

First operational experiences of the next generation PROven[®] system at a Coke Plant - “PROven[®] NG”

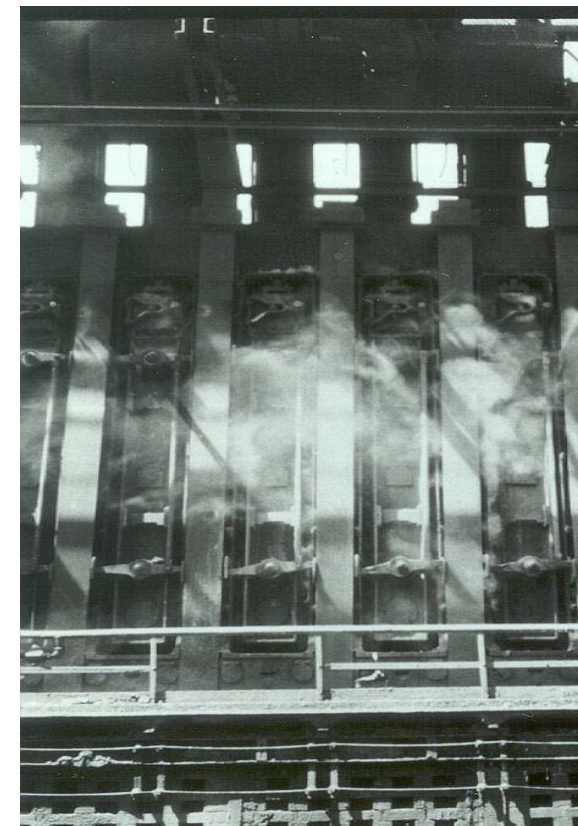
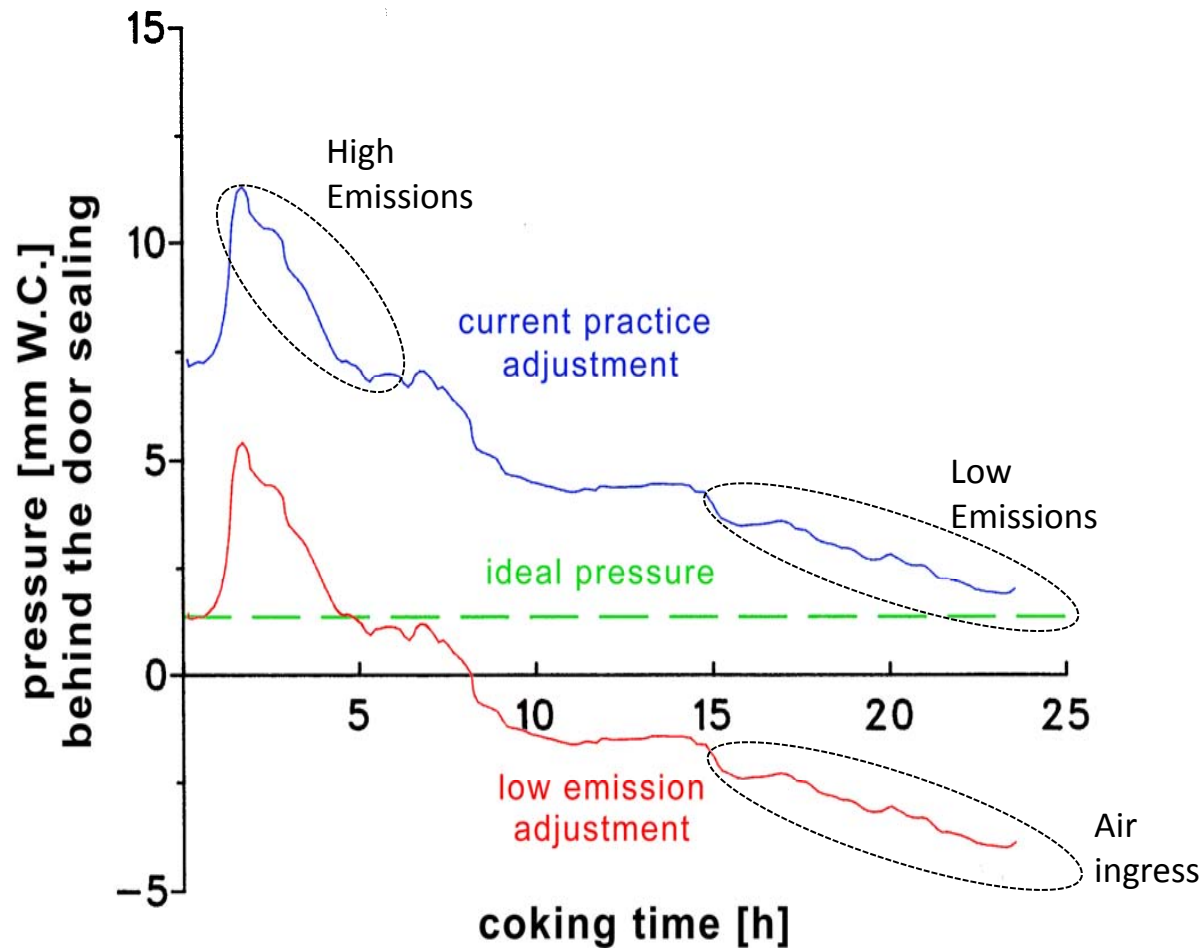
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◆ STEEL'S PREMIER TECHNOLOGY EVENT
AISTech2016
16-19 May • Pittsburgh, Pa., USA
David L. Lawrence Convention Center

