ON-LOAD BOILER CLEANING SYSTEMS

Efficient Cleaning of Heating and Reaction Surfaces
We Increase Availability and Efficiency of Boilers

Our Scope of Supply for Energy Generation Facilities

Centre of Competence for On-load Boiler Cleaning

Headquartered in the German town of Wesel, Clyde Bergemann GmbH is the competence centre for on-load boiler cleaning within the Clyde Bergemann Power Group. The company’s typical fields of operation include thermal energy conversion processes based on coal, waste and/or biomass. For over 60 years, we have focused our work on the development and production of efficient solutions for on-load cleaning of heating and reaction surfaces. We offer an extensive range of cleaning devices specifically designed for the different cleaning requirements within a boiler by applying various cleaning methods and nozzles as well as nozzle arrangements.

Complete Solutions & Life-long Support

We construct and deliver complete solutions in which hardware, software, shut off and regulation valves, as well as controllers, are perfectly coordinated. Our diligence, which is applied by our experts in the design of boiler cleaning systems, is also apparent during installation, commissioning and servicing throughout the service life of our technology.

Your Benefits:

- Extended boiler availability
- Increased boiler efficiency
- Controllable deposit build-up regardless of flexible boiler operation and changing fuel mixture or varying fuel quality
- Effective and efficient boiler cleaning
- Professional consultation in all boiler cleaning matters
- Procedural expertise from more than 60 years of experience in power plant boiler cleaning solutions
- Comprehensive service
- Training for your employees by our own experts

Technology leader with process expertise

As a pioneer in the industry, we play a vital role in shaping cleaning technology. As such we were the first in the market successfully applying water for furnace cleaning. Likewise, we were quick to spot the advantages of demand-driven boiler cleaning which is performed according to the actual deposit situation and not following a fixed cleaning scheme. A whole new philosophy has evolved out of the advantages of demand-driven boiler cleaning. We call this “SMART CLEAN”.
Fit for Purpose Technology Designed from Experience

Standard-Compliant Design
Our on-load boiler cleaning systems correspond to national and international safety provisions and our company is DIN ISO 9001 certified. Also important to us is the safety of power plant employees who are responsible for handling sootblowers, therefore we pay close attention to details. For example, we only use bolts made of standard-compliant materials for secure screw connection of the steam-carrying lance tube. Particular safety-requirements can be covered by special designs.

Durable Assembly
As the sootblower travel length increases, the lance or blowing tube’s weight imposes huge forces. To limit bending tension, these tubes are designed in multiple parts and with different tube wall thicknesses. The first partial tube has the largest wall thickness to ensure structural stability.

We use self-developed and scientifically verified engineering software to ensure design planning quality. This consistent approach makes every design objective and can be replicated.

Avoiding Condensate Corrosion
Incorrect sizing of the internal steam feed tube can have expensive consequences. If the feed tube outlet is positioned too far from the boiler wall opening, the steam can condense in the feed tube whilst the sootblower is not in operation. Consequence: Condensate continually drips on the inner lance tube wall, eventually leading to corrosion.

Clyde Bergemann feed tubes always terminate within the lance tube after the sootblower front plate, so that the heat emitted by the boiler wall opening is used to prevent condensation.

Safety
Generally, all steam-carrying components are disconnected from the drive. This ensures the safety of your employees and protects the sootblower from expensive damage.

Protection of Mechanical Components
Drive unit suspension is selected to balance the weight on several suspension points. This prevents overloading of mechanical components, e.g. by a single spindle, from the very first operation.

Factors of Success for Cleaning with Steam or Air

Careful Engineering – The Key for Effective Boiler Cleaning
Every system, every deposit build-up is distinctive and requires comprehensive design planning. Decades of experience in a wide range of applications showed that only careful design – as sketched as an example in the following – will lead to the best cleaning results.

