TÜVNORD

TÜV NORD Programme

TN-P-V01-001

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Validation and Verification of claims – Wind Energy

Based on principles of ISO 17029

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This document has been approved according to CERT-401-VA-007. Details are available from the QM-Department.

CONTENT

1. INTRODUCTION

1.1. Notice

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Legislation on the subject is currently very volatile and in constant development. Any changes to legal requirements, standards, technical regulations or other fundamentals relevant to testing and/or assessment as part of the certification must be taken into account accordingly and will be promptly included in an updated version of this standard.
In such a case, statements that have been issued remain valid, because the assessment was based on the applicable and most current version of the standard at that time.

For clarifications of understanding "Clarification Sheets" will be issued and published. These Clarification Sheets become part of this standard.

Any comments may be sent by e-mail to windenergy@tuev-nord.de.

1.2. Edition History

Edition	Date	Changes
1	2024-01	First Edition
2	2024-04	Level of assurance for verification added
3	2024-07	More details for concept of proof; editorial changes
4	2025-05	New application case added; Level of assurance for validation added Details for handling of facts discovered after the issue of the validation/verification statement

1.3. Basic Concept

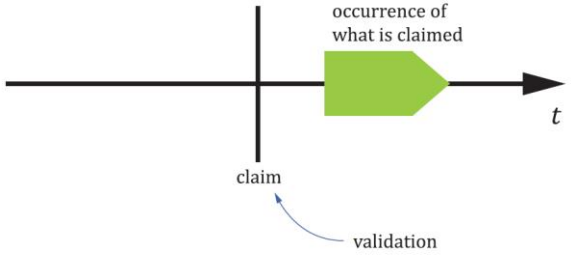
This document describes rules and procedures for validation and verification of truthfulness of information declared by applicant in claims, in the field of wind energy. This standard is based on principles of ISO/IEC 17029.

The final validation/verification statement shall provide trust against the claim to stakeholders and parties. Purpose of this document is to describe the requirements and the process to issue these statements. Assurance about truthfulness of information shall be reached via validation and verification.

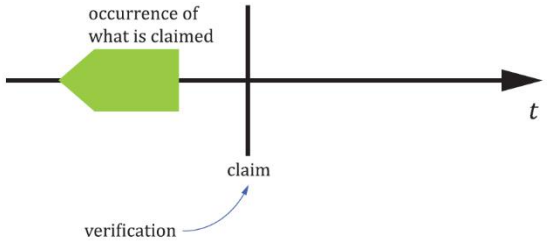
In sense of scope of application of this standard following definitions apply:

- Validation: Evaluation of processes by document review and plausibility check concerning suitability to achieve the claim
- Verification: Evaluation of processes by assessing (e.g. witnessing) application of these processes in field and evaluation of results as objective evidence if the claim has been achieved

But general definitions can be found in ISO/IEC 17029.

