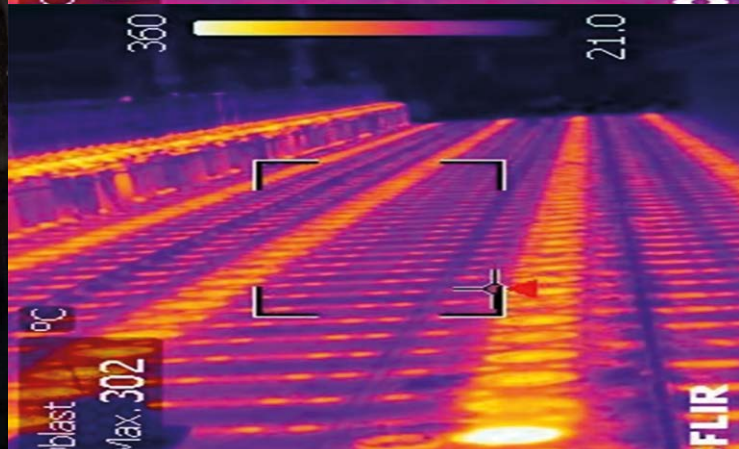
HUTNÍ PROJEKT
FRÝDEK-MÍSTEK

OVER 70 YEARS OF EXPERIECE IN COKE OVEN PLANTS

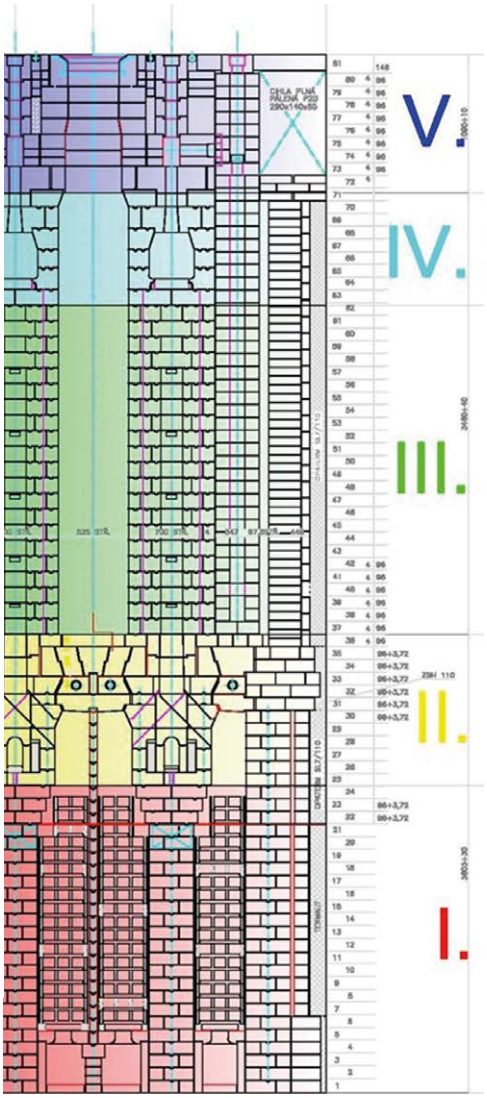
SERVICES FOR COKE OVEN BATTERIES
Thermo – Technical Division



