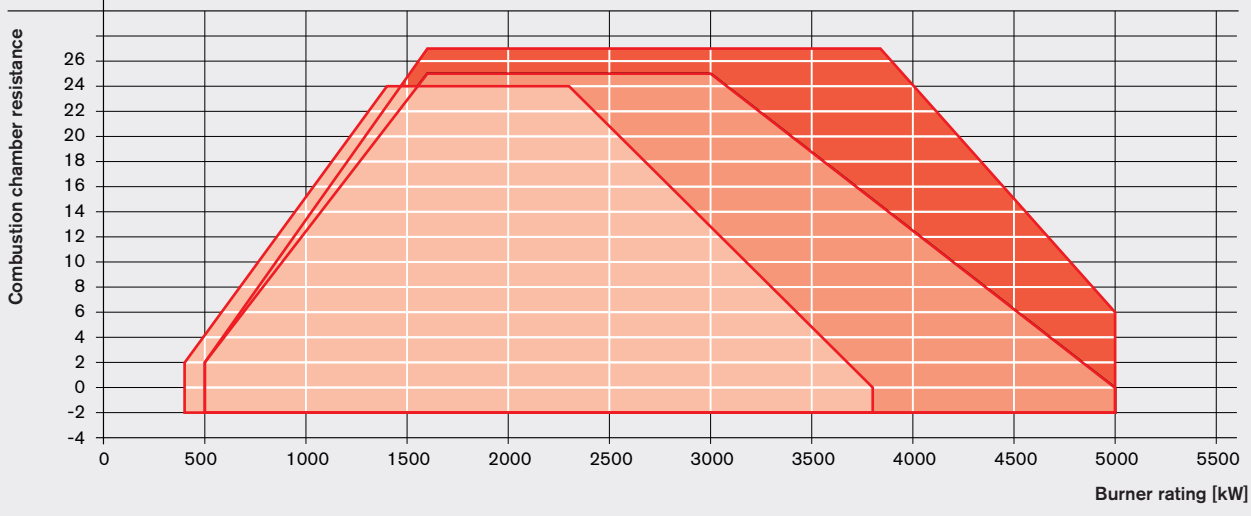
Capacity charts
WM-G20 and WM-G30

	Fuel	Capacity range	
WM-G20/2-A ZM-4LN	Natural gas	200–1450 kW	50 Hz mains frequency
	LPG	250–1450 kW	
WM-G20/3-A ZM-4LN	Natural gas	350–2000 kW	50 Hz mains frequency
	LPG	400–2000 kW	



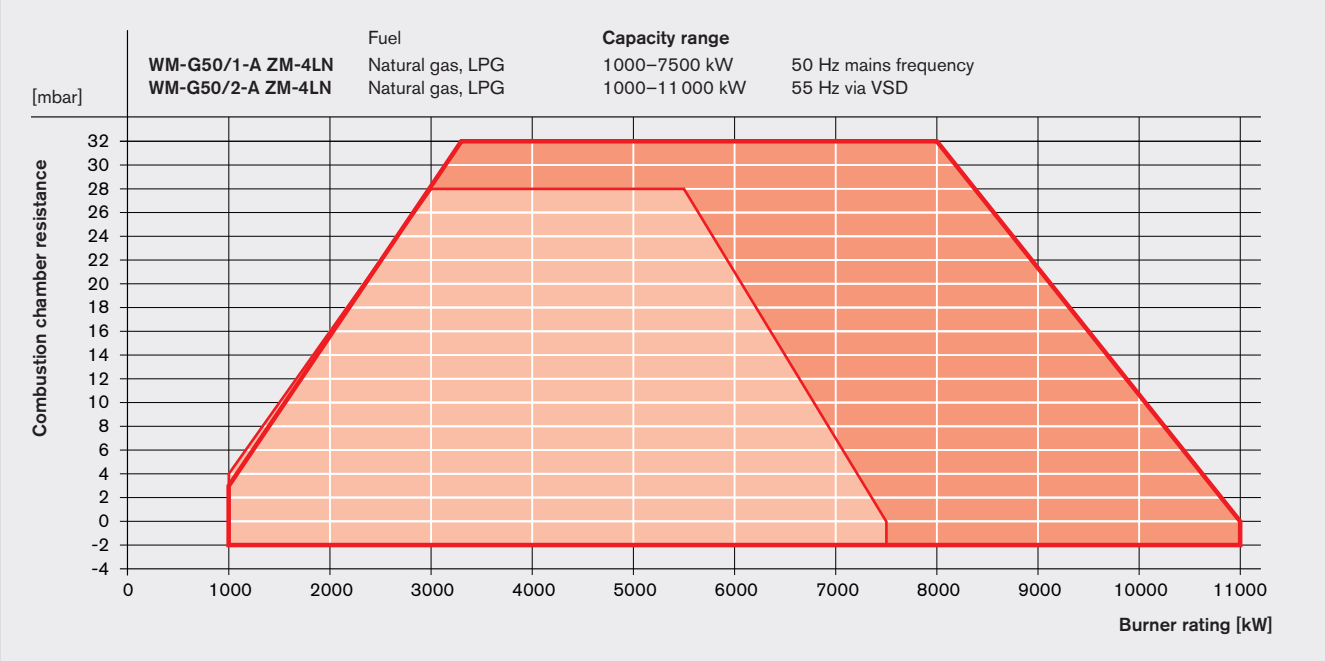
TÜV-certified capacity chart showing maximum burner capacity at a recirculation rate of 0 % – refer to page 5 for examples of capacity reductions with x % recirculation

