FOREWORD

DNV is a global provider of knowledge for managing risk. Today, safe and responsible business conduct is both a license to operate and a competitive advantage. Our core competence is to identify, assess, and advise on risk management. From our leading position in certification, classification, verification, and training, we develop and apply standards and best practices. This helps our customers safely and responsibly improve their business performance. DNV is an independent organisation with dedicated risk professionals in more than 100 countries, with the purpose of safeguarding life, property and the environment.

DNV service documents consist of among others the following types of documents:

— Service Specifications. Procedural requirements.
— Standards. Technical requirements.

The Standards and Recommended Practices are offered within the following areas:

A) Qualification, Quality and Safety Methodology
B) Materials Technology
C) Structures
D) Systems
E) Special Facilities
F) Pipelines and Risers
G) Asset Operation
H) Marine Operations
J) Cleaner Energy
O) Subsea Systems
U) Unconventional Oil & Gas

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Any comments may be sent by e-mail to rules@dnv.com
CHANGES – CURRENT

General
This document supersedes DNV-DSS-904, January 2012.

Text affected by the main changes in this edition is highlighted in red colour. However, if the changes involve a whole chapter, section or sub-section, normally only the title will be in red colour.

Det Norske Veritas AS, company registration number 945 748 931, has on 27th November 2013 changed its name to DNV GL AS. For further information, see www.dnvgl.com. Any reference in this document to “Det Norske Veritas AS” or “DNV” shall therefore also be a reference to “DNV GL AS”.

Main changes January 2014

• Sec.1 Introduction
  — [1.2.1]: The definitions “shall”, “should” and “may” have been rephrased and the verbal forms “can” and “will” have been deleted.
  — [1.3.3]: IEC 61400-3 and IEC 61400-4 have been included.

• Sec.2 Service overview
  — [2.2.1.3]: Possibility to integrate design basis and design evaluation modules have been included.
  — [2.2.2.3] and [2.2.4.2]: Type Certificate Offshore has been defined.
  — Figure 2-2: “Foundation Manufacturing Evaluation” has been added.

• Sec.3 Detailed service description
  — [3.1.1.3]: Clarification sheets have been included.
  — [3.3.4.2] and [3.3.5.1]: IEC 61400-3 has been included.
  — [3.3.5.1]: IEC 61400-4 has been included.
  — [3.3.5.6]: New paragraphs dealing with transition rules related to the introduction of IEC 61400-4 have been included.
  — [3.3.5.7]: Nacelle and spinner design evaluation scope have been included.
  — [3.3.8.3]: Personnel safety scope has been further defined accounting for CE marking.
  — [3.8.1.6]: Publication requirements for type certificates have been added.
  — [3.10.4]: Type Certificate Offshore has been defined.

Editorial Corrections
In addition to the above stated main changes, editorial corrections may have been made.
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SECTION 1 INTRODUCTION

1.1 General

1.1.1 Function of document

1.1.1.1 This DNV Service Specification (DSS) specifies DNV’s services for type certification of wind turbines.

1.1.1.2 The document provides:

— a common platform for describing the scope and extent of verification activities for type certification of wind turbines
— a reference document for defining the scope of work in accordance with requirements by the applicable certification system.

1.1.1.3 This service specification refers to specifications in IEC 61400-22 and needs to be read together with IEC 61400-22 in order to obtain a full overview of the services described in this document.

1.1.1.4 For each type certification to be carried out, it is a prerequisite that a detailed scope of work for DNV’s type certification services is worked out and included in the type certification contract between the wind turbine manufacturer and DNV.

1.1.2 Objective

1.1.2.1 This document has a dual objective: It serves as a publicly available description of DNV’s type certification services for wind turbines and it will be referred to as a contractual document in the type certification contract between the wind turbine manufacturer and DNV.

1.1.2.2 The document specifies the obligations of the client, usually the wind turbine manufacturer, when his wind turbine is to become certified. The document also specifies the obligations of DNV and the tasks carried out by DNV for type certification.

1.1.3 Scope of application

1.1.3.1 This specification applies to type certification of wind turbines.

1.1.4 Structure of document

1.1.4.1 This document consists of three sections. Section 1 provides general information and necessary prerequisites. Sec.2 provides an overview of the type certification services for wind turbines. Sec.3 provides a more detailed service description.

1.2 Definitions

1.2.1 Verbal forms

1.2.1.1 The terms will, can and may are used when describing DNV’s actions and activities, whereas the terms shall, should and may are used when referring to actions and activities by other parties than DNV.

1.2.1.2 Shall: verbal form used to indicate requirements strictly to be followed in order to conform to the document.

1.2.1.3 Should: verbal form used to indicate that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others, or that a certain course of action is preferred but not necessarily required.

1.2.1.4 May: verbal form used to indicate a course of action permissible within the limits of the document.

1.2.2 Definitions

1.2.2.1 Certification: Action by a certifying body, providing written assurance that adequate confidence is provided that the subject of the certification, i.e. the wind turbine, is demonstrably in conformity with a specific standard or other normative document. The term designates all the activities associated with the process leading to the issue of a certificate. The scope of work is defined by the certifying body or by a regulatory body.