COKE OVEN BATTERY SERVICES

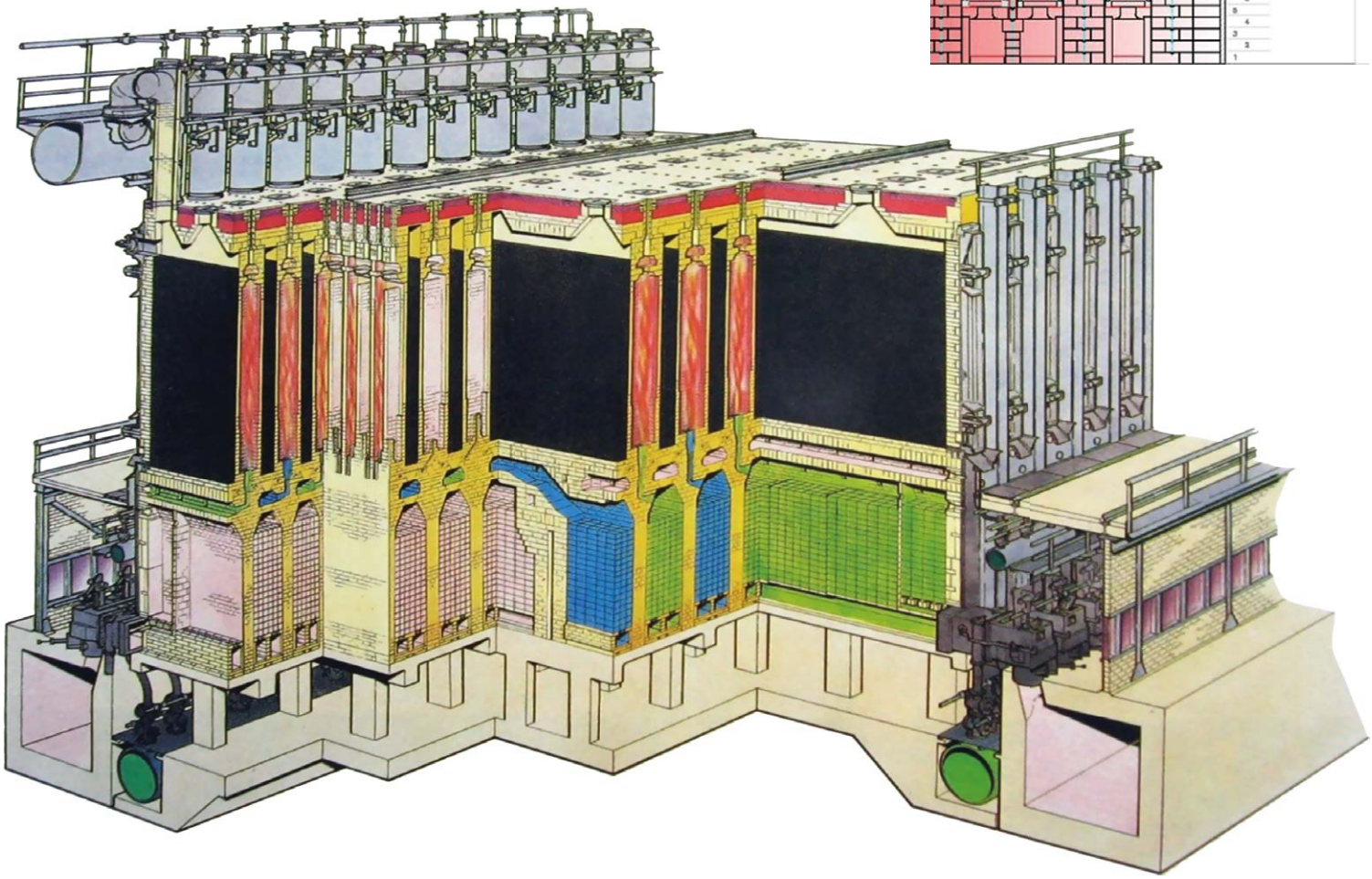
HUTNÍ PROJEKT Frýdek-Místek has over 70 years of experience in Coke oven batteries. Based on deep knowledge and know-how in coke oven batteries designing, building, revamping and operation, group of our experts from Thermo-technical division (TTD) can provide complex services in this field as per latest standards.

Our services will extend the battery's lifespan, improve the quality of the produced coke, optimize operational costs, and enhance the battery's environmental impact to meet new requirements for efficient battery operation.



Provided services:

- regulation and optimization of heating process in coke oven batteries,
- thermal regulation of coke oven batteries,
- battery anchoring alignment,
- audits of COB,
- expert studies,
- hot and cold repairs preparation,
- supervisions during entire process of coke oven battery building or revamping, heating-up, commissioning after revamping,
- checks and tests of new refractory during its taking over at manufacturer.
- heating - up of batteries,
- designing and implementing of computerized software for heating management of coke ovens,
- environmental impact assessment, proposals for improvement and their implementation.



BATTERY REGULATION - TEMPERATURE AND THERMAL

Regulation of the coke oven battery (COB)

The process involves setting up the combustion of the heating gas to achieve an optimal distribution of heat across the coke oven battery (COB). This regulation improves the quality of the coking process and primarily reduces emissions of CO and NOx resulting from uncontrolled combustion processes. The optimized temperature should be consistent across both the horizontal and vertical cross sections of the battery.

GOAL – to find out and set optimal temperature and heat distribution across the battery

Procedure consists from two processes:

TEMPERATURE REGULATION:

- setup of optimal temperature distribution across the particular heating wall,
- setup of optimal temperature distribution cross the length of COB.

HEAT (THERMAL) REGULATION:

- setup of pressure conditions of coke battery to find optimized value of the burning ratio,
- setup of optimal combustion air ratio between heating gas and air.

