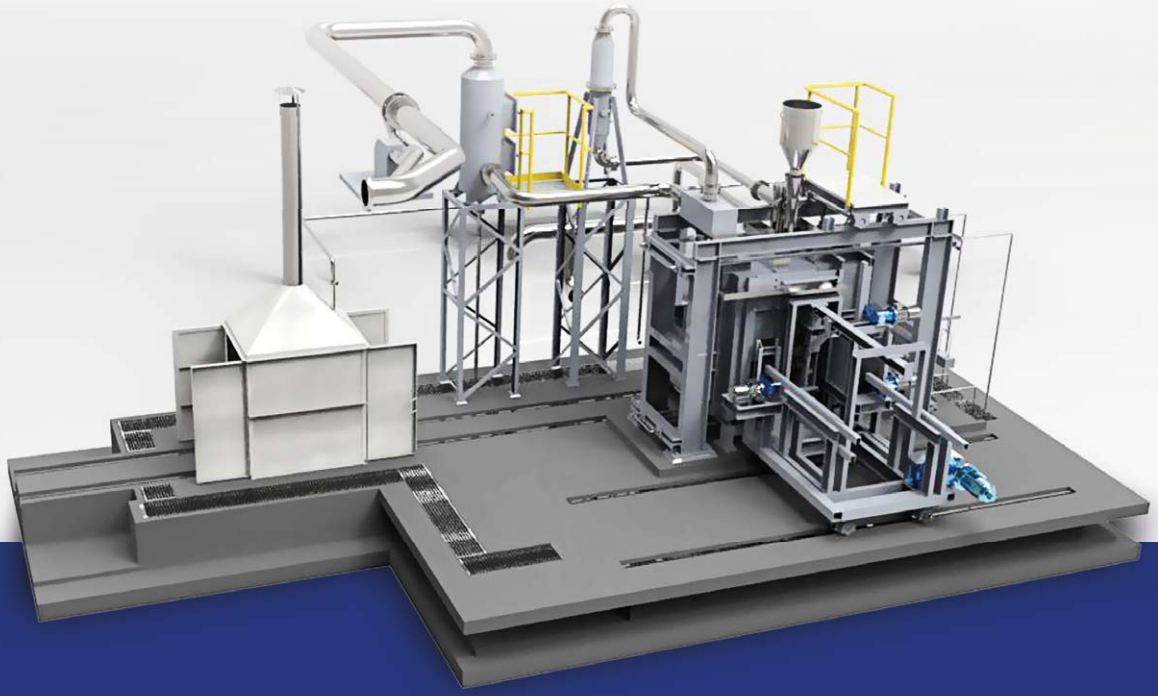
HUTNÍ PROJEKT
FRÝDEK-MÍSTEK

OVER 70 YEARS OF EXPERIENCE
IN COKE OVEN PLANTS



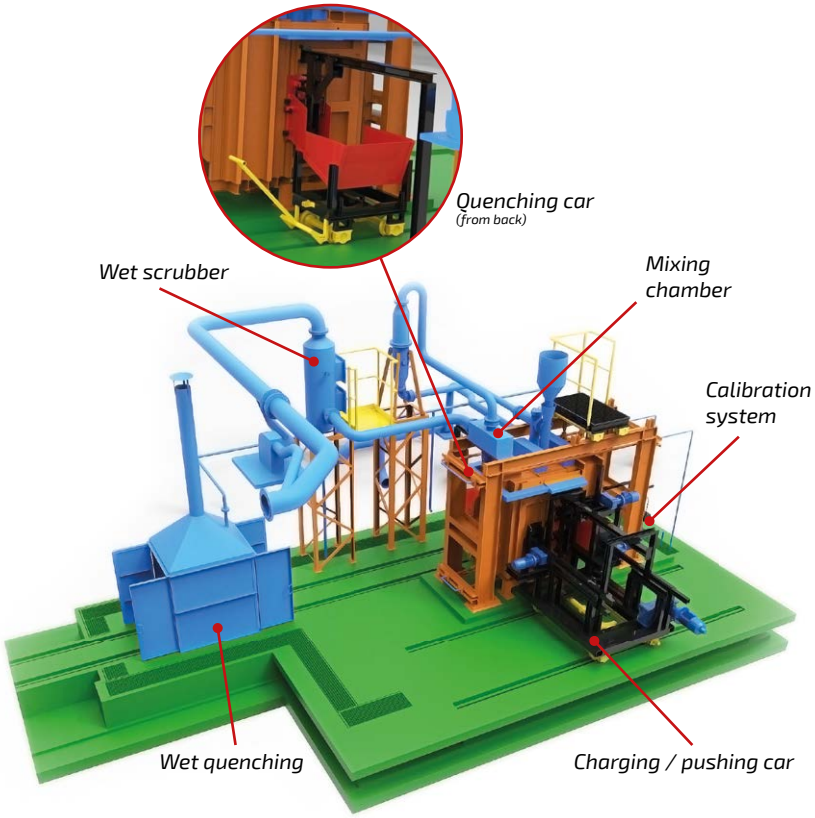
PILOT COKE OVENS

PILOT COKE OVENS WITH MOVABLE WALL

A tool for simulation of carbonization process with oven wall pressure determination

The pilot coke oven is a lab scale facility:

- designed for dedicated research work and routine support to industrial coke oven operations striving for excellence and expanding the knowledge on the safe blend design, raw material cost optimization, coke quality, and the battery lifetime prolongation,
- suitable for determination of the quality of coal and coal blends including their expansion behavior during the carbonization process and the influence on the quality of produced coke,
- capable of serving both top charge and stamp charge batteries thanks to its design and auxiliary equipment.



Coking pressure generated by different coking coals ranks among the most critical coal quality characteristics as it may give rise to operational troubles such as hard pushes and stickers, or even cause damages to coke oven refractory. A thorough understanding of