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A Review on Type Certification Schemes of Wind Turbine

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***Abstract*— This paper reviews various type certification schemes of wind turbine in India and in world wide. The wind energy market is undergoing a rapid expansion and is expected to continue this trend over the medium term with support from the market framework, local policies and economic attractiveness. As the wind energy industry continues to flourish, an increasing number of manufacturers are entering the wind generation field. Hence it is necessary to have type certification for wind turbine. Type certification is to confirm that the wind turbine type is designed, documented and manufactured in conformity with design assumptions, specific standards and other technical requirements. Reliability and safety of the wind turbines have to be ensured for the sustained growth of wind industry. Type certification of wind turbines plays an important module for increasing confident among stakeholders including investors, utilities, financial institution, insurance agencies, governmental authorities and such others. Therefore it is important to know about the guidelines and certifying bodies which gives a clear idea of wind turbine certification in India and in world. Certification has been issued based on scope, requirements and depth depending upon the schemes. This paper also gives an insight view of International Electro technical Commission standards (IEC), Dutch type certification and Danish type certification schemes. A detailed review on standards some of IEC standards used for wind turbine certification is also included in this paper.**

***Keywords*— IEC, Type certification schemes**

I. INTRODUCTION

In need of population growth which is increasing at a rapid rate, the demand of power and energy is also rapidly increasing. New technologies and betterment of existing technologies are needed to meet this increasing demand. These technologies may use conventional and non-conventional resources for energy production. Among these resources, renewable resources play a key role. In the emerging new technologies wind energy is considered as a promising and encouraging renewable energy for power generation which contributes a greater percentage in energy production. Wind is a vital for energy production due to its non-exhaustive nature and environmental benefits. It is available abundant in nature. It does not produce any greenhouse gases about 83 countries in the world uses wind energy for power generation. The electrical energy is generated by installing wind turbines in places with relative wind speed. Since they are installed at high cost, it is necessary to the ensure reliability and safety of wind turbine. Type certification of wind turbines play a important role in ensuring safety of wind turbines. To certify a wind turbine model should meet the specified standards and certification schemes. Various survey and assessments are performed before certifying a wind turbine. Certification is necessary to distinguish which manufacturers offer products that meet relevant standards and codes**.** This certification is addressed to manufacturers of wind turbine components (blades, gear boxes, towers, etc.).Hence certification from an internationally recognized certification body is a must and depending on the country, it is a mandatory requirement for wind turbine manufactures.

II. VARIOUS TYPE CERTIFICATION SCHEMES

The certification of wind turbine is given as per the result of testing and evaluation report from certification body. Type testing of the wind turbine will flow the flowchart given in the fig -1 [1]. After the type testing the turbine is certified for installation.

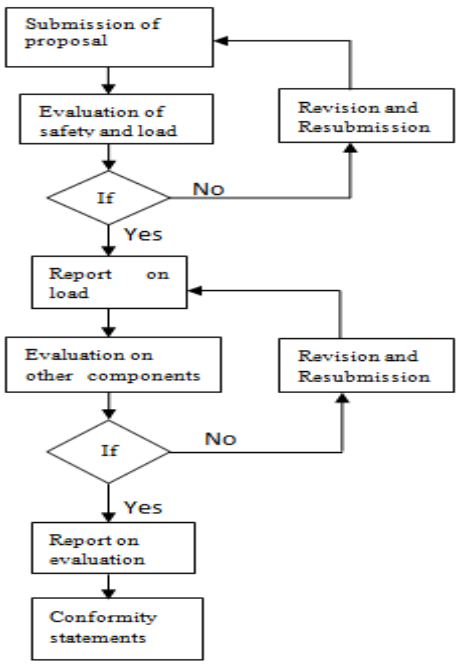

Fig -1:Flow chart

There are various certification schemes and agencies are available worldwide for certifying wind turbines. These schemes may be based on European standards, British standards or Canadian standards. The globally accepted standards for type certification is international Electrochemical commission (IEC) standards. There are other standards which are also globally accepted and are mainly based of IEC standards includes i) IEC wt 01 type certification ii) Dutch type certification iii) Danish type certification. The various types of wind turbine certification agencies all over the world are given in the table -1 [2].

A. IEC WT 01 type certification:

Design basis evaluation, Design evaluation, Type testing, Manufacturing evaluation are the modules which are mandatory to get certification. For the final evaluation and certification, the following modules is also includes Type characteristics measurement and Foundation design evaluation. The wind turbine must pass through these evaluation before begin certification.

Table -1: Certifying Agencies

Sl.no	Certifying Agency	Country	Website and Email
1.	Centre for Wind Energy Technology	INDIA	www.cwet.tn.nic.in info@cwet.res.in
2.	Bureau Veritas Quality International BVQI	DENMARK	www.bqvi.com
3.	Det Norske veritas(DNV)	DENMARK	www.dkvind.dk ceri@remove-this.dnv.com
4.	Tuv Nord CertGmbH & Co	GERMANY	www.tuev-nord.de
5.	Wind-consult	GERMANY	www.wind-consult.de
6.	European Wind Turbine Certification	THE NETHERLANDS	www.ecn.nl wind@remove-this.cres.gr
7.	CRES	GREECE	www.cres.gr
8.	National Wind Turbine Certification	USA	http://wind.nrel.gov/cert_stds/Certification
9.	China General Certification Centre	CHINA	www.cgc.org.in
10.	China Classification Society	CHINA	www.ccs-c.com.in

B. Dutch type certification:

Type certification is based on NVN 11400-0. This certification also includes IEC161400-1. NVN 11400-0 type certification was used for certifying of wind turbines in the years between 1999-2005.IEC standards are revised based on this system. The NVN system was published by Netherland Normalistic Institute [4]. Currently almost all standards of NVN standards are used by IEC. The following table -2 specifies some of the type certificates expired which are certified under dutch certification scheme.

