

**Exhibit Q**

**Visual Impact Assessment**

**6011 Greenwich Windpark, LLC**

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## **1.0     *Introduction***

6011 Greenwich Windpark, LLC (the Applicant), a limited liability company whose sole member and manager is Windlab Developments USA, Ltd. (Windlab) a subsidiary of Windlab Systems Pty Ltd, is proposing to construct, own and operate up to 60 megawatts (MW) in nameplate capacity of wind-powered electric generation located in Huron County, Ohio (the Greenwich Windpark or the Facility). The proposed Facility is located within an approximate 4,650-acre area (Project area) in Greenwich Township in Huron County, Ohio. The Applicant selected the Project area based primarily upon the wind resource, transmission access, land availability, community support, site accessibility, and minimal environmental, ecological, and agricultural impact risk.

This Visual Impact Assessment Report (Report) summarized the methodology and results of the visual assessment conducted in the Project area. The Applicant completed this assessment to provide an understanding of the Facility's appearance and its potential visual effects.

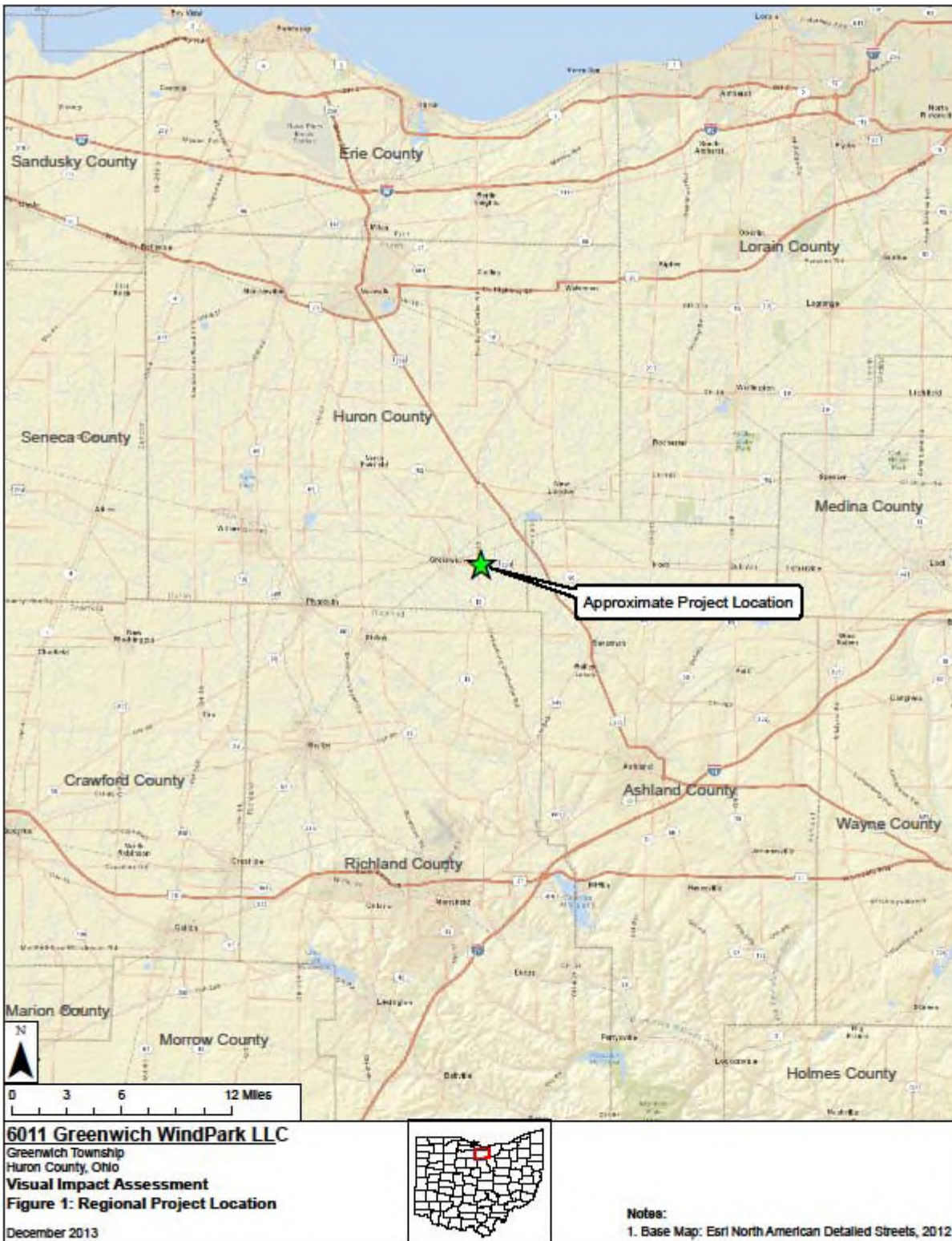
This assessment supports the Applicant's submittal to the Ohio Power Siting Board (OPSB) for a Certificate of Environmental Compatibility and Public Need ("Certificate"), in accordance with Chapter 4906-17 of the Ohio Administrative Code, Application Filing Requirements for Wind-Powered Electric Generating Facilities.

## **2.0     *Project Description***

### **2.1     *Project Site***

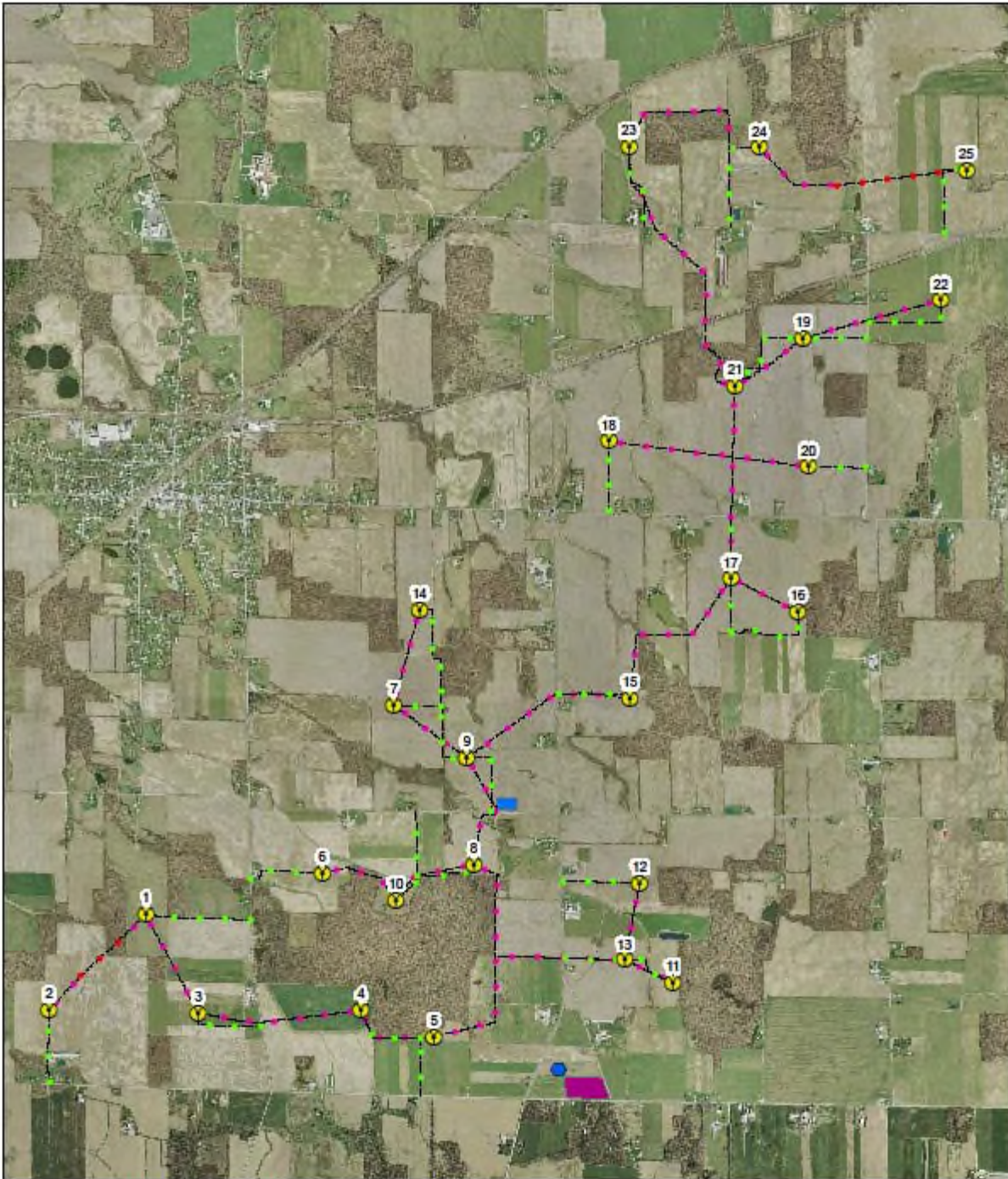
The Project area is located within Huron County, Ohio and encompasses approximately 4,650 acres of privately-owned leased land in Greenwich Township (Figure 1). The Facility lies in the southeast portion of Huron County. The site is generally intersected by US Route 224 and State Route 13; bound by Alpha Road to the north, Ninevah Road to the east, Greenwich-Milan Townline Road to the west and Richland County/Baseline Road to the south. The site is located approximately 0.5 mile south and east of the Village of Greenwich, 1.25 miles southwest of the Village of New London, 3.6 miles northeast of the Village of Shiloh, 6.5 miles east of the Village of Plymouth, and 9.5 miles east of the City of Willard (as measured to the nearest turbine). It is approximately 56 miles west of Akron, and 65 miles southwest of Cleveland.

The Project site is located in an area that is primarily developed, with farms and rural residences interspersed along area roadways. The land elevations are in the range of 950 to 1,200 feet above mean sea level (AMSL). Land use within the Project area is dominated by active agriculture, with farms and single-family rural residences generally occurring along the road frontage.



## **2.2 Proposed Project**

The proposed Project evaluated in this Visual Impact Assessment is a wind-powered electric generating facility, consisting of up to 25 wind turbine generators, each with a nameplate capacity rating of 2.4 MW, with a total generating capacity of up to 60 MW. Along with the turbines, the Project includes associated support facilities including access roads, buried electrical interconnect cable, meteorological towers, a substation, and an operations and maintenance building. The project configuration/layout is illustrated in Figure 2. The major components of the proposed Project are described below.



**6011 Greenwich WindPark LLC**  
 Greenwich Township  
 Huron County, Ohio  
**Visual Impact Assessment**  
**Figure 2: Proposed Project Layout**  
 December 2013

- Wind Turbine
- Met Tower
- Directional Boring
- Access roads
- Proposed Collection System
- Temporary Laydown Yard
- Substation

**Notes:**  
 1. Base Map: One-foot resolution orthoimagery, 2011

### 2.2.1 Wind Turbines

This study assumes use of the Nordex N117 turbine on the Project site. Each wind turbine consists of three major components; the tower, the nacelle, and the rotor, all of which will be white in color. The heights of the tower, or “hub height” (height from foundation to top of tower) will be approximately 298 feet (91 meters). The nacelle sits atop the tower, and the rotor hub is mounted to the nacelle. Assuming a 117 meter rotor diameter, the total turbine height (i.e., height at the highest blade tip position) will be approximately 490 feet (149 meters). Descriptions of each of the turbine components are provided below.

*Tower:* The towers used for this Project are conical steel structures manufactured in 4 sections. The towers have a base diameter of approximately 14 feet and a top diameter of approximately 9.7 feet. Each tower will have an access door, internal lighting, and an internal safety ladder to access the nacelle.

*Nacelle:* The main mechanical components of the wind turbine are housed in the nacelle. These components include the drive train, gearbox, and generator. The nacelle is approximately 37 feet long, 12 feet tall and 11 feet wide. Attached to the top of up to approximately half of the nacelles, per specifications of the Federal Aviation Administration (FAA), will be a single aviation warning light. These will be medium intensity flashing red lights (L864) and operated only at night. For the purposes of this study, it is assumed that the nacelle will include no obvious lettering, logo, or other exterior markings.

*Rotor:* A rotor assembly is mounted on the nacelle to operate upwind of the tower. The rotor consists of three fiberglass composite blades, each approximately 191.9 feet (58.5m) in length. The rotor is attached to the drive shaft at the front of the nacelle. The pitch of each blade is varied according to wind speed and adjusted within the rotor hub. The wind turbines begin generating at wind speeds as low as 6.7 mph (3 m/s) and automatically shut down at speeds above 44.7 mph (20 m/s). Maximum rotor speed is approximately 13.2 revolutions per minute (rpm).

### 2.2.2 Electrical System

The proposed Project will have an electrical system consisting of 1) buried 34.5 kilovolt (kV) cables that will collect power from each wind turbine, and 2) a substation that steps up and transfers the power from the 34.5 kV cables to the existing section of the Willard – South Greenwich 69 kV transmission line and regional power grid. Each of these components is described below.

*Collection System:* A transformer located at the base of each turbine raises the voltage of electricity produced by the turbine generator up to the 34.5 kV voltage level of the collection system. From the transformer, cables will join the collector circuit and turbine communication cables to form the electrical collection system. A total of approximately 14 miles of cable will be installed underground. It is currently anticipated that no overhead collection system lines will be installed. Consequently, this component of the Project is not the subject of further evaluation in this visual impact study.

*Substation:* The substation will be located near the intersection of Plymouth East Road and State Route 13 in Greenwich Township, adjacent to the existing Willard – South Greenwich

69 kV transmission line. The substation will step up voltage from 34.5 kV to 69 kV to allow connection with the existing transmission line. The substation will encompass up to 3 acres. The substation building will be enclosed by a chain link fence, and accessed from Plymouth East Road by a new gravel-surfaced road approximately 0.1 mile in length.

### 2.2.3 Access Roads

The Project site includes an extensive network of existing state, county and local roads. Therefore, existing roads will be used as the primary means of accessing the proposed Project. While it is possible that some existing public roads will need to be improved to facilitate Project construction, the location and extent of these public road improvements is currently unknown. Furthermore, these improvements are not anticipated to significantly change the character of the existing roadways. Minor improvements to existing roads are therefore not evaluated in this study.

In addition to using the existing public roads, the Project will require the construction of new or improved private roads to access individual turbine sites. The proposed location of Project access roads is shown in Figure 2. The total length of access roads required to service all proposed wind turbine locations is approximately 9 miles, the majority of which will be upgrades to existing farm lanes. The roads will be gravel-surfaced and could result in temporary soil disturbance of up to 40 feet in width (including side slopes) during Project construction. Each road will be individually designed for site-specific engineering and environmental constraints, therefore as-built road widths may vary. Following construction, Project access roads will be reduced in width to approximately 20 feet or less, and will receive very limited use. These access roads take on the appearance of farm lanes and generally do not have a significant long-term visual impact. Consequently, the visibility and visual impact of Project access roads, on their own, are not evaluated in this study.

### 2.2.4 Meteorological Towers

Up to two 80-meter (262 feet) permanent meteorological wind measurement towers will be installed to collect wind data and support performance testing of the turbines. The Applicant anticipates that these towers will be galvanized steel structures equipped with wind velocity directional measuring instruments at three different elevations and a red aviation warning lighting mounted at the top. It is anticipated that each tower will be self-supporting. Meteorological towers typically have limited visibility and visual impact relative to the adjacent turbines. Consequently, this component of the Project is not addressed in this study.

### 2.2.5 Operations and Maintenance Facility

An O&M building and associated storage yard will be required to house operations personnel, equipment, and materials, and to provide operations staff parking. It is anticipated that an existing structure in the vicinity of the Facility will be purchased or leased and refurbished for O&M activities. If construction of a new building is needed, it is not expected to exceed 6,000 square feet in total size, or permanently disturb an area of greater than 3 acres. The Applicant will incorporate motifs and design elements into the construction of the O&M building to ensure that it blends with the area's agricultural landscape. Likewise, if necessary, the Applicant will provide visual screening (e.g. vegetation, berms, etc.) to reduce the visual impact of the associated storage yard. Consequently, the O&M facility should be compatible with the existing landscape, and is not evaluated as part of this study.

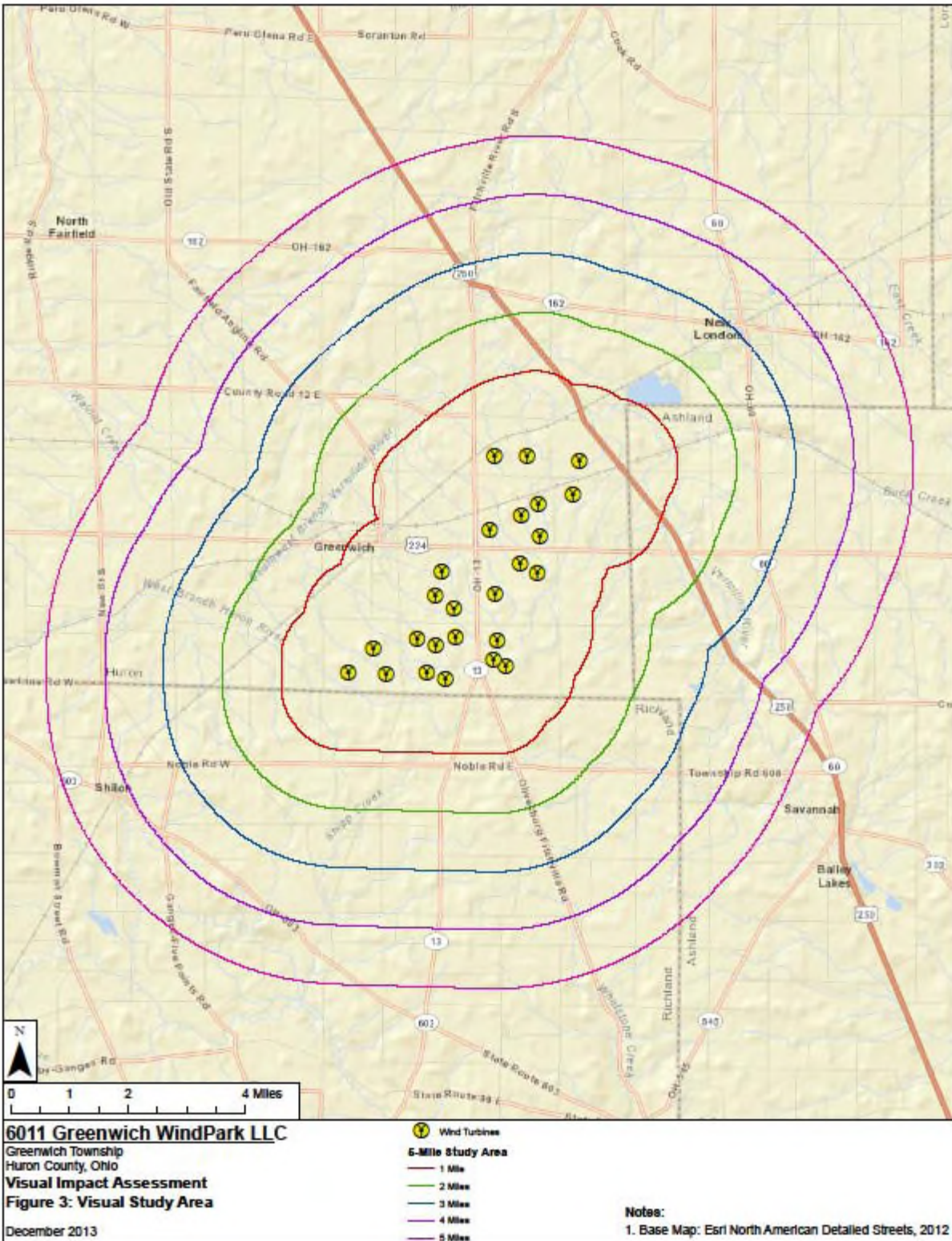
### **3.0 Visual Study Area**

The visual study area for the Project was defined as the area within a 5-mile radius of each of the proposed wind turbines. Chapter 4906-17-05 of the Ohio Administrative Code (OAC), Application Filing Requirements for Wind-Powered Electrical Generation Facilities, indicates that a 5-mile radius is the appropriate study area for the identification of scenic and historic resources. The study area encompasses approximately 163 square miles. The study area is located in the southeast corner of Huron County, the northwest corner of Ashland County, and the north-central area of Richland County. The study area encompasses the Village of Shiloh, the Village of Greenwich, the Village of New London and Greenwich Township. The location and extent of the visual study area is illustrated in Figure 3.

#### **3.1 Visually Sensitive Resources**

The 5-mile radius visual study area includes several sites that could be considered scenic resources of statewide significance. These include 5 sites and 1 district listed on the National Register of Historic Places, plus five additional sites that have been determined as eligible for listing. Within the study area, there is one State Nature Preserve (Fowler Woods) and one National Natural Landmark (Crall Woods). There are no State Forests, National Wildlife Refuges, National Park Service Lands, designated State or Federal trails, or designated scenic roads or scenic overlooks within the visual study area.

There is one recreation area located within a one-mile radius of the project area. The Greenwich Reservoir Park is located approximately 1.13 miles from the nearest proposed turbine; however, this recreation area will not be physically impacted by this project.



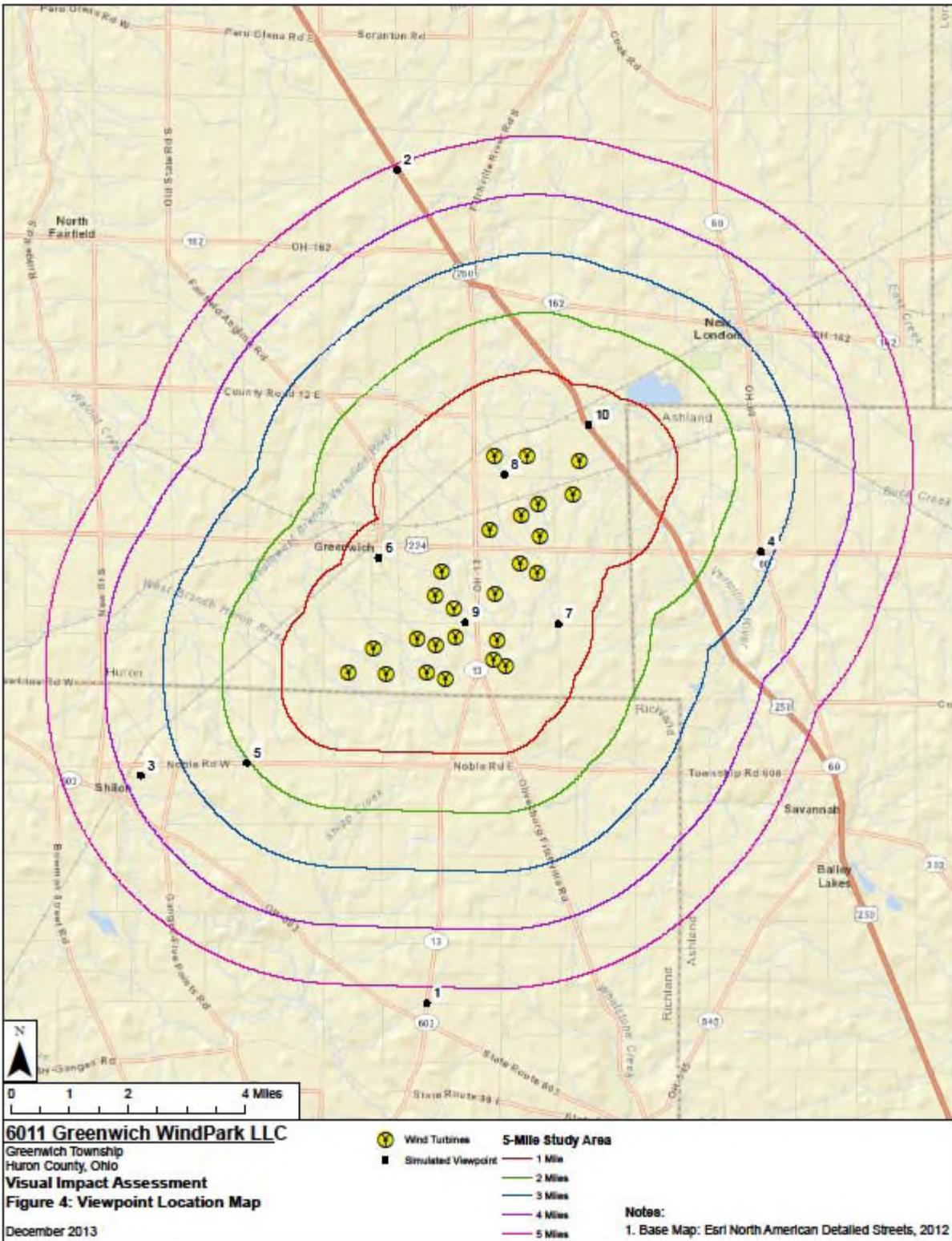
#### **4.0 Visual Impact Assessment Methodology**

To provide an understanding of the Facility's appearance and its potential effects on representative views in the Project area, photo simulations were prepared for views from ten viewpoints. See Figure 4 for the location of the ten viewpoints selected for this evaluation. The Applicant selected these viewpoints through a process that included review of area maps, review of Google Earth© air photos, and field investigations. Furthermore, these viewpoints were selected based upon the following criteria:

- They provide clear, unobstructed views of the Project (as determined/verified through field verification).
- They illustrate Project visibility from sensitive sites/resources within the visual study area.
- They illustrate typical views from a variety of landscape zones where views of the Project will be available.
- They illustrate typical views of the proposed Project that will be available to representative viewer/user groups within the visual study area.
- They illustrate typical views of different numbers of turbines, from a variety of viewer distances, and under different lighting conditions (sunny/partly sunny/overcast), to illustrate the range of visual change that will occur with the Project in place.

Figures 1-10 contained in Appendix A present the existing view from each viewpoint, along with a photo-simulation that depicts the view as it would appear with the Facility in place. These images were prepared through a process that entailed photo documentation of existing views from each of the 10 viewpoints around the proposed Project area using a single lens digital camera set to take photos equivalent to those taken with a 35 mm camera.

To illustrate anticipated visual changes associated with the proposed Project, high-resolution computer-enhanced images were used to create realistic photo simulations of the completed turbines from each of the 10 selected viewpoints. The photographic simulations were developed by construction a three-dimensional computer model of the proposed turbine and turbine layout based on the turbine specifications and site layout coordinates. [For the purposes of this analysis, it was assumed that all new turbines would be Nordex N 117 machines.] The Applicant then utilized computer modeling and rendering techniques for each view to produce the simulated images. Existing topographic conditions and site data were factored into developing the digital modeled images.



## **5.0 Visual Impact Assessment Results**

Review of the figures presented in the Facility simulations of Viewpoints 1 and 2, which are located approximately 5 miles from the edge of the Project area, indicate the range of potential turbine visibility in these more distant views. At Viewpoint 1, located along State Route 13, intervening trees, other landscape elements, and topography would almost completely hide the one visible turbine. At Viewpoint 2, located along US Route 250 just north of the Project area, there is an open view toward a portion of the Project area; however, the two turbines would be visible as relatively small features along a distant horizon.

In the mid-range views, such as Viewpoint 3, located approximately 3.85 miles from the closest turbine, the turbines would be visible along the horizon in the background. In Viewpoint 4, located along State Route 60 and US Route 224 approximately 3.33 miles from the nearest turbine, the turbine would be slightly screened by vegetation and where visible would appear to be in scale with the trees in the foreground. In Viewpoint 5, approximately 2.14 miles from the closest turbine, the one visible turbine would be slightly screened by existing topography with only the top portion visible along the horizon. In Viewpoint 6, which is a view from Greenwich Reservoir Park in Greenwich, the closest turbines seen in this view would be located approximately 1.13 miles away. In this view, although the turbines would be readily visible and large in scale, they would be partially screened and appear generally in scale with the middle-ground elements in the view.

In closer views, the turbines would become more visually prominent, and would have more of an effect on the character and composition of the landscape. In Viewpoint 7, where the closest turbine that would be visible would be located approximately 0.95 mile from the viewpoint, the turbines would be partially screened and appear to be generally in scale with the background elements in the view. In Viewpoint 8, the closest turbine would be located approximately 0.8 mile from the viewpoint. Because the foreground zone of this view is completely open and because the turbines are close to the viewpoint, the nearby turbines would dominate the view. In Viewpoint 9, the closest turbine that would be visible would be located approximately 0.67 mile from the viewpoint. Because the foreground zone of this view is completely open and because the turbines are close to the viewpoint, the nearby turbines would dominate the view. In Viewpoint 10 (GPS 29), located along US Route 250 just northeast of the Project area, the closest turbine would be located approximately 0.5 mile from the viewpoint. Because the foreground zone of this view is almost entirely open (with a few small trees in the middle-ground), the turbines would be fully visible, and would become important elements in the overall landscape composition.

**Table 1. Summary of Viewpoints (Presented in increasing visible prominence)**

<b>Viewscape</b>	<b>Viewpoint Figure</b>	<b>Discussion</b>
<b>Distant</b>		
	Viewpoint 1	Located approximately 5 miles from the nearest turbine. Intervening trees, other landscape elements, and topography almost completely hide the turbine.
	Viewpoint 2	Located approximately 5 miles from the nearest turbine. Turbines may be visible as a small, distant element that is visible in some of the breaks in the tree line.
<b>Mid-Range</b>		
	Viewpoint 3	Located approximately 3.85 miles from the closest turbine, the turbines would be visible along the horizon in the background.
	Viewpoint 4	Located approximately 3.33 miles from the nearest turbine, the turbine would be slightly screened by vegetation and where visible would appear to be in scale with the trees in the foreground.
	Viewpoint 5	Approximately 2.14 miles from the closest turbine, the one visible turbine would be slightly screened by existing topography with only the top portion visible along the horizon.
	Viewpoint 6	View from Greenwich Reservoir Park. Closest turbines would be located approximately 1.13 miles away. Although readily visible and large in scale, the turbines would be partially screened and appear generally in scale with the middle-ground elements in the view.
<b>Close Range</b>		
	Viewpoint 7	Closest turbine would be located approximately 0.95 mile from the viewpoint. Turbines would be partially screened and appear to be generally in scale with the background elements in the view.
	Viewpoint 8	Closest turbine would be located approximately 0.8 mile from the viewpoint. Because the foreground zone is completely open and because the turbines are close to the viewpoint, the nearby turbines would dominate the view.
	Viewpoint 9	Closest turbine would be located approximately 0.67 mile from the viewpoint. Because the foreground zone of this view is completely open and because the turbines are close to the viewpoint, the nearby turbines would dominate the view.
	Viewpoint 10	Closest turbine would be located approximately 0.5 mile from the viewpoint. Because the foreground zone of this view is almost entirely open (with a few small trees visible in the middle-ground), the turbines would be fully visible, and would become important elements in the overall landscape composition.

A comprehensive summary of potential Project visibility from each of the 10 simulated viewpoint sites is presented in Appendix A.

## **6.0 Conclusion**

The Visual Impact Assessment for the Greenwich Windpark allows the following conclusions to be drawn:

1. Viewshed analysis indicates that the Project has the potential to be visible from a number of sites within the 5-mile radius study area. However, in many areas a significant number of turbines will be partially and/or mostly screened by trees, existing vegetation, topography, or other structures.
2. Viewshed analysis indicates that views of the Project may occur at visual sensitive areas that occur within the 5-mile radius study area. However, for many sensitive sites within the study area, including National Register-listed historic sites and others that occur in the various villages, the Project may not be visible or will be significantly screened by foreground vegetation and structures. As a result, construction of the Project is not expected to result in a significant adverse impact on the visual settings associated with historic properties. There is one recreation area located within a one-mile radius of the project area. The Greenwich Reservoir Park is approximately 1.13 miles away from the nearest proposed turbine; however, this recreation area will not be physically impacted by this project.

### **6.1 Mitigation**

Mitigation options are limited, given the nature of the Project and its siting criteria (tall structures typically located in open fields/areas). However, various mitigation measures were considered. These include the following:

- A. Screening. Due to the height of individual turbines and the geographic extent of the proposed Project, screening of individual turbines with earthen berms, fences, or planted vegetation will generally not be effective in reducing Project visibility or visual impact. However, if adequate natural screening is lacking at the proposed substation site, a planting plan should be developed and implemented to minimize the visibility of this facility.
- B. Camouflage. The white color of wind turbines (as mandated by the FAA to eliminate the need for day time lighting) minimizes contrast with the sky under most conditions, especially when viewed at distance against the horizon. Consequently, it is recommended that this color be utilized on the Project.
- C. Nonspecular Materials. Where possible, non-reflective paints and finishes will be used on the wind turbines to minimize reflected glare. Where this is not feasible, natural weathering/dulling of any glossy surfaces (on turbine or substation components) will typically occur within one year following installation.
- D. Lighting. Turbine lighting will be kept to the minimum allowable by the FAA. Medium intensity red strobes will be used at night, rather than white strobes or steady burning red lights. Lighting at the proposed substation should be kept to a minimum, and turned on only as needed by switch or motion detector.

- E. Maintenance. The turbines and turbine sites will be maintained to ensure that they are clean, attractive, and operating efficiently. In addition, the Project operator will establish a decommissioning fund to ensure that if the Project goes out of service and is not repowered and/or redeveloped, all visible above-ground components will be removed.

In addition to the mitigation measures described above, other measures that will reduce or mitigate visual impact have been incorporated into the Project design. These include the following:

- All turbines will have uniform design, speed, color, height, and rotor diameter.
- The projects electrical collection system will be placed underground.
- The Project operations and maintenance building (although not yet designed and/or selected) will reflect the vernacular architecture of the area (i.e., resemble an agricultural structure).
- New access road construction will be minimized by utilizing existing farm lanes whenever possible.
- The placement of any advertising devices on the turbines will be prohibited.

## **Appendix A. Viewpoint Simulations**

## Viewpoint 1

### *Existing View*

This view is from State Route 13 on the eastern edge of Blooming Grove Township. It is oriented to the north and is approximately 5.5 miles from the nearest turbine that would be visible in this view. The paved roadway of Route 13 extends diagonally from the lower left corner toward the center of the view, and proceeds away from the view into the mid-ground. The overhead utility poles that flank the roadway provide a scale reference and depth perspective. Tall deciduous trees (with some of their leaves still on) along each side of the road, anchor the view. These mixed hardwoods define the visible horizon and extend across the entire view. The sky in this view is partly cloudy. This view is representative of the view experienced by a typical passenger in a vehicle along a well-traveled state highway.

### *Proposed Project*

With the Project in place, one turbine can be seen rising in the distance along the horizon. Due to the viewing distance, intervening trees, and significant topography changes that occur between this viewpoint and the turbine location (see Appendix B, Figure B-1), the presence of this turbine does not alter the character of the landscape. The overall effect on this view is minimal due to the perceived size of the turbine relative to the other elements in the view.



**6011 Greenwich Windpark, LLC  
Viewpoint 1**

State Route 13 south of Wharton Road.  
Existing and with-project  
simulated views looking north.

## Viewpoint 2

### *Existing View*

This view from Rome-Greenwich Road and US Route 250 in Fitchville Township faces south and is approximately 5.12 miles from the nearest turbine that would be visible in this view. A rural roadway occupies the near foreground, extending beyond the horizon to exit the view in the center-right. A line of utility poles, whose receding size gives this view a strong sense of perspective depth, accentuates the strong converging lines of the road. The rest of the view shows one white farmhouse, flanked by medium size trees surrounded by agricultural fields. The distant horizon in this view is a low, even ridge that stretches across the entire view. The upper half of the view is open sky, interrupted only by the utility poles and the crowns of bare trees.

### *Proposed Project*

With the proposed Project in place, two turbines are present in the distance – one in the center and one toward the left side of the view. The turbines – although clearly taller than the existing vegetation – at this distance appear smaller relative to the existing utilities poles in the foreground. Due to the viewing distance and topography changes that occur between this viewpoint and the turbine location (see Appendix B, Figure B-2), the presence of these turbines does not alter the character of the landscape. While visible, the two turbines are relatively small features along a distant horizon. The overall effect is considered minimal because of the perceived size of the turbine relative to the other elements in the view.



**6011 Greenwich Windpark, LLC  
Viewpoint 2**

US Route 250 at Rome-Greenwich Road.  
Existing and with-project  
simulated views looking south.

### Viewpoint 3

#### *Existing View*

This view from Brenneman Road in Cass Township, just beyond the Shiloh Village limits, faces northeast and is approximately 3.85 miles from the nearest turbine that would be visible in this view. This view features open agricultural fields that extend away from the mid-ground and terminate at the horizon. Two clusters of farm buildings, including a farm house, barns, tree clusters, and silos, interrupt the horizon – one at the far right side and one in the center. A narrow strip of roadway curves and exits along the left side of the view, flanked by narrow wooden utility poles at regular intervals. The whole scene is brightly lit and features rich colors, including a medium-toned blue sky streaked with white cirrostratus clouds.

