JÄGER GROUP

CASE STUDY

PLASTIC HALF-SHELLS FOR WIND TURBINES

STABLE PROTECTION FOR ROTOR BLADE ASSEMBLY

CHALLENGE

Precisely fitting rotor blades
with more than 50 bolts

Low-cost protection
for rotor blade bolts against damage

Facilitate blade alignment
during assembly

SOLUTION

Half-shells made of PP as assembly
protection for rotor blade bolts

Stable and cost-effective material

Simple assembly principle by click lock

RESULT

Secure protection of rotor blade bolts
against damage

Expensive replacement procedures
on running turbines are eliminated

Faster initial assembly of the rotor blades

CHALLENGE

FAULT-FREE ASSEMBLY AT LOFTY HEIGHTS

The assembly of rotor blades is a highly complex process. Depending on the type of turbine, at least 54 bolts must be aligned simultaneously with the arrangement of the respective rotor blade hub opening. A process with large weights swinging on the crane at airy heights. This does not always succeed without problems; it can lead to damage to the rotor blade bolts. But damaged bolts can corrode over time and lose stability. High costs would be the consequence in this case.

With this problem, a manufacturer of wind turbines contacted Jäger Gummi und Kunststoff GmbH. They know each other: JÄGER has already developed highly efficient and cost-optimized processes and products for previous challenges of the customer. So how will JÄGER now design a protection for the expansion shaft of the 36 millimeter diameter bolt, which at the same time facilitates blade alignment, avoids maintenance costs and ideally reduces assembly costs?

Picture: Kruwt - stock.adobe.com

CHALLENGE

HIGH COSTS DUE TO ASSEMBLY DAMAGE

These add up for the turbine manufacturer in two ways. On the one hand the replacement of a rotor blade bolt burdens the cost accounting, on the other hand the turbine is not in operation whilst the replacement of the damaged rotor blade bolt talks place. Thus, the wind turbine cannot produce electricity during the replacement, resulting in a loss of revenue.

