DP Specialist Anti - Corrosion

Boiler

DP CleanTech

Creating value from waste

DP Specialist Anti - Corrosion Boiler

At DP CleanTech we are always looking to improve our products and services to meet or exceed the levels of performance needed by our customers to maintain a sustainable and profitable business. Our patented combustion technology is already proven to be of world class quality; and we are the market leader in biomass technology in China. Our R&D is focused on identifying and addressing issues that are compromising the performance of our existing solutions; as well as developing innovative performance - enhancing products for our customers. Our collaborative and information sharing approach with key clients enables us to investigate problems thoroughly and to trial possible solutions. Our latest product and service package represents a significant step towards addressing several key problems that are prevalent in biomass power plants in China: corrosion, boiler stability and emissions management.

Key Design and Operation Requirements for China Biomass

Multifuel flexibility - Boiler designs for biomass combustion must have superior fuel flexibility - particularly in China and other emerging markets. Experience has shown that actual fuel supply is not always consistent with design fuel. Not only will the actual fuel type vary, but frequently there is a mixture of different fuels for simultaneous combustion. Technology must therefore adapt to available fuel types and the high likelihood of mixed fuels.

Boiler operation stability - High levels of availability are a feature of successful power plants. Availability is a key measure of boiler efficiency, whilst boiler operation stability is critical to maximise boiler efficiency.

Emissions management - Emissions standards in China have become significantly more rigorous, and therefore cost effective emissions management control will become increasingly important for biomass power plant operators.

DP's existing, patented HPHT combustion technology is not only adaptable to different fuel types; but has been proven to be the most efficient solution on the market for mixed fuels. DP adopts a total solution approach to the design of biomass power plants, from the fuel to the stack, thereby optimizing the equipment for fuel handling and combustion, and to minimize the emissions.

Some Fundamental Factors Affecting Boiler Stability, Efficiency and Availability

Boiler design not optimized for the fuel combustion characteristics

- Fuel combustion characteristics not well analysed or understood
- Using the wrong design and technology can affect combustion efficiency through incomplete combustion; increased slagging and corrosion

Incorrect or poor installation, commission, operation and maintenance standards

- Unplanned shutdowns
- Equipment failure
- Premature equipment and component replacement
- Boiler instability

