



TYPE CERTIFICATION OF

WIND TURBINES

Certification Description
January 2011, rev. 12



DET NORSKE VERITAS, DANMARK A/S
DNV Wind Turbine Certification
*a unit in technical co-operation with **RISØ***

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Company Presentation

Det Norske Veritas (DNV) was established in 1864 as an independent foundation. The objective of DNV is:

To Safeguard Life, Property, and the Environment

DNV is a global provider of services for managing risk. DNV has a network of 300 offices in about 100 countries, and about 9,000 employees worldwide.

DNV is organised in four geographical divisions covering the energy and the maritime business areas:

- Division Americas and Sub-Saharan Africa
- Division Asia Pacific and Middle East
- Division Europe and North Africa
- Division Norway, Finland and Russia

In addition, the Sustainability and Innovation division, based at Høvik, will pursue new opportunities outside the energy & maritime industry and act as a growth engine for DNV. The division will among other things contain DNV's efforts within:

- Climate change
- Healthcare
- Research and Innovation

In addition, DNV's four independent business units (IBU) have been given some freedom in order to accommodate their respective markets. These are:

Independent business units:

- DNV Business Assurance
- DNV IT Global Services
- DNV Petroleum Services (DNVPS)
- DNV Software

In Denmark DNV is registered as a Danish company, Det Norske Veritas, Danmark A/S which employs approximately 150 people.

The Wind Turbine Certification activity is organised under region Cleaner Energy, Division Europe and North Africa. The DNV Wind Turbine Certification unit is operated in technical co-operation with RISØ National Laboratory. RISØ has through a long term engagement in research and development projects obtained a leading role in the global wind turbine community.

The objective of this technical co-operation is to match the requests from the fast growing wind turbine industry for efficient and high quality certification services.



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DNV is accredited for

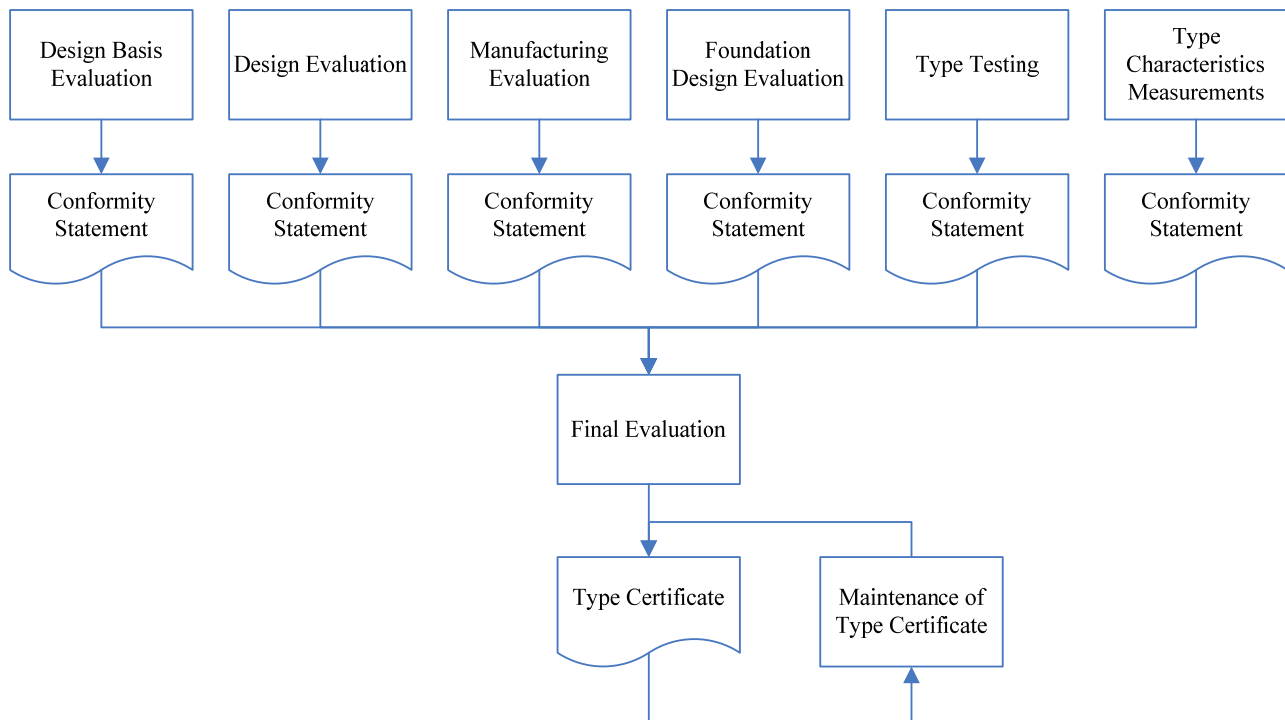
- Type Certification of Wind Turbines according to the following systems:
 - IEC Type Certification system (IEC 61400-22/IEC WT 01)
 - Danish Type Certification System
 - Dutch Type Certification System

