PULP & PAPER

EXTEND ASSET LIFE AND LOWER COST

POWER PLANT SERVICE FOR FLUIDIZED BED TECHNOLOGIES

ANDRITZ

ENGINEERED SUCCESS

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Fluidized bed expertise: extend asset life, lower costs

Put our in-depth knowledge of fluidized bed technologies and years of experience to work at your plant to get the maximum return out of your investment.

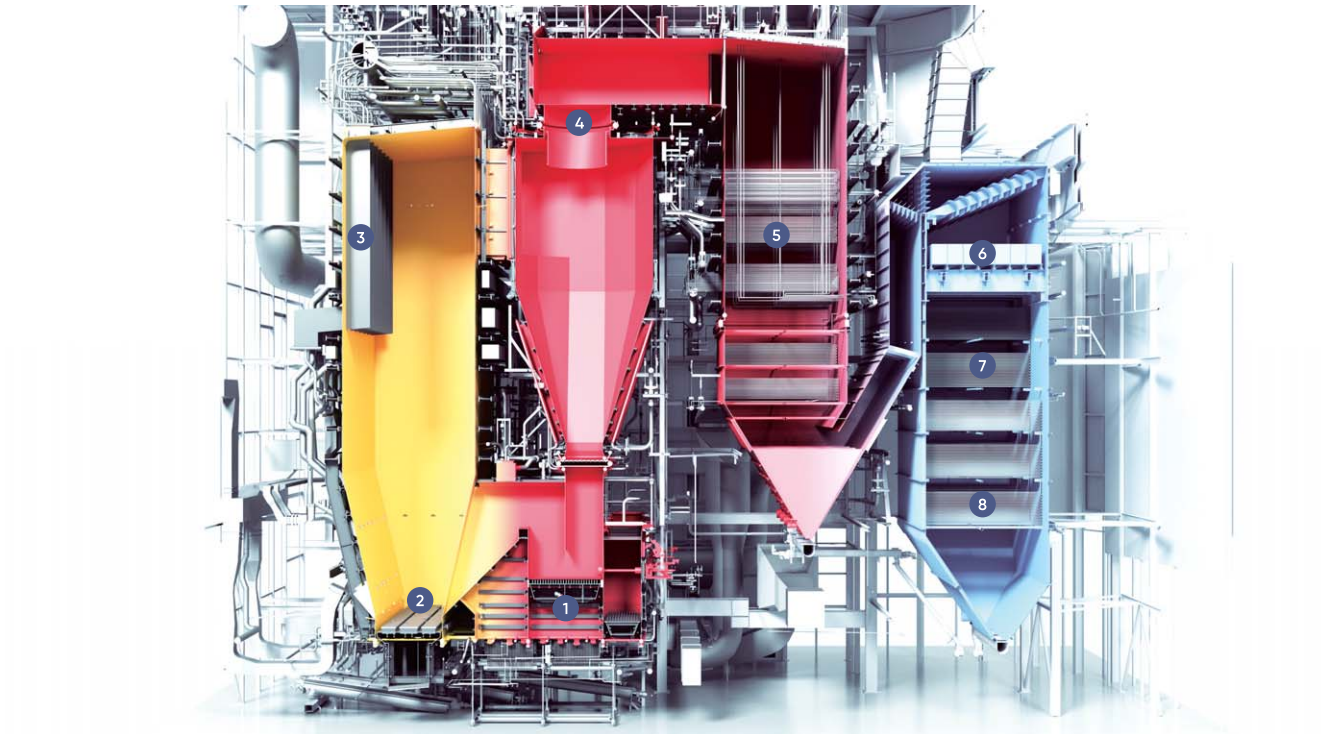
ANDRITZ is your dependable technology and service partner. Our key competence is our ability to innovate fluidized bed technologies. Our specialists are skilled in helping you upgrade and renew the essential components of your bubbling fluidized bed (BFB) or circulating fluidized bed (CFB) boiler, improve performance and reliability with value-added enhancements, reduce emissions, minimize corrosion, and integrate challenging fuels.

