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bei der Arbeit

VDSI-Rule

Use of drones on wind turbines



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02/2019

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Professional group Renewable Energy

- 11/2022 -

VDSI-Rule:

VDSI-Guidelines are elaborations of VDSI working groups, VDSI professional groups and other committees within the VDSI. They focus on topics requested by whomever out of engineering practice where no other institutions in the sector occupational health and safety and environmental protection have published information. As a result of this VDSI-Guidelines document a new circumstance or show up the state of technology in a defined specific field.

Imprint

Publisher

VDSI - Verband für Sicherheit, Gesundheit und Umweltschutz bei der Arbeit e.V.
Internet: www.vdsi.de

Created by

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Contents:

1. Introduction
2. Basic information on the use of drones
3. General conditions for a drone operation
4. Specific requirements for a drone operation
5. Training concept
6. Task and Responsibility Matrix

1. Introduction

Target

The VDSI rule 02/2019 describes a rule for the safe and activity-related use from the point of view of a drone pilot, an entrepreneur, a manufacturer and an operator of an onshore/offshore wind turbine (WEA). It thus forms a standard template for all areas of application on a wind turbine.

The VDSI rule was developed by members of the VDSI “Renewable Energies” department. Experts from operators, installers, manufacturers, suppliers and service providers of renewable energy generation systems, especially wind turbines, work in the specialist area. All work with a focus on occupational safety, health protection and environmental protection. The VDSI rule reflects the well-founded opinion of these members and can be understood as a guideline for a safety-related industry standard.

The target groups are all those involved in the use of drones at wind turbines onshore/offshore. These include owners, operators, manufacturers, installers, service providers and craftsmen.

Scope

The validity of the present VDSI rule refers to the national German environment for construction, installation, commissioning, operation, maintenance and repair, large component replacement, special operations such as e.g. B. Fire damage investigation and dismantling of wind turbines.

Alle geltenden Gesetze und Verordnungen sind von dieser VDSI-Regel unberührt und müssen vollumfänglich berücksichtigt werden.

Begriffsbestimmungen

ARC =	Risk class for possible damage to the air
ConOps =	Concept of Operations
Dipul =	Digital Platform Unmanned Aviation (dipul.de)
EASA =	European Aviation Safety Agency
EU =	European Union
Drohnenpilot =	Drone pilot
GRC =	Risk class for possible damage to the ground
LBA =	Federal Aviation Office
LuftVO =	Air Traffic Regulations
MTOW =	Maximum Take-Off Weight
Emergency response =	Under emergency protection, in the area of nuclear power plant Safety Understood protective measures in the event of severe accidents, which aim either to alleviate a core meltdown that is already in progress by technical emergency measures within the affected power plant (units), or then to ensure the power plant-external

protection of the population.

OSO =	Operational Safety Objective
SORA =	Specific Operational Risk Assessment
UAS =	Unmanned Aircraft System
UAV =	Unmanned Aircraft Vehicle
WTG =	Wind turbine

2. Basic information on the use of drones

The aim is to create a uniform regulation for drones throughout the EU. For this purpose, a commission of the EASA (European Aviation Safety Agency) has developed a uniform regulation that standardizes (harmonizes) the regulations and rules for drone operation in the EU. The following EU regulations apply to drones (internationally referred to as Unmanned Aircraft System - UAS) and model aircraft.

COMMISSION DELEGATED REGULATION (EU) 2019/945 of 12 March 2019 on unmanned aircraft systems and third country operators of unmanned aircraft systems. This Regulation contains the design and manufacturing requirements for unmanned aerial vehicle systems (hereafter "UAS") intended to operate in accordance with the rules and conditions set out in Implementing Regulation (EU) 2019/947, as well as the design and manufacturing requirements of additional devices for remote identification. It also contains specifications for the design of the UAS, the design, manufacture and maintenance of which is subject to approval.

COMMISSION IMPLEMENTING REGULATION (EU) 2019/947 of 24 May 2019 on the rules and procedures for the operation of unmanned aerial vehicles. This regulation contains detailed provisions for the operation of unmanned aircraft systems and personnel, including remote pilots and organizations involved in such operations.

COMMISSION IMPLEMENTING REGULATION (EU) 2020/639 of 12 May 2020 amending Implementing Regulation (EU) 2019/947 as regards default scenarios for operation in or out of direct view.

LAW ADJUSTING NATIONAL REGULATIONS TO THE IMPLEMENTING REGULATION (EU) 2019/947 of the Commission of May 24, 2019 on the rules and procedures for the operation of unmanned aircraft of July 14, 2021.