the phenomenon coupled with an exact quantification of its magnitude is one of the key blend design limits requiring strict control with reference to variability in coal blend composition and oven charge bulk density in particular.

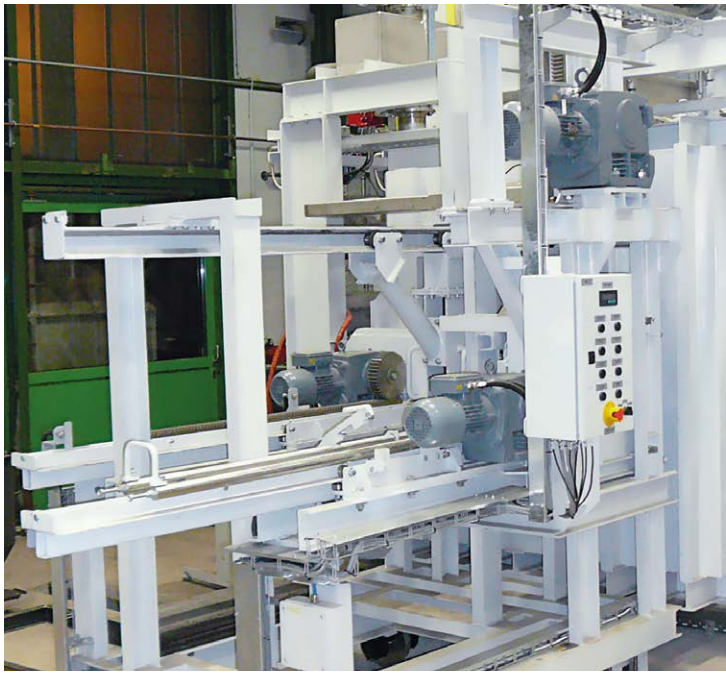
The principle of the coking pressure measurement in the pilot oven is based on measuring the force generated by the expanding plastic layer due to evolution of volatile matter developing so called internal gas pressure in the plastic mass of coal. The force is exerted on the oven wall through semi-coke and coke layers and is further transmitted through the movable "free-hanging" heating wall onto the load cell mounted on the fixed frame located outside the coking chamber. The oven wall pressure is therefore considered a consequence of an internal gas pressure.

During the entire coking process the internal gas pressure as well as temperature of the charge is simultaneously measured using a combined probe which is inserted through the oven door into the coal charge. The probe can be inserted from both sides of the oven and into multiple locations in the charge as per operator's order.