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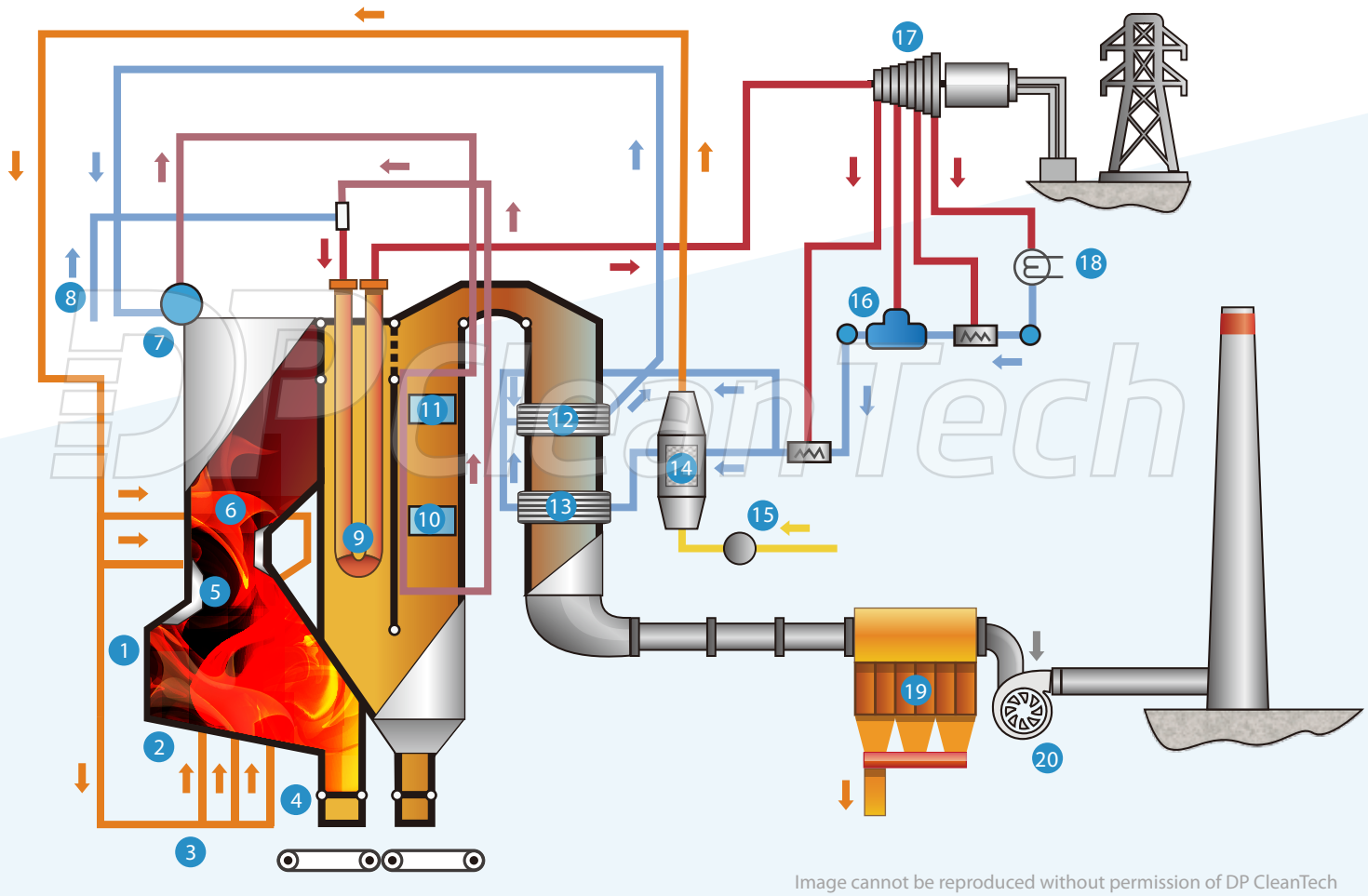

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1. Water cooling duct
2. Vibrating grate
3. Preheated combustion air
4. Slag conveyor
5. Cladding
6. Combustion chamber
7. Steam drum
8. Water for atemperators
9. Superheater 3
10. Superheater 2
11. Superheater 1
12. Economizer
13. Flue gas cooler
14. Air preheater
15. FD fan
16. Deaerator
17. Turbine
18. Condenser
19. Bag filter
20. ID fan

- Equipped with DPCT's Advanced Automatic Control solution.
- The Boiler dimensions are changed to reduce fly ash. Secondary air and distribution system have been redesigned.
- The Boiler and Superheater configuration has been redesigned, and the steam order between Superheaters 2 and 3 has been changed.
- Integration of Low Nox SNCR + SCR technology reduces the cost of additional emissions handling equipment.

DP's new Anti Corrosion Solution

10 years of experience in China have clearly demonstrated that the variable nature and the quality of fuels most commonly used are the major contributors to high levels of corrosion within the boiler. The main impact of fuel-induced corrosion is on levels of fouling, reduction of combustion efficiency and superheater degradation. The end result is lower levels of efficiency, higher maintenance costs and shorter life cycle of the equipment

Such levels of corrosion are more pronounced in China and other emerging markets due to a number of other additional factors such as irregular or improper maintenance and operator error in boiler calibration. The effects of corrosion can have a significant impact on both ROI and day to day operations.

DP's new product solutions package aims to address these problems more effectively, in order to improve boiler availability and meet emissions standards. Using data gathered over a 10-year period, DP experts have redesigned our core boiler products and auxiliaries, with the aim of reducing the occurrence and the effects of corrosion; and to better manage emissions.

Furthermore, our experience reveals that an often - overlooked element of lower boiler efficiency is related to poor boiler commissioning and operator training; and a lack of automation. Poor standards of commissioning and equipment calibration are frequently an initial cause of general operating problems. This is often compounded by the fact that operators– through lack of training or simply human error – further negatively impact the efficiency of the boiler operation and therefore the lifetime of the boiler.