	Fuel	Capacity range	
WM-G30/1-A ZM-4LN	Natural gas, LPG	400–3800 kW	50 Hz mains frequency
WM-G30/2-A ZM-4LN	Natural gas, LPG	500–5000 kW	50 Hz mains frequency
WM-G30/3-A ZM-4LN	Natural gas, LPG	500–5000 kW	60 Hz via VSD



TÜV-certified capacity chart showing maximum burner capacity at a recirculation rate of 0 % – refer to page 5 for examples of capacity reductions with x % recirculation

Capacity chart
WM-G50



TÜV-certified capacity chart showing maximum burner capacity at a recirculation rate of 0 % – refer to page 5 for examples of capacity reductions with x % recirculation

Order numbers

Gas burners

Burner type	Version	Gas valve assembly size	Order No.
WM-G20/2-A	ZM-4LN	R 1	217 218 11
		R 1½	217 218 12
		R 2	217 215 13
		DN 65	217 218 14
		DN 80	217 218 15
		DN 100	217 218 16
		DN 125	217 218 17
WM-G20/3-A	ZM-4LN	R 1	217 219 11
		R 1½	217 219 12
		R 2	217 219 13
		DN 65	217 219 14
		DN 80	217 219 15
		DN 100	217 219 16
		DN 125	217 219 17

CE-PIN: CE 0085BS0032

Gas burners

Burner type	Version	Gas valve assembly size	Order No.
WM-G30/1-A	ZM-4LN	R 1½	217 322 12
		R 2	217 322 13
		DN 65	217 322 14
		DN 80	217 322 15
		DN 100	217 322 16
		DN 125	217 322 17
WM-G30/2-A	ZM-4LN	R 1½	217 323 12
		R 2	217 323 13
		DN 65	217 323 14
		DN 80	217 323 15
		DN 100	217 323 16
		DN 125	217 323 17
WM-G30/3-A	ZM-4LN	R 1½	217 324 12
		R 2	217 324 13
		DN 65	217 324 14
		DN 80	217 324 15
		DN 100	217 324 16
		DN 125	217 324 17
		DN 150	217 324 18

CE-PIN: CE-0085BU0359

Gas burners

Burner type	Version	Gas valve assembly size	Order No.
WM-G50/1-A	ZM-4LN	R 2	217 523 13
		DN 65	217 523 14
		DN 80	217 523 15
		DN 100	217 523 16
		DN 125	217 523 17
		DN 150	217 523 18
WM-G50/2-A	ZM-4LN	DN 65	217 524 14
		DN 80	217 524 15
		DN 100	217 524 16
		DN 125	217 524 17
		DN 150	217 524 18

CE-PIN: CE-0085CP0102

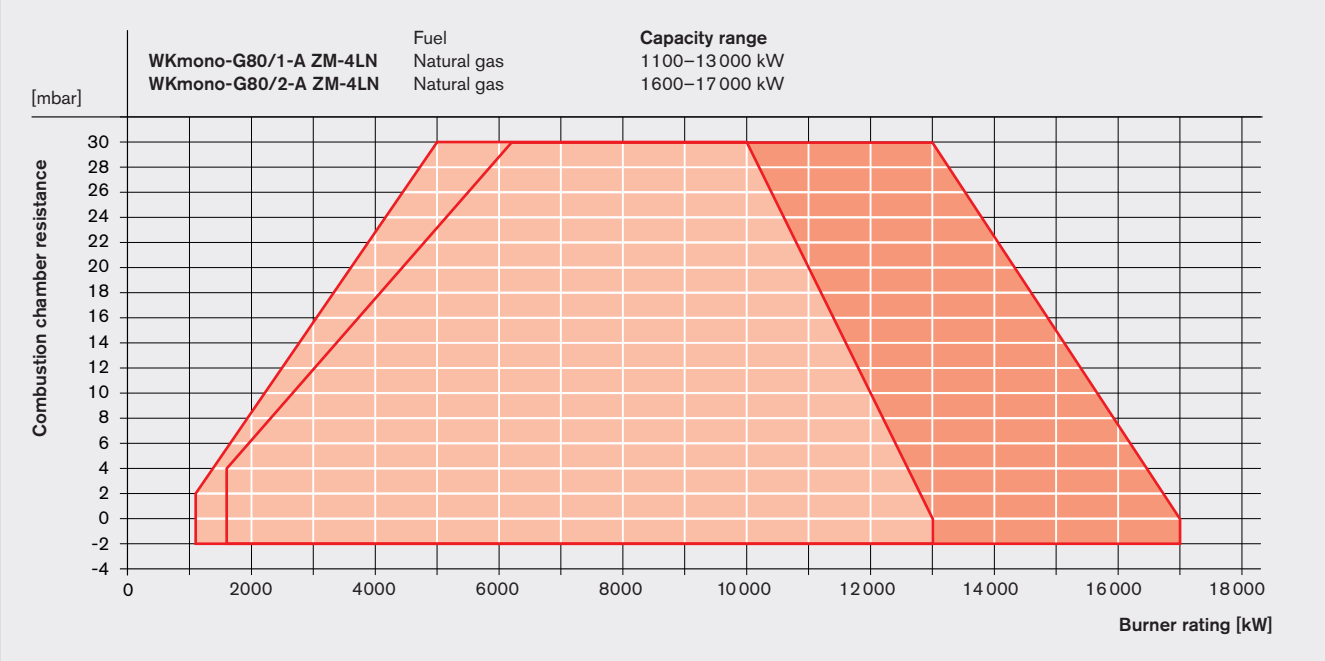
4LN-version industrial burners WKmono-G80

FGR connecting bend with actuator and Pt100

4LN-version gas mixing assembly

Flexibility with flue gas recirculation
The various gas mixing assemblies can be combined with flue gas recirculation to suit the NO_x emission limit values. Weishaupt takes advantage of the special properties of the flame geometry for the adaption to the combustion chamber. When it comes to capacity, NO_x emission values, and operational reliability, the newly developed 4LN version is groundbreaking.

