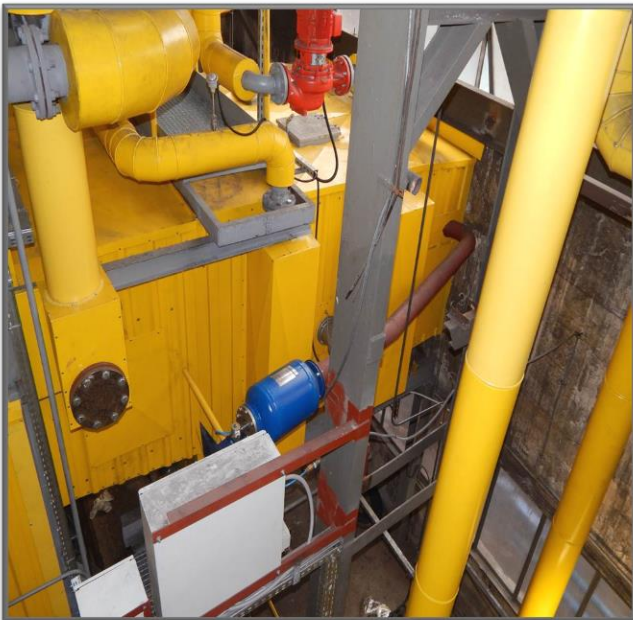




Cleaning system for additional economizers behind the boilers using GFU-24/8 shock wave generators

EKOZUB Ltd. Company specializes in the installation of surface cleaning of surface heat exchanger from the exhaust side. As a result of solid fuel combustion, precipitates are deposited on sediment economizer tubes, which increase the temperature of the exhaust gases and increase the fuel consumption. The operation of the cleaning system in full automation and at high frequency keeps the heat exchange surfaces clean and increases the efficiency of the boiler. The cleaning installation has been tested on many boiler houses in Poland.



They trusted us:

- PEC Gliwice Sp. z o.o. - three WR-25 boilers
- Węglkoks Energia Sp. o.o. - five WR-10 boilers
- PEC Jastrzębie S.A. - three WR-25 boilers
- PE Megawat Sp. z o.o. - OR-32 boiler
- ZEC Starachowice Sp. z o.o. - WR-17 boiler
- MPEC Sp. z o.o. in Piekary Śląskie - two boilers WR-5
- T.B. Fruit Dwikozy - two KE-6,5 boilers
- TOP S.A. - boiler OSR-25/32
- Celsius Sp. z o.o. - boiler WLM-2,5
- ENWOS Sp. z o.o. - boiler OSR-25



System of cleaning extra economizers - description of technology

Many stocker-fired boilers fired with culm coal as well as other solid fuels have an additional economizer built into the flue duct behind the boiler. It is used to lower the exhaust gas temperature from the boiler. Due to limited space for construction the economizer is most often a very compact and rigid construction, and the pipe system is designed in a pivoting system. Manual cleaning is not very effective and embarrassing. Use of mechanical cleaning systems (pneumatic or electromagnetic swabs or vibrators) are not effective and can lead to damage the pressure part. Use of an effective cleaning installation based on the GFU-24/8 shock wave generators largely eliminate the accumulation problem of getting sludge and increase the efficiency of the entire heat exchange system.

Based on use of shock wave technology for cleaning economisers built behind the boilers the following effects are achieved:

- high efficiency of removal of deposits from the heat exchange surface,
- increase in annual efficiency of grate boilers,
- reduced fuel consumption,
- increasing the availability of boilers,
- reducing the phenomenon of wiping pipes,
- eliminate local evaporation of water,
- effective heat exchange through the entire convection surface of the boiler,
- reducing electricity consumption by reducing the flue gas flow resistance,
- low operating costs of the cleaning system, including low consumption of compressed air,
- very quick return on investment.



Additional boiler economiser WR-5 in MPEC Sp. z o.o. in Piekary Śląskie



Installation of cleaning boiler economizer WR-10 in Nadwiślańska Spółka Energetyczna - Heating Plant in Bieruń

System of cleaning extra economizers - economic effects

On the example of WR-10 boiler with additional water heater (economizer) we can estimate the economic effects of using a clean-up installation based on shock wave generators GFU-24/8, related with increased efficiency.

Assumptions to evaluate economic effects:

Power of the boiler WR-10	- 12 MW
Boiler working time	- 4 500 h / year
Average boiler output	- 10 MW
Cost of coal with transport	- 350 PLN / t
Flue gas temperature before cleaning	- 180 °C
Exhaust gas temperature after cleaning	- 150 °C
Boiler efficiency increase ($\Delta t = 50$ °C)	- 3%
Boiler efficiency increase ($\Delta t = 30$ °C)	- 1.77%
Average fuel consumption (10 MW)	- 1 900 kg / h

Boiler efficiency is estimated from the table below. For exhaust temperature 150 °C and oxygen content of 8% outlet loss is 7.93% and for temperature 180 °C and oxygen content of 8% outlet loss is 9.7%. Lowering the exhaust temperature by 30 degrees, the efficiency of the boiler is increased by 1.77%. Fuel consumption (power - 10 MW, calorific value - 22 MJ / kg, efficiency - 86%) is 1 902.75 kg / h. Fuel consumption with efficiency reduced by 1.77% (power - 10 MW, calorific value - 22 MJ / kg, efficiency - 84.23%) is 1 942.73 kg / h. Hourly savings in the case of culm coal, the efficiency of the boiler is increased by 1.77% by about 40 kg / h. Over the course of the heating season, you can save over 180 tonnes of mud at the above assumptions, which at a price of 350 PLN per ton gives you a saving of 63,000.00 zł per heating season. With an increase in boiler efficiency of 3% resulting from the use of shock wave generators, annual savings will be over PLN 100,000.

Tlen	Lamda	T sp.	delta T	Sk
%		°C		%
13	2,63	150	135	12,92
12	2,33	150	135	11,48
11	2,10	150	135	10,33
10	1,91	150	135	9,38
9	1,75	150	135	8,60
8	1,62	150	135	7,93
7	1,50	150	135	7,36
6	1,40	150	135	6,87
5	1,31	150	135	6,44
4	1,24	150	135	6,06

Tlen	Lamda	T sp.	delta T	Sk
%		°C		%
13	2,63	180	165	15,79
12	2,33	180	165	14,03
11	2,10	180	165	12,62
10	1,91	180	165	11,47
9	1,75	180	165	10,51
8	1,62	180	165	9,70
7	1,50	180	165	9,00
6	1,40	180	165	8,40
5	1,31	180	165	7,87
4	1,24	180	165	7,41

Tab. 1 Outlet loss for exhaust gas temperature 150 °C and 180 °C depending on the oxygen content.