

Project Report

HADEK

PROTECTING POWER
PLANT CHIMNEYS

Quang Ninh Power Station

Key facts about Quang Ninh Power Station

- 4 x 300 MW coal fired power station
- Wet limestone FGD
- Reheat by rotating gas-to-gas heaters
- 2 concrete chimneys each with two Pennguard® lined steel flues



New 4 x 300 MW coal fired power station in Vietnam uses FGD chimneys with Pennguard® lined steel flues.

The Vietnamese power generating industry is expanding rapidly to keep pace with the country's growing economy and increasing prosperity. According to projections of state company Electricity of Vietnam (EVN), total electricity production will have to grow from about 106 TWh in 2010 to 227 TWh in 2015, with production doubling once again by 2025. To achieve such fast growth, EVN will invest 30 billion USD in the 2008-2015 period.

One of the largest new power stations to be commissioned in the near future is the 4 x 300 MW Quang Ninh Power Station near Halong, on Vietnam's Northeastern coastline. The station will be owned by Quang Ninh Thermal Power Joint Stock Company, a company owned by EVN and other investors.

The project consists of Quang Ninh 1 and Quang Ninh 2 power stations and each of these has two, 300 MW coal fired units. The EPC contractor for both phases of the project is Shanghai Electric Corporation, who have selected Jiangsu Electric Power Construction Company for all civil works.

Both power stations have been designed identically by the Chinese Northwest Power Design Institute (NWEPTI) and to maintain power station SO₂ emissions within the allowed limits, all four coal fired units are equipped with flue gas desulfurization units based on wet limestone gypsum technology.

Both Quang Ninh 1 and Quang Ninh 2 power station have a 656 ft reinforced concrete chimney, each with two steel flues. The flue gas entering the chimneys, even though desulfurized and reheated, will be highly corrosive. Following a detailed investigation of different technologies, the owner and EPC contractor agreed that all four flues would be lined with the Pennguard® Block Lining System, using 1.5" thick Pennguard® Block 55.

Pennguard® is a registered
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& Emulsions, Inc.

PENNGUARD® Block Lining System

Total Quality Control: how to make sure that a Pennguard® lining will be durable and reliable

Modern power stations are engineered to run almost full-time, with a minimum of maintenance. Owners expect near 100% availability from every component of their plant, including the chimney lining. The steel flues of the two Quang Ninh Power Station chimneys have been lined with 331,200 pieces of Pennguard® Block. To meet the owner's expectations, the production, engineering and installation of the Pennguard® lining system followed a rigorous step-by-step quality control process.



1. Manufacturing

The manufacturing of Pennguard® Block is performed under systematic quality control. Only high quality, newly produced borosilicate glass is used as a raw material. Production itself takes place within very stringent, closely controlled parameters and every batch is tested on a number of key points including mechanical strength, thermal properties and closed cell structure. The other components of a Pennguard® lining, such as Pennguard® Adhesive Membrane, are manufactured with similar quality control systems.

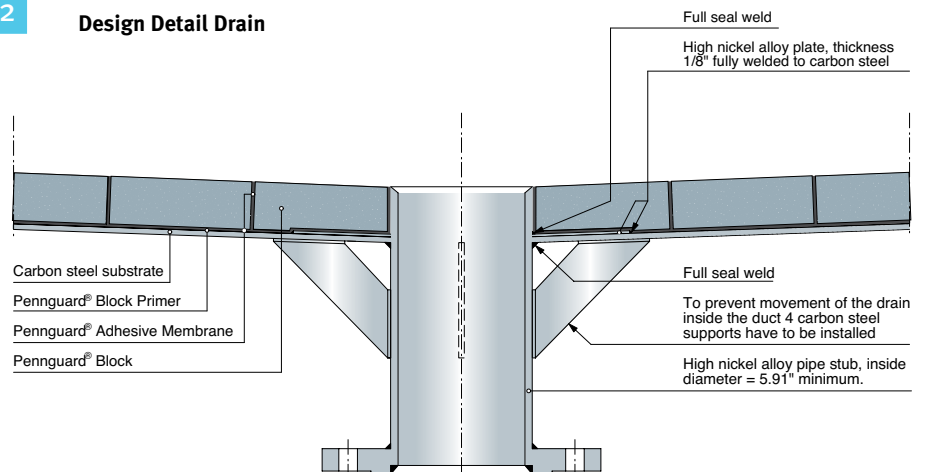
2. Engineering

When planning a Pennguard® application for a customer, Hadek looks closely at key technical aspects of the proposed project. For the Quang Ninh chimneys, Hadek prepared thermal calculations to predict the steel flue temperature under various operating conditions. Hadek also supports its customers with proven design details for pipe stubs, drains, manholes and expansion joints.