1.2.2.2 Certification system: Certification scheme, i.e. a sequence of phases or modules to be completed prior to the issue of a certificate.
1.2.2.3 **Class B certificate:** Type certificate with some outstanding matters without safety implications and with limited period of validity, maximum one year.

1.2.2.4 **Client:** DNV’s contractual partner, usually the certificate applicant.

1.2.2.5 **Component certification:** Type certification of specific wind turbine components such as gearbox, nacelle and rotor–nacelle assembly. Component certification covers relevant modules of type certification with the extent depending on the component in question.

1.2.2.6 **Conformity statement:** IEC term for statement of compliance.

1.2.2.7 **Det Norske Veritas (DNV):** An autonomous and independent foundation with the purpose of safeguarding life, property and the environment. The foundation operates through the limited company Det Norske Veritas AS, which is registered in Norway and operates through a worldwide network of offices.

1.2.2.8 **Final evaluation report:** IEC term for final verification report.

1.2.2.9 **Final verification report:** Final report, issued as reference document for the type certificate, and providing documentation of the evaluation of the elements in the type certification. The report includes a reference list of all supporting product documentation, an evaluation of whether the detailed documentation is complete and all relevant requirements are confirmed by type test results, and a review of the final product documentation.

1.2.2.10 **Manufacturer:** The manufacturer of the wind turbine or of any wind turbine component in question.

1.2.2.11 **Recommendation:** Non-mandatory advice.

1.2.2.12 **Statement of compliance:** A statement or report signed by a qualified party affirming that, at the time of assessment, a product or a service meets specified requirements.

1.2.2.13 **Type certificate:** A certificate issued by a certifying body, here DNV, when it has been demonstrated that a product type in question, here a wind turbine type, complies with the applicable regulations. The type certificate will allow the client to manufacture certified wind turbines during the period of validity of the certificate.

1.2.2.14 **Verification:** An evaluation to confirm that an activity, a product or a service is in accordance with specified requirements. Upon confirmation according to an agreed scope of work for the verification service, DNV will issue a statement of compliance, which in IEC terminology is referred to as a conformity statement.

1.2.2.15 **Wind turbine:** System which converts kinetic energy in the wind into electrical energy.

### 1.2.3 Acronyms

1.2.3.1 Acronyms as given in Table 1-1 are used in this service specification.

<table>
<thead>
<tr>
<th>Acronym</th>
<th>In full</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEK</td>
<td>Bekendtgørelse (Executive Order, in Danish)</td>
</tr>
<tr>
<td>DANAK</td>
<td>Den Danske Akkrediterings- og Metrologifond (The Danish Accreditation and Metrology Fund, in Danish)</td>
</tr>
<tr>
<td>DNV</td>
<td>Det Norske Veritas</td>
</tr>
<tr>
<td>DSS</td>
<td>DNV Service Specification</td>
</tr>
<tr>
<td>EN</td>
<td>European Norm</td>
</tr>
<tr>
<td>IEC</td>
<td>International Electrotechnical Commission</td>
</tr>
<tr>
<td>ISO</td>
<td>International Organization for Standardization</td>
</tr>
<tr>
<td>NVN</td>
<td>Nederlandse Voor Norm (Dutch pre-norm, in Dutch)</td>
</tr>
<tr>
<td>RvA</td>
<td>Raad voor Accreditatie (Dutch Board for Accreditation, in Dutch)</td>
</tr>
<tr>
<td>TR</td>
<td>Technical Report</td>
</tr>
<tr>
<td>TS</td>
<td>Technical Specification</td>
</tr>
<tr>
<td>WTCAC</td>
<td>IEC Wind Turbine Certification Advisory Committee</td>
</tr>
</tbody>
</table>
1.3 References

1.3.1 General

1.3.1.1 This document makes reference to relevant DNV standards and to international codes and standards and other international publications. Unless otherwise specified in the certification agreement or in this DSS, the latest valid revision of each referenced document applies.

1.3.2 DNV standards

1.3.2.1 The following DNV standards are referenced in this service specification:

— DNV-DS-J102 “Design and Manufacture of Wind Turbine Blades, Offshore and Onshore Wind Turbines”.

1.3.3 International standards and other referenced publications

1.3.3.1 The following international standards and other relevant publications are referenced in this service specification:

— EN 50308 “Wind Turbines – Protective Measures – Requirements for Design, Operation and Maintenance”
— IEC 61400-1 “Design requirements”
— IEC 61400-2 “Design requirements for small wind turbines”
— IEC 61400-3 “Design requirements for offshore wind turbines”
— IEC 61400-4 “Design requirements for wind turbine gearboxes”
— IEC 61400-11 “Acoustic noise measurements techniques”
— IEC 61400-21 “Measurement and assessment of power quality characteristics of grid connected wind turbines”
— IEC 61400-22 “Conformity testing and certification of wind turbines”
— IEC TS 61400-23 “Full scale structural blade testing”
— ISO 9001 “Quality Management Systems – requirements”
— Eurocodes
— ISO/IEC 17020 “General Criteria for the Operation of Various Types of Bodies Performing Inspection”
SECTION 2 SERVICE OVERVIEW

2.1 General

2.1.1 Objective

2.1.1.1 The objective of this section is to provide an overview of the verification activities relating to type certification of wind turbines.