Capacity chart / order numbers



TÜV-certified capacity chart showing maximum burner capacity at a recirculation rate of 0 % – refer to page 5 for examples of capacity reductions with x % recirculation
For LPG please enquire

Gas burners

Burner type	Version	Gas valve assembly size	Order No.
WKmono-G80/1-A	ZM-4LN	DN 65	287 814 44
		DN 80	287 814 45
		DN 100	287 814 46
		DN 125	287 814 47
		DN 150	287 814 48
WKmono-G80/2-A	ZM-4LN	DN 65	287 824 44
		DN 80	287 824 45
		DN 100	287 824 46
		DN 125	287 824 47
		DN 150	287 824 48

CE-PIN: Type approval pending

Availability

Burner type	Version	
WKmono-G80/1-A	ZM-4LN	Available
WKmono-G80/2-A	ZM-4LN	From 2018-Q2

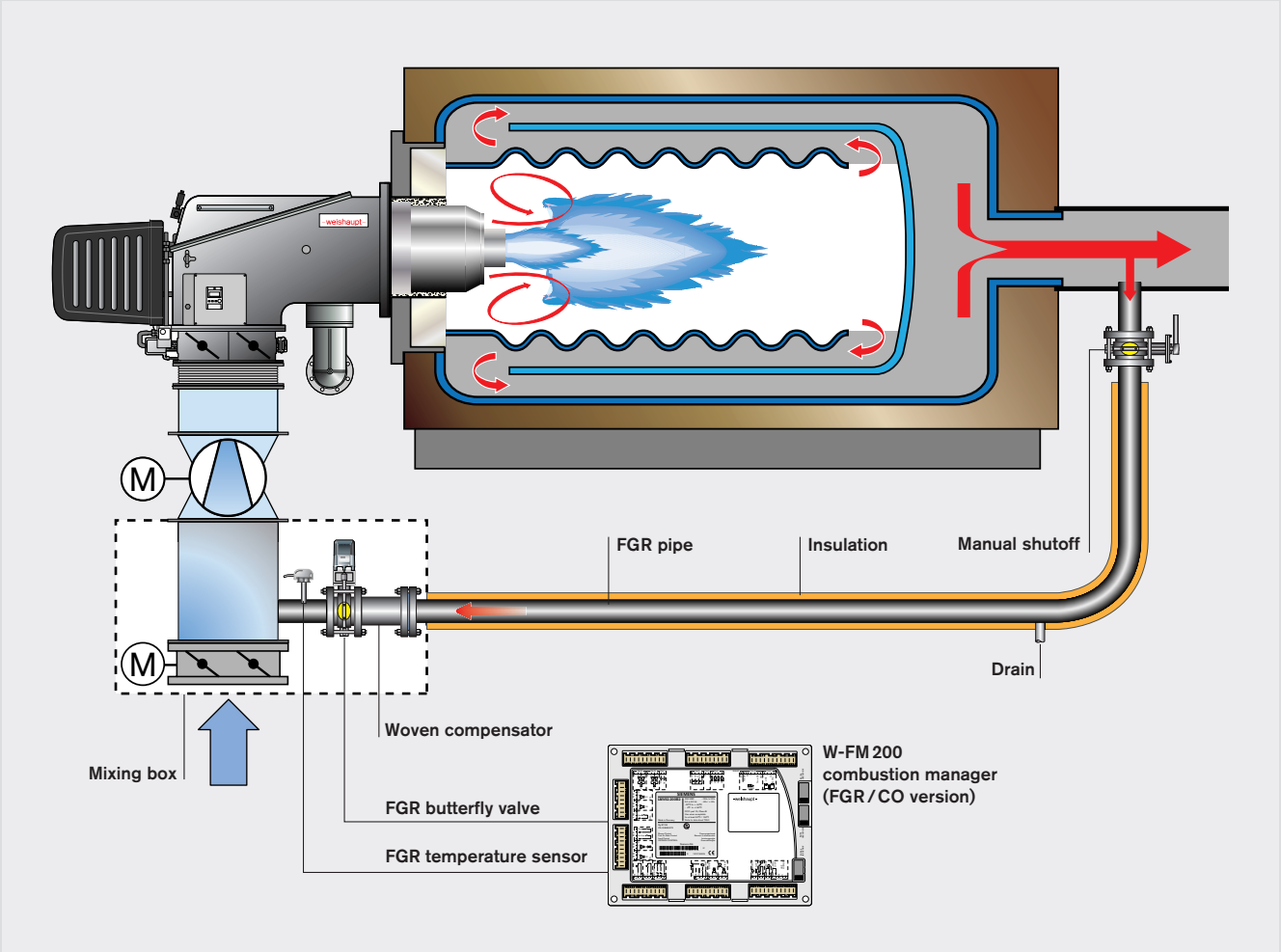
4LN-version industrial burners WKG70 and WKG80

Flue gas recirculation is of course also available for Weishaupt's WK-series industrial burners. The special modular design of the WK-series burners separates burner body from combustion air fan, thus facilitating innovative and customer-oriented solutions.

