

Project REPORT

Pennguard® protects steel chimney liners in a heavy oil fired power plant

Some 30 kilometres from Budapest, near the town of Százhalombatta, lies Hungary's largest power plant. With its 10 boilers and an installed capacity of well over 2.000 MW, the Dunamenti power station supplies 20 % of the country's electricity. In addition, Dunamenti power station supplies district heat to the town of Százhalombatta and process steam to the nearby refinery complex, MOL.

The base load capacity of the Dunamenti power station is made up of six oil fired boilers, rated at 220 MW each. The fuel for these units is a heavy residual oil from the neighbouring MOL refinery. This fuel presents a number of technical challenges and one of the most important is corrosion, which can affect the boiler and all downstream equipment in contact with the corrosive flue gas.

Electricity demand in Hungary will grow considerably over coming years and the immediate concern for the Dunamenti management is to ensure the



Dunamenti power station

best possible availability of the power station. To achieve this, modern burners are being installed on the oil fired units, which will improve economical as well as environmental efficiency.

At the same time, the Dunamenti power station is solving a serious corrosion problem in its chimneys. There are two, 200 metre high concrete chimneys, each with three internal steel liners.

Although the exhaust gas temperature is 150-160 °C, the steel liners are under strong acid attack in many places, especially around 'cold spots'.

In 1994 Karrena GmbH, the German chimney builder (in cooperation with Kraftszer Budapest) introduced the Pennguard® Block Lining System to the power station and in that same year, the first steel liner was repaired and partially (540 m²) lined with Pennguard®. In 1995 and 1997, the same repair method was used for a further two steel liners and recently, in March 1998, the fourth liner was protected with Pennguard®. The power station currently has almost 2.200 m² of Pennguard® linings in use. ♦



HADEK

Duct & Chimney Linings

The problem of heavy oil firing

In comparison with other fossil fuels, heavy oil creates one of the most acidic and corrosive flue gases.

Most fossil fuels, including coal and lignite contain sulfur, which will be converted to SO_2 and SO_3 in the combustion process. SO_3 , in the presence of water (H_2O), will readily convert to sulfuric acid



(H_2SO_4) and this is the main cause of corrosion in ducts and chimneys. For coal fired power plants, the SO_3 content of the flue gas is typically 1-2 % of its SO_2 content.

This is where heavy oil is completely different; this fuel typically



One of the 200 MW oil fired units.

contains trace elements like vanadium, which act as a catalyst in the combustion process, converting large amounts of SO_2 into far more aggressive SO_3 . For an oil containing 2-3 % sulfur, it is quite possible to find more than 150 mg/Nm^3 of SO_3 in the exhaust gas, depending on the combustion technology used.

With such high amounts of SO_3 present, the acid dewpoint of a flue gas will be higher than 150 °C. In this situation, any steel surface with a somewhat lower temperature will quickly be covered with a strongly acidic condensate.

At 125 °C, the sulfuric acid concentration of such a condensate will be around 75-80 % and this combination of temperature and acidity presents an impossible challenge to most materials.

A Pennguard® lining is based on borosilicate glass and therefore has unlimited resistance against sulfuric acid. This has been proven once more in the Dunamenti chimneys, where the Pennguard® lining is completely unaffected after years of operation. ♦





Cold spots: a fundamental problem solved by Pennguard®

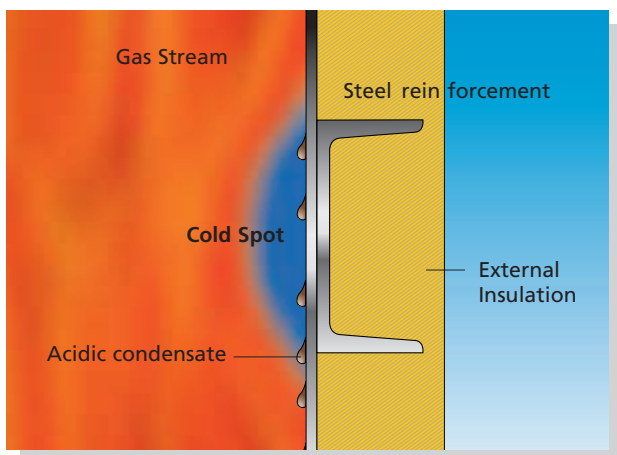
The top of each flue sticks out of the concrete shell and is especially vulnerable to cold spots.

The corrosion problem in the Dunamenti power station chimneys centers around so-called 'cold spots'. Cold spots can be caused by faulty or wet external insulation but also by the presence of external steel reinforcements. Cold spots constantly 'drain' heat from the gas stream, causing the formation of acidic condensate on the inside of a flue.

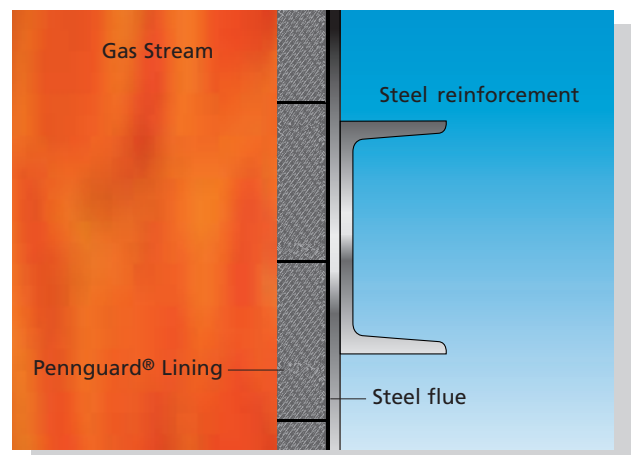
Cold spots can be a problem in any flue gas handling system, regardless of fuel type and gas temperature.

A Pennguard® lining forms a temperature insulation on the inside of the duct or chimney and so, by its nature, it prevents cold spots from occurring in the first place. This is an important advan-

tage. New structures that will receive a Pennguard® lining can be designed without fear for cold spots. Furthermore, external insulation of the flues becomes unnecessary and can be omitted altogether. ♦



Cold spot on the inside of the flue due to outside steel reinforcement.



With an insulating Pennguard® Lining on the inside of the flue, outside steel reinforcements can no longer lead to cold spots.

Suitable in theory- suitable in practice

The chimney flues at Dunamenti power station require a lining system that is resistant to harsh operating conditions. In addition, they require a lining system that can be applied successfully, even under strict time constraints and difficult circumstances.

Before the Pennguard® lining could be applied, the worst corrosion damage had to be repaired by the installation of new steel panels. In all other parts, the lining was applied over the existing steel substrate, which had already been affected by pitting corrosion. It is clear that, despite a thorough grit

blasting of all surfaces, a slight chemical contamination with traces of acids or chlorides had to be expected, given the fact that the chimney had been in opera-

tion for a number of years. Furthermore, the existing welding in the chimney was somewhat irregular, as it was never meant to be lined. However, thanks to the robust and impermeable nature of Pennguard®, these factors did not affect the good result of the lining operation. ♦



A high quality application was achieved in spite of time pressure and challenging conditions.



Four Hungarians without fear of heights.

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