



## DRYCON™

Dry ash conveying solutions for  
lower emissions, lower costs and  
increased efficiency





## Leaders in materials handling solutions for the global power market



Clyde Bergemann, global leaders in the materials handling solutions market, focus on many technologies within a fossil-fired power plant where improvements can be implemented in order to increase plant performance and reduce operational costs. In the competitive power market of today, operators must be economic in their decisions to run plants efficiently and at minimal cost. With environmental protection regulations getting tougher worldwide, the choice for DRYCON™ is an investment in the future in order to save precious water, reduce emissions and return heat energy to the boiler resulting in lower coal usage and so with lower costs for emission trading. It can also be retrofitted into existing applications where space is at a premium therefore contributing to the continued life span of the power generation facility.

In order to assist in this strategy, Clyde Bergemann present the DRYCON™ system which extracts bottom ash from coal-fired boilers using a dry mechanical solution. The more commonly used wet bottom ash extraction systems can now be safely replaced with DRYCON™ to ensure a more cost effective system is installed that is designed to increase efficiency and comply with environmental protection regulations.

### ☰ Benefits

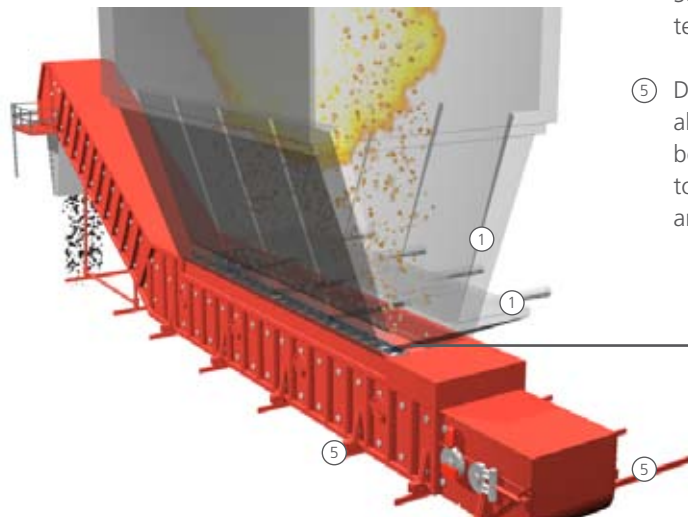
- **Environmental protection**
  - elimination of water usage
  - elimination of water effluent and treatment
  - easier compliance with environmental protection regulations
  - fully enclosed system
- **Increased efficiency**
  - reduction of thermal energy losses
  - reduction of unburned carbon
  - increased boiler efficiency
  - reduction in CO2 emissions
- **Cost reduction**
  - reduced maintenance costs
  - reduction in materials handling costs
  - no water usage
  - no water treatment costs
- **Increased revenue**
  - improved boiler efficiency
  - saleable ash quality



## DRYCON™ is designed and positioned for maximum effectiveness

### The arrangement

- ① Installed beneath the combustion chamber and supported by a steel structure is the boiler collection hopper and isolation gates. Jaw crushers are installed on the isolation gate to ensure large lumps are broken down into a suitable size for cooling and conveying. The hopper is lined with a special refractory and insulation to withstand radiation from the combustion chamber of the boiler.
- ② A heat resistant fabric compensator will typically be installed between the boiler/hopper outlet and DRYCON™ to compensate the movement between the cold and hot condition of the boiler.
- ③ The steel plate conveyor has a direct drive provided by two round link chains and a frequency controlled drive station (electro mechanical or hydraulic speed drive can be used). The speed of the conveyor can have stepless variation from 0,005 to 0,10 m/s. Optimal conveyor speed is provided by a torque-dependant drive system based on the accumulating ash on the conveyor. For improved cooling, longer and wider conveyor sizes can be produced dependant on the size of the ash hopper.
- ④ The independent spring-loaded or automatic hydraulic tensioning station maintains the tension of each chain (provided with a limit switch and a scale for in-service monitoring of tension adjustment). Sensors for remote control of tension and temperature can also be added.
- ⑤ DRYCON™ can be built on a rail system which allows it to be repositioned to the side when the boiler is out of operation. This allows free access to the boiler combustion chamber for maintenance and repairs.

