



PROFILE

SYSTEM SEALS

CHALLENGING THE STATUS QUO

System Seals was created to address a need that most industries were ignoring: Designing and manufacturing unique sealing systems based on the application. (Courtesy Shutterstock)

By designing and manufacturing unique sealing systems to protect wind-turbine bearings, System Seals has transformed sealing technology by maximizing the performance and longevity of essential systems and parts.

By **KENNETH CARTER** ▸ Wind Systems editor

Seals are an essential part of making sure the bearings in wind turbines stay properly lubricated and perform the way they should.

Until recently, those essential seals were generic, off-the-shelf items, largely designed for general industrial use. The result of using those seals was often main shaft damage leading to premature leakage, which, in turn, led to untimely maintenance and grease cleanup.

System Seals was created to address a need that most industries were ignoring: Designing and manufacturing unique sealing systems based on the application — not just what was available — with a goal of maximizing performance and reliability.

“After proving successful with OEMs, we quickly found out that this same approach had a profound impact on the repair markets and end users,” said Matthew Zalick, director of business development for System Seals. “It was not just for new equipment builds. And so, for aftermarket customers, these custom sealing systems ended up preventing costly leakage on existing equipment. The output of that is you’re saving thousands of dollars on either lost opportunity cost or frequent or unplanned maintenance. The System Seals approach has really helped transform sealing technology in a multitude of industries worldwide.”

BRANCHING OUT TO WIND

System Seals first started designing custom rotary seals for the steel-mill bearing industry, but it soon began to branch out into supplying its unique sealing systems to other industries, including wind, according to Zalick.

“We started developing some new seal technology with a bearing OEM quite some time ago,” he said. “That company was a major player in the steel industry, and at the time was exploring the possibility of entering into the wind-energy market with a unique bearing and sealing package. It was then that System Seals realized there was an opportunity for custom seals in the wind-energy market.”

That created an opportunity for System Seals, who began working with wind companies in 2008, according to Zalick.

“The seals used in wind turbines are typically off-the-shelf commodity parts, or metallic labyrinth seals,” he said. “Our partner was looking for extended seal life, which gave us permission to look outside of traditional elastomers and into lower-friction materials like urethane and PTFE, and it freed our engineers to think creatively with the design. We still have some of these early long-life seals made from PTFE running leak free after 14 years of operation. To my knowledge, these are the longest running main bearing seals out there.”

AN EXTENSIVE ARRAY OF PRODUCTS

In addition to the main bearing seals, System Seals also designs, manufactures, and supplies seals for pitch and yaw bearings, as well as a unique material used for the wear pads in the hydraulic yaw braking systems, according to Zalick.

“The VORTEX main bearing seals are definitely our latest disruptive technology in wind energy, but we do supply other unique components outside of just that,” he said. “With the turbine manufacturers, owners, and operators desiring more products designed specifically for their applications, we are able to push the boundaries of what the industry deemed as acceptable in performance.”

‘A SEAL THAT DOESN’T ACT LIKE A SEAL’

Zalick pointed out that System Seals believes in challenging the status quo, and the company’s VORTEX main bearing seal is a testament to that.

“That’s kind of the mantra of System Seals, and that plays out in wind with our VORTEX main bearing seal being a perfect example,” he said. “VORTEX is the first disruptive technology for main bearing seals in the history of wind energy. The way that the seal’s designed is it has a helical-shaped lip and, as the seal rotates with the housing or when the shaft rotates against the seal, that helical shape acts as an auger, like a pump. It’s just constantly pushing the grease back toward the bearing.”

“We’re using not just the newest technology as far as sealing profiles go, but also in the development of our polyurethane that we use to manufacture those seals,” Zalick said. “It’s a complete departure from what has typically been used in the past in the wind industry.”

LARGER PARTS NEEDING PROTECTION

As the wind industry continues to grow, Zalick pointed out that the industry’s assets are growing as well, which means larger parts that will need protection.

“With the growth in size of new wind turbines, we’re seeing bearings get larger, which means deflections are larger, clearances are larger,” he said. “And that comes with a whole host of issues related to lubricity and additive technology, which we need to consider from a sealing design and material standpoint. This is a major driver for continued growth in both manufacturing technology and our fluid-compatibility research.”

FOCUSING ON PROBLEM SOLVING

In addition to the growing size of assets, as existing turbines reach their end-of-life, the repowering of those turbines be-



System Seals VORTEX main bearing seal.
(Courtesy: System Seals)

comes a distinct possibility in order to increase the power output, according to Zalick.

With each job — especially when it comes to repowering or retrofitting — offering its own set of challenges, Zalick said System Seals' focus on problem solving becomes an essential part of getting a job done quickly and efficiently.

