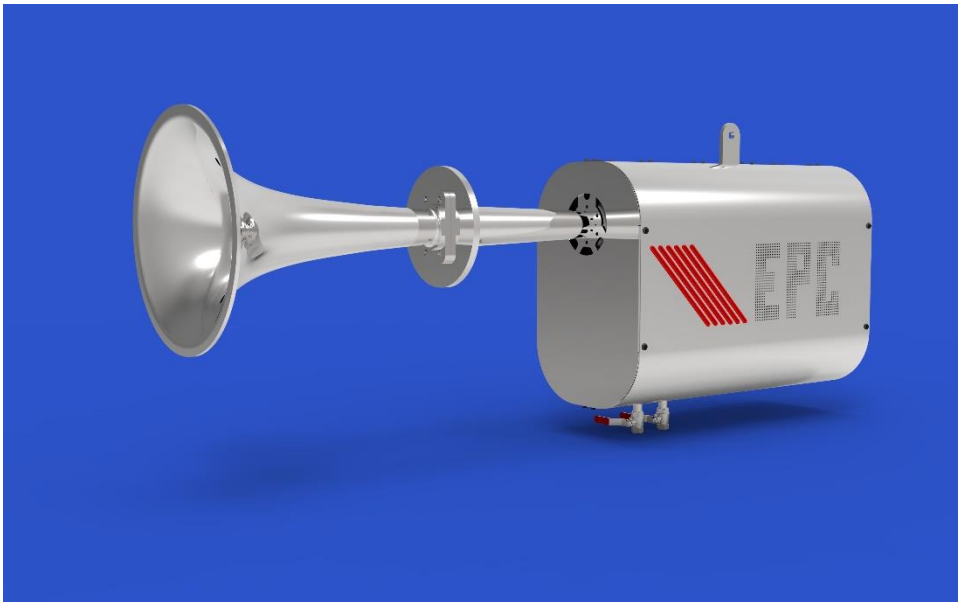
EPC System: The Protective Shield at the Heart of Power Plants

What is EPC – Explosion Pulse Cleaning?



The Explosion Pulse Cleaning system is designed to eliminate stubborn particles adhering to each other and surfaces by using shock waves and high sound pressure. The sound pressure generated by the explosion reaches **170 decibels**, and with a sequential frequency of 5-6 explosions per second, it has a significant impact on ash or slag. The system offers an impressive cleaning range of **10 meters**, making it highly versatile for various applications. Whether you need to clean large industrial areas or extensive surfaces, this technology meets your needs.

Particles causing surface accumulation gradually adhere to the surface of tube bundles over time.

This system, which we call Explosion Pulse Cleaning, generates a powerful **sonic sound wave**. The high-pressure sound wave (170 dB) produced by the sonic wave surpasses the effectiveness of conventional cleaning methods, effectively removing stubborn dirt and debris. Simultaneously, the explosion shock pressure causes thermal and mechanical fatigue in tough particles like slag or ash, as the force exceeds their adhesion strength. This eliminates molecular bonds formed between the particles and the surface, achieving acoustic cleaning.

Efficiency of EPC Systems

The efficiency of the EPC system depends not only on the characteristics of the deposits but also on various parameters such as ambient temperature, the surface area and structure of the applied surfaces, as well as the height and width dimensions of the environment. Based on these parameters, the positioning of the EPC units in the area, the number of EPCs to be installed, and the cleaning frequencies are determined.

The mentioned cleaning frequencies can be controlled through an automatic control system included in the EPC system. Programming is easily managed via a touch screen. Depending on the density of the particles, light or heavy-duty cleaning modes can be applied. This ensures effective results even under the most challenging operating conditions.

The system consists of 6 main components:

- **Actuator**
- **Horn**
- **Pneumatic Units**
- **Gas Units**
- **Ignition System**
- **Electric Apparatus**

EPC – Operating Principle

To briefly summarize the formation of the sonic wave pressure: Two fluid gases, air and a combustible gas, pass through various valves and measurement units and are combined in a mixing chamber, ensuring a specific ratio of mixing. The resulting ideal mixture is then ignited within milliseconds via spark plugs suited to the system during its natural expansion phase. The suddenly expanding gas exits the combustion chamber at a velocity where **Ma ≥ 1**, thereby generating a shock wave.

This pressure shock is directed towards the boiler. Depending on the setup, **5 to 15 seconds** of operation can produce **6 to 90 shock pulses**.

THE EFFECT OF EPC ON ASH AND SLAG LAYERS

The strong pressure wave generated by the EPC system has sufficient energy to remove sintered slag or unsintered ash structures formed in boilers. The pressure wave does not negatively impact tube erosion. Additionally, the required operating frequency is lower than that of conventional sonic horns.

Shock waves create both mechanical and thermal effects on slag layers.

Thermal Effects

As shock waves propagate along their path, parameters such as pressure, temperature, density, entropy, and fluid velocity increase and decrease abruptly. These sharp fluctuations in temperature and entropy cause the slag layer to weaken thermally. This thermal fatigue breaks the bonds between the slag and ash particles, as well as their adherence to the surface, enabling their removal from the system

Mechanical Effects

- The push-and-pull motion created by shock waves in the air generates a **scrubbing action** on the tube surface.
- The fine and sharp nature of the shock waves exerts a **high shear force** on the slag layer.
- The sharp pressure increases and decreases caused by the shock wave as it moves through its path weaken the molecular bonds within the deposit layers and induce stress.
- When the shock wave strikes the slag layer, it reflects between the voids within the layer, causing **internal weakening** of the masses.
- Additionally, as the wave reflects between the pipe bundles, its energy is transferred deeper into the boiler.

The EPC system, specially designed to remain effective even at flue gas temperatures reaching **1200°C**, represents a groundbreaking technology for industries and can be applied across various sectors.

ADVANTAGES OF THE EPC SYSTEM

- **Online Cleaning:** The system provides cleaning while remaining operational (online).
- **Automated Operation:** It operates periodically without human intervention via PLC control.
- **Sustainable Processes:** Permanent cleaning is achieved on heat transfer surfaces and other surfaces requiring maintenance, enhancing process sustainability and preventing unnecessary interruptions.
- **Comprehensive Cleaning:** The power of the generated sonic shock wave is carried by air molecules, enabling cleaning effects at every point air can reach. Considering the spherical propagation of sound, even hard-to-clean corners experience significant cleaning effects.
- **Non-Damaging:** The energy remains below the threshold that could damage structures, ensuring no mechanical wear, corrosion, or erosion occurs.
- **Compact and Easy Installation:** The system takes up minimal space and is very easy to install.

The placement of the EPC system is designed by **USER Engineering** based on the specific features of the application area, including surface dimensions, height and width, temperature, particle density, and other characteristics. A custom project tailored to your system is prepared, making the system ready for delivery and installation.