• Choosing the Right Cleaning System
The chemical composition of the fuel influences the formation of slagging and fouling. The more detailed the information available, the better the suitable cleaning device or combination of different devices for a coordinated overall system can be selected. Further selection factors we consider are the boiler design and specific design parameters like flue gas temperatures and steam parameters.

• Design of Parameter for the Cleaning System
Economic arrangement of the selected sootblowers is also important. The sootblower should provide complete coverage of the contaminated tube surfaces whilst avoiding overlaps to prevent the danger of damage from overcleaning. The sootblower cleaning range must be verified depending on the geometries of the surfaces to be cleaned, the pitch and the superheater package height.

Selection of the right nozzle depends on the degree of the deposit formation. The decision for the nozzle shape, nozzle diameter, application angle and blowing pressure is derived from this. The CFBII nozzle with a specific nozzle geometry was developed for the extreme cleaning requirements of the black liquor recovery boilers.

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The Complete Range of Sootblowers for Cleaning with Steam or Air

### Description

<table>
<thead>
<tr>
<th>Type</th>
<th>Travel</th>
<th>Cleaning area</th>
<th>Principle of function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retractable sootblower</td>
<td>PK-H</td>
<td>0.3-5.0 m</td>
<td>Cleaning of heat exchangers with heavy fouling and high flue gas temperatures up to 1,500°C</td>
</tr>
<tr>
<td></td>
<td>PS-H</td>
<td>0.3-10 m</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RSG-H</td>
<td>0.5-14 m</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RKC-H</td>
<td>12-20 m</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>360°</td>
<td></td>
</tr>
<tr>
<td>SMART RSG</td>
<td>SMART RSG</td>
<td>0.5-14 m</td>
<td>Cleaning of heat exchangers with heavy fouling and high flue gas temperatures up to 1,500 °C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0-360°</td>
<td>Advanced retractable sootblower</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Dual-motor design which allows independent and variable traversing and rotational speeds, cleaning parameters can be adjusted to the fouling condition</td>
</tr>
<tr>
<td>Oscillating sootblower</td>
<td>PSG-P</td>
<td>0.3-6.0 m</td>
<td>Cleaning of heat exchangers with heavy fouling</td>
</tr>
<tr>
<td></td>
<td>PS-PB</td>
<td>0.5-6.0 m</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RSG-P</td>
<td>0.3-6.0 m</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RSG-PB</td>
<td>0.5-6.0 m</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>60-360°</td>
<td></td>
</tr>
<tr>
<td>Axial sootblower</td>
<td>PS-A</td>
<td>0.3-10 m</td>
<td>Cleaning of heat exchangers with heavy fouling</td>
</tr>
<tr>
<td></td>
<td>RSG-A</td>
<td>0.5-14 m</td>
<td>Non rotational movement</td>
</tr>
<tr>
<td></td>
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</tr>
</tbody>
</table>

For Travels up to 20 Meters

### Description

<table>
<thead>
<tr>
<th>Type</th>
<th>Travel</th>
<th>Cleaning area</th>
<th>Principle of function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part retractable sootblower</td>
<td>PK-HB</td>
<td>0.3-5 m</td>
<td>Cleaning of heat exchangers with heavy fouling</td>
</tr>
<tr>
<td></td>
<td>PS-HB</td>
<td>0.3-5.5 m</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RSG-HB</td>
<td>0.5-8 m</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>360°</td>
<td></td>
</tr>
<tr>
<td>Wall blower</td>
<td>VS-H</td>
<td>0.255 m</td>
<td>Cleaning of wall heating surfaces with heavy slagging and high flue gas temperatures up to 1,800 °C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30-360°</td>
<td></td>
</tr>
<tr>
<td>Rotating element sootblowers</td>
<td>DB</td>
<td>-</td>
<td>Cleaning of heating surface banks with heavy fouling</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Blowing tube remains in flue gas pass</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Non axial movement</td>
</tr>
<tr>
<td>Rake sootblowers</td>
<td>PK-AR</td>
<td>0.3-5 m</td>
<td>Cleaning of heat exchangers, DeNOx and air preheaters</td>
</tr>
<tr>
<td></td>
<td>PS-AR</td>
<td>0.3-5.5 m</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RSG-AR</td>
<td>0.5-8 m</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multi-media sootblower</td>
<td>PS-A Multi-Media Jet Blower</td>
<td>0.3-10 m</td>
<td>Cleaning of heat exchangers, DeNOx, air preheaters and gas-gas heaters</td>
</tr>
<tr>
<td></td>
<td></td>
<td>360°</td>
<td>Jet Blower is fully retractable design</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Non rotational movement</td>
</tr>
</tbody>
</table>
Cleaning parameters aligned with the requirements of badly deposited zones