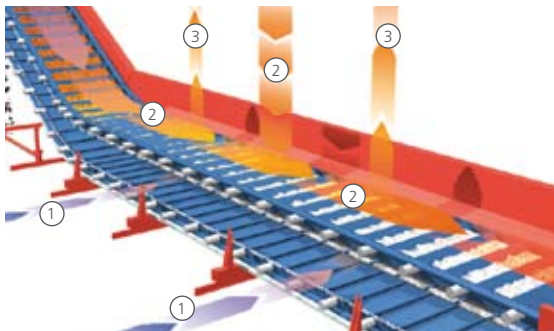




## Increased thermal energy as a result of the re-burning process



### The process



- ① Air is induced into DRYCON™ at the top end and along the length of the conveyor by the negative pressure inside the furnace.
- ② This air travels in counter flow direction along the ash. A re-burning process of the glowing ash is activated. This reduces the unburned carbon level and frees up additional thermal energy.
- ③ Before entering the combustion chamber, the air is heated and adds additional thermal energy to the steam generating process within the boiler.

No more than 1 - 1.5% of the combustion air is added to the boiler - the combustion process and exhaust gas composition are not adversely affected.

### Comparison between wet and DRY handling

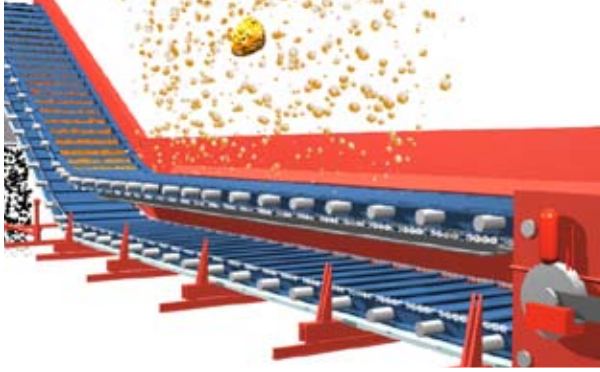
Case study of an installed DRYCON™ system (Heyuan power plant, China) \*

	WET	DRYCON™
Combustion air through ash cooling	0.00	1.00
Losses due to bottom ash (MW) **	9.54	3.24
Additional flue gas losses (MW) ***	0.00	0.26
DRYCON heat losses from the cover (MW)	0.00	0.77
Losses, total (MW)	9.54	4.27
Energy content, fuel	1061.8	1056.5
Fuel savings (%)	0	0.50

\* Boiler load was kept as constant

\*\* Includes bottom ash sensible and chemical heat and furnace radiation through the hopper

\*\*\* Flue gas losses increase, when part of the combustion air bypasses air preheaters



## Extended life cycle with DRYCON™'s robust system elements

### Design features

#### Chain and sprocket wheel

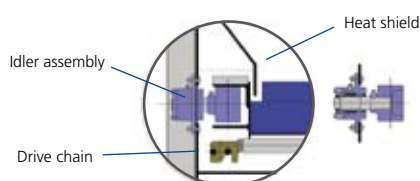
The sprockets are manufactured from wear resistant material and have exchangeable pockets for easy replacement. High breaking strength matched lengths of 25 x 95 mm case hardened chain are used with cast case hardened pins to connect to the steel carrying plates.

#### Tension and drive stations

Having a maximum stroke of 600 mm the tension roller is mounted in lubricated long life heavy duty roller bearings. Tension is applied via manually or automatically operated hydraulic cylinders.

#### Supporting idler

Mounted at 600 mm centres and lubricated, manually or automatically, with heat resistant grease the 125 mm diameter rollers can be replaced from the outside whilst the boiler is still on-line.