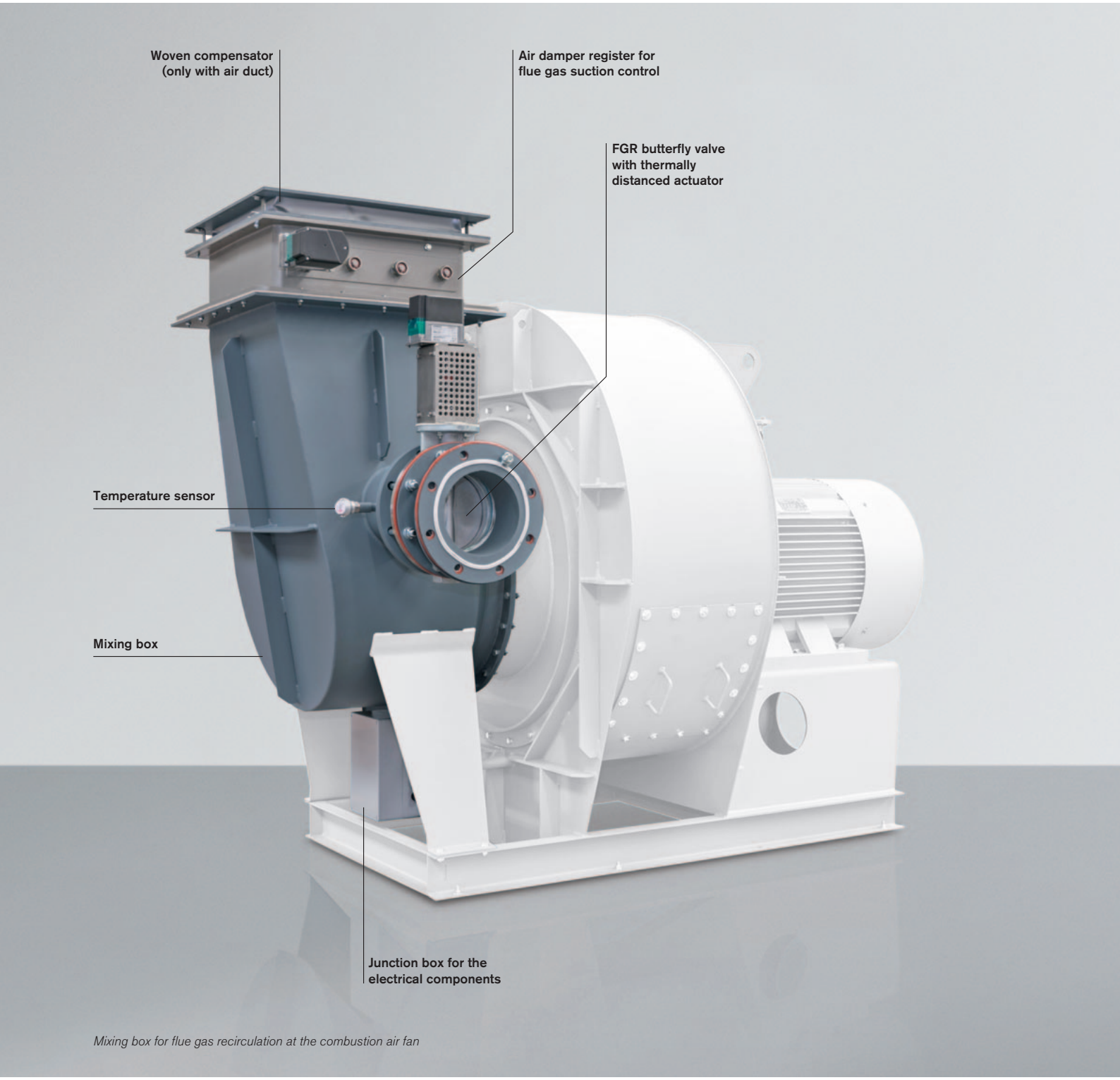
Weishaupt mixing box
The Weishaupt mixing box has been developed in a collaborative project with our combustion air fan manufacturer. It is fitted directly to the combustion air fan and forms a compact assembly with fixed dimensions. The mixing box consists of a housing with an integrated air damper register for suction control, a flanged connection for easy installation of the FGR butterfly valve, and a sleeve with an inbuilt temperature sensor.

Advantages
To the customer, the mixing box presents many advantages. Precise site plans can be drawn up, the manufacture of fully encapsulating fan sound absorbers can proceed without the need for on-site measurements, installation times are reduced, and – the crucial factor when it comes to functionality – everything is in the right place.

All in all, a convincing, fully packaged solution.