Cleaning parameters adjusted to the requirements of the fouling condition

SMART RSG – Maximum Flexibility for On-load Cleaning of the Convection Area

Factors of Success for Cleaning With Water

Lower Steam Consumption, Lower Erosion – While Still Achieving an Enhanced Cleaning Effect

Deposits in the convective heating areas tend to have an uneven distribution. The use of conventional cleaning technologies can lead to the following issues: Insufficient cleaning of badly affected areas due to cleaning parameters set to less deposited areas; tube wear in zones with less or no deposits due to intensified cleaning of heavily deposited areas.

The non-uniform fouling distribution requires a corresponding flexibility from the on-load boiler cleaning system to achieve the best and most economic cleaning results. Certain fuels have a tendency to build-up strong deposits which push conventional retractable sootblowers to their limit. This situation encouraged us to the further development of the sootblower to a selective and efficient working cleaning device.

The SMART RSG is a retractable sootblower with a unique dual-motor design which allows independent and variable traversing and rotational speeds. The speeds can be varied at any time. All parameters required for cleaning – traversing speed, rotational speed, blowing pressure, blowing angle – can be set as required with a flexible combination. This leads to different cleaning intensities that best match the fouling condition.

Freely adjustable cleaning parameters of SMART RSG

traversing speed  ✔ freely adjustable
rotational speed  ✔ freely adjustable
blowing pressure  ✔ freely adjustable
intensive cleaning  ✔ freely adjustable
repeat cleaning  ✔ freely adjustable
oscillation yes/no  ✔ freely adjustable

Your Benefits:

• Cleaning parameters can be adjusted to match the fouling condition
• SMART RSG minimises erosion
• SMART RSG economically uses steam or air – cleaning media savings of up to 60 %
• Extended boiler availability
• Improved heat transfer
• Increased boiler efficiency
• When combined with diagnostics/analysis modules of the SMART CLEAN platform, it is turned into a fully automated on-load cleaning system that can be seamlessly integrated into your control system

Water Jet Quality is Vital

To achieve the water jet quality required for successful on-load boiler cleaning, several parameters must be perfectly aligned with each other and to slagging and fouling.

Nozzle geometry and nozzle diameter, as well as the blowing pressure, are essential factors that determine the water jet quality. In the cleaning operation, the water impact angle, the water volume and the size of the covered area must match the intensity and characteristics of the deposit. By varying the water jet speed, the impact time is adjusted to the fouling intensity.

Two Cleaning Principles When Using Water

The wall blower F149 achieves its cleaning effect via the peak impact pressure. The kinetic energy of the blowing jet is converted to pressure energy when escaping the nozzle.

The SMART Cannon and the Shower-Clean System SCS do not achieve their cleaning effects by peak impact pressure. Water penetrates the deposits’ pores, vaporises due to direct heat transfer, and leads to a sudden increase of volume. The deposits then break off.