Both regulations has to be done together

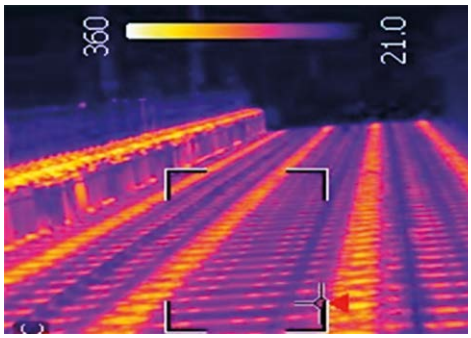
Steps:

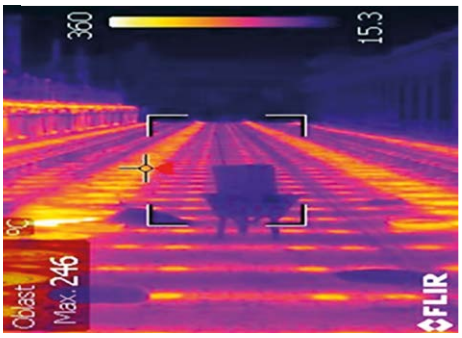
- measurement of temperature in each heating flue in particular heating wall,
- daily measurement of temperature across the length of COB,
- measurement of temperature changes during coking period,
- measurement of temperature changes after reversing,
- flue gas analysis in particular gas boxes,
- flue gas analysis before chimney,
- pressure measurement in particular gas boxes and on battery roof,
- heating gas analysis and calorific value,
- charge composition, moisture.

Procedure:

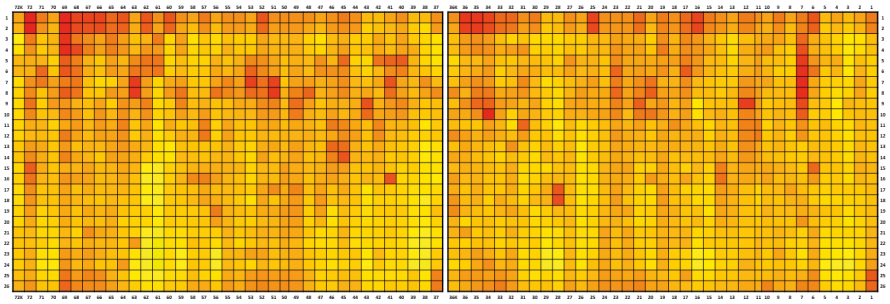
- Daily evaluation of measured results by special SW.
- Regulation of particular temperature deviations (heating gas flow to particular heating flue).
- Regulation of combustion air inlet in particular gas boxes.
- Regulation of flue gas outlet from particular gas boxes.