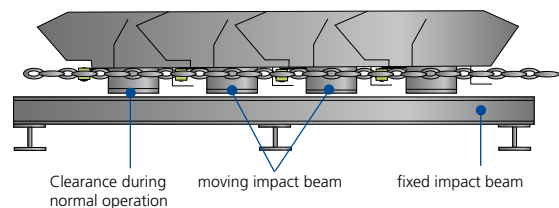


#### Fines recirculation

The system is self cleaning with the integration of a fines re-circulation plate on every sixth steel plate element to ensure clean operation.

#### Impact beams

Impact beams have been designed into the conveyor casing to withstand any loads imposed from large lumps ensuring that the drive elements are not damaged.



#### Jaw crushers

Large lumps can be broken down by jaw crushers in order to ensure they are an appropriate size to be cooled and conveyed.

#### Safe monitoring

Should a blockage occur, the drive motor stops immediately then enters a removal procedure before giving an alarm to the control room.

Further technical information can be found on page 6



## Custom designed to specific requirements



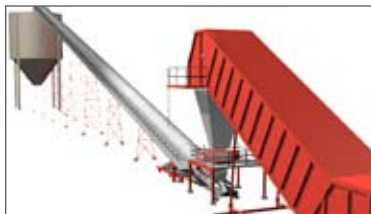
### System configurations

DRYCON™ can be custom designed for the delivery of ash downstream of the boiler. Typical configurations include:

- Pneumatic conveying



- Belt conveyors



- Directly to silos



### Clyde Bergemann DRYCON™ technical details

Inside width	800 - 2,400, determined by the width of ash hopper and required capacity
Horizontal length	Determined by the length of ash hopper
Inclined length	Determined by the downstream transport system
Capacity	According to the accumulated ash volume
Conveying velocity	Step-less variable, from 0,01 to 0,1 m/s
Cooling air volume	Approx 1% of the total combustion air. Required volume will be drawn in by the negative pressure of the combustion chamber and regulated by throttle flaps on the air inlets
NOx values	Burning process and NOx values are not affected
Ash temperature	Intake approx. 600°C to 860°C / outlet crusher <110°C

### Conveyor elements

Chain	Round link 26mm diameter, 100mm pitch
Sprocket	10 teeth, 639mm PCD
Head/tail shaft	180mm diameter
Connecting pin	45mm diameter
Support idler	125mm diameter, 600mm pitch
Air inlet	80/100mm diameter, 800mm pitch
Case	Main body 10mm thick with stiffeners



## Proven low maintenance design for maximum boiler availability

### Shenzhen Energy Company (SEC) Heyuan Power Plant, China

In 2009, DRYCON™ was successfully installed on the two 600 MW boilers of SEC's new power plant in Heyuan, China.

SEC's initial intention was to use a wet bottom ash removal system, or submerged scraper conveyor (SSC), however after many discussions with the Clyde Bergemann team, DRYCON™ was selected as the ideal solution for such a high reliability arrangement. SEC also valued the water consumption of an SSC and realised the cost savings of installing DRYCON™ where no water usage was evident.

#### The results

From start-up in January until October 2009, Heyuan Unit 1's required less than 7 hours for maintenance with the boiler unit still on-load. Availability was recorded at 99.9%

The client was very satisfied with DRYCON™ technology and the services provided by Clyde Bergemann's experienced engineers. After the PAC of Unit 2 in August 2009, SEC issued a commendatory letter to praise the performance of Clyde Bergemann staff.

Additional DRYCON™ references			
Country	Installation	Boiler units MW	Max capacity each boiler
China	Daihai	2 x 600	50 t/h
China	Tuyou	2 x 600	23 t/h
China	Ala'er	3 x 120	5 t/h
China	Jinzhou	2 x 300	26 t/h
China	Junliangcheng	2 x 350	35 t/h
China	Xuanhua	2 x 300	20 t/h
Indonesia	T.J.Awar	2 x 300	15 t/h
India	Mettur	1 x 600	90 t/h
China	Shuidonggou	2 x 660	45 t/h
China	Xingang	1 x 105	8 t/h
China	Changji	2 x 300	20 t/h
Germany	Lünen	1 x 800	18 t/h

Clyde Bergemann is represented in over 40 countries worldwide



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