Info
Information on ultra-low NO\textsubscript{x} gas burners

NO\textsubscript{x} emissions < 30 mg/kWh

4LN-version gas burners (with flue gas recirculation)
NOx emissions below 30 mg/kWh: 4LN-version Weishaupt monarch® burners

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

The 4LN-version of the current WM 20 to WM 50 range of Weishaupt monarch® burners can comply with the strictest environmental standards in force worldwide. A 4LN-version burner is equipped with a flue gas recirculation system whose control components are integrated with the burner.

Specially designed mixing assemblies and digital combustion management ensure that the key characteristics of Weishaupt burners – reliable ignition, a high degree of flame stability, and safe operation – remain very much to the fore.

The values are for the stated burner versions on three-pass combustion chambers with medium temperatures ≤ 110 °C. Weishaupt constraints based on the requirements of EN 676.

NOx emissions achievable when firing natural gas

Air inlet housing with factory-preassembled flue gas recirculation components
General arrangement of a flue gas recirculation system with a WM-series burner

Burner type                      Capacity range
WM-G20/2-A ZM-4LN       200–1500 kW
WM-G20/3-A ZM-4LN       350–2000 kW

Burner type                      Capacity range
WM-G30/1-A ZM-4LN       400–3800 kW
WM-G30/2-A ZM-4LN       500–5000 kW
WM-G30/3-A ZM-4LN       500–5000 kW

Burner type                      Capacity range
WM-G50/1-A ZM-4LN       1000–7500 kW

TÜV-certified capacity chart showing maximum burner capacity at a recirculation rate of 0 % – refer to page 4 for examples of capacity reductions with x % recirculation

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

<table>
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<tr>
<th>[mbar]</th>
<th>Burner type</th>
<th>WM-G30/3-A ZM-4LN</th>
<th>Capacity range</th>
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Example:
Calculation for a burner installation with the following specifications:

- NOx limit: 30 mg/kWh
- Burner rating: 3070 kW
- Resistance: 13 mbar
- Installation altitude: 500 m asl
- Fuel – natural gas E: 10.35 kWh/Nm³
- 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

Why does burner capacity reduce?
Equipping a burner with flue gas recirculation reduces its capacity range. The extent of the reduction has to be calculated individually for each individual installation.

The burner fan was designed to supply combustion air. If a burner is equipped with flue gas recirculation, however, then the fan has to draw both air and flue gas and mix the two together. As a consequence, while the overall volume supplied by the fan remains the same, the addition of the flue gas reduces the total oxygen concentration. With less oxygen in the combustion air, the burner’s capacity is reduced.

What does flue gas recirculation do?

- Reduce oxygen concentration per m² of air
- Increase the air flow speed
- Shorten dwell times for combustion gases in the hot reaction zone
- Lower flame temperatures
- Cut NOₓ emissions

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.
### Order numbers / availability

#### Gas burners

<table>
<thead>
<tr>
<th>Burner type</th>
<th>Version</th>
<th>Valve train size</th>
<th>Order No.</th>
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**CE-PIN:** CE-0085BO0032

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**CE-PIN:** CE-0085 CP 0102

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**CE-PIN:** CE-0085BU0359
Very high capacity, very low emissions: The 4LN-version WKmono 80

Flexibility with flue gas recirculation
Where stringent emission limits for oxides of nitrogen are in force, Weishaupt’s multiflam® mixing assemblies for gas-fired burners can be combined with flue gas recirculation. Weishaupt takes advantage of the special properties of the flame geometry, and with it the adaption to the combustion chamber, to reduce NOx levels.
The multiflam® principle developed and patented by Weishaupt is a way to reduce nitrogen oxide emissions to a minimum.

At the heart of Weishaupt’s multiflam® technology is a special mixing assembly design, which distributes the fuel among primary and secondary nozzles. This results in extremely efficient combustion thanks to recirculation of the flue gases directly at the mixing assembly.

If a specific market demands ultra-low NOx emissions, Weishaupt combines multiflam® technology with external flue gas recirculation. This system, which is designed for gaseous fuels, reduces NOx emissions to levels that will meet the most stringent of standards worldwide.

The compact FGR dosing unit is worth highlighting. 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.

The FGR system is controlled by the W-FM 200 combustion manager. An additional software module ensures the return of a temperature-compensated volume of flue gas at all operating stages, reliable cold start behaviour, and the highest degree of operational availability.
Very high capacity, very low emissions:
WK-series burners with flue gas recirculation

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 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 sound absorbers can proceed without the need for on-site measurements, installation times are reduced, and – the crucial factor for functionality – everything is in the right place.

All in all, a convincing, fully packaged solution.
Fabric compensator (only with air duct)

Air damper register for flue gas suction control

FGR butterfly valve with thermally distanced actuator

Temperature sensor

Mixing box

Junction box for the electrical components

Mixing box for flue gas recirculation at the combustion air fan
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 NOx 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 just two additional 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 NOx 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 W-FM 200 combustion manager’s software 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 worldwide:

Branch offices across Germany and numerous subsidiary companies, representatives and agents across the world provide local support.

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- Israel
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- Kuwait
- Latvia
- Lebanon
- Luxembourg
- Malaysia
- Macedonia
- Moldova
- Morocco
- Netherlands
- New Zealand
- Nigeria
- Norway
- Pakistan
- Philippines
- Portugal
- Russia
- Singapore
- Spain
- Switzerland (W)
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- Taiwan
- Thailand
- Tunisia
- Turkey
- Ukraine
- UAE
- Vietnam

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