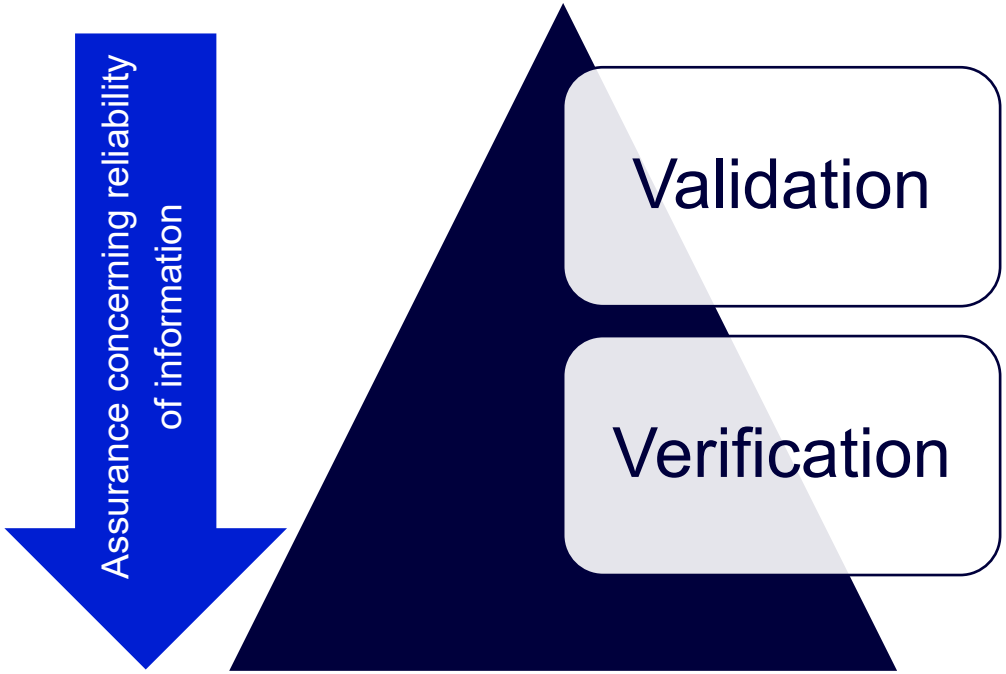


NOTE Validation bodies provide assurance by confirming the plausibility of claims regarding information on intended future use.



NOTE Verification bodies provide assurance by confirming the truthfulness of claims regarding historic information.

Figure C.2 acc. ISO 17029



There are different *types of claims* regarding timely validity.

- If the claim is related to something happened in the past, this claim can be evaluated by verification only
- If the claim is related to something in the future, truthfulness of claim shall be evaluated by validation and additionally, optionally by verification. These claims can't be evaluated by verification only, because validation of processes ensuring same results in the future as evaluated during verification is required.

Note:

- Example for claim related to the past: "Our pencils produced within the last 6 months are yellow"
- Example for claim related to the future: "Our pencils produced within the next 6 months will be yellow"

2. SCOPE OF APPLICATION

This standard applies to business field of wind energy. It does not apply to product or project certification or management system certification or service certification. The object of validation/verification is in any case a claim by an applicant.

3. DEFINITIONS

Generally, definitions of ISO 17000 and 17029 apply.

Furthermore, following definitions are applicable:

- Shall: requirement
- Should: recommendation
- May: permission
- Can: possibility as information
- Applicant: customer requesting a statement
- UAV: unmanned aerial vehicles

4. RESPONSIBILITIES AND COMPETENCES

4.1. Definition of claim

Definition of claim is in responsibility of applicant. It is neither task nor responsibility of TÜV NORD Validation/Verification body to formulate or advise on claim.

4.2. Competences

Only personal with sufficient and documented experience for specific application cases shall be involved in the process (especially determination and review/attestation). The requirements for sufficient experience shall be defined by TÜV NORD Validation/Verification body. TÜV NORD Validation/Verification body shall define further requirements in compliance to ISO 17029 (chapter 7.2 and 7.3).

5. MANAGEMENT OF CONFORMITY ASSESSMENT

5.1. Validation/Verification Body

Bodies applying this standard shall fulfill requirements of ISO 17029.

5.2. Statement

Statement on Validation
After successful validation of information a statement can be issued. Successful validation exists if reliability of information provided by claim can be fully confirmed as plausible. The statement has perpetual validity, as long as the processes are not changed. Significant changes in processes shall be submitted to TÜV NORD Validation/Verification body for evaluation.

Statement on Verification
After successful verification of information a statement can be issued. Successful verification means that the content of claim is fully confirmed. The statement has perpetual validity, as long as the validated processes are not changed. Significant changes in processes shall be submitted to TÜV NORD Validation/Verification body for evaluation. Further verification may be required.

