TEMPERATURE MONITORING OF WIND TURBINES

Isen, September 2025
Early warning with the d-LIST system

This white paper describes the structure, operating principles, and application scenarios of LISTEC GmbH's d-LIST systems for mitigating the risk of fire in wind turbines.

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1. Introduction & press reports

Despite their relatively low frequency, fires at wind turbines pose a serious risk. Due to the height and exposed location of the turbines, fires are difficult to extinguish and often result in total loss of the affected turbine. In addition to the economic consequences, such events can also pose a threat to the environment, grid security and nearby people and animals. Preventive measures, continuous maintenance and innovative safety systems are therefore becoming increasingly important.

Fires at wind turbines.
Examples from press reports:

May 16, 2025, Bremervörde-Iselersheim
Wind turbine catches fire in Bremervörde: Blade breaks off

https://www.ndr.de/nachrichten/niedersachsen/oldenburg_ostfriesland/Windrad-in-Bremervoerde-faengt-Feuer-Fluegel-abgebrochen,aktuelloldenburg18774.html

August 07, 2025, Bönitz
Fire in wind turbine on the B183 – "No one is going up there."

https://www.lr-online.de/lausitz/elsterwerda/brand-bei-bad-liebenwerda-feuer-im-windrad-an-der-b183-das-ist-bekannt-78231787.html

2. Fire risks & triggers

Wind turbines are playing an increasingly central role in the energy transition. At the same time, their complex design and the necessary electrical infrastructure pose particular fire risks. Such hazards often arise from technical defects, such as short circuits in electrical components, overheating of generators or damage to the rotor blade structure.

Causes of fire in wind turbines are often due to:

- Overheating of power and signal cables (e.g. due to overload, faulty connections, damage to insulation)
- Short circuits caused by moisture, mechanical damage or animal bites
- Partial discharges/insulation degradation in medium and low-voltage cables

Early detection of such faults in cables and their supply lines is crucial for preventing fires and increasing operational safety. This is where the **d-LIST system** comes in:

- Continuous, automated monitoring of the cable infrastructure
- Targeted alerts and initiation of protective measures.

Consequences of undetected damage

- Local overheating with fire
- Failure of control and safety functions
- Long downtimes, expensive repairs and risk of consequential damage
- Increased insurance premiums and damage to reputation

The focus is on monitoring signal and power cables in the tower and in cable ducts between individual wind turbines. The aim is to detect defects and abnormal operating conditions at an early stage. This prevents fires, shortens repair times and increases operational safety.

3. LISTEC solutions

LISTEC GmbH has been developing, manufacturing, and distributing sensor cable systems for early fire detection and temperature monitoring for over 30 years – **“Made in Germany”** near Munich for customers worldwide. Thanks to their robust, enclosed design, our sensor cables are ideal for use in wind turbines. Towers and cable ducts are often subject to demanding conditions: vibrations, moisture, extreme temperature fluctuations, and high electrical loads. In these areas in particular, early detection of temperature rises is crucial to prevent fires, ensure operational safety, and avoid downtime.

The **LISTEC sensor cable** has integrated temperature sensors at defined intervals, which enable precise localisation of temperature changes – along the power and signal cables in the tower and in the cable ducts between the turbines. This allows critical areas to be reliably monitored and potential sources of fire to be detected at an early stage.
With this technology, LISTEC has been ensuring greater safety and operational continuity for decades – including in onshore and offshore wind farms worldwide.

Temperature monitoring of wind turbines

Seamless temperature monitoring of wind turbines is essential for early fire detection and efficiency monitoring. The **d-LIST system** can enable significant improvements in this area.