From the point of view of the VDSI, this rule contains the necessary information for the safe use of drones at wind turbines. In addition, further specifications, e.g. by the operator, manufacturer or owner, may be required.

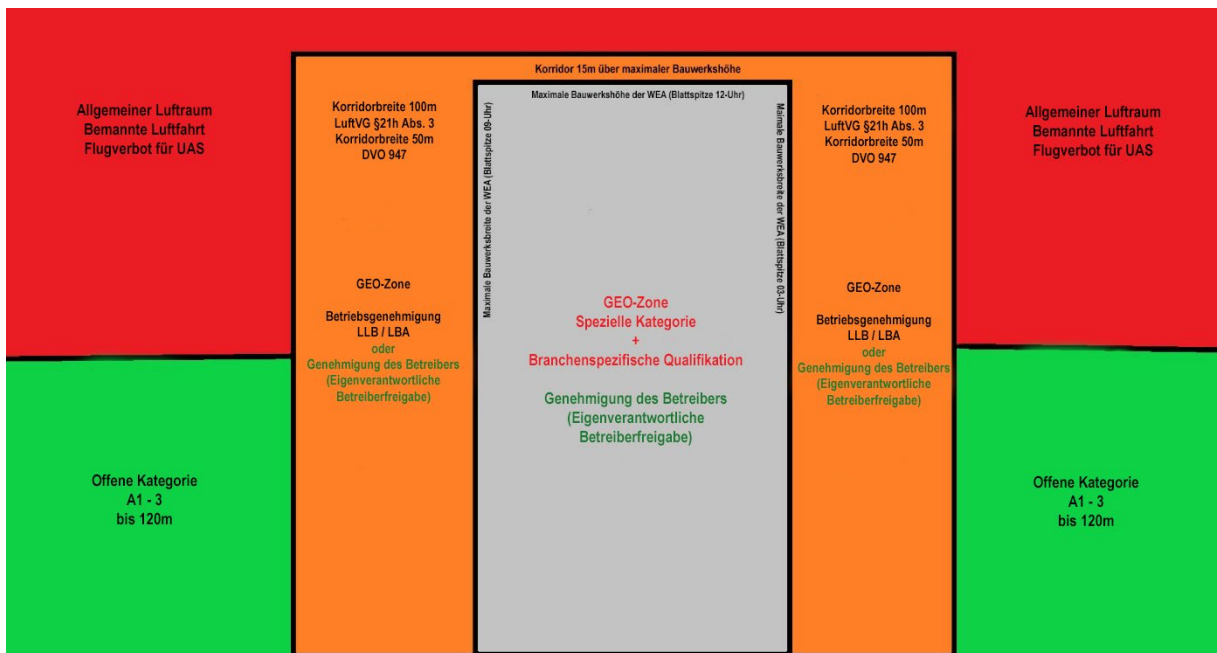
With the help of this VDSI rule, a uniform standard for the safe use of drones at wind turbines onshore and offshore is to be created.

On the basis of the law on the adaptation of national regulations to the Commission Implementing Regulation (EU) 2019/947 of May 24, 2019 on the regulations and procedures for the operation of unmanned aircraft § 21h Regulations for the operation of unmanned aerial vehicles in geographic areas of the Implementing Regulation (EU) 2019/947 Para. 3.

(3) Operation in the following geographical areas is permitted under the following conditions: Above and within a lateral distance of 100 meters from the boundary of industrial plants, prisons, correctional facilities, military plants and organisations, central energy production and

energy distribution plants and facilities in which activities requiring a permit of protection level 4 according to the Biological Substances Ordinance are carried out if the competent authority **or the operator of the facilities has expressly consented to the operation of the unmanned aerial vehicle**. Plants of central energy generation are all those energy generation plants connected to the distribution network that are not decentralized generation plants within the meaning of Section 3 number 11 of the Energy Industry Act.

Operators can thus issue autonomous operator approval within the GEO zone of wind turbines and wind farms.



Representation of the GEO zone including the structure cylinder of a wind turbine

The implementation of DVO 947 applies within the GEO zone of a wind turbine or wind farm. Permission from the operator is required within the structural cylinder. Approving authorities also issue operating licenses subject to an additional operator approval.

Individual ascent permits may be required for the use of drones at wind turbines in special locations (e.g. near other industrial plants or no-fly zones). The prerequisite for this independent operator approval is participation in a certified training system with theoretical and practical parts in the area of drone flight, ConOps, occupational health and safety management and wind energy.

