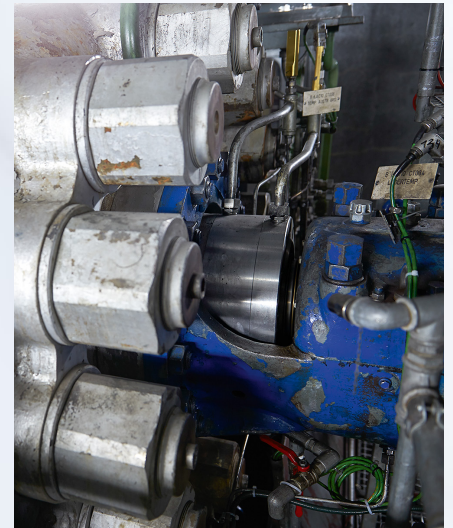


Diamond-faced mechanical seals for boiler feed water pumps defy electrochemical corrosion and offer long service life.

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Rely on excellence

## Diamond solution for the power station sector



Weller boiler feed water pump in the black coal power station in North Rhine Westphalia

**For years, premature wear of mechanical seals due to electrochemical corrosion has been posing great difficulties to power station operators. The use of EagleBurgmann diamond-faced high performance seals in fossil and nuclear power stations has successfully solved these problems. Since November 2010, a well-known power station operator in Germany has been using this high tech sealing technology in its largest black coal power station in the northwest of the Ruhr area in North Rhine Westphalia. The three installed mechanical seals work faultlessly and without objection.**

At the end of the 1970s, the conversion of the water chemistry from "alkaline" to "combination" or "neutral operation" and the use of increasingly larger and more rapidly rotating feed water pumps considerably reduced the service life of mechanical seals at many power stations, due to electrochemical corrosion. This damage phenomenon, which caused the destruction of the face materials, had been especially observed in large boiler feed pumps with high circumferential velocities. For operating periods that required at least 24,000 operating hours, the mechanical seals that were damaged by corrosion often needed to be replaced after only a few thousand hours. The premature seal replacement continually caused production losses, unnecessary expenditure, and maintenance costs.

### In dialog to success

Mechanical seals and electrochemical corrosion were consequently an issue for the black coal power station operator who had already been

working with EagleBurgmann since the establishment of his plant in 1971. Four units at the North Rhine Westphalia location produce an output of more than 2,200 MW. Around 7.5 billion kilowatt hours of electricity, which can cover the requirements of 1.9 million single family households, are produced there each year. In addition to electrochemical corrosion these machines and their components are faced with further technical challenges: The changes in the power market due to seasonal causes or the addition of renewable energy sources often result in that the coal-fired power stations are used to cover medium-load power and operate less at full load. For the previously described power station, this meant that the more than 250 starts and stops due to the alternating load operation put the utilized seals under additionally high mechanical and hydraulic loads.

Weller type boiler feed water pumps have been installed in two of the four power station units. One pump is completely fitted with two DF-SAFI type mechanical seals.

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Durable and proven:  
EagleBurgmann mechanical seal type DFSAF



The specialists Andreas Kretschmer and Christoph Bolte are satisfied:  
The diamond-faced mechanical seal has been operating without problems for more than 13,000 hours.

The drive side of the second pump had already been equipped with the type DFSAFI. The material combination for these seals consists of a stationary arranged seal face of carbon composite material against a rotating arranged diamond-faced stationary seat of silicon carbide. During a pump inspection in 2012, one of the installed seals was inspected and then reinstalled without objection. „Collaboration with EagleBurgmann has always worked out well for us. The problems were known and we had been working together in close dialog from the beginning. During the further development of the mechanical seals, such as the conversion of the water chemistry from alkaline to the present combination operation, we have been able to draw on EagleBurgmann’s great development and material knowledge. And we have indeed found a very good solution,” says Christoph Bolte, unit manager for mechanical engineering at the black coal power station.

### Using “vaccinations” to extend the operating period

The two experts Christoph Bolte and Andreas Kretschmer (Head of application engineering Power, Pulp & Paper, EagleBurgmann Germany) know what they are talking about with regard to the technical further development in their long-standing business relationship. In the 1990s, the cooling circuit of the mechanical seals was reconditioned in order to circumvent the low conductivity of the feed water, which had been the trigger for electrochemical corrosion on the sliding surfaces. The circulating feed or cooling water was specifically “vaccinated” to make it softer and thereby more conductive. “In the process we added ammonia, for example, in “homeopathic” amounts so that we virtually provided the mechanical seal with an environment which corresponded to the alkaline feed water,” explains Andreas Kretschmer.



„This let us eliminate the disruptive ‘electrochemical corrosion’ factor first of all – and we achieved better operating periods. But of course that was not a satisfactory permanent solution for us yet,” adds Christoph Bolte. “Vaccinating” the cooling circuit not only requires constant monitoring and maintenance but also specific HSE (Health, Safety & Environment) measures.

### Innovative solution with Diamond

The breakthrough occurred with the diamond thin-layer technology, originally developed in 2007 by EagleBurgmann together with the Fraunhofer Institute for Surface Engineering and Thin Films (IST) and has been further optimized by the Bavarian seal manufacturer over the years. It is offered by EagleBurgmann under the brand name of DiamondFace. The diamond layer of usually only up to 10 µm, which is applied to the seal faces under vacuum and at temperatures of 2,000 °C (3,632 °F) by way of chemical vapor deposition (CVD), is characterized by extreme hardness, high resistance to wear, excellent thermal conductivity, greatest chemical resistance and minimal friction. The maximum adhesion to the base material is convincing here. Another advantage is the considerably reduced heating during friction, which is reduced by a factor of 15 in comparison to uncoated silicon carbide sliding surfaces.



“Now that DiamondFace coatings have been proven for years in the sealing of pumps, agitators and compressors in the areas of oil & gas, chemical and pharmaceutical industry, we have also ‘discovered’ this coating for use in power station technology – and solved the difficult issue of ‘electrochemical corrosion’ in the process,” explains Andreas Kretschmer.

This uses the good electrical conductivity of the special EagleBurgmann diamond facing. Additional and time-consuming vaccination of the mechanical seal cooling circuit therefore becomes superfluous.

In the meantime, the advantages of the innovative „Diamond solution“ are being used by numerous conventional power stations and nuclear power stations throughout the world.