ANDRITZ can be by your side in an instant (either physically or through remote diagnostics) with analytical tools and expert assistance. Our service experts can analyze your operations, assess the condition of your equipment, advise how to improve efficiency and performance, and install the right equipment if necessary.

We are passionate about engineering success for our customers through innovation, quality, and sustainable relationships. If this is kind of success is what you desire for your plant, we can help you engineer it.

BENEFITS OF ANDRITZ SERVICE

- Efficient production
- Increased throughput
- Increased reliability and availability
- Reduced Total Cost of Ownership (TCO)
- Shorter/more effective shutdowns
- Longer service intervals
- Improved safety
- Increased energy efficiency
- Minimized emissions



1 Bed material heat exchanger 2 CFB nozzle grid 3 Additional CC heat surfaces 4 Vortex finder
5 Superheater 6 Catalyst of the Advanced Hybrid SNCR system 7 ECOs 8 APH (air preheater)

ANDRITZ Replacement^{PLUS} pressure parts

More than the supply of one-to-one replacements, we also engineer and deliver components that offer more capabilities than traditional replacements.

ANDRITZ, as an OEM supplier of boilers, offers a full complement of replacement parts and wear components for our own plants and plants delivered by other suppliers. But, more than this, we supply pressure parts with distinct advantages due to our product/process knowledge and engineering capabilities – what we call Replacement^{PLUS} pressure parts.

DOUBLE-PITCH SUPERHEATER

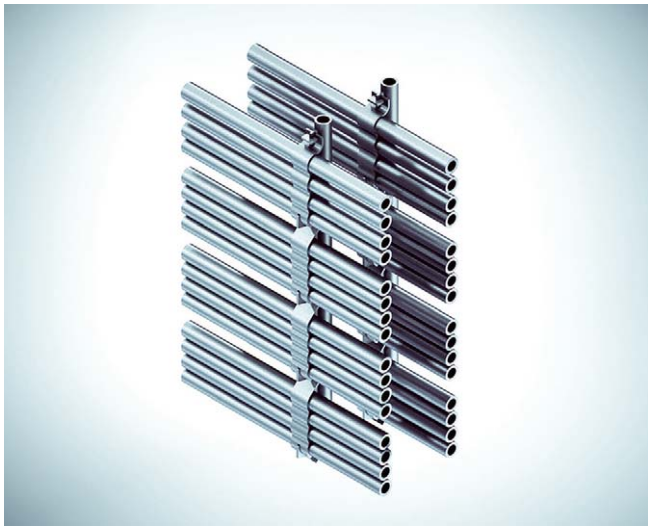
The tube supports in a superheater can often create a bottleneck that will have an adverse effect on performance and service life. This becomes very apparent when there is a change in fuels and the existing pitch in the superheater is no longer sufficient. The unfortunate result is increased slagging, leading to a loss in heat transfer efficiency and the potential for plugging.

ANDRITZ offers a Replacement^{PLUS} Double-pitch Superheater that provides the same amount of surface heating area as a traditional design, but has the value-added of special supports which increase the pitch. This provides perfect cooling and aligns the heating surfaces to optimize gas flows through the superheater.