Most of these recommended standards can also be applied to industrial sectors such as energy supply (conventional/nuclear generation, photovoltaic systems), petroleum and chemical industries.

3. General conditions for a drone operation

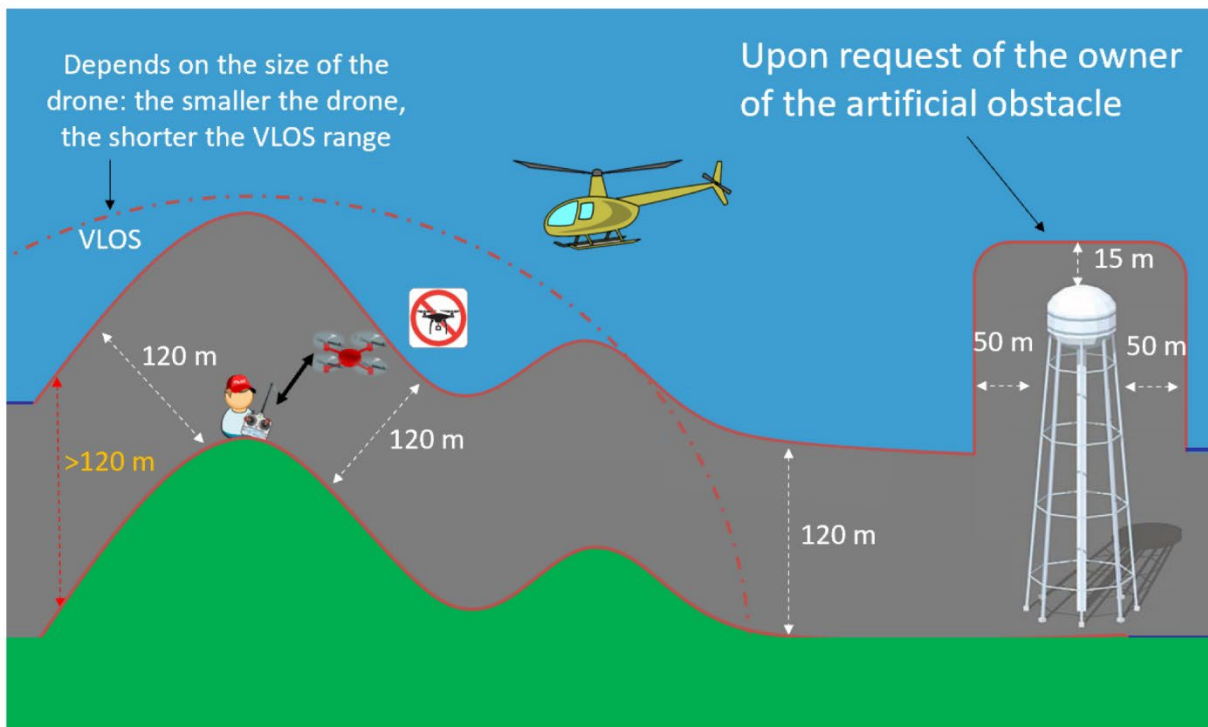
3.1 Requirements for the drone

The technical requirements existing at the time of use must correspond to the state of the art. Specifications from the ConOps of the responsible operator approval are to be implemented.

3.1.1 Classification in drone category

Unmanned Aircraft System (UAS) operations are classified in the open, special, or certified category under the following conditions.

- Open category
- Special category
- Certified category



Quelle: Acceptable Means of Compliance and Guidance Material to the Annex to Regulation (EU) 2019/947 - Issue 1, Amendment 2

All essential information on the categories, requirements and necessary tests are published on the Digital Platform for Unmanned Aviation (dipul) of the Federal Ministry for Digital Affairs and Transport (www.dipul.de).

3.2 Standard for drone pilots

When using drones at wind turbines, the physical and mental requirements of the drone pilot, such as participation in a recognized training module with a focus on wind energy in theory and practice, must be met in addition to the requirements listed below.

3.2.1 Necessary tests of a drone pilot before use

Before starting a UAS operation, the drone pilot must have updated information about the planned UAS operations regarding specifics. He must observe the operating environment, check the presence of obstacles, and check the presence of undetected people. It must be ensured that the UAS is able to safely complete the intended flight. If the UAS is equipped with an additional payload, check that its mass does not exceed the MTOW (Maximum Take-Off-Weight) specified by the manufacturer or the MTOW limit of its class.