2.1.2 Selection of certification system

2.1.2.1 The type certification system to be applied for the certification shall be agreed in the contract between the manufacturer and DNV.

2.1.2.2 Type certification of wind turbines is carried out according to one of several type certification systems. The following type certification systems are available and recognized by DNV:

— IEC 61400-22 Type Certification System
— IEC WT 01 Type Certification System
— Danish Type Certification Scheme
— Dutch Type Approval Scheme
— Special Level Type Certification System.

2.1.2.3 Details of the type certification systems are given in Sec.3.

2.2 DNV Type certification of wind turbines

2.2.1 Certification modules

2.2.1.1 The DNV type certification system is based on the IEC type certification system as specified in IEC 61400-22.

2.2.1.2 The DNV type certification system consists of a series of five mandatory modules and three optional modules. The five mandatory modules refer to five major tasks during the design, manufacturing and testing of the wind turbine. The three optional modules refer to design and manufacturing of the foundation for the wind turbine and to type characteristic measurements. Reference is made to Figure 2-1.

![Figure 2-1](image_url)

**Figure 2-1**
**Type certification process, modules**

2.2.1.3 The certification modules “design basis evaluation” and “design evaluation” cover the steps necessary to achieve final design verification of the wind turbine. This verification includes an evaluation of the design basis and an evaluation of the design itself. The two modules are mandatory, however, although not recommended, the design basis module may be integrated in the design evaluation module. The design evaluation module does not cover the foundation and may therefore be supplemented by an optional module “foundation design evaluation”, see Figure 2-1.
2.2.1.4 The certification module “manufacturing evaluation” is mandatory. The manufacturing evaluation module does not cover the foundation and may therefore be supplemented by an optional module “foundation manufacturing evaluation”, see Figure 2-1.

2.2.1.5 The certification module “type testing” is mandatory. The type testing module may be supplemented by an optional module for “type characteristic measurements”, see Figure 2-1.

2.2.1.6 The certification module “final evaluation” is mandatory.

2.2.2 Deliverables

2.2.2.1 Upon successful completion of each certification module, a Conformity Statement is issued.

2.2.2.2 Following the successful completion of all mandatory certification modules in the certification system, a DNV type certificate will be issued for the wind turbine type subject to certification. A final verification report will be issued to the client as a reference document for the DNV type certificate. In IEC terminology, the final verification report is referred to as the final evaluation report.

2.2.2.3 The following type certificates are available depending on type certification system and provisions:

— Dutch type certificate
— Danish type certificate
— IEC WT 01 type certificate
— IEC 61400-22 type certificate
— IEC 61400-22 provisional (class B) type certificate
— IEC 61400-22 prototype certificate
— DNV (provisional) class B certificate; is an IEC WT 01 type certificate with some outstanding matters without safety implications and with limited period of validity, maximum one year. When the outstanding matters have been resolved, the certificate is converted to an IEC WT 01 certificate.
— Special level type certificate; is based on IEC 61400-22, but deviates from IEC 61400-22 in that blade fatigue testing is not required. If blade fatigue testing is carried out and completed successfully, the certificate is converted to an IEC 61400-22 certificate.
— Type Certificate Offshore.

Guidance note:
IEC 61400-22 is in practice a revision of IEC WT 01 with some requirements being stricter than those of IEC WT 01, such that if IEC 61400-22 is fulfilled, then also IEC WT 01 is fulfilled. In particular, the IEC WT 01 system does not include an evaluation of the design basis.

DNV recommends that the IEC 61400-22 type certification system is selected for the type certification. The special level type certification is meant to facilitate a fast and flexible path to the market for new wind turbine types, when availability of test facilities for blade fatigue tests is limited and would delay the introduction on the market, and offers the option to convert to a full IEC 61400-22 type certificate at a later time. The conversion to a full IEC 61400-22 type certificate is recommended, because blade fatigue testing in DNV’s opinion reduces the technical and commercial risk attached to the wind turbine.

2.2.3 Validity and maintenance of certificate

2.2.3.1 The type certificate refers to conformity statements issued for the completed modules. The type certificate is valid for 5 years after date of first issuance, except for the DNV (provisional) class B type certificate and the IEC 61400-22 provisional (class B) type certificate whose validities are both limited to one year. Moreover, the IEC prototype certificate is usually valid for a period of between 6 months and 3 years; however, 3 years is the maximum period of validity.

2.2.3.2 Changes of the wind turbine design may lead to issuance of a new revision of the certificate upon successful review. The new revision will have the same expiry date as the original certificate. In case of major changes as referred to in [3.9.3], a new certificate with 5-year validity will be issued upon successful review.

2.2.3.3 Maintenance of the type certificate is conditioned on:

— annual reporting by client covering all installed turbines of the certified type and including information about
  — abnormal or deviant operating experience or operating failures
  — minor modifications.
— reporting by client of planned major modifications without delay and in sufficient time to allow for evaluation by DNV before implementation and to enable update of the type certificate
— periodic reviews by DNV during the validity period of the certificate, at least once every 2½ years, to check that the wind turbines produced correspond to the type-certified turbines.

