Drying monolithic Linings

Product-Information 3

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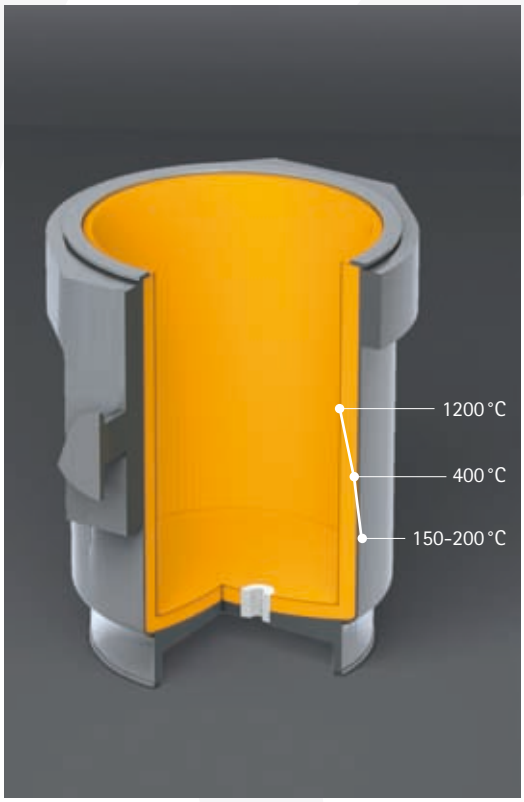
economical preheating



Theory ...

All heating and drying curves prescribed by lining manufacturers refer to the material temperatures.

Unfortunately, it has never been exactly defined, at which point (in which depth) the temperature should be measured. It rather seems that the heating rates and dwell times of the curves are determined with a test cube in a laboratory furnace.
However, the heating process in a vessel varies substantially in that only one side is heated, while the other side has ambient temperature.

... and Practice

For the regulation of a drying process, a temperature must be measured and fed to the controller as the actual value. The temperature easiest to measure is the exhaust gas temperature.
When regulating according to the exhaust gas temperature, it has to be taken into consideration that for the heat transfer into the wall a temperature difference is necessary.
This difference is larger at lower temperatures, when the heat is transferred by convection only, than at higher temperatures, when the radiation proportion is predominant. These differences are well known from comparative measurements.

Based on many Years of Experience MAPEKO recommends:

A guide to an efficient use of technology

- Start with exhaust gas temperatures higher than 100°C - this prevents combustion-generated condensation of the water in the wall.
- Avoid dwell times in the programme as much as possible.
  It is better to reduce the heating rate (°C/h) instead.
  This way, any shock on the lining due to a sudden increase of the burner output is avoided.
- Bring the final temperature up to the later preheating temperature (minimum 1.000°C).
  This ensures that a temperature guaranteeing complete drying even in the outermost bottom corners is reached.

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1 1 pc vertical preheater / dryer System FOEHN ®

Technical data

Dimensions of ladle (outside) …….....:	ø 2.740 x 4.050 mm, cap 60 to
Capacity …….....:	60 to
Height heating position .....:	approx. 4.050 mm from level 0 to ladle rim,
Ladle drawing no. .....:	Not available
Weight of lining .....:	~ 20 to
Ladle cover …….....:	ø 2.700 mm, with **cardanic** suspension and ceramic fibre insulation
Burner type .....:	MGE 3
Burner capacity .....:	$P_{max.}$ = 1.500 kW
Heating medium .....:	Natural gas
Heating value .....:	H_i ~ 10,0 kWh/m_N^3
Heating medium - pressure .:	p_e = 100 mbar
Heating medium - consumption .....:	$V_{max.}$ ~ 150 m_N^3/h
Heating temperature .....:	max. 1.200 °C (or less)
Heating time .....:	20 °C – 1.100 °C → ~5h or longer Or according to dry pattern
System of temperature regulation .....:	Programmable temperature controller Jumo Imago.
Temperature measurement…….:	Thermocouple PtRh-Pt
System of ratio control .....:	Double solenoid valve GAS with in-built air-/gas ratio controller
System of drying .....:	**MAPEKO Soft Drying System FOEHN ® with additional air**