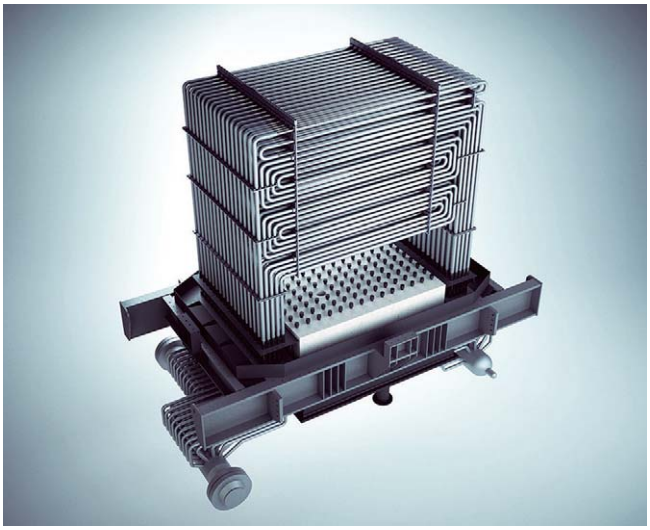
BED MATERIAL HEAT EXCHANGER

The Replacement^{PLUS} Bed Material Heat Exchanger is a specialized and engineered component for use in waste-fired, circulating fluidized bed boilers with highly corrosive fuels. Due to its location in the flow of hot sand, the maximum amount of energy can be transferred without coming into contact with the flue gas. This Bed Material Heat Exchanger is designed as a final superheating zone for the highest steam temperatures. The selection of quality materials and use of proper manufacturing techniques ensure excellent performance in this demanding and abrasive environment.

ANDRITZ's value-added design demonstrates the company's extensive knowledge of metallurgies and the internal workings and heat transfer characteristics of fluidized bed boilers. This knowledge is being continuously updated as new metallurgies and manufacturing methods become available.



Double-pitch superheater



Bed material heat exchanger

Fluidized bed enhancements to improve boiler performance

ANDRITZ offers retrofit solutions which can be tailored to any boiler's combustion requirements. These retrofits optimize air flows, remove coarse impurities, and ensure homogeneous fuel intake.

RETROFIT BFB NOZZLE GRID

To maintain an optimum fluidized bed, the air flow through the bed must be controlled to ensure the correct pressure drop. Otherwise, the bed will not burn uniformly – hot spots or dead spots will form – and operational or emissions problems result.

ANDRITZ offers several retrofit solutions for air nozzle grids which can be tailored to any boiler. These retrofits not only correct for air distribution issues by producing the optimum pressure drop, they also accommodate different volumes and sizes of impurities which enter the combustion chamber with the fuel. These impurities can include stones, wires, nails, and sometimes larger objects.

If the impurities in the incoming fuel are small, the choice might be an ANDRITZ retrofit nozzle grid typically installed on biomass boilers. This grid permits the small impurities to pass through while ensuring that the bed temperature is evenly distributed, and fuel integration is maintained.

If the boiler's fuel sources contain larger and more coarse impurities, or for applications where the volume of impurities in the fuel is high (typically waste fuel and multi-fuel boilers), the choice might be an ANDRITZ BFB nozzle grid with an open design. The larger spaces between air supply headers reduce or eliminate blockages caused by larger impurities.

For these open grid designs, ANDRITZ has replaced the traditional bubble-shaped air nozzles with a new and improved T-nozzle design. The T-nozzle prevents wires from accumulating around the nozzles, shedding off these impurities so that they fall through the nozzle grid without blocking the openings.

Retrofit BFB nozzle grid for biomass.

Retrofit BFB nozzle grid for waste fuel.

PNEUMATIC FUEL FEEDING SYSTEM

A critical factor in stabilizing the operation of waste-fired boilers is to ensure homogeneous fuel intake regardless of the source of waste fuels entering the combustion chamber. If a boiler has a traditional fuel chute, the lighter fractions in the fuels (e.g. plastics, fines, etc.) tend to fly upwards and burn in the post-combustion zone, such as the second pass. This carryover not only affects the bed temperature, but also can cause fouling in the convective pass.

The solution in this case is to ensure that both the heavy and light fractions of fuel are burned in the same zone, low in the fluidized bed. To achieve this, ANDRITZ offers a pneumatic fuel feeding system which can be installed as an additional fuel feeding point, or as a replacement to existing systems. The pneumatic system uses air to blow the lighter fractions of fuel into the correct area of the combustion zone, ensuring complete combustion of fuel at the proper place in the boiler to avoid fouling.