---end-of-Guidance-note---
2.2.4 Component certificates

2.2.4.1 Component Certificates are type certificates that can be issued for specific components, such as blades, gearbox and rotor–nacelle assembly. Component certification covers relevant modules of type certification with the extent depending on the component in question. For component certification it is required that the interface shall be clearly defined.

2.2.4.2 Component Certificates for rotor-nacelle assembly intended for use in offshore projects may be issued as a Type Certificate Offshore. The Type Certificate Offshore includes electrical installations in the tower but excludes the tower structural design, manufacturing and tower manuals. The Type Certificate Offshore comprises certification according to IEC 61400-22 for the complete wind turbine including design basis, design evaluation, type testing, manufacturing evaluation and final evaluation except for the tower design, manufacturing and final evaluation. The tower will be sufficiently documented to enable type testing and load calculations for the complete wind turbine.

2.2.5 Outline of certification system

2.2.5.1 The DNV Type Certification system is outlined in Figure 2-2.

Figure 2-2
DNV Type Certification system for wind turbines
SECTION 3 DETAILED SERVICE DESCRIPTION

3.1 Introduction

3.1.1 General

3.1.1.1 This section provides details of DNV's verification activities for each of the modules covered by the DNV Type Certification System for wind turbines.

3.1.1.2 The DNV type certification system is based on the IEC type certification system as specified in IEC 61400-22. For each verification activity, verification of compliance will be made against standards specified in IEC 61400-22. For verification activities, for which no particular standard is specified in IEC 61400-22, verification of compliance will be made against agreed standards, specifications or guidelines that meet the safety level according to IEC 61400-22.

3.1.1.3 There is established an advisory committee WTCAC according to IEC 61400-22 comprising accredited certification bodies as well as stakeholders and test laboratories. The accredited certification bodies forms a subgroup, CBC, which will publish clarification sheets when agreed by all members of the CBC (www.wtcertification.org). DNV will apply these agreed clarification sheets when certifying according to IEC 61400-22.

3.2 Design basis evaluation

3.2.1 General

3.2.1.1 The design basis submitted to DNV for evaluation shall identify all requirements, assumptions and methodologies which are essential for the design and for the documentation of the design. Hence, the design basis shall include codes and standards, design parameters, assumptions, methodologies and principles as well as other requirements related to manufacturing, transportation, installation, commissioning and operation and maintenance.

3.2.1.2 The design basis shall refer to IEC or ISO standards when available for the detail, component or system in question. Otherwise, for structural design of tower, support structure and foundation, DNV-OS-J101 and Eurocodes are recommended. For design, manufacturing and testing of wind turbine blades, DNV-DS-J102 provides a detailed interpretation of the basic IEC requirements for blades in IEC 61400-1 and IEC TS 61400-23 and is therefore recommended. For design of offshore wind turbine towers, DNV-OS-J101 is recommended. For personnel safety aspects, EN 50308 is recommended.

3.2.1.3 DNV will verify that the design basis is properly documented and sufficient for safe design of the wind turbine type according to IEC 61400-22. DNV will verify that the selected codes, standards and guidelines together with parameters, assumptions, methods and other requirements are appropriate and in line with the requirements in IEC 61400-22. Following a successful completion of the verification of the design basis, DNV will issue a conformity statement.

3.3 Design evaluation

3.3.1 General

3.3.1.1 The purpose of the design evaluation is to verify that the wind turbine design complies with the approved design basis.

3.3.1.2 The manufacturer shall supply all necessary documentation of the design. Guidance for list of documentation is given in IEC 61400-22, Annex A.

3.3.1.3 DNV will verify the final design for compliance with design assumptions, standards and other requirements specified in the DNV verified and approved design basis. Following a successful completion of the verification of the final design, DNV will issue a conformity statement.

3.3.1.4 The design evaluation will address the following topics:

— design control
— control and protection system
— loads and load cases
— rotor blades
— machine components and structural components
— electrical components
— housings
— component tests
— foundation design requirements
— manufacturing process
— transportation process
— installation process
— maintenance process
— personnel safety
— details of the evaluation of each topic are given in the following subsections.

3.3.2 Design control

3.3.2.1 The design control procedures shall comply with ISO9001 Sub-Clause 7.3 Design Control. The design control procedures shall include control of documents such that the revision status of every document is clear to all parties.

3.3.2.2 DNV will evaluate the quality procedures used by the wind turbine manufacturer to control the design processes. The requirements for the design control procedures are considered to be satisfied when the quality system of the wind turbine manufacturer has been certified according to ISO9001:2008 with design included in the scope. In case no ISO9001:2008 certified quality system is in place, a quality system evaluation will be carried out in connection with the Manufacturing Evaluation.

3.3.3 Control and protection system

3.3.3.1 DNV will evaluate the documentation of the control and protection system. The evaluation will comprise the following documentation:
— description of wind turbine modes of operation
— design of functionality of all elements
— fail-safe design of the protection system
— system logic and hardware implementation
— authentication of reliability of all safety critical sensors
— braking system(s) analysis.

3.3.3.2 A Failure Mode and Effect Analysis shall be executed by the manufacturer when deemed necessary by DNV.

3.3.4 Loads and load cases

3.3.4.1 The manufacturer shall document the load analysis and provide a summary of the loads used for design. The documentation shall include a load case description and a description of calculation models and input data such as
— parameter values relating to aerodynamics
— structural characteristics
— parameter values relating to the control system.

