

Three industrial pipes are shown: a silver threaded pipe at the top, a blue smooth pipe in the middle, and a blue smooth pipe with a threaded end at the bottom. The background is a dark grey with a white geometric shape and a pattern of diagonal lines.

**CASE STUDY**

**RELIABLE**  
**SURGE PROTECTION**  
**FOR WIND TURBINES**

**OPTIMAL PRODUCT ADAPTATION**  
**THROUGH INDIVIDUAL ASSEMBLY TECHNOLOGY**

## CHALLENGE

Process-safe material combination required

Smallest tolerances in the tenth of a millimeter range

Extensive requirements: waterproof, flexible, durable



## SOLUTION

Intensive endurance tests in the plunge pool

Wall thickness adjustment and intelligent compressed air process

Specially developed cutting device with highest precision



## RESULT

Reliable fulfilment of all requirements

Process-safe completion of the prepared double ends

Reliable surge protection for up to 25 years





## POWER GENERATION UNDER HIGH VOLTAGE

Wind turbine generators must be well protected against overvoltage caused by lightning strikes. This also applies to the smallest components in the transition from rotor hub to generator. This is the challenge facing a plant manufacturer who has presented Jäger Gummi und Kunststoff GmbH with a solution proposal he has developed himself: So-called double ends, which connect the rotor

hub with the generator (rotor), are to be covered between their thread areas with a hose made of a special material. This is to prevent voltage transmission to the generator in the event of a lightning strike. However, this process turns out to be more difficult than initially assumed, because the demands on the project are extensive.

## HIGHEST REQUIREMENTS FOR LIGHTNING STRIKES

The experts at Jäger are meeting these challenges, but the fundamentals for this must first be clarified. The hub of a wind turbine is bolted to the rotor of the generator from 72 to 108 double ends, depending on its size. Each of these metal bolts should be fully protected in the shaft area. This means that the hose must not only fit tightly, but also be precise in its length and diameter. The special compound selected must also meet the requirements permanently: It must be extremely flexible and must not be damaged at all during the assembly process. A tiny hole would destroy the surge protection. In addition, it must be ensured that no moisture can penetrate between the shaft of the double end and the hose.

Jäger tests such properties in a special plunge pool. The double ends, in this case with a diameter of 42 millimeters and a length of 506 millimeters, are already covered with the special hose. The pressure generated simulates the pressure prevailing on the system under full load. The double ends and the special hose are designed for the life cycle of a wind turbine, which is calculated at 25 years.

But the engineers have not yet reached that point. All previous attempts to apply a hose to the double ends have failed. All too often the hose, whose inner diameter is smaller than the outer diameter of the double end, is overstretched and no longer fulfills its intended function. The quality of the manufactured components is not in question. The assembly process is the key.





## INTELLIGENT ADJUSTMENT WITH GREAT EFFECT

The hose and compound experts at Jäger Gummi und Kunststoff develop a hose that is tailored to the specific application in its compound composition and resulting properties. The special hose is manufactured with a slightly higher wall thickness than before. In a compressed air process, the hose can now be applied to the double end without damage. The air pressure stretches the hose just enough to allow it to be brought over the thread area and shaft of the double end. Afterwards, however, the hose contracts to such an extent that it sits firmly and water-tight on the double end.

The double ends have a hot-dip galvanized surface to protect them against corrosion. However, tiny chips and zinc residues can remain in the thread area. Such sharp chip edges are fatal for the protective hose. For this reason, Jäger's experts check every single double end very carefully: Their tolerance range here is in the tenth of a millimeter. But this is only the first step, because the collar length of the hose must still be shortened precisely!

**RESULT**



## ACCURATE TO A TENTH OF A MILLIMETER

Cutting devices specially developed by Jäger shorten the hose to a tenth of a millimeter. Minimized waste ensures minimum production costs. The blade stops precisely to protect the important zinc coating of the double end. The surge protection is made perfect by an additionally applied silicone seal of the hose end on the bolt itself. This precision and care can be proven at any time: Each individual double end is numbered and can be traced back to its batch number. The same applies to the hose applied to it.

For Jäger Gummi und Kunststoff, the development and production of this surge protection for double ends is a milestone as a long-standing supplier to the wind energy industry. All goals have been achieved, the requirements for the finished product have been fulfilled. Process-safe production and delivery on time of the prepared double ends are guaranteed.





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