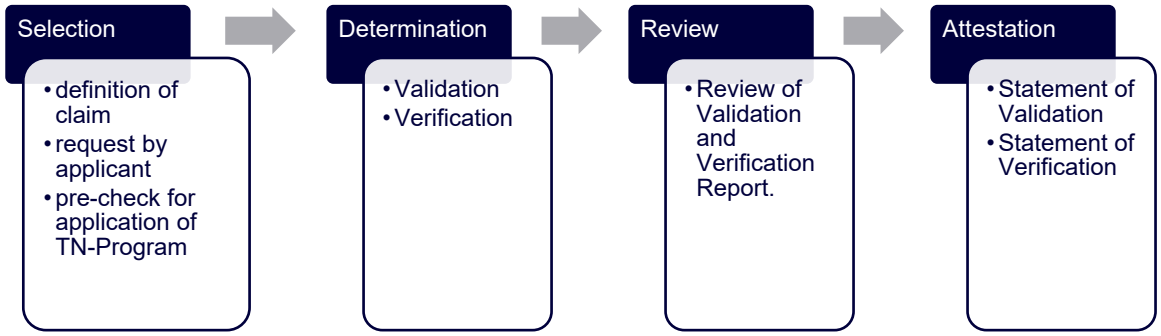
5.3. Maintenance of statements.

The statements have generally perpetual validity.
But for claims related to future, changes in processes shall be submitted to TÜV NORD Validation/Verification body without request.
Furthermore, TÜV NORD Validation/Verification body shall be informed about incidents related to non-fulfillment of claim. Based on root cause analysis the statements may be withdrawn and a re-validation and/or re-verification may be required.

6. PROCESS DESCRIPTION

6.1. Functional Approach

The complete conformity assessment approach consists of:



Determination and Review/Attestation shall be done by different persons.

6.2. Consideration of technical standards

If technical standards exist, those shall be considered within validation and verification.

6.3. Consideration of test reports

If tests shall be considered, these tests shall be provided by:

- Accredited test labs
- Approved test labs (see DNV-SE-0436)
- Under witnessing of TÜV NORD

6.4. Selection

Selection process shall ensure that the claim is explicit and can be validated/verified under this standard. If necessary the application case specific requirements defined in this standard need to be extended to cover complete content of the claim. Furthermore, it shall be clarified whether

the claim is past related or future related to decide if verification or validation is applicable.

6.5. Validation

Validation shall provide assurance of reliability of the claim based on document review.
These documents shall describe how the claim will be realized in the future.

These documents shall be evaluated for completeness, traceability and robustness with regard to fulfillment of claim.

Basically, following shall be described:

- Basic concept (if applicable) to achieve the claim
- Detailed process to achieve the claim

It shall be evaluated if the basic concept and detailed processes are capable to produce recurring reliable results.

Result of validation shall be summarized in a validation report. Validation report shall state method of validation and either confirm that the claim is free from material misstatements or list the material misstatements.

If the applicant uses subcontractors for parts of the process, the process of the subcontractor shall be part of validation as well, if not already validated.

If applicable technical standards exist, these standards shall be considered and listed in validation report.

6.6. Verification

6.6.1. General

Verification shall provide assurance of reliability of the claim based on on-site or laboratory tests, recorded data and/or additional calculations as objective evidence. Purpose of verification is to evaluate if the claim was achieved in the past. If the claim was achieved based on validated basic concept and/or processes it can be assumed that the claim will be achieved in the future again.

Scope of verification depends on *type of claim* and application case. Generally, if the claim is past related verification can be done by review of documents like test results or recorded data.

In any case there shall be a final evaluation of reliability of results. For tests, accredited test labs or witnessing might be required to provide sufficient reliability.

Verification could consist of:

- Evaluation of "concept of proof"
- Witness of application of validated process
- Final evaluation of reliability of process results

Result of verification shall be summarized in a verification report. The verification report shall state method of verification and either confirm that the claim is free from material misstatements or list the material misstatements.

If the applicant uses subcontractors, the underlying concept shall be part of verification if not yet verified.

If applicable technical standards exist, these standards shall be considered and listed in verification report.

6.6.2. Evaluation of concept of proof

Assessment of the concept of proof is a communication method between applicant and TÜV NORD to ensure that the claim can finally be confirmed.
The concept of proof shall define how the verification shall finally support the truthfulness of the claim. The concept of proof should be submitted by the applicant.
The concept of proof shall e.g. consider criticality (e.g. as product of probability of occurrence and risk analysis) if the validated process fails. Furthermore, number of tests shall be defined.