3.3.4.2 The required load cases are defined in IEC 61400-1 and/or IEC 61400-3. The design of the control and protection system shall be considered in the detailed set-up of load cases. The following design situations are covered by the load cases defined in IEC 61400-1 and/or IEC 61400-3:
— power production
— power production plus occurrence of fault
— start up
— normal shutdown
— emergency shutdown
— parked (standing still or idling)
— parked or fault conditions
— transport, assembly, maintenance and repair.

3.3.4.3 DNV will verify the loads and the load cases. The extent of the verification will depend on the wind turbine concept and on the size of the wind turbine.

3.3.4.4 As part of the verification of loads and load cases, DNV will carry out independent load analyses using another analysis program than the one used by the manufacturer. The focus of the independent analyses will be on fatigue loads and critical extreme load cases.

The independent load analysis will imply an aeroelastic load simulation in the time domain in conjunction with solution of the equations of motion using a special-purpose aeroelastic code.
3.3.4.5 The load analysis will serve as an independent check of applied input and confirm important load cases and load combinations. It will also verify:

- load level calculated by manufacturer
- dynamic behaviour
- presence of any instabilities.

3.3.5 Components

3.3.5.1 DNV will evaluate the designs of structural, mechanical and electrical components for compliance with the requirements of IEC 61400-22, IEC 61400-1, IEC 61400-2, IEC 61400-3 and IEC 61400-4 as applicable, and the agreed additional codes and standards, such as DNV-DS-J102 and DNV-OS-J101.

3.3.5.2 The design documentation relating to components normally consists of specifications, descriptions, schematics and design calculations, which may be combined with measurement reports, test reports, drawings and part lists. DNV requires that the documentation clearly identifies the basis for the design, i.e. codes and standards, as well as loads and relevant external conditions.

3.3.5.3 The DNV assessment consists of documentation reviews and independent analyses.

3.3.5.4 For components whose design documentation includes advanced analyses, such as FEM analyses of highly utilized members, DNV may carry out independent analyses for verification of the design.

3.3.5.5 For components subject to component tests, the results of the component tests may be used as full or partial documentation of the structural capacity. In this case, the test plan is subject to approval by DNV.

3.3.5.6 The gearbox standard IEC 61400-4 is to be applied for new wind turbine gearbox designs included in type and/or component certification. The former version of this standard, ISO 81400-4, may still be applied for gearbox designs from before 2013. This also applies to new versions of old gearbox designs from before 2013 typically new gear ratio including changed high speed stage.

3.3.5.7 For nacelle cover and spinner, the review of the design documentation will focus on the strength of connection points between cover/spinner and main structure/hub. Structures integrated in the nacelle cover/spinner e.g. for crane support, hook-up points and helicopter platforms will be reviewed as well together with the crane structure, hook-up point structure and helicopter deck structure.

3.3.6 Foundation design requirements

3.3.6.1 Evaluation of the foundation design is not a mandatory module for type certification. DNV will, however, assess the design requirements for the foundation. The characteristic loads and the design loads will be assessed, and the permissible range for foundation flexibility at the foundation–tower interface will be assessed. The assessment will be carried out by a review of documentation.

3.3.7 Manufacturing, transportation, installation and maintenance

3.3.7.1 The purpose of this part of the design verification is to verify that the wind turbine can be manufactured, transported, installed and maintained according to any requirements identified in the design documentation.

3.3.7.2 The DNV assessment consists of a documentation review. The documentation to be reviewed consists of specifications, instructions, manuals and other documents that DNV may require. Final manuals will be reviewed as part of the final evaluation.

3.3.8 Personnel safety

3.3.8.1 DNV will evaluate personnel safety aspects in the design documentation. The evaluation will comprise documentation of the following aspects according to the design basis:

- safety instructions
- climbing facilities
- access ways and passages
- standing places, platforms and floors
- hand rails and fixing points
- lighting
- electrical system and earthing system
- fire resistance
- emergency stop buttons.

3.3.8.2 The DNV assessment consists of a documentation review. The documentation to be reviewed normally consists of specifications, instructions and manuals. Final manuals will be reviewed as part of the final evaluation.
3.3.8.3 In the case that documentation (declaration of conformity) is provided for CE marking of the wind turbine according to the EU Machinery Directive, the DNV assessment may be reduced/omitted except for design of electrical equipment/installations. The DNV assessment of design of electrical equipment/installations will not be influenced by the CE marking.

3.4 Manufacturing evaluation

3.4.1 General

3.4.1.1 The purpose of the manufacturing evaluation is to verify that the requirements identified and specified during the design evaluation with regard to critical components and critical manufacturing processes are observed and implemented in production and assembly.

3.4.1.2 The manufacturing evaluation consists of the following two elements:

— quality system evaluation
— manufacturing inspection.

3.4.1.3 The requirement for evaluation of the quality system is considered satisfied if the manufacturer’s quality system is certified by an accredited certification body to be in conformance with ISO 9001:2008 with scope including design. When the manufacturer’s quality system is not certified to ISO 9001:2008 as specified, DNV will carry out an audit for verification of compliance with ISO 9001:2008.

