



**National Institute of Wind Energy**  
**Testing & Research Station**  
**Chennai-600 100**

Technical Note: NIWE/T&R/TN/01/2018

Date: 01.11.2018

**Evaluation of test site for Type testing as per the recommendations of relevant standards**

**1. Introduction**

The Type Testing of wind turbines is being conducted at WTTS as well as at field sites as per the recommendations of relevant IEC standards. The following tests are being conducted as per the certification scheme in vogue.

- 1.1** Power Performance Measurements
- 1.2** Safety and Function Testing
- 1.3** Yaw Efficiency
- 1.4** Load measurements

Presently, the Type testing of wind turbines is being conducted at WTTS (Wind Turbine Test Station, Kayathar) under Category II/III and at field sites under Category II/III of the Certification Scheme after the evaluation of the site as per the recommendations of relevant IEC standards.

**2. Assessment of the Site**

The site conditions of terrain, environmental and electrical grid should be favorable in order to carry out the above mentioned tests as per the recommendations of the International Standards. The sites proposed by the customer shall be assessed based on the following information provided by the customer and in accordance with the method recommended in the relevant standard.

**3. Information to be provided by the Customer**

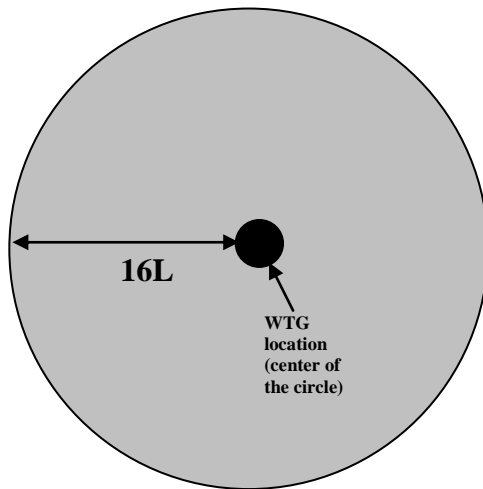
- 3.1.** Customer shall make available a 1:50000 contour map (at least 30m (DTM) resolution contour interval-Survey of India Map) with the proposed test site and the meteorological mast clearly marked on it. The 30m (DTM) contour should be provided separately in \*.dwg/ \*.dxf format.

Type tests shall be conducted in complex terrains if the requirements of relevant standards regarding site calibration are met. The terrain shall be treated as complex if the slopes are above the limits mentioned in table 4.1.3.

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**3.2.** Customer shall make available 1 m contour map of the area around the proposed location of the test turbine up to a distance of 16L where  $L=2.25D\pm 0.25$  (Varies 2 to 4 times rotor diameter of test turbine) and D is the rotor diameter of the test turbine. The contour map should have a scale of 1:1 and in \*.dwg/ \*.dxf format.

**3.2.1.** The contour map shall clearly indicate any significant objects in the area such as other wind turbines, proposed wind turbines, belonging to any developer including those of the customer, transmission towers, vegetation, hutments, plantations etc. These objects shall be drawn to scale and should be recent in time. A table providing details including height and width of objects shall be provided in the format as required by WAsP (Wind Atlas Analysis and Application Program). Photographs in eight directions standing from North through East, south and West should also be included.



*Figure 3.2.1 Area to be covered for contour map (highlighted in figure)  
 $L=2.25D\pm 0.25$  where D is the rotor diameter of test turbine*

**3.3.** Time series wind data from the proposed site, which is continuous at least for one year, should be made available as 10-minute averages. If the measurement site is different, a contour map (Survey of India map of 1:50000) with at least 30 m contour interval should be supplied with the exact location of the wind mast and the proposed test turbine site clearly marked. In no case data from more than 10 km in level terrain and 3 km in case of complex terrain shall be acceptable.

**3.4** Extreme climatology at the proposed locations as per IS 875 part III.

**3.5.** The design power curve of the proposed test turbine in table format (0.5m/s bin width) wherein the wind speed corresponding to rated power is also shown.