The data logging runs automatically, and all readings are saved in the control system for further processing and evaluation.

Movable wall oven design features:

- suspended "free hanging" movable wall,
- robust, high load bearing capacity steel structure combined with water cooled anchoring rods,
- special quality alumina-silica based heat resistant refractory with a long lifetime,
- replaceable load cells for low pressure and high pressure coals,
- wall pressure measurement calibration system suppressing the influence of false forces arising from frictions or temperature dependent steel dilatation,
- electrical heating by Kanthal rods with an independent thyristor control and variable heating ramp options,
- environmental-friendly operation thanks to the forced raw gas afterburning using natural gas or LPG followed by wet scrubbing and mechanical separation of fine particles,
- service machine with an integrated stamping box and the charging/pushing ram,
- manually operated coke quenching car and the quench station with water sprays,
- suction hoods above the oven doors and the exhaust fan for the elimination of charging/pushing emissions.



1 Prepared Coal cake

2 Coal cake in chamber

3 Chamber door opening

4 After 10h coking

5 Coke pushing ...

6 ... to quenching car

7 Quenched coke

Pilot oven features:

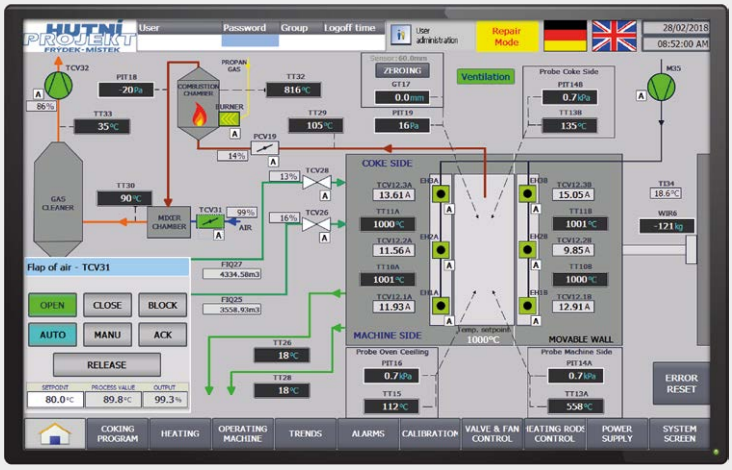
- continuous oven wall pressure measurement,
- internal gas pressure probes (0 – 400 kPa) with simultaneous temperature and internal gas pressure measurement in coal charge in optional insertion holes,
- vertical shrinkage measurement from the top of the oven,
- adjustable coke end temperature (max. 1,200°C) with heating ramp options,
- variable coking time depending on the targeted coking rate,
- automatic control of gas overpressure in the oven chamber,
- replaceable load cells for low pressure (0 – 40 kPa @ 1 ton load cell) and high pressure (0 – 200 kPa @ 5 ton load cell) coals and blends.

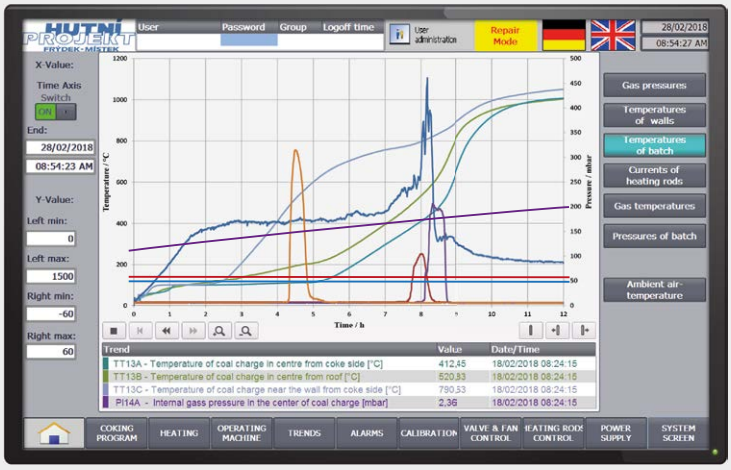
Calibration

In order to make the measurement of the oven wall pressure as accurate as possible, a calibration system is installed so that not only the load cell but also other parts of the entire measuring chain are under control. In such a way the bias resulting from false forces generated by either friction between the fixed and movable part of the oven or steel dilatation due to temperature changes is suppressed.