3.2.2 Suitability test according to DGUV principle "Driving, control and monitoring activities" (G25)

The drone pilot must reliably fulfill all physical and mental abilities, skills and characteristics

(e.g. hearing and sight, physical resilience and the sense of touch). Mental abilities and characteristics include: B. the comprehension, the mental resilience, the ability to concentrate and coordinate as well as the technical understanding and the ability to react. Evidence of physical suitability must be provided by means of a valid aptitude test for "driving, steering and monitoring activities".

3.2.3 Other drone pilot requirements

During the flight, the drone pilot must not be under the influence of psychoactive substances or alcohol. In terms of health, he must also be able to carry out the flight without danger (form on the day).

The flight must be canceled if continuation of the flight could endanger other aircraft, people, animals, the environment or property.

The remote pilot must comply with operating restrictions in defined geographic zones or published local conditions.

He must have the ability to take control of the UAV except in the event of a loss of connection or when operating a UAV in free flight.

He must operate the UAS in accordance with the user manuals provided by the manufacturer, including any applicable restrictions.

The drone pilot must conduct a thorough visual inspection of the airspace around the UA to observe other aircraft and maintain a safe distance.

During flight, drone pilots and UAS operators are not allowed to fly the UAV near or into areas where so-called emergency response is being conducted unless they have permission from the relevant emergency services.

Drone pilots may be assisted by a line-of-sight observer of the UA who will assist the drone pilot in safely conducting the flight through unattended visual observation of the UA. Clear and effective communication must be ensured between the drone pilot and the UA observer.

3.2.4 Fly out of sight

When using UAS on wind turbines, it can happen that the drone is out of the pilot's view. In order to ensure safe flying here, e.g. B. the use in direct display flight or with virtual reality glasses can be trained.

3.3 Standard for working with drones - drone deployment regulations -

When using drones at wind turbines, general requirements such as existing business and drone liability, knowledge of the location and system, an existing work order and the correct selection of the drone used must be met in addition to the requirements listed below.

3.3.1 Goal and purpose

With the general information, all those involved in the process receive an overview of the WTG site as part of the scope of services to ensure the necessary coordination, communication, cooperation and monitoring on the basis of legal, local (customers, operators) and internal requirements.

The aim is to continue to enable trouble-free drone use and to ensure the safety of those involved, bystanders and equipment (work and operating materials). Country-specific

requirements or project-specific requirements may make further measures necessary.

The drone deployment regulations and their other applicable documents are created and kept up to date by the executing company or an external approved service provider. Any additional information required will be provided by the client.

3.3.2 Scope

The drone deployment regulations and the applicable documents apply to the named onshore and offshore wind farms and their wind turbines.

The drone use regulations to be created and the other applicable documents also apply to subcontractors and visitors of the service company and the client (customer / operator).

3.3.3 General information

As part of the service assignment, current documentation from the companies involved in the service, safety signs and a daily service process meeting must exist.

3.3.4 Emergency management

An emergency management is to be created by the contractor's service operations management in cooperation with the respective client.

3.3.4.1 Emergency plan

Before any work begins at the service location, an emergency plan must be drawn up and adherence to ensured.

The VDSI Information 01/2016 "Optimization of the rescue chain - onshore" describes in its focus the optimization of the rescue chain, the location and access for wind turbines and other, predominantly regenerative energy generation systems that are set up in remote locations.

3.3.5 Instruction, qualification and suitability

The personnel working on site must be verifiably qualified and instructed for the work to be carried out and commissioned by the operator for the work.

3.3.6 General regulations and specifications

3.3.6.1 Working hours

Working hours must comply with the statutory provisions (Working Hours Act). A continuous driving time of more than 60 minutes should be avoided. Battery changing times can be taken into account.

3.3.6.2 Outsourcing of orders to subcontractors and partner organizations

The owner of a responsible operator approval has to comply with his coordination obligation and support and coordination obligation according to § 8 ArbSchG and § 6 paragraph 1 accident prevention regulation "Principles of Prevention" (DGUV Regulation 1) before service work when assigning work to other companies. The owner has an obligation to provide information and documentation when commissioning subcontractors and partner organizations.

3.3.6.3 Visitors, place of work strangers

An entry and stay ban is to be set up by the commissioned company in agreement with the operator.

3.3.6.4 Mandatory use of personal protective equipment (PPE)

The personal protective equipment PPE (e.g. safety shoes S3 ankle-high, helmet, high-

visibility vest...) must be specified by the commissioned contractor as part of the risk assessment, taking into account operator specifications.

3.3.6.5 Hazards during use and the environment

Any existing analyzes regarding hazards at the place of use and the environment are available from the customer and can be requested / viewed if necessary. Measures resulting from the analysis are to be implemented and as-built plans are to be made available, e.g.