Checking of ceiling, temperature measurement



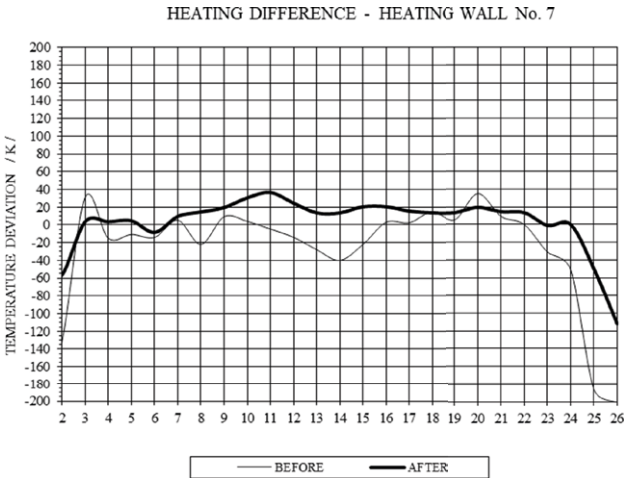


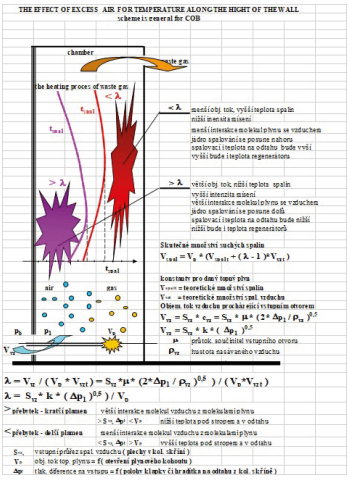
Distribution of temperatures on COB



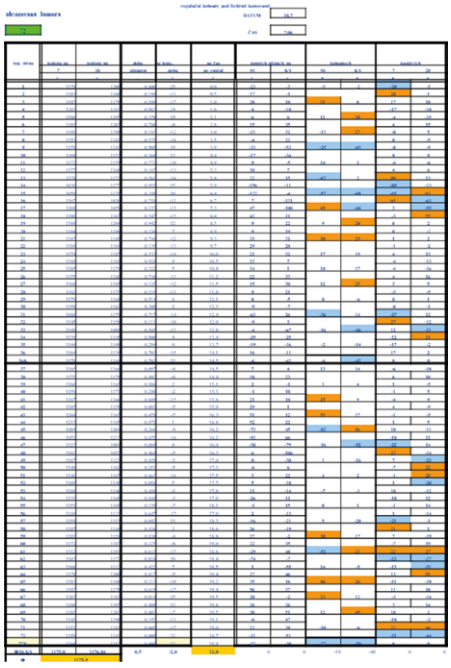
Graphic view on surface distribution of temperatures in individual heating flues on the ceiling of the battery. It enables a clear and simple view of the overall temperature distribution in the battery.

Programs and calculation used for checking of heating process

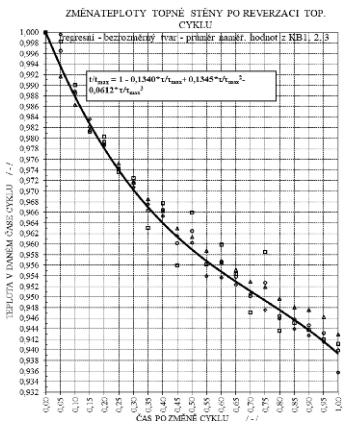


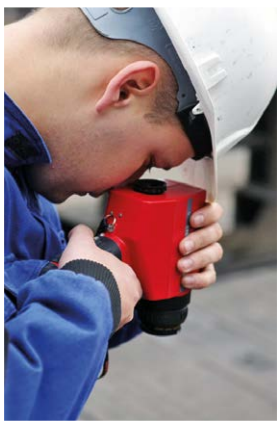


$$Q = V'_{pl} * [(q_{pl}+c_{pl}*t_{pl})+\lambda*V_{vzteor}*c_{vz}*t_{vz}]*\eta_t$$



Decrease in temperature after the change cycle





Checking of combustion

BATTERY REGULATION - ANCHORING

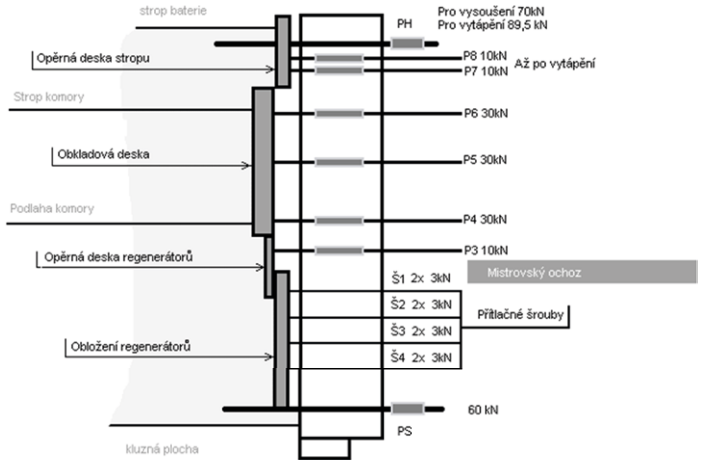
Anchoring the battery is one of the key elements in the life of coke oven battery. In case of incorrect anchoring adjustment or neglecting the adjustment of the battery anchoring, significant damage to the refractory will occur. The proper operation of the battery is affected and the lifetime of the battery is significantly shortened.

Battery anchoring:

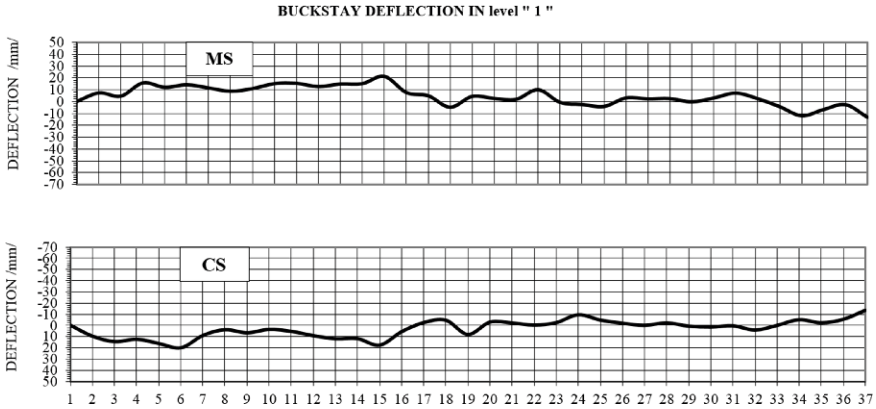
- keep COB "together",
- consists of tire rods, buckstays, springs, flash plates.