The retractable sootblower SMART Helix Water uses a combination of both cleaning principles.
### The Complete Range of Water Cleaning Devices

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Travel</th>
<th>Cleaning area</th>
<th>Principle of function</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMART Cannon</td>
<td>WLB CB100</td>
<td>-</td>
<td>90° horizontal 90° vertical</td>
<td>Cleaning of the furnace, and in individual cases may be suitable for the cleaning of the lateral gas passes. A concentrated water jet cleans the side and the opposite boiler wall.</td>
</tr>
<tr>
<td>SMART Helix Water</td>
<td>SMART Helix Water</td>
<td>0.5-8 m</td>
<td>0°-360°</td>
<td>System for selective cleaning of convective heating surfaces with heavy fouling and high flue gas temperatures. Employs two gear motors, one for the axial and one for the rotational movements.</td>
</tr>
<tr>
<td>Shower-Clean System SCS</td>
<td>SCS</td>
<td>-</td>
<td>360°</td>
<td>Removes deposits from the lower side, the membrane walls, the pendant heater and superheater surfaces. Cleaning nozzle is mounted on a flexible, temperature-resistant metal hose – the nozzle enters the boiler guided by a flange.</td>
</tr>
</tbody>
</table>

### When Using Coal, Waste or Biogenic Fuels

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Travel</th>
<th>Cleaning area</th>
<th>Principle of function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wall blower</td>
<td>F149</td>
<td>1.185 m</td>
<td>30°-360°</td>
<td>Cleaning of wall heating surfaces with heavy slagging.</td>
</tr>
<tr>
<td>Multi-Media sootblower</td>
<td>Jet Blower</td>
<td>0.5-8, 250 m</td>
<td>360°</td>
<td>Cleaning of air preheaters and gas-gas heaters. The blowing tube is withdrawn completely from the flue gas pass. Non rotational movement.</td>
</tr>
</tbody>
</table>
SMART Cannon
The Most Effective Method of Furnace Cleaning

Water: a Proven Alternative

The high temperatures in the furnace may lead to slagging hotspots. As a specialist for on-load boiler cleaning, we have recognised the potential of cleaning with water very soon. The SMART Cannon has proven its efficiency in furnace cleaning around the world. The assembly is based on two linear drives and a ball-shaped suspension for the blowing lance. The light, compact design is made for the challenging conditions in the power plant. Each of the horizontal and vertical linear drives is subjected to quality inspection with a 100 kg weight before delivery. Load resistance of the drives and uninterrupted current intake of the motor are therefore ensured.

Operation Principle

Due to its specially developed control technology, the water jet creates a meander shaped pattern on the side and opposite wall. With its horizontal and vertical blowing arc each of 90°, a single cannon can clean a large area of the furnace. The cleaning configurations can be determined precisely and repeated consistently. The lance movements are directly and continuously monitored. We do not rely on monitoring the drive unit alone, therefore preventing uncontrolled water application into the furnace.

Unbeatably Efficient

To clean opposite walls at a distance of up to 25 meters, we combine different nozzle sizes and blowing pressures.

A single SMART Cannon cleans a much larger area – coloured blue in the above figure – than several conventional wall blowers together – cleaning areas coloured white in the above figure.

Technical Highlights

Water-Jet Quality:
A specifically developed high-performance nozzle creates a concentrated water jet. A rectifier calms the water jet at the lance entry. A very precisely designed nozzle end prevents the water jet from expanding.

Flexible Blowing Figures:
The control programme enables precise adjustment of the blowing configuration to match the geometry of the area to be cleaned. Different monitoring functions ensure blowing figure repeatability.

Protection of Critical Areas:
The control system can ensure certain areas are excluded from water jet application.

Large Cleaning Area and Reliable Flue Gas Sealing:
The blowing lance is mounted in a ball-shaped suspension that gives the SMART Cannon its large cleaning range while also securely sealing it against the flue gas outlet.

High-Performance Motor:
Moving parts can be blocked by deposits at any time. The direct current servo drive used also works at a constant drive force at this resistance, ensuring reliable operation of the SMART Cannon.

Low and Easy Maintenance:
Robustly designed assembly consisting of a vertical and horizontal linear drive. An individual can perform replacement without using any jacks.