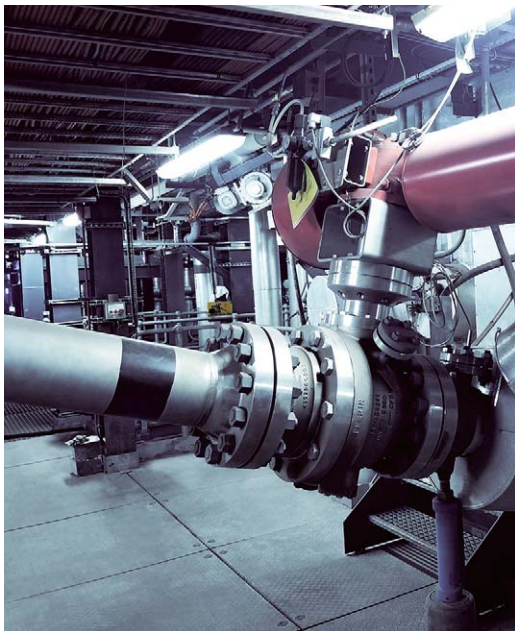
The ANDRITZ system is very compact and is easily installed to handle the feeding of additional fuels to the boiler. This way, the traditional feed, which is set up for the parameters of the main fuel, can remain untouched, while the pneumatic system is added to feed alternative or lighter fuels.

Pneumatic fuel feeding system

SLUDGE FIRING SYSTEM

When a boiler also burns sludge, either as the primary fuel or in a co-firing situation, a standard fuel dosing screw is often not ideal for feeding the sludge. The mechanics of the screw produce large, uneven blocks or balls of sludge which may burn on the outside, but remain as sludge inside, with high moisture content. This leads to situations where bed combustion is not well distributed due to localized moisture peaks, which create localized CO peaks and a too-low bed temperature even though the heating value of the fuel is sufficient.

The ANDRITZ upgrade or retrofit solution is a sludge firing system that ensures that the sludge fed into the boiler is uniformly small so that it is burned completely. This avoids fuel agglomerations and the formation of localized CO peaks. Steam injection is employed to atomize the sludge so that it is well distributed as it is being fed into the boiler.



Sludge firing system

ADVANCED BED MATERIAL RECIRCULATION

If the alkaline concentration in the fluidized bed is too high, bed agglomeration will occur. If the agglomeration accelerates, this can present a major operational problem and ultimately lead to sintering of the entire bed. To keep the alkaline content at the proper level, and remove the impurities in the bed, continual bottom ash extraction is critical. Unfortunately, traditional ash extraction techniques can remove the "good" sand along with the impurities. The cost of excessive make-up sand can be significant.

Several traditional extraction methods rely on screens or sieves. The screening material invariably is eroded or damaged due to constant abrasion, and quite often plugs up due to the presence of small pieces of metal in the ash.

ANDRITZ engineered a simple and excellent retrofit or upgrade solution for separating good sand from the impurities. The bed material recirculation system uses a steady flow of under-pressure air to return the sand and small particles to the bed while allowing heavier materials to fall into a bin for removal. The air flow is adjustable to fine-tune the particle size desired in order to be able to obtain optimum bed material recirculation. The under-pressure air in the second pass of the boiler is normally enough to draw sufficient air through the wind screen and the separator. As a result, the system has no moving parts and is maintenance-free.

Upgrades to reduce NOx emissions

In order to reduce emissions, the correct first step is ensuring exact control of the firing process through air staging. Installing SNCR technology is another step that can be taken to reduce emissions further.

ADVANCED AIR STAGING AND FGR

To keep NOx emissions low and within limits, it is essential to maintain tight control and ensure homogeneous distribution of the combustion air. Homogeneous temperatures in the combustion chamber result in lower NOx emissions when full combustion is achieved to prevent CO emissions from increasing.

This control of flame and bed temperature is best achieved by proper air staging to ensure optimum distribution of air in the combustion chamber, and recirculation of flue gas to control the amount of oxygen available to react with the flame. Homogeneous air distribution over the cross-section of the combustion chamber and fluidized bed is essential in any case to achieve full combustion with low CO and NOx emissions, without requiring secondary measures such as an SNCR or SCR system.

ANDRITZ offers the ideal upgrade for existing boiler plants: combining advanced air staging with Flue Gas Recirculation (FGR). In order to achieve optimum combustion in an existing boiler, ANDRITZ conducts extensive Computational Fluid Dynamics (CFD) simulations that not only integrate the balances and combustion kinetics, but also take into account the dynamics of particle sizes and other factors related to the fluidized bed.