- Component Certification according to the following systems:
 - IEC Type Certification system (IEC 61400-22/IEC WT 01)
 - Danish Type Certification System

Furthermore, DNV is authorised by German authorities as “Gutachter” according to German Regulations.

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Type Certification



0. General

The description of the IEC Type Certification System is based on IEC 61400-22:2010, 'Wind Turbines – Part 22, Conformity Testing and Certification' which is an update/revision of the IEC Certification System described in IEC WT 01 'IEC System for Conformity Testing and Certification of Wind Turbines, Rules and Procedures'.

The following modules of the Type Certification System are mandatory:

- Design Basis Evaluation
- Design Evaluation
- Type Testing
- Manufacturing Evaluation
- Final Evaluation

The following modules are optional:

- Foundation Design Evaluation
- Type Characteristics Measurements



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The Danish Type Certification system is based on the IEC Type Certification System with special Danish requirements as described in chapter 9.

All suppliers of Wind Turbines have access to apply for Type Certification of Wind Turbines. Upon accept of the quotation, an agreement will be made stating scope of work and cost rate.

1. Design Basis Evaluation

The purpose of the Design Basis module¹ is to document:

- Codes and Standards
- Safety Factors
- Design Parameters
- Design Methods
- Load Analysis
- Requirements for O&M and Installation

The extent of the design basis shall be sufficient to form a basis for the safe design of the wind turbine. The evaluation is carried out as document review for compliance with the appropriate IEC/ISO standards.

2. Design Evaluation

The Design Evaluation module comprises the following elements:

- Design Control
- Control and Protection System
- Load Analysis
- Structural, Mechanical and Electrical Components
- Component Tests
- Foundation Design Requirements
- Manufacturing Process
- Installation and Transport Process
- Maintenance Process
- Personnel Safety

The Design Evaluation is carried out as a review of the design documentation received from the client. The design documentation must cover the whole wind turbine including service lift, crane(s), transformer, nacelle cover and spinner.

¹ This module is introduced in IEC 61400-22 and is not mandatory for IEC WT 01 based certifications.



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The Design Control is covered by the manufacturer's quality system in case this is certified according to ISO 9001:2008 with design included in the scope. In case of no ISO 9001:2008 certified quality system, a quality system evaluation will be carried out in connection with the Manufacturing Evaluation.

As part of the verification of Loads and Load Cases independent load calculations are carried out. The extent of the verification depends on size and concept of the wind turbine.

For areas where the design documentation includes, e.g. FEM analyses of highly utilised components, an independent analysis may be carried out in order to verify the design documentation.

Component Tests may be used as full or partial documentation for the strength of a component.

The Manufacturing, Installation, Transport and Maintenance Process and Personnel Safety must normally be covered by specifications, instructions and manuals. The final manuals will be reviewed in connection with the Final Evaluation.

3. Type Testing

The Type Testing module comprises the following elements:

- Safety and Function Tests
- Load Measurements
- Power Performance Measurements
- Blade Tests²
- Other Tests including Gearbox Field Test³

The Type Testing elements shall be carried out by accredited testing laboratories. Otherwise DNV will verify that the testing is carried out according to IEC/ISO 17020 or IEC/ISO 17025, as applicable.

DNV will witness the Safety and Function Tests. In connection with this test the wind turbine will be inspected for compliance with design drawings and specifications.

4. Manufacturing Evaluation

The Manufacturing Evaluation module comprises the following elements:

² Projects with Application/Contract for Type Certification from before June 2010 may use the previous version of IEC 61400-24. Regardless of Application/Contract, the requirement for either testing of blades for verifying the lightning protection or verification based on documented experience will only be applied to new blade designs for which testing has not been concluded in 2010. Lightning protection requirements will be stated in the DNV Technical Report.