Pilot oven Control system:

- Simatic S7-1200 Process Control integrated in a power & control free-standing cabinet,
- color touchscreen Simatic HMI 1500 Comfort simplifying the control of the oven operation and visualization of the measured results,
- data storing and displaying,
- optional data transmission to external PC/network.





HUTNÍ PROJEKT FRÝDEK-MÍSTEK

OVEN CHAMBER AND COAL CHARGE PARAMETERS

	PO60-HP	PO250-HP	PO500-HP
Oven chamber Dimensions W x L x H [mm]	300 x 500 x 670	400 x 1060 x 735	450 x 1190 x 1040
Coal cake Dimensions W x L x H [mm]	280 x 480 x 500	380 x 117 x 585	430 x 1180 x 840
Coal charge capacity [kg]	60	250	500
Charge bulk density (dry)*) [kg/m³]	720 - 1000	720 - 1000	720 - 1000
Kanthal rods temperature (max) [°C]	1300	1300	1300
Heating wall temperature (max) [°C]	1200	1200	1200
Coking temperature [°C]	1050 - 1200	1050 - 1200	1050 - 1200
Temperature in tar seam [°C]	1050	1050	1050

*) *as per customer specification; stamp charge operation, simulation of top charge operation available*

PILOT OVEN TECHNICAL DATA

	PO60-HP	PO250-HP	PO500-HP
Pilot oven dimension W x L x H [mm]	1500 x 4050 x 2800	2100 x 5200 x 3800	2300 x 6000 x 4200
Required minimal area for Pilot oven installation W x L x H [mm]	6000 x 11000 x 5000	10000 x 15000 x 7000	10000 x 15000 x 8000
Max. power consumption [kW]	60	120	160
Natural gas consumption [m³/h]	0,4	0,6	0,9

ADD-ON OPTIONS:

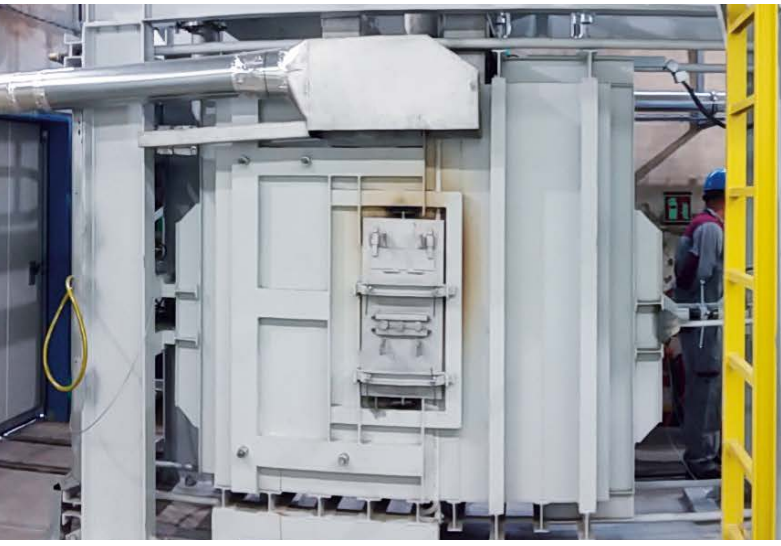
Wet quenching box
- closed steel box with opening gate and small chimney
- incorporated water spraying nozzles

Coal charge preparation system
- coal crushing, milling
- coal charge mixing and moisturizing
- coal handling, storing

Coke stabilization
- equipment for coke test (fall test)

Dry quenching car
- dry quenching of coke by nitrogen in air closed dry quenching car upon request

Pilot oven capacity and oven chamber dimensions
- other Pilot oven capacity as well as different oven chamber dimensions available upon individual request



PO60-HP PILOT COKE OVEN instalation in Třinecké Železárny a.s.

CONTACT:

HUTNÍ PROJEKT Frýdek-Místek a.s.
28. října 1495
738 01 Frýdek-Místek
Czech Republic

Phone: +420 558 877 210
E-mail: hpfm@hpfm.cz
www.hpfm.cz / www.hutniczech.com