ADVANCED SNCR SYSTEM

When the above is not sufficient to achieve emissions targets, installation of a Selective Non-Catalytic Reaction (SNCR) system is usually the next choice. This system injects a urea-water or ammonia-water mixture into the boiler to react with the nitrogen oxides in the flue gas, which reduces emissions. Key to system design is ensuring homogeneous distribution of the diluted urea or ammonia over the entire cross-section of the combustion chamber and injecting the mixture at proper points, in the optimum temperature range, and at the right volume to avoid ammonia slip.

ANDRITZ is very experienced in integrating SNCR systems into new or existing fluidized bed boilers. A modern SNCR system with nozzles on two levels and advanced temperature measurement using two-color pyrometers allows operators to achieve emissions targets even at part-load and with changing fuel qualities, as long as the flue gas temperature at the injection point is above 850°C and combustion is complete.

There may be occasions where an off-the-shelf SNCR system will suffice, but in our experience, a SNCR system that is tailor-made or optimized achieves the best results. Optimization requires extensive knowledge of the impact that the combustion of different fuels has on NOx removal. ANDRITZ has this knowledge and, when necessary, can supplement this knowledge with computer simulations of the combustion and NOx removal processes for a particular boiler to ensure that the SNCR system is optimized.

Advanced air staging and FGR upgrade

Upgrades to reduce corrosion

Corrosion is a fact of life in any boiler. While corrosion cannot be totally avoided, it can be slowed significantly. ANDRITZ has proven upgrade solutions to dramatically slow the corrosion process.

SULPHUR DOSING

The alkalis in normal ash chemistry (e.g. sodium and potassium chloride) have a lower melting point and tend to form a sticky coating on hot boiler surfaces. When the chlorides come into contact with steel, a "chloride-iron cycle" is initiated. This cycle builds upon itself as the sticky coating attracts and binds more ash particles, making the coating thicker and thicker. The thick coating reduces heat transfer efficiency, which raises the surface temperature, causing more alkalis to accumulate and the component to fail. This results in fouling.

ANDRITZ has a proven upgrade solution which involves dosing and mixing sulphur granulate into the fuel. The addition of sulphur encourages sulphates to form instead of chlorides – forming a dry, non-sticky, and porous ash that does not adhere to the boiler surfaces. This dramatically reduces the risk of bed agglomeration, fouling, and the resulting corrosion.

The alkali sulphates that are formed act as a combustion catalyst and help reduce CO emissions. In this way, the oxygen content and basic NOx emissions can be further reduced.

ChlorOut®

ANDRITZ combines its "whole system" knowledge of fluidized bed boilers with a licensed product from ChlorOut® AB, to provide an effective upgrade or retrofit solution for removing chlorine from the deposits on the heating surfaces and sustainably reducing corrosion caused by chlorine. The use of ChlorOut® has yielded very good results, especially in biomass- and waste-fired boilers with a high chlorine content in the fuel.

Ammonium sulphate is injected into the flue gas upstream of the superheaters. This immediately reacts with flue gas to form ammonia, SO3, and water after being injected. The SO3 is very effective in converting alkali chlorides in the flue gas to alkali sulphates, which are much less prone to depositing on and corroding surfaces. The ammonia reacts with NO in the flue gas to achieve a simultaneous reduction in NOx emissions (SNCR reaction). ChlorOut® also includes the option of on-line measurement of alkali chlorides, In-situ Alkali Chloride Measurement (IACM®). This can be used to control the addition of sulphate and to monitor effects on KCl from variation in fuel quality.

In-situ alkali chloride monitor (IACM)

ChlorOut® is a registered trademark of Vattenfall Group (Sweden).

ANDRITZ: A DEPENDABLE SERVICE PARTNER WITH EXTENSIVE BFB/CFB EXPERIENCE

ANDRITZ is a global supplier of technology and services for key industries, including pulp, paper, and power generation. With our global reach and financial strength, we have the resources to invest in having the specialized tools and technologies in place. However, our most unique assets are our knowledgeable, experienced, and motivated people. Our people know how to help your plant achieve the highest availability with optimum performance over its entire life – with the lowest cost of ownership. The foundation for our service is a spirit of partnership, clear and open communication, and professional competence – on time and within budget.

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