#### *Proposed Project*

With the Project in place, portions of 3 turbines are visible in the background, on and behind the ridge that forms the horizon line in this view. Overall the Project's impact is minimal. The effect of distance results in minimal scale contrast, and the presence of the utility poles, silos, tree clusters, and agricultural buildings in the mid-ground offset the cluttering effect of the turbines.



**6011 Greenwich Windpark, LLC  
Viewpoint 3**

Brenneman Road east of Village of Shiloh.  
Existing and with-project  
simulated views looking northeast.

#### Viewpoint 4

##### *Existing View*

This view is from the intersection of US Route 224 and State Route 60 in Ruggles Township. It is oriented northwest and is approximately 3.33 miles from the nearest turbine that would be visible in this view. The road signs and overhead utility poles that flank the roadway provide scale reference and depth perspective. Off the northwest corner of the intersection, a cluster of tall deciduous trees anchor the view. The woodlot ends at bare agricultural fields which extend into the distance. The sky in this view is slightly overcast and crisscrossed by multiple overhead lines. The view is representative of the view experience by a typical passenger in a vehicle along a well-traveled state highway.

##### *Proposed Project*

With the proposed Project in place, two turbines can be seen in the distant horizon. The turbines are partially screened by existing vegetation and topography (Appendix B, Figure B-4), and appear smaller in height to the existing utility poles and vegetation in both the foreground and mid-ground. Because of the presence of existing utility poles, signs, utility lines, and trees, the overall effect on the view is minimal. The turbines appear compatible with the existing land use in the view.



**6011 Greenwich Windpark, LLC  
Viewpoint 4**

US Route 224 and State Route 60.  
Existing and with-project  
simulated views looking northwest.

## Viewpoint 5

### *Existing View*

This view from Noble Road at Heifner Road in Blooming Grove Township faces north and is approximately 2.14 miles from the nearest turbine that would be visible in this view. This view is of a farm landscape in fall. The immediate foreground features an open, agricultural field. The horizon, formed by the crest of the low hill that extends across the mid-ground of the view, is interrupted by one silo that rises next to the barn complex in the center of the view. A woodlot of deciduous trees (with their leaves on) rises behind these buildings at the left side of the view. The sky is predominately cloudy, with rolling gray and white clouds interrupted by patches of medium-to-dark blue sky.

### *Proposed Project*

With the Project in place, the top half of one turbine is visible in the far right of the view. Due to the lack of foreground screening, the turbine blades are a dominant focal point. However, due to the existing topography (see Appendix B, Figure B-5) between this viewpoint and the turbine, a majority of the turbine structure is screened at this distance. The presence of this turbine does not alter the agricultural character of the landscape. However, the overall contrast it creates is moderately strong, owing primarily to the sky conditions in the photo against the white color of the turbine blades.



**6011 Greenwich Windpark, LLC  
Viewpoint 5**

Noble Road at Heifner Road.  
Existing and with-project  
simulated views looking north.

## Viewpoint 6

### *Existing View*

This view is from the center of Reservoir Park in the Village of Greenwich located just south of US Route 224. The view is to the east, approximately 1.13 miles from the nearest turbine that would be visible in this view. In the immediate foreground of the view, a paved roadway extends diagonally from the lower left corner toward the right side of the view. A small wood utility pole and line are also visible. The center-view features an open, level, green lawn extending away from the viewer towards the park reservoir. A row of somewhat evenly spaced mixed evergreens forms the horizon across the view. This band of trees creates a strong horizontal buffer separating the park and reservoir from the residential structures located past the parks edge. The sky is expansive and mostly cloudy, with banks of white stratus or stratocumulus clouds, interrupted by a large patch of blue in the upper atmosphere.

### *Proposed Project*

With the proposed Project in place, this view provides unobstructed mid-ground views of four turbines, located at the center and right sides of the view. In this view, although the turbines would be readily visible and large in scale, they would be partially screened and appear generally in scale with the foreground elements in the view.



**6011 Greenwich Windpark, LLC  
Viewpoint 6**

Reservoir Park south of US Route 224.  
Existing and with-project  
simulated views looking east.

## Viewpoint 7

### *Existing View*

This view from the intersection of Plymouth East Road and Ninevah Road in Greenwich Township faces northwest and is approximately 0.95 miles from the nearest turbine that would be visible in this view. The foreground is dominated by the paved intersection, flanked by narrow wooden utility poles at regular intervals, with an open grass area extending into the lower right hand corner. A white farmhouse with agricultural buildings and a few small trees are located to the left. A mix of hardwoods and deciduous trees (some with their leaves, some without leaves) form the horizon across the view. The sky is expansive and mostly cloudy, with banks of white stratus or stratocumulus clouds, interrupted by a large patch of blue in the upper atmosphere. This view is representative of the view experienced by a typical passenger in a vehicle along a well-traveled intersection.

### *Proposed Project*

With the proposed Project in place, three turbines appear in the view. The two nearest turbines, at the center-right side of the view, appear to be located in close proximity to the row of trees. The proximity of these turbines to the view results in the turbines appearing out of scale with the existing structures and vegetation. However, the tree line absorbs the vertical lines of the turbines. The other turbine is located in the background of the view at the left side. This turbine is partially screened by the house, existing vegetation, and topography (Appendix B, Figure B-7). It appears to be generally in scale with the other elements of the view. Overall, the effect on this view is considered moderate only because of the perceived size of the two nearest turbines relative to the other elements in the view.



**6011 Greenwich Windpark, LLC  
Viewpoint 7**

Plymouth Road East and Ninevah Road.  
Existing and with-project  
simulated views looking northwest.

## Viewpoint 8

### *Existing View*

This view from Alpha Road just east of State Route 13 in Greenwich Township faces south and is approximately 0.8 miles from the nearest turbine that would be visible in this view. The foreground is dominated by an unpaved gravel driveway located in the center view. This gravel drive ends at the paved road, which extends along the horizon of the view. The focal point of the view is a ranch-style house at center. Small trees/shrubs, at the right and left sides of the view, act as bookends to the house. The sky is mostly overcast and gray in color, with streaks of white stratus clouds.

### *Proposed Project*

With the Project in place, seven total turbines are visible. Four turbines are immediately visible along the horizon within a one mile view. (These turbines are fairly uniform in their spacing.) Three additional turbines can be seen in the distance to the center left, center right, and right hand side of the view. Given the foreground of this view is completely open, the elevation change between the viewer and turbines (see Appendix B, Figure B-8), and the proximity of turbines to the viewpoint, the overall contrast they create is strong. However, the presence of the turbines does not alter the agricultural character of the landscape.



**6011 Greenwich Windpark, LLC  
Viewpoint 8**

Alpha Road east of State Route 13.  
Existing and with-project  
simulated views looking south.

## Viewpoint 9

### *Existing View*

This view from Plymouth Road East in Greenwich Township faces east and is approximately 0.67 miles from the nearest turbine that would be visible in this view. A rural roadway occupies the near foreground, extending beyond the horizon to exit the view along the right side. A line of wood utility poles line the right side of the road and whose receding size gives this view a strong sense of perspective depth. A larger overhead utility line runs perpendicular to the road. The silhouette of the top of a hill or ridge rises in the center-left side of the view. The open agricultural land on this rise is fairly uniform and featureless. The sky is mostly overcast and grayish-blue in color, with streaks of white stratus clouds.

### *Proposed Project*

With the Project in place, four total turbines are visible. Two turbines (located within one mile of the view) occupy the mid-ground in the center and right side of the view. Two additional turbines can be seen rising in the distance behind the hillcrest to the center left and left. Due to the foreground zone of this view being completely open and the proximity of turbines to the viewpoint, the nearby turbines would dominate the view. However, the vertical lines of the turbines echo the form and orderly spacing of other vertical elements in the view, such as the larger utility poles located along the hill/ridge. The presence of the turbines does not alter the agricultural character of the landscape.



**6011 Greenwich Windpark, LLC  
Viewpoint 9**

Plymouth Road East west of State Route 13.  
Existing and with-project  
simulated views looking east.

## Viewpoint 10

### *Existing View*

This view from US Route 250 south of Omega Road in Greenwich Township faces southwest and is approximately 0.5 mile from the nearest turbine that would be visible in this view. A rural roadway occupies the near foreground, crossing diagonally to exit the view on the left. A small retaining pond runs along the road's shoulder in the center foreground. A small house and agricultural building are located to the right of the view. Smaller size deciduous and evergreen trees line the left side and right side of the horizon in this view. The distant horizon is a low, even ridge that stretches across the entire view. The ridge is mostly in shadow, backlit by the blue of the afternoon sun. The upper half of the view is open sky, interrupted only by the utility line that runs parallel to the roadway. This view is representative of the view experienced by a typical passenger in a vehicle along a well-traveled state highway.

### *Proposed Project*

With the proposed Project in place, a total of 8 turbines can be counted in this view. One turbine (located within one mile of the view) is featured prominently in the center of the view. Three mid-sized turbines (located approximately 1.5 miles from the view) occupy the center view with another located in the right of the view. Three smaller turbines – which are located 2 miles from the view – are visible along the horizon (two in the center, one to the right). The proximity of the house and agricultural building to the turbines emphasizes their large size and scale contrast. Because the foreground zone of this view is open, the turbines would be fully visible, and would become important elements in the overall landscape composition. The presence of the turbines does not alter the agricultural character of the landscape.



**6011 Greenwich Windpark, LLC  
Viewpoint 10**

US Route 250 south of Omega Road.  
Existing and with-project  
simulated views looking southwest.

## **Appendix B. Topography Profiles**

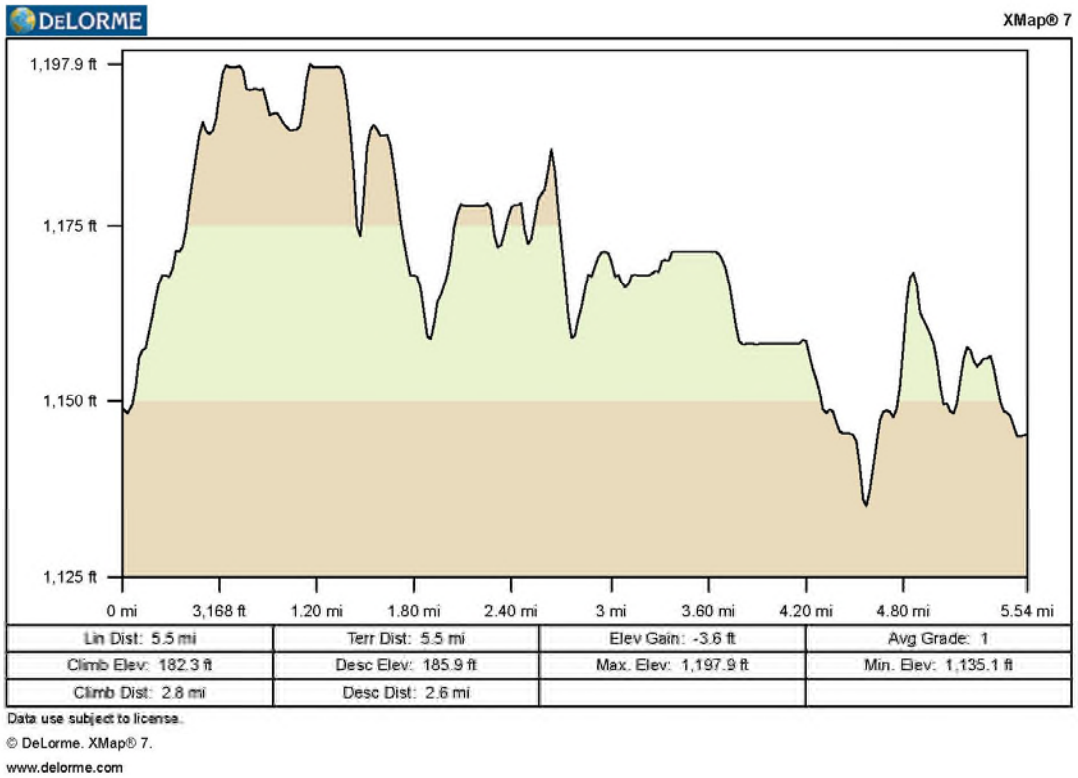


Figure B-1

## Topography Profile: Viewpoint 1 – State Route 13 south of Wharton Road

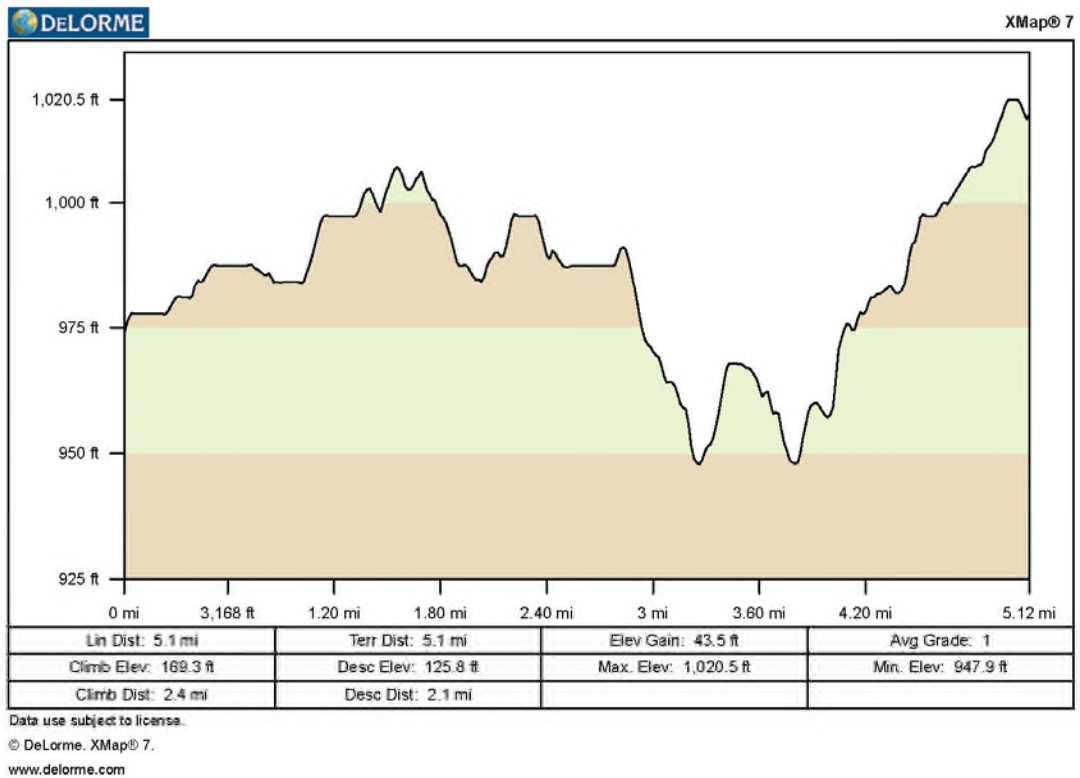


Figure B-2

## Topography Profile: Viewpoint 2 – US Route 250 at Rome-Greenwich Road

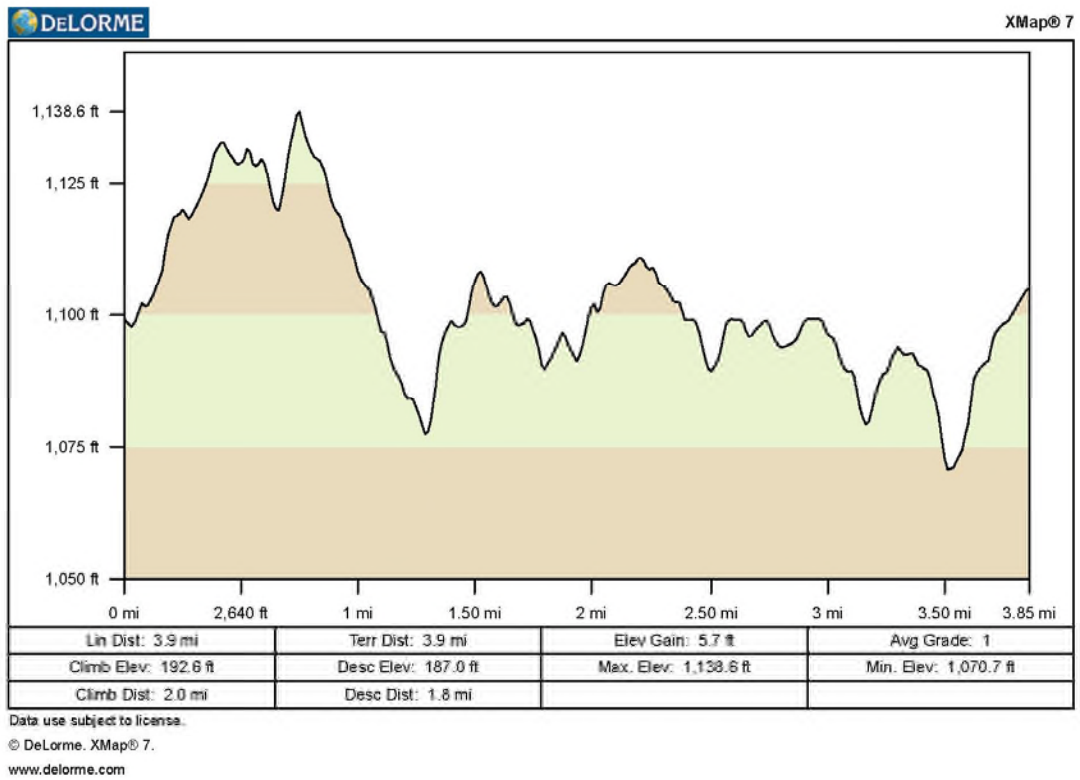


Figure B-3

### Topography Profile: Viewpoint 3 – Brenneman Road east of Village of Shiloh

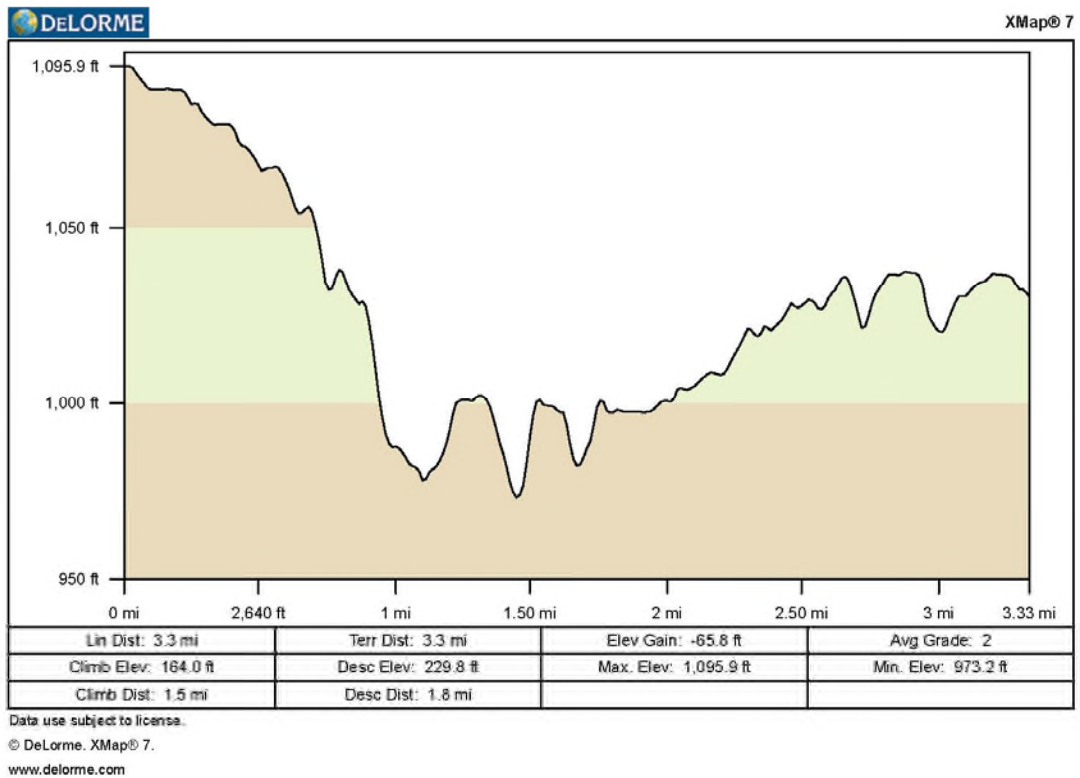


Figure B-4

### Topography Profile: Viewpoint 4 – US Route 224 and State Route 60

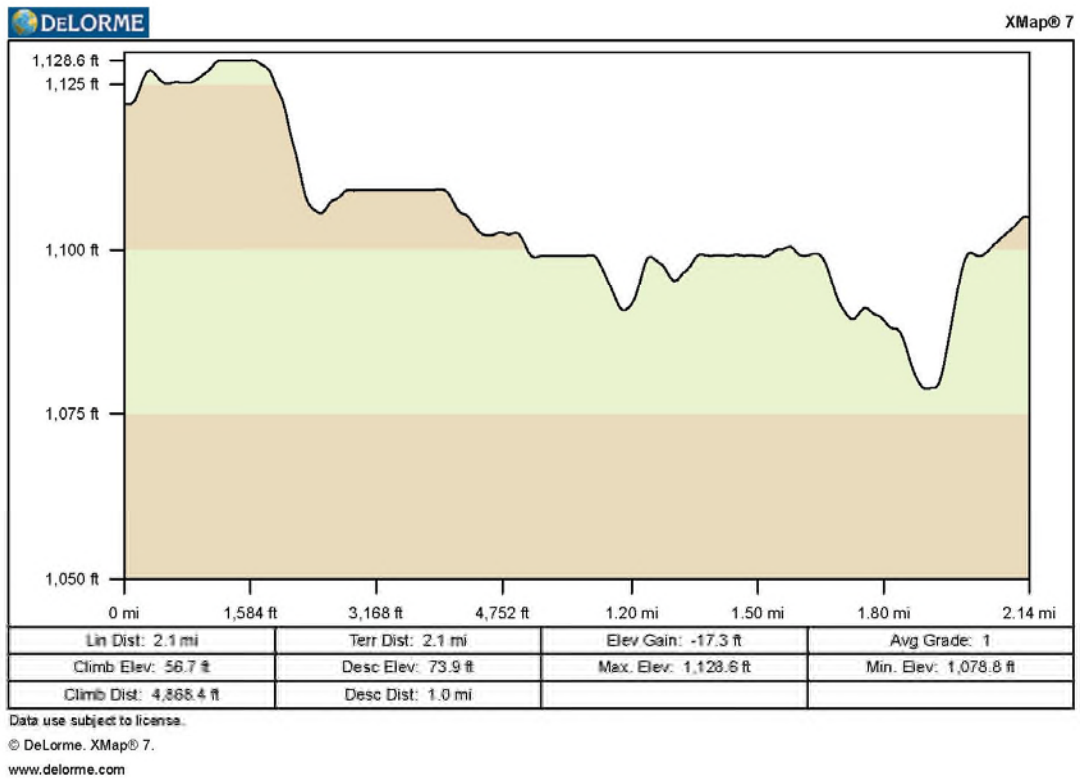


Figure B-5

## Topography Profile: Viewpoint 5 – Noble Road at Heifner Road

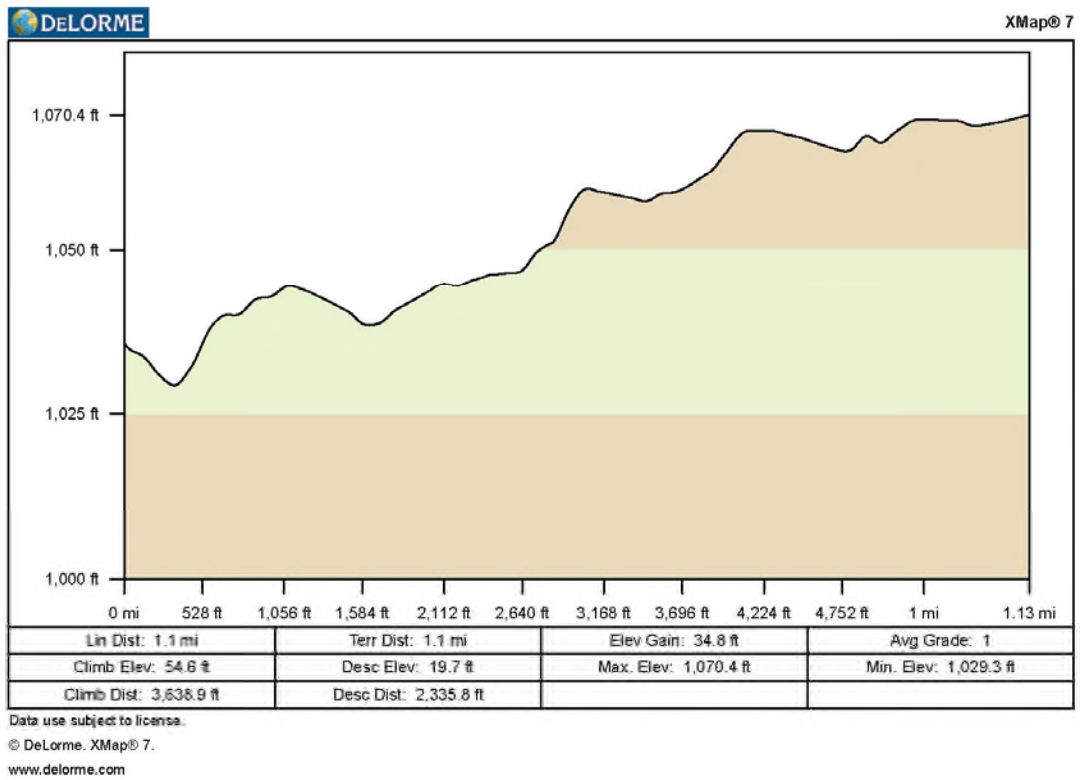


Figure B-6

### Topography Profile: Viewpoint 6 –Reservoir Park south of US Route 224

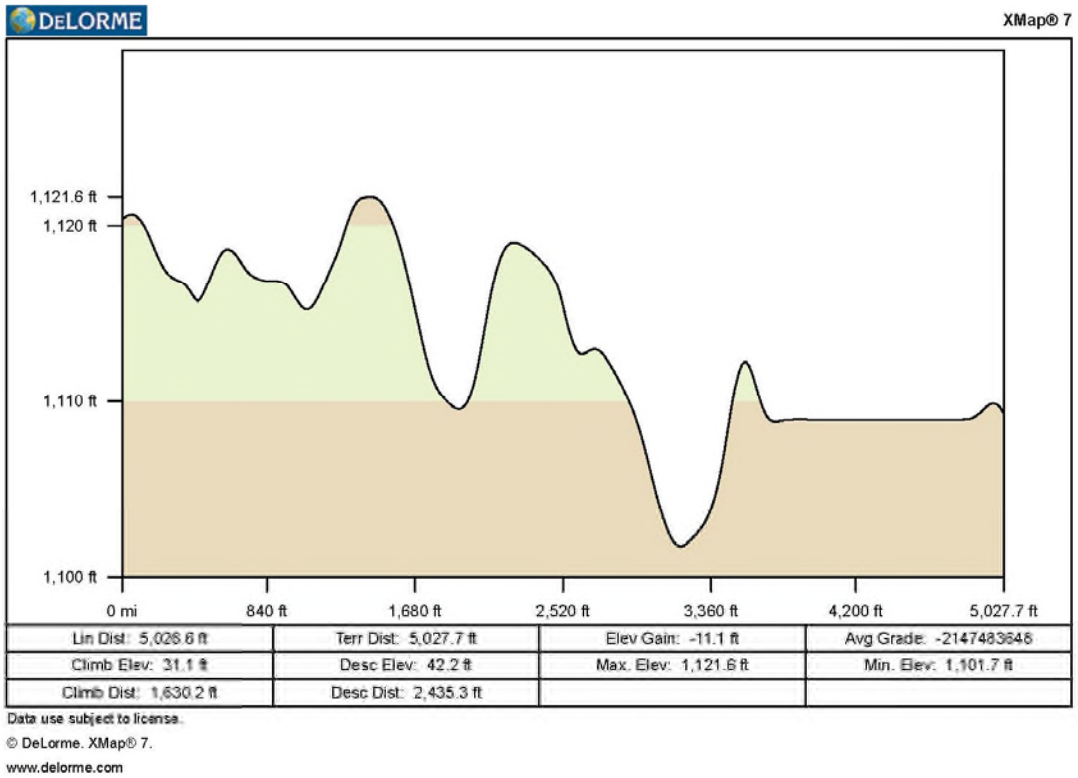


Figure B-7

### Topography Profile: Viewpoint 7 – Plymouth Road East and Ninevah Road

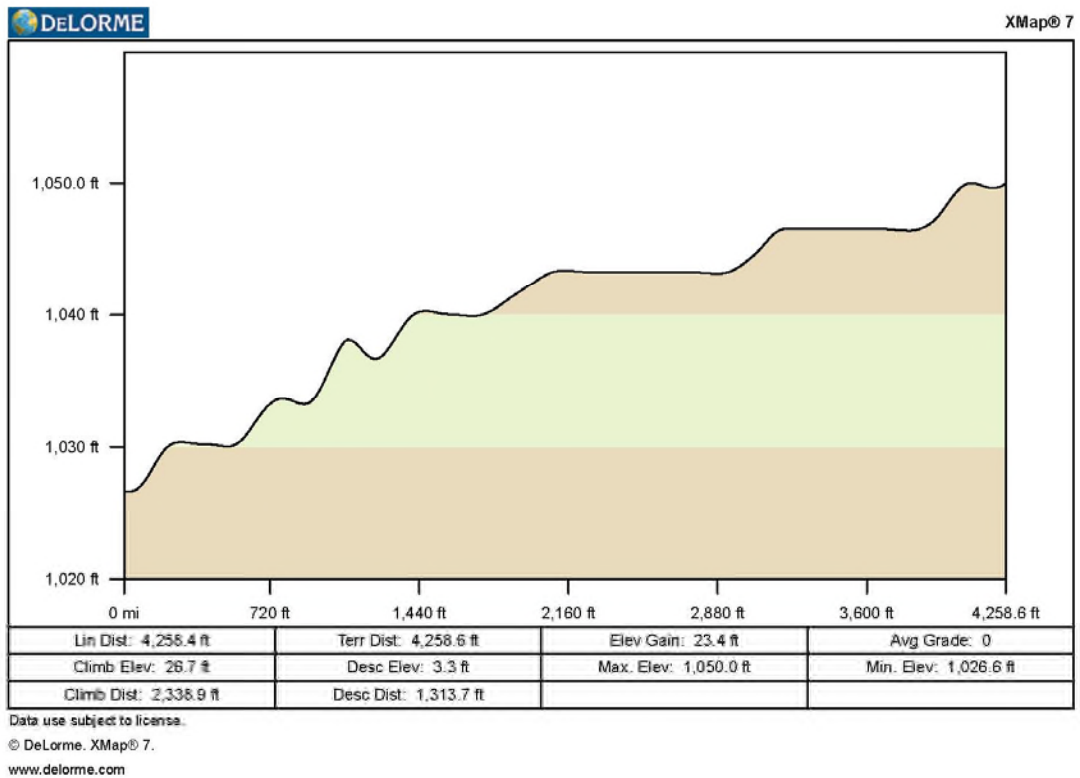


Figure B-8

### Topography Profile: Viewpoint 8 – Alpha Road east of State Route 13

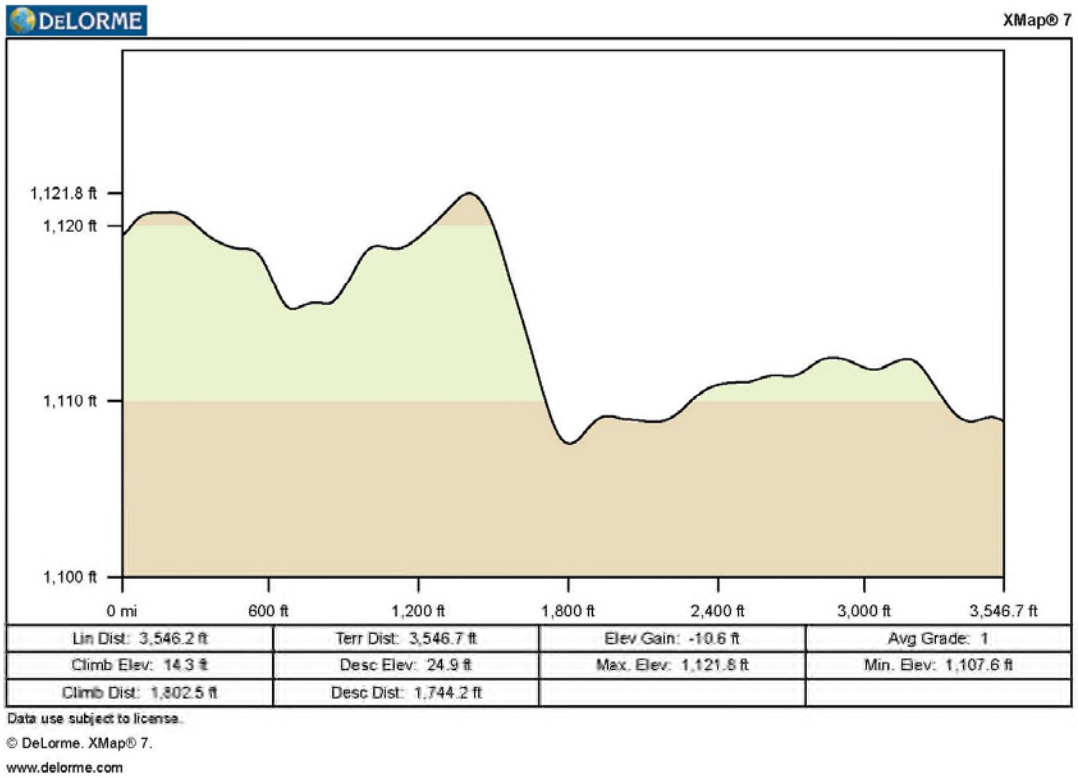


Figure B-9

### Topography Profile: Viewpoint 9 –Plymouth Road East west of State Route 13

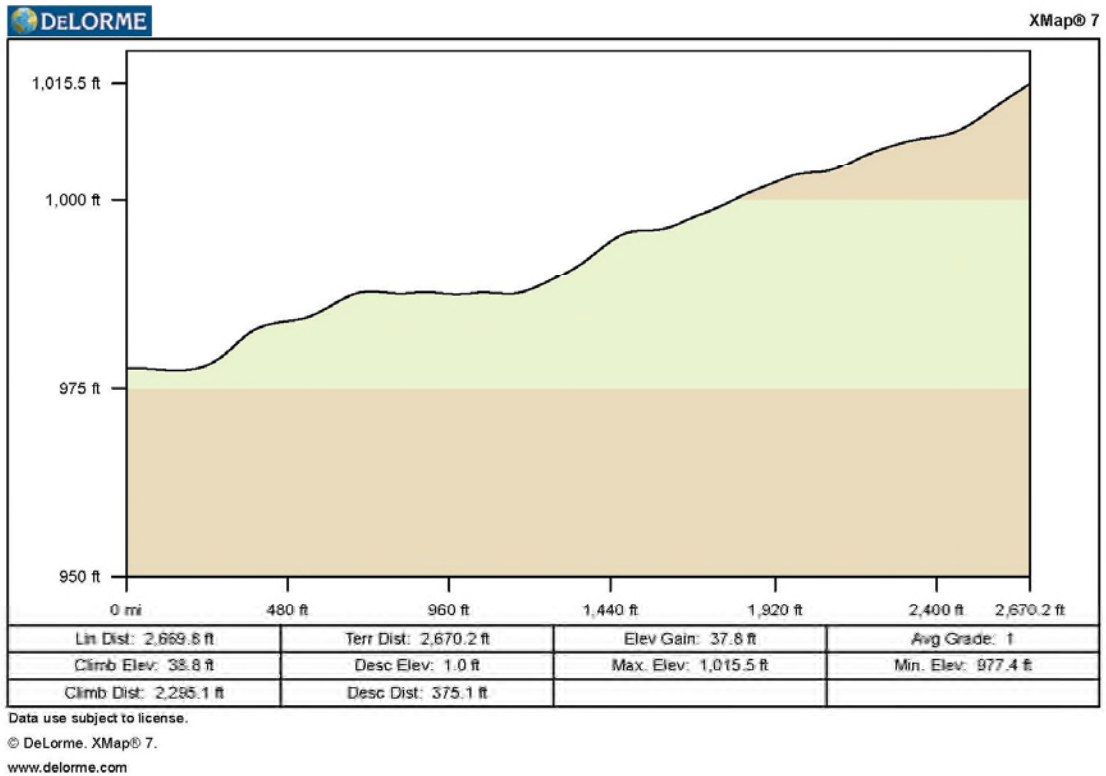


Figure B-10

## Topography Profile: Viewpoint 10 – US Route 250 south of Omega Road

**Exhibit R**  
**Turbine Safety Manual**

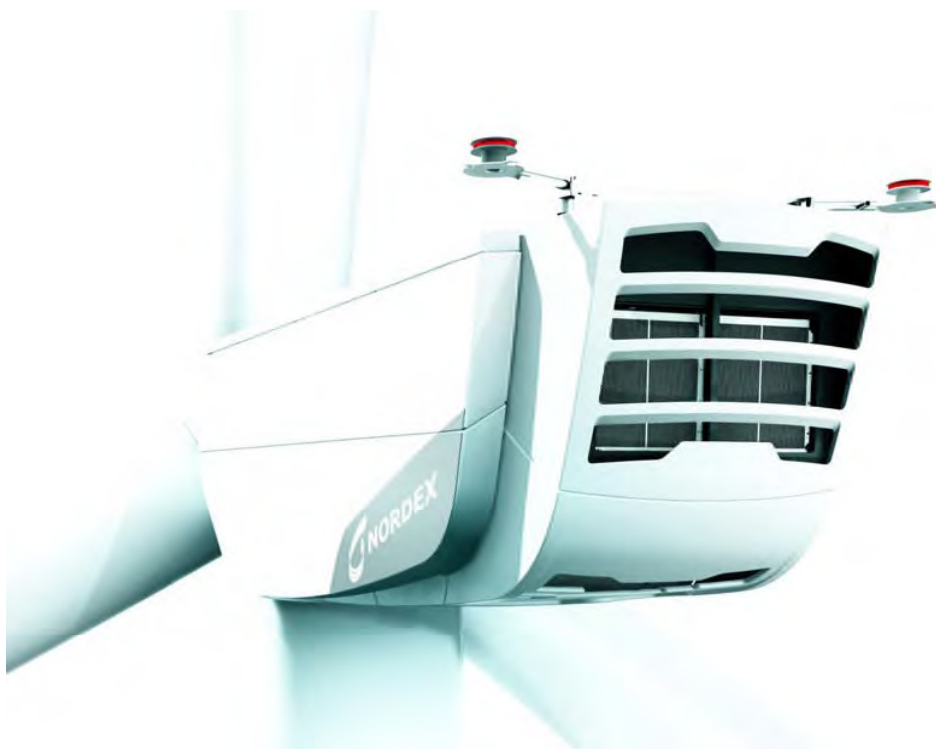
**6011 Greenwich Windpark, LLC**

**Safety Manual**

**Rules of Conduct on, in and around Wind Turbines**

**Turbine Classes K06, K07, K08**

**All Types**



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### **Technical modifications**

This documentation was created with greatest care taking into account the currently applicable standards.