- Transmission equipment (e.g. mobile radio, directional radio, WLAN...)
- Restrictions in the range of wooded areas

3.3.6.6 Limiting influences from the environment of the place of use

The conditions, regulations and measures restricting the service activities, e.g. B. for flies outside the field of vision, fire hazards, environmentally hazardous substances are to be documented.

3.3.6.7 Traffic safety obligation towards third parties

The following measures for the public area must be defined and ensured:

- Protective measures against falling objects and a potentially crashing drone.

3.3.7 Traffic routes at the site

3.3.7.1 Traffic routes for vehicles and people

Access routes for fire brigade, rescue, police and other auxiliary vehicles must be ensured. The speed specifications of the operator for the wind farm must be observed. The traffic routes for people must be safe to use in all weather conditions.

3.3.8 Electrical systems, equipment and drone training

Electrical systems and equipment must be checked regularly by all companies involved in accordance with the accident prevention regulation "Electrical systems and equipment" DGUV regulation 3 and the operational safety regulation.

Drone batteries must be kept in a fireproof case or container!

A safe use of drones is to be ensured by instructed, trained and certified personnel. This must be verified by an approved and accredited drone training academy.

3.3.9 Operating instructions, occupational health care, suitability

The companies involved must ensure that current operating instructions are available for all activities.

Required preventive occupational medicine and aptitude tests (G25) must be currently valid.

3.3.10 Weather hazards

Measures against dangers caused by weather influences must be defined before the service call. These include e.g. B. Icing and ice shedding, storms, heavy rain, extreme heat and cold, heavy fog and snowfall as well as thunderstorms and lightning. The entrepreneur is responsible for the safety of people working in his company - including temporary workers. When the contract is awarded, the client is responsible for checking that this duty of care is being adequately complied with. The decision as to whether work is to be carried out when visibility is poor is the responsibility of each person involved, although each person concerned can make the decision to stop the work in a controlled manner.

The entrepreneur ensures that the necessary communication for his employees is guaranteed at all times.

4. Specific requirements for using drones on wind turbines

In this section, the additional required aviation law criteria as well as the specific requirements of the operator / manufacturer are presented.

4.1 Standard for the special use of drones on wind turbines

The safety management system required in the Implementing Ordinance 947 is used for risk analysis of the different areas of application of drones and is directly related to the autonomous operator approval or the operating license by an LLB or the LBA. The drone deployment regulations described above with their associated appendices represent a suitable safety management system. The safety management system must be created by a technically suitable person (e.g. the specialist for occupational safety).

Risk identification, risk assessment, risk minimization and risk control are the essential and superordinate points of security management. For this purpose, a risk assessment for specific operations, the so-called SORA, is carried out.

4.1.1 SORA (risk management)

As part of safety management, the company that uses the drone must also prepare an activity-related risk assessment (hazard assessment) for the specific work task. This is done on the basis of Implementing Regulation 947 using a standardized SORA procedure in which, for example, the ground risk (GRC), the air risk (ARC) and the OSOs are assessed.

4.1.2 Other requirements by third parties or other authorities

If necessary, other rights must be taken into account. These can be e.g.:

- Special site requirements
- Data protection requirements
- Antitrust Requirements
- Patent Law Requirements
- Copyright Requirements

The drone company is responsible for obtaining the information required for this and, if necessary, implementing the resulting measures, requirements and specifications.

5. Training concept

The VDSI rule 01/2013 serves as a **safety rule for determining the basic qualifications for personnel who are to work in onshore and offshore wind turbines** and describes the necessary minimum training standards in its modules. Additional information is described in the supplementary modules 13a "Remote pilots - category special - on onshore/offshore wind turbines" and 13b "Responsible operator approval - category "Special" - on wind turbines onshore/offshore".

6. Task and Responsibility Matrix

With the help of this matrix, the tasks and responsibilities of the parties involved, operators (in individual cases also manufacturers), long-distance pilots and drone companies are to be shown.

Task	operators WTG	drones	
		drone pilot	company
Tendering, selection, commissioning, voting	R	C	C
Delivery of specifications and information on the wind farm / WTG	R	C	C
Creation of drone deployment regulations and other applicable documents	C	C	R
Fulfillment of the required Qualification (e.g. according to VDSI rule module 13a and 13b)	-	C	R
Granting of the self-responsible operating approval	R	C	C
System responsibility and work coordination within the wind turbine and on the wind turbine site	R	C	C
Compliance with the specifications during the drone flight	C	R	C

R - Responsible

C - Cooperation