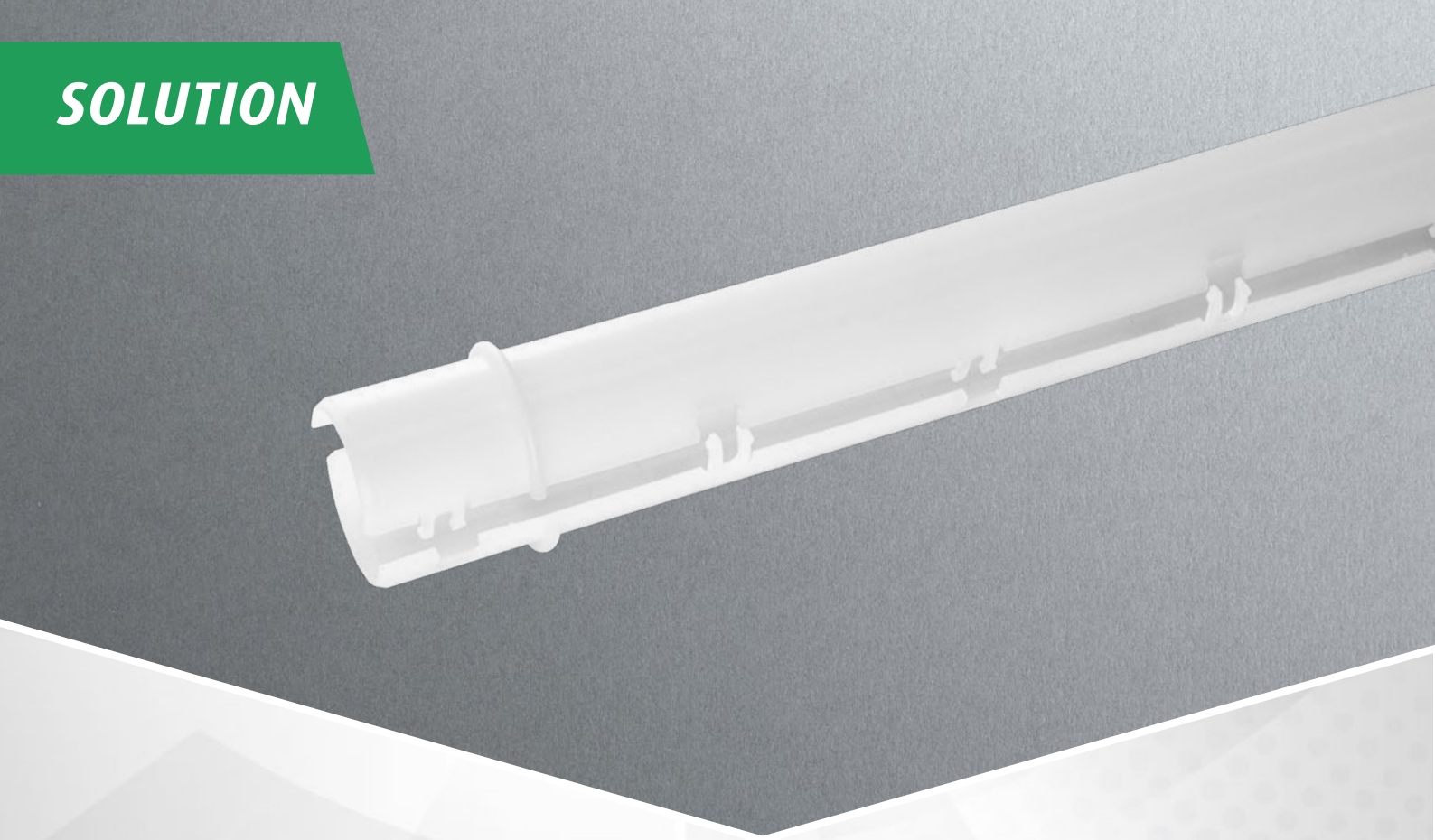
The planners had not considered this potential weak point on the bolt in the initial calculation. Therefore, the development of the desired half shell for the bolt now adds up to the repair items. The pressure to find a cost-effective solution that is as simple as it is resilient, both in production and assembly, is correspondingly high.

CHALLENGE

PROTECTIVE COATING NOT SUITABLE FOR EXPANSION SHANK

The weak point on the expansion shank of the bolt, which is supposed to absorb or compensate for dynamic forces with its taper in diameter, is due to a change in the corrosion protection. Hot-dip galvanizing has been replaced by the so-called "zinc-flake coating": The bolts are given a high-quality paint finish, which offers opportunities for corrosion due to smallest scratches. Alternative approaches to countering this weak point have already proved unsuitable. The application of an elastic protective sleeve is also ruled out because the thread of a rotor bolt is larger than the shaft itself. This makes the application of a protective hose much more difficult and thus more cost-intensive than it would have been with bolts of uniform diameter. The high number of pieces required also made the engineers rethink their approach.