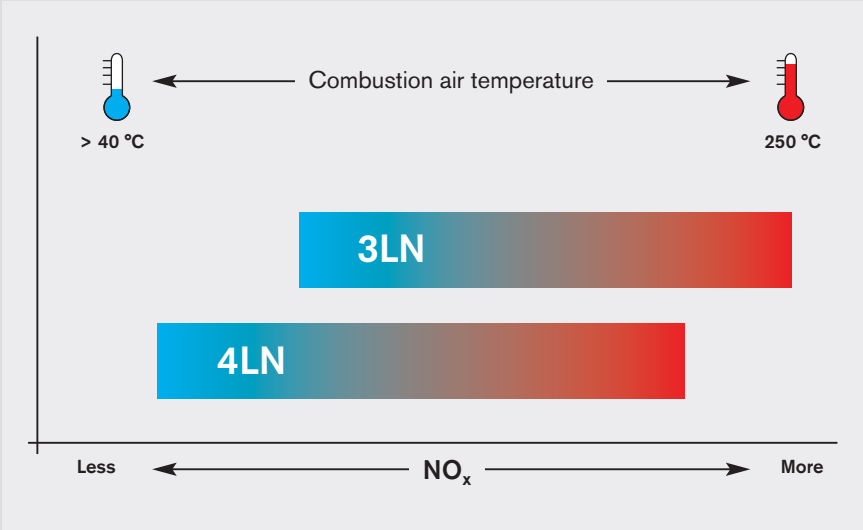
General arrangement of a flue gas recirculation system with WK-series burner and mixing box in ambient-air execution for flue gas temperatures in the 150–300 °C range at the takeoff point



Mixing box for flue gas recirculation at the combustion air fan

4LN-version WK burners with FGR and preheated combustion air up to 250 °C

Cooling air for actuators and flame monitoring



NOx behaviour on WK burners with preheated combustion air
Comparison of 4LN (FGR) with 3LN (multiflam®)

Weishaupt 4LN burners can now operate with preheated combustion air.

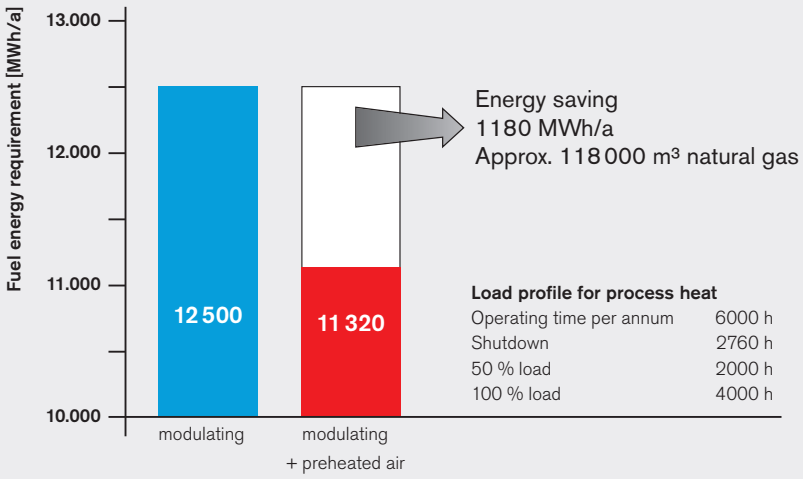
Heat generators with very high medium temperatures can exploit less of the heat in the flue gases. Consequently, flue gas temperatures are always higher than the medium temperature. Without additional heat exchangers, a lot of energy will be lost to the atmosphere and wasted. One way of utilising this energy is through the use of hot-air versions of the WK-series duobloc burners.

A cross-flow heat exchanger between the combustion air duct and the flue gas system draws heat from the hot flue gas and transfers it to the combustion air. Using this method, efficiency increases of up to 10 percent are possible.

Despite these extreme conditions, 4LN burner technology is able to reduce NO_x emissions considerably.

Comparison of the fuel energy requirement for a WK-series industrial burner with / without preheated combustion air

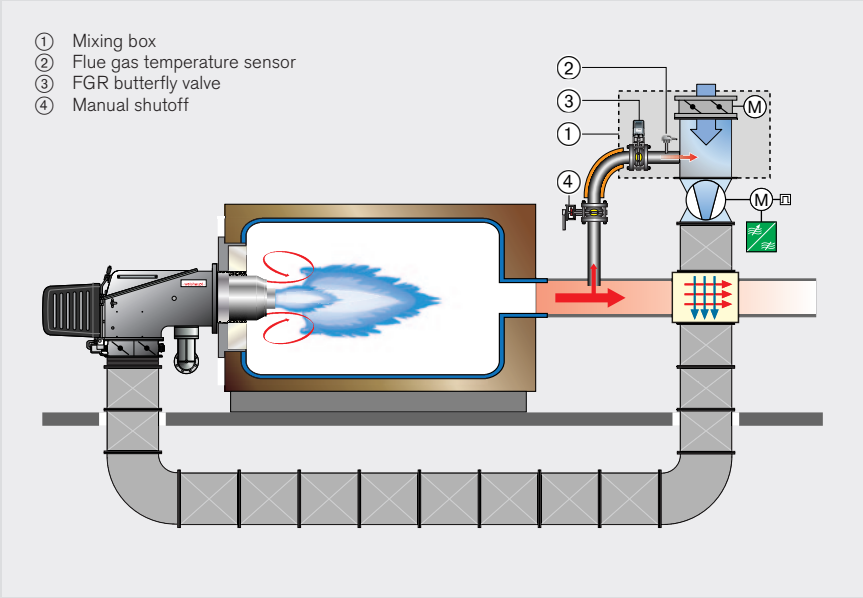
Example: WKG50/1-A ZMH-3LN with 250 °C preheated air