- Protection of human life
- Comprehensive early fire detection and monitoring
- Temperature monitoring
- Control of cooling and extinguishing systems
  (see existing protection concept VdS-S619004 PV-Protect)
- Control of systems and disconnection from the grid

Advantages of the d-LIST system (SEC 15 + d-LISTcontroller / SCU)

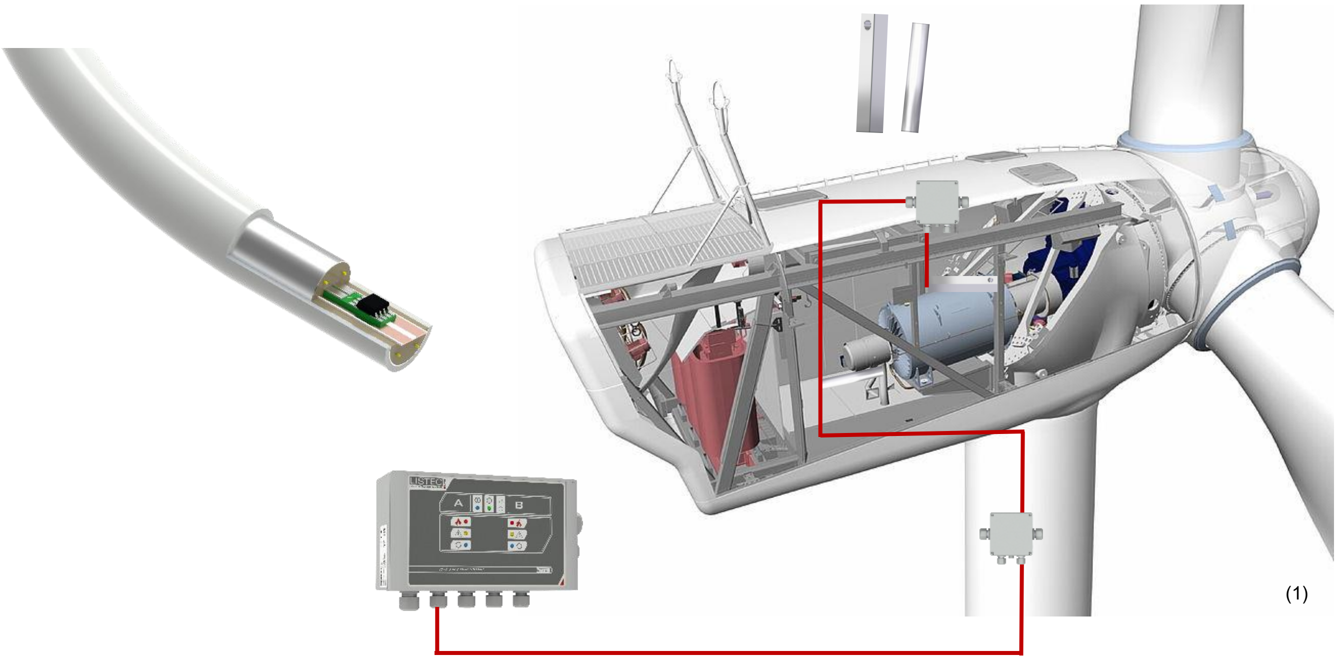
- Resistant to dust/dirt/gases/vibrations
- Differential and maximum temperature evaluation
- Installation possible in single-branch operation or with multiple branches
- Measurement resolution (always 0.1 °C, internally 0.0625 °C for d-LIST)
- Repeat accuracy (always ± 0.1 K along the entire cable length)
- Detection of overheating along the entire cable length
- Freely selectable sensor spacing, individual identification possible at any time via cable markings
- Systems are generally maintenance-free, resulting in long-term cost savings
- Low commissioning and maintenance costs
- Calibration-free and location-specific resolution in the event of a fire over the entire service life
- Use of individual sensors for object monitoring can be integrated into
  sensor cable installations

4. Applications/assembly/monitoring

Monitoring in the tower

- Installation of sensor cables along the power and signal cables in the tower
- Early detection: Temperature rise at connectors, increase in contact resistance, leakage currents.
- Protective measures: Automatic alarm, activation of an emergency relay, control of ventilation or shutdown processes.