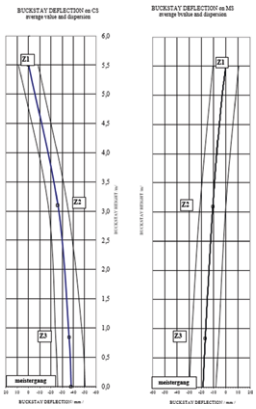
Anchoring regulation:

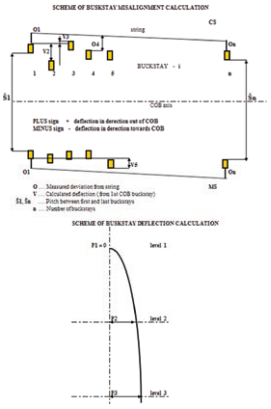
- if loose => refractory splitting
- if too tight => refractory cracking



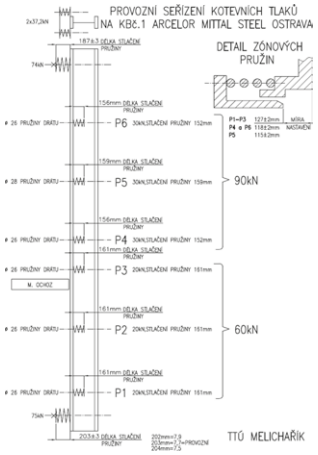
Measurement of buckstays misalignment and deflection

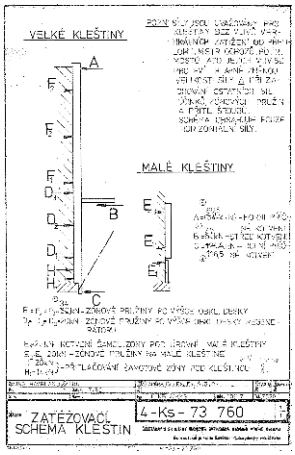




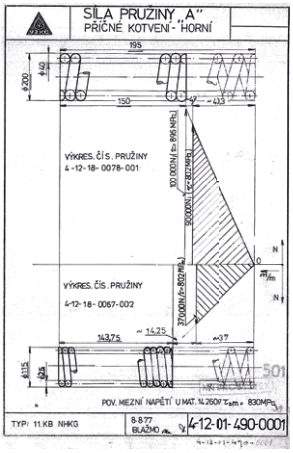


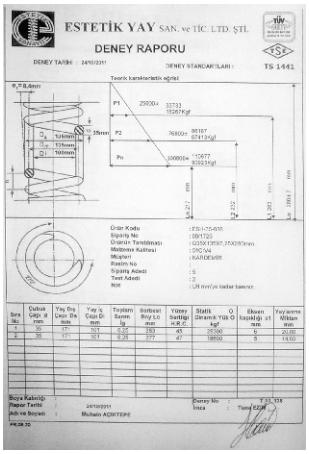
Regulation of springs adherence pressure - - set value from passport of COB