However, due to continuous development, the figures, functional steps and technical data are subject to change without prior notice.

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# 1. Conventions

## 1.1 Symbols and notes

### 1.1.1 Hazard of personal injury



Failure to comply with the instructions and notes will result in life-threatening injury.

---



Failure to comply with the instructions and notes may result in serious injury.

---



Failure to comply with the instructions and notes will result in injury.

---

### 1.1.2 Warning of material damage



Warning of damage to components or material

---

### 1.1.3 Notes and information



#### NOTE

Additional information, notes and hints

---



#### OBSERVE DOCUMENT

Reference to information in other documents

---

### 1.1.4 Integrated safety notes and information

Information and safety notes integrated into the text. Indicated by the signal word in bold: Note, Notice, Caution, Warning.

Example

**Notice:** To prevent damage to the paintwork, the tower sections must not touch the ground.

## 1.2 Lists and work steps

- Work step
  - ▶ Result of a work step
- List
  - Subordinate list

## 1.3 Italic text

Identification of proper names: e. g. manufacturer names, document titles.

## 2. Introduction

This document is confidential and intended for the owner/operator, Nordex employees, and employees of contractual companies.

This document contains general regulations and notes for the safe and risk-free operation, as well as the execution of all necessary work steps for the erection, commissioning and maintenance/repair of a Nordex wind turbine (WT).

It applies to all turbine types of the classes K06, K07 and K08, see "Table: Overview of wind turbine classes and types".

Strict adherence to and observation of these regulations and notes prevent possible dangerous situations. For this reason, it is absolutely essential that all persons operating or working on a wind turbine read this document carefully, and act in accordance with the instructions and regulations.

The Safety Manual must be understood in order to ensure safety on and around the WT. If questions arise when reading this document, clarify them first and, if required, consult Nordex.

The respective specific safety notes in the technical documentation (which, for example, describe the operation or maintenance) must also be read and understood.

In addition, the current version of the Document *NX\_HS\_WI\_0002 Instructions for all Work Steps to be Performed in and on Wind Turbines (WT)* is binding for Nordex employees. The Document *NX\_HS\_0004* applies for employees of contractual companies.

The Chapters *Special features of K06 et seqq.* apply to trained, specialized personnel, such as service employees.

In the interest of their own safety, the owner/operator should only perform any operations in a hazardous situation (i.e., if they or a casualty must be rappelled out of the nacelle) or if they belong to the group of trained, specialized personnel.

**Table: Overview of wind turbine classes and types**

Turbine class	Type
K06	N54-Mk3/1000 N60/1300 N62/1300
K07 alpha	S70/1500 S77/1500 S82/1500
K07 beta	N70/1500 N77/1500 N82/1500

Turbine class	Type
K08 beta	N80/2500 N90/2300 N90/2500
K08 gamma	N80/2500 N90/2500 N100/2500 N117/2400

### 3. Abbreviations and terms

The following terms and abbreviations are defined in this document:

Term	Definition
Electrically instructed person	Persons with electrotechnical training are those who have been trained and, if necessary, taught by an electrician about the tasks assigned to the electrician and the possible dangers that could occur in cases of improper conduct. They are also instructed in the necessary protective equipment and protective measures.
Electrically skilled person	An electrically skilled person is a person who is able to appraise the work steps allocated to them and recognize possible dangers, due to their specialist training, knowledge and experience, as well as knowledge of the relevant regulations.
Expert for personal protective equipment against falling from a height	Expert for personal protective equipment against falling from a height is somebody who, on account of expert training and experience, has sufficient knowledge in the field of personal protective equipment against falling from a height and is familiar with the relevant occupational health and safety regulations, accident prevention regulations and generally accepted standards of technology to be able to evaluate whether or not a personal protective equipment against falling from a height is in a safe condition and is applied properly. In Germany, these requirements are fulfilled by anyone who has successfully participated in a training course, in accordance with the BG (Institution for Statutory Accident Insurance and Prevention) policy "Selection, training and proof of capability of experts for PPE against falling from a height" (BGG 906).
PPE	Personal protective equipment
Self-contained electrical operating site	Self-contained electrical operating sites are rooms or locations which are used solely to operate electrical turbines and are kept locked. Only electrically skilled and electrically instructed persons have access. Persons without electrotechnical training must only enter these rooms when supervised by electrically skilled persons.
Trained, specialized personnel	Trained, specialized personnel include those trained, instructed and authorized for the professional execution of work on wind turbines.
WT	Wind turbine

## 4. Safety regulations

### 4.1 Intended use

The WT is solely intended to convert the kinetic energy of the wind into electrical energy, and to feed this into an existing electricity network.

The WT must only be used for the intended purpose within the specified performance limits and operating conditions.

Usage outside of these parameters is not permitted.

The manufacturer accepts no liability for damage caused by improper use or failure to adhere to safety regulations.

### 4.2 General rules

Persons who want to enter, operate, or work on the WT must first have read and understood this Safety Manual and the Operating Instructions for the WT.

It is within the interest of your own safety and the safety of the WT to strictly adhere to the safety and operating instructions contained in these documents.



#### NOTE

The owner must ensure that this Safety Manual and the current Operating Instructions are always available in the WT and are in a usable condition.

#### 4.2.1 Basic occupational safety equipment

Persons who want to enter the WT must have the following basic occupational safety equipment:

- Working suit
- High safety shoes class S3
- Safety helmet
- Safety gloves

This equipment is compulsory for service employees.

Depending on the task in hand, service employees also require:

- 1 pair of safety glasses for work steps involving hydraulic tools
- 1 set of hearing protection, when noisy work is carried out in the tower or nacelle

The personal protective equipment (PPE) must also be used for the ascent in the tower using the vertical ladder or the service lift, or while staying in a fall hazard area, see Chapter 7.1 "Personal protective equipment (PPE)".

### 4.2.2 Access

The WT is classified as a self-contained electrical operating site.

For this reason, persons who want to enter the WT or must carry out work in or on the WT must meet special requirements.



Persons with pacemaker are not permitted to enter the turbine.

---



#### NOTE

The owner of the WT must take suitable measures (e.g. key authorizations) to ensure that unauthorized persons cannot access the WT.

---

The following persons are authorized to access the WT:

- Electrically skilled persons
- Electrically instructed persons

Persons without electrotechnical training must only enter the WT under the supervision of one of the aforementioned persons.

If the medium-voltage transformer is installed in the tower, then it is located in a separated, locked area, due to the high electrical voltage applied. This area must only be entered when de-energized, and by electrically skilled persons only.

### 4.2.3 Inside/around the WT

When inside the WT or in its direct proximity, safety helmet and high safety shoes must be worn.

All warning and safety signs in the WT and all operating instructions must be strictly followed.

While inside the WT, it must be ensured that unauthorized persons do not enter the WT. This is achieved by means of corresponding signs.

If more than one person is inside or around the WT, the tower door can be locked from inside.

However, prerequisite for this is that access for the emergency services is ensured in case of emergency, e.g., by visibly leaving a key to the turbine in the locked service vehicle.

Depending on the general weather conditions, observe changes to the weather when inside the WT for prolonged periods, particularly when working in the nacelle, as well as on and in the rotor hub.

This is necessary in order to take measures early enough to prevent dangerous situations caused by freshening wind or approaching thunderstorms.

Loose, long hair, loose clothing, or jewelry that may get caught or dragged into rotating parts are not permitted.

Smoking is not permitted in the WT.

#### 4.2.4 Operation

The WT has been designed, constructed and erected using state of the art technologies and in accordance with the relevant technical standards and regulations.

Despite this, incorrect usage can result in dangerous situations, which can put persons' health and lives, and the WT or other material assets at risk.

For this reason, the WT must only be operated:

- According to its intended use
- In technically sound condition
- In compliance with the operating and maintenance instructions

The owner/operator may only perform operator control actions on the WT after receiving expert instructions. These are restricted to starting and stopping the WT, and querying WT production data using the software provided by the manufacturer.

Individual components of the WT must only be manually operated by trained specialized personnel, who are trained, instructed and authorized for this purpose.

Operating personnel currently undergoing training must only work on the WT under the supervision of an experienced person. A successfully completed training must be confirmed in writing.

The WT is operated automatically. Operational faults are identified by the control system, and trigger respective error messages, right through to shutting down the WT. Faults must only be identified and rectified by trained, specialized personnel.

#### 4.2.5 Ascending to the nacelle



---

**NOTE**

Only persons who are physically capable and have a valid certificate for working at heights are permitted to ascend into the nacelle.

---

It is only permitted to enter the nacelle in the following conditions:

- 10-minute average wind speeds up to
  - 20 m/s for tubular towers
  - 12 m/s for lattice towers
- A second person is present

- Service lift and vertical ladder with fall arrest system are in sound condition (valid test badge or test certificate).

Before ascending into the nacelle:

- Inform the responsible Remote Monitoring
- Stop the WT and secure it against re-activation
- Disable remote access to the control system
- Put on the personal protective equipment (PPE)

### **Communication**

When ascending to the nacelle, at least one mobile communication device (two-way radio, cell phone) must be carried along in order to ensure communication with persons remaining on the ground and, in cases of emergency, with the emergency services.

If no further persons are remaining on the ground, a communication device, which is activated and secured against access by third parties, must be deposited in the tower base.

### **Using the service lift (option)**

If there is a service lift in the WT, the following applies:

- The service lift must be generally used for ascending and descending the tower. Only use the vertical ladder if the service lift is out of order.
- The service lift must only be operated by persons instructed in its operation
- It is not permitted to use the service lift and the vertical ladder at the same time, as this would endanger the person using the vertical ladder
- When using the service lift, it is obligatory to always secure yourself against falling from a height. For this purpose, the PPE must be used together with the attachment points in the service lift cage.

### **Vertical ladder**

The following rules apply when using the vertical ladder:

- Before using the vertical ladder, remove any loose objects from pockets in clothing and either leave these behind or secure them against falling out
- It is obligatory to always secure yourself against falling. For this purpose, use the PPE in connection with the fall arrest system

- Before and during the ascent, visually inspect the vertical ladder and fall arrest system for damage
  - If in any doubt, cancel the ascent, and, if necessary, also secure yourself on the ladder upright using the lanyard with energy absorber
  - Immediately inform the responsible service company and remote monitoring
- Only one person at a time is allowed on the vertical ladder in the area between two tower platforms
- If a tower platform has an access hatch, this must be closed immediately after passing through it

## **PPE**

Rules for using the PPE:

- Only use your own PPE
- All components of the PPE must have a valid test badge
- The PPE must be checked for damage before use
- A PPE that has been put under stress due to a fall must no longer be used, and must be inspected by an expert
- The PPE must be inspected regularly by an expert, at least once a year

### **4.2.6 Exiting the WT**

Owner and operator must restore the operational state of the WT before leaving it.

This means in particular:

- Inform Remote Monitoring of the intention to leave the WT
- For lattice towers:
  - Bring the service lift cage into the parked position
  - Deactivate the supply voltage to the service lift
- For towers with external ascent:
  - Attach the ladder guard and secure it with a lock
  - Store the key for the lock on the bracket for the PPE
- The PPE must be complete and properly stored in the correct place
- If the WT has been stopped manually, if necessary, restart the WT
- Log off on the turbine PC
- If necessary, re-establish remote access to the control system
- Switch off the lights

- Lock the door in the tower base (tubular tower) or of the transformer station (lattice tower)

The same applies to specialized personnel after completion of work on the WT.

The following must also be ensured:

- The rotor lock must be released and the rotor lock bolt secured
- The working rope and the chain for the on-board crane must be hauled in
- The jib for the on-board crane (K06 and K08 beta) must be in the parked position
- The chain bag of the on-board crane must be secured (K08 only)
- The nacelle roof (K06 and K08 beta) must be closed and secured
- The WT control system must be ready for operation
- Any contamination must be removed, and the WT must be cleared of tools and packaging

If specialized personnel intend to briefly leave the WT, although the work is not yet complete, the following must be ensured:

- Remote access to the WT control system is not possible
- The WT must be in a safe condition
- The nacelle roof (K06 and K08 beta) must be closed
- Unauthorized persons must not be able to access the WT

## **4.3 Additional safety regulations for specialized personnel**

### **4.3.1 General**

Work steps for erecting, commissioning, and maintaining the WT must only be performed by trained, specialized personnel.

During work in the WT, at least 2 employees must be on site at all times.

In addition, the generally accepted rules on safe and proper execution of work as well as the latest versions of the accident prevention regulations must be observed.

In all countries where turbines are erected the existing national regulations concerning accident prevention and environmental protection must be adhered to.

#### **Specialized personnel**

Specialized personnel working on the WT must:

- Regularly take part in rescue training and first-aid training

- Possess a valid certificate for working at heights

### **Safety equipment**

- Each employee must carry and use their own PPE.  
The PPE and, if applicable, the rappelling equipment provided in the WT are only intended for use by the owner.
- Hearing protection must be used when carrying out noisy work, particularly in the tower.  
When using hearing protection, it must be ensured that those persons present are able to communicate by using hand signals agreed in advance.
- In the case of work on the hydraulic or cooling system, an emergency eyewash bottle must be carried along.

### **Responsibility and communication**

- For the period of the completed work, the responsible employee is technically and disciplinary responsible for all subordinate employees.  
Before starting the work, he must instruct them in the safety regulations to be observed, and make sure that they are adhered to.
- The responsible employee must be familiar with the telephone numbers of the local rescue services and the power utility and keep them readily available.
- It must be ensured that all those involved are able to perfectly communicate at all times (if necessary, an interpreter must be used).  
An adequate number of two-way radios with uniform frequencies must be available. It must be checked whether or not the frequencies are permitted in the relevant countries where the turbines are erected.

### **Preventing re-activation and remote access**

- If parts of the WT or the entire WT are switched off during maintenance or repair work, these parts must be secured against automatic or accidental re-activation.



#### **WARNING**

#### **AUTOMATIC RESTART**

The WT may be at a standstill due to an error that occurred during idle mode (standby). If the error is no longer active, the WT will automatically restart.

Prior to starting work on the WT, perform a manual stop and disable remote access to the control system.

- 
- For individual turbines it may be necessary to remove the telephone plug from the telephone socket. In the case of a wind farm, the network plug must be removed in order to prevent remote access to the control system.

### Changing settings and repair work

- To ensure that the WT can operate correctly and safely, factory-set switching points on monitoring and control components (such as pressure monitoring devices, valves, throttles or control parameters) must only be changed for testing purposes.
- Once tests have been completed, the specified values must be reset immediately.
- Only use original spare parts from the manufacturer for repair work. It is prohibited to use parts from manufacturers that have not been expressly approved by the manufacturer of the WT.
- Any damaged machine components must be replaced. If this is not possible, the WT must remain disconnected.

### Disassembling safety devices

- If it is necessary to disassemble safety devices in order to execute work steps, these must be re-assembled directly after the work has been completed, and must then be checked for proper functioning.
- It is not permitted to permanently put safety devices out of service.

### Using the on-board crane

- Do not transport persons with the on-board crane.
- Do not stand or walk under suspended loads.
- When using the on-board crane, observe the safety notes in the respective chapter "Using the on-board crane".

## 4.3.2 Working in the separated transformer area



### NOTE

This section only applies to WTs with internal transformer.

If the medium-voltage transformer is installed in the tower, and if work must be executed in this specially separated area (e.g. maintenance work on foundation screw connections), the following special safety regulations apply:

- Before entering the separated, locked area of the transformer, an electrically skilled person with switching authorization must disconnect this area, including the supply cables of the medium-voltage cables (ring cable), observing the five safety rules.
- Only electrically skilled persons with a valid switching authorization for the medium-voltage switchgear for the corresponding voltage level are

authorized to enter the transformer area. Other persons are only permitted to work in this area under their supervision.

- While in the transformer area, the escape route must be kept free at all times. If the WT has a service lift, it must be parked on the next highest platform.

Once the work steps in the transformer area have been carried out, the switch-authorized electrically skilled person must check whether everyone has left the area and that all objects brought into the area have been removed again.

Only after this check, the entire system, including the medium-voltage cables, must be connected again.

### 4.3.3 Using the vertical ladder during erection

During erection, it may occur that the fall arrest system is not yet available, or has not yet been released for use.

If the vertical ladder must still be used, then special rules of conduct must be adhered to:

- A sign on the vertical ladder must explicitly indicate that the fall arrest system is not yet available, and that the person ascending the vertical ladder must be secured against falling using the lanyard with energy absorber
- Always safeguard yourself against falling by alternately attaching the two ends of the lanyard with energy absorber to the ladder uprights

### 4.3.4 Work in the nacelle

#### Permissible wind speeds

Depending on the situation in the nacelle, work in the nacelle is only permitted up to the following wind speeds:

Situation in the nacelle	Permissible wind speed 10-minute average/3-second average [m/s]			
	K08 gamma	K08 beta	K07 alpha beta	K06
Drive train completely enclosed, rotor not locked	20/26	20/26	20/26	20/26
Rotor locked on the rotor shaft	12/17	12/17	12/17	12/17
Drive train not completely enclosed, rotor locked on the brake disk or by the rotor brake	9/12	12/17	12/17	12/17

To be able to keep the above-mentioned conditions the Service technician has to monitor the developing weather conditions and, if necessary, repeatedly check the wind speed.

### **After entering the nacelle**

Immediately after entering the nacelle, the following initial tasks must be carried out prior to performing any maintenance or repair work:

- Switch the service switch on the manual control unit of the Topbox to service mode
- Close the access hatch
- Close the shut-off valve if the nacelle is equipped with an automatic fire extinguishing system with a shut-off valve
- Transport the rappelling equipment, which must be carried in the service vehicle, into the nacelle and deposit it ready-for-use in cases of emergency

To ensure personal safety on WT's with a drive train that is not completely enclosed, the following is required:

- Ensure that the rotor brake is applied and cannot be released by the control system
- Lock the rotor on the rotor shaft

### **Work on the drive train**

For any work on the drive train, the rotor must always be locked on the rotor shaft. The rotor must only be locked with the rotor lock on the brake disk or with the rotor brake if required for completing certain work steps.

The rotor lock on the brake disk must only be used under certain conditions, for K08 beta see Chapter 14.2.2 "Rotor lock on the brake disk" and for K08 gamma see Chapter 15.2.2 "Rotor lock on the brake disk".

### **Using the rotor brake**

When using the rotor brake, please observe that the full holding torque is only reached 25 s after actuating the rotor brake.

### **Error in the pitch system**

In the case of an error in the pitch system, i.e. not all rotor blades are in the 90° position, this error must be rectified before starting any work on the drive train.

### **Working with the roof open**

When working with the roof open, all employees in a fall hazard area must secure themselves at one of the marked attachment points in the nacelle or at the safety rope system, using the lanyard with energy absorber.

There is a fall hazard in the following areas:

- The side of the drive train which faces the open roof edge
- The front and rear end of the nacelle

It is not permitted to leave the WT with the roof open.

### **Working on the roof**

When working on the roof, the employee must be attached to one of the marked personal attachment points using a lanyard with energy absorber.

### **Working alone in the nacelle**

If a person is working alone in the nacelle, they must remain in regular verbal or visual contact with one of the other employees.

### **Staying in the nacelle with the WT in operation**

If it is necessary to stay in the nacelle with the WT in operation, in order to complete certain work steps (e.g., for test runs), the following rules must be observed:

- The access hatch to the nacelle must be closed
- All protective covers over rotating parts must be in place, unless they must be removed in order to complete the work steps
- The working rope and the chain for the on-board crane must be hauled in
- The jib for the on-board crane (K08 beta and K06) must be in the parked position
- The roof must be closed
- The safety harness with lanyards must be taken off
- Tight work clothes must be worn
- Everyone must be in a safe position
- Hearing protection must be worn and reliable communication between the present persons must be ensured

## **4.3.5 Work on and in the rotor hub**

It is only permitted to access the rotor hub and perform work on or in the rotor hub if:

- The 10-minute average wind speed is less than 12 m/s
- The rotor is locked on the rotor shaft
- Additionally, the rotor brake is applied
- Another employee is in the nacelle, who can operate the WT control system

- Both persons are equipped with a mobile communication device

If the rotor hub is accessed from the outside by crossing the hub (WTs of turbine class K06 and K08), the corresponding instructions must be strictly adhered to, see Chapter 11.5 "Entering the rotor hub", see Chapter 14.5 "Entering the rotor hub", and see Chapter 15.3 "Entering the rotor hub".

**WARNING****ROTATING PARTS**

Directly after climbing into the rotor hub, disconnect the pitch drives, if applicable.

If the work to be performed does not allow this, ensure that no body parts, clothing or harness parts come into contact with the slewing bearings and pinions of the pitch system.

#### 4.3.6 Work on the electrical system

Work on the electrical system in the WT must only be performed by electrically skilled and electrically instructed persons.

**DANGER****HAZARDOUS VOLTAGE**

Potentially lethal voltage in some parts of the WT switch cabinets. Any contact with live parts may cause fatal injury.

**DANGER****HAZARDOUS VOLTAGE**

If the transformer is located in the tower of the WT, there is a potentially lethal high voltage in its immediate vicinity. Even approaching a live part may cause a fatal voltage flashover.

Always disconnect the transformer before entering the separated area.

Special regulations apply for work in this area of the tower base, see Chapter 4.3.2 "Working in the separated transformer area".

Work on medium-voltage switchgears must only be performed by electricians with a valid switching authorization.

Electrical equipment on which inspection, maintenance and repair work must be performed, must be disconnected.

In the process, the 5 safety rules must be observed:

- Disconnect completely
- Secure against reconnection

- Verify that the installation is dead
- Ground and short-circuit
- Provide protection against adjacent live parts

To verify whether all components are dead, use two-pole voltage testers according to EN 61243-3 (IEC 61243-3). Devices that comply with this standard (not equipped for current measurement) prevent the development of arc short-circuits.

Only electrically skilled persons with switching authorization are permitted to measure voltages on converters/converter cabinets of WTs up to 1500 V DC and to verify that they are dead. These operations must only be performed while wearing complete and suitable PPE (helmet with face protection, insulating gloves, insulating jacket, and insulating mat), which is mandatory for persons with switching authorization.

Always keep the electrical switch cabinets locked. Only authorized persons who are in the possession of a key or special tools are authorized to access these switch cabinets.

It is prohibited to perform any work on live parts or cables. The only exception is troubleshooting performed by specialized personnel with suitable measuring devices.

Never clean electrical equipment with water or similar liquids.

#### **4.3.7 Work on the hydraulic system and with hydraulic tools**

Any work on the hydraulic system of the WT must only be performed by trained specialized personnel.

Before starting any work, all hydraulic parts of the turbine, including any accumulators, must be depressurized. The hydraulic pump must be secured against automatic re-activation.

Make sure everything is kept scrupulously clean and prevent dirt and water from entering the system when performing work on the hydraulic system.

Always wear safety glasses when working with hydraulic tools (e.g., hydraulic preloading of screw connections).

### 4.3.8 Dealing with hazardous substances and environmental protection

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#### **OBSERVE MANUFACTURER'S INSTRUCTIONS**

When handling hazardous substances such as oils, greases, coolants, or cleaning fluids, observe the manufacturer's safety instructions applying to the product.

The responsible employee must carry the safety instructions and instructions for using the applied hazardous substances with them.

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Any work that is performed on the wind turbine must comply to the regulations of waste avoidance and of proper waste treatment and waste disposal.

Especially, make sure that substances hazardous to ground water, such as greases, oils, coolants and solvent-based cleaning fluids, cannot penetrate into the ground, into waters or into the sewage system. These substances must be collected, stored, transported, and disposed of in suitable containers.

Remove any oil leaks without delay in order to avoid the risk of slipping and the possible destruction of the concrete foundations.

Determine and eliminate the cause of abnormal leaks.

If this is not possible, the WT must be shut down.

### 4.3.9 Regulations for crane work

#### **General**

The regulations for crane work may be different from one country to another. The responsible employee must find out about country-specific regulations before starting the work, and must inform subordinate employees about these regulations in writing.

A contact person who is familiar with these regulations must be available for consultation.

#### **Regulations on lifting components**

Only suitable, approved and certified lifting tackles with sufficient load capacity must be used to hoist components.

In order to prevent uncontrolled pendular movements when lifting loads with two cranes, always lift the load with only one crane first, and position the crane hook directly above the lifting tackle before lifting.

No one must stand or walk under the suspended load.

All individuals must maintain an adequate safety distance from suspended loads to prevent injuries from falling objects.

**NOTE**

Special work under suspended loads, which cannot be completed in a different way, is only permitted at the express instruction of a defined responsible person.

Prerequisite for this is a clear agreement with the crane operators and a safety person.

**Weather conditions**

During thunderstorms, all crane work must be stopped due to a risk of lightning striking the crane or a component.

Consult the crane operator to determine the maximum wind speed at which crane work is possible.

The limit wind speed for crane work depends on the type of crane, the design of the crane and the wind conditions.

The crane operator is fully responsible during all crane work.

The responsible employee and the crane operator mutually agree when crane work must be stopped due to the wind conditions and when they can be resumed.

## 4.4 Special obligations of the owner

The owner is particularly responsible for ensuring a high degree of safety when operating the WT and while persons are inside the WT.

In particular, the owner must ensure that:

- Only authorized persons have access to the WT, e.g., by means of an appropriate key concept. If no authorized persons are in the WT, it must be kept locked
- The PPE in the WT or the wind farm is carefully stored
- In a wind farm where not all WTs are equipped with a PPE, suitable information on the storage location of the PPEs available in the wind farm is provided in all WTs
- This document and all others stored in the WT by the manufacturer (e.g., the Operating Instructions for the WT and circuit diagrams) are always available in the WT and are in a usable condition
- The signs on and in the WT are in a proper condition, and are replaced, if necessary
- The work steps required for WT maintenance are organized and executed on time and in accordance with the manufacturer's specifications

- A specific safety concept has been developed and implemented for themselves and any accompanying person in the WT, which is used particularly in case of emergencies
- The WT is stopped as soon as there is a risk of icing, and is only restarted when there is no risk of ice throw

### **Inspections of special equipment**

Depending on the country in which the WTs are erected, there are specific, periodic inspection obligations for WT safety equipment, various safety devices and turbine components.

These inspections are not part of the standard maintenance work and must be performed by special experts.

The owner is responsible for organizing these inspections and for checking the proper and timely execution.

These special inspections apply to:

- The owner's PPE
- The rappelling equipment stored in the WT
- The fall arrest system for the vertical ladder
- Specific pressure tanks of the hydraulic system
- The service lift
- The on-board crane
- The fire extinguishers and, if available, the automatic fire alarm and fire extinguishing system
- The first-aid kits

Detailed specifications, including inspection periods, are included in the Maintenance Report.

## 5. Warning and safety notes inside the WT

Corresponding signs inside the WT provide warnings about possible dangerous situations, see "Table: WT signs".







Furthermore, signs containing operating notes and rules of conduct are attached to various turbine components. These must be observed at all times.



### NOTE

The owner is responsible for ensuring that the signs in and on the WT are in a usable condition and are replaced, if necessary.

**Table: WT signs**

Sign/symbol	Meaning
	Warning of a falling or slip hazard
	Warning of a crushing hazard
	Warning of hazardous voltage
	Do not step here
	First-aid kit
	Fire extinguisher

## 6. Residual risks

Nordex WT's comply with the state of the art technology and have high safety standards.

Despite this, certain risks remain when the WT is operated, and particularly when performing maintenance work in and on a WT.

### **Slip hazard due to ice**

In icy conditions, there is an increased risk of slipping when approaching the WT, and particularly when using the external staircase.

In this weather conditions, watch your step accordingly when approaching the WT or take actions to avoid slipping on iced floor.

### **Ice throw**

The primary residual risk when operating the WT is the risk of ice throw during the cold season.

If there is a risk of icing, the owner must ensure that the WT is stopped. It must only be restarted when the owner/operator has assured himself on site that there is no longer a risk of ice throw.

If there is a risk of ice throw, take particular caution when approaching the WT. In particular, avoid standing or walking below the rotor blades.

For this reason, particularly in locations with an increased risk of icing, it is advisable to equip the WT with an ice sensor, which is optionally available.

In this case, the control system stops the WT automatically when detecting any signs of icing on the ice sensor. However, proceed in the same way as described above when restarting the WT.

### **Falling objects**

When working at heights, objects may be dropped accidentally.

For this reason, it is prohibited to stand or walk underneath persons working at heights.

### **Falling into the safety harness**

When working at heights, persons may fall into the safety harness, despite adhering to all rules of conduct.

In this case, a quick rescue is necessary in order to prevent the risk of a suspension trauma and any associated health risks for the person affected.

### **Tripping and slipping**

There is an increased risk of tripping, especially in the nacelle and the rotor hub, due to the different height and width of steps, as well as the limited space.

Minor leaks, grease or climatic influences may also cause a risk of slipping.

For this reason, particular caution is advised while staying and moving in the WT.

## 7. Safety equipment

The WT is equipped with various pieces of safety equipment to ensure safety when inside the WT.



### NOTE

The safety equipment must be regularly inspected by an expert in accordance with the manufacturer's specifications.

For safety equipment that is permanently stored in the WT, the owner of the WT is responsible for completing these inspections.

### 7.1 Personal protective equipment (PPE)

Next to the standard protective clothing, which includes at least high safety shoes, safety gloves and a safety helmet, personal protective equipment (PPE) is required, particularly when using the vertical ladder.

It protects against falling while standing or walking in a fall hazard area.

The PPE for the owner and one accompanying person can be provided by Nordex.



### NOTE

The scope of supply of the PPE depends on the applicable contract.

If the supply of PPEs has been agreed to contractually, the owner is obliged to carefully store the PPE.

In a wind farm where not all WTs are equipped with a PPE, the owner must provide suitable information on the storage location of the PPEs available in the wind farm in all WTs.

#### 7.1.1 Inspection/maintenance

The PPE must be checked once a year by an expert.

The owner is solely responsible for organizing and monitoring the inspection of the owner's PPE, see Chapter 4.4 "Special obligations of the owner".

#### 7.1.2 Components of the PPE

The PPE for trained, specialized personnel consists of the following parts:

- 1 fall arrester
- 1 lanyard with energy absorber (Y-lanyard)
- 1 fall arrester, permitted for use with the respective fall arrest system in the tower

- 1 adjustable work-positioning lanyard
- 1 hub rope
- 1 head torch

In EU member states, the PPE must comply with the standards EN 361 (safety harnesses), EN 353-1 (fall arrest systems) and EN 354 (lanyards).

The scope of the PPE available for the owner depends on the applicable contract. The minimum equipment for ascending into the nacelle consists of safety harness, Y-lanyard and fall arrester for the respective fall arrest system in the tower.

### Safety harness

The safety harness has an abdominal lug for attaching the fall arrester in the middle of the abdominal strap, and a dorsal lug (e.g., for rescue purposes), see Fig.1.

The two lateral lugs of the abdominal strap can be used, for example, for an equipment bag.

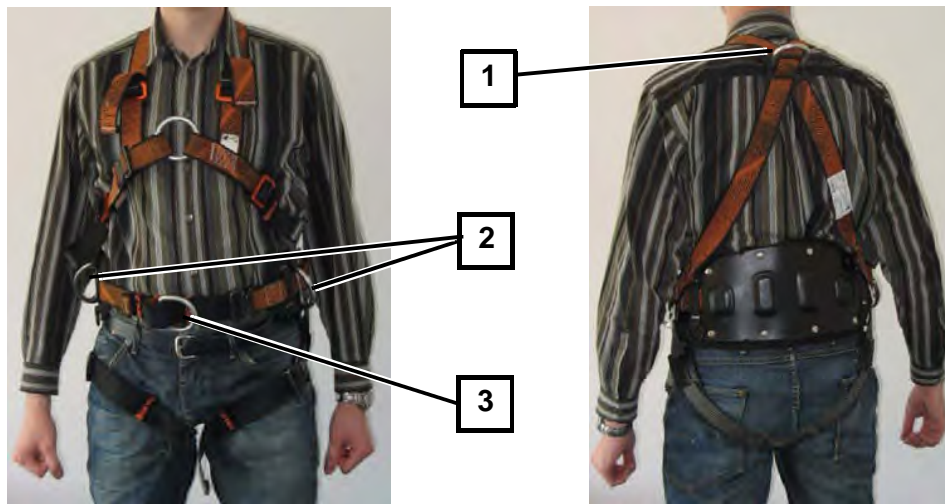


Fig. 1 Safety harness (example)

- 1 Dorsal lug
- 2 Lateral lugs
- 3 Abdominal lug on abdominal strap

### Lanyard with energy absorber ("Y-lanyard")

The lanyard with energy absorber serves for safeguarding at a fixed attachment point, for example when there is a fall hazard during a change of location.

The lanyard with energy absorber has 2 large snap hooks for attaching to an attachment point, and 1 small snap hook for hooking into the dorsal lug on the backplate of the safety harness, see Fig.2.

The energy absorber behind the small snap hook ensures that the fall of a person is arrested smoothly.



Fig. 2 *Lanyard with energy absorber*

### **Adjustable work-positioning lanyard (Service only)**

A further piece of safety equipment is required in order to secure yourself in awkward positions where there is a fall hazard. This also ensures to have both hands free for performing the necessary work.

An adjustable safety rope with flexible edge protection is provided for this purpose, see Fig.3.

The adjustable work-positioning lanyard is attached to the lateral lugs on the safety harness.



Fig. 3 *Adjustable work-positioning lanyard with flexible edge protection*

### **Hub rope, including accessories**

In the case of WTs of turbine classes K08 and K06, use the hub rope with its accessories as additional safety equipment to secure yourself when climbing into the rotor hub, see Fig.4.

The hub rope is a fall arrester on a moveable guide with flexible edge protection and a length of 10 m. It must be stored together with the webbing sling in an equipment bag.

For more information on the handling, see Chapter 11.5.1 "Attaching the hub rope" for WT's of the K06 turbine class and see Chapter 14.5.1 "Attaching the hub rope" for WT's of the K08 turbine class.