The concept can be based on, e.g.:

- Comparison of results to established methods (consider independency in determination of results)
- Multiple test samples and comparison of test results

Based on concept of proof the reachable level of assurance shall be discussed between TÜV NORD and the customer.

6.6.3. Level of assurance

The verification may require multiple test samples and comparison of test results. However, already after first test sample there might be sufficient evidence for the truthfulness of the claim. To allow issuing of statement of verification based on limited number of test samples, approach of level of assurance can be applied.

- Level 1: basic assurance
- Level 2: advanced assurance
- Level 3: high assurance

Finally, assurance level 3 shall be achieved within limited period. Further details can be provided in the special application cases.

6.7. Review and Attestation

Review and attestation shall be independent from validation and verification.
Within review the validation and/or verification report shall be reviewed concerning

- applied method
- completeness
- material misstatements
- compliance to agreement
- compliance to this standard

Both, review and attestation, shall be documented.

For facts discovered after the issue of the validation/verification statement measures shall be defined by the VeVa-Body.

7. APPLICATION CASES

7.1. Validation and verification of concept for inspections of rotor blades via UAVs

Inspections of rotor blades can be done with help of or completely based on inspections via UAVs.
For inspections via UAVs, finally it shall be evaluated if the overall concept is suitable and reliable to ensure detection of all relevant defects.

The claim to be confirmed could be: "Our concept for inspections of rotor blades is suitable to ensure structural integrity of the rotor blade".
This is a claim related to future. Hence, validation is recommended.

7.1.1. Validation

7.1.1.1. General

For this application case validation consists of evaluation of:

- Basic concept
- Customer's detailed process description

7.1.1.2. Basic concept

The basic concept for inspections with drones shall describe which defects could occur and how these defects shall be detected safely.
It shall be evaluated, if at least following aspects are covered:

- Which areas shall be inspected
  - Turbine type specific or generic?

- Based on Maintenance manual and further requirements from authority
- Inside/Outside

- Which defects shall be detected
  - List of possible defects
  - Which of these defects shall be detected by UAV
  - How to deal with the other defects?
    - E.g. combination with rope access
  - How often (assuming inspection via rope access will be done rarer than inspections via drones)
  - How to ensure sufficient safety of the rotor blade?
    - Probability of occurrence of defects detected by rope access
    - Effect and risk analysis if defect is not detected
- Requirements for UAV or used UAV
  - Description of required/used UAV (e.g. properties of equipment - camera - and UAV itself)
  - Requirements for maintenance, calibration and adjustments
- Quality assurance
  - Qualification of staff
    - Which competence is required to fly the UAV?
      - Trainings, pilot license
    - Which competence is required to evaluate the images/test results?
    - Quality assurance for reports

- Furthermore, following could be part of basic concept:
  - How to deal with detected defects
    - Repair or Periodic monitoring

Beside basic evaluation for plausibility, the Validation/Verification body shall evaluate if:

- Are the areas inspectable by the UAV
- Is the list of possible defects complete?
- Is the UAV able to detect the defects intended to be detected via UAV?
- Does the UAV have applicable equipment (e.g. IR for delamination)
- Is the method of inspection of defects, which shall not be detected via UAV, reliable?
- Does the combination of both methods lead to a reliable concept?