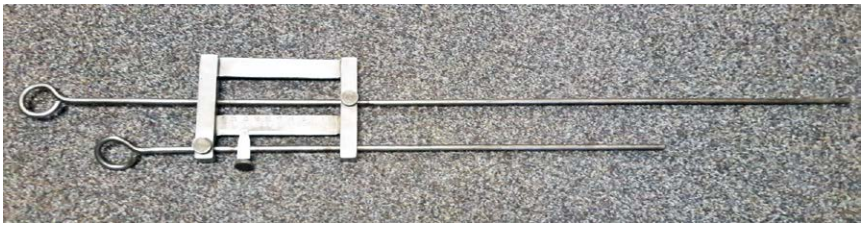


Spring characteristics





Regulation of springs adherence pressure

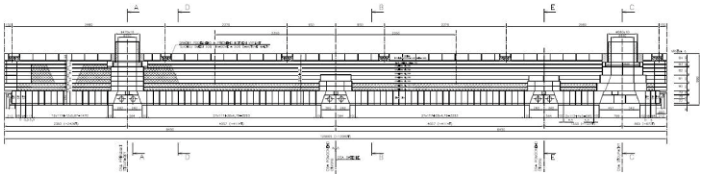


BATTERY REPAIRS - PREPARATION

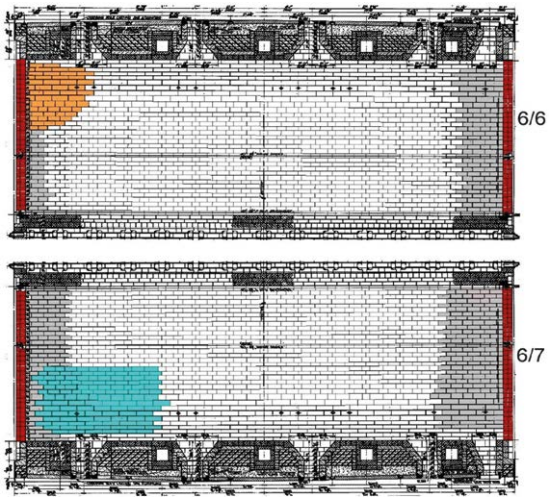
During operation of coke oven battery battery, damage to refractory occurs due to various reasons. Refractory repairs significantly extend the life of the coke oven battery.

Battery repairs:

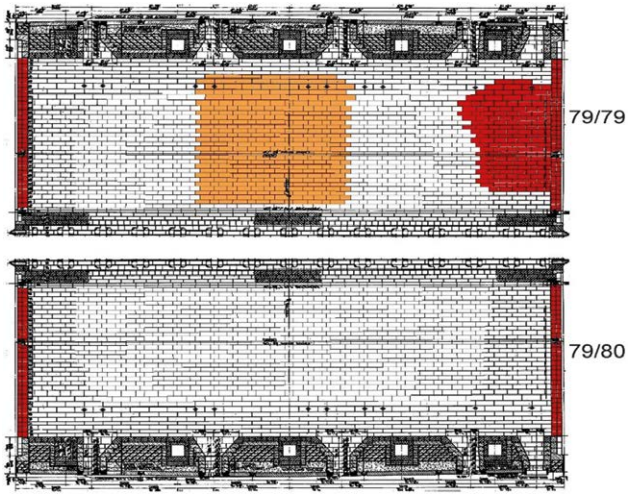
- Hot repairs (welding, guniting, end flue rebuilding
- Cold repairs (one or goup of few adjacent walls rebuilding)



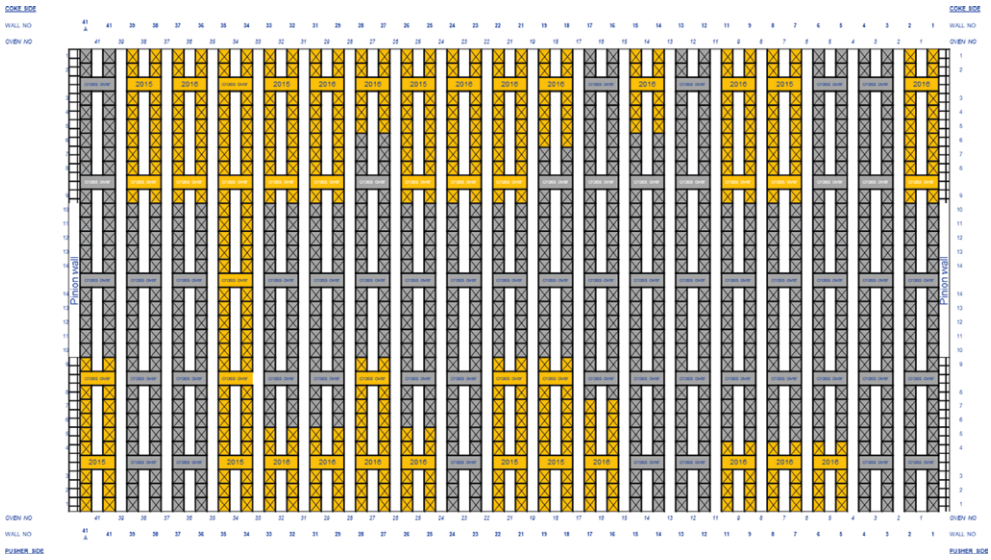
Audit of the heating walls is carried out by experts from Thermo-Technical Division. Wall damages are plotted, an evaluation is made. Based on this, the need, extent and type of repairs are determined. Repairing works are supervised by HUTNI PROJEKT specialists.

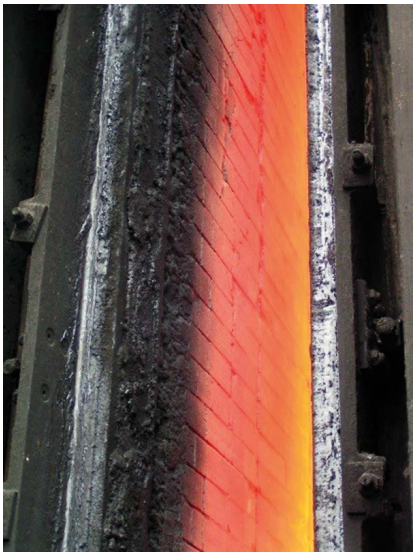


An example of the graphical output of the heating wall audit with the damaged areas drawn.