Fig. 4 Hub rope, including accessories

- A Hub rope
- B Storage bag
- C Webbing sling

### 7.1.3 Handling the safety harness



#### NOTE

The handling of the PPE is explained here with an example.  
In principle, the same procedure also applies to other versions of the safety harness.

- Attach the lanyard with energy absorber to the dorsal lug at the backplate of the safety harness using the small snap hook and secure it
- Attach the large snap hooks to the lateral lugs on the left and right side
- Put on the safety harness like a jacket
- Pull the right chest strap through the chest lug and lock it into the buckle

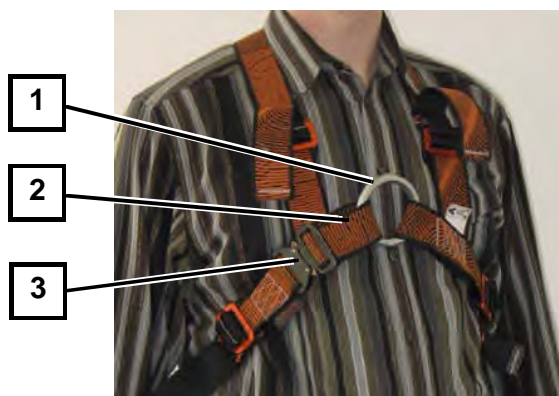


Fig. 5 Fastened safety harness (example)

- 1 Chest lug
- 2 Right chest strap
- 3 Chest strap buckle

- Fasten the abdominal strap
- Guide the leg straps through the legs from behind and lock them into the lateral buckles



Fig. 6 Fastened safety harness (example)

- 1 Abdominal strap buckle
- 2 Leg strap buckle

- Pull all straps tight so that the safety harness fits tightly around the body



#### NOTE

Rule of thumb for correct strap tension:  
A flat hand may fit between strap and body, but not a fist.

## 7.2 Rappelling equipment



### NOTE

For handling the rappelling equipment, see Chapter 9.7 "Leaving the nacelle in hazardous situations (rappelling)"

If the service lift or the vertical ladder with the fall arrest system cannot be used for descending from the nacelle, the nacelle can only be exited by rappelling to the ground.

For the owner of the WT, the rappelling equipment required for this purpose is provided in sealed packaging inside a sealed aluminum box. The storage location of the rappelling equipment is different for the individual turbine classes.

### Turbine classes K06 and K07

The rappelling equipment is located on the top platform of the tower, tied down with a strap.

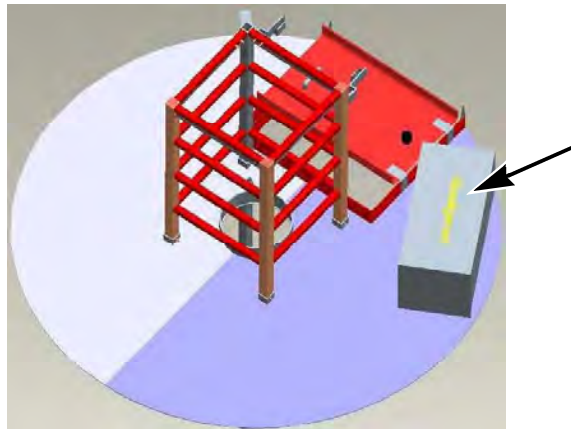
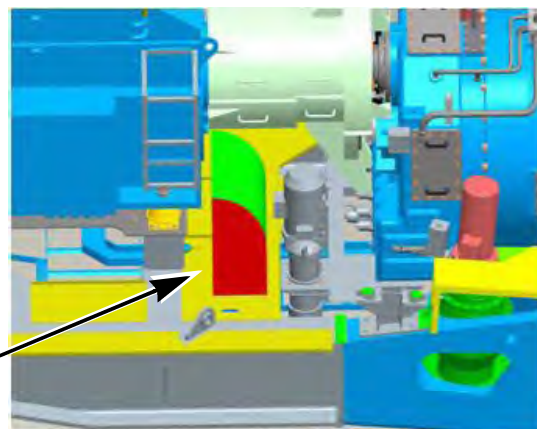


Fig. 7 Position of the rappelling equipment on WTs of turbine class K06/K07

### Turbine class K08 beta

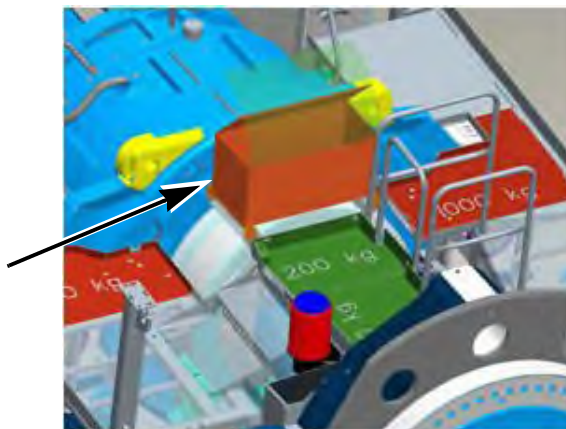
So far, the rappelling equipment was located in the same location as in WTs of turbine class K06 and K07. If the WT has already been retrofitted, the rappelling equipment is now located in the nacelle between generator and gearbox next to the shaft, tied down with a strap.



*Fig. 8 Position of the rappelling equipment in the K08 beta nacelle*

### **Turbine class K08 gamma**

The rappelling equipment is located in the nacelle on top of the rotor shaft cover between rotor bearing and gearbox, tied down with a strap.



*Fig. 9 Position of the rappelling equipment in the K08 gamma nacelle*

Service employees must carry their own rappelling equipment in the service vehicle. Except for the aluminum box, this consists of the same components as the rappelling equipment for the owner of the WT.

## **7.2.1 Equipment/accessories**

The rappelling equipment consists of a transport bag, the descender with a rope corresponding to the tower height, and a 1.5 m work-positioning lanyard for attaching the descender, see Fig.10.

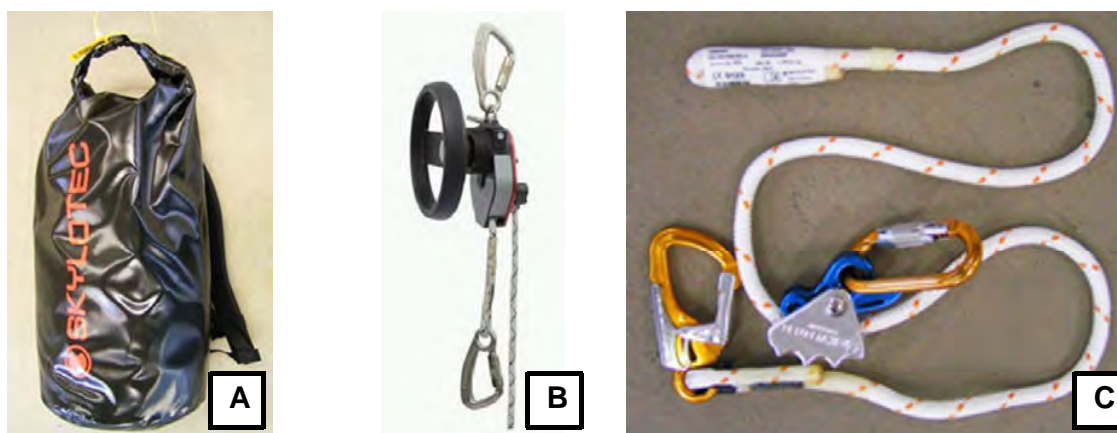


Fig. 10 Main components of the rappelling equipment

- A Transport bag
- B Descender
- C Work-positioning lanyard

The rappelling equipment also contains the following accessories:

- 1 edge protection for WTs (K06 and K08) for guiding the rope over the edge of the nacelle wall, see Fig.11
- 2 snap hooks and 1 rope clamp as alternative lifting tackles, see Fig.11.

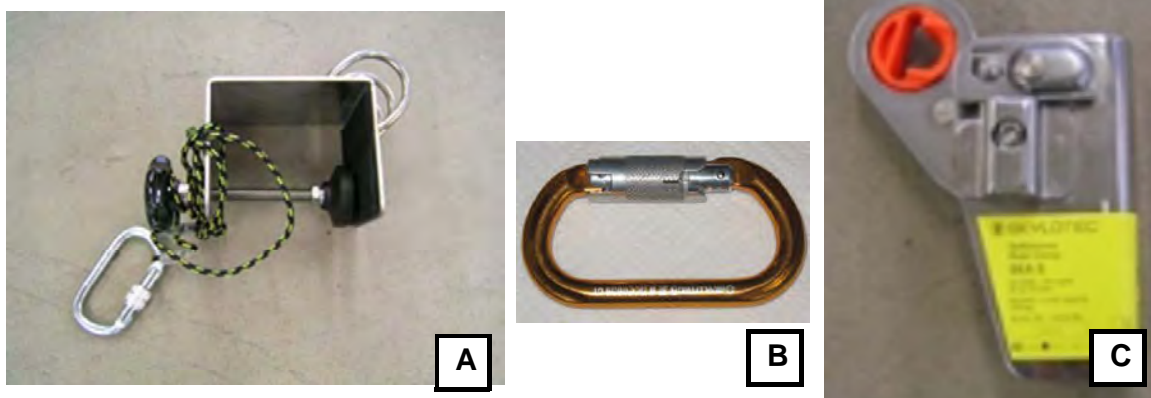


Fig. 11 Accessories for rappelling equipment

- A Edge protection (K06 and K08)
- B Snap hook (2x, similar to photo)
- C Rope clamp

Individual pieces of equipment may differ, e.g., a webbing sling for attachment instead of a work-positioning lanyard.

## 7.2.2 Inspection/maintenance

The rappelling equipment must be inspected by an expert once a year, in accordance with the manufacturer's instructions.

**NOTE**

The WT owner is solely responsible for organizing and checking these inspections, see Chapter 4.4 "Special obligations of the owner".

## 7.3 Fire extinguisher

At least two fire extinguishers are available in the WT for quickly fighting incipient fires:

- One in the tower base, next to the door
- One in the nacelle

These are ABC powder fire extinguishers, which are used to extinguish burning solids and liquids, as well as fires in electrical systems of up to 1000 V.

The WT can also be optionally equipped with a fire alarm and a fire extinguishing system.

## 7.4 First-aid kit

Generally, there are two first-aid kits in the WT for treating injuries:

- One in the tower base, next to the door
- One in the nacelle, either on the nacelle wall (turbine class K07) or on the front surface of the Topbox.

## 8. Safety devices

The WT is equipped with various safety devices, which are particularly necessary for the safe execution of maintenance work.

### 8.1 Fall arrest system

The WT is equipped with a vertical ladder with a fall arrest system.

Like the PPE, the fall arrest system must be inspected regularly by an expert.

The owner is responsible for organizing these inspections, see Chapter 4.4 "Special obligations of the owner".

#### 8.1.1 Fall arrest systems used

Nordex WTs can be equipped with three different fall protection systems, see Chapter 8.1.2 "Attaching the fall arrester":

- A fall arrest rail in the center of the vertical ladder
- A safety rope next to the vertical ladder
- A safety rope in the center of the vertical ladder (Latchways system)

Each fall arrest system has a special fall arrester.

When using the vertical ladder, only the fall arrester permitted for the installed fall arrest system must be used.

The fall arrester must be connected directly to the abdominal lug of the safety harness.

**Note:** Refer to the operating instructions of the safety harness for which abdominal lug must be used to connect the fall arrester.

In case of a fall, the fall arrester locks in place after just a few centimeters. The delayed reaction reduces the high loads to which the falling person is subjected and their fall will be arrested safely.

**A****B**

Fig. 12 Fall arrester

- A On the safety rope next to the vertical ladder
- B On the fall arrest rail

## 8.1.2 Attaching the fall arrester

### Safety rope next to the vertical ladder

- Completely loosen the knurled thumb screw on the fall arrester
- Push the ratchet down and open the fall arrester
- Place the open fall arrester around the safety rope
  - Make sure that the fall arrester is in the correct mounting position
  - The "up" arrow on the fall arrester must point upward

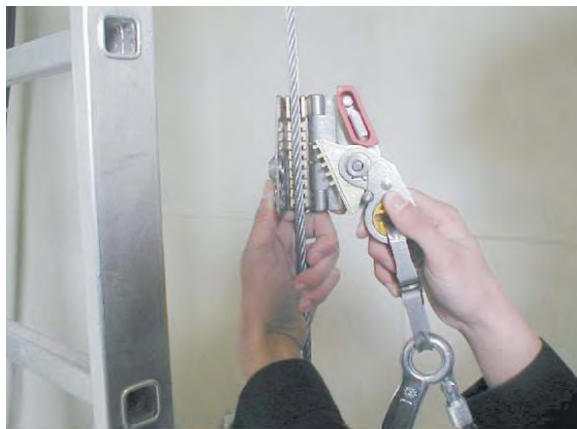


Fig. 13 Attaching the fall arrester to the safety rope

- Close the fall arrester so that the ratchet locks in place

**Note:** This is easier if you slightly lift the snap hook.
- Manually retighten the knurled thumb screw
- Perform a functional test

## Safety rope in the center of the vertical ladder ("Latchways" system)



Fig. 14 Fall arrester "Latchways" system with starwheel (arrow)

- Hook the fall arrester in the abdominal lug on the abdominal strap
- Use your right hand to hold the fall arrester in a hanging position, and use your thumb to operate the ratchet release mechanism

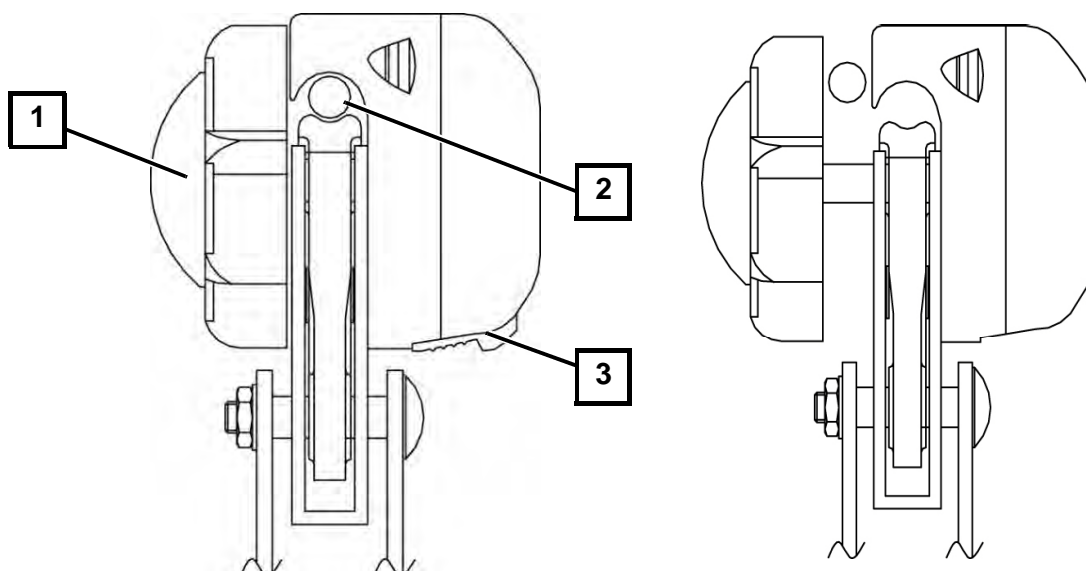


Fig. 15 Fall arrester, "Latchways" system (left closed, right open)

- 1 Starwheel
- 2 Safety rope
- 3 Ratchet release mechanism

- Use your left hand to remove the left part of the fall arrester (starwheel) to the side
- Slide the fall arrester onto the rope, so that the rope runs through the inside of the housing

- Operate the ratchet release mechanism with your thumb and press both halves of the fall arrester together
- Check that the fall arrester is properly locked and can no longer be pulled apart
- Carry out a suspension test

### Fall arrester with release mechanism (Haca)

The fall arrester with release mechanism can be attached and removed at any point on the fall arrest rail.

- Open the cover
- Push in the locking pin
- Pull the right half of the fall arrester to the side
- Attach the fall arrester to the fall arrest rail
  - Note:** The arrow on the fall arrester must point upwards
- Release the right half, so that both halves pull together
- Check that the rollers are sitting correctly on the fall arrest rail
  - Note:** The locking pin must be completely disengaged again
- Carry out a suspension test

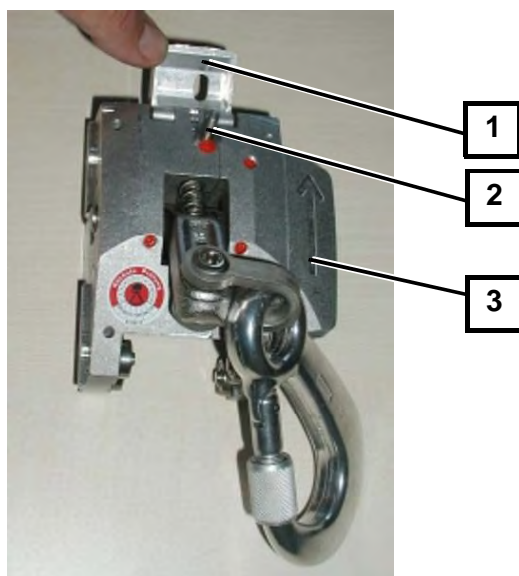


Fig. 16 Fall arrester (Haca)

- 1 Cover
- 2 Locking pin
- 3 Arrow marking

## 8.2 Rotor lock

The rotor lock is used to reliably mechanically lock the entire drive train. It prevents personal hazard to those working in the nacelle and rotor hub caused by rotating parts of the drive train.

WTs of all turbine classes are equipped with a rotor lock on the rotor shaft. This consists of 1 or 2 bolts and the rotor lock disk, which is located on the rotor shaft. With the rotor at standstill, the bolt/s are inserted into one of the drill holes in the rotor lock disk.

WTs of turbine class K08 can be equipped with an additional rotor lock on the brake disk. This must only be used under certain conditions.

The rotor lock must only be operated by trained specialized personnel.

## 8.3 Attachment points

There are specific attachment points in the WT for the PPE to safeguard against falling from a height. These attachment points are indicated with yellow paint, or with red paint in WTs that have been operational for a longer period of time.

The attachment points in the nacelle are a lifting lug on the rotor bearing and a lifting lug each on the left and right side of the gearbox, see Fig.17.

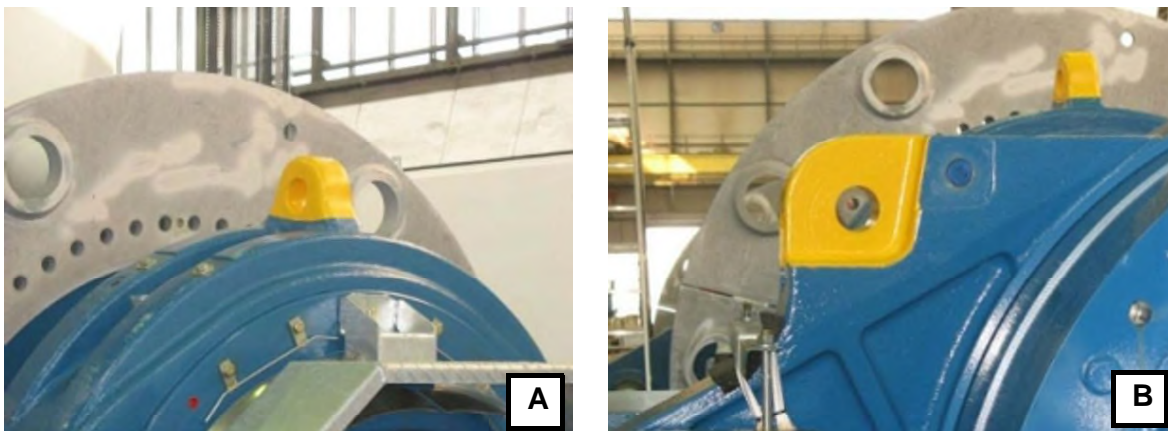


Fig. 17 Attachment points in the nacelle (example)

A Lifting lug on rotor bearing

B Lifting lug on the left side of the gearbox

In WTs of turbine class K08, the lifting lugs on the generator are also permitted as attachment points, see Fig.18.

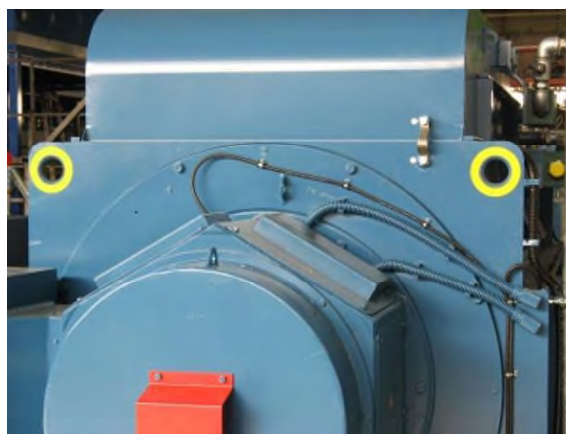


Fig. 18 Attachment points on generator (K08)

### Additional attachment points K08 beta

WTs of turbine class K08 can be additionally equipped with a safety rope system, see Fig.19.

In this case, the safety rope serves as a continuous attachment point.

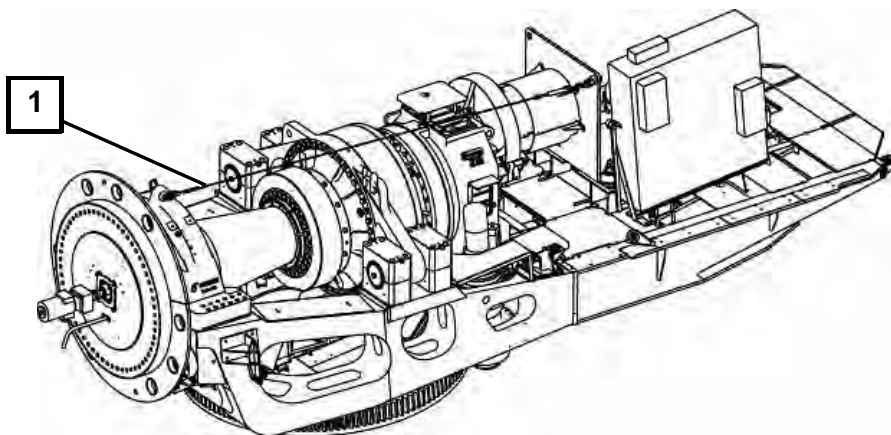


Fig. 19 WT with safety rope system (example)

1 Safety rope

If a sign indicates that the cross bolt for the front roof prop is a permitted attachment point in a WT of the K08 beta turbine class, this can be used to attach persons, particularly when rescuing a casualty in the nacelle.

Both roof props must be mounted in this case. Without props, the cross bolt is not permitted as an attachment point.

Eyebolts marked as attachment points are located in the tower and on the nacelle roof.



Fig. 20 Attachment point at the roof (K08 beta)

### Additional personal attachment points K08 gamma

- At the front of the machine frame
- Vertical rod 1 of the crane support structure
- Vertical rod 4 of the crane support structure (at the crane hatch)
- On the crane rail
- On the roof
- On the rotor hub access hatch

## 8.4 Emergency stop switches

There are several emergency stop switches in the WT. They serve to stop the WT as quickly as possible in hazardous situations.

Actuating an emergency stop switch interrupts the *safety chain* of the WT, which is a hard-wired series connection of various monitoring devices.

The interruption of the safety chain leads to an emergency stop of the WT. This brings the rotor to a standstill as quickly as possible and disconnects the generator and converter from the grid.

The emergency stop switches have a twist release.

The knob must be turned to the right to reset the switch to its original position.

To return the WT to the operational state, the safety chain must be additionally reset directly on site.

The emergency stop switches are located at different points in the WTs of each turbine class. For detailed information, refer to the operating instructions of the respective WT.

## 8.5 Access hatch switch

Certain turbine types are equipped with an access hatch switch at the access hatch to the nacelle, see Fig.21.

This is activated when the access hatch is opened. It switches the WT into service mode and the rotor brake is applied.

In this way, the access hatch switch ensures that the rotor is at a standstill before entering the nacelle.

If, contrary to the regulations, the WT has not been stopped before ascending to the nacelle, the access hatch switch triggers one of the brake programs when the access hatch is opened. This stops the WT as quickly as possible.

Once the access hatch has been closed, the rotor brake is released again.

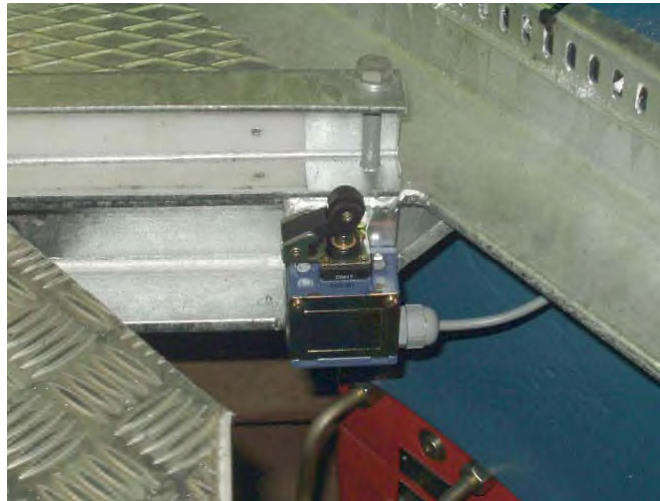


Fig. 21 Access hatch switch (example)

## 8.6 Area stop switches and battery disconnectors in the rotor hub

WTs with pitch systems (K07, K08) are equipped with various options for deactivating the pitch drives.

### K07 alpha

Each pitch box is provided with the following for the respective pitch drive:

- A mains switch for disconnecting the pitch power supply
- A battery disconnecter for disconnecting the battery voltage

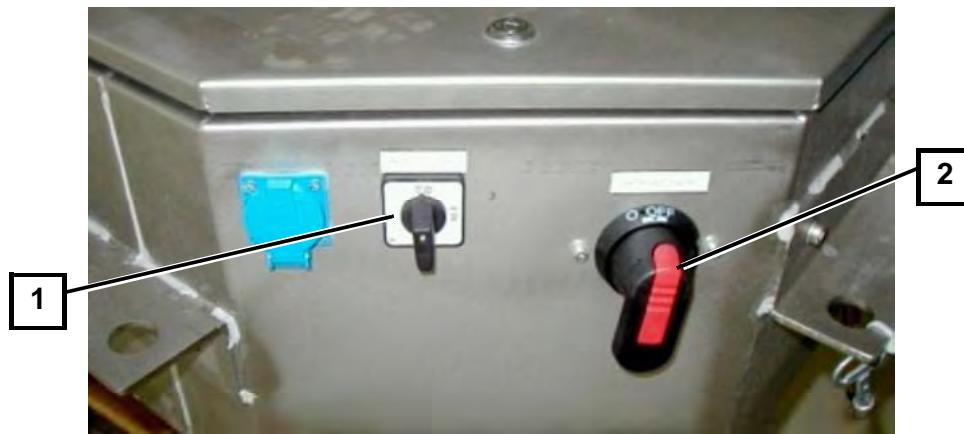


Fig. 22 Pitch box K07 alpha

- 1 Mains switch
- 2 Battery disconnecter

If all battery switches are activated, deactivating one of the mains switches also causes an emergency pitch run of all pitch drives using the batteries – i.e., including the pitch drive whose mains switch was deactivated.

If the emergency pitch run for one of the pitch drives must be prevented, its battery disconnecter must first be deactivated before deactivating one of the mains switches.

### K07 beta

Each pitch box is equipped with an area stop switch for completely disconnecting the respective pitch drive and with 1 battery disconnecter for disconnecting the battery voltage.

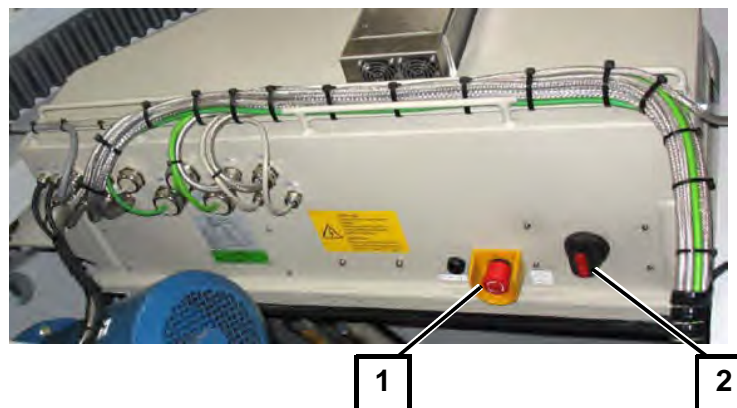


Fig. 23 Pitch box K07 beta

- 1 Area stop switch
- 2 Battery disconnecter

Like the emergency stop switches, the area stop switches are equipped with a twist release.

The knob must be turned to the right to reset the switch to its original position.

It has the same functionality as described under the section "K08 with 1 battery box per pitch drive" below.

### **K08 with two battery boxes per pitch drive (Pitch 1)**

Each pitch box is equipped with an area stop switch for completely disconnecting the respective pitch drive.

At the same time, the pitch supply voltage for the other two pitch drives is disconnected but their emergency pitch run using battery voltage is also triggered.

The emergency pitch run can only be prevented if the fuses for the battery voltage in the respective pitch boxes are opened in advance.

Like the emergency stop switches, the area stop switches are equipped with a twist release.

The knob must be turned to the right to reset the switch to its original position so that the pitch supply voltage is reconnected.

### **K08 with one battery box per pitch drive (pitch 2 and higher)**

Each pitch box is equipped with an area stop switch for completely disconnecting the respective pitch drive.

Each battery box is equipped with a battery disconnecter for disconnecting the battery voltage.



*Fig. 24 Pitch boxes K08 (example)*

- A Area stop switch
- B Battery box and pitch boxes
- C Battery disconnecter

Each area stop switch also disconnects the pitch supply voltage for the other two pitch drives. However, these remain connected to the battery voltage.

Actuating an area stop switch also triggers an emergency pitch run for the other two pitch drives, provided that the battery disconnecters are activated. This can

be prevented for each individual pitch drive by deactivating the respective battery disconnecter in advance.



#### NOTE

When actuating the area stop switch, a rotor blade that is not in a vertical position could move for a short time. This is because the pitch motor brake is applied with delay.

Like the emergency stop switches, the area stop switches are equipped with a twist release. The knob must be turned to the right to reset the switch to its original position.

To reconnect the pitch supply voltage, unlock the area stop switch and then actuate the blue reset button on pitch box 1 (pitch FU 1).

To re-activate a previously de-activated battery disconnecter, first reconnect the pitch supply voltage before re-activating the battery disconnecter. This prevents the rechargeable batteries of the respective pitch drive from being connected to the empty direct current link (DC link) of the pitch converter. Otherwise a high load would occur on the DC link capacitors, several semiconductor components and the rechargeable batteries which would in turn reduce the service life of these components.

## 8.7 Call button rotor hub

WTs of turbine class K07 beta and K08 as of pitch 2 include a call button in the rotor hub. If this button is actuated, you can hear an acoustic signal in the nacelle. Using this button, persons in the rotor hub are able to attract attention in cases of emergency.

Each pitch box has a call button next to the area stop switch.



Fig. 25 Call button in the rotor hub

- 1 Call button
- 2 Area stop switch

## 8.8 Rotor brake selector switch

WTs of turbine class K08 and K07 beta with active rotor brake include a "rotor brake selector switch" on the Topbox.

It is used for switching between automatic and manual operation of the rotor brake.

Switching over from automatic to manual operation triggers a fast braking and an immediate application of the rotor brake.

The rotor brake can now only be released by using the *Release Brake* button on the manual control unit.

Now the wind turbine control system can no longer access the rotor brake.

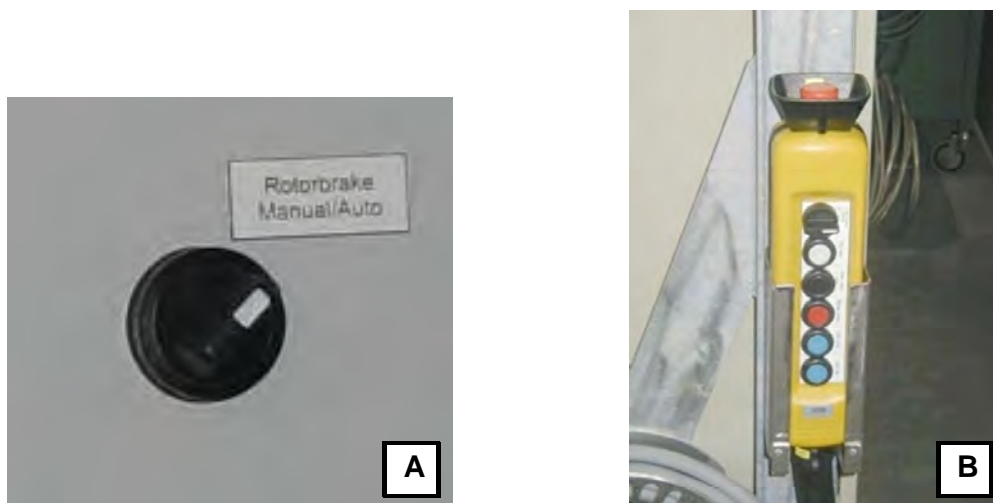


Fig. 26 Operational controls on the Topbox (example)

A Rotor brake selector switch

B Manual control unit

## 8.9 Emergency lighting

The WT is equipped with emergency lighting in the tower and nacelle if the power supply of the WT should fail.

The emergency lighting switches on automatically with a maximum delay of 15 seconds and ensures that the WT is lit for at least 1 hour.

This ensures a safe descent from the nacelle.

## 9. Behavior in specific situations

### 9.1 Grid failure



**⚠ DANGER**

#### FALL HAZARD

There is a fall and injury hazard when using the vertical ladder without sufficient lighting.

The emergency lighting in the WT is ensured for only 1 hour.

The descent into the tower base must be completed within one hour after the grid failure.



#### OBSERVE DOCUMENT

Work Instructions *F010\_002 Wind Turbines Without Grid Connection or With Locked Drive Train*

In the case of a grid failure, the lighting in the WT is automatically switched to emergency lighting.

If there is a grid failure during service work on the WT, and if it cannot be foreseen when the power supply will be restored, proceed as follows:

- Stop all work in the rotor hub and nacelle
- If the cabin roof is open, close and lock it
- Proceed as described in the Work Instructions *F010\_002*
- Descend to the tower base
- Inform the responsible Remote Monitoring

### 9.2 Thunderstorm



**⚠ DANGER**

#### LIGHTNING STRIKE

During thunderstorms, there is a danger to life inside or close to the WT in case of lightning strike.

In case of an approaching thunderstorm, leave the WT or do not enter it.

Once the thunderstorm has passed, be aware of crackling noises as you approach the WT, as these are a result of electrostatic charging.

Only enter the WT when these noises have stopped.

A WT is at high risk from lightning strikes.

The WT itself is adequately protected against damage by comprehensive lightning protection measures. However, persons inside or in the proximity of a WT are still at risk.

- Initially, proceed as in a grid failure
- Leave and lock the WT
- Wait at a safe distance from the WT until the thunderstorm has passed

Do not re-enter the WT until the thunderstorm has passed.

## 9.3 Fire



### FALLING TURBINE PARTS

In case of a fire in the nacelle or on the rotor, parts may fall off the wind turbine.

In case of a fire, nobody is permitted within a radius of 500 m from the turbine.



### NOTE

The WT is equipped with ABC powder fire extinguishers for fighting incipient fires.

At least one fire extinguisher is located in the tower base near the door and another in the nacelle near the Topbox.

This makes it possible to extinguish burning solids and liquids, as well as fires in electrical systems of up to 1,000 V.

These fire extinguishers are not suitable for extinguishing a fire on the high-voltage elements, see Chapter 9.3.2 "Fire in medium-voltage switchgear or transformer".

### 9.3.1 Fire in the WT

- Remove any persons from the danger area
- If possible, disconnect the burning object from the grid
- Fight the fire with available means if there is any chance of success
- If the fire cannot be extinguished or if there is no chance of success, call the fire department
- Inform the responsible Remote Monitoring

### 9.3.2 Fire in medium-voltage switchgear or transformer



**DANGER**

#### HIGH VOLTAGE

Parts of the medium-voltage switchgear and the medium-voltage transformer are subject to high voltage.

Do **not** attempt to extinguish such fires with the fire extinguishers found in the WT.

These are only suitable for equipment up to 1,000 V.

- Immediately disconnect the WT

**Note:** If this is not possible, inform the responsible power utility and have the wind turbine disconnected from there.