Your Benefits:

- Heavy-duty cleaning system suited for the high furnace temperatures
- Compact design
- Cleans areas difficult to access, e.g. hopper, centre wall
- Cleaning figures can be individually adjusted to boiler geometry – simple change on demand
- Precise, repeatable water jet positioning
- Open system to connect different control systems

SMART Cannon uses a gear with constant drive force

SMART Cannon
High Performance, Compact Design
SMART Shower-Clean System (SCS)
Increased Availability for Waste and Biomass Fired Boilers

Suitable for Different Deposit Characteristics
The SMART SCS uses water as the cleaning medium. Located on the boiler roof, it removes deposit from the lower side, the membrane walls, the pendant heater and superheater surfaces.

The cleaning nozzle is mounted on a flexible, temperature-resistant metal hose. The nozzle enters the boiler guided by a flange, which is opened and closed through an electromechanical valve.

The surfaces of deposits are characterised by different properties. Their development depends on the chemical composition of the fly ash in combination with the actual flue gas temperature. The cleaning nozzle forms a water jet with a defined spectrum of water droplets and momentum. To achieve successful cleaning, it is important that the frequency of cleaning, water impact and quantity hitting the deposits are specifically set to match the requirements of each individual plant. When using waste and biomass as the fuel, the cleaning effectiveness of a water based on-load boiler cleaning system depends on the actual fuel composition and the consequential deposit characteristics. By using different nozzle designs and cleaning parameters, the cleaning efficiency can be adjusted to specific surface deposit characteristic.

Three Different Versions are Available:
- Stand-alone: recommended for open passes with small, uniform cross-section
- Single-Row: recommended for boilers with rectangular cross-section
- Multiple-Row: recommended for boilers with complex geometry – flanges are arranged in multiple rows across the boiler roof, by using a crane runway, different areas can be cleaned

Your Benefits:
- Increased plant availability due to reliable cleaning of the open passes which are important for efficient plant operation
- Stable flue gas temperature
- Lower risk for high-temperature corrosion and reduced corrosion rate
- Shorter revision period as time-consuming manual primary cleaning is almost eliminated
- The construction of SCS allows cleaning of narrow designed open passes
- Corrosion protection of the flange by applying sealing air

SMART Helix Water
For Strong Deposit Build-up at Waste, Biomass and RDF Fired Plants

Intensive Cleaning Effect of Water Applied Gently
Fuels with the most variable heating values and chemical compositions are used in incinerators and biomass boilers. Due to their tendency to develop complex deposits, waste, refuse derived fuels and biomass are seen as challenging energy sources. Incinerators and biomass boilers often have low steam parameters for the sootblowers so intensive cleaning is not possible. The strong deposit build-up in the convective area can also mean that conventional steam sootblowers will not work effectively. Consequently, the fouling will continue to increase, causing unplanned downtimes and reduced boiler availability.

Water as the cleaning medium is capable of producing the required intensive cleaning effect. To perform the cleaning as gently as possible on the heat exchanger pipes, specially designed hardware and software components and two gear motors with high-resolution rotary position sensors ensure that the SMART Helix Water moves precisely to the cleaning position within the space between the heat exchanger tubes. Water is released for cleaning only. This new cleaning method is also called the “Go-Stop-Clean-Go” technique. Novel water jet controls guarantee an instant build-up and interruption of the water outlet from the pressure-active nozzle. If no cleaning is performed, the entire water flow is used for cooling the retractable sootblower in a closed cooling circuit.

Only the deposit surfaces are hit by the water and this is solely done at the time of cleaning. Heat exchanger pipes are not thermally loaded and the amount of water poured into the boiler is reduced to a necessary minimum.