Example of Hot repair plan





BATTERY - REFRACTORY ACCEPTANCE AND INSPECTION

Coke oven battery is a huge massive of refractory. During its construction and revamping, special attention must be paid to the quality of refractory.

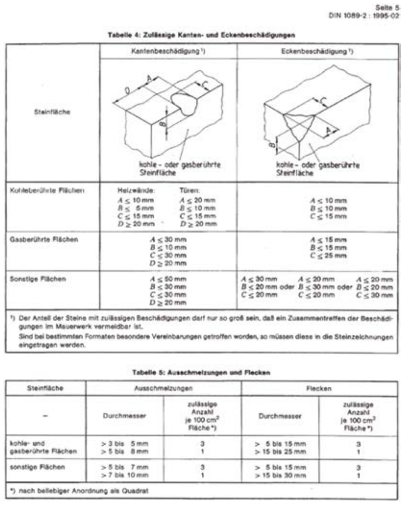


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Tabelle 4: Zulässige Kanten- und Eckenbeschädigungen

	Kantenbeschädigung ¹)	Eckenbeschädigung ¹)
Steinfläche	(Skizze: kohle- oder gasberührte Steinfläche)	(Skizze: kohle- oder gasberührte Steinfläche)
Kohleberührte Flächen	Heizwände: $A \leq 10$ mm, $B \leq 5$ mm, $C \leq 15$ mm, $D \geq 20$ mm; Türen: $A \leq 20$ mm, $B \leq 10$ mm, $C \leq 15$ mm, $D \geq 20$ mm	$A \leq 10$ mm, $B \leq 10$ mm, $C \leq 15$ mm
Gasberührte Flächen	$A \leq 30$ mm, $B \leq 10$ mm, $C \leq 30$ mm, $D \geq 20$ mm	$A \leq 15$ mm, $B \leq 15$ mm, $C \leq 25$ mm
Sonstige Flächen	$A \leq 50$ mm, $B \leq 30$ mm, $C \leq 30$ mm, $D \geq 20$ mm	$A \leq 30$ mm, $B \leq 20$ mm, $C \leq 20$ mm oder $A \leq 20$ mm, $B \leq 30$ mm, $C \leq 20$ mm oder $A \leq 20$ mm, $B \leq 20$ mm, $C \leq 30$ mm

¹) Der Anteil der Steine mit zulässigen Beschädigungen darf nur so groß sein, daß ein Zusammentreffen der Beschädigungen im Mauerwerk vermeidbar ist.
Sind bei bestimmten Formaten besondere Vereinbarungen getroffen worden, so müssen diese in die Steinzeichnungen eingetragen werden.

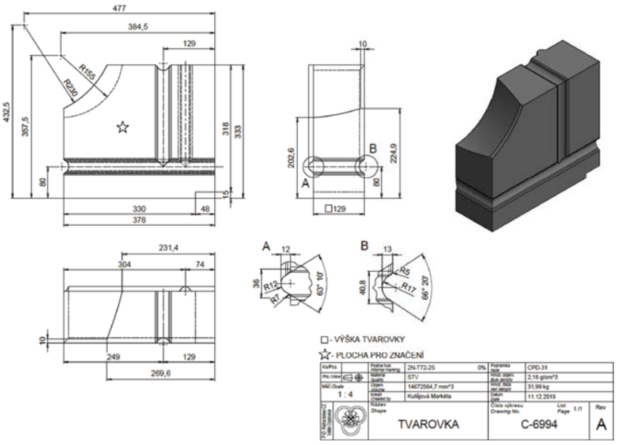
Tabelle 5: Ausschmelzungen und Flecken

Steinfläche	Ausschmelzungen		Flecken	
–	Durchmesser	zulässige Anzahl je 100 cm^2 Fläche *)	Durchmesser	zulässige Anzahl je 100 cm^2 Fläche *)
kohle- und gasberührte Flächen	> 3 bis 5 mm > 5 bis 8 mm	3 1	> 5 bis 15 mm > 15 bis 25 mm	3 1
sonstige Flächen	> 5 bis 7 mm > 7 bis 10 mm	3 1	> 5 bis 15 mm > 15 bis 30 mm	3 1