- Evacuate the WT
- Call the fire department

## 9.4 Accident

- Remain calm
- Take care of your own safety
- Take action to prevent further casualties
- Rescue casualties from the danger area
- Perform first-aid
- Inform the rescue service
- Inform the responsible Remote Monitoring

#### Electrical accidents

- Immediately disconnect the voltage in the WT
 

**Note:** If this is not possible, the power utility must be informed to disconnect the wind turbine
- Only use non-conductive devices for any rescue attempts
- Continuously check the consciousness and breathing (circulation) of casualties
- Always seek medical treatment, even after minor electrical accidents

## 9.5 Oil spill



### SLIP HAZARD

Move particularly carefully and, where possible, avoid stepping on oil-polluted surfaces.

- Stop the WT
- Inform the responsible Remote Monitoring

### Further measures, to be carried out by service employees only

- Locate the leak
- If possible, either seal the leak or otherwise block the oil flow
- Properly remove any escaped oil
- Replace damaged parts
- Remove any contamination
- If oil has penetrated into the soil, inform the responsible local authorities and agree further measures with them

## 9.6 Earthquake

If the WT is located in an area with earthquake hazard, the following rules of conduct must be observed.

### Earthquakes during work on the WT

- Immediately leave the WT
- Wait at a safe distance until the end of the earthquake
- Do not re-enter the WT until it has been checked for damage and no safety risk has been identified

### After an earthquake

- Stop the WT
- Check the WT, particularly the tower and foundation, for external damage
- Inform the responsible Remote Monitoring, and agree further procedure with them

## 9.7 Leaving the nacelle in hazardous situations (rappelling)



### NOTE

The following information only applies to Nordex employees and employees of commissioned subcontractors.

The owner must create and use their own safety concept to be used on the WT.

A corresponding training course can be taken at Nordex to familiarize oneself with the rappelling equipment.

There are 2 escape routes out of the nacelle:

- Descending inside the tower via the vertical ladder
- Rappelling outside the tower, if descending inside the tower is not possible

**Warning:** Do not use the service lift during a fire or an earthquake.



- If the rotor has not been stopped prior to rappelling out of the nacelle, there is a danger to life
- Before rappelling, ensure that the rotor has been locked or, at the very least, is secured with the rotor brake

For WTs of the following turbine types it is possible to rappel out of the nacelle as follows

- K06 and K08 beta: With the roof open, over the edge of the nacelle wall
- K07: Through the transport hatch in the rear part of the nacelle
- K08 gamma: Through the transport hatch (crane hatch) in the rear part of the nacelle or via the roof

### 9.7.1 Fastening the descender

- Depending on the equipment, remove the webbing sling or work-positioning lanyard from the transport bag
- Attach the webbing sling or work-positioning lanyard

#### **K06 and K08 beta:**

To the left lifting lug of the gearbox

#### **K07 and K08 gamma:**

Place it over the craneway above the transport hatch

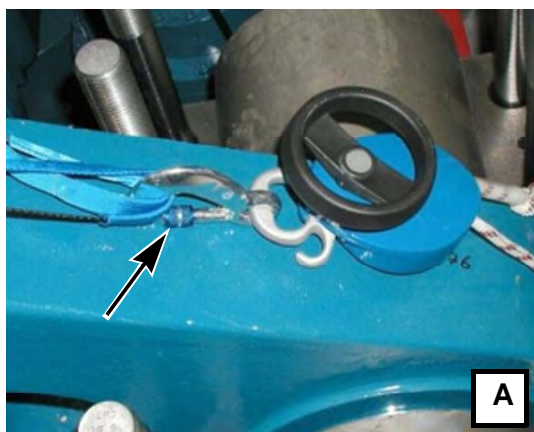


*Fig. 27 Attachment points*

A Webbing sling attached to lifting lug on gearbox (K06)

B Webbing sling attached to the craneway (K07)

- Take the descender out of the transport bag
- Attach the hook of the descender to the two eyes of the webbing sling or the work-positioning lanyard



*Fig. 28 Descender with knurled nut (arrow) on webbing sling*

A Turbine class K06

B Turbine class K07

- Screw the knurled nut down
  - ▶ In this way the hook of the descender is secured to prevent unintentional opening.
- To secure it, guide the long end of the rope via the diverter hook through the cam cleat of the descender

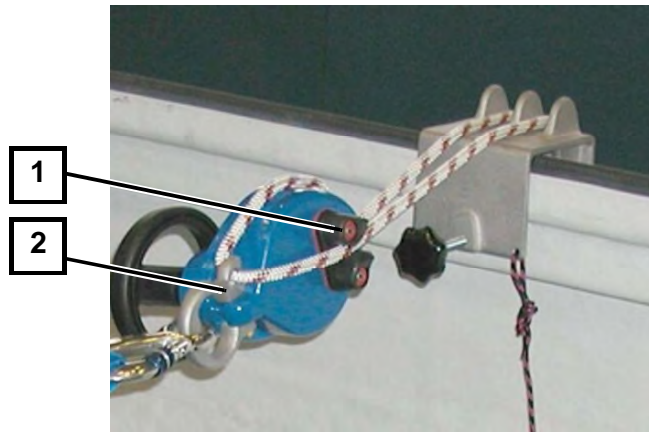


Fig. 29      *Securing the rope on the descender*

- 1 Cam cleat
- 2 Diverter hook

- Throw down the transport bag with the rope from the nacelle

### **DANGER**

#### **JAMMING ROPE**

Before using the rope, check it for knots and kinks.

Otherwise there is a risk that the rappelled person does not reach the ground.

#### **Additional attachment point for K08 beta turbines**

If a sign indicates that the cross bolt for the front roof prop is a permitted attachment point in a WT of the K08 beta turbine class, this can be used to attach persons, particularly when rescuing a casualty in the nacelle.

Prerequisite is that the roof has been secured with both props as specified.



Fig. 30 Additional attachment point for the K08 beta turbine class

- A Work-positioning lanyard on front roof prop
- B Descender on work-positioning lanyard

## 9.7.2 Attaching the edge protection (K08 beta and K06)



### NOTE

This edge protection is the edge protection of the rappelling equipment. In some WTs there is also an edge protection for using the working rope, which is stored in the nacelle.

- Take the edge protection out of the transport bag
- Fasten the safety rope of the edge protection to a fixed point
- Attach the edge protection where the rope of the descender rests on the nacelle wall

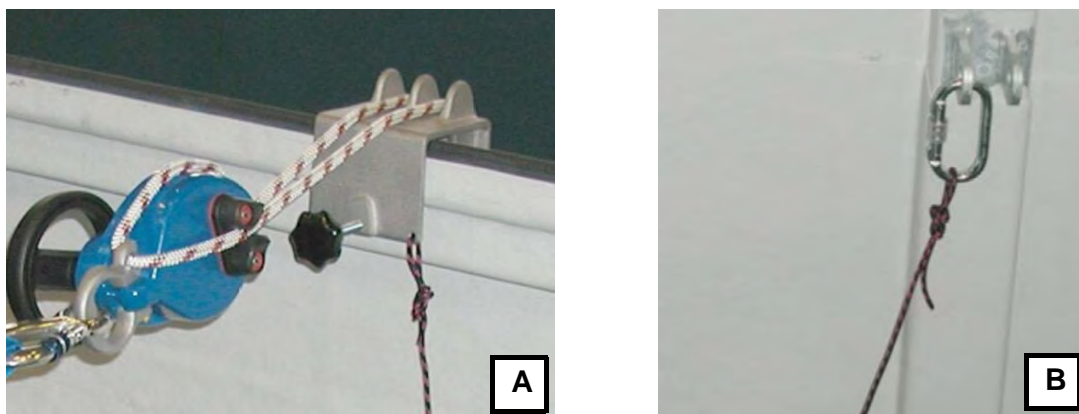


Fig. 31 Edge protection (example)

- A On the nacelle wall (with rope ends already positioned)
- B Safety rope of the edge protection

- Guide the descender rope over the edge protection

### 9.7.3 Rappelling yourself

- Hook the short rope end of the descender into the chest lugs of the safety harness and secure it
- Pull the long rope end out of the cam cleat
- Rappel over the edge of the nacelle (K06 and K08 beta) or through the transport hatch (K07 and K08 gamma)

### 9.7.4 Rappelling casualties



#### NOTE

The procedure for rappelling a casualty described in the following only applies if the casualty is conscious and can be transported whilst hanging in the safety harness.

Otherwise, height rescue workers must be requested.



#### SUSPENSION TRAUMA

Hanging in the safety harness for a longer period may lead to a fatal suspension trauma.

Once the casualty has been lowered, leave them in a sitting position until the ambulance arrives, but for at least 20 minutes.

Under no circumstances put the casualty directly into a horizontal position.

Inform the ambulance explicitly about the suspected suspension trauma.

- Request an ambulance and helpers to receive the rappelled person on the ground
- Hook the hook of the short rope end of the descender into the dorsal lug on the backplate of the casualty's safety harness and secure it
- Move the casualty over the edge of the nacelle wall (K06 and K08) or through the transport hatch, hanging in the safety harness (K07 and K08 gamma)
- Pull the long rope end out of the cam cleat
- Lower the casualty
  - The descender brakes automatically
  - The long rope end can also be guided manually via the diverter hook on the descender
- Ask the casualty to move the legs, if possible, in order to maintain blood circulation
- On the ground, unhook the casualty from the rope together with a helper and put them in a sitting position, see Fig.32



*Fig. 32 Casualty in a sitting position*

- After approx. 20 minutes, slowly stretch the casualty's legs and, if possible, place him/her in a horizontal position
- Transfer the casualty to the ambulance for medical care
- Inform the ambulance explicitly about the suspected suspension trauma

## 10. Ascending inside the tower

### **WARNING**

It is only permitted to ascend into the nacelle in the following conditions:

- 10-minute average wind speeds up to 20 m/s for tubular towers and
- 12 m/s for lattice towers
- A second person is present



### **WARNING**

#### **ICY VERTICAL LADDER**

In the case of icing on the vertical ladder, the risk of injury increases due to slipping and falling into the safety harness.

The vertical ladder must not be used in the case of icing.

### 10.1 Preparing for the ascent



### **DANGER**

#### **FALL HAZARD**

A PPE either with an invalid test badge or which has been damaged or strained by a fall must no longer be used.

Replace the PPE immediately and have it checked by an expert.

- Inform the responsible Remote Monitoring about the intended ascent.
- Stop the WT and disable remote access to the WT.  
**Note:** To do this, see the Operating Instructions of the respective WT type.
- Remove any loose objects from pockets and clothing and leave them behind in the tower base or secure them from falling down during the ascent
- Make sure that the test badge of the safety harness is valid and that the safety harness does not show any signs of damage
- Put on the safety harness as described under "Safety equipment", see Chapter 7.1.3 "Handling the safety harness"
- Visually inspect the vertical ladder and fall arrest system as far as possible; make sure that there is no visible damage and that the test certificate is valid

In the case of damage or an invalid test certificate, proceed as follows:

#### **Owner/operator**

- Stop preparations for the ascent

The vertical ladder must not be used until it is released again by an expert.

- Have an expert rectify the damage to the vertical ladder and release the vertical ladder again

### Service employee

- Stop preparations for the ascent

The vertical ladder must not be used until it is released again by an expert.

- Inform the responsible employee immediately
- Have an expert rectify the damage to the vertical ladder and release the vertical ladder again

## 10.2 Using the vertical ladder



 **DANGER**

### FALL HAZARD

There is a fall hazard if the service lift and the vertical ladder are used at the same time.

If a service lift is available it must always be used for ascending and descending the tower. Only use the vertical ladder if the service lift is out of order.



 **DANGER**

### FALL HAZARD

There is a fall hazard if the vertical ladder is used without fall arrest system.

The vertical ladder must only be used while wearing the PPE, while secured with the fall arrester permitted for the respective fall arrest system, and while carrying the lanyard with energy absorber.



 **DANGER**

### FALL HAZARD

No more than two persons at one time must be secured to the safety rope of the Latchways fall arrest system.



## **DANGER**

During the ascend: Do not allow your full body weight to rest in the fall arrester.

Always have at least three points in contact with the vertical ladder: 2 feet and 1 hand or 2 hands and 1 foot.



## **NOTE**

- Wear safety gloves during the ascend.
  - The vertical ladder has a foldable rest platform about every 9 m.
- 
- In the case of lattice towers, unlock the ladder guard on the vertical ladder, remove it and put it aside
  - Attach the fall arrester permitted for the respective fall arrest system to the fall arrest system
  - Check whether the fall arrester works properly
  - Attach the snap hook of the fall arrester to the abdominal lug in the middle of the abdominal strap, and secure it using the knurled nut
  - Check the personal protective equipment for correct fit and perform a suspension test
  - Make sure that there is no other person on the vertical ladder in the section up to the next platform  
Otherwise, wait until the other person has reached the next platform and, if applicable, has closed the hatch.
  - Start the ascent  
Pull lightly on the fall arrester to release the locking mechanism.
  - During the ascent, keep checking regularly whether the vertical ladder and the fall arrest system are fully functional and do not show any signs of damage
  - When reaching the next platform, open the hatch upward (if applicable), climb through, and close the hatch again



## **DANGER**

### **FALL HAZARD**

There is a fall hazard if the vertical ladder is left without fall protection.

Before detaching from the fall arrester, attach the lanyard with energy absorber to a suitable attachment point, e.g., bracket or upright of the vertical ladder.

## Using the vertical ladder without fall arrest system



**⚠ DANGER**

### FALL HAZARD

There is a fall hazard if the vertical ladder is used without fall arrest system.  
If the fall arrest system is not available, use a lanyard with energy absorber for securing.



**⚠ DANGER**

### FALL HAZARD

The rungs of the ladder are not permitted as attachment points.  
Connect the lanyard to one of the ladder uprights.

If the vertical ladder must be used without the fall arrest system being available (e.g. during erection), the persons using the vertical ladder must be secured using the lanyard with energy absorber of the PPE.

Proceed as follows:

- Start the ascent
- At a height of about 1 m, connect one end of the lanyard with energy absorber to a ladder upright as high as possible
- Only climb the vertical ladder so far that you can still reach the first snap hook of the lanyard
- Attach the second end of the lanyard as high as possible on the vertical ladder upright
- Release the first snap hook of the lanyard
- Move further up the vertical ladder, as described, and alternately secure yourself with the two snap hooks

## 10.3 Using the service lift

**⚠ WARNING**

### FUNCTIONAL LIMITATIONS IN SEVERE FROSTY WEATHER

The service lift is approved for temperatures down to  $-25^{\circ}\text{C}$ .  
At lower temperatures, only use the vertical ladder to ascend into the nacelle.


**⚠ DANGER**
**FALL HAZARD**

There is a fall hazard for persons on the vertical ladder when using the service lift.

If a service lift is available it must always be used for ascending and descending the tower. Only use the vertical ladder if the service lift is out of order.


**⚠ DANGER**
**FALL HAZARD**

If the service lift is used without fall protection, there is a fall hazard.

In the service lift cage, always secure yourself by attaching the lanyard with energy absorber to one of the attachment points.

**⚠ WARNING**

Improper use of the service lift may lead to wind turbine damage and put the life and health of persons at risk.

Only instructed persons are permitted to operate the service lift.

**⚠ WARNING**

Objects in the operating area of the service lift may lead to turbine damage. Before and while using the service lift, always make sure that the operating area of the service lift is clear.

In the case of lattice towers, some preparations must be made before using the service lift. This is because the service lift cage is parked approx. 8 m above the ground.

The service lift cage can only be reached via the vertical ladder.

- Switch on the operating voltage for the service lift  
The switch (-1F1) is located in the switch cabinet room of the transformer station, in the fuse box on the left wall.
- Use the vertical ladder to climb to the service lift cage  
To do so, proceed as described, see Chapter 10.2 "Using the vertical ladder" (among others removing the ladder guard, using the fall arrester).

To use the service lift, proceed as follows:

- Before using the service lift, familiarize yourself once more with its operation, particularly in the event of a fault, using the operating instructions provided on site
- Enter the service lift cage
- Attach the lanyard with energy absorber to one of the attachment points in the service lift cage
- Start the service lift

## 10.4 Entering the nacelle



### NOTE

Certain turbine types have an access hatch switch, see Chapter 8.5 "Access hatch switch".

- Prior to leaving the vertical ladder or the service lift, attach yourself to a suitable attachment point, e.g. ladder upright, using the lanyard with energy absorber.
- Release yourself from the fall arrester or the attachment point in the service lift
- If necessary, remove the fall arrester upwards out of the fall arrest rail, or from the fall arrest system, and hang it on the top rung until descending
- Step onto the top platform and close the hatch
- After the hatch has been closed, detach the lanyard from the attachment point
- Open the access hatch into the nacelle (depending on the design, slide it open or push it upwards)
- Ascend into the nacelle
- Switch the service switch on the manual control unit of the Topbox to service mode
- Close the access hatch into the nacelle

## 11. Special features of K06



### NOTE

Types:

- N54-Mk3/1000
- N60/1300
- N62/1300

### 11.1 Operating the rotor brake without system pressure

The following describes how the rotor brake can be operated when the hydraulic unit is not ready for operation, meaning there is no system pressure.

When there is no pressure, the rotor brake is applied.

If the hydraulic unit of the WT is not ready for operation, the rotor brake can be released using a hydraulic hand pump and the spring assembly can be locked in the open position by screwing on a nut.

### NOTICE

#### DAMAGE TO HYDRAULIC SYSTEM

When operating the rotor brake using a hand pump, observe the following:

- Observe the maximum operating pressure of the rotor brake
- The hydraulic oil used in the hydraulic hand pump must be identical to the hydraulic oil of the WT
- To filter the hydraulic oil, use a 5- $\mu$  filter



#### SPURTING HYDRAULIC OIL

The hydraulic system may be under pressure.

Prior to working on hydraulic lines, depressurize the hydraulic system.

- Ensure that the hydraulic system is depressurized
- Remove the hydraulic hose of the brake system from the hydraulic supply line



Fig. 33      *Hydraulic supply line*

- Absorb escaping hydraulic oil with a cloth
- Connect the hydraulic hand pump to the hydraulic hose
- Attach a protective cap to the hydraulic supply line
- Apply and release the rotor brake by either building up or releasing pressure using the hand pump

When the rotor brake must remain open for prolonged periods of time it can be locked in the open position. To do so:

- Remove the protective cap from the bolt in the spring assembly

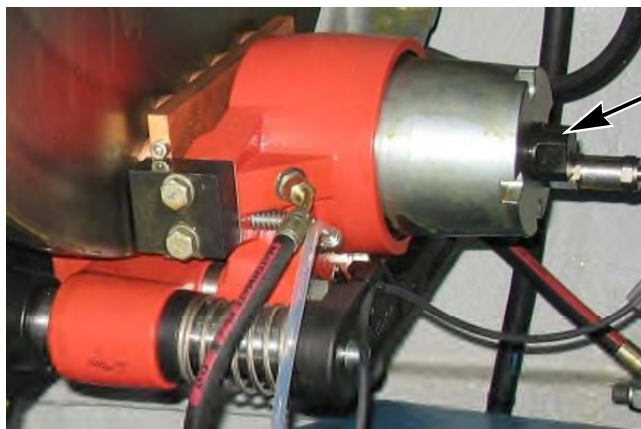


Fig. 34      *Protective cap on the bolt in the spring assembly*

- Screw the nut A/F 36 attached to the brake caliper onto the bolt in the spring assembly

Once the work is complete:

- Restore the operational state of the rotor brake
- Vent the hydraulic circuit of the brake
- If necessary, refill any lost hydraulic oil

## 11.2 Operating the rotor lock

The rotor lock is a device for mechanically locking the rotor.

It prevents personal injuries in the nacelle and the rotor hub resulting from contact with rotating parts of the drive train.

### **WARNING**

The rotor lock must only be used at 10-minute average wind speeds of up to a maximum of 12 m/s.

### **NOTICE**

#### **GEARBOX DAMAGE**

If the rotor is locked for more than 24 hours, observe the current revision of the Work Instructions *F010\_002*.

WTs of turbine class K06 are equipped with two rotor lock bolts, which are positioned to the left and right of the rotor bearing.

These must be inserted manually into the corresponding drill holes in the rotor lock disk.

### **WARNING**

Danger of life-threatening injuries and serious wind turbine damage.

The rotor shaft must always be locked with both rotor lock bolts.

### Locking the rotor



Fig. 35 Storage location of the left rotor lock bolt

- 1 Locking screw
- 2 Rotor lock bolt

- Ensure that manual control for the rotor brake is activated, the rotor brake is applied, and the rotor is locked
- Loosen the locking screw on both rotor lock bolts
- Manually push one of the rotor lock bolts to just before the rotor lock disk
- Release the rotor brake

**NOTE**

For instructions on operating the rotor brake without hydraulic pressure, see Chapter 11.1 "Operating the rotor brake without system pressure"

- Align the rotor lock disk
- Re-apply the rotor brake
- Insert each rotor lock bolt into a drill hole in the rotor lock disk

**NOTICE**

The rotor lock bolts must only be inserted into the rotor lock disk with the rotor shaft at a standstill.

- Tighten the locking screws to lock the rotor lock bolts in position

**Releasing the rotor lock**

- Make sure that the rotor brake is applied
- Loosen the locking screws
- Pull both rotor lock bolts out of the rotor lock disk
- Check whether the rotor lock bolts have been completely retracted, and whether the rotor lock disk can turn freely
- Secure the two rotor lock bolts with the locking screws

## 11.3 Operating the roof

The roof on WTs of turbine class K06 can be opened. It is necessary to open it, for example, in order to transport pieces of equipment into the nacelle or perform various maintenance tasks.

The roof is fastened to the right nacelle wall (when looking towards the rotor hub) by means of hinges, and secured to the left nacelle wall with two locks.

To open the roof, open the locks, then open the roof using the hinges and the hydraulic system, and secure it with 2 props.

## Opening the roof

### **WARNING**

#### **PERSONAL INJURY AND DAMAGE TO THE NACELLE**

The roof of the nacelle offers a large surface for the wind to act upon.

- Opening the roof is only permitted at 10-minute average wind speeds up to 12 m/s.
- With freshening wind, do not open the roof downwind



#### **NOTE**

In the case of rain, the nacelle should be positioned perpendicular to the wind direction so that the roof is opened against the wind, offering some degree of protection.

It is recommended to open the cabin roof as a team of two. Proceed as follows:

- Inform all persons in the nacelle of your intention to open the roof



### **DANGER**

#### **FALLING HAZARD WITH ROOF OPEN**

While in a fall hazard area, always secure yourself at one of the marked attachment points in the nacelle.

- Open the two locks on the left nacelle wall, see Fig.36



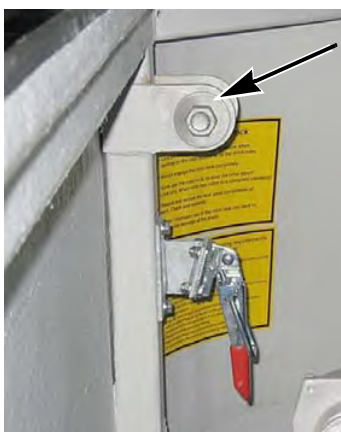
*Fig. 36 Lock on the left nacelle wall*

- Using the hydraulic system, open the roof so far that the bolts of the roof lock can still be easily reached



*Fig. 37 Bolt for roof prop, example N60*

- Remove the props from the brackets on the left nacelle wall and attach them to the bolts of the roof locks  
Ensure that the props are secured on the bolts
- Continue to open the roof until the props can be attached to the bolts for the locks on the nacelle wall



*Fig. 38 Bolt for prop on nacelle wall*

- Attach the props to the bolts of the locks on the nacelle wall  
**Note:** Ensure that the props are secured on the bolts.

### **Closing the roof**

To close the roof, proceed as follows:

- Ensure that the edge of the nacelle wall is clear and the roof can be closed without obstruction
- Remove the props from the bolts on the nacelle wall.
- Lower the roof using the hydraulic system until the props can be removed from the roof

- Remove the props and place them on the brackets
- Lower the roof completely
- Hook the two locks of the roof lock into the left nacelle wall and lock them

## 11.4 Operating the roof hydraulics for turbine class K06

The roof on a WT of turbine class K06 can be operated using system pressure or the hand pump of the hydraulic unit.

### Opening the roof



#### NOTE

For instructions on how to open the roof, see Chapter 11.3 "Operating the roof".

Only the operation of the roof hydraulics is described here.

- Attach the bracket provided with the hydraulic unit across the double valve 460.0 so that the pin is positioned at the side facing away from the generator



Fig. 39 Bracket on hydraulic unit

- 1 Pin
- 2 Bracket

- Move the bracket toward the generator.  
If system pressure is available, the roof opens.
- If no system pressure is available: Attach the extension pipe to the hand pump of the hydraulic unit and build up pressure by pumping so that the roof opens, see Fig.40

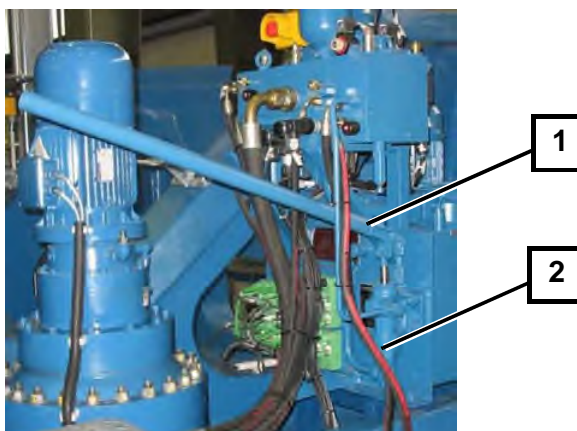


Fig. 40 Hydraulic unit of turbine class K06

- 1 Extension pipe
- 2 Hand pump

- When the roof is completely opened, remove the bracket and place it back

### Closing the roof



#### NOTE

For closing the roof, see Chapter 11.3 "Operating the roof"  
Only the operation of the roof hydraulics is described here.

- Turn the bracket across the double valve 460.0 until the pin is positioned at the side facing away from the generator
- Move the bracket toward the rotor hub  
If system pressure is available, the roof closes.
- If no system pressure is available: Attach the extension pipe to the hand pump of the hydraulic unit and build up pressure by pumping so that the roof closes
- When the roof is completely closed, remove the bracket and place it back. If the hand pump has been used, remove the extension pipe and place it back

## 11.5 Entering the rotor hub

To perform maintenance or repair work on the rotor blades and hydraulic system, it is necessary to enter the rotor hub.

In the case of WTs of turbine class K06, the rotor hub must be crossed and entered from the outside. For this purpose, a modified pilot ladder is required as hub ladder, see Fig.41. This must be carried in the service vehicle.



Fig. 41 Hub ladder K06

In the interest of safety of the person performing the work, a second person who is able to operate the WT controls must be present in the nacelle.

### **WARNING**

Work on the drive train and in the rotor hub is only permitted at 10-minute average wind speeds of less than 12 m/s.

### **WARNING**

If the rotor is suddenly set into motion, this may result in life-threatening or serious injury.

Before entering the rotor hub, always lock the rotor on the rotor shaft using the rotor lock, and ensure that the rotor brake is also applied.

For instructions on how to operate the rotor lock, see Chapter 11.2 "Operating the rotor lock".



### **WARNING**

#### **FALLING OBJECTS**

Make sure that nobody is present in the area below the turbine when climbing onto the rotor hub.

Make sure that there are no loose parts that may fall down.

Secure any tools carried along.

## **11.5.1 Attaching the hub rope**

In the case of WTs of turbine class K06, the respective service employee must be secured with the hub rope when crossing the rotor hub.

- Make sure that the hub rope and hub ladder are in sound condition and test badges are valid.

**⚠ DANGER****FALL HAZARD**

A PPE either with an invalid test badge, or which has been damaged or strained by a fall, must no longer be used.

Replace the PPE immediately and have it checked by an expert.

- Attach the hub rope directly to the lifting lug on the rotor bearing

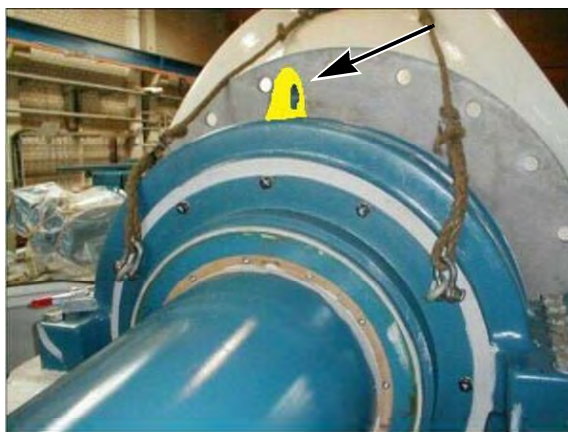


Fig. 42 Lifting lug on rotor bearing

### 11.5.2 Crossing the rotor hub

To access the rotor hub, proceed as follows:

- Turn the rotor out of the wind (nacelle perpendicular to wind)
- If the roof is not yet open, open and secure it

**⚠ DANGER****FALL HAZARD**

There is fall hazard when the roof is open.

While staying in a fall hazard area, secure yourself at one of the marked attachment points in the nacelle

- Check whether the rotor is locked in such a way that the step on the rotor hub is in the bottom position  
**Note:** This is indicated by a red arrow on the rotor hub. This must be visible from the nacelle, and located in the top position.



Fig. 43 Step on the rotor hub

- If this is not the case, release the rotor lock, turn the rotor hub, and lock the rotor again
- Attach the hub ladder to the eyebolts on the rotor bearing, and lower it across the rotor hub

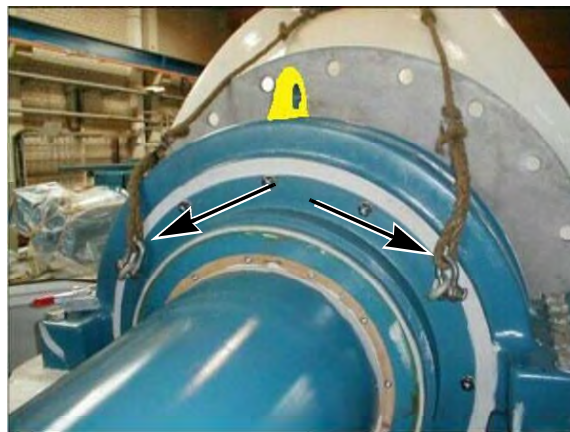


Fig. 44 Eyebolts on the rotor bearing



**DANGER**

### FALL HAZARD

There is a fall hazard when crossing the rotor hub

When crossing the rotor hub, always use the hub rope attached to the rotor bearing to secure yourself against falling from a height. The hub ladder and the three eyebolts around the entrance to the rotor hub are not suitable as attachment points for protection against falling from a height.

- Ensure that the hub rope is attached to the lifting lug on the rotor bearing
- Check the guided-type fall arrester for proper functioning

- Hook the snap hook of the guided-type fall arrester of the hub rope into the chest lug of the safety harness and secure it
- Carrying the lanyard with energy absorber, step onto the hub ladder and carefully move on the hub ladder toward the rotor hub access. Step by step, move the guided-type fall arrester along so that in the event of slipping the fall height is as low as possible
- Check the step on the rotor hub for tight fit, and if it is safe, step onto it

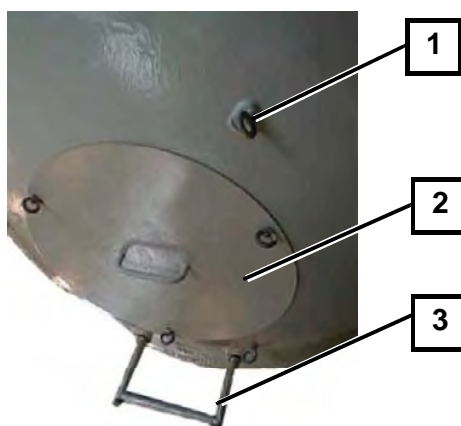


Fig. 45 Rotor hub entrance

- 1 Eyebolt
- 2 Rotor hub hatch
- 3 Step

If the step is damaged, the service employee must decide whether to continue the access into the rotor hub or to cancel. The damage must always be reported to the responsible employee.

- Loosen and unscrew the two upper eye nuts on the rotor hub hatch. If necessary, loosen the rotor hub hatch stays in advance
- Only loosen the third eye nut so that the rotor hub hatch can be pivoted downward
- Enter the rotor hub
- Attach the lanyard with energy absorber at a suitable location in the rotor hub



**DANGER**

### FALL HAZARD

There is a fall hazard in the rotor hub within 2 m of the rotor hub access. While working in this area, secure yourself using the lanyard with energy absorber.

- Release the guided-type fall arrester of the hub rope from the safety harness, and attach it at a suitable location inside the rotor hub

For returning into the nacelle, secure yourself and proceed in the same manner as described above:

- Hook the snap hook of the guided-type fall arrester of the hub rope into the chest lug of the safety harness and secure it
- Release the lanyard with energy absorber from the attachment point in the rotor hub
- Step out of the rotor hub onto the hub ladder
- Re-attach the hub hatch
- Move upwards on the hub ladder. In the process, move the guided-type fall arrester along step by step
- Enter the nacelle
- Secure yourself by attaching the lanyard with energy absorber to one of the attachment points in the nacelle
- Release the hub rope from safety harness and attachment point
- Bring in the hub ladder and release it from the attachment points

## 11.6 Transporting objects into the nacelle

NORDEX WT's are equipped with an on-board crane for transporting objects into the nacelle.

If the objects to be transported are not too heavy, they can also be transported using the working rope.



### **WARNING**

#### **FALLING OBJECTS**

Do not stand or walk in an appropriate radius under suspended loads.

The on-board crane must only be operated by instructed persons.

On-board cranes can differ in design from one WT to the other. Always refer to the operating instructions stored in the WT.

If the working rope is used on WT's of turbine type K06, use the edge protection, see Chapter 11.6.2 "Using the edge protection for the working rope", if available.

If this is not available, other arrangements must be made. This prevents damage to the edge of the nacelle wall and the sponge rubber seal on the wall.

### **NOTICE**

Risk of damaging the edge of the nacelle and the sponge rubber seal.

Do not guide the working rope over the unprotected edge of the nacelle wall.

## 11.6.1 Using the on-board crane



### NOTE

The following applies to the standard version of the on-board crane for WT's of turbine class K06, i.e., the pillar jib crane with a load capacity of up to 250 kg.

### NOTICE

#### PENDULAR MOVEMENTS

Danger of damage to the tower and to the objects to be transported due to uncontrolled pendular movements.

Secure the load to be transported with an additional rope from the ground and keep it clear from tower and nacelle.

To use the on-board crane, do the following:

- Remove the power supply cable coiled up on the crane pillar and connect it
- To lift the crane jib out of the bracket on the gearbox, turn the crank lever on the manual lifting jack



Fig. 46 Crane jib in parked position

- Unhook the locking device for the chain hoist
- Slew the crane jib far enough out of the parked position so that the chain hoist can be moved right forward
- Move the chain hoist forward on the crane jib until the ratchet is activated

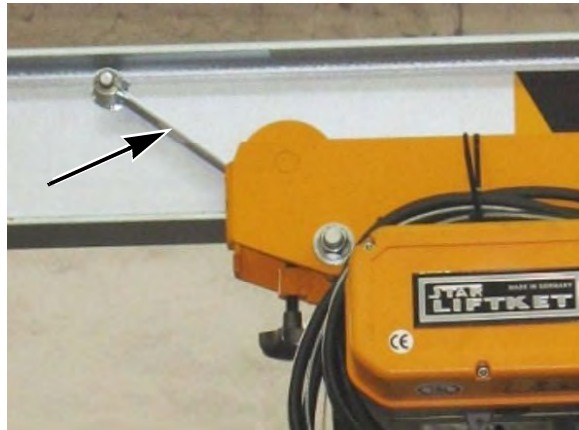


Fig. 47 Ratchet

- Attach the working rope to the crane hook and lower it to the ground
- To avoid any damage, use the working rope from the ground to keep the crane hook clear of nacelle and tower
- If necessary, load the crane hook with a big bag and make sure that the crane hook safety latch is closed
- Remove the securing bolt for the crane pillar from the gear rack bracket

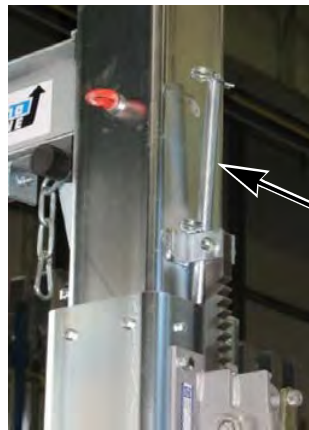


Fig. 48 Securing bolt in the gear rack bracket

- Fully extend the crane pillar using the manual lifting jack, and insert the securing bolt through the drill holes that become visible in the crane pillar

### **WARNING**

Risk of injury and material damage due to failure of the self-locking function of the gear rack drive.