Source: Weishaupt Energy Efficiency Calculator

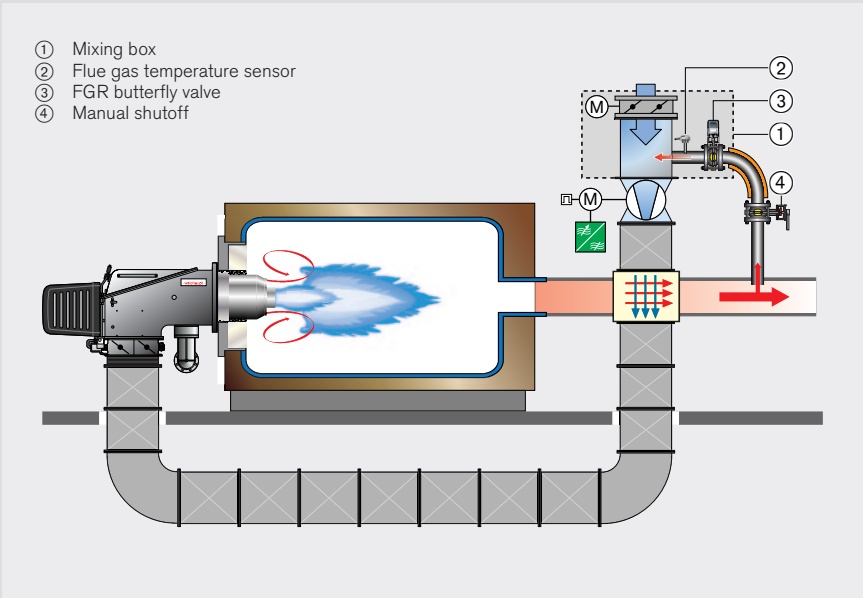
Flue gas withdrawal before the air preheater
The flue gas temperature determines the position of the flue gas takeoff point. At nominal load, using standard flue gas recirculation components, the flue gas temperature must not exceed 300 °C.

For hot-air version WK-series burners, the takeoff point has to be positioned before or after the combustion air preheater accordingly. Special solutions are available for those individual cases where the temperature limit cannot be adhered to.



General arrangement of an FGR system with WK-series burner and mixing box in hot-air execution for flue gas temperatures ≤ 300 °C before the combustion air preheater.

Flue gas withdrawal after the air preheater
If it is possible to position the flue gas takeoff point after the combustion air preheater, it is advantageous to do so.

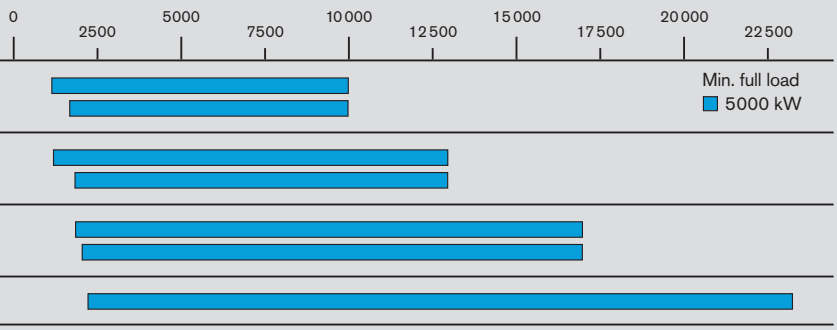


General arrangement of an FGR system with WK-series burner and mixing box in hot-air execution for flue gas temperatures > 300 °C after the combustion air preheater.

Capacity ranges
WK-series burners

4LN-version WKG gas burners (ambient combustion air up to 40 °C)

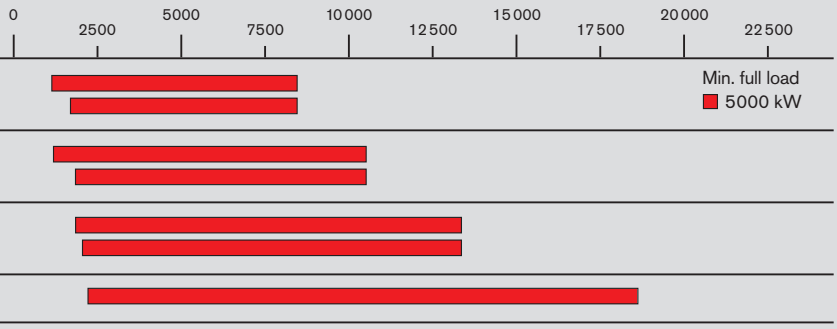
Burner	Version	Fuel	Capacity range
WKG70/1-A	ZM-4LN	Natural gas	1000–10 000
		LPG	1550–10 000
WKG70/3-A	ZM-4LN	Natural gas	1100–13 000
		LPG	1750–13 000
WKG80/1-A	ZM-4LN	Natural gas	1800–17 000
		LPG	2000–17 000
WKG80/2-A	ZM-4LN	Natural gas	2200–23 000



Ratings shown are at a recirculation rate of 0 %.
FGR requirements must be taken into account when selecting a combustion air fan.

4LN-version WKG gas burners (preheated combustion air up to 250 °C)

Burner	Version	Fuel	Capacity range
WKG70/1-A	ZMH-4LN	Natural gas	1000–8000
		LPG	1550–8000
WKG70/3-A	ZMH-4LN	Natural gas	1100–10 400
		LPG	1750–10 400
WKG80/1-A	ZMH-4LN	Natural gas	1800–13 600
		LPG	2000–13 600
WKG80/2-A	ZMH-4LN	Natural gas	2200–18 400



Ratings shown are at a recirculation rate of 0 %.
FGR requirements must be taken into account when selecting a combustion air fan.