3.4.1.4 DNV will verify by inspection that at least one representative wind turbine is manufactured according to the design subject to certification, i.e. in compliance with verified design drawings and design specifications. DNV will verify that the requirements identified during the design evaluation with respect to critical components and critical manufacturing processes are observed and implemented in production and assembly.

3.4.1.5 The manufacturing inspection will comprise:

— a survey of the manufacturing of at least one wind turbine of the type
— verification that design specifications are properly implemented in workshop drawings, workshop instructions, purchase specifications and installation instructions
— evaluation of manufacturer’s workshop, if relevant
— verification of fabrication methods, procedures and qualifications of personnel
— review of material certificates
— random checks on effectiveness of procedures for acceptance of purchased components
— random checks of fabrication processes.

3.4.1.6 If a critical component is produced by more than one component manufacturer and the components differ significantly in specifications or manufacturing processes or both, all differing components shall be considered for inspection.

3.5 Optional modules for foundation design and manufacturing

3.5.1 Foundation design evaluation

3.5.1.1 The foundation design evaluation module, when included in the type certification, will be carried out as a review of design documentation received from the client.

3.5.2 Foundation manufacturing evaluation

3.5.2.1 The foundation manufacturing evaluation module, when included in the type certification, will cover a quality system evaluation and a manufacturing inspection.

3.6 Type Testing

3.6.1 General

3.6.1.1 The purpose of the type testing is to prove the wind turbine performance with respect to power production and to verify the load calculations and the blade design.

3.6.1.2 The type testing module comprises the following elements:

— safety and function tests
— load measurements
— power performance measurements
— blade tests
— other tests including Gearbox Field Test.
3.6.1.3 The elements of the type testing should be carried out by accredited laboratories. Otherwise, DNV will verify that the testing is carried out according to IEC/ISO 17020 or IEC/ISO 17025, as applicable.

3.6.1.4 Unless an accredited laboratory carries out the Safety and Function Tests, DNV will witness the Safety and Function Tests and carry out a Type Inspection of the wind turbine. When an accredited laboratory carries out the Safety and Function Tests, DNV may waive the witnessing of the Safety and Function Tests, but will still carry out the Type Inspection. The Type Inspection implies that the turbine will be inspected for compliance with the documentation approved by DNV for the Design Evaluation such as approved design drawings and design specifications.

3.6.1.5 Regarding blade tests for lightning protection, projects with application or contract for type certification from before June 2010 may refer to the previous version of IEC 61400-24, viz. IEC TR 61400-24:2002. Regardless of dates of application and 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 Final Evaluation Report.

3.6.1.6 The Gearbox Field Test is specified in IEC 61400-22, but is not mandatory for IEC WT 01 based certifications.

3.7 Type characteristics measurements

3.7.1 General

3.7.1.1 Type characteristics measurements form an optional module in the type certification system.

3.7.1.2 The type characteristics measurements module, when included in the type certification, comprises one or more of the following elements:

— power quality tests
— low-voltage ride-through (LVRT) tests
— acoustic noise measurements.

3.7.1.3 Regarding power quality tests and low-voltage ride-through tests, projects with application and/or contract for Type Certification from before August 2008 may use the previous version of IEC 61400-21, viz. IEC 61400-21:2001, ed. 1. Regardless of dates of application and contract, the requirements for power quality measurements will only be applied to new wind turbine designs for which power quality measurements have not been concluded in 2008. Low-voltage ride-through (LVRT) tests may be excluded, in which case this exclusion will be stated in the Conformity Statement for Type Characteristics Measurements.

3.7.1.4 The measurements should 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.

3.8 Final evaluation and issue of type certificate

3.8.1 General

3.8.1.1 The purpose of the final evaluation is to provide documentation of the findings from the evaluation of the elements of the type certification.

3.8.1.2 The final evaluation module summarizes the mandatory modules and the selected optional modules. It will address 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 manuals is reviewed for compliance with the Manufacturing Evaluation and the design calculations and assumptions.

3.8.1.3 The Final Evaluation Report is issued when a satisfactory result of the evaluation described in [3.8.1.2] has been achieved.

3.8.1.4 The Final Evaluation Report will contain a reference list of all supporting product documentation. It will contain an evaluation of whether the detailed documentation is complete. It will also contain an evaluation of whether the type test results confirm that all relevant requirements set forth in the design documentation have been met.

3.8.1.5 The Final Evaluation Report will contain a review of the final product documentation, including

— drawings
— components list
— procurement specifications
— manuals,
and will confirm that it is consistent with the manufacturing evaluation report, with the supporting design calculations and with relevant design assumptions.

3.8.1.6 The type certificate for the wind turbine type subject to certification will be issued based on a satisfactory final evaluation. The type certificate will be issued in accordance with the type certification system selected for the certification, see Sec.2. The type certificate is valid for 5 years, unless otherwise stated, and refers to conformity statements for the completed modules:

— design basis evaluation
— design evaluation
— manufacturing evaluation
— type testing
— type characteristics measurements (optional)
— foundation design evaluation (optional)
— foundation manufacturing evaluation (optional)

The front page of the type certificate or component certificate will as a minimum be published on the DNV internet site.