**3.6.** The power law index at the proposed site.

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## 4. Evaluation methodology

NIWE on receipt of the proposal will carry out the following:

### 4.1. Evaluation of the information provided by the customer

#### 4.1.1. Wind conditions

The wind data of the site shall be evaluated as per the recommendations of IEC standards for  $1.5 \cdot V_{ref}$  where  $V_{ref}$  corresponds to the wind speeds at 85% of rated power. The wind speed measured at a particular height shall be extrapolated to the height of the hub of the proposed test turbine based on the power law index. The annual variation of 5% lower wind speeds shall be considered for a site which shall be incorporated in the measured data ( $10_{min} - 5\% \cdot 10_{min}$ ), where  $10_{min}$  is the 10 minute measured average wind speed

#### 4.1.2. Measurement Sector

The measurement sector shall exclude directions having significant obstacles, significant variations in topography or other wind turbines, as seen from both the test turbine and the meteorological mast. The elimination methodology shall be as per the recommendations of Annexure A of IEC 61400-12-1 standard. However the recommendation does not indicate any absolute sector and this has to be determined from the data of the wind direction and the proposed period of measurements.

No significant obstacles (e.g. buildings, trees, parked wind turbines) shall exist in the measurement sector within a reasonable distance from the wind turbine or from the Meteorological Mast. Only small buildings, connected to the wind turbine operation or the wind measurement equipment, are acceptable. The criterion for the significance of an obstacle (with respect to the wind turbine under test and/or with respect to the Meteorological Mast) is to exceed one or more of the limits given in Table 4.1.2.

Table 4.1.2. Obstacle requirements-relevance of obstacles

Distance <sup>a</sup>	Sector <sup>b</sup>	Maximum obstacle height from terrain surface <sup>c</sup>
< 2L	360Deg	<1/3 (H-0.5D)
≥ 2L and < 4L	preliminary measurement sector	<2/3 (H-0.5D)
≥ 4 L and < 8L	preliminary measurement sector	Not applicable
≥ 8L and < 16L	preliminary measurement sector	<4/3 (H-0.5D)
≥ 2L and < 16L	Clearly outside preliminary measurement sector by 40Deg or more	No limit to height

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- a. From obstacle to wind turbine under test, respectively from obstacle to WME – whereas  $L$  is the horizontal distance between wind turbine under test and wind measurement equipment.
- b. *Preliminary measurement sector* shall be understood here as the valid sector which remains after evaluation of neighboring operating wind turbines, whereas all directions which are less than  $40^\circ$  outside shall also be considered.
- c.  $H$  is the hub height and  $D$  is the rotor diameter of the wind turbine under test.

### 4.1.3. Terrain Slopes

The slopes of the terrain shall be evaluated and compared at  $L$ ,  $2L$ ,  $4L$ ,  $8L$  and  $16L$  from the 1 m contour map with the recommended slopes in the standard given in the following table

Table: 4.1.3. Slopes specified in the IEC recommendations.

Distance	Sector	Maximum Slope %	Maximum terrain variation from plane
$< 2L$	$360^\circ$	$< 3^b$	$< 1/3 (H-0.5D)$
$\geq 2L$ and $< 4L$	Measurement sector	$< 5^b$	$< 2/3 (H-0.5D)$
$\geq 2L$ and $< 4L$	Outside measurement sector	$< 10^c$	Not applicable
$\geq 4L$ and $< 8L$	Measurement sector	$< 10^b$	$< (H-0.5D)$
$\geq 8L$ and $< 16L$	Measurement sector	$< 10^c$	Not applicable
<ul style="list-style-type: none"> <li>a. Measurement sector is understood here by default as the remaining valid sector after execution of the procedure defined in Annexure A of IEC 61400-12-1 standard, whereas it is also allowed to use a smaller measurement sector.</li> <li>b. The maximum slope of the plane, which provides the best fit to the terrain in the sector being considered and passes through the tower base.</li> <li>c. The line of steepest slope that connects the tower base to individual terrain points on the surface of the terrain within the sector.</li> </ul>			

The slopes of the terrain determined in a complex terrain will give an indication for the position of the mast. However further analysis may be required during the site visit for positioning the meteorological mast.

## 4.2. Site visit of the proposed locations

During the site visit by the testing unit of NIWE the following activities shall be carried out.

**4.2.1** Verification of the obstacles and terrain conditions as per the map.

**4.2.2** Finalization of the position of the meteorological mast

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**4.2.3** Finalization of the sector for measurements considering the final position of the mast.

**4.2.4** Information from the customer regarding the following critical local issues, which shall be verified at the site.

**4.2.4.1** Land availability for met mast

**4.2.4.2** Grid availability

**4.2.4.3** Security issues for the data acquisition equipment

### **4.3. Selection of most feasible location for testing**

The proposed site shall be selected provided it conforms to the IEC recommendations regarding measurement sector, terrain and wind conditions. The viability of measurements at the location in respect to the above mentioned critical local conditions shall be studied and finalized

The feasibility of measurements at the proposed site shall be reported to the customer.

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