Your Benefits:
- Removal of complex deposits in convective heating surfaces
- Cleaning with water without thermal loading of heat exchanger pipes (“Go-Stop-Clean-Go” mode)
- On the spot starting and stopping of the water jet for cleaning minimises the amount of water poured into the boiler
- Even narrow passes are cleaned reliably
- Flue gas temperature remains in the rated range
- Extension of boiler availability
- More flexibility as to the fuel mix since cleaning intensity can be adjusted to the fouling condition at any time
- No steam required for cleaning

Your Benefits:
Rapping Devices – Gentle Removal of Deposits Without Use of a Cleaning Medium

Application Range
Especially long-stretched boiler passes such as those found in waste incineration plants, can be cleaned with the help of a rapping device. They can be applied to remove deposits from the heating and reaction surfaces of the convection area and economisers without any additional cleaning media like steam, air or water.

The impact systems can be designed to work mechanically or pneumatically. In our experience, pneumatic single rapper is the best solution. The individually adjustable impact energy permits target optimisation of the heating surface cleaning procedure to ensure the overall efficiency of the evaporators, superheaters and economisers are kept consistently high. This lays the basis for extending the plant’s availability. BUS-connection in the control centre makes it possible to provide cleaning of each heating area which is both variable and process-dependent. The breakdown of a rapping device has little effect on boiler operation. The single rappers can be assembled easily.

We develop and produce pneumatic rapping devices in cooperation with Norgren company.

On request, we also offer rapping carriages.

Operation
By rapping the fouled convection heating surfaces the bank tubes are caused to vibrate so that the deposited combustion residues fall off.

Cleaning takes place by means of mechanical hammers or by pneumatically driven impact cylinders. We recommend pneumatic single rappers as their impact energy can be adjusted to the plant conditions.

In-House Competence in Controls

Complete Solution from a Single Source
For optimal operation of each on-load boiler cleaning system, it is important that the control equipment is aligned with the system according to its specific requirements.

For this reason, we develop and generate dedicated controls solutions. After detailed consultation on inclusion of your individual requirements, the plans are carefully put into practice by experienced employees. This will save you extensive interface coordination between the boiler cleaning system and the control system.

In our solution, we place special value on uninterrupted monitoring of drives and actuators. Verification of motor function for identification of the operating condition only is not sufficient in our experience. Our standard monitoring functions verify that the cleaning system actually cleans.

Our controls are designed to be flexible in order to adhere to the requirements of a modern power plant operation under changing load. The order and sequence of controlling the individual cleaning devices can be changed at any time.

Our Performance Range
- Engineering
- Performance of tests under simulated operational conditions before commissioning
- Development of distributed automation concepts
- Modernisation of existing control systems
- Migration of existing S5-controls to S7 or other types
- Hard-/software products used by the manufacturers Siemens, ABB, Allen Bradley, Mitsubishi
- Visualisation systems used: Siemens WinCC / WinCC flexible, Labview
- Interfaces: We generally implement all interfaces, like profibus, modbus, ethernet and others
- Control cabinet production according to customer specification

<table>
<thead>
<tr>
<th>Description Type Functional principle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rapping device Cleaning of heat exchangers and economisers in plants with varying fuels and light fouling</td>
</tr>
</tbody>
</table>
Due to the multitude of influencing factors and their interdependencies, there cannot be a global, once defined and always applicable cleaning strategy. SMART Clean holds the intelligence to recognise where exactly in the boiler are the deposits, to what extent and what effects will they have on the efficiency and availability of the boiler.

Here, the combined application of diagnostics and analysis is the enabler. The diagnostics comes from various sensor systems, which continuously and directly measure important process parameters. This data is passed on to the analysis centre where various software modules evaluate and interpret the data. Once the analysis is complete, the results are transformed into necessary cleaning actions incorporating following three key information:

- **WHERE** in the boiler is the deposit located?
- **HOW** intensive has the cleaning to be?
- **WHEN** is the best point in time to initiate cleaning?

By selecting the impending cleaning actions, the preservation of boiler efficiency and availability as well as other factors relevant to the process are taken into account.

As this is a closed loop system, the sensors also report back how successful the cleaning has been.