7.1.1.3. Customer's detailed process description

The detailed process for inspections with UAVs shall describe how in detail the inspection shall be executed. It shall be evaluated, if at least following aspects are covered:

- UAV type
- Permitted range of boundary conditions during flight (weather – wind, temperature, rainfall, solar radiation)
- Creating images/test results - How are images/test results created and in which extent
  - Detailed description of flying process (sequence, distance, records)
  - Definition of location of defect
  - Assurance of sufficient quality of pictures

  - Assurance of defined location of defects
- Assessment of images/test results - How are images/test results evaluated and defects detected
  - Assessment of quality
  - Assessment of findings
- Quality assurance
  - 4-eye-principle during evaluation of findings
  - Trouble shooting (e.g. if quality of pictures is not sufficient)

7.1.2. Verification

7.1.2.1. General

For this application case, the verification consists of:

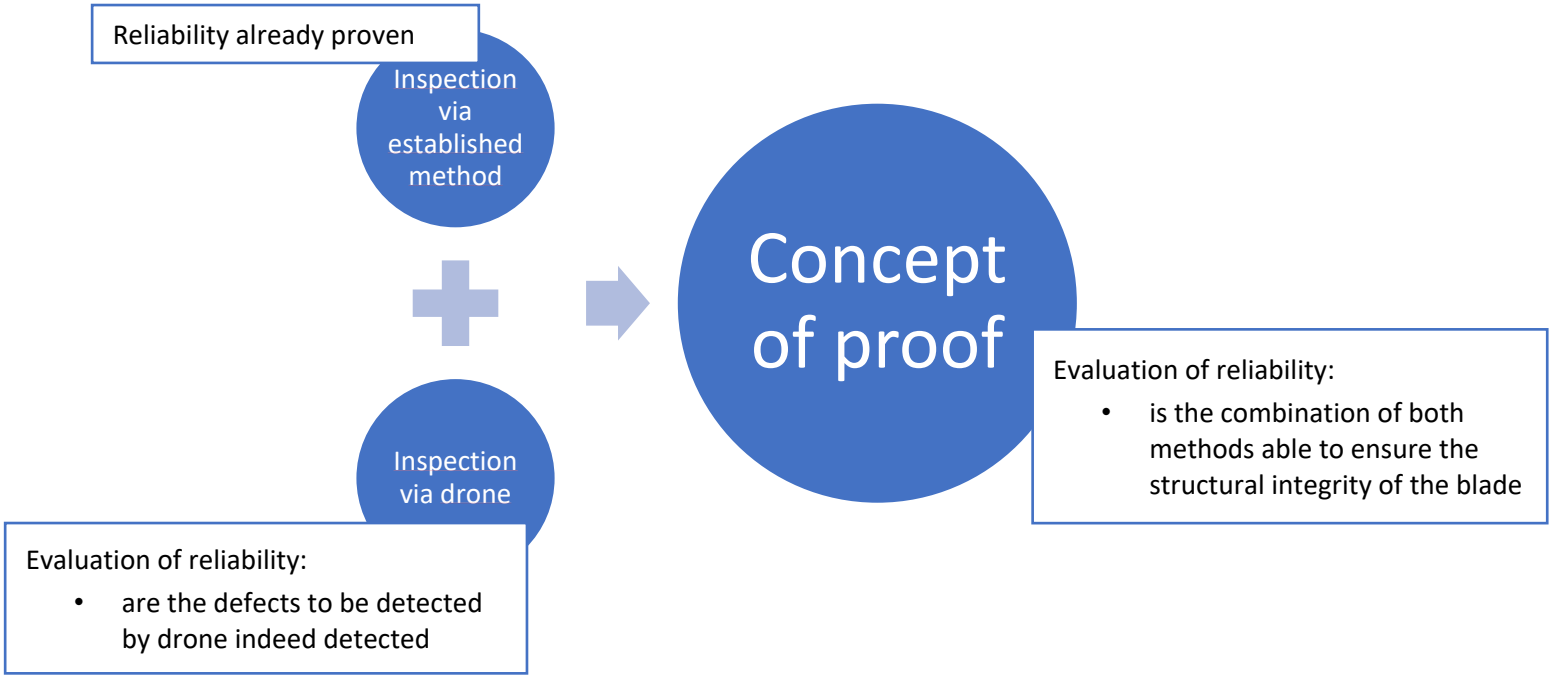
- Evaluation of "concept of proof"
- Witness of application of validated processes
- Final evaluation of reliability of results

7.1.2.2. Concept of proof

The reliability of the inspection results is the most important aspect. If there are doubts about reliability, the verification can’t be finalized.