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Design Detail Drain



Notes:

1. Pipe stub and supports have to be insulated.

Inspection and Test Plan

Customer: JEPCC1

Ref. No.: 2008716.Pe

Revision: QA-1

Project: Quang Ninh I + II TPP project

Subject: Pennguard® 55 - 1.5" lining on the interior steel surfaces of two new chimney flues



Item	Activity:	Verification by:		Inspection frequency	Reference/standard	Form of reporting	Inspection method
		Hadek	JEPCC1				
1	Phase 1 - Inspection of object / jobsite						
1.1	Verify, that the installation of the Pennguard® Block Lining System can take place under controlled conditions.	100% inspection	spot check	before start of lining project		daily report	visual
1.2	Verify, that scaffoldings and platforms are safe and equipped with railings where appropriate. The distance between the platform and the substrate to be lined must be 7.87".	100% inspection	spot check	before start of lining project		daily report	visual
1.3	Carbon steel substrate: Welds must be free of pinholes, undercutting, etc. Smooth ripple welds are acceptable. Weld spatter, slag and old anchor welds must be removed. Rustgrade A and B are acceptable, C is subject to agreement.	100% inspection	witness	before blasting	ISO 8501-1: 1988 & HPS1	daily report	visual
1.4	Verify, that all leading edges of the Pennguard® Block Lining System (e.g. at manholes, pipe stubs, expansion joints) are protected from undercutting by the gas stream through the use of properly designed "stop bars". The stop bars shall be fabricated of a corrosion resistant material. Stop bars must be installed using continuous welds.	100% inspection	witness	before blasting	HPS1	daily report	visual
1.5	Protocol 1 - Acceptance of the steel substrate - , attached hereto and incorporated herein, which						

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3. Work preparation on the project site

Hadek QA Inspectors visited the Quang Ninh project site several months before the start of the lining installation work. Together with Shanghai Electric Corporation and its civil contractor the QA Inspectors planned the equipment, work platform, number of installers and the schedule for the Pennguard® installation.

4. Quality Assurance Inspections during installation

Hadek has a group of 14 experienced QA Inspectors who travel the world to provide technical support and QA Inspections to customers installing Pennguard® linings in their chimneys. Before the start of the lining work, the owner, the chimney builder and Hadek agree on a specific, detailed Inspection and Test Plan (ITP). During the Pennguard® lining installation in the Quang Ninh chimney flues, Hadek QA Inspectors were present full time to make sure that all work was performed correctly.

5. Performance Monitoring System

Once a power plant chimney has been lined with Pennguard® Block and placed in service, Hadek remains active to ensure that the Pennguard® lining delivers full protection and performs as expected. Whenever an owner wishes to inspect its Pennguard® lined chimney, Hadek will send one of its QA Inspectors to participate in the inspection. In case of any problems, these can be identified immediately, allowing a fast and effective solution.



Two functions in one: a Pennguard® lining provides both corrosion protection and thermal insulation

In the initial design for the Quang Ninh chimneys, the customer planned to use external insulation for the steel flues. After a thorough technical evaluation it became clear that the thermal insulating property of a Pennguard® lining met all the project requirements.

The designers then decided to avoid the use of any external insulation.

The insulating properties of Pennguard® linings have several important advantages:

1. **The steel flue external surfaces will remain cool, even when the flue gas temperature is high.**

Figure 1 shows that when the flue gas temperature in the Quang Ninh flues is 248°F, the steel flue external surface temperature will be around 100°F.

2. **The temperature losses in the chimney will be very limited.**

Once again assuming a 248°F flue gas entry temperature, the predicted flue gas exit temperature at the top of the chimney is 246°F.

3. **The thermal expansion of the steel flue will be limited.**

When going from non-operation at a 68°F ambient temperature to operation with 248°F flue gas, the 617 ft long steel flues of the Quang Ninh chimneys will experience a temperature rise from 68°F to 100°F, resulting in an expansion of only 1.61".

It is important to note that for most applications, it is recommended to avoid external insulation of Pennguard® lined chimneys. This prevents overheating of the Pennguard® Adhesive Membrane between the Pennguard® Blocks and the substrate.

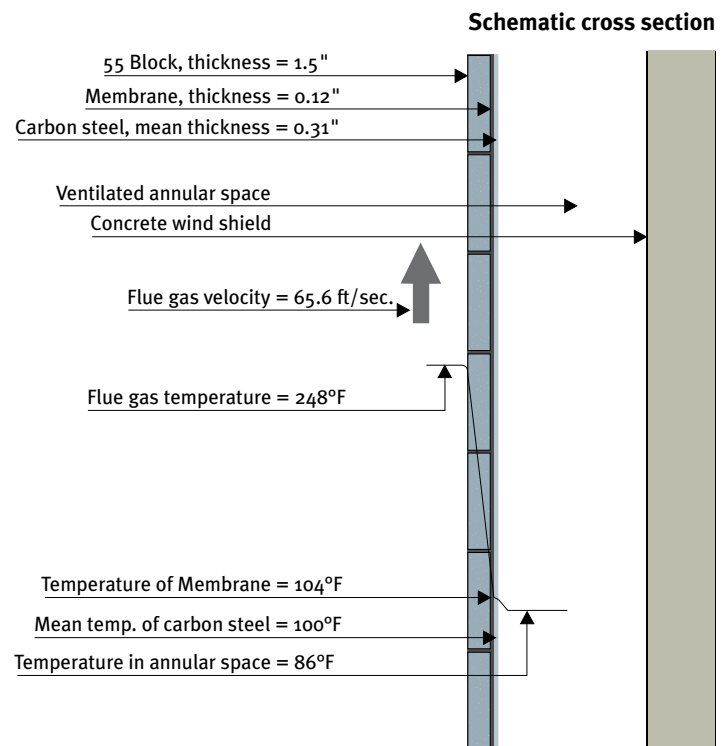


Figure 1