Individual ESD-A5 sensors for monitoring objects in the nacelle, e.g., generator, gearbox, brake. SEC 15 sensor cable for monitoring cable routes and cable ducts.



Monitoring in cable ducts between wind turbines

- Use of d-LIST for continuous monitoring of longer cable routes and cable runs between systems.
- Segmented localisation enables quick location of the affected section.
- Ideal for parks with many parallel medium- and low-voltage lines.

Interfaces to security and fire protection concepts

- Integration with fire protection systems (e.g., automatic shutdown of certain circuits, activation of extinguishing or smoke extraction measures, if available).
- Supplement to visual inspections, thermographic checks, and periodic measurements through continuous monitoring.

The d-LIST systems offer a robust and scalable solution for reducing risk in wind turbines. Continuous monitoring of the electrical infrastructure inside towers and cable ducts allows early warning indicators to be detected efficiently and translated into safety measures.

(1) Drawing of the wind turbine courtesy of Bundesverbandes WindEnergie e.V. (BWE) (www.wind-energie.de)

5. Extract from certificates

The d-LIST / SEC 15 system is, among other things, a VdS-approved system in accordance with EN 54-22:2015+A1:2020:

Anerkennung
Approval

VdS

von Bauteilen und Systemen
of Components and Systems

Inhaber der Anerkennung / Holder of the Approval

LISTEC GmbH
Am Sandberg 34
DE-84424 Isen

Anerkennungs-Nr. / Approval No.	Anzahl der Seiten / No. of pages	gültig vom (TT.MM.JJJJ) / valid from (dd.mm.yyyy)	gültig bis (TT.MM.JJJJ) / valid until (dd.mm.yyyy)
G 221004	14	26.06.2023	25.06.2027

Gegenstand der Anerkennung / Subject of the Approval

Rücksetzbarer linienförmiger Wärmemelder /
Resettable line-type heat detector
d-LIST

Verwendung / Use

in automatischen Brandmeldeanlagen /
in automatic fire detection and fire alarm systems

Anerkennungsgrundlagen / Basis of the Approval

VdS 2344:2014-07
VdS 2543:2021-03
EN 54-17:2005 + AC:2007
EN 54-22:2015 + A1:2020

Die Anerkennung umfasst nur das angegebene Bauteil/System in der zur Prüfung eingereichten Ausführung

- mit den Bestandteilen nach Anlage 1,
- dokumentiert in den technischen Unterlagen nach Anlage 2,
- zur Verwendung in den angegebenen Einrichtungen der Brandschutz- und Sicherungstechnik.

Bei der Anwendung des Gegenstandes der Anerkennung sind die Hinweise nach Anlage 3 zu beachten.

Das Zertifikat darf nur unverändert und mit sämtlichen Anlagen vervielfältigt werden. Alle Änderungen der Voraussetzungen für die Anerkennung sind der VdS-Zertifizierungsstelle – mitsamt den erforderlichen Unterlagen – unverzüglich zu übermitteln.

This Approval is valid only for the specified component/system as submitted for testing

- together with the parts listed in enclosure 1
- documented in the technical documents according to enclosure 2
- for the use in the specified fire protection and security installations.

When using the subject of the approval the notes of enclosure 3 shall be observed.

This certificate may only be reproduced in its present form without any modifications including all enclosures. All changes of the underlying conditions of this approval shall be reported at once to the VdS certification body including the required documentation.

VdS Schadenverhütung GmbH
Amsterdamer Str. 174
D-50735 Köln

Ein Unternehmen des Gesamtverbandes der Deutschen Versicherungswirtschaft e.V. (GDV), durch die DAkkS akkreditiert als Zertifizierungsstelle für Produkte in den Bereichen Brandschutz und Sicherungstechnik

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G 213072	14	31.10.2024	30.10.2028

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