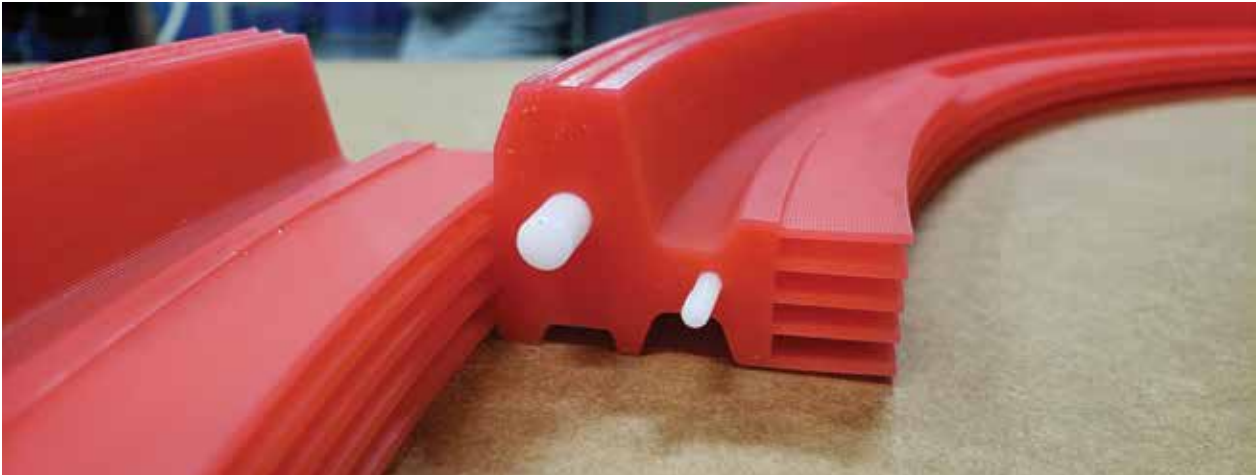
“Turbine operators are updating their equipment, and, so along with that, there’s this opportunity to either put in a higher-quality seal and to replace the traditional single lip type of seal, or, in a lot of cases, some of these turbines were not designed with the seal at all,” he said. “What we’ve done is we’re actually able to create custom-sealing solutions that fit into existing metal work where seals weren’t originally designed. That allows us to give some reliability to the turbine company, knowing that there’s actually a seal in there without having to add the cost of adjustments to existing metal work or design.”

“One of our biggest unique qualities as a company is our focus on problem solving,” Zalick said. “Typically, when



System Seals' first “Super VORTEX” seal with an inside diameter of 3.8 meters. (Courtesy: System Seals)

we’re courting a new potential customer, the first questions we ask are: What’s your biggest headache? Where are you having leakage issues? What’s the problem you can’t solve? Because we are structured in a way that we can develop unique solutions and develop custom seals to be able to help do that. Along with that open mindset of problem solving, our engineering group comes with over 25 years of this idea of developing and supplying custom-sealing solutions. We could address these customer challenges with a unique approach every time.”



A split VORTEX seal for aftermarket repair. The VORTEX seal is designed to be installed without gluing or bonding. (Courtesy: System Seals)

LOOKING TO THE FUTURE

With that main directive, Zalick said System Seals has carved out what has become a vital niche for wind-energy assets, and as wind-turbine capacity and component sizes continue to increase, the lubrication requirements are going to have to change in order to manage lubricity at that size.

“I know some companies are talking about a desire to change to oil lubrication for main bearings, which has always been a difficult undertaking, but they also want to operate in more extreme environments,” he said.

“For System Seals, we’re trying to work ahead of these trends by expanding our manufacturing capabilities. Currently, we’re able to manufacture endless seals at a little over five meters in diameter. We want to stay ahead of making sure that we can continue to grow those capabilities to match the needs of the generator and bearing manufacturers. We’re also constantly performing compatibility tests with our materials and the latest greases. Right now, we’re actually on the tail end of qualifying our VORTEX seal for oil-lubricated bearings.”

DESIGNING SEALS SINCE 1995

System Seals is a U.S.-based company with its headquarters in Cleveland, Ohio, where the company recently expanded to include a new facility in Brecksville, Ohio, according to Zalick.

“This new wind-energy division of System Seals is solely dedicated to the manufacturing of our VORTEX main bearing seal,” he said.

System Seals has its European headquarters in Hamburg,



System Seals molded pitch bearing seal. (Courtesy: System Seals)

Germany, and it recently acquired a manufacturing facility in Austria that had closed in 2021, so the expanded HQ and the Austrian facility have been big assets to the company, according to Zalick.

“That office has been critical in our day-to-day access to the largest wind-turbine manufacturers,” he said. “Most of the OEMs are there.”

Even though System Seals has been involved with wind for a little more than a decade, the company has actually been active since 1995, when it was founded by Arnold von Engelbrechten, a German-born engineer. With a career in seals, he started applying newer technologies to how seals were designed, because, at that time, hydraulic seals weren’t an off-the-shelf type of product.

By revolutionizing how industries looked at seals, System Seals was able to offer solutions to problems many industries had not, historically, been overly concerned about, according to Zalick. In doing so, it pushed many industries to address issues that ultimately saved them time and money. ↵

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