³ This type test is introduced in IEC 61400-22 and is not mandatory for IEC WT 01 based certifications.



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- Quality System Evaluation
- Manufacturing Inspection

The requirements for the Quality System Evaluation are satisfied if the client's Quality Management System is certified by an accredited Certification Body to ISO 9001:2008 with scope including design. If this is not the case, DNV will perform an audit for verification of compliance with ISO 9001:2008.

During the Manufacturing Inspection the manufacturing of at least one wind turbine will be inspected for compliance with design drawings and specifications.

5. Foundation Design Evaluation

The Foundation Design Evaluation module is carried out as a review of the design documentation received from the client.

6. Type Characteristics Measurements

The Type Characteristics Measurements module comprises one or more of the following elements:

- Power Quality Tests⁴
- Low Voltage Ride Through Tests⁴
- Acoustic Noise Measurements

The measurements shall be carried out by accredited testing laboratories. Otherwise DNV will verify that the testing is carried out according to IEC/ISO 17020 or IEC/ISO 17025, as applicable.

7. Final Evaluation & Type Certificate

The Final Evaluation module summarises the mandatory and the selected optional modules. Furthermore, it is evaluated whether the design documentation is complete, and whether the type test results confirm the relevant design assumptions. Also the final turbine documentation including drawings, specifications and manual is reviewed for compliance with the Manufacturing Evaluation and the design calculations and assumptions.

The Final Evaluation Report and the Type Certificate for the wind turbine type are issued when a satisfactory result of the evaluation of the above items has been completed.

⁴ Projects with Application/Contract for Type Certification from before August 2008 may use the previous version of IEC 61400-21. Regardless of Application and/or Contract, the requirement for power quality measurements will only be applied to new wind turbine designs for which power quality measurements has not been concluded in 2008. LVRT may be excluded, in which case it will be stated in the Conformity Statement for Type Characteristics Measurements.



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8. Maintenance of Type Certificate

The validity period of a wind turbine Type Certificate is normally 5 years, unless otherwise specified by codes/authorities.

The client shall take appropriate actions according to the certified ISO 9001:2008 system with respect to complaints and any deficiencies that affect compliance with the requirements for the Type Certificate. The client shall keep records of all complaints relating to the compliance for the wind turbine with the standards and requirements used for the Type Certificate. These records as well as documentation for actions taken shall be available to DNV and to the certification body which have certified the ISO 9001:2008 system. Reporting of these records as well as minor modifications must be submitted to DNV.

Major modifications to the design, procedures, specifications etc. must be reported without delay together with all documentation affected by the modification for the Type Certificate to be maintained/extended.

Surveys of randomly chosen specimens of each type of turbine are carried out during the validity period of the Type Certificate for the purpose of verification of the manufacturer's design procedures, their maintenance and implementations in relation to the design procedures and design parameters initially approved by DNV. The client must provide access to the turbine chosen for inspection.

The client shall, immediately upon knowledge of any safety related accident/failure of the installed Type Certified Turbines, report this to DNV. Such major accidents/failures may result in request for corrective actions to be taken by the client in order to maintain the Type Certificate. Based on an evaluation of the accident/failure and if relevant an evaluation of the corrective actions, DNV will decide if the Type Certificate shall be suspended until a satisfactory corrective action is implemented. A suspension means that turbines may not be advertised, sold, manufactured or installed with reference to the suspended Type Certificate. The Type Certificate may be suspended up to maximum one year provided that a plan for Corrective Action is agreed with DNV.

If no satisfactory corrective action is taken, the Type Certificate in question will be withdrawn and the accreditation authority, under whose authority the Type Certificate was issued, will be informed accordingly. Certification documents issued by DNV shall upon withdrawal or suspension be returned as requested by DNV.

Modifications to a wind turbine for which a Type Certificate has been issued are permitted only if they do not change or affect the principle characteristics at all, or to the extent described in the applicable design code/standard.

Hence, the following changes will require a new Type Certificate:



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- a change in rotor diameter and rotor rotational speed by more than 2%;
- a different design of safety system;
- a different way of limiting the power input;
- modified blade profiles;
- modifications which lead to a significant increase in the load spectrum;
- increase of the power output by more than 5%.