Only use the extended crane pillar when the securing bolt is inserted.

- Slew the crane jib over the nacelle wall and use the snap hook to secure it to the eyebolt on the crane pillar



*Fig. 49      Locking device crane jib*

The chain hoist is now ready for operation and can be operated with its keyboard.

After using the on-board crane, return it to the parked position and secure it there.

- Retract the crane hook
- Release the crane jib's locking device from the crane pillar
- Slew the crane jib into the nacelle until the crane hook can be reached
- Remove any loads hanging on the crane hook
- Bring in the working rope and release it from the crane hook
- Open the ratchet and move the chain hoist toward the crane pillar
- Secure the chain hoist on the crane jib with the snap hook
- Remove the securing bolt from the crane pillar and store it in the bracket of the gear rack
- Position the jib over the bracket on the gearbox and use the manual lifting jack to lower it
- Pull the power supply cable out of the power outlet and coil it up on the crane pillar

### **11.6.2      Using the edge protection for the working rope**

To protect the edge of the nacelle wall and the sponge rubber seal, use the edge protection when using the working rope for transporting objects into the nacelle with the roof open.

- Remove the edge protection from its storage location
- Place it over the edge of the nacelle wall
- Secure it with the star knob



*Fig. 50      Edge protection in use*

After use, return the edge protection to the storage location and secure it there.

## 12. Special features of K07 alpha



### NOTE

Types:

- S70/1500
- S77/1500
- S82/1500

### 12.1 Operating the rotor brake without system pressure

The following describes how the rotor brake can be operated when the hydraulic unit is not ready for operation, meaning there is no system pressure.

When there is no pressure, the rotor brake is applied.

If the hydraulic unit of the WT is not ready for operation, the rotor brake can be released using a hydraulic hand pump and the spring assembly can be locked in the open position by screwing on a nut.

### NOTICE

#### DAMAGE TO HYDRAULIC SYSTEM

When operating the rotor brake using a hand pump, observe the following:

- Observe the maximum operating pressure of the rotor brake
- The hydraulic oil used in the hydraulic hand pump must be identical to the hydraulic oil of the WT
- To filter the hydraulic oil, use a 5-μ filter



#### SPURTING HYDRAULIC OIL

The hydraulic system may be under pressure.

Prior to working on hydraulic lines, depressurize the hydraulic system.

- Ensure that the hydraulic system is depressurized
- Remove the hydraulic hose of the brake system from the hydraulic supply line



Fig. 51 Hydraulic supply line

- Absorb escaping hydraulic oil with a cloth
- Connect the hydraulic hand pump to the hydraulic hose
- Attach a protective cap to the hydraulic supply line
- Apply and release the rotor brake by either building up or releasing pressure using the hand pump

When the rotor brake must remain open for prolonged periods of time it can be locked in the open position. To do so:

- Remove the protective cap from the bolt in the spring assembly



Fig. 52 Protective cap on the bolt in the spring assembly

- Screw the nut A/F 36 attached to the brake caliper onto the bolt in the spring assembly

Once the work is complete:

- Restore the operational state of the rotor brake
- Vent the hydraulic circuit of the brake
- If necessary, refill any lost hydraulic oil

## 12.2 Operating the rotor lock

The rotor lock is a device for mechanically locking the rotor. It prevents personal injuries in the nacelle and the rotor hub resulting from contact with rotating parts of the drive train.

### **WARNING**

The rotor lock must only be used at 10-minute average wind speeds of up to a maximum of 12 m/s. In the case of WTs with pitch system at least two rotor blades must be in the feathered position.

### **NOTICE**

#### **GEARBOX DAMAGE**

If the rotor is locked for more than 24 hours, observe the current revision of the Work Instructions *F010\_002*.

WTs of turbine class K07 are equipped with two rotor lock bolts, which are located on the right and left of the rotor bearing, and are inserted into corresponding drill holes in the rotor lock disk using an operating screw each.

### **WARNING**

The rotor shaft must always be locked with both rotor lock bolts.

### Locking the rotor

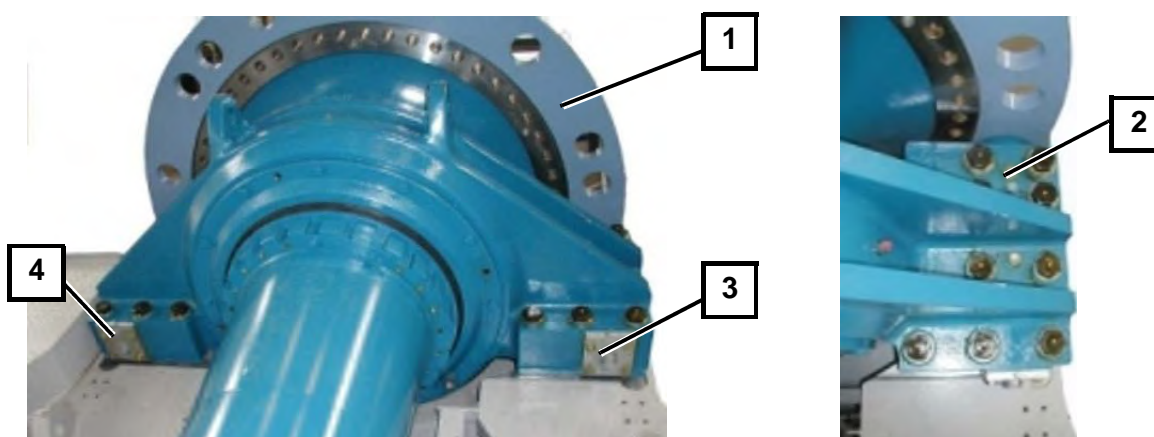


Fig. 53 Rotor shaft with rotor lock disk (WTs of turbine class K07)

- 1 Rotor lock disk
- 2 Locking screw for right rotor lock bolt
- 3 Operating screw for right rotor lock bolt
- 4 Operating screw for left rotor lock bolt

- Ensure that manual control for the rotor brake is activated, the rotor brake is applied, and the rotor is locked
- Release the locking screw for the left rotor lock bolt

---

**NOTICE**

The left rotor lock bolt must be extended first, followed by the right rotor lock bolt.

- 
- Extend the left rotor lock bolt until just before the rotor lock disk by turning the operating screw
  - Release the rotor brake

**NOTE**

For instructions on operating the rotor brake without hydraulic pressure, see Chapter 12.1 "Operating the rotor brake without system pressure"

- 
- Align the rotor lock disk
  - Re-apply the rotor brake
  - Extend the left rotor lock bolt into the rotor lock disk

---

**NOTICE****RISK OF TURBINE DAMAGE**

The rotor lock bolts must only be inserted into the rotor lock disk with the rotor shaft at a standstill.

- 
- Tighten the locking screw to lock the rotor lock bolt in position
  - Proceed in the same way for the right rotor lock bolt

**Releasing the rotor lock**

- Make sure that the rotor brake is applied
- Loosen the locking screws
- Retract the right rotor lock bolt from the rotor lock disk by turning the operating screw
- Retract the left rotor lock bolt from the rotor lock disk by turning the operating screw
- Check whether the rotor lock bolts have been completely retracted, and whether the rotor lock disk can turn freely
- Secure the two rotor lock bolts with the locking screws

## 12.3 Entering the rotor hub

To perform maintenance or repair work on the rotor blades and pitch system, it is necessary to enter the rotor hub.

For WT's of turbine class K07, the rotor hub is covered with a spinner, so that the rotor hub is accessed from the inside of the nacelle through the spinner.

In the interest of safety of the person performing the work, a second person who is able to operate the WT controls must be present in the nacelle.

---

### **WARNING**

Work on the drive train and in the rotor hub is only permitted at 10-minute average wind speeds of less than 12 m/s.

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### **WARNING**

If the rotor is suddenly set into motion, this may result in life-threatening or serious injury.

Before entering the rotor hub, always lock the rotor on the rotor shaft using the rotor lock, and ensure that the rotor brake is also applied.

---

For operating the rotor lock, see Chapter 12.2 "Operating the rotor lock"

## 12.4 Transporting objects into the nacelle

Nordex WT's are equipped with an on-board crane for transporting objects into the nacelle.

If the objects to be transported are not too heavy, they can also be transported using the working rope.

In the case of WT's of turbine class K07, the transport hatch in the bottom rear part of the nacelle is used for this purpose.



### **DANGER**

#### **SUSPENDED LOAD**

Risk of injury due to falling objects.

Do not stand or walk under suspended loads.

---

The on-board crane must only be operated by instructed persons.

On-board cranes can differ in design from one WT to the other. Always refer to the operating instructions stored in the WT.

## 12.4.1 Using the on-board crane



### NOTE

The following applies to the standard version of the on-board crane for WT's with a load capacity of up to 250 kg.

### NOTICE

#### UNCONTROLLED PENDULAR MOVEMENTS

Danger of damage to the tower and to the objects to be transported due to uncontrolled pendular movements.

Secure the load to be transported with an additional rope from the ground and keep it clear from tower and nacelle.

The on-board crane for WT's of turbine class K07 has a fixed crane rail.

This means, only the chain hoist must be moved and secured in the respective end positions using the locking screw.

The chain bag does not have to be secured separately.



Fig. 54 Chain hoist for turbine class K07

- 1 Crane rail
- 2 Locking screw

To use the on-board crane, do the following:

- Roll out the coiled up power supply cable and connect it
- Loosen the chain hoist locking screw
- Move the chain hoist over the transport hatch
- Attach the working rope to the crane hook and lower it to the ground  
To avoid any damage, use the working rope from the ground to keep the crane hook clear of nacelle and tower

- If necessary, load the crane hook with a big bag and make sure that the crane hook safety latch is closed

The chain hoist is now ready for operation and can be operated with its keyboard.

After using the on-board crane, return it to the parked position and secure it there.

- Retract the crane hook
- Remove any loads hanging on the crane hook
- Bring in the working rope and release it from the crane hook
- Loosen the chain hoist locking screw
- Move the chain hoist into the parked position
- Fasten the chain hoist with the locking screw
- Remove the power supply cable from the power outlet and roll it up

## 12.5 Operating the hydraulic unit

When releasing the pressure using the vent screws, make sure not to loosen them more than half a turn.

If the pressure does not drop, tighten and loosen the screw again.

## 13. Special features of K07 beta



### NOTE

Types:

- N70/1500
- N77/1500
- N82/1500

### 13.1 Operating the rotor brake without system pressure

In the case of a grid failure, the rotor brake is normally released and can no longer be applied automatically.

It can be applied manually using the hand pump on the hydraulic unit and released again using a valve.

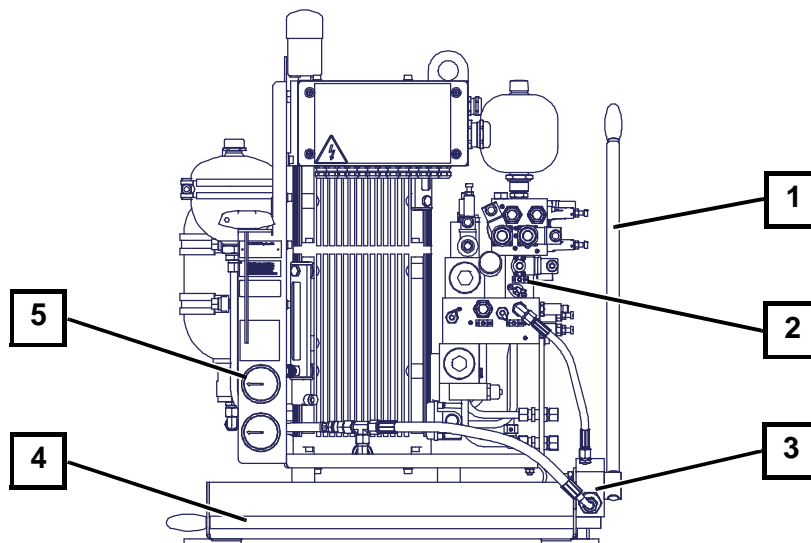


Fig. 55 Hydraulic unit

- 1 Attached extension pipe for hand pump
- 2 Vent 19.16
- 3 Hand pump
- 4 Extension pipe for hand pump in storage position
- 5 Pressure gage for rotor brake pressure

#### Applying the rotor brake

- Remove the extension pipe from the bracket and attach it onto the lever of the hand pump
- Build up the pressure using the hand pump until the pressure gage for the rotor brake pressure displays a value of 125 bar.

### Releasing the rotor brake

- Open vent 19.16  
When releasing the pressure make sure not to loosen the vent screw more than half a turn.  
If the pressure does not drop, tighten and loosen the screw again.
- After the pressure has been released, close valve 19.16 again



#### NOTE

If valve 19.16 is open it is not possible to start up the WT.

## 13.2 Operating the rotor lock

The rotor lock is a device for mechanically locking the rotor. It prevents personal injuries in the nacelle and the rotor hub resulting from contact with rotating parts of the drive train.

For instructions on how to operate the rotor lock, see "Operating the rotor lock" page 89.

## 13.3 Entering the rotor hub

To perform maintenance or repair work on the rotor blades and pitch system, it is necessary to enter the rotor hub.

For WTs of turbine class K07 beta, the rotor hub is covered with a spinner, so that the rotor hub is accessed from the inside of the nacelle through the spinner.

For information on how to proceed, see "Entering the rotor hub" page 91.

## 13.4 Transporting objects into the nacelle

Nordex WTs are equipped with an on-board crane for transporting objects into the nacelle. If the objects to be transported are not too heavy, they can also be transported using the working rope.

In the case of WTs of turbine class K07, the transport hatch in the bottom rear part of the nacelle is used for this purpose.

For information on how to proceed, see "Transporting objects into the nacelle" page 91.

## 13.5 Operating the hydraulic unit

When releasing the pressure using the vent screws, make sure not to loosen them more than half a turn.

If the pressure does not drop, tighten and loosen the screw again.

## 14. Special features of K08 beta



### NOTE

Types:

- N80/2500
- N90/2300
- N90/2500

### 14.1 Operating the rotor brake without system pressure

The following describes how the rotor brake can be operated when the hydraulic unit is not ready for operation, meaning there is no system pressure.

In the case of WTs of turbine class K08 beta, there are WTs with passive rotor brake and with active rotor brake.

#### 14.1.1 WTs with active rotor brakes

In the case of a grid failure, the active mechanical rotor brake is normally released and can no longer be applied automatically.

It can be applied manually using the hand pump on the hydraulic unit and released again using a valve.

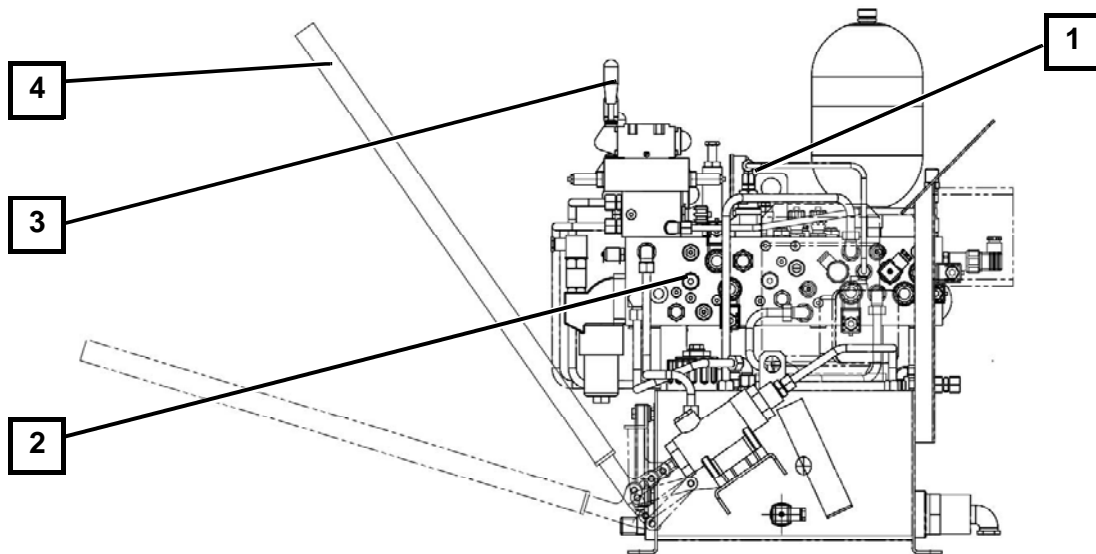


Fig. 56 Hydraulic unit for active rotor brake

- 1 Pressure gage
- 2 Valve 810.2
- 3 Valve 610
- 4 Lever of the hand pump with extension pipe

### Applying the rotor brake

- Move the lever of valve 610 into the "Rotor Brake" position
- Remove the extension pipe from the bracket and attach it onto the lever of the hand pump
- Build up the pressure using the hand pump until the pressure gage displays a value of 115 bar.
- Shift the lever of valve 610 back into the center position

### Releasing the rotor brake

- Open valve 810.2
- After the pressure has been released, close valve 810.2 again



#### NOTE

If valve 810.2 is open it is not possible to start up the WT.

## 14.1.2 WTs with passive rotor brakes

The following describes how the passive rotor brake can be operated if the hydraulic unit is not ready for operation, meaning there is no system pressure.

When there is no pressure, the passive rotor brake is applied.

If the hydraulic unit of the WT is not ready for operation, the rotor brake can be released using a hydraulic hand pump and the spring assembly can be locked in the open position by screwing on a nut.

#### NOTICE

##### DAMAGE TO HYDRAULIC SYSTEM

When operating the rotor brake using a hand pump, observe the following:

- Observe the maximum operating pressure of the rotor brake
- The hydraulic oil used in the hydraulic hand pump must be identical to the hydraulic oil of the WT
- To filter the hydraulic oil, use a 5-μ filter



##### SPURTING HYDRAULIC OIL

The hydraulic system may be under pressure.

Prior to working on hydraulic lines, depressurize the hydraulic system.

- Ensure that the hydraulic system is depressurized

- Unscrew the hydraulic hose from one of the two brake calipers. Absorb escaping hydraulic oil with a cloth

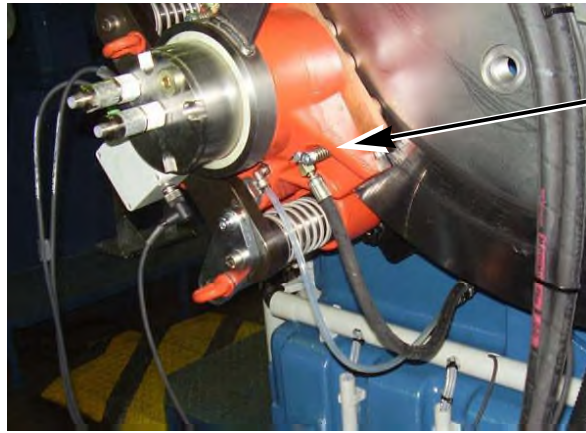


Fig. 57 Hydraulic hose port

- Seal the hydraulic hose with a cap in order to prevent dirt from entering and hydraulic oil from escaping
- Connect the hydraulic hand pump to the brake caliper
- Open the brake caliper by building up pressure using the hydraulic hand pump
- Remove the supply cable of the middle sensor for checking the brake pad thickness



Fig. 58 Sensor for checking the brake pad thickness

- Remove the sensor (wrench size 24mm)
- To lock the brake caliper in the open position, screw the locking screw (hexagon screw M18x50 ISO4017, stored in the vicinity of the brake) into the drill hole



Fig. 59 Locking screw

- Remove the hydraulic hand pump and close the hydraulic port on the brake caliper with a cap
- Proceed in the same way for the second brake caliper

After work has completed

- Restore the operational state of the rotor brake
- Vent the hydraulic circuit of the brake
- If necessary, refill any lost hydraulic oil

## 14.2 Operating the rotor lock

The rotor lock is a device for mechanically locking the rotor. It prevents personal injuries in the nacelle and the rotor hub resulting from contact with rotating parts of the drive train.

---

### **WARNING**

The rotor lock must only be used at 10-minute average wind speeds of up to a maximum of 12 m/s, with at least two rotor blades in the feathered position.

---

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### **NOTICE**

#### **GEARBOX DAMAGE**

If the rotor is locked for more than 24 hours, observe the current revision of the Work Instructions *F010\_002*.

---

All WT's of turbine class K08 beta have a rotor lock bolt for the rotor lock on the rotor shaft. This is integrated into the left side of the machine frame, and is inserted hydraulically into the rotor lock disk on the rotor shaft.

In addition, WTs with active brake can also be equipped with a rotor lock on the brake disk.

### 14.2.1 Rotor lock on the rotor shaft

#### **WARNING**

If the mechanical design allows it, the rotor lock bolt must always be secured in both positions (extended and retracted), using the securing bolt.

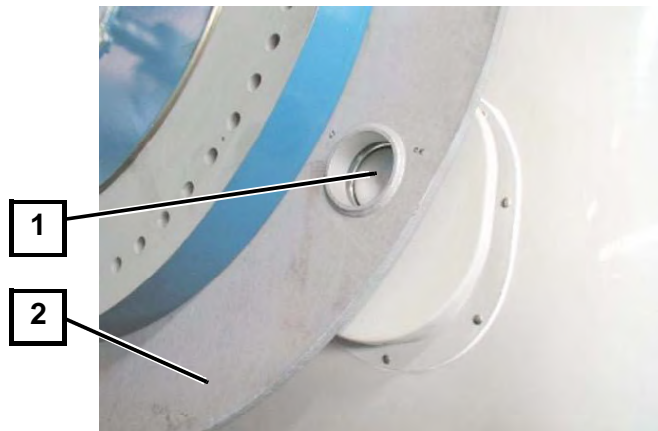


Fig. 60 Rotor lock on the rotor shaft

- 1 Rotor lock bolt
- 2 Rotor lock disk

#### Aligning the rotor

- Ensure that manual control for the rotor brake is activated, the rotor brake is applied, and the rotor is locked



#### **NOTE**

For instructions on operating the rotor brake without hydraulic pressure, see Chapter 14.1 "Operating the rotor brake without system pressure"

- Temporarily release the rotor brake by actuating the *Release Brake* button on the manual control unit of the Topbox. Position the rotor in such a way that one of the markings on the rotor shaft is aligned with the marking on the rotor bearing housing

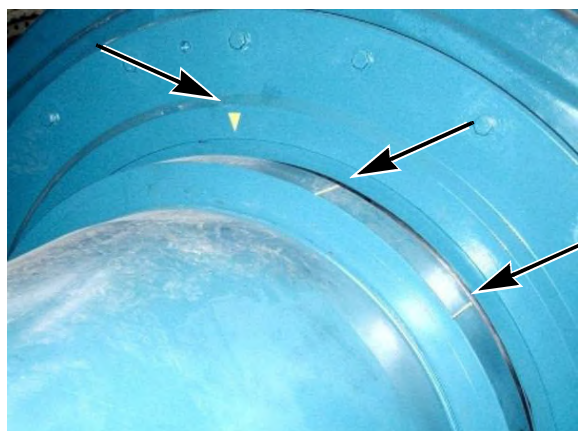


Fig. 61 Markings on rotor shaft and rotor bearing housing

- Make sure that the rotor brake is applied again

If system pressure is available, the rotor brake applies as soon as the *Release Brake* button on the manual control unit is released.

If no system pressure is available, the rotor brake must be manually applied again after the manual release.

- Remove the securing bolt from the mechanism of the rotor lock bolt, see Fig.62

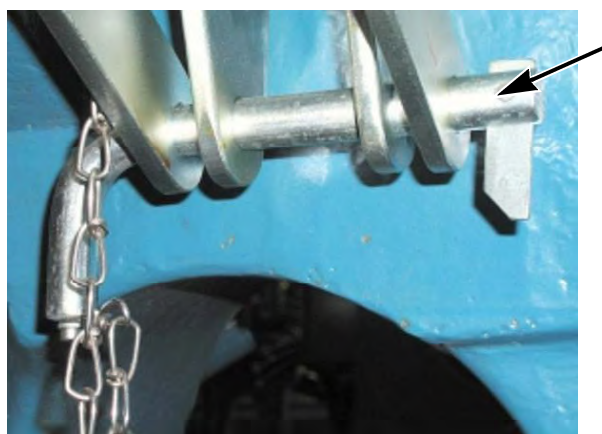


Fig. 62 Securing bolt on rotor lock bolt

- Remove the extension pipe from the bracket and attach it onto the lever of the hand pump

### Locking the rotor with the active rotor brake

- Move the lever of valve 610 on the hydraulic unit into the "Rotor lock" position

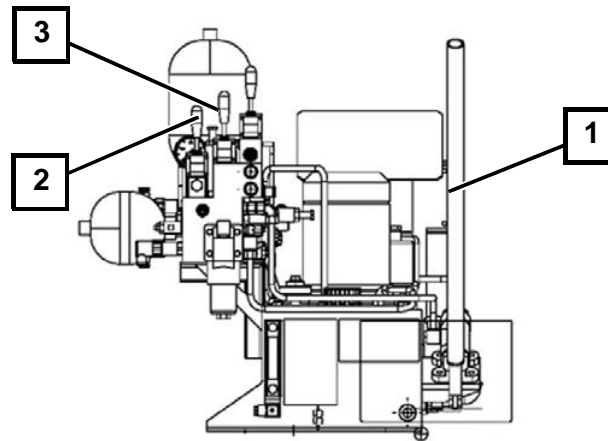


Fig. 63 Hydraulic unit for active rotor brake

- 1 Extension pipe for hand pump
- 2 Valve 600
- 3 Valve 610

- Move the lever of valve 600 into the "Extend lock cylinder" position and hold it in position  
The lever is spring-centered and does not lock so that otherwise it would automatically return to the center position.

### NOTICE

#### DAMAGE TO THE MECHANICAL STRUCTURE

Prior to extending the rotor lock, the rotor must be stopped and precisely aligned in accordance with the markings.

- Extend the rotor lock bolt into the rotor lock disk by operating the hand pump
- If the pump resistance increases noticeably, check whether the rotor lock bolt has been correctly extended into the rotor lock disk. Otherwise, retract the rotor lock bolt and re-align the rotor
- Release the lever of valve 600 so that it returns to the center position
- Secure the rotor lock bolt with the securing bolt

#### Locking the rotor with the passive rotor brake

### NOTICE

#### DAMAGE TO THE MECHANICAL STRUCTURE

Prior to extending the rotor lock, the rotor must be stopped and precisely aligned in accordance with the markings.

- Move the lever of valve 280 on the hydraulic unit to the right until it stops, see Fig.64
- Move the lever of valve 290 on the side of the hydraulic unit upward, see Fig.64

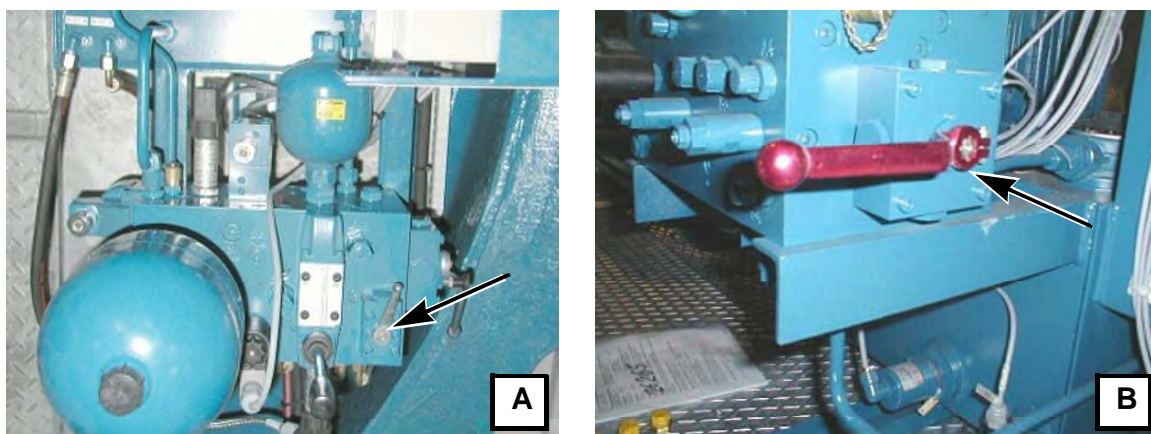


Fig. 64 Locking the rotor

A Vent 280

B Vent 290

- Extend the rotor lock bolt into the rotor lock disk by operating the hand pump
- If the pump resistance increases noticeably, check whether the rotor lock bolt has been correctly extended into the rotor lock disk. Otherwise, retract the rotor lock bolt and re-align the rotor
- Secure the rotor lock bolt with the securing bolt

### Releasing the rotor lock

To release the rotor lock, proceed as follows:

- Make sure that the rotor brake is applied
- Adjust the valves on the hydraulic unit

Active brake:

- Move the lever of valve 610 into the "Rotor lock" position
- Move the lever of valve 600 into the "Retract lock cylinder" position and hold it in position

Passive brake:

- Move the lever of valve 290 on the side of the hydraulic unit downward
- To retract the rotor lock bolt from the rotor lock disk, use the hand pump
- If the pump resistance increases noticeably, make sure that the rotor lock bolt has been retracted from the rotor lock disk

Otherwise:

- In order to release the tension, temporarily release the rotor brake by actuating the "Release brake" button on the manual control unit of the Topbox

**NOTE**

For instructions on operating the rotor brake without hydraulic pressure, see Chapter 14.1 "Operating the rotor brake without system pressure"

- Make sure that the rotor brake is applied again
- Continue to pump until the rotor lock bolt is fully retracted
- Only for active brake:
  - Release the lever of valve 600 so that it returns to the center position
  - Shift the lever of valve 610 into the center position
- Remove the extension pipe from the hand pump and place it in the bracket
- Secure the rotor lock bolt with the securing bolt

### 14.2.2 Rotor lock on the brake disk

The rotor lock on the brake disk is only available for WT's with active rotor brake.



The rotor lock on the brake disk is only an auxiliary lock.

Work in the rotor hub, on the rotor, and on the drive train is only permitted with the rotor lock engaged on the rotor shaft.

**NOTE**

Only use the rotor lock on the brake disk under the following conditions:

- The 10-minute average wind speed is less than 12 m/s.
- The rotor blades are in the feathered position
- The rotor brake is applied.

It is not permitted to leave the WT while the rotor is locked at the brake disk.

**Locking the rotor**

- Ensure that the manual control for the rotor brake is activated and the rotor brake is applied

**NOTE**

For instructions on operating the rotor brake without hydraulic pressure, see Chapter 14.1 "Operating the rotor brake without system pressure"

- Temporarily release the rotor brake by actuating the *Release Brake* button on the manual control unit of the Topbox. Align the brake disk so that the lock bolt can be inserted through the brake caliper halves and one of the 3 drill holes in the brake disk.
- Make sure that the rotor brake is applied again
- Remove the lock bolt from the bracket on the brake caliper

---

**⚠ WARNING**

Risk of injury and damage to the mechanical structure.  
Prior to inserting the lock bolt, the rotor must be stopped.

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- Insert the lock bolt through both brake caliper halves and through the brake disk

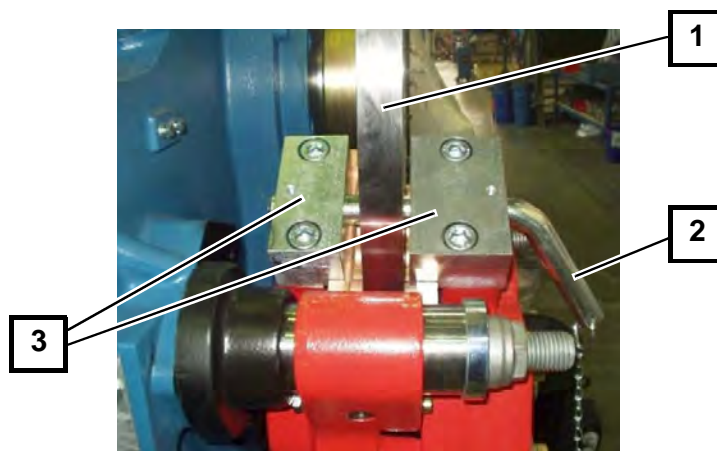


Fig. 65 Rotor lock on brake disk

- 1 Brake disk
- 2 Lock bolt
- 3 Brake caliper halves

- Secure the lock bolt with the spring cotter

### Releasing the rotor lock

- Make sure that the rotor brake is applied
- Remove the spring cotter from the lock bolt
- Remove the lock bolt and store it in the bracket on the brake caliper

## 14.3 Operating the roof

The roof on WTs of turbine class K08 beta can be opened.

It is necessary to open it, for example, in order to transport pieces of equipment into the nacelle or perform various maintenance tasks.

The roof is fastened to the right nacelle wall (when looking towards the rotor hub) by means of hinges, and secured to the left nacelle wall with 2 locks.

To open the roof, open the locks, then open the roof using the hinges and the hydraulic system, and secure it with 2 props.

### Opening the roof



#### **DANGER**

##### **FALL HAZARD**

There is a fall hazard when the roof is open.

While in a fall hazard area, always secure yourself at one of the marked attachment points in the nacelle.

#### **WARNING**

##### **HAZARD OF PERSONAL INJURY AND DAMAGE TO THE NACELLE.**

The roof of the nacelle offers a large surface for the wind to act upon.

- Opening the roof is only permitted at 10-minute average wind speeds up to 12 m/s
- With freshening wind, do not open the roof downwind

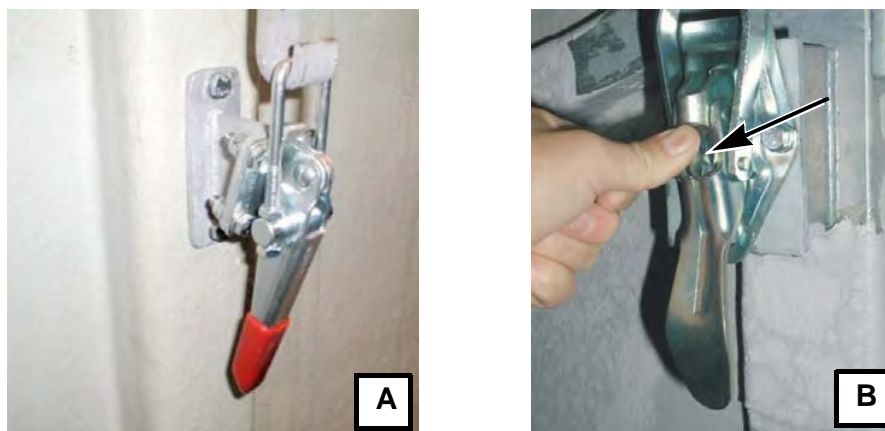


##### **NOTE**

In the case of rain, the nacelle should be positioned perpendicular to the wind direction so that the roof is opened against the wind, offering some degree of protection.

It is recommended to open the cabin roof as a team of two. Proceed as follows:

- Inform all persons in the nacelle of your intention to open the roof
- Open the two locks on the left nacelle wall



*Fig. 66 Lock on the left nacelle wall*

A Old design

B New design with locking mechanism (arrow)

In the new design, slide the locking mechanism upward, releasing the latch.

- Using the hydraulic system, open the roof so far that the bolts of the roof lock can still be easily reached



*Fig. 67 Bolt for roof prop, example N90/2500*

- Remove the props from the brackets on the left nacelle wall and attach them to the bolts of the roof locks  
Make sure that the props are secured on the bolts.
- Continue to open the roof until the props can be attached to the bolts for the locks on the nacelle wall

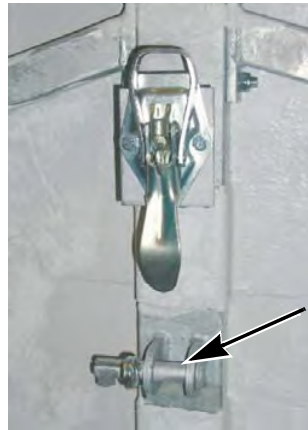


Fig. 68 Bolt for prop on nacelle wall

- Attach the props to the bolts of the locks on the nacelle wall  
Make sure that the props are secured on the bolts.

### Closing the roof

- Ensure that the edge of the nacelle wall is clear and the roof can be closed without obstruction
- Remove the props from the bolts on the nacelle wall
- Lower the roof using the hydraulic system until the props can be removed from the roof
- Remove the props and place them on the brackets
- Lower the roof completely
- Hook the two locks of the roof lock into the left nacelle wall and lock them

## 14.4 Operating the roof hydraulics

The roof on a WT of turbine class K08 beta can be operated with system pressure or using the hand pump of the hydraulic unit.

However, the handling of the hydraulic unit for a WT with active rotor brake is slightly different from that for WTs with passive rotor brake.

### 14.4.1 WT with active brake

#### Opening the roof



#### NOTE

For instructions on how to open the roof, see Chapter 14.3 "Operating the roof".

Only the operation of the roof hydraulics is described here.