Table -2:Dutch type certification

Manufacturer	Turbine	Certificate number
Vestas Wind Systems A/S	NM 64C/1500	CPH-215501-0
NEG Micon A/S	NM 44/750 HH 36 IEC 3a	CPH-213001-0
NEG Micon A/S	NM 900/52 - IEC II NL	CPH 203401-1
Nordtank Energy Group	NTK600/43 NL	ROT 97.0805
Nordtank Energy Group	NTK600/43 RI DR	ROT 97.1942
Siemens Wind Power A/S	BONUS 300 kW Mk II/III	ROT 96.8380
Siemens Wind Power A/S	BONUS 600 kW Mk IV	ROT 96.4624

C. Danish type certification:

Danish type certification are issued according to executive order No:73 on "Technical certification scheme for wind turbine"[4]. The type certification is issued and is based on Type A and Type B system Type A certificates are intended for large serial production. Type B certificates are intended for limited serial production. Now Type C certificates are issued for tested and demonstrated wind turbines. The table -3 below specifies some expired Danish certificate

Table -3: Danish type certification

Manufacturer	Turbine	Certificate number
Siemens Wind Power A/S	SWT-3.0-101 DD	B-DNV-222213-0
Siemens Wind Power A/S	SWT-3.0-101 DD	B-DNV-222214-0
Siemens Wind Power A/S	Izar BONUS 1.3 MW LM29	A-202302-3
Vestas Wind Systems A/S	V90-1.8MW (50Hz)	B-DNV-221001-0
Vestas Wind Systems A/S	NM 72C/1500 Evo II	B-DNV-213601-1
NEG Micon A/S	NM 72	A-642040-4
NEG Micon A/S	NM52 alt. NM52/900 or NM900/52 - IEC II	A-64203404-5
NEG Micon A/S	NM 92/2750 (IEC S)	A-207601-1

D. Type certification schemes in India:

In India, wind turbine certification is provided by "Centre of wind energy technology"(C-WET). There are many schemes and policies are available for Indian wind energy technology. This certification is intended on the basis of IEC 61400-22.For Indian certification, the following modules are mandatory, 1) Design basis evaluation, 2) Wind turbine design evaluation, 3) Type testing, 4) Manufacturing evaluation,5) Final evaluation. The optional modules are, 6) Foundation design evaluation, 7) Foundation manufacturing evaluation. The certification of wind turbine is based on satisfactory evaluation for completeness of the final evaluation report [5].

III. IEC STANDARDS:

There are number if IEC standards available for the certification of wind turbine components. The detailed discussion on this is given below which is based on the studies regarding wind turbine standards [6].

A. IEC 61400-1 - Wind turbine design and safety

It specifies design requirement to ensure integrity of wind turbines. It provides a appropriate level of protection from all types of hazards.

B. IEC 61400 - 1(II) - Wind turbine class:

The wind turbine is classed based on the type of generator used Type A: wind power plant using squirrel cage induction generator. Type B: wind power plant using wound rotor induction generator. Type C: wind power plant using doubly fed induction generator. Type D: wind power plant using wound rotor induction generator

C. IEC 61400 -2 – Small wind turbine design:

This standard deals with safety, integrity and requirement of small wind turbine. It also includes maintenance and operation under specified external conditions.

D. IEC 61400-11-Acoustic noise measurement:

This provides the measurements of noise emission of a wind turbine. Appropriate measurement methods are used for assessments at location close to machine.

E. IEC 61400-12(2) – Power performance measurement:

Specific measuring procedures are performed for the single wind turbine and applied to the wind turbines of all type and size connected to the power network.

F. IEC 61400-13-Mechanical load measurement:

Act as a guide for structural loading of wind turbines especially for horizontal axis turbine.

G. IEC 61400 -14-Declaration of sound power level and tonality value:

Gives the guidelines for the apparent sound power level and tonality value of a bunch of wind turbines.

H. IEC 61400 – 21-Measurement and Assessment of Electric Power Quality characteristics of grid connected Wind Turbine:

It gives the quality testing of power of the grid connected wind turbines. Currently it also deals with inter harmonics and current distortion voltage dips, grid protection and reconnection time after grid faults

I. IEC 61400-22-Wind Turbine Certification:

It comprises both type certification and certification of wind turbine installed. This system specifies rules for procedures and management for carrying out conformist evaluation of wind turbines.

J. IEC 61400-23-Full –Scale Structural testing for Wind Turbines:

Is a technical specification providing guidelines for the full scale structural testing of winding turbine blades and for the interpretation of evaluation of result. It includes static strength tests, fatigue test and other tests determining blade properties.

K. IEC 61400-24-Lightening protection of Wind Turbines:

This applied lightening protection for wind turbines, generator and power system. Guides for applicable use of lightening protection and earthing.

L. IEC 61400-25(6)- Communications for monitoring and control of wind power plants - Conformance testing:

Specifies information models related to condition monitoring for wind turbine power plant.

IV. CONCLUSION:

With the rapid growth of the wind industry in capacity and size of wind turbines, importance of type certification is increased. Type certification of wind turbines provides confidence various stakeholders on the product. In order to the quality of the wind turbines used in a wind farm project, availability of a type certificate included as a part of evaluation criterian by the developers, financial institutions and insurance companies. The type certification of wind turbine helps the industry to develop reliable wind farm projects.

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BIOGRAPHIES

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