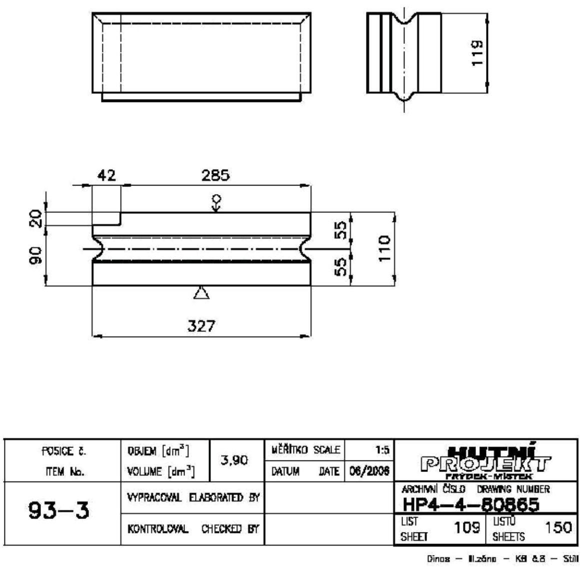
*) nach beliebiger Anordnung als Quadrat

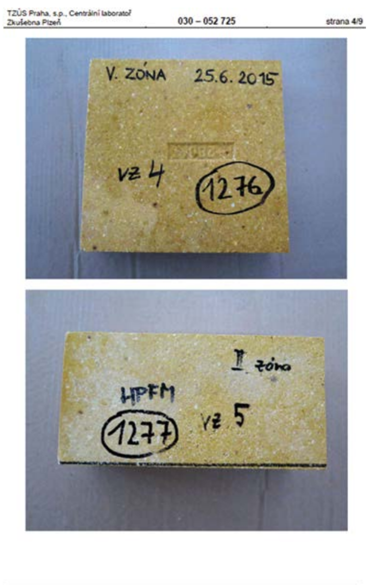
Experts from Thermo-Technical Division provide for clients independent dimensional and quality inspections of refractory at manufacturer before shipping or on building site.

Inspection are carried out based on EU DIN 1089 standard or alternatively can be done as per own client standard.



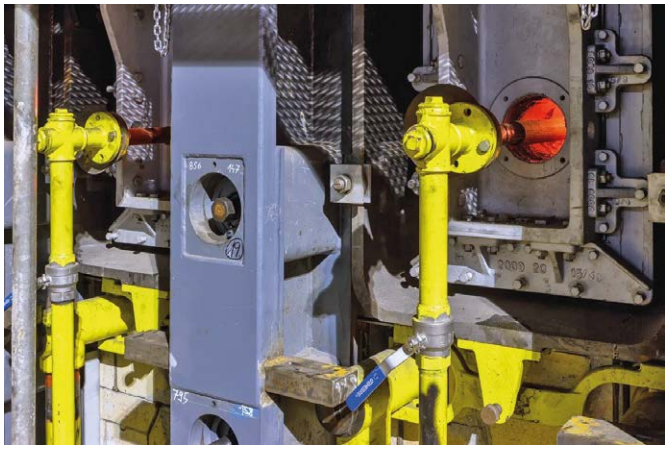
Shaped piece No. 93-3





BATTERY - REFRACTORY ACCEPTANCE AND INSPECTION

Coke oven batteries which technical conditions or environmental levels does not allow their further operation are revamped so as to meet current technological and environmental requirements.

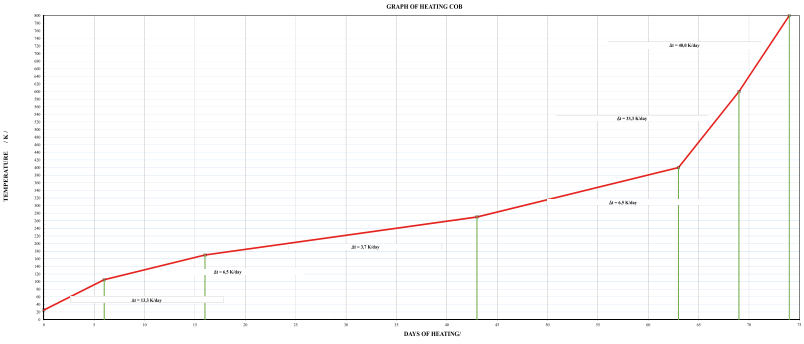


In order to ensure proper battery operation as well as its long years functionality, the extreme attention must be put to the correct construction of refractory.

Experienced experts from TTD can provide to the client independent and full time supervision guaranteeing the complete correctness of the heating walls construction.

After revamping or after cold repairs the next extremely important step is to heat-up the battery properly. Based on determined physical properties of refractory the heating-up curve is calculated and elaborated.

Following this curve the battery is under TTD experts supervision heated-up and commissioned. Further after commissioning, first battery regulation is done.



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