Order numbers

Gas burners with ambient combustion air

Burner type	Version	Gas valve assembly size	Order No.
WKG 70/1-A	ZM-4LN	DN 80	277 741 15
		DN 100	277 741 16
		DN 125	277 741 17
		DN 150	277 741 18
WKG 70/3-A	ZM-4LN	DN 80	277 725 15
		DN 100	277 725 16
		DN 125	277 725 17
		DN 150	277 725 18
WKG 80/1-A	ZM-4LN	DN 100	277 813 26
		DN 125	277 813 27
		DN 150	277 813 28
WKG 80/2-A	ZM-4LN	DN 100	277 814 26
		DN 125	277 814 27
		DN 150	277 814 28

CE-PIN: Type approval pending

Gas burners with preheated combustion air

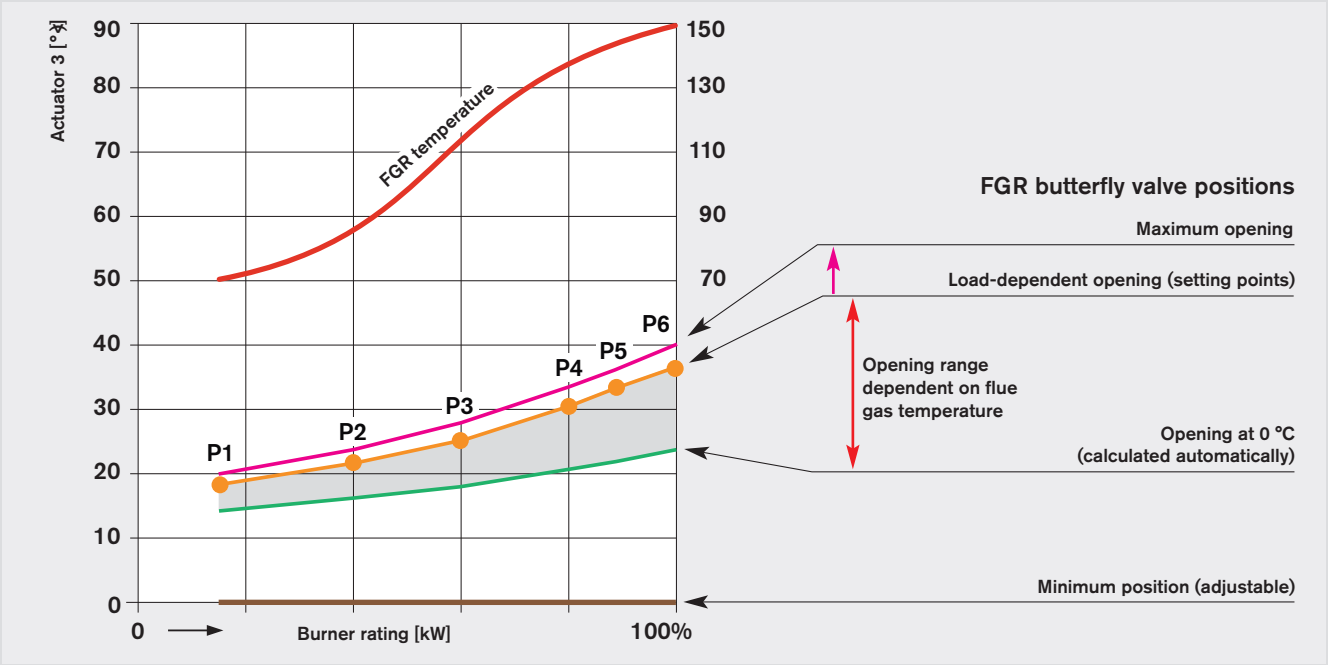
Burner type	Version	Gas valve assembly size	Order No.
WKG 70/1-A	ZMH-4LN	DN 80	277 742 15
		DN 100	277 742 16
		DN 125	277 742 17
		DN 150	277 742 18
WKG 70/3-A	ZMH-4LN	DN 80	277 727 15
		DN 100	277 727 16
		DN 125	277 727 17
		DN 150	277 727 18
WKG 80/1-A	ZMH-4LN	DN 100	277 818 26
		DN 125	277 818 27
		DN 150	277 818 28
WKG 80/2-A	ZMH-4LN	DN 100	277 819 26
		DN 125	277 819 27
		DN 150	277 819 28

CE-PIN: Type approval pending

Availability

Burner type	Version	
WKG 70/1-A	ZMH-4LN	Please enquire
WKG 70/3-A	ZMH-4LN	Please enquire
WKG 80/1-A	ZMH-4LN	Please enquire
WKG 80/2-A	ZMH-4LN	From 2018-Q3

Functional and safe:
Temperature-compensated flue gas dosing



Flue gas recirculation
You connect the burner's air inlet to the flue of the boiler with a hose, draw the flue gas off with the burner fan, and feed it back into the flame with the combustion air. The result: extremely low NO_x emissions.

However, the critical factor is the precise dosing of the recirculated flue gas. The W-FM 200 combustion manager is best placed to control this. With the addition of just two further components – a flue gas temperature sensor and a butterfly valve – and some additional software, the W-FM 200 can control the flow of flue gas so that the correct amount will be fed into the combustion air under all operating conditions, providing reliable startup and operational behaviour – just as you would expect.