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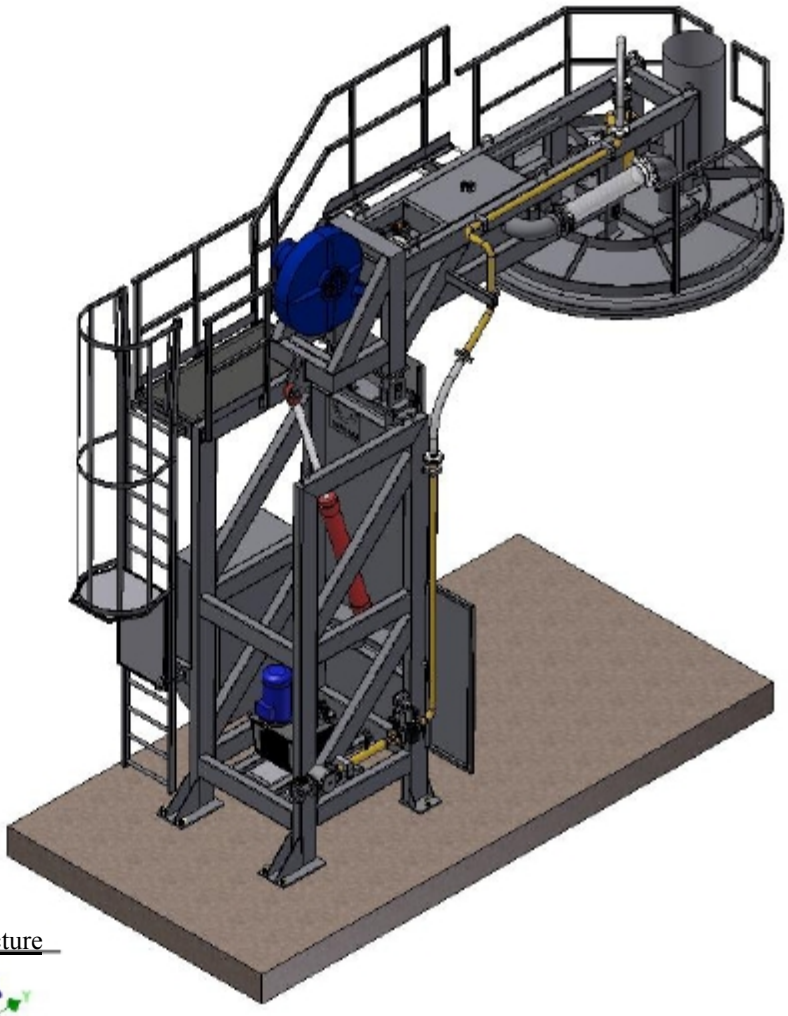
Ignition	..... :	directly by ignition electrode **without ignition burner!**
Supervision of the main flame	..... :	UV cell with indication
Additional safety equipment	..... :	Two main gas valves Tightness control after every BURNER OFF
Blower data	..... :	V = 3.360 m³N/h; p = 50 mbar P = 7,5 kW; n = 3.000 rpm
Hydraulic data	..... :	p = 160 bar; Q = 16 l/min; P = 5,5 kW; n = 1.500 rpm Cylinder ø 125/70
Hydraulic fluid	..... :	Type HPL 46 (DIN 51 524 part 1)
Electric data	..... :	400 V ±5%, 50 Hz – 4 x 16 mm² 230 V ±5%, 50 Hz – 3 x2,5 mm²
Total weight per unit	..... :	~ 4800 kg



Example picture

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Scope of delivery

1.1 1 pc vertical preheater / dryer System FOEHN®

1.1.1 1 pcs. MAPEKO high performance burner, type MGE 3 – 1.500 kW

~ 80 kg

Burner head completely made of heat- and temperature-change-resistant stainless steel cast.
Incl. ignition electrode, ignition transformer and UV cell for flame supervision.

