Project Report

HADEK

PROTECTING POWER PLANT CHIMNEYS

Castle Peak
Power Station

Key facts about Castle Peak B Power Station

- 4 x 677 MW coal fired boilers
- FGD for SO_2 reduction
- Flue gas reheated to 80°C
- Pennguard® linings installed in existing 250 m chimney with 4 steel flues

Largest coal fired power station in Hong Kong fits FGD and installs Pennguard® linings in 250 m high chimney with four flues.

CLP Power, a subsidiary of China Light & Power, is the leading supplier of electricity in Hong Kong. CLP Power's Castle Peak Power Station has a combined installed capacity of 4,108 MW. It is located across the water from Chek Lap Kok International Airport and it is one of the largest coal firing power stations in the world.

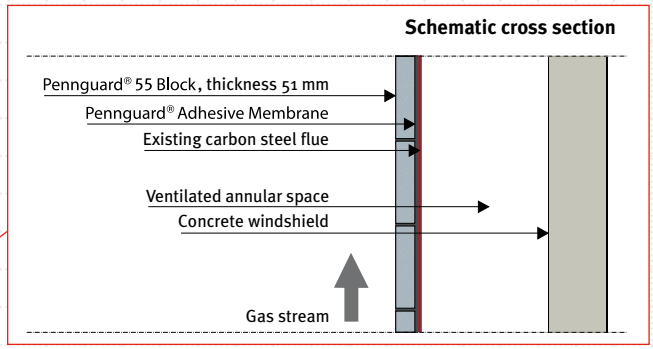
The Castle Peak B Power Station consists of four 677 MW units that were commissioned between 1985 and 1989. Running at over 38% efficiency at full load, the Castle Peak B units are a key generating asset for the Hong Kong economy.

In recent years, the rapid industrialization of Southeast Asia and the Hong Kong region in particular has affected the air quality in and around Hong Kong. To help improve air quality, it was decided in 2006 that all four units of Castle Peak B Power Station should be equipped with highly efficient flue gas desulphurization plants.

The four units of Castle Peak B use a common 250 m high chimney, which contains four steel flues within a reinforced concrete windshield. The steel flues were originally constructed without an internal lining. CLP Power recognized however that following the FGD retrofit, the flue gas temperature would drop well below its acid dewpoint, resulting in the need for a chimney flue lining system.

Following an evaluation of different chimney flue lining technologies, CLP Power selected the Pennguard® Block Lining System, using 51 mm thick Pennguard® Block 55. Pennguard® linings were installed in all four flues during planned boiler outages in 2008, 2009 and 2010.

Four large flues. Four boiler outages. How to install Pennguard® linings for 20 years of service with minimal maintenance.



CLP Power decided to install Pennguard® linings in the Castle Peak B chimney flues and to do so within scheduled outage time only. More than just being quick, the installation would also have to be safe and the quality of the work would have to result in a lining service life exceeding 20 years, without any significant maintenance or repair.

The CLP Power project team made a key decision to perform the lining work during the relatively long, scheduled boiler outages, rather than the shorter FGD tie-in outages. As a result, each of the Pennguard® lined flues would be exposed to several months of high temperature, non-FGD service. This is acceptable for Pennguard® linings, provided that any external insulation is first removed from the steel flues.

CLP Power awarded the lining installation contract to Balanced Engineering & Construction Pte Ltd ("BEC") from Singapore. To ensure a safe, timely, high quality completion of the works, BEC paid close attention to several key aspects of the project.

1. Safety

For the duration of the project, a designated Safety Manager was part of the BEC team on site. The Safety Manager worked with a small team of assistants, who were tasked exclusively with enforcing safety rules at all times. Furthermore, any persons entering the chimney were strictly required to have completed both Hong Kong Government and CLP Power safety courses.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2. Access and weather protection

A strong platform, with a full floor and a fast, separate hoist for materials supply was built, to ensure optimum access to all steel surfaces, as well as an uninterrupted supply of Pennguard® materials to the installation crews.
To protect the works from the torrential rains that can sometimes hit Hong Kong, the top of each flue was closed off with a temporary waterproof seal.