### Your Benefits:
- With SMART Clean, on-load boiler cleaning only takes place when necessary
- Less use of cleaning media
- Less erosion on the heating surfaces
- Improved heat transfer and process efficiency
- Reduced furnace exit gas temperature
- Stable flue gas temperature at full load operation
- More flexibility while firing fuel mixes
- Avoidance of uncontrollable deposit formation and reduced shutdowns and damage

### Selection of our References

<table>
<thead>
<tr>
<th>Plant</th>
<th>Fuel</th>
<th>MW</th>
<th>Installed on-load boiler cleaning system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Niederaußem power plant/Germany</td>
<td>lignite</td>
<td>1,000</td>
<td>22 x water cannons WLB 90, 52 x water lance blowers F140, 98 x long retractable sootblowers RK-SL, 76 x helical sootblowers RX-SB</td>
</tr>
<tr>
<td>Taean power plant/Korea</td>
<td>hard coal</td>
<td>2 x 550</td>
<td>96 x wall deslaggers VS2, 68 x long retractable sootblowers PS-SL, 24 x long retractable sootblowers FS-SL</td>
</tr>
<tr>
<td>Beregovskaya GRES 1 power plant/Russia</td>
<td>lignite</td>
<td>2 x 800</td>
<td>12 x SMART Cannon WLB CB100, 28 SMART Flux sensors (Unit 1), 2 x SMART isotherm incl. 12 parameters, 16 x long retractable sootblowers RK-SL, 100 x helical sootblowers RK-SB, 36 x long retractable sootblowers RX-SMART Helix</td>
</tr>
<tr>
<td>Torrevialdighi North power plant/Italy</td>
<td>hard coal</td>
<td>3 x 660</td>
<td>108 x wall deslaggers VS2, 6 x thermos probes TS-L, 84 x long retractable sootblowers RX-SL, 12 x helical sootblowers PS-SB, 12 x axial sootblowers PS-DG</td>
</tr>
<tr>
<td>Medupi &amp; Kusile power plant/South Africa</td>
<td>hard coal</td>
<td>12 x 800</td>
<td>12 x SMART Furnace FACOS incl. 28 SMART Flux sensors, 96 x SMART Cannon WLB CB100, 30 x long retractable sootblowers RK-SL, 96 x helical sootblowers RK-SB</td>
</tr>
<tr>
<td>Belchatow power plant/Poland</td>
<td>lignite</td>
<td>3 x 360</td>
<td>24 x SMART Cannon WLB CB100, 190 x long retractable sootblowers PS-SL, 72 x helical sootblowers PS-SB</td>
</tr>
<tr>
<td>La Robla power plant/Spain</td>
<td>hard coal</td>
<td>350</td>
<td>84 x wall deslaggers VS2, 120 SMART Flux sensors, 36 x long retractable sootblowers RL-SL, 12 x helical sootblowers RX-SL, SMART Connection incl. 16 SMART Gauge sensors, Matrix Clean &amp; TDM</td>
</tr>
<tr>
<td>Soma power plant/Turkey</td>
<td>lignite</td>
<td>4 x 165</td>
<td>32 x SMART Cannon CB100, 44 x long retractable sootblowers PS-SL</td>
</tr>
<tr>
<td>Hitachi Power Europe comoni (Bochum/Datteln/Moorburg/Walsum/Weilheimavenstedt/Maastricht/Rotterdam power plant/Germany &amp; The Netherlands)</td>
<td>lignite &amp; hard coal</td>
<td>6,060</td>
<td>8 x 8-12 SMART Furnace FACOS incl. 20-32 SMART Flux sensors, 8 x control systems, 6 x 40-54 long retractable sootblowers RK-SL, 8 x 7-20 helical sootblowers RK-SL, 8 x 16-30 rake sootblowers RK-AT</td>
</tr>
</tbody>
</table>
Clyde Bergemann is represented in over 40 countries worldwide.

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