Simple commissioning
The W-FM 200's compound regulation provides up to 15 setting points which can be positioned as required throughout the burner's operating range. This allows the volume of recirculated flue gas to be matched precisely to the combustion conditions.

Flue gas temperature is also crucial in determining the volume of flue gas to be recirculated. The temperature of the flue gas affects its density and thus the mass flow rate.

The flue gas temperature is measured continuously to ensure stable burner operating behaviour and consistently low NO_x levels. Variations in temperature are compensated for automatically by adjustments to the FGR butterfly valve.

System-specific adaptions
As well as controlling the FGR butterfly valve, the software of the W-FM 200 combustion manager has parameters at hand that allow additional adjustments to be made.

It is possible to define minimum and maximum FGR butterfly valve positions, and make adjustments via correction factors if the operational behaviour of the system as a whole calls for it.

Burners with FGR on long-term test in the Weishaupt factory's boiler room

–weishaupt–

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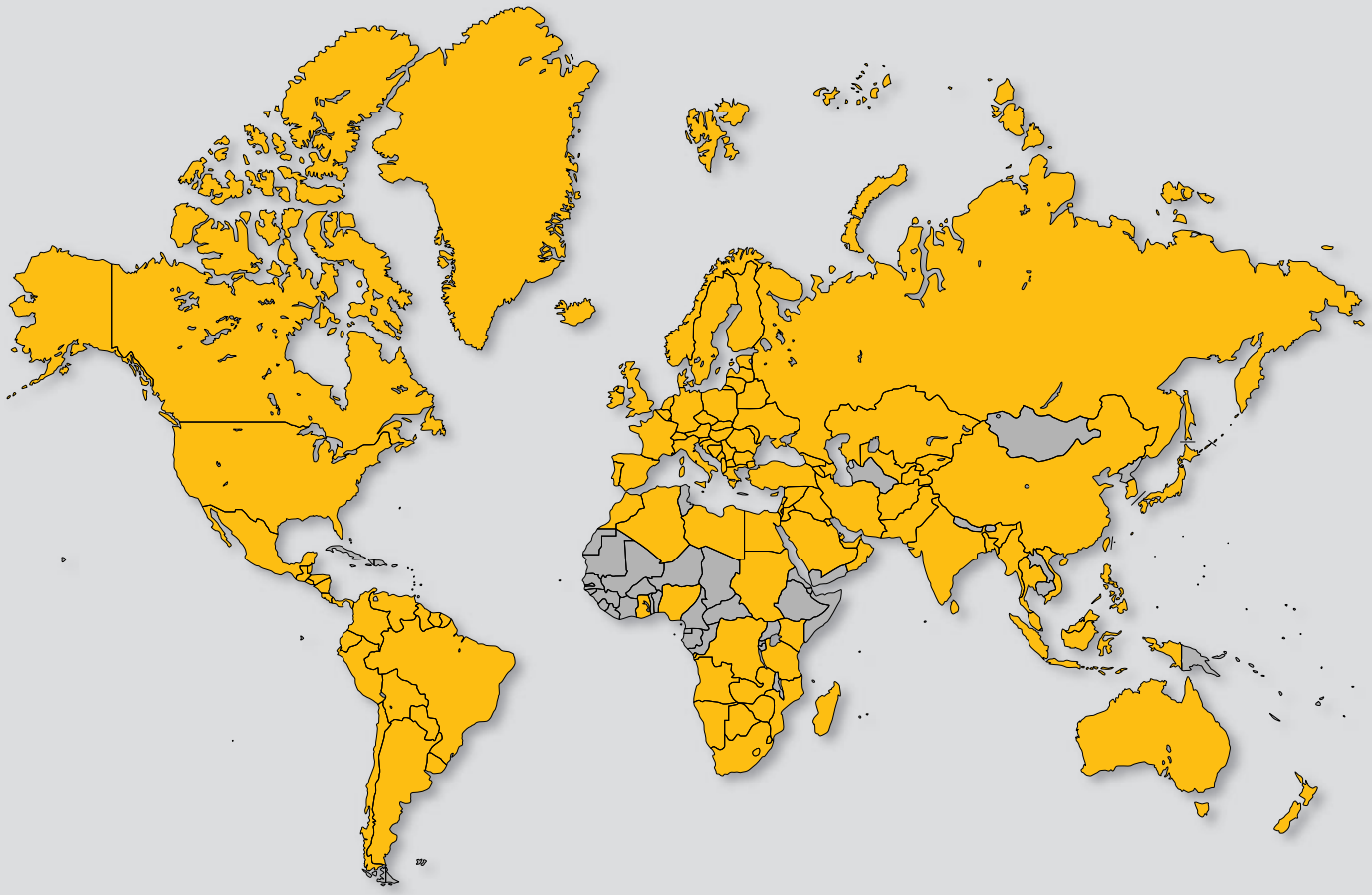

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Bosnia-Herzegovina
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China
Colombia
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Cyprus
Czechia
Denmark
Ecuador
Egypt
El Salvador
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Myanmar
Namibia
Netherlands
New Zealand
Nicaragua
Nigeria
North Macedonia
Norway
Oman
Pakistan
Panama
Paraguay
Peru
Philippines
Poland
Portugal
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Tajikistan
Tanzania
Thailand
Turkey
UAE
Ukraine
United Kingdom
Uruguay
USA
Uzbekistan
Vatican City
Venezuela
Vietnam
Zambia
Zimbabwe