Re-certification may be required if additional requirements for maintenance of the Type Certificate are set by the national authorities or the applicable design code/standard during the validity period of the certificate.

Upon failure to conform to the conditions of the Type Certificate, the Certificate Holder is requested to correct the non-conforming situation within a specified time frame.

If no satisfactory corrective action is taken, the Type Certificate in question will be withdrawn and the accreditation authority, under whose authority the Type Certificate was issued, will be informed accordingly. Certification documents issued by DNV shall upon withdrawal or suspension be returned as requested by DNV.

9. Danish Type Certification System

The Danish Type Certification system is defined in Executive Order BEK no. 651 of 26/06/2008 'Bekendtgørelse om teknisk godkendelsesordning for konstruktion, fremstilling, opstilling, vedligeholdelse og service af vindmøller'. This system is based on the international IEC WT 01 Type Certification system 'IEC System for Conformity Testing and Certification of Wind Turbines Rules and procedures'.

For the Danish Type Certification System all the modules of the IEC WT 01 Type Certification System are mandatory. Special requirements for the Danish system are defined in Executive Order BEK no. 651.

10. Dutch Type Certification System

The Dutch Certification system applied before the IEC Type Certification System was established is defined in NVN 11400-0:1999, 'Wind turbines – Part 0: Criteria for type-certification – Technical criteria'.

The main differences compared to the IEC Type Certification System are the following:

- Manufacturing Evaluation is not required. However, a Quality Management System must be present
- Foundation Design Requirements and Foundation Design Evaluation is not included
- Acoustic Noise Measurement is required



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The Dutch Certification System is now replaced by the IEC Type Certification System and will require use of IEC 61400-1 ed. 3.

11. Prototype and Provisional Certification

In order to account for the different stages in the development of a wind turbine DNV may in addition to the Type Certificate issue the following certificates:

Prototype Certificate (class C)

This certificate is issued to enable testing of prototypes and is based on a design evaluation issued according to the IEC Type Certification System. The location of the turbine is stated on the certificate. The certificate may have outstanding matters limited to:

- quality control system and procedures
- matters with no safety implication within the period of validity (up to 3 years)
- manufacturing, installation and maintenance manuals

Provisional Certificate (class B)⁵

The Provisional Certificate is issued to allow for 0-series production as well as to allow for outstanding matters with no safety implication. The outstanding matters are however limited to:

- matters with no safety implication within the period of validity (maximum 1 year)
- matters related to the finalization of manuals and quality control procedures

⁵ The Provisional Certificate (class B) is introduced in IEC 61400-22 and is equivalent to the DNV B type certificate which is a provisional certificated based on IEC WT 01.



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Rules for the use of the Certification

The Type Certificate must not be used in such a manner as to bring DNV into disrepute. Furthermore, misleading or unauthorised statements regarding the Type Certificate are not allowed.

The certification mark, as shown in appendix 1, may only be used on or with a reference to the Type Certified Product.

The certification mark should not be used in such a way that it can mislead or give the impression that other products than the type certified are covered by the Type Certificate.

When used in brochures, letters and other printed material, a distinct reference to the Type Certified Products must be stated.

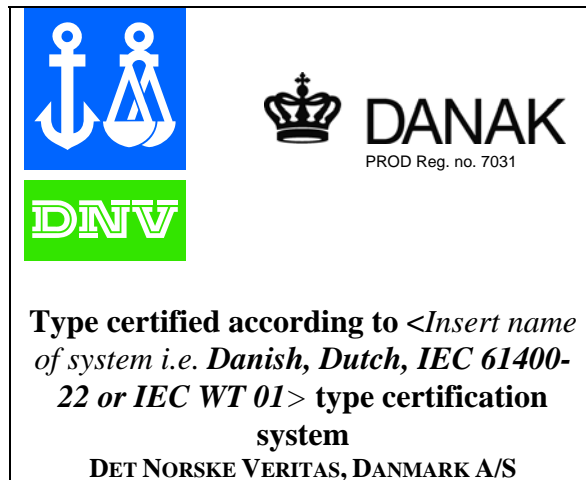
Any claims regarding the Type Certificate must be with reference to a specific item in the scope for certification.



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APPENDIX 1

CERTIFICATION MARK



The colours of the DNV logo are: Green: PMS 370 and Blue: PMS 286
The colour of the DANAK mark is: 100% black