The proof of reliability can be done by comparison of detected defects via drone vs. detected defects via established methods (e.g. rope access). That means, blades, already inspected via rope access, shall be inspected again by drone and results shall be compared. Independency during comparison needs to be ensured (different person for assessment of pictures via drone and rope access). For purpose of comparison, location of defects must be clearly defined.

But other meaningful methods can be applied as well.



Depending on criticality of the defects (product of probability of occurrence and FMEA) more than one proof of reliability per defect/defect class is required. That means, it must be shown more than once, that the defect/defect class was detected via drone.

The concept to proof reliability shall describe

- Criticality of defects, which shall be detected via drone
- Corresponding required number of proofs
- Concept of evaluation of reliability of inspection results
  - E.g. independent comparison of inspection results via rope access vs. inspection results via drone

7.1.2.3. Witnessing

Witnessing shall consist of in-field witnessing of process to create images and in-office witnessing of process for evaluation of images.
It is sufficient to witness the process once, although several proofs are required (for critical defects). Purpose of witnessing is to proof that the validated processes are suitable and robust.

7.1.2.4. Final evaluation of reliability of results

Reliability of inspection results shall be finally evaluated. It shall be evaluated if defects which should have been detected, have been detected and if the process is reliable to detect the defects in safe way also in the future. All permitted boundary conditions shall be considered. If several proofs are required (for very critical defects) every proof of process reliability shall be evaluated.

7.1.2.5. Level of assurance

In cases the concept of proof requires multiple test samples the approach of level of assurance can be applied for this application case. Especially, in case of critical defects were not present at the inspected blade for verification, this approach can help to issue the statement of verification, but keep the option to get more assurance. The measures to achieve level 2 and/or 3 shall be stated clearly in the verification report. The period to achieve assurance level 3 should not exceed 1 year.

8. APPENDICES

8.1. Example Statement on Validation/Verification

Statement on Validation/Verification

Registration no. **S-AAAAAAAAAA-001-CC**

This Statement is issued to
Company
Street
Zip Code
COUNTRY

Claim
XXX

This Statement attests compliance with the below cited validation/verification programme.

Validation/Verification programme:
TN-P-V01-001: " Validation and Verification of claims – Part 01: Wind Energy", ed. 3, 10-2024

Level of assurance: 1 "Basic"

THE CONFORMITY ASSESSMENT IS BASED ON THE FOLLOWING DOCUMENTS:

Evaluation Reports:

TÜV NORD	ER-8XXXXXXXXX-001-00	Validation	Rev. 0	yyyy-mm-dd
TÜV NORD	ER-8XXXXXXXXX-002-00	Verification	Rev. 0	yyyy-mm-dd

Any change in the processes or product is to be approved by TÜV NORD CERT GmbH. Without approval, this Statement loses its validity.

Essen, YYYY-MM-DD

TÜV NORD CERT GmbH
Certification Body - Wind Energy
Am TÜV 1 | 45307 Essen
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Dipl.-Ing./M.Sc. M. Lange

TÜV ®

8.2. Content of Evaluation Report for Validation and/or Verification

Documents

- Evaluated
- Noted

Applied Standards

- Program
- Recognized technical standards

Introduction

- Note: describe what the claim is about

System Description

- Note: provide information what has been "inspected" to pick up the reader

Evaluation

- Scope
  - Note: describe what is within scope, e.g. Validation, Verification, both
- Methodology
  - Note: describe the method chosen for evaluation (document review, witnessing of tests, …)
- Remarks
  - Note: add noteworthy aspects to be included in the report
- Results

- Note: include results of evaluation

Conditions

- Note: Conditions are actions to be considered to keep the final conclusion valid

Material misstatements

- Note: material misstatements lead to non-fulfillment of the programme's

Conclusion

- Note:
  - are the requirements of applied standards fulfilled?
  - eventually not or only partly (in case of material misstatements)

9. OTHER RELEVANT DOCUMENTS

In addition to the documents already referred to above

none