- Shift the lever of valve 610 into the center position

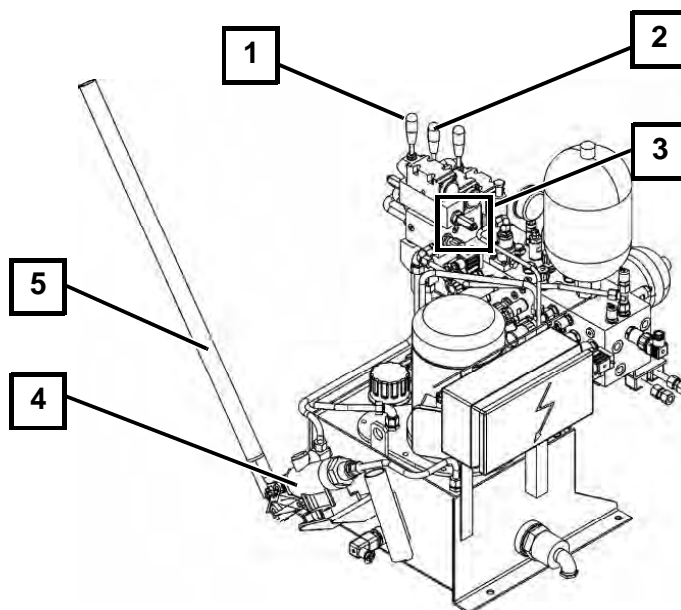


Fig. 69 Hydraulic unit for active rotor brake

- 1 Valve 640
- 2 Valve 610
- 3 Hand wheel 670
- 4 Hand pump
- 5 Extension pipe

- Provide hydraulic pressure:
  - Operation with system pressure: Slightly open the hand wheel 670
  - Operation with the hand pump: Remove the extension pipe from the bracket, attach it onto the lever of the hand pump, and start pumping



#### NOTE

The hand wheel 670 has a throttling function. It can be used to control the speed of the moving roof.

- Release the hydraulic pressure. To do this, move the lever of valve 640 into the "Open roof" position and hold it in position  
The roof opens slowly.



#### NOTE

Valve 640 is spring-centered and does not lock. It returns automatically to the center position.

- Once the required roof position has been reached, release the lever of valve 640 so that it returns to the center position
  - ▶ The roof remains in this position
- Only for operation with system pressure:  
Close the hand wheel 670

### **Closing the roof**

- Shift the lever of valve 610 into the center position
- Provide hydraulic pressure:
  - Operation with system pressure: Slightly open the hand wheel 670
  - Operation with the hand pump: Remove the extension pipe from the bracket, attach it onto the lever of the hand pump, and start pumping
- Release the hydraulic pressure. To do this, move the lever of valve 640 into the "Open roof" position and hold it in position
  - ▶ The roof closes slowly
- Once the required roof position has been reached, release the lever of valve 640 so that it returns to the center position
  - ▶ The roof remains in this position

Once the roof has been closed:

- Only for operation with system pressure:  
Close the hand wheel 670
- Only for operation with hand pump:  
Remove the extension pipe from the hand pump and place it in the bracket

## **14.4.2 WTs with passive brake**

### **Opening the roof**

- Only for operation with system pressure:  
Open valve 240.2

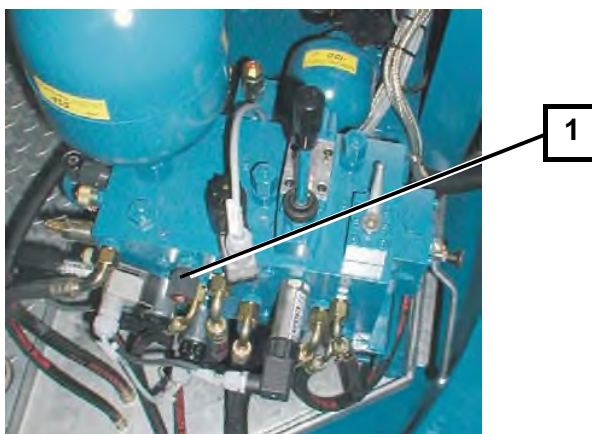


Fig. 70 Hydraulic unit for passive rotor brake

1 Valve 240.2

- Only for operation with hand pump
  - Move the lever of valve 280 counter-clockwise, fully to the left
  - Remove the extension pipe from the bracket, attach it onto the lever of the hand pump, and start pumping



Fig. 71 Hydraulic unit for passive rotor brake

1 Valve 280

2 Valve 310

- Release the hydraulic pressure: Move the lever of valve 310 toward the rotor shaft
  - The roof opens slowly
- Once the required roof position has been reached, move the lever of valve 310 away from the rotor shaft
  - The roof remains in this position

## Closing the roof



### NOTE

For instructions on how to close the roof, see Chapter 14.3 "Operating the roof"

To close the roof, proceed as follows:

- Only for operation with system pressure: Open valve 240.2
- Only for operation with hand pump
  - Move the lever of valve 280 counter-clockwise, fully to the left
  - Remove the extension pipe from the bracket, attach it onto the lever of the hand pump, and start pumping
- Release the hydraulic pressure: Move the lever of valve 310 toward the rotor shaft
  - ▶ The roof closes slowly
- Once the required roof position has been reached, move the lever of valve 310 away from the rotor shaft
  - ▶ The roof remains in this position

Once the roof has been closed:

- Only for operation with system pressure: Close valve 240.2.
- Only for operation with hand pump:
  - Move the lever of valve 280 clockwise, fully to the right
  - Remove the extension pipe from the hand pump and place it in the bracket

## 14.5 Entering the rotor hub

To perform maintenance or repair work on the rotor blades and pitch system, it is necessary to enter the rotor hub.

In the case of WT's of turbine class K08 beta, the rotor hub must be crossed on the outside.

In the interest of safety of the person performing the work, a second person who is able to operate the WT controls must be present in the nacelle.



Work on the drive train and in the rotor hub is only permitted at 10-minute average wind speeds of less than 12 m/s.

---

 **WARNING**

If the rotor is suddenly set into motion, this may result in life-threatening or serious injury.

Before entering the rotor hub, always lock the rotor on the rotor shaft using the rotor lock, and ensure that the rotor brake is also applied.

---

For operating the rotor lock, see Chapter 14.2 "Operating the rotor lock"

---

 **WARNING****FALLING OBJECTS**

Make sure that nobody is present in the area below the turbine when climbing onto the rotor hub. Make sure that there are no loose parts that may fall down. Secure any tools carried along.

---

### 14.5.1 Attaching the hub rope

In the case of WT's of turbine class K08, the respective service employee must be secured with the hub rope when crossing the rotor hub.

- Make sure that the hub rope and its accessories are in sound condition and test badges are valid.
- 

 **DANGER****FALL HAZARD**

A PPE either with an invalid test badge, or which has been damaged or strained by a fall, must no longer be used.

Replace the PPE immediately and have it checked by an expert.

---

#### K08 beta without safety rope system

- Pull the webbing sling through the lifting lug on the rotor bearing

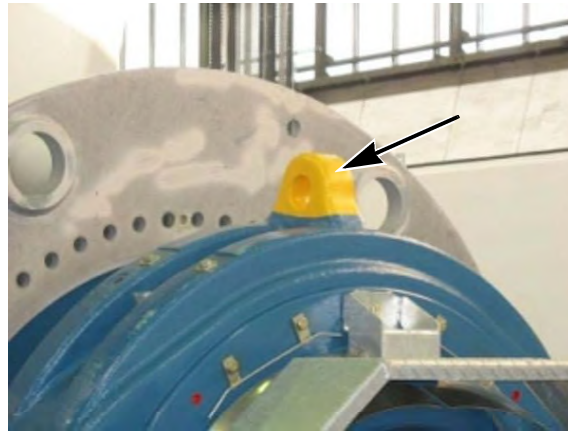


Fig. 72 Lifting lug on rotor bearing

- Hook the hub rope into both ends of the webbing sling using the large snap hooks and secure it

#### K08 beta with safety rope system

- Using the large snap hook, hook the hub rope directly into the attachment lug of the swivel hoist ring of the safety rope system on the lifting lug of the rotor bearing and secure it

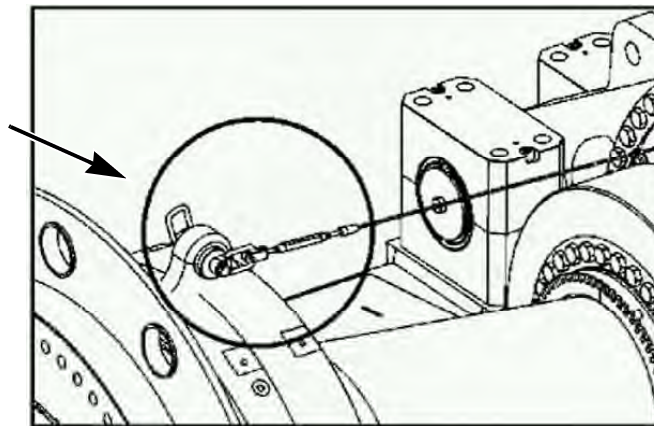


Fig. 73 Attachment lug of swivel hoist ring of safety rope system

### 14.5.2 Crossing the rotor hub



**! DANGER**

#### FALL HAZARD

There is a fall hazard when the roof is open.

While in a fall hazard area, always secure yourself at one of the marked attachment points in the nacelle.

**⚠ DANGER****FALL HAZARD**

When crossing the rotor hub, always use the hub rope attached to the rotor bearing to secure yourself against falling from a height.

For extra safety, use the lanyard with energy absorber.

**⚠ DANGER****FALL HAZARD**

In the case of icing on the hub ladder, the risk of injury increases due to slipping and falling into the safety harness.

Cancel the crossing of the rotor hub.

**⚠ DANGER****FALL HAZARD**

If a person slips, incorrect attachment to the hub cage may cause injury or material damage.

Only use the hub cage brackets as attachment points.

**⚠ DANGER****FALL HAZARD**

There is a fall hazard in the rotor hub within 2 m of the rotor hub access.

While working in this area, secure yourself using the lanyard with energy absorber

To access the rotor hub, proceed as follows:

- If the roof is not already open, open and secure it, see Chapter 14.3 "Operating the roof"
- Check whether the rotor is locked in such a way that one of the hub ladders is in the top position



*Fig. 74 Hub ladder in position*

- If this is not the case, release the rotor lock, turn the rotor hub, and lock the rotor again, see Chapter 14.2 "Operating the rotor lock"
- Ensure that the hub rope is attached to the lifting lug on the rotor bearing
- Check the guided-type fall arrester for proper functioning
- Hook the snap hook of the guided-type fall arrester of the hub rope into the chest lug of the safety harness and secure it
- Visually inspect the hub ladder. Check for missing screws, deformations, breaks, or damaged weld seams
- Prior to using the hub ladder, rectify any damage which impairs the safety and stability of the hub ladder  
If this is not possible, cancel the crossing of the rotor hub and commission the necessary repair work.
- The lanyard is attached to the backplate of the safety harness with a snap hook. For extra safety, release the lanyard with energy absorber from the attachment point in the nacelle and connect it to the hub ladder.
- Climb onto the hub ladder. During this process, make sure that the hub rope is protected against mechanical damage by the protective tube at the contact point on the rotor lock disk.
- On the hub ladder, move with appropriate care toward the rotor hub access. Step by step, move the guided-type fall arrester along so that in the event of slipping the fall height is as low as possible
- Detach the lanyard with energy absorber and attach it further down on the hub ladder
- Proceed in this manner until reaching the hub cage

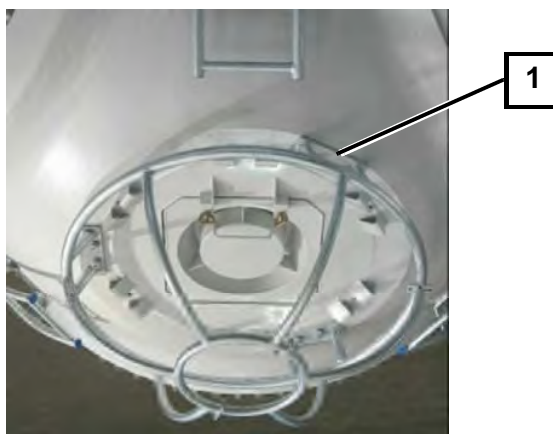


Fig. 75 Hub cage in front of the access hatch

1 One of the three brackets (attachment points)

- Visually inspect the hub cage. Check for any missing screws, deformations, breaks, or damaged weld seams.  
In the case of damage, the service employee must decide whether to continue the access into the rotor hub or to cancel. The damage must always be reported to the responsible employee.
- Enter the hub cage and, for extra safety, attach the lanyard with energy absorber to a hub cage bracket
- Loosen the cage nuts on the access hatch and fold the fastening bolt
- Fold the access hatch inward until the locking mechanism locks in place
- Release the lanyard with energy absorber from the last attachment point and enter the rotor hub
- Make sure that the access hatch is properly secured with the retention hook
- Attach the lanyard with energy absorber to an attachment point in the rotor hub
- Detach the guided-type fall arrester of the hub rope from the safety harness and hook it to the hub cage

For returning into the nacelle, secure yourself and proceed in the same manner as described above:

- Hook the guided-type fall arrester of the hub rope into the chest lug of the safety harness
- Release the lanyard with energy absorber from the attachment point in the rotor hub and, for extra safety, attach it to one of the hub cage brackets
- Climb out of the rotor hub into the hub cage
- Close the access hatch, fold the fastening bolt, and tighten the cage nuts

- Leave the hub cage and move up the hub ladder. In the process, move the guided-type fall arrester along, step by step, and feed the lanyard with energy absorber after it
- Enter the nacelle
- Release the lanyard with energy absorber from the hub ladder and attach it to an attachment point in the nacelle
- Release the hub rope from safety harness and attachment point

## 14.6 Transporting objects into the nacelle

NORDEX WT's are equipped with an on-board crane for transporting objects into the nacelle. Objects can also be transported using the working rope.



**DANGER**

### SUSPENDED LOAD

Risk of injury due to falling objects.

Do not stand or walk under suspended loads.

### NOTICE

#### RISK OF DAMAGE TO NACELLE AND SPONGE RUBBER SEAL

Do not guide the working rope over the unprotected edge of the nacelle wall.

Use an edge protection.

The on-board crane must only be operated by instructed persons.

On-board cranes can differ in design from one WT to the other. Always refer to the operating instructions stored in the WT.

If the working rope is used on WT's of turbine type K08 beta, use the edge protection, see Chapter 14.6.2 "Using the edge protection for the working rope".

If the edge protection is not available, other arrangements must be made. This prevents damage to the edge of the nacelle wall and the sponge rubber seal on the wall.

### 14.6.1 Using the on-board crane

The following applies to the standard version of the on-board crane for WT's of turbine class K08 beta, i.e., the pillar jib crane with a load capacity of up to 250 kg.

**NOTICE****UNCONTROLLED PENDULAR MOVEMENTS**

Secure the load to be transported with an additional rope from the ground and keep it clear from tower and nacelle.

To use the on-board crane, do the following:

- Remove the power supply cable coiled up on the crane pillar and connect it
- To lift the crane jib out of the bracket on the gearbox, turn the crank lever on the manual lifting jack



Fig. 76 Crane jib in parked position

- Unhook the locking device for the chain hoist

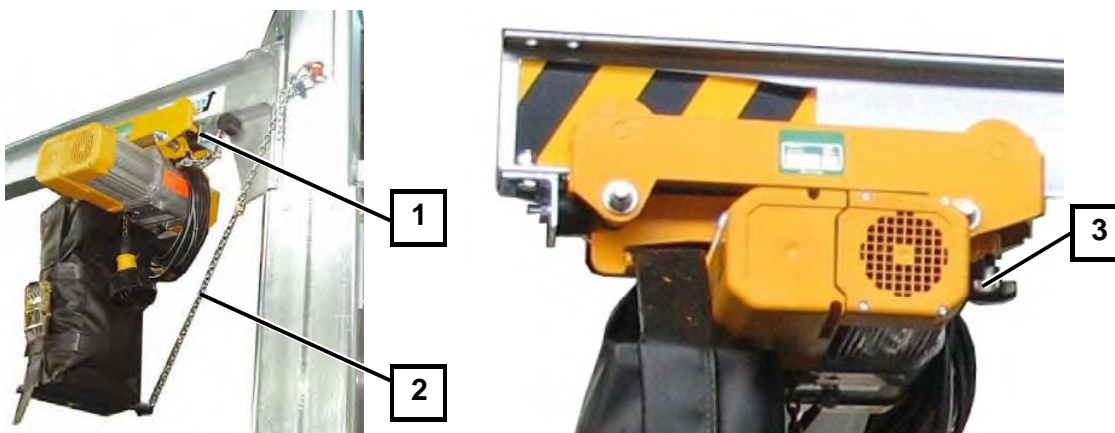


Fig. 77 Chain hoist

- 1 Locking device of the chain hoist
- 2 Safety chain for chain bag
- 3 Locking screw

- Release the safety chain on the chain bag from the eyebolt on the crane pillar

- Loosen the chain hoist locking screw
- Slew the crane jib far enough out of the parked position so that the chain hoist can be moved right forward
- Move the chain hoist forward on the crane jib until the ratchet is activated

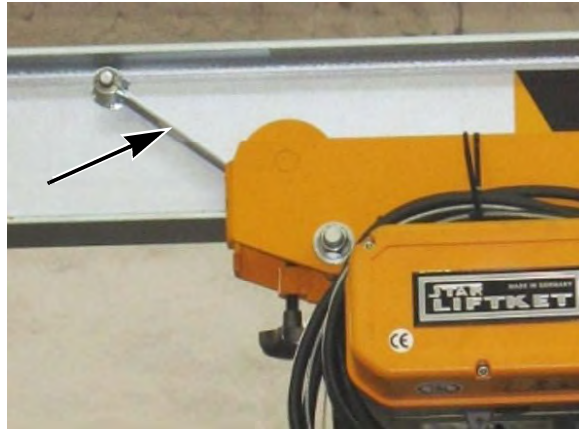


Fig. 78 Ratchet

- Attach the working rope to the crane hook and lower it to the ground
- To avoid any damage, use the working rope from the ground to keep the crane hook clear of nacelle and tower
- If necessary, load the crane hook with a big bag and make sure that the crane hook safety latch is closed
- Remove the securing bolt for the crane pillar from the gear rack bracket



Fig. 79 Securing bolt in the gear rack bracket

- Fully extend the crane pillar using the manual lifting jack, and insert the securing bolt through the drill holes that become visible in the crane pillar

**⚠ WARNING**

Risk of injury and material damage due to failure of the self-locking function of the gear rack drive.

Only use the extended crane pillar when the securing bolt is inserted.

- Slew the crane jib over the nacelle wall and use the snap hook to secure it to the eyebolt on the crane pillar



*Fig. 80 Locking device crane jib*

- Remove the chain hoist's power supply cable from the crane pillar and connect it to the 400-V power outlet on the Topbox

The chain hoist is now ready for operation and can be operated with its keyboard.

After using the on-board crane, return it to the parked position and secure it there.

- Retract the crane hook
- Release the crane jib's locking device from the crane pillar
- Slew the crane jib into the nacelle until the crane hook can be reached
- Remove any loads hanging on the crane hook
- Bring in the working rope and release it from the crane hook
- Loosen the chain hoist locking screw
- Open the ratchet and move the chain hoist toward the crane pillar
- Fasten the chain hoist with the locking screw
- Secure the chain hoist on the crane jib with the snap hook
- Secure the chain bag on the crane pillar's eyebolt using the safety chain
- Remove the securing bolt from the crane pillar and store it in the bracket of the gear rack

- Position the jib over the bracket on the gearbox and use the manual lifting jack to lower it
- Pull the power supply cable out of the power outlet and coil it up on the crane pillar

### 14.6.2 Using the edge protection for the working rope

In WTs of turbine class K08 beta, an edge protection for the working rope may be already stored in the nacelle.

To protect the edge of the nacelle wall and the sponge rubber seal, use the edge protection when using the working rope for transporting objects into the nacelle with the roof open.

The edge protection is stored inside the nacelle on the center fastening on the left nacelle wall (when looking towards the rotor hub).



*Fig. 81 Edge protection in storage location*

- Remove the edge protection from its storage location
- Place it over the edge of the nacelle wall
- Secure it with the star knob



*Fig. 82 Edge protection in use*

- After use, return the edge protection to the storage location and secure it there

## 15. Special features of K08 gamma



### NOTE

Types:

- N80/2500
- N90/2500
- N100/2500
- N117/2400

### 15.1 Operating the rotor brake without system pressure

The following describes how the rotor brake can be operated when the hydraulic unit is not ready for operation, meaning there is no system pressure.

In the case of a grid failure, the active mechanical rotor brake is normally released and can no longer be applied automatically.

It can be applied manually using the hand pump on the hydraulic unit and released again using a valve.



Fig. 83 Hydraulic unit for rotor brake and yaw brakes

#### 15.1.1 Manually applying the rotor brake

The rotor brake is released by default.

- Open the hand wheel 810.3 on the hydraulic unit
- Remove the extension pipe from the bracket and attach it onto the lever of the hand pump
- Build up a pressure of 115 bar using the hand pump
  - The rotor brake is now applied.

- Close the hand wheel 810.3 again

### 15.1.2 Releasing the rotor brake

- Open valve 810.2
- After the pressure has been released, close valve 810.2 again



#### NOTE

If valve 810.2 is open it is not possible to start up the WT.

## 15.2 Operating the rotor lock

The rotor lock is a device for mechanically locking the rotor. It prevents personal injuries in the nacelle and the rotor hub resulting from contact with rotating parts of the drive train.



The rotor lock must only be used at 10-minute average wind speeds of up to a maximum of 12 m/s, with at least two rotor blades in the feathered position.

#### NOTICE

##### GEARBOX DAMAGE

If the rotor is locked for more than 24 hours, observe the current revision of the Work Instructions *F010\_002*.

### 15.2.1 Rotor lock on the rotor shaft

The rotor of WTs of turbine class K08 gamma is locked with a single rotor lock bolt that is moved by a spindle with hexagon. The spindle must be turned manually, using a torque wrench set to 200 Nm. The torque wrench is stored in a special bracket next to the rotor lock and secured with a spring cotter.

In the locked position the rotor lock bolt must be secured with the securing bolt.

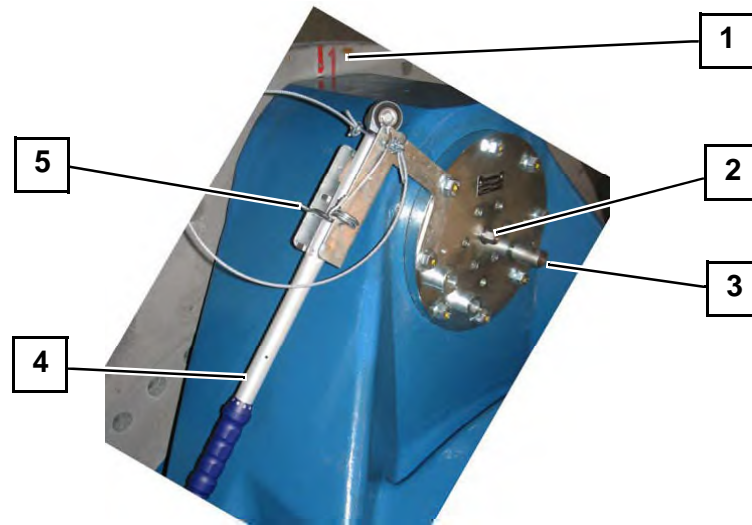


Fig. 84 Rotor lock on the rotor shaft

- 1 Marking on the rotor lock disk
- 2 Spindle with hexagon
- 3 Securing bolt, inserted
- 4 Torque wrench with securing cable
- 5 Bracket with spring cotter

### Locking the rotor

- Allow the rotor to run at idle until the marking on the rotor lock disk is aligned with the center axis of the rotor bearing
- Apply the rotor brake
- Use the torque wrench to turn the spindle counter-clockwise until it stops
  - The rotor lock bolt is inserted into the rotor lock disk.

**Notice:** The maximum permissible actuating torque of the spindle is 200 Nm.
- Hand-screw the securing bolt into the provided drill hole
 

The securing bolt is stored in the shallow pit on the rotor bearing below the rotor lock.



#### NOTE

The rotor lock bolt is fully extended only when the securing bolt is screwed in all the way.

### Releasing the rotor lock

- Make sure that the rotor brake is applied
- Remove the securing bolt and place it into the shallow pit on the rotor bearing below the rotor lock.

- Use the torque wrench to turn the spindle clockwise until it stops
    - ▶ The rotor lock bolt is removed from the rotor lock disk
- Notice:** The maximum permissible actuating torque of the spindle is 200 Nm.
- Put the torque wrench into the bracket and secure it

### 15.2.2 Rotor lock on the brake disk

The rotor lock on the brake disk is designed in the same way as in WT's of turbine class K08 beta.

---

#### NOTICE

In WT's of turbine class K08 gamma the rotor lock on the brake disk must only be used up to 10-minute average wind speeds of 9 m/s.

The rotor lock on the brake disk is operated in the same way as in WT's of turbine class K08 beta, see "Rotor lock on the brake disk" page 106.

## 15.3 Entering the rotor hub

To perform maintenance or repair work on the rotor blades and pitch system, it is necessary to enter the rotor hub.

In the interest of safety of the person performing the work, a second person who is able to operate the WT controls must be present in the nacelle.

---

#### WARNING

Working inside the rotor hub is only permitted at 10-minute average wind speeds up to 12 m/s.

---

#### WARNING

If the rotor is suddenly set into motion, this may result in life-threatening or serious injury.

Before entering the rotor hub, lock the rotor on the rotor shaft using the rotor lock, and ensure that the rotor brake is also applied.

For instructions on how to operate the rotor lock, see Chapter 15.2 "Operating the rotor lock".

---

**WARNING****FALLING OBJECTS**

Make sure that nobody is present in the area below the turbine when climbing onto the rotor hub.

Make sure that there are no loose parts that may fall down.

Secure any tools carried along.

- Fold down the ladder in the nacelle



*Fig. 85 Hatch and ladder in the nacelle*

- Open the hatch in the nacelle and secure yourself at the yellow personal attachment points on the roof

**WARNING****FALL HAZARD**

The hand rails are not suitable as personal attachment points. Only secure yourself against falling from a height at the yellow-marked personal attachment points.

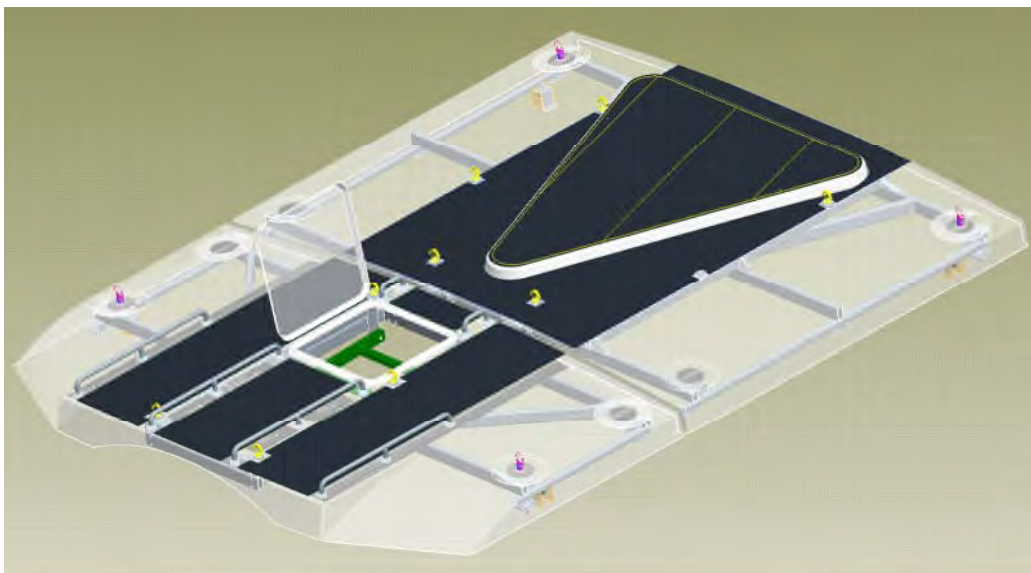


Fig. 86 *Nacelle roof: crossing to the rotor hub*

- Cross the nacelle roof toward the rotor hub
- Open and secure the access hatch



#### **RISK OF INJURY**

The lock must be properly locked in place so that the hatch is not able to automatically shut again.

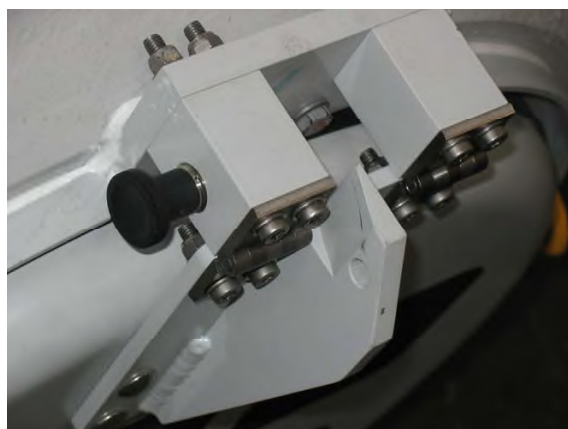


Fig. 87 *Access hatch rotor hub*

- Climb backwards into the rotor hub

## 15.4 Transporting objects



**⚠ DANGER**

### SUSPENDED LOAD

- Do not stand or walk under suspended loads
- Do not exceed the load capacity stated on the crane
- Immediately put down carried loads after the transport process has been completed

Objects are transported from the ground into the nacelle using an electric chain hoist, see Fig.88.

For transporting objects within the nacelle, WT's of turbine class K08 gamma are equipped with a manually-operated overhead crane, see Fig.91.

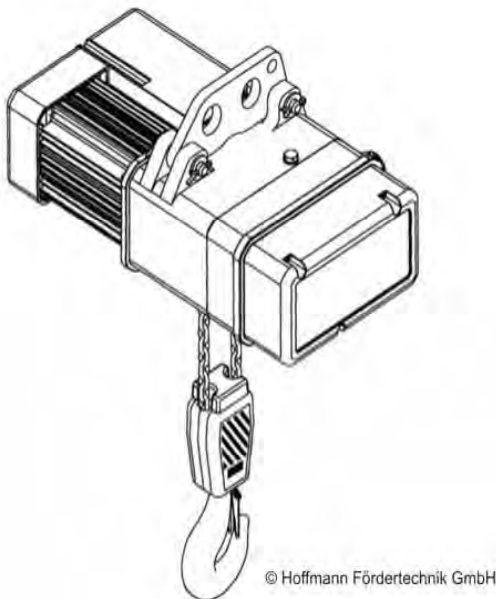
Both cranes are designed for a maximum load capacity of 1000 kg.

### 15.4.1 Using the electric chain hoist



#### OBSERVE DOCUMENT

Operating Instructions *K0813\_032789 Electric chain hoists K08 gamma*



© Hoffmann Fördertechnik GmbH

Fig. 88 Electric chain hoist

The electric chain hoist is operated using a remote control with emergency stop function.

**NOTE**

The electric chain hoist must only be operated by trained and instructed personnel.

Always refer to the operating instructions deposited at the electric chain hoist. Observe the manufacturer's instructions on safety and operation.

- Secure yourself at the personal attachment points (vertical rod 4 left/right)
- Remove the cover plates from the crane hatch and secure them

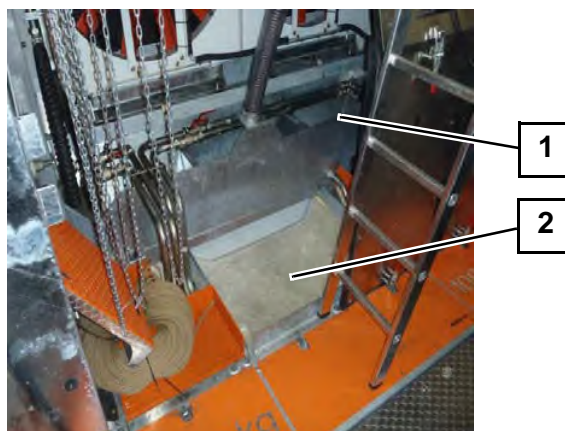


Fig. 89 Crane hatch and oil drip tray

- 1 Oil drip tray
- 2 Crane hatch

- Attach the guide rope to the hook of the electric chain hoist and lower it through the crane hatch  
**Note:** The guide rope is stored in the oil drip tray.
- Lift the load

**NOTICE****PENDULAR MOVEMENTS**

Secure the load to be transported with an additional rope from the ground and keep it clear from tower and nacelle.

After completing the crane operation:

- Attach the remote control's snap hook to the snap hook in the eyebolt on the divider

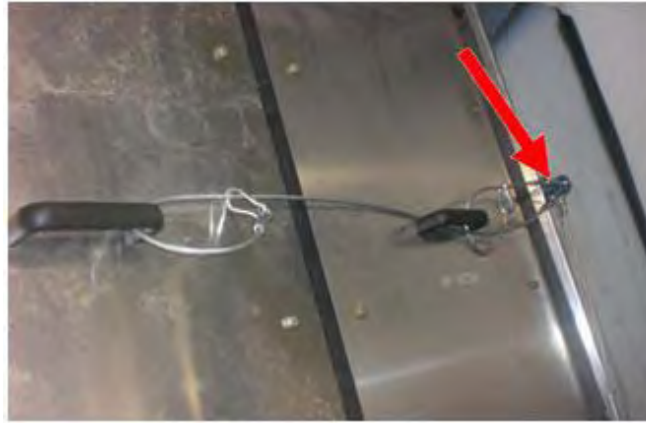


Fig. 90 Position of the remote control

- Bring in the guide rope, coil it up, and deposit it in the oil drip tray
- Close the hatch with the cover plates

## 15.4.2 Operating the overhead crane



### NOTE

The overhead crane must only be operated by trained and instructed personnel.

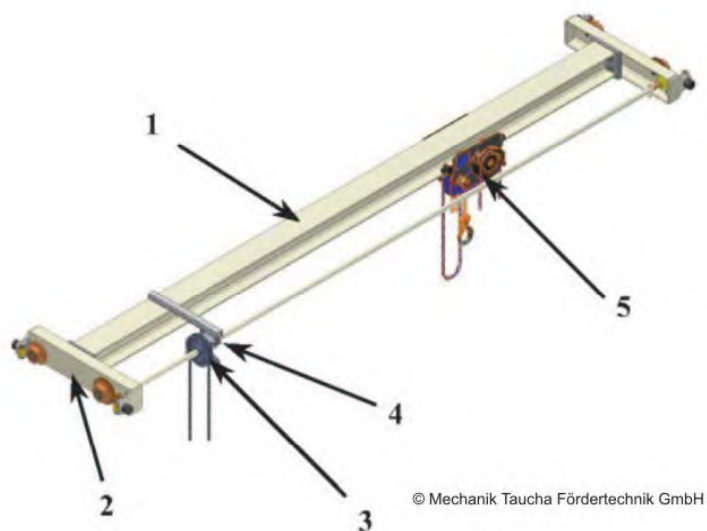
Always refer to the operating instructions deposited at the overhead crane.

Observe the manufacturer's instructions on safety and operation.

The overhead crane EBK 1000 (single-girder overhead crane) is operated only manually. The load can be lifted and lowered and moved on 2 axes.

The load is lifted by a chain hoist with a crane hook.

The overhead crane is equipped with a spur gear chain pulley block that is operated by a hand-gear trolley.



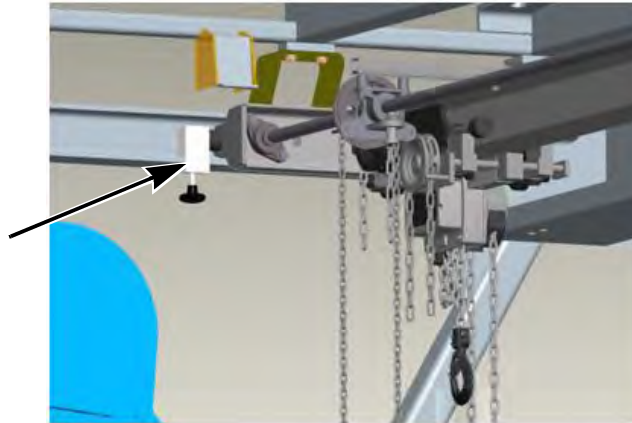
*Fig. 91*      *Overhead crane*

- 1 Main girder
- 2 End carriage with guide rollers and buffer
- 3 Hand-gear trolley for crane operation
- 4 "Fall out" protection for the chain of the hand-gear trolley for crane operation
- 5 Spur gear chain pulley block with hand-gear trolley and locking device



*Fig. 92*      *Spur gear chain pulley block with hand-gear trolley and locking device*

During operation of the WT, the overhead crane is locked with two crane stoppers in the parked position. The crane stoppers with star knob are mounted on the left and right of the crane rail.