3.9 Maintenance of type certificate

3.9.1 Period of validity

3.9.1.1 The validity period of a wind turbine type certificate is normally 5 years, unless otherwise specified by codes or authorities.

3.9.2 Client obligations

3.9.2.1 The client shall take appropriate actions according to the requirements of the ISO 9001:2008 certification 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 of 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 manufacturer’s quality system to ISO 9001:2008. Reports of these records and actions taken as well as reports of minor modifications to the design shall be submitted to DNV, at least once per year.

3.9.2.2 Proposals for major modifications to the design, to procedures, and to specifications and other documents shall be reported without delay together with all documentation affected by the modification in order for the type certificate to be maintained and extended.

3.9.2.3 Surveys of randomly chosen specimens of each type of turbine will be 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 the design parameters initially approved by DNV. The client shall provide access to the turbine chosen for inspection.

3.9.2.4 Once any safety-related accident or failure of the installed type-certified turbines comes to the client’s knowledge, the client shall report this accident or failure to DNV. Such major accidents or failures may result in a request by DNV for corrective actions to be taken by the client in order to maintain the type certificate. Based on an evaluation of the accident or 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 implies that wind 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 by the client is agreed with DNV.

3.9.2.5 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 to DNV as requested by DNV.

3.9.3 Modifications and recertification

3.9.3.1 Modifications to a wind turbine for which a type certificate has been issued are permitted only if they do not change or affect the principal characteristics at all, or if they change or affect the principal characteristics within the extent specified in the applicable design code or standard.

3.9.3.2 In accordance with [3.9.3.1], any of the following changes will require a new type certificate:

— a change in rotor diameter by more than 2%
— a change in rotor rotational speed by more than 2%
— a different design of safety system
— a different way of limiting the power output
— modified blade profiles
— modifications which lead to a significant increase in the load spectrum
— increase of the power output by more than 5%
— major changes to the wind turbine design.

Major changes may lead to recertification if required by the applicable standard or if deemed necessary by DNV.

3.9.3.3 DNV may require recertification if additional requirements for maintenance of the type certificate are set by national authorities or by the applicable design code or standard during the validity period of the certificate.

3.9.3.4 Upon failure to conform to the conditions of the type certificate, the client will be requested by DNV to correct the nonconforming situation within a specified time frame.

3.9.3.5 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.

3.9.3.6 Major revision to a referenced standard as well as other new industry learning during the validity period for a type certificate will be evaluated by DNV. If such a revision is judged to have implications for the integrity and safety of the certified wind turbine, the wind turbine will have to be modified and/or re-evaluated in order to retain its type certificate. Transition periods and guidance for implementation of new revisions will be established by DNV for each individual case.

3.10 Certification to other certification systems

3.10.1 Danish Type Certification System

3.10.1.1 The Danish Type Certification system is defined in Executive Order BEK no. 73 of 25/01/2013 “Bekendtgørelse om teknisk certificeringsordning for vindmøller”. This system is based on the system defined in IEC 61400-22: 2010 “Wind Turbines – Part 22; Conformity Testing and Certification”.

3.10.1.2 The Danish Type Certification System includes all the mandatory modules according to IEC 61400-22. The Type Characteristic Measurement for Acoustic Noise according to IEC 61400-22 is also mandatory.

3.10.2 Dutch Type Certification System

3.10.2.1 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’.

3.10.2.2 The main differences from the IEC Type Certification System are the following:
— Manufacturing Evaluation is not required; however, a Quality Management System must be in place
— Foundation Design Requirements and Foundation Design Evaluation are not included
— Acoustic Noise Measurement is required.

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

3.10.3 Special Level Type Certification System

3.10.3.1 The Special Level Type Certification system is based on type certification according to IEC 61400-22, but deviates from type certification according to IEC 61400-22 in that blade fatigue testing is not required. If blade fatigue testing is carried out and completed successfully, the certificate is converted to an IEC 61400-22 certificate.

Guidance note:
DNV recommends that the IEC 61400-22 type certification system is selected for the type certification. The special level type certification is meant to facilitate a fast and flexible path to the market for new wind turbine types, when availability of test facilities for blade fatigue tests is limited and would delay the introduction on the market, and offers the option to convert to a full IEC 61400-22 type certificate at a later time. The conversion to a full IEC 61400-22 type certificate is recommended, because blade fatigue testing in DNV’s opinion reduces the technical and commercial risk attached to the wind turbine.
3.10.4 Type Certificate Offshore

3.10.4.1 Component Certificates for rotor-nacelle assembly intended for use in offshore projects may be issued as a Type Certificate Offshore. This corresponds to an IEC 61400-22 Type Certificate for which the detailed tower design is not included; see [2.2.4.2] for further details.

3.11 Rules for the use of the type certificate

3.11.1 General

3.11.1.1 The type certificate must not be used in such a manner as to bring DNV into disrepute. Furthermore, misleading or unauthorized statements regarding the type certificate are not allowed.

3.11.1.2 The certification mark, as shown in App.A, may only be used on or with a reference to the type-certified product.

3.11.1.3 The certification mark must not be used in such a way that it can mislead or give the impression that other products than the type-certified product are covered by the type certificate.

3.11.1.4 When the certification mark is used in brochures, letters and other printed material, a distinct reference to the type-certified product must be stated.