SOLUTION

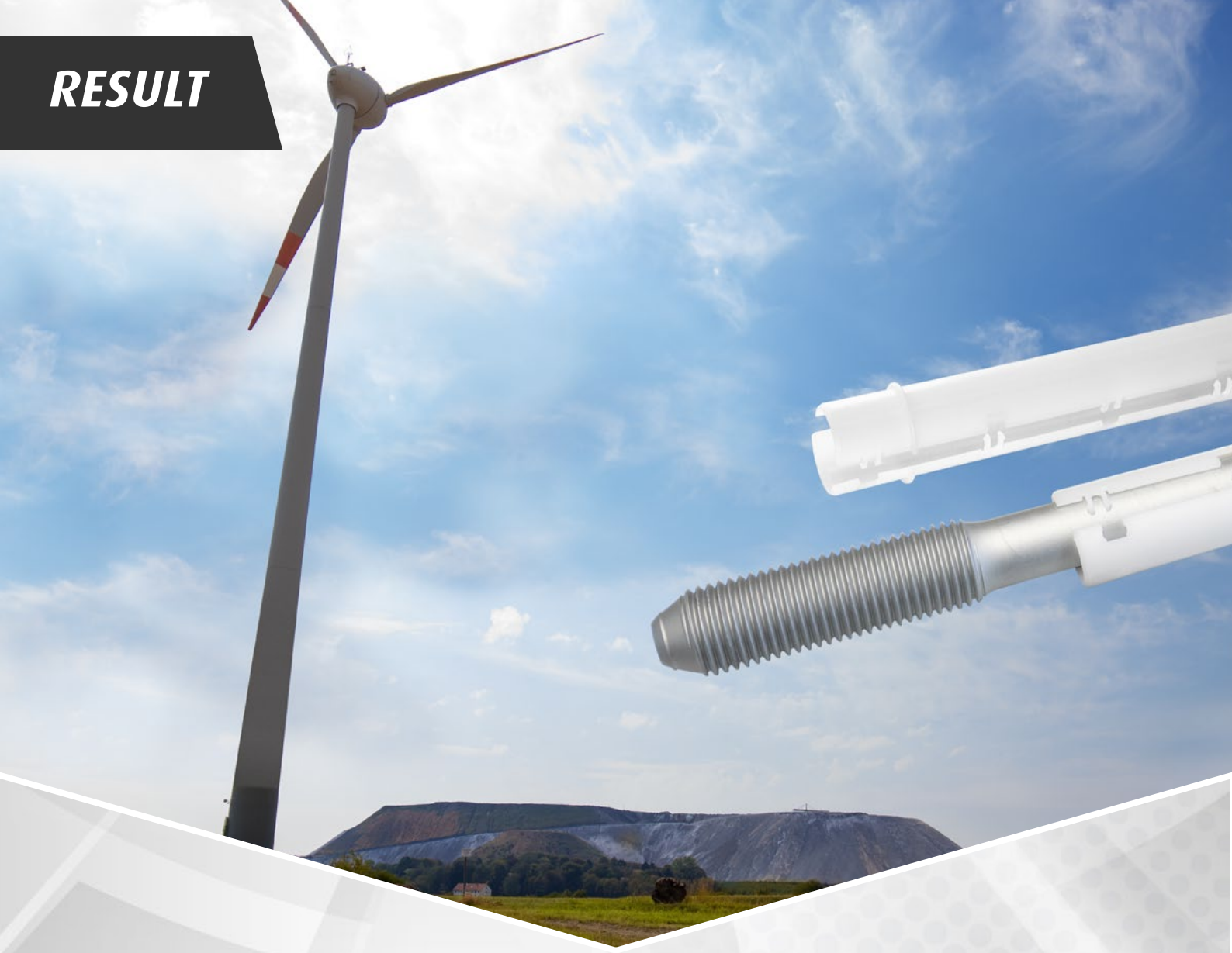


HALF-SHELLS ARE FIRST CHOICE

The experts at JÄGER suggested an alternative: two half-shells that could be closed together, produced by injection molding. After an initial exchange of ideas between the engineers at Jäger Gummi und Kunststoff and the developers at the bolt manufacturer, as well as with the equipment manufacturer, the JÄGER engineers produce the first joint designs using the 3D printing process. The prototypes, which are produced on the basis of drawings, go through the coordination process with all parties involved in several steps.

The basic idea is as simple as it is convincing: two half-shells wrap around the area of the expansion shaft and connect via a click closure. The half-shells are made of PP (polypropylene) and provide the right balance between stability and dimensional tolerance of the expansion shaft. To ensure that the bolts are centered within the grommet opening during the process of mounting, the half-shell is given a narrow, circumferential bead. In this way the scratch-sensitive surface material is effectively protected from damage. Furthermore, the rotor blade bolt is fixed to the hub with a nut, while the protection of the expansion shaft remains in the system.

RESULT



A FASTER ASSEMBLY SECURES LOWER COSTS

The exact development process and sample production proved to be cumbersome for this task. But the perseverance of the JÄGER engineers paid off for the customer: As a result, the company now has a cost-effective and resilient solution. The JÄGER solution speeds up installation and saves future costly maintenance work on the already installed wind turbine, each worth several thousand euros.

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