New PW Coke Oven Batteries 2A & 2B for JFE Steel Corporation at Kurashiki Plant

BY

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1. **Introduction**

2. **Project Highlights**
   - Project Constraints
   - Project Time Schedule

3. **Technological Improvements**
   - Heating and Combustion System
   - PW Design Tools – Combustion System
   - Bracing System
   - PW Design Tools – Bracing System
   - Refractory
   - PW Design Tools – Refractory
About 1,630 highly-qualified staff

26 Group members in 17 countries, including 20 operational entities

Joint ventures: TMT, Paul Wurth-IHI, P&A Industrial Engineering, Paul Wurth Kovrov

Other countries covered by Representations
Summary

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Project Highlights

PW and PW-IHI have realized the New Top Charging Coke Ovens Batteries 2A and 2B for JFE Steel Corporation plant located in Kurashiki, Japan

Project includes:

- Engineering
- Procurement
- Erection Supervision
- Heating-up
- Commissioning

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<th>COKE OVEN BATTERIES 2A &amp; 2B</th>
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<tr>
<td>OVEN PARAMETERS</td>
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<tr>
<td>Oven Height</td>
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<td>Oven Lenght</td>
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<td>Oven Width</td>
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<td>Useful Volume</td>
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<td>Oven pitch</td>
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<th>COKE PLANT</th>
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<td>Coke Production</td>
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<td>Batteries 2A &amp; 2B</td>
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Project Constraints

Pad-up of new Batteries 2A & 2B (43 + 43 ovens) in line with the existing batteries

New Batteries 2A & 2B built in the same place as the old-ones
- Reuse of the existing stack and waste gas channel
- Reuse of existing civil foundation, pinion wall and end-platforms

New Batteries in Line with the existing-ones
- Constraints of existing old batteries
- Same set of operating machines
## Project Time Schedule

<table>
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<tr>
<th>Stage</th>
<th>Start Month</th>
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<tr>
<td>DEMOLITION</td>
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<tr>
<td>CIVIL WORKS</td>
<td>9th month</td>
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<tr>
<td>BUKSTAY &amp; WPP ERECTION</td>
<td>12th month</td>
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<td>REFRACTORY ERECTION</td>
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<td>HEATING-UP</td>
<td>23rd month</td>
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<td>FIRST COKE</td>
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**SEAISI 2017 – New PW Coke Oven Batteries 2A & 2B at JFE Kurashiki**
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PW has introduced in the new COB 2A & 2B all the latest technological solutions, with the final result of having in the same place two new State-of-The-Art Coke Oven batteries

- New Batteries Twin Flue design instead of Half Divided
- Optimized Combustion (emission and consumption reduction)
- Bracing System Taylor Made
- Heating-wall Stability Increased
HEATING WALL CONFIGURATION
• Twin-flue
  ✓ Waste gas ricirculation
  ✓ 1 Level for Air Staggering

SOLE CHANNEL CONFIGURATION
• Symmetrical

HEATING GAS
• Compound (COG & MG)

COG FEEDING
• Under-jet

TARGET
Gas Consumption minimization
NOx minimization
Constant Coke quality
COMBUSTION MODELLING:
Combustion diagnosis of Existing Batteries
Combustion optimization in Pad-up project
Turn over point optimisation based on coke shrinkage

PW in house developed tool for heating flue combustion based on fluent CFD modelling:
• 3D Temperature profile of complete heating flues
• Air, Gas and Waste gas mixing
• NOx formation
• Unburned Gas concentrations
PW Design Tools – Combustion System

REGENERATOR MODELLING:
Waste gas thermal loss optimization in Pad-up and Hot-Repair/Re-checkering projects

PW in house developed tool for regenerator and checker brick optimization:
- Proper sizing of regenerator height
- Definition of regenerator wall fireclay-silica sliding joint position
- Increased regenerator efficiency by improved checker design
TARGET
Increase the battery life preserving refractory brickwork:
• No Tensile stress in refractory bricks
• No Leakage between oven and heating wall

Bracing System Configuration
Optimized solution taking into considerations plant constraints:
• Existing Oven and Heating wall width
• Interface with existing Machines

PW Top Charging force distribution for mid-size oven along heating wall 45 kN/m
**BRACING MODELLING:**

Bracing design optimization for Pad-up and hot repair project introducing state of the art solution

Bracing force distribution defined according to battery type and heating wall design

In house developed tool for bracing system based on ANSYS modelling

FEM analysis on heating wall head, wall protection plate and door frame under thermal and mechanical loads

- Wall protection plate and door frame deformation to ensure the correct force transmission to refractory brickwork
- Wall protection plate and door frame stress to ensure equipment long life

**BAN (Bracing system ANalysis)**

Wall protection plate and door frame deformation to ensure the correct force transmission to refractory brickwork

Wall protection plate and door frame stress to ensure equipment long life
TARGET

Strongest Heating Wall Refractory Design:

- Liner/Binder fixed Joints with Internal Hammer Head
- Tongue and Groove bricks connection between liner & binder and between different layers
- Combination in odd & even layers of different internal hammer heads creating proper liner overlapping to increase strength and gas tightness
- Thermal Shock Resistant bricks on oven contour
REFRACTORY DESIGN MODELLING:
In house developed tool for coke oven battery refractory design based on 3D modelling software:

- Automatic brick interference check
- Automatic bill of quantity generation
- Complete battery assembly avoiding brick assembly on workshop/site
Thank you for the attention!
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