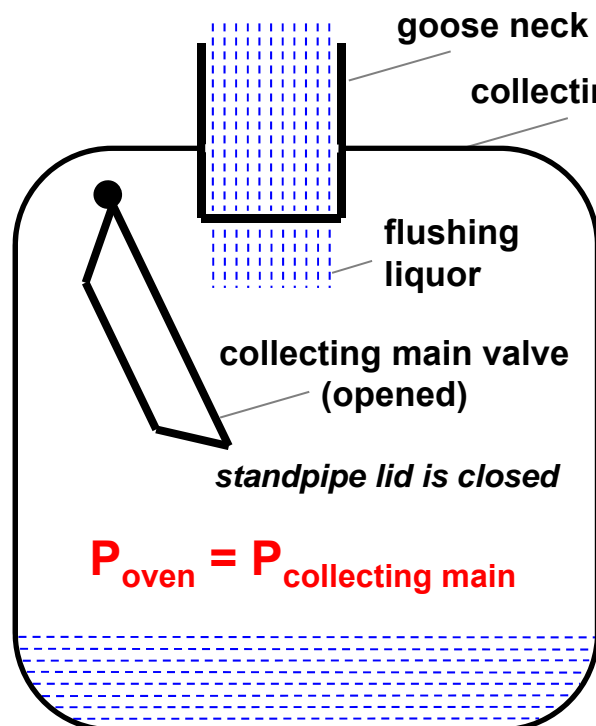


Pressure development during coking time at coke oven doors



Conventional operation: „on the main“ and „off the main“

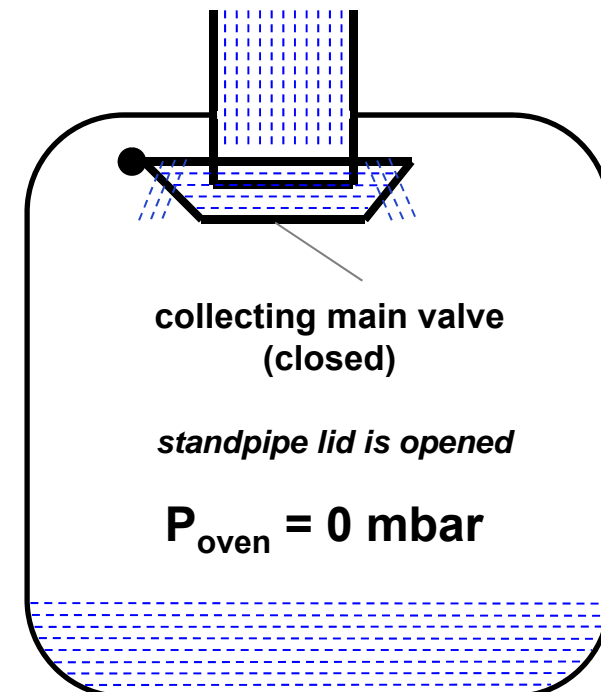
Oven is „**on the main**“
ready for charging / coking process



**No oven
pressure control
during
coking process.**



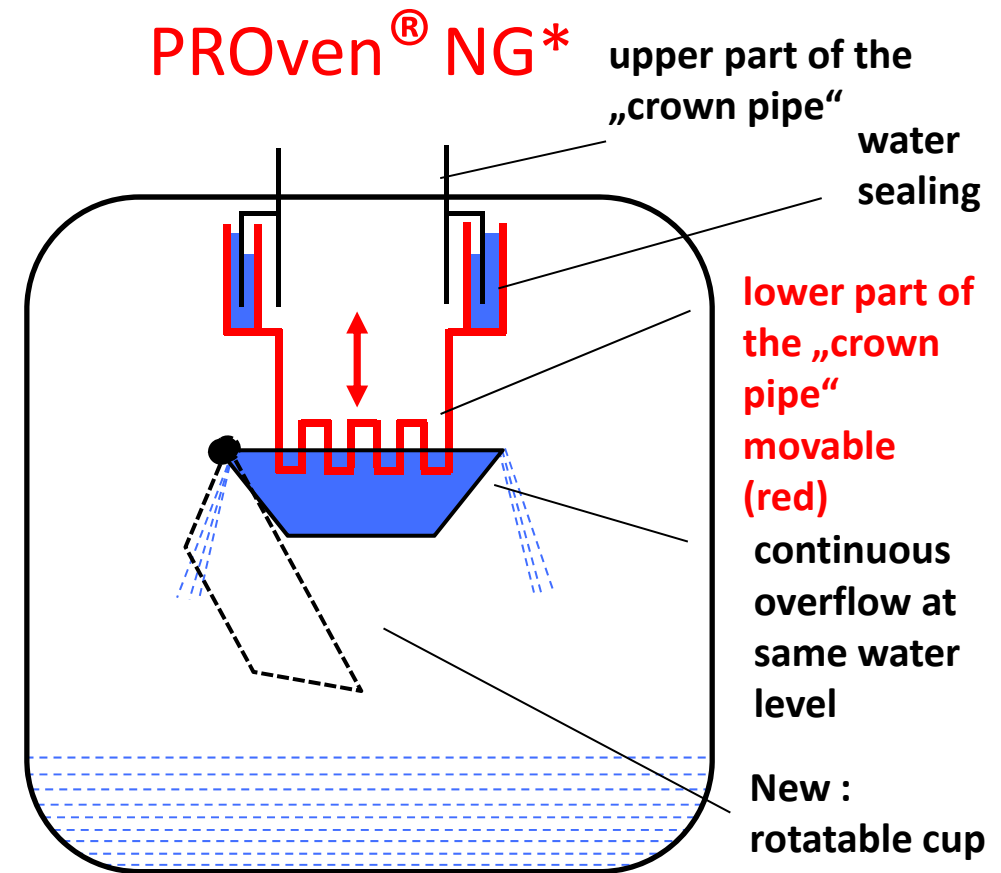
Oven is „**off the main**“
ready for pushing



Some basics of PROven[®] - Pressure Regulated Oven

The most important technological improvements of PROven[®] :

- The oven pressure is decoupled from the collecting main pressure.
- The collecting main operates with negative pressure.
- The pressure inside each oven is controlled individually.
- Charging gases are sucked off by negative collecting main pressure.
- With PROven[®] NG the conventional valve is replaced by a so called „Rotatable Cup“.
- The new rotatable cup can be rotated like a „conventional valve“.
- The water level inside the new rotatable cup is fixed (always in **overflow** mode).
- The crown pipe itself is moved to directly control the oven pressure!



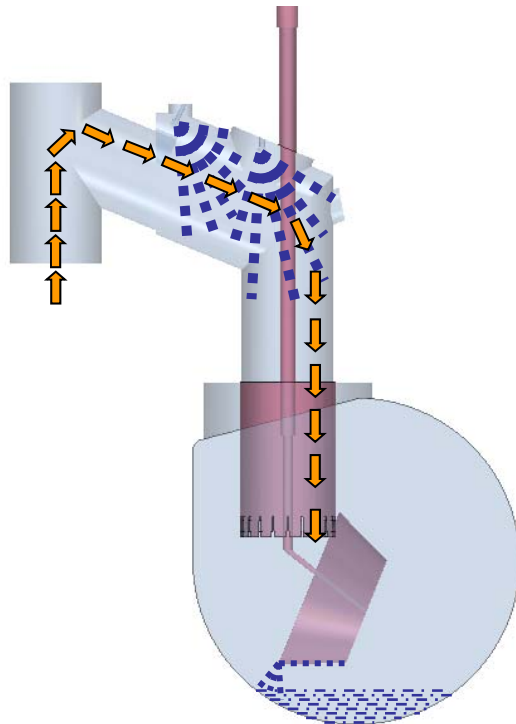
*NG = Next Generation

PROven[®] NG :

Operation of the rotatable cup

Oven is „**on the main**“
ready for charging

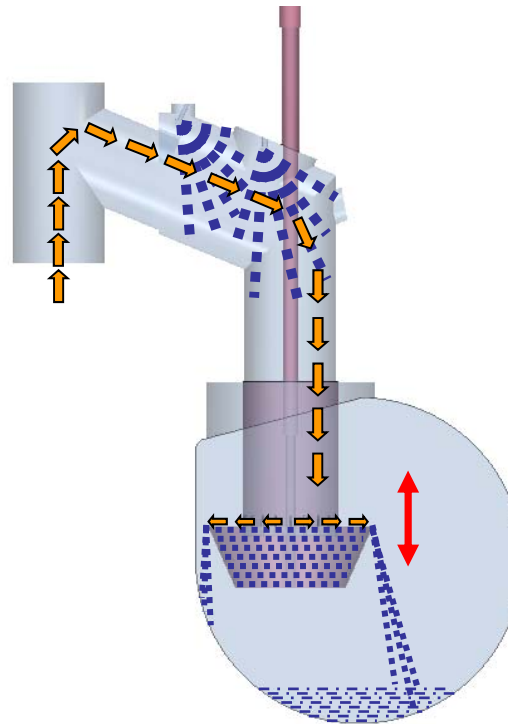
$$P_{\text{oven}} = P_{\text{collecting main}}$$



Crown pipe open;
standpipe lid is closed

Oven **pressure regulation** during
coking process

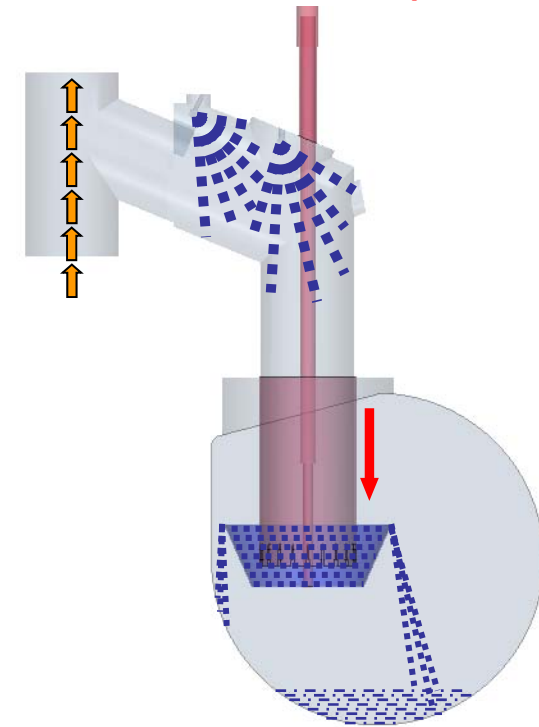
$$P_{\text{oven}} \neq P_{\text{collecting main}}$$



Crown pipe moves in water;
standpipe lid is closed

Oven is „**off the main**“
ready for pushing

$$P_{\text{oven}} = P_{\text{atmosphere}}$$



Crown pipe dipped in water;
standpipe lid is open

Operation at a single oven in a coke plant: Retrofitting of **PROven[®] NG** to an old coke oven

Battery data:

- Age of battery: 25 years
- Number of ovens: 65
- Height of ovens: 5.5 m (30 m³ oven volume)
- 2 gas collecting mains

Retrofit

- **PROven[®] NG** has been mounted in between collecting main valve and standpipe basis (flange connection) under full operation basis
- Remote data acquisition installed
- Operation at +20°C (October '15) down to -15°C (January '16)
- Operation period: October 2015 to May 2016 (8 months without interruption)

Typical **PROven[®] NG** Data

- Liquor flow for water sealings: max. 600 l/h





Retrofit installation of **PROven[®] NG** to an old coke oven

Moved in 1 piece
to battery top



PROven[®] NG still „at the
hook“

Installation complete

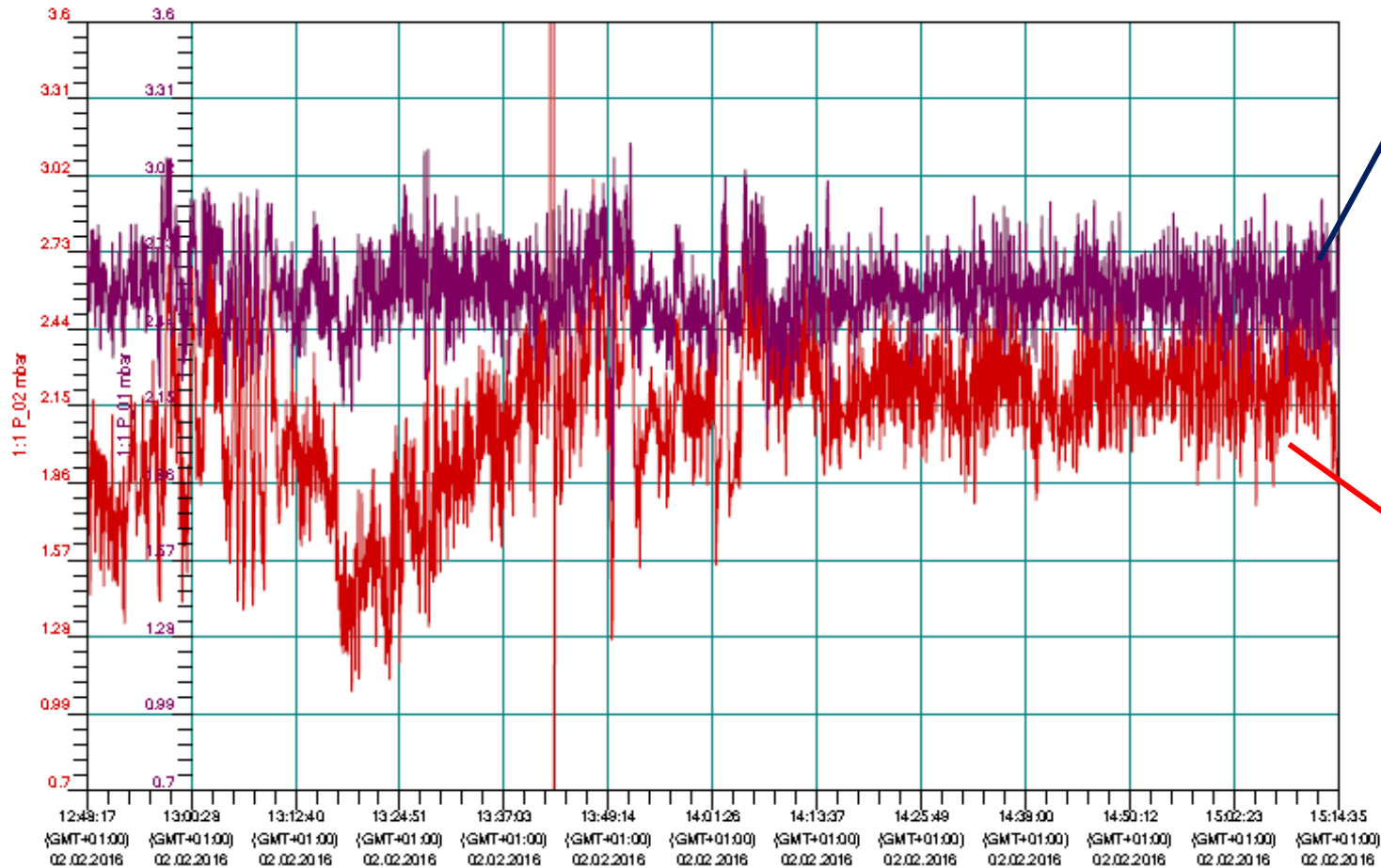


Retrofit installation of **PROven[®] NG** to an old coke oven – after some months of operation



Pressure Control in coke oven – 02.02.2016

Angewandte Control
Kanäle



Gas pressure in
coke oven
(setpoint: 2,6 mbar)

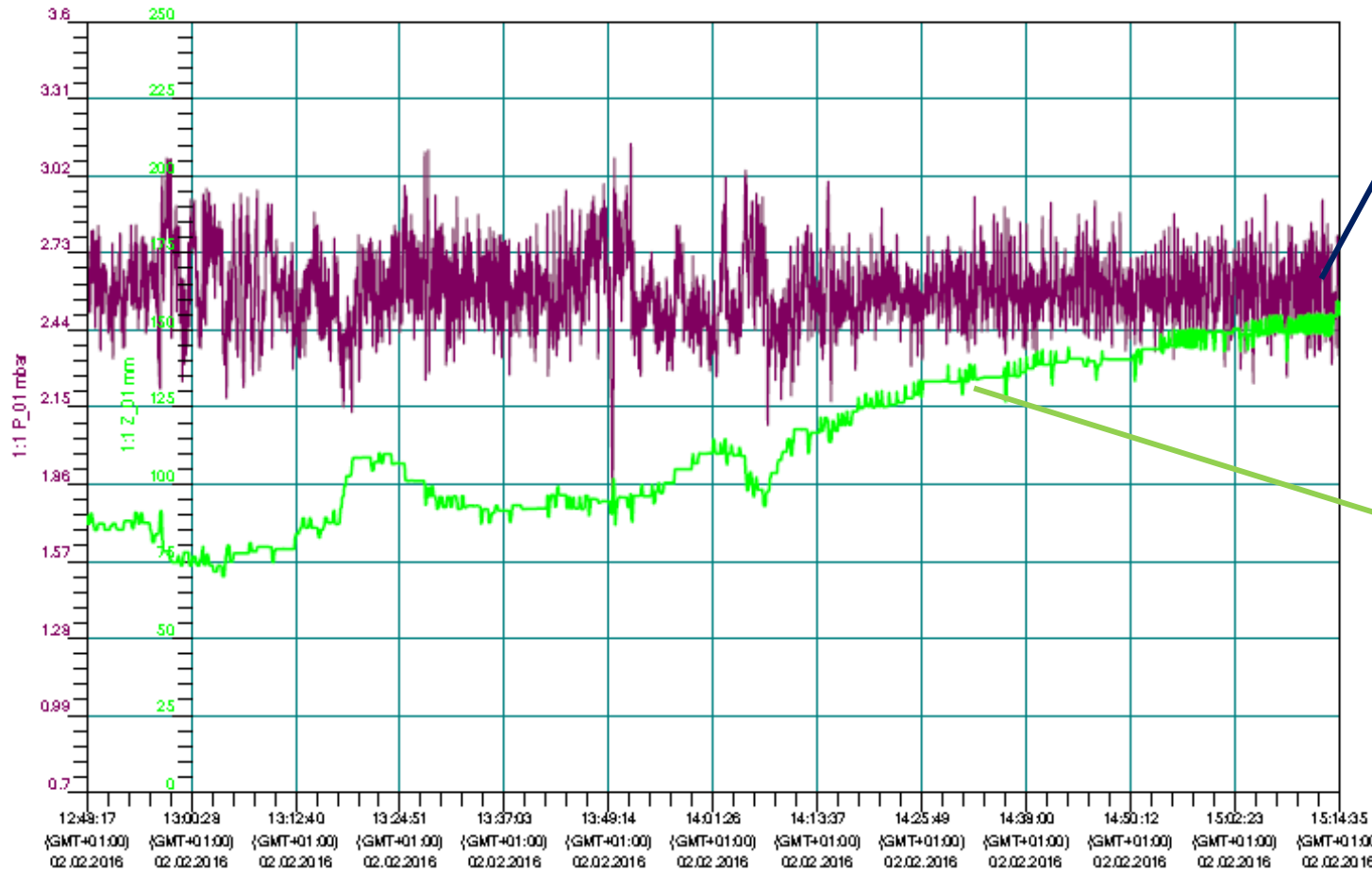
Gas pressure in
gas collecting
main

Start: 12:48

End: 15:14

Pressure Control in coke oven – 02.02.2016

Angewandte Technik
Kanäle



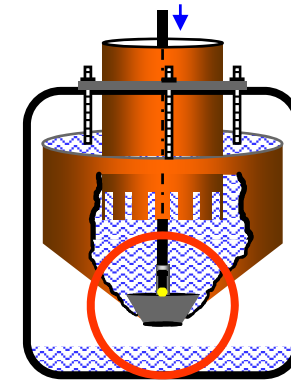
Gas pressure in coke oven (setpoint: 2,6 mbar)

Movement of crown pipe (Position in mm)

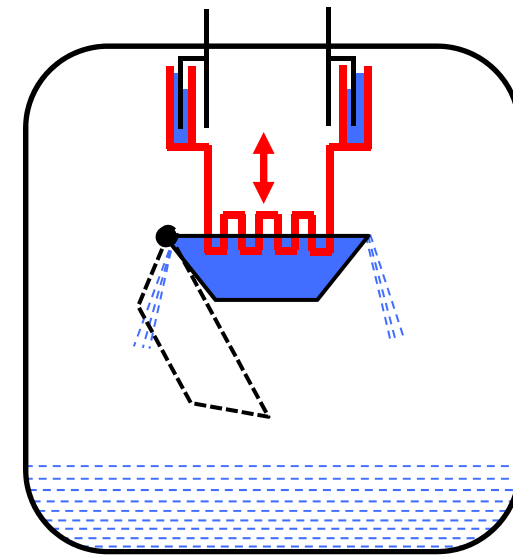
Start: 12:48
End: 15:14

Conclusions (1/3)

- The **PROven[®] NG** design is much simpler and more rugged compared to previous **PROven[®]** model.
 - The new crown pipe and rotatable cup are less prone to blockages than the previous drain valve in the FixCup.
 - The **PROven[®]** system has narrow clearance in some parts of the drain valve that can be blocked by deposits and reduces watertightness of the drain valve.
 - Permanent discharge of buoyant particles by continuous water overflow over the rim of the rotatable cup into the gas collecting main.
 - Bigger particles are swept out by rotating the new rotatable cup during pushing of the oven.
- No relative movement of the **PROven[®] NG** components, if the collecting main and the goose neck misalign.



PROven[®]

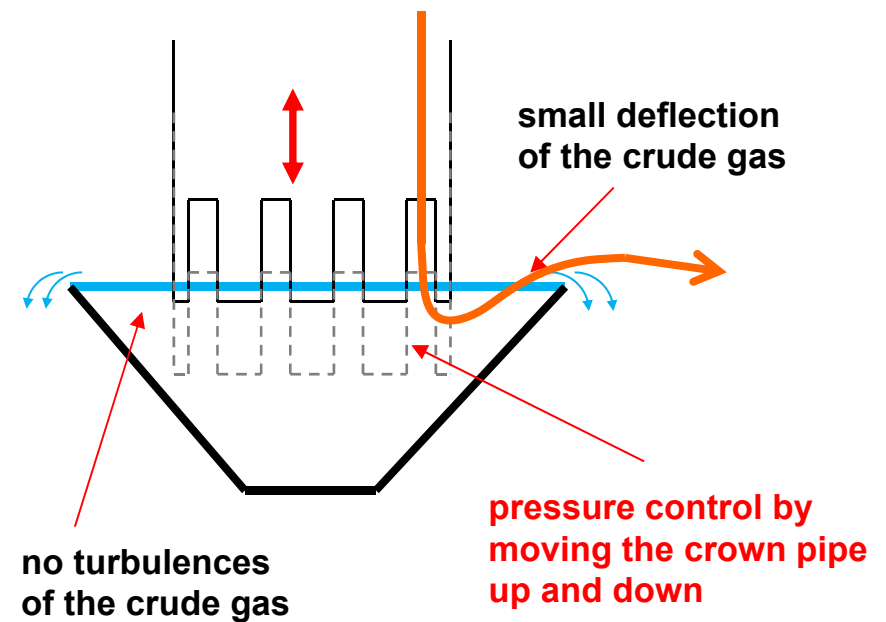


PROven[®] NG

Conclusions (2/3)

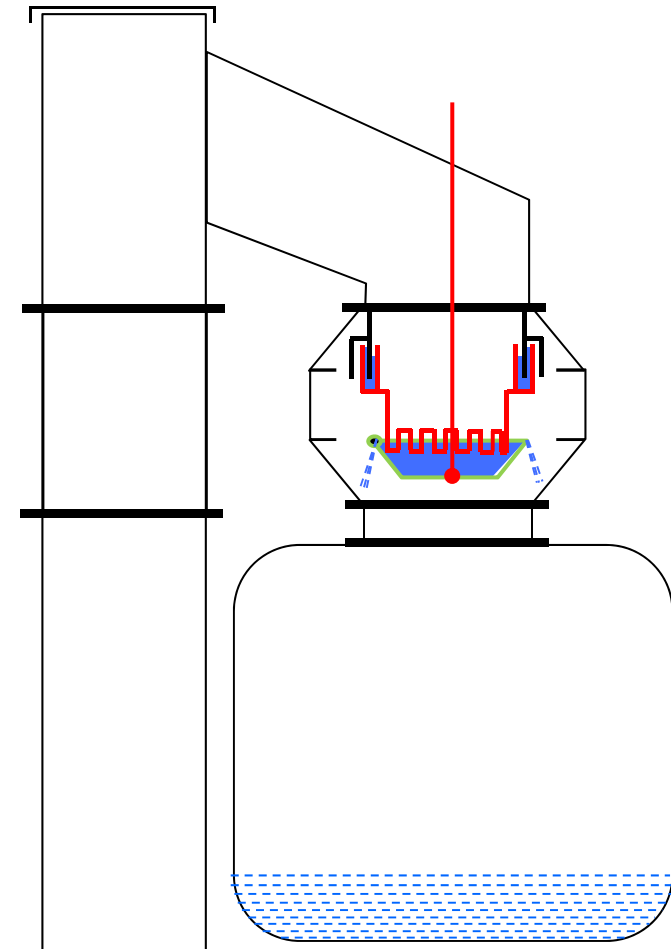
- The pressure control speed with **PROven[®] NG** is enhanced.
 - By moving the crown pipe up and down in the water of the rotatable cup the oven pressure control is fast and direct.
 - The pressure control is decoupled from the previous water level rise or fall (which is different in speed).

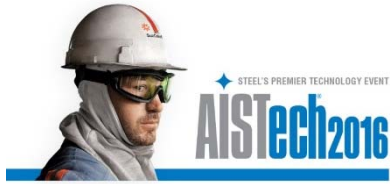
PROven[®] NG



Conclusions (3/3)

- The dimension of the **PROven® NG** system is significantly smaller.
 - Retrofitting with **PROven® NG** can be done without modification of the gas collecting main.
 - Arrangement of the complete **PROven® NG** system outside the gas collecting main is possible.
 - The water seal of the actuation rod is located outside the goose neck with **PROven® NG**, therefore less heat impact and direct accessibility for maintenance & visual control.





Success Stories – PROven[®] (Pressure Regulated Oven)

PROven[®]
a registered Trademark of
DMT GmbH & Co. KG



Installed by Uhde GmbH, Germany,
under license of DMT for

- **KBS Schwelgern**, Germany
- **Taiyuan Iron and Steel**, China
- **POSCO**, Korea
- **Ma Anshan**, China
- **CST**, Brazil
- **Hyundai Steel Company**, Korea
- **Shougang**, China
- **CSN**, Brazil
- **Shagang**, China
- **HKM**, Germany
- **Clairton**, USA
- **Algoma**, Canada

PROven[®]
is installed in more than 2100
ovens worldwide.



THANK YOU FOR YOUR ATTENTION!