Summary of Anti - Corrosion Boiler Package Solution

Feature*	Details
Fuel analysis	DP will evaluate the fuel and compare against existing data to identify corrosion and emission characteristics. Steam parameters will be optimised to reduce these problems whilst meeting efficiency requirements.
Inconel cladding and welding	Where corrosion in the furnace is expected to be severe, Inconel cladding will be applied to specific parts of the boiler wall using proprietary CMT welding techniques. Applied correctly and in the right environment, this Inconel cladding is very resistant to high temperature corrosion and will extend the lifecycle of key pressure parts. It can also be applied 'on the spot' to existing boilers using CMT.
Boiler dimensions and fly ash convey-or	DP has adjusted key dimensions of the boiler to reduce the amount of fly ash carry over. These changes significantly reduce fouling, corrosion and erosion caused by fly ash carry over.
Secondary air distribution	Using CFD models and our experience, DP has redesigned the secondary and primary air system. This improves combustion and significantly reduces the corrosion caused by local hot spots.
DK Superheater re-design	DP have redesigned the boiler configuration to ensure maximum efficiency at 100% load. The stress on the super heaters will be significantly reduced given reduced loading. Further, the design modifications are adapted for different heat inputs.
Material specifications	Where corrosion is difficult to avoid, DP will add a carefully calculated "Corrosion Factor" allowance to increase the boiler lifetime. This allowance represents the acceptable balance between extended life, heat transfer and cost/ benefit. Each situation will vary depending on the fuels and the operating philosophy (maximum loading against stable operation).
Control system and automation	DP has redesigned the existing Chinese control system to enable more stable automated operation of the boiler. This also minimises the number of staff and reduces human error. This positively and significantly impacts the ongoing performance and the lifetime of the boiler.
Effective boiler commissioning and operator training	Many of the corrosion related issues are due to operational instability. The causes are linked to a systemic failure to effectively commission and calibrate equipment and system loops; faulty/ inaccurate measuring instrumentation and insufficient or incorrect links to the control system. We are reintroducing European commissioning supervisors and train a dedicated team in China to service our key customers on new products.
Warranty and maintenance	DP provides an extended 2 year warranty for the anti - corrosion boiler. During this time, DP will provide a maintenance inspection package; advice on how to maintain the boiler and an annual boiler maintenance schedule. This will be free for the 2 year warranty period and available for a further three years for an upfront agreed sum.

*Patent

Key Features of the new Anti - Corrosion Boiler Solution

The new comprehensive product package aims to enhance equipment efficiency through the following measures

- New boiler design
- New materials specifications
- Integrated low Nox technology
- Redesigned control systems
- Commissioning and training
- Extended warranty and maintenance package

This product and service package will be applicable for new boiler products going forward, and will be selectively applied for each project situation.

For existing plants, boiler remediation options have been developed using patented 'on the spot' welding techniques for application of Inconel cladding. This will significantly extend the lifecycle of key pressure parts by protecting them against high temperature corrosion.

Materials Specification

- New materials are added to certain components and equipment to pre-empt the effects of corrosion and preserve the lifecycle of key pressure parts. The materials require the use of special welding techniques and proprietary expertise to identify the correct location of the materials and welds.
- A 'Corrosion Factor' ("CF") is added to material specifications. The Corrosion Factor is based on the expert assessment of specific situations including additional fuel analysis and modelling techniques.

Detailed Major Boiler Redesign

- Boiler and Superheater configuration
- Boiler dimensions changed to reduce Fly Ash
- Secondary air system and distribution

Additional Measures to Improve Product Performance

- Integrated, automated controls
- European commissioning supervisors and operator training - dedicated to key customers in order to train operators commissioning, calibration and operating procedures.
- 2 year extended Warranty and Maintenance package. DP will provide an annual review of maintenance requirements and subsequent scheduling of works for the duration of the extended 2 year warranty period.
- Long term Maintenance package. For the subsequent 3 years, this same package will be provided for an agreed upfront payment.

Emissions Management

- Integration of Low Nox SNCR + SCR technology reduces the cost of additional emissions handling equipment.

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