*Fig. 93 Crane stopper for overhead crane*

Before using the overhead crane, remove the stoppers. Remount them after use.

## 16. Revision Index

Rev.	Date	Modification	AST	Author
05	2011-11-14	New location of the rappelling equipment Modifications of the project "ideal nacelle" Other additions and corrections	7164 7165 6727	Simon

### Safety regulations

- If applicable, closing the shut-off valve of the automatic fire extinguishing system after entering the nacelle (AST 7222)
- Special PPE for dangerous work on the converter (Safety Alert 08-2011)

### Safety equipment

- Location of rappelling equipment corrected (AST 7164 and 7165)

### Safety devices

- Functioning of battery disconnectors corrected
- Note on possible short movements of the rotor blade in the case of an area stop
- New section "call button rotor hub" added

### Special features of K08 gamma

- Guide rope location added
- Remote control location added
- Crane stoppers overhead crane added

### Crane operation of all turbine classes

- Note on crane drum removed

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Germany  
<http://www.nordex-online.com>  
[info@nordex-online.com](mailto:info@nordex-online.com)

**Exhibit S**  
**Aeronautical Studies**



# OHIO DEPARTMENT OF TRANSPORTATION AVIATION

2829 W. DUBLIN-GRANVILLE ROAD • COLUMBUS, OH • 43235-2786

December 18, 2013

Windlab Developments USA  
Attn: John Sidor  
927 Wing Street  
Plymouth, MI 48170

Proposal: Wind Turbine Farm  
Greenwich, Ohio  
Height 490 ft. AGL

Subject: CONSTRUCTION/ALTERATION PERMIT  
Aeronautical Study No: 2013-DOT-64-OE thru 2013-DOT-79-OE &  
2013-DOT-94-OE thru 2013-DOT-102-OE

To Whom It May Concern,

In response to the application received on the above date concerning the proposed construction/alteration described above, a study has been conducted under provisions of Ohio State Law Chapter 119, Section 4561.34 of the Revised Code to determine whether proposed construction would be an obstruction to air navigation. The findings of that study are as follows:

The proposed construction exceeds obstruction standards adopted under Section 4561.32 of the Ohio Revised Code, but will not effect the safe and efficient use of the airports nor effect the safety of persons and property on the ground. However, the following applies to the construction proposed:

☒ [ X ] Notice is required if the project is abandoned or modified; maximum height 490' AGL.

☒ [ X ] Obstruction Marking and/or Lighting is required.

☒ [ X ] The structure should be obstruction marked and lighted per current FAA Advisory Circular (AC 70/7460-1K) "Obstruction Marking and Lighting".

☒ [ X ] Required lighting SHALL be maintained in operable condition.

☒ [ X ] Compliance with the FAA conditions of approval.

This authorization to initiate construction/alteration of the subject proposal expires on August 7, 2014 unless it is extended, revised or terminated by the Ohio State Department of Transportation. This permit does not exempt you from contacting local zoning authorities regarding compliance with local zoning ordinances.

If you have any questions, please call; (614)387-2350.

Respectfully,

John P. Carpico, Aviator  
ODOT Office of Aviation  
2829 W. Dublin-Granville Road  
Columbus, OH 43235

# Construction Permit for ODOT study 2013-DOT-64-OE thru 2013-DOT-79-OE & 2013-DOT-94-OE thru 2013-DOT-102-OE

This permit covers the following FAA ASN's Determinations of No Hazard:

FAA ASN	Lat	Long	Site Elevation (feet)	Structure Height (feet)	Total Height (feet)
2013-WTE-230-OE	40° 59' 52.71" N	82° 31' 31.99" W	1112	490	1602
2013-WTE-231-OE	41° 0' 26.96" N	82° 31' 9.92" W	1086	490	1576
2013-WTE-232-OE	40° 59' 53.43" N	82° 30' 53.17" W	1110	490	1600
2013-WTE-233-OE	40° 59' 54.12" N	82° 30' 0.52" W	1142	490	1632
2013-WTE-234-OE	41° 0' 22.71" N	82° 30' 11.93" W	1114	490	1604
2013-WTE-235-OE	40° 59' 48.87" N	82° 29' 35.49" W	1148	490	1638
2013-WTE-236-OE	41° 0' 27.51" N	82° 29' 32.96" W	1137	490	1627
2013-WTE-237-OE	41° 1' 13.28" N	82° 30' 15.91" W	1080	490	1570
2013-WTE-238-OE	41° 1' 7.97" N	82° 29' 55.40" W	1085	490	1575
2013-WTE-239-OE	41° 0' 50.68" N	82° 29' 32.35" W	1111	490	1601
2013-WTE-240-OE	41° 0' 2.15" N	82° 28' 30.10" W	1168	490	1658
2013-WTE-241-OE	41° 0' 10.53" N	82° 28' 46.15" W	1162	490	1652
2013-WTE-242-OE	41° 0' 24.30" N	82° 28' 42.49" W	1156	490	1646
2013-WTE-243-OE	41° 0' 52.85" N	82° 28' 24.44" W	1124	490	1614
2013-WTE-244-OE	41° 1' 7.60" N	82° 28' 44.59" W	1107	490	1597
2013-WTE-245-OE	41° 1' 32.30" N	82° 28' 58.74" W	1083	490	1573
2013-WTE-246-OE	41° 1' 24.54" N	82° 27' 55.12" W	1110	490	1600
2013-WTE-247-OE	41° 1' 33.74" N	82° 28' 13.45" W	1093	490	1583
2013-WTE-248-OE	41° 1' 58.46" N	82° 28' 25.90" W	1066	490	1556
2013-WTE-249-OE	41° 2' 18.91" N	82° 28' 37.12" W	1049	490	1539
2013-WTE-250-OE	41° 3' 11.99" N	82° 28' 45.68" W	1020	490	1510
2013-WTE-251-OE	41° 2' 3.67" N	82° 27' 47.49" W	1066	490	1556
2013-WTE-252-OE	41° 2' 27.61" N	82° 27' 54.25" W	1043	490	1533
2013-WTE-253-OE	41° 3' 7.80" N	82° 28' 4.78" W	1025	490	1515
2013-WTE-254-OE	41° 2' 32.08" N	82° 27' 6.19" W	1040	490	1530



Mail Processing Center  
Federal Aviation Administration  
Southwest Regional Office  
Obstruction Evaluation Group  
2601 Meacham Boulevard  
Fort Worth, TX 76137

Aeronautical Study No.  
2013-WTE-239-OE

Issued Date: 02/07/2013

Windlab Developments USA  
Windlab Developments USA  
927 Wing Street  
Plymouth, MI 48170

**\*\* DETERMINATION OF NO HAZARD TO AIR NAVIGATION \*\***

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine Greenwich Wind Turbine
Location:	Greenwich, OH
Latitude:	41-00-50.68N NAD 83
Longitude:	82-29-32.35W
Heights:	1111 feet site elevation (SE) 490 feet above ground level (AGL) 1601 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

As a condition to this Determination, the structure is marked/lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, white paint/synchronized red lights - Chapters 4,12&13(Turbines).

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be e-filed any time the project is abandoned or:

☐ At least 10 days prior to start of construction (7460-2, Part I)  
☒ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

While the structure does not constitute a hazard to air navigation, it would be located within or near a military training area and/or route.

This determination expires on 08/07/2014 unless:

- (a) the construction is started (not necessarily completed) and FAA Form 7460-2, Notice of Actual Construction or Alteration, is received by this office.
- (b) extended, revised, or terminated by the issuing office.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

Additional wind turbines or met towers proposed in the future may cause a cumulative effect on the national airspace system. This determination is based, in part, on the foregoing description which includes specific coordinates and heights . Any changes in coordinates will void this determination. Any future construction or alteration requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

If we can be of further assistance, please contact our office at (404) 305-7081. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2013-WTE-239-OE.

**Signature Control No: 181072419-182741720**

( DNE -WT )

Michael Blaich  
Specialist



Mail Processing Center  
Federal Aviation Administration  
Southwest Regional Office  
Obstruction Evaluation Group  
2601 Meacham Boulevard  
Fort Worth, TX 76137

Aeronautical Study No.  
2013-WTE-232-OE

Issued Date: 02/07/2013

Windlab Developments USA  
Windlab Developments USA  
927 Wing Street  
Plymouth, MI 48170

**\*\* DETERMINATION OF NO HAZARD TO AIR NAVIGATION \*\***

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine Greenwich Wind Turbine
Location:	Greenwich, OH
Latitude:	40-59-53.43N NAD 83
Longitude:	82-30-53.17W
Heights:	1110 feet site elevation (SE)
	490 feet above ground level (AGL)
	1600 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

As a condition to this Determination, the structure is marked/lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, white paint/synchronized red lights - Chapters 4,12&13(Turbines).

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be e-filed any time the project is abandoned or:

☐ At least 10 days prior to start of construction (7460-2, Part I)  
☒ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

While the structure does not constitute a hazard to air navigation, it would be located within or near a military training area and/or route.

This determination expires on 08/07/2014 unless:

- (a) the construction is started (not necessarily completed) and FAA Form 7460-2, Notice of Actual Construction or Alteration, is received by this office.
- (b) extended, revised, or terminated by the issuing office.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

Additional wind turbines or met towers proposed in the future may cause a cumulative effect on the national airspace system. This determination is based, in part, on the foregoing description which includes specific coordinates and heights . Any changes in coordinates will void this determination. Any future construction or alteration requires separate notice to the FAA.

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Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

If we can be of further assistance, please contact our office at (404) 305-7081. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2013-WTE-232-OE.

**Signature Control No: 181072412-182741721**

( DNE -WT )

Michael Blaich  
Specialist



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Federal Aviation Administration  
Southwest Regional Office  
Obstruction Evaluation Group  
2601 Meacham Boulevard  
Fort Worth, TX 76137

Aeronautical Study No.  
2013-WTE-249-OE

Issued Date: 02/07/2013

Windlab Developments USA  
Windlab Developments USA  
927 Wing Street  
Plymouth, MI 48170

**\*\* DETERMINATION OF NO HAZARD TO AIR NAVIGATION \*\***

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine Greenwich Wind Turbine
Location:	Greenwich, OH
Latitude:	41-02-18.91N NAD 83
Longitude:	82-28-37.12W
Heights:	1049 feet site elevation (SE)
	490 feet above ground level (AGL)
	1539 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

As a condition to this Determination, the structure is marked/lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, white paint/synchronized red lights - Chapters 4,12&13(Turbines).

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be e-filed any time the project is abandoned or:

☐ At least 10 days prior to start of construction (7460-2, Part I)  
☒ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

While the structure does not constitute a hazard to air navigation, it would be located within or near a military training area and/or route.

This determination expires on 08/07/2014 unless:

- (a) the construction is started (not necessarily completed) and FAA Form 7460-2, Notice of Actual Construction or Alteration, is received by this office.
- (b) extended, revised, or terminated by the issuing office.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

Additional wind turbines or met towers proposed in the future may cause a cumulative effect on the national airspace system. This determination is based, in part, on the foregoing description which includes specific coordinates and heights . Any changes in coordinates will void this determination. Any future construction or alteration requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

If we can be of further assistance, please contact our office at (404) 305-7081. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2013-WTE-249-OE.

**Signature Control No: 181072429-182741722**

( DNE -WT )

Michael Blaich  
Specialist



Mail Processing Center  
Federal Aviation Administration  
Southwest Regional Office  
Obstruction Evaluation Group  
2601 Meacham Boulevard  
Fort Worth, TX 76137

Aeronautical Study No.  
2013-WTE-253-OE

Issued Date: 02/07/2013

Windlab Developments USA  
Windlab Developments USA  
927 Wing Street  
Plymouth, MI 48170

**\*\* DETERMINATION OF NO HAZARD TO AIR NAVIGATION \*\***

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine Greenwich Wind Turbine
Location:	Greenwich, OH
Latitude:	41-03-07.80N NAD 83
Longitude:	82-28-04.78W
Heights:	1025 feet site elevation (SE) 490 feet above ground level (AGL) 1515 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

As a condition to this Determination, the structure is marked/lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, white paint/synchronized red lights - Chapters 4,12&13(Turbines).

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be e-filed any time the project is abandoned or:

☐ At least 10 days prior to start of construction (7460-2, Part I)  
☒ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

While the structure does not constitute a hazard to air navigation, it would be located within or near a military training area and/or route.

This determination expires on 08/07/2014 unless:

- (a) the construction is started (not necessarily completed) and FAA Form 7460-2, Notice of Actual Construction or Alteration, is received by this office.
- (b) extended, revised, or terminated by the issuing office.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

Additional wind turbines or met towers proposed in the future may cause a cumulative effect on the national airspace system. This determination is based, in part, on the foregoing description which includes specific coordinates and heights . Any changes in coordinates will void this determination. Any future construction or alteration requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

If we can be of further assistance, please contact our office at (404) 305-7081. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2013-WTE-253-OE.

**Signature Control No: 181072433-182741723**  
Michael Blaich  
Specialist

( DNE -WT )



Mail Processing Center  
Federal Aviation Administration  
Southwest Regional Office  
Obstruction Evaluation Group  
2601 Meacham Boulevard  
Fort Worth, TX 76137

Aeronautical Study No.  
2013-WTE-245-OE

Issued Date: 02/07/2013

Windlab Developments USA  
Windlab Developments USA  
927 Wing Street  
Plymouth, MI 48170

**\*\* DETERMINATION OF NO HAZARD TO AIR NAVIGATION \*\***

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine Greenwich Wind Turbine
Location:	Greenwich, OH
Latitude:	41-01-32.30N NAD 83
Longitude:	82-28-58.74W
Heights:	1083 feet site elevation (SE)
	490 feet above ground level (AGL)
	1573 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

As a condition to this Determination, the structure is marked/lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, white paint/synchronized red lights - Chapters 4,12&13(Turbines).

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be e-filed any time the project is abandoned or:

☐ At least 10 days prior to start of construction (7460-2, Part I)  
☒ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

While the structure does not constitute a hazard to air navigation, it would be located within or near a military training area and/or route.

This determination expires on 08/07/2014 unless:

- (a) the construction is started (not necessarily completed) and FAA Form 7460-2, Notice of Actual Construction or Alteration, is received by this office.
- (b) extended, revised, or terminated by the issuing office.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

Additional wind turbines or met towers proposed in the future may cause a cumulative effect on the national airspace system. This determination is based, in part, on the foregoing description which includes specific coordinates and heights . Any changes in coordinates will void this determination. Any future construction or alteration requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

If we can be of further assistance, please contact our office at (404) 305-7081. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2013-WTE-245-OE.

**Signature Control No: 181072425-182741724**  
Michael Blaich  
Specialist

( DNE -WT )



Mail Processing Center  
Federal Aviation Administration  
Southwest Regional Office  
Obstruction Evaluation Group  
2601 Meacham Boulevard  
Fort Worth, TX 76137

Aeronautical Study No.  
2013-WTE-250-OE

Issued Date: 02/07/2013

Windlab Developments USA  
Windlab Developments USA  
927 Wing Street  
Plymouth, MI 48170

**\*\* DETERMINATION OF NO HAZARD TO AIR NAVIGATION \*\***

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine Greenwich Wind Turbine
Location:	Greenwich, OH
Latitude:	41-03-11.99N NAD 83
Longitude:	82-28-45.68W
Heights:	1020 feet site elevation (SE)
	490 feet above ground level (AGL)
	1510 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

As a condition to this Determination, the structure is marked/lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, white paint/synchronized red lights - Chapters 4,12&13(Turbines).

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be e-filed any time the project is abandoned or:

☐ At least 10 days prior to start of construction (7460-2, Part I)  
☒ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

While the structure does not constitute a hazard to air navigation, it would be located within or near a military training area and/or route.

This determination expires on 08/07/2014 unless:

- (a) the construction is started (not necessarily completed) and FAA Form 7460-2, Notice of Actual Construction or Alteration, is received by this office.
- (b) extended, revised, or terminated by the issuing office.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

Additional wind turbines or met towers proposed in the future may cause a cumulative effect on the national airspace system. This determination is based, in part, on the foregoing description which includes specific coordinates and heights . Any changes in coordinates will void this determination. Any future construction or alteration requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

If we can be of further assistance, please contact our office at (404) 305-7081. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2013-WTE-250-OE.

**Signature Control No: 181072430-182741725**

( DNE -WT )

Michael Blaich  
Specialist



Mail Processing Center  
Federal Aviation Administration  
Southwest Regional Office  
Obstruction Evaluation Group  
2601 Meacham Boulevard  
Fort Worth, TX 76137

Aeronautical Study No.  
2013-WTE-234-OE

Issued Date: 02/07/2013

Windlab Developments USA  
Windlab Developments USA  
927 Wing Street  
Plymouth, MI 48170

**\*\* DETERMINATION OF NO HAZARD TO AIR NAVIGATION \*\***

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine Greenwich Wind Turbine
Location:	Greenwich, OH
Latitude:	41-00-22.71N NAD 83
Longitude:	82-30-11.93W
Heights:	1114 feet site elevation (SE)
	490 feet above ground level (AGL)
	1604 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

As a condition to this Determination, the structure is marked/lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, white paint/synchronized red lights - Chapters 4,12&13(Turbines).

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be e-filed any time the project is abandoned or:

☐ At least 10 days prior to start of construction (7460-2, Part I)  
☒ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

While the structure does not constitute a hazard to air navigation, it would be located within or near a military training area and/or route.

This determination expires on 08/07/2014 unless:

- (a) the construction is started (not necessarily completed) and FAA Form 7460-2, Notice of Actual Construction or Alteration, is received by this office.
- (b) extended, revised, or terminated by the issuing office.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

Additional wind turbines or met towers proposed in the future may cause a cumulative effect on the national airspace system. This determination is based, in part, on the foregoing description which includes specific coordinates and heights . Any changes in coordinates will void this determination. Any future construction or alteration requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

If we can be of further assistance, please contact our office at (404) 305-7081. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2013-WTE-234-OE.

**Signature Control No: 181072414-182741726**  
Michael Blaich  
Specialist

( DNE -WT )



Mail Processing Center  
Federal Aviation Administration  
Southwest Regional Office  
Obstruction Evaluation Group  
2601 Meacham Boulevard  
Fort Worth, TX 76137

Aeronautical Study No.  
2013-WTE-235-OE

Issued Date: 02/07/2013

Windlab Developments USA  
Windlab Developments USA  
927 Wing Street  
Plymouth, MI 48170

**\*\* DETERMINATION OF NO HAZARD TO AIR NAVIGATION \*\***

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine Greenwich Wind Turbine
Location:	Greenwich, OH
Latitude:	40-59-48.87N NAD 83
Longitude:	82-29-35.49W
Heights:	1148 feet site elevation (SE) 490 feet above ground level (AGL) 1638 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

As a condition to this Determination, the structure is marked/lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, white paint/synchronized red lights - Chapters 4,12&13(Turbines).

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be e-filed any time the project is abandoned or:

☐ At least 10 days prior to start of construction (7460-2, Part I)  
☒ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

While the structure does not constitute a hazard to air navigation, it would be located within or near a military training area and/or route.

This determination expires on 08/07/2014 unless:

- (a) the construction is started (not necessarily completed) and FAA Form 7460-2, Notice of Actual Construction or Alteration, is received by this office.
- (b) extended, revised, or terminated by the issuing office.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

Additional wind turbines or met towers proposed in the future may cause a cumulative effect on the national airspace system. This determination is based, in part, on the foregoing description which includes specific coordinates and heights . Any changes in coordinates will void this determination. Any future construction or alteration requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

If we can be of further assistance, please contact our office at (404) 305-7081. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2013-WTE-235-OE.

**Signature Control No: 181072415-182741727**

( DNE -WT )

Michael Blaich  
Specialist



Mail Processing Center  
Federal Aviation Administration  
Southwest Regional Office  
Obstruction Evaluation Group  
2601 Meacham Boulevard  
Fort Worth, TX 76137

Aeronautical Study No.  
2013-WTE-237-OE

Issued Date: 02/07/2013

Windlab Developments USA  
Windlab Developments USA  
927 Wing Street  
Plymouth, MI 48170

**\*\* DETERMINATION OF NO HAZARD TO AIR NAVIGATION \*\***

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine Greenwich Wind Turbine
Location:	Greenwich, OH
Latitude:	41-01-13.28N NAD 83
Longitude:	82-30-15.91W
Heights:	1080 feet site elevation (SE) 490 feet above ground level (AGL) 1570 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

As a condition to this Determination, the structure is marked/lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, white paint/synchronized red lights - Chapters 4,12&13(Turbines).

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be e-filed any time the project is abandoned or:

☐ At least 10 days prior to start of construction (7460-2, Part I)  
☒ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

While the structure does not constitute a hazard to air navigation, it would be located within or near a military training area and/or route.

This determination expires on 08/07/2014 unless:

- (a) the construction is started (not necessarily completed) and FAA Form 7460-2, Notice of Actual Construction or Alteration, is received by this office.
- (b) extended, revised, or terminated by the issuing office.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

Additional wind turbines or met towers proposed in the future may cause a cumulative effect on the national airspace system. This determination is based, in part, on the foregoing description which includes specific coordinates and heights . Any changes in coordinates will void this determination. Any future construction or alteration requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

If we can be of further assistance, please contact our office at (404) 305-7081. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2013-WTE-237-OE.

**Signature Control No: 181072417-182741728**  
Michael Blaich  
Specialist

( DNE -WT )



Mail Processing Center  
Federal Aviation Administration  
Southwest Regional Office  
Obstruction Evaluation Group  
2601 Meacham Boulevard  
Fort Worth, TX 76137

Aeronautical Study No.  
2013-WTE-230-OE

Issued Date: 02/07/2013

Windlab Developments USA  
Windlab Developments USA  
927 Wing Street  
Plymouth, MI 48170

**\*\* DETERMINATION OF NO HAZARD TO AIR NAVIGATION \*\***

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine Greenwich Wind Turbine
Location:	Greenwich, OH
Latitude:	40-59-52.71N NAD 83
Longitude:	82-31-31.99W
Heights:	1112 feet site elevation (SE) 490 feet above ground level (AGL) 1602 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

As a condition to this Determination, the structure is marked/lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, white paint/synchronized red lights - Chapters 4,12&13(Turbines).

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be e-filed any time the project is abandoned or:

☐ At least 10 days prior to start of construction (7460-2, Part I)  
☒ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

While the structure does not constitute a hazard to air navigation, it would be located within or near a military training area and/or route.

This determination expires on 08/07/2014 unless:

- (a) the construction is started (not necessarily completed) and FAA Form 7460-2, Notice of Actual Construction or Alteration, is received by this office.
- (b) extended, revised, or terminated by the issuing office.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

Additional wind turbines or met towers proposed in the future may cause a cumulative effect on the national airspace system. This determination is based, in part, on the foregoing description which includes specific coordinates and heights . Any changes in coordinates will void this determination. Any future construction or alteration requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

If we can be of further assistance, please contact our office at (404) 305-7081. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2013-WTE-230-OE.

**Signature Control No: 181072410-182741729**

( DNE -WT )

Michael Blaich  
Specialist



Mail Processing Center  
Federal Aviation Administration  
Southwest Regional Office  
Obstruction Evaluation Group  
2601 Meacham Boulevard  
Fort Worth, TX 76137

Aeronautical Study No.  
2013-WTE-231-OE

Issued Date: 02/07/2013

Windlab Developments USA  
Windlab Developments USA  
927 Wing Street  
Plymouth, MI 48170

**\*\* DETERMINATION OF NO HAZARD TO AIR NAVIGATION \*\***

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine Greenwich Wind Turbine
Location:	Greenwich, OH
Latitude:	41-00-26.96N NAD 83
Longitude:	82-31-09.92W
Heights:	1086 feet site elevation (SE) 490 feet above ground level (AGL) 1576 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

As a condition to this Determination, the structure is marked/lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, white paint/synchronized red lights - Chapters 4,12&13(Turbines).

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be e-filed any time the project is abandoned or:

☐ At least 10 days prior to start of construction (7460-2, Part I)  
☒ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

While the structure does not constitute a hazard to air navigation, it would be located within or near a military training area and/or route.

This determination expires on 08/07/2014 unless:

- (a) the construction is started (not necessarily completed) and FAA Form 7460-2, Notice of Actual Construction or Alteration, is received by this office.
- (b) extended, revised, or terminated by the issuing office.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

Additional wind turbines or met towers proposed in the future may cause a cumulative effect on the national airspace system. This determination is based, in part, on the foregoing description which includes specific coordinates and heights . Any changes in coordinates will void this determination. Any future construction or alteration requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

If we can be of further assistance, please contact our office at (404) 305-7081. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2013-WTE-231-OE.

**Signature Control No: 181072411-182741730**  
Michael Blaich  
Specialist

( DNE -WT )



Mail Processing Center  
Federal Aviation Administration  
Southwest Regional Office  
Obstruction Evaluation Group  
2601 Meacham Boulevard  
Fort Worth, TX 76137

Aeronautical Study No.  
2013-WTE-233-OE

Issued Date: 02/07/2013

Windlab Developments USA  
Windlab Developments USA  
927 Wing Street  
Plymouth, MI 48170

**\*\* DETERMINATION OF NO HAZARD TO AIR NAVIGATION \*\***

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine Greenwich Wind Turbine
Location:	Greenwich, OH
Latitude:	40-59-54.12N NAD 83
Longitude:	82-30-00.52W
Heights:	1142 feet site elevation (SE) 490 feet above ground level (AGL) 1632 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

As a condition to this Determination, the structure is marked/lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, white paint only - Chapters 12&13(Turbines).

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be e-filed any time the project is abandoned or:

- ☐ At least 10 days prior to start of construction (7460-2, Part I)  
☒ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

While the structure does not constitute a hazard to air navigation, it would be located within or near a military training area and/or route.

This determination expires on 08/07/2014 unless:

- (a) the construction is started (not necessarily completed) and FAA Form 7460-2, Notice of Actual Construction or Alteration, is received by this office.
- (b) extended, revised, or terminated by the issuing office.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION

OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

Additional wind turbines or met towers proposed in the future may cause a cumulative effect on the national airspace system. This determination is based, in part, on the foregoing description which includes specific coordinates and heights . Any changes in coordinates will void this determination. Any future construction or alteration requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

If we can be of further assistance, please contact our office at (404) 305-7081. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2013-WTE-233-OE.

**Signature Control No: 181072413-182742158**

( DNE -WT )

Michael Blaich  
Specialist



Mail Processing Center  
Federal Aviation Administration  
Southwest Regional Office  
Obstruction Evaluation Group  
2601 Meacham Boulevard  
Fort Worth, TX 76137

Aeronautical Study No.  
2013-WTE-236-OE

Issued Date: 02/07/2013

Windlab Developments USA  
Windlab Developments USA  
927 Wing Street  
Plymouth, MI 48170

**\*\* DETERMINATION OF NO HAZARD TO AIR NAVIGATION \*\***

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine Greenwich Wind Turbine
Location:	Greenwich, OH
Latitude:	41-00-27.51N NAD 83
Longitude:	82-29-32.96W
Heights:	1137 feet site elevation (SE)
	490 feet above ground level (AGL)
	1627 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

As a condition to this Determination, the structure is marked/lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, white paint only - Chapters 12&13(Turbines).

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be e-filed any time the project is abandoned or:

- ☐ At least 10 days prior to start of construction (7460-2, Part I)  
☒ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

While the structure does not constitute a hazard to air navigation, it would be located within or near a military training area and/or route.

This determination expires on 08/07/2014 unless:

- (a) the construction is started (not necessarily completed) and FAA Form 7460-2, Notice of Actual Construction or Alteration, is received by this office.
- (b) extended, revised, or terminated by the issuing office.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION

OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

Additional wind turbines or met towers proposed in the future may cause a cumulative effect on the national airspace system. This determination is based, in part, on the foregoing description which includes specific coordinates and heights . Any changes in coordinates will void this determination. Any future construction or alteration requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

If we can be of further assistance, please contact our office at (404) 305-7081. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2013-WTE-236-OE.

**Signature Control No: 181072416-182742159**

( DNE -WT )

Michael Blaich  
Specialist



Mail Processing Center  
Federal Aviation Administration  
Southwest Regional Office  
Obstruction Evaluation Group  
2601 Meacham Boulevard  
Fort Worth, TX 76137

Aeronautical Study No.  
2013-WTE-238-OE

Issued Date: 02/07/2013

Windlab Developments USA  
Windlab Developments USA  
927 Wing Street  
Plymouth, MI 48170

**\*\* DETERMINATION OF NO HAZARD TO AIR NAVIGATION \*\***

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine Greenwich Wind Turbine
Location:	Greenwich, OH
Latitude:	41-01-07.97N NAD 83
Longitude:	82-29-55.40W
Heights:	1085 feet site elevation (SE) 490 feet above ground level (AGL) 1575 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

As a condition to this Determination, the structure is marked/lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, white paint only - Chapters 12&13(Turbines).

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be e-filed any time the project is abandoned or:

- ☐ At least 10 days prior to start of construction (7460-2, Part I)  
☒ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

While the structure does not constitute a hazard to air navigation, it would be located within or near a military training area and/or route.

This determination expires on 08/07/2014 unless:

- (a) the construction is started (not necessarily completed) and FAA Form 7460-2, Notice of Actual Construction or Alteration, is received by this office.
- (b) extended, revised, or terminated by the issuing office.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION

OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

Additional wind turbines or met towers proposed in the future may cause a cumulative effect on the national airspace system. This determination is based, in part, on the foregoing description which includes specific coordinates and heights . Any changes in coordinates will void this determination. Any future construction or alteration requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

If we can be of further assistance, please contact our office at (404) 305-7081. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2013-WTE-238-OE.

**Signature Control No: 181072418-182742364**

( DNE -WT )

Michael Blaich  
Specialist



Mail Processing Center  
Federal Aviation Administration  
Southwest Regional Office  
Obstruction Evaluation Group  
2601 Meacham Boulevard  
Fort Worth, TX 76137

Aeronautical Study No.  
2013-WTE-240-OE  
Prior Study No.  
2011-WTE-22257-OE

Issued Date: 02/07/2013

Windlab Developments USA  
Windlab Developments USA  
927 Wing Street  
Plymouth, MI 48170

**\*\* DETERMINATION OF NO HAZARD TO AIR NAVIGATION \*\***

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine Greenwich Wind Turbine
Location:	Greenwich, OH
Latitude:	41-00-02.15N NAD 83
Longitude:	82-28-30.10W
Heights:	1168 feet site elevation (SE) 490 feet above ground level (AGL) 1658 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

As a condition to this Determination, the structure is marked/lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, white paint/synchronized red lights - Chapters 4,12&13(Turbines).

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be e-filed any time the project is abandoned or:

       At least 10 days prior to start of construction (7460-2, Part I)  
  X   Within 5 days after the construction reaches its greatest height (7460-2, Part II)

This determination expires on 08/07/2014 unless:

- (a) the construction is started (not necessarily completed) and FAA Form 7460-2, Notice of Actual Construction or Alteration, is received by this office.
- (b) extended, revised, or terminated by the issuing office.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO

SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

Additional wind turbines or met towers proposed in the future may cause a cumulative effect on the national airspace system. This determination is based, in part, on the foregoing description which includes specific coordinates and heights . Any changes in coordinates will void this determination. Any future construction or alteration requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

If we can be of further assistance, please contact our office at (404) 305-7081. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2013-WTE-240-OE.

**Signature Control No: 181072420-182742589**

( DNE -WT )

Michael Blaich  
Specialist



Mail Processing Center  
Federal Aviation Administration  
Southwest Regional Office  
Obstruction Evaluation Group  
2601 Meacham Boulevard  
Fort Worth, TX 76137

Aeronautical Study No.  
2013-WTE-242-OE

Issued Date: 02/07/2013

Windlab Developments USA  
Windlab Developments USA  
927 Wing Street  
Plymouth, MI 48170

**\*\* DETERMINATION OF NO HAZARD TO AIR NAVIGATION \*\***

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine Greenwich Wind Turbine
Location:	Greenwich, OH
Latitude:	41-00-24.30N NAD 83
Longitude:	82-28-42.49W
Heights:	1156 feet site elevation (SE)
	490 feet above ground level (AGL)
	1646 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

As a condition to this Determination, the structure is marked/lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, white paint/synchronized red lights - Chapters 4,12&13(Turbines).

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be e-filed any time the project is abandoned or:

       At least 10 days prior to start of construction (7460-2, Part I)  
  X   Within 5 days after the construction reaches its greatest height (7460-2, Part II)

This determination expires on 08/07/2014 unless:

- (a) the construction is started (not necessarily completed) and FAA Form 7460-2, Notice of Actual Construction or Alteration, is received by this office.
- (b) extended, revised, or terminated by the issuing office.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO

SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

Additional wind turbines or met towers proposed in the future may cause a cumulative effect on the national airspace system. This determination is based, in part, on the foregoing description which includes specific coordinates and heights . Any changes in coordinates will void this determination. Any future construction or alteration requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

If we can be of further assistance, please contact our office at (404) 305-7081. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2013-WTE-242-OE.

**Signature Control No: 181072422-182742590**

( DNE -WT )

Michael Blaich  
Specialist



Mail Processing Center  
Federal Aviation Administration  
Southwest Regional Office  
Obstruction Evaluation Group  
2601 Meacham Boulevard  
Fort Worth, TX 76137

Aeronautical Study No.  
2013-WTE-243-OE

Issued Date: 02/07/2013

Windlab Developments USA  
Windlab Developments USA  
927 Wing Street  
Plymouth, MI 48170

**\*\* DETERMINATION OF NO HAZARD TO AIR NAVIGATION \*\***

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine Greenwich Wind Turbine
Location:	Greenwich, OH
Latitude:	41-00-52.85N NAD 83
Longitude:	82-28-24.44W
Heights:	1124 feet site elevation (SE)
	490 feet above ground level (AGL)
	1614 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

As a condition to this Determination, the structure is marked/lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, white paint/synchronized red lights - Chapters 4,12&13(Turbines).

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be e-filed any time the project is abandoned or:

       At least 10 days prior to start of construction (7460-2, Part I)  
  X   Within 5 days after the construction reaches its greatest height (7460-2, Part II)

This determination expires on 08/07/2014 unless:

- (a) the construction is started (not necessarily completed) and FAA Form 7460-2, Notice of Actual Construction or Alteration, is received by this office.
- (b) extended, revised, or terminated by the issuing office.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO

SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

Additional wind turbines or met towers proposed in the future may cause a cumulative effect on the national airspace system. This determination is based, in part, on the foregoing description which includes specific coordinates and heights . Any changes in coordinates will void this determination. Any future construction or alteration requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

If we can be of further assistance, please contact our office at (404) 305-7081. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2013-WTE-243-OE.

**Signature Control No: 181072423-182742591**

( DNE -WT )

Michael Blaich  
Specialist



Mail Processing Center  
Federal Aviation Administration  
Southwest Regional Office  
Obstruction Evaluation Group  
2601 Meacham Boulevard  
Fort Worth, TX 76137

Aeronautical Study No.  
2013-WTE-251-OE

Issued Date: 02/07/2013

Windlab Developments USA  
Windlab Developments USA  
927 Wing Street  
Plymouth, MI 48170

**\*\* DETERMINATION OF NO HAZARD TO AIR NAVIGATION \*\***

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine Greenwich Wind Turbine
Location:	Greenwich, OH
Latitude:	41-02-03.67N NAD 83
Longitude:	82-27-47.49W
Heights:	1066 feet site elevation (SE) 490 feet above ground level (AGL) 1556 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

As a condition to this Determination, the structure is marked/lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, white paint/synchronized red lights - Chapters 4,12&13(Turbines).

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be e-filed any time the project is abandoned or:

       At least 10 days prior to start of construction (7460-2, Part I)  
  X   Within 5 days after the construction reaches its greatest height (7460-2, Part II)

This determination expires on 08/07/2014 unless:

- (a) the construction is started (not necessarily completed) and FAA Form 7460-2, Notice of Actual Construction or Alteration, is received by this office.
- (b) extended, revised, or terminated by the issuing office.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO

SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

Additional wind turbines or met towers proposed in the future may cause a cumulative effect on the national airspace system. This determination is based, in part, on the foregoing description which includes specific coordinates and heights . Any changes in coordinates will void this determination. Any future construction or alteration requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

If we can be of further assistance, please contact our office at (404) 305-7081. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2013-WTE-251-OE.

**Signature Control No: 181072431-182742592**

( DNE -WT )

Michael Blaich  
Specialist



Mail Processing Center  
Federal Aviation Administration  
Southwest Regional Office  
Obstruction Evaluation Group  
2601 Meacham Boulevard  
Fