

A thunder storm can be critical for wind turbines. Especially for the blades. Even small strikes may damage the blade composites. In the vicinity of a thunder storm, the air becomes heavily charged. The internal parts of the blades traditionally have a potential close to earth potential, either due to an actual down conductor, due to internal humidity on the inner surface or due to carbon structures. The voltage potential between the internal parts and the surface may puncture or otherwise damage the composite material of the blade. Jomitek has developed a method of keeping the surface of the blade at the same potential as the inner parts of the blade. When the potential of the inner parts and the surface is equalized no damage can take place in the internal parts of the blade.

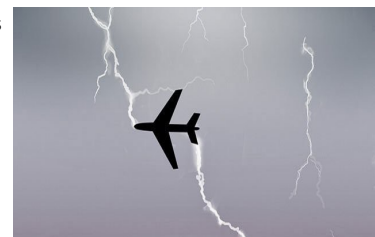
By adding a conducting tape at the surface of the blade in a finger-like layout the blades are protected.

#### **Jomitek Lightning tape functions**

- Keeps electrical fields outside the blades
- For fiber glass blades
- For Carbon fiber blades
- Ready for design into new construction
- Retrofit protection of installed blades

Integument and Jomitek has developed a tape solution that is based on tapes that Integument has designed for supersonic flights. The lightning tape is made for extreme conditions.

The aerospace industry is using surface conduction to protect fuel tanks and other vital parts.

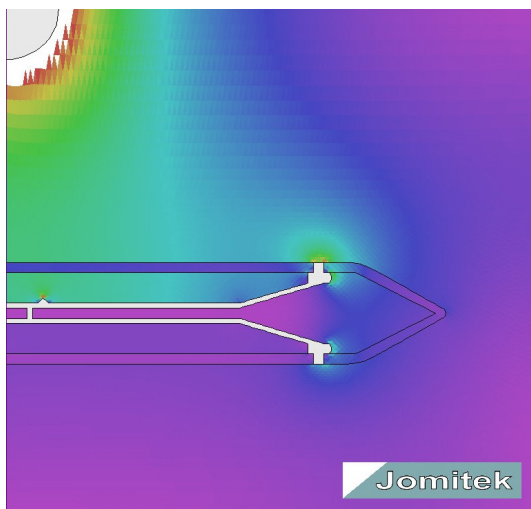


## Thunder storm model

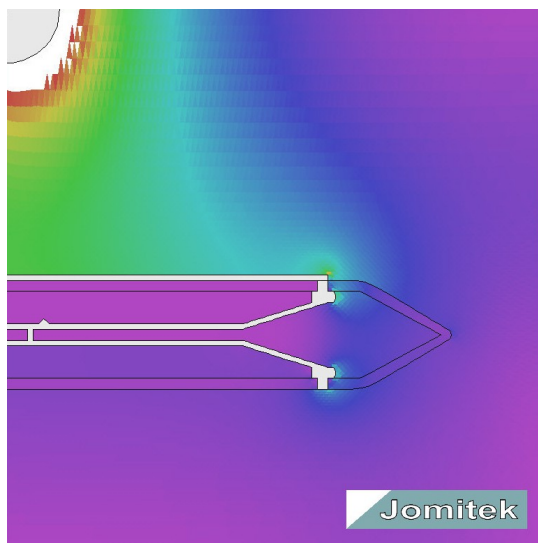
In a thunderstorm, the sky is charged, giving a very high potential compared to the earth.

The electrical potential is distributed down to the blade as shown on the model below. The blade has an internal down conductor and a receptor at the tip end.

The picture shows a strong field at the receptor, but also inside the blade.

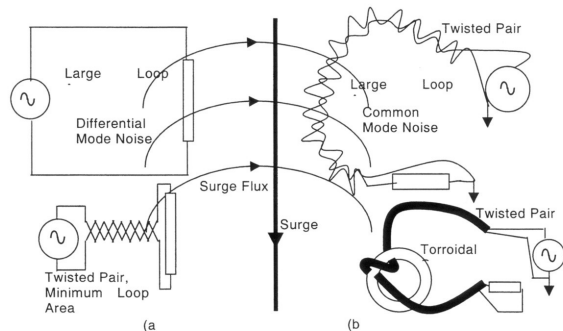
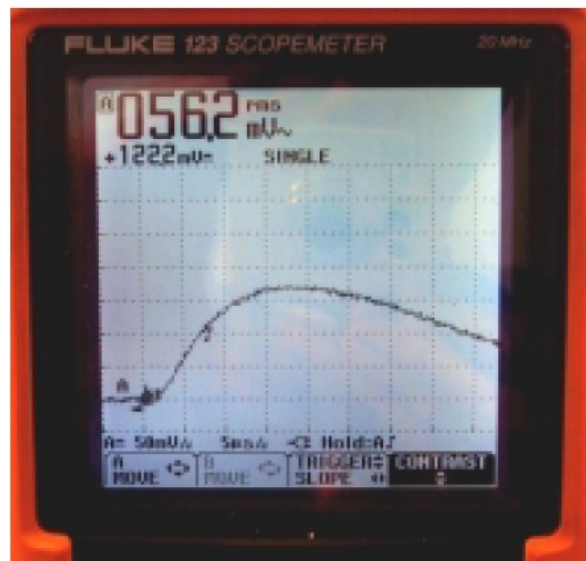


By adding a conductor at the surface of the blade, the potential inside the blade drops to ground potential. By having ground potential inside and outside the blade, no discharge will occur inside the blade.



## When the strike hits

When a lightning stroke eventually hits a wind turbine, a high current will be lead through the structure towards earth. The current will typically be in the range of 10.000 amps to 200.000 amps, and having a rise-time of 0.5usec to 200usec.



A large increase of the current within a short time will induce a voltage in whatever conducting loop that might be exposed for the magnetic field from such a current flow.

## Lightning tape - based on advanced science

The manufacturer of lightning tape, Integument Technologies Inc., is using an advanced handling of the film surface to make the adhesive bond permanent and to be able to withstand a harsh environment as we see on the surface of turbine blades.

Integument is using a cold gas plasma modification of the film. This treatment makes it possible to apply adhesives that bond to surfaces of any fluoropolymer film. This new material is called FluoroGrip.

The Chemical covalent bond formed between Fluorogrip materials and the adhesive is permanent - enabling Fluorogrip to be used in applications where no conventional adhesive fluoropolymer sheet or film products can. The covalent bond withstands a variety of industrial stresses including extreme temperature cycling, UV, humidity and a wide range of aggressive chemicals without de-laminating from the adhesive.

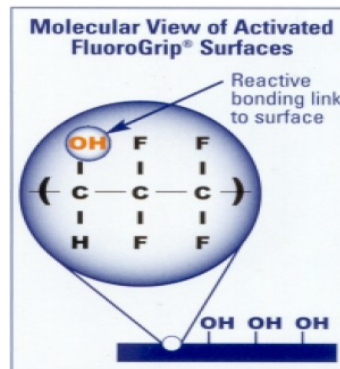


## Lightning tape - The lightning strike survival

When lightning strokes hit the lightning tape, the current will run inside the tape and in the ionized air above the tape. The tape may get a burning mark at the point of entrance. This point will have a size that is proportional with

the size of the lightning strike. Small strikes will make small marks that will have no influence on the tape or the aerodynamics on the surface.

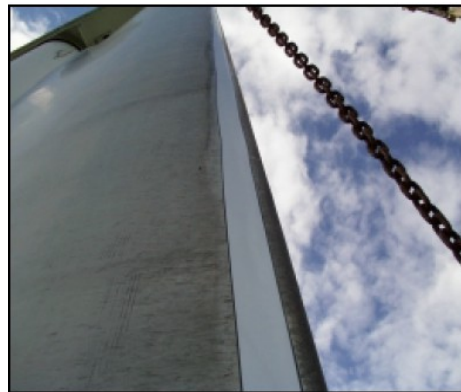
Medium size strikes may make a punctuation of the tape that may be repaired at the next ordinary service of the blade.



Big strikes may cause damage to the tape and a part of the tape must be replaced by a repair segment of tape.

## Testing

The company Lightning Technology in Pittsfield (USA) have made full scale testing of the tapes from Integument.



Jomitek lightning tape mounted on wind turbines in Holland

## Integrated edge sealing

The thin top film layer is extended 1 cm in each side. This top layer film functions as an effective sealing of the edges of the tape. The thin top layer film is also available without the copper layer for use as sealing at the ends of the tape.



## Assembly of tape sections

The individual tape sections may be cut together ensuring a distance between the copper ends below 1 mm. A thin film is added above the assembly.

## Product Ordering information

FluoroGrip LS-1000	Lightning tape	Width: 6 inch (15cm) copper, 7 inch (18cm) top layer, Length 10
FluoroGrip E300W-A2	ECTFE film	Top layer film White, 3 mil thick, 2 mil acrylic adhesive, 1" x 30' feet
FluoroGrip LS-145	Surface Degreaser	16oz. bottle
FluoroGrip LS-155	Surface Preparation	16oz. bottle

## Lightning Sensor System

It is strongly recommended to install the Jomitek Lightning Sensor System at the turbine. The Lightning sensor indicate a direct stroke of the turbine. The Lightning sensor then automatically can stop the turbine and inspection is possible before further damage has occurred. For more information see [www.jomitek.dk](http://www.jomitek.dk).

Ask for technical details at [info@jomitek.dk](mailto:info@jomitek.dk).