3. Surface preparation

When preparing a steel flue for a Pennguard® lining installation, the substrate needs to be grit blasted to an SA 2 1/2 "near white metal" cleanliness with a minimum 35 µm surface profile. BEC prepared for this by installing a single, 336 m^3/hour compressor on ground level, with 3 blast pots placed on the support floors within the chimney windshield.

Pennguard® linings offer a great advantage for lining used steel flues that were not originally fabricated as "fit-for-lining": small imperfections in welds, such as ripples, protrusions and pinholes can be left uncorrected and even slight pitting in the steel plate is not a problem. Surface preparation and spray application of Pennguard® Block Primer could be completed in 27-31 days in each of the flues.

4. Pennguard® lining installation

The Pennguard® installation work was performed by two teams, each with 8 trained brick layers, working in two shifts per day. Lining installation in two of the flues was completed in less than 24 days, while two other flues required longer, 34 and 36 days respectively.


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5. Quality Assurance

Hadek was present on site at all times during the work. One Hadek QA Inspector attended surface preparation. During installation of the Pennguard® lining, one Hadek QA Inspector was present during the day shift and a second Hadek inspector worked during the night shift. As on most Pennguard® lining projects, Hadek performed intensive, systematic QA supervision, allowing any defects to be identified and corrected immediately.

Cold spots: a fundamental problem for steel chimneys and chimney flues eliminated by the use of Pennguard® linings

For structural stability as well as for construction purposes, every steel chimney flue (or steel chimney) has stiffeners on its outside.
In these areas, the steel is much thicker than the standard plate thickness and it is often difficult to apply an effective thermal insulation.

As a result, these stiffeners generate "cold spots" on the inside of the chimney flue, where excessive condensate formation can take place especially during start-ups and low load operation **(Figure 1).**

The use of thermally insulating Pennguard® linings on the inside of steel flues eliminates this problem. As shown by **Figure 2**, the Pennguard® lining system will provide effective thermal insulation in all areas of the flue, even where the outside flue surface is covered with external stiffeners.

In newly constructed chimneys, Pennguard® lined steel flues do not receive any external insulation.

When a Pennguard® lining is installed in existing steel flues, it is usually necessary to remove any thermal insulation system present on the outside flue surface. In the case of the Castle Peak B chimney flues, a glass wool thermal insulation had to be removed prior to commissioning the lined flues.

Glass wool thermal insulation.

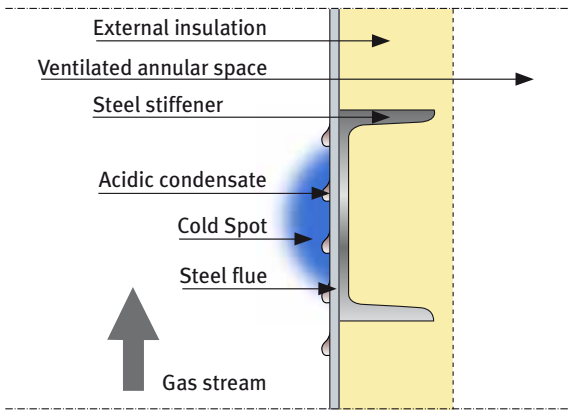

Figure 1
Cold spot on the inside of the flue due to outside stiffener.

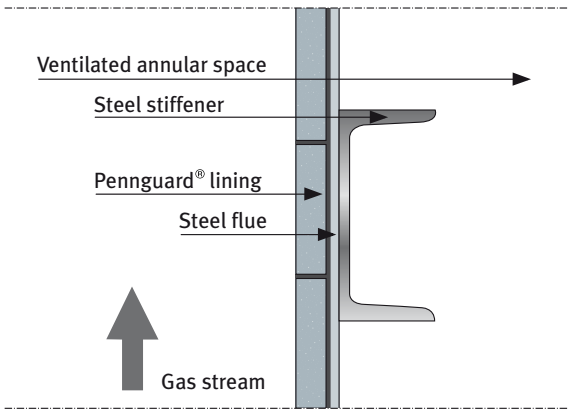

Figure 2
With an insulating Pennguard® lining on the inside of the flue, outside stiffeners can no longer lead to cold spots.

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