1.1.2 Energy control line NG, p_e = 100 mbar

~ 120 kg

All elements are assembled and wired acc. to DIN EN 746-2, 2011! All parts are correspond to DIN/DVGW.
Unit is shop-tested due to complete installation and testing at our works prior to delivery.

1.1.3 Control line - COMBUSTION AIR / ADDITIONAL AIR, System FOEHN®

~ 290 kg

All elements are assembled and wired.
Unit is shop-tested due to complete installation and testing at our works prior to delivery.

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1.1.4 Ladle cover, ceramic fibre - ø 2.700 mm

~ 1.050 kg

Reinforced steel structure with cardanic suspension. **Additional air box** and exhaust gas pipe.

Insulation: 100 mm thick, vertically arranged and highly compressed ceramic fibre, t_{max} = 1.200°C, gravity = 200 kg/m³; rim insulated with segments of concrete, already dried at our works and thereby ready for immediate use.

Cardanic suspension at the cantilever arm guarantees optimum sealing of the ladle, able to compensate variations in heights from one side to the other side.

All parts coming into contact with flame or exhaust gas are made of heat- and temperature-change resistant stainless steel.

Corrosion protection:
Steel parts de-rusted and double coated with heat resistant paint (250°C). Coating according to RAL 9006 (white aluminium, silver aluminium) with layer thickness of approx. 80µ. The paint fulfils DIN-EN-ISO 12944-6 for all 6 corrosive categories.

1.1.5 90°-Swivel drive

~ 360 kg

1 pcs. hydraulic aggregate MH-Rexroth with hydraulic cylinder HOERBIGER

All elements are preassembled and wired. Unit is shop-tested due to complete installation and tested at our works prior to delivery.

1.1.6 Steel construction

~ 2.600 kg

Machine frame, cantilever arm, gangway for access to ladle cover, railing on ladle cover for maintenance, heat protection.

Corrosion protection:
Steel parts de-rusted and double coated with heat resistant paint (250°C). Coating according to RAL 9006 (white aluminium, silver aluminium) with layer thickness of approx. 80µ. The paint fulfils DIN-EN-ISO 12944-6 for all 6 corrosive categories.

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1.2 Operation of vertical ladle drier, System FOEHN ®

The offered unit is to dry newly lined empty ladles in vertical position. The operation is simple and clear. The operator chooses the required program number at the **external program selector** and -if necessary- modifies the FINAL-temperature.

By pressing the button BURNER ON the selected program is released. All other functions proceed automatically:

- The combustion-air blower starts running
- The cantilever arm with ladle cover and burner moves vertically downwards onto the ladle by means of a hydraulic cylinder. The last part of swivel movement is done by the ladle cover's own weight for tight sealing of the ladle. Ladle is completely covered – no gap between.
- After a pre-ventilation start is released by burner control device and the flame is ignited directly by high voltage - no manually ignition, no ignition burner!
- Then the ladle is dried according to the selected heating program - no manually adjustment, no survey by eyes!
- After the program has ended, the final temperature is held until the ladle is to be used and the operator presses the button BURNER OFF: The energy supply is cut and the cantilever arm moves vertically upwards.

During the entire heating process the burner is monitored by a UV cell. In case of a flame disruption the energy supply is cut.

After each heating cycle the tightness of the main valves is checked automatically with the tightness control device. In case of a failure the unit cannot be started again unless the failure has been cleared.

In case of any failure shut-off and following re-start the unit continues at that certain step of program where it stopped (as long there was no power failure).

1.3 MAPEKO Soft drying system FOEHN ®

Refers to vertical ladle drier

In case of very slow heating rates (**~ 10°C / h**) and very slow starting temperatures (**~ 150 °C**) are required the unit is equipped with the special drying system "**SOFT®**

ings with the aim to achieve highest life expectancy.

Each ladle drier is able to operate with **additional air** which is guided during the drying program into the ladle by coaxial air ducts around the burner. This way the ladle is flushed with **additional air** which generates **a warm whirling wind inside the ladle** and avoids a too strong and quick heat radiation. With this system you achieve a very high touch-down ratio of the burner capacity.