3.11.1.5 Any claims regarding the type certificate must be promoted with reference to a specific item in the scope for the certification.
APPENDIX A ACCREDITATIONS, CERTIFICATION MARKS AND SAMPLE CERTIFICATE

A.1 Accreditations and Certification Marks

DNV and GL have merged to form DNV GL. The certification marks and the certificates will gradually be updated with new logo and layout. Read more here: www.dnvgl.com/merger.

A.1.1 Accreditations

A.1.1.1 DNV is accredited for type certification of wind turbines and for component certification according to systems as specified in [A.1.1.2] and [A.1.1.3].

A.1.1.2 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.

A.1.1.3 DNV is accredited for component certification according to the following systems:
— IEC Type Certification System (IEC 61400-22; IEC WT 01)
— Danish Type Certification System.

A.1.1.4 Depending on the type certification system in question, the DNV accreditation may be limited to one or more specific DNV subsidiaries. The accreditation to the Danish and Dutch type certification systems is granted by DANAK and is limited to DNV Denmark (Det Norske Veritas, Danmark A/S) only. DNV Korea (DNV Korea Ltd.) is accredited by RvA and only for certification to IEC 61400-22 and IEC WT 01.

A.1.1.5 DNV is accepted by German building authorities as “Gutachter” according to German regulations.

A.1.2 Certification marks

A.1.2.1 Different certification marks are used, depending on which accreditation board has accredited DNV, which DNV unit carries out the type certification, and which type certification system is used; see examples in Figure A-1 to Figure A-3.

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

Figure A-1
Certification mark example no. 1
Type certified according to <Insert name of scheme i.e. IEC 61400-22 or IEC WT 01>
type certification system

DNV KOREA LTD.

The colours of the DNV logo are: Green: PMS 370 and Blue: PMS 286
The colours of the RvA mark is: Ochre: PMS 131 and Blue: PMS 296.

Figure A-2
Certification mark example no. 2

Type certified according to <Insert name of system i.e. Danish, Dutch, IEC 61400-22 or IEC WT 01>
type certification system

Figure A-3
Certification mark example no. 3
A.2 Sample Type Certificate

A.2.1 Sample type certificate

A.2.1.1 A sample type certificate is presented in Figure A-4 and Figure A-5.
DET NORSKE VERITAS

TYPE CERTIFICATE

Wind Turbine Type

IEC TC-235401-1

Type Certificate number

2011-12-13

Date of issue

Manufacturer:
Wind Turbine Manufacturer

Address line 1
Address line 2

Valid until: 2016-12-13

Conformity evaluation has been carried out according to IEC 61400-22: 2010 "Wind Turbines - Part 22: Conformity Testing and Certification". This certificate attests compliance with IEC 61400-1 ed. 3: 2005 and IEC 61400-22 concerning the design and manufacture.

Reference documents:
- Design Basis Conformity Statement: IEC DB-225401-0
- Design Evaluation Conformity Statement: IEC DE-225401-0
- Type Test Conformity Statement: IEC TT-225401-0
- Manufacturing Conformity Statement: IEC MC-225401-0
- Foundation Design Evaluation Conformity Statement(s): IEC FE-225401-0
- Type Characteristics Measurement Conformity Statement(s): IEC TM-225401-0
- Final Evaluation Report: PD-642354-125XZ5Y-23

Wind Turbine specification:
IEC WT class: II B. For further information see Appendix 1 of this Certificate.

Date: 2011-12-13

Christer Eriksson
Management Representative
Det Norske Veritas, Danmark A/S

Bente Vestergaard
Project Manager
Det Norske Veritas, Danmark A/S

Figure A-4
Sample type certificate, page 1
APPENDIX 1 - WIND TURBINE TYPE SPECIFICATION

General:
- IEC WT class acc. to IEC 61400-1 ed. 3: 2005:
  - Rotor diameter:
  - Rated power:
  - Rated wind speed \( V_r \):
  - Hub height(s):
  - Operating wind speed range \( V_{in} - V_{out} \):
  - Design life time:

Wind conditions:
- \( V_{ref} \) (hub height):
- \( V_{ave} \) (hub height):
- \( I_{ref} \) acc. to IEC 61400-1 ed. 3: 2005:
- Mean flow inclination:

Electrical network conditions:
- Normal supply voltage and range:
- Normal supply frequency and range:
- Voltage imbalance:
- Maximum duration of electrical power network outages:
- Number of annual electrical network outages:

Other environmental conditions (where taken into account):
- Air density:
- Normal and extreme temperature ranges:
- Relative humidity:
- Solar radiation:
- Salinity:
- Design conditions in case of offshore WT (water depth, wave conditions etc.):
- Description of lightning protection system:
- Earthquake model and parameters:

Main components:
- Blade type:
- Gear box type:
- Generator type:
- Tower type:
- Service lift: Type / Not present
- Crane: Type / Not present

Figure A-5
Sample type certificate, page 2
CHANGES – HISTORIC

Note that historic changes older than the editions shown below have not been included. Older historic changes (if any) may be retrieved through http://www.dnv.com.

January 2012 edition

Amendment February 2013

— New Danish scheme came into force on 2013-02-01. The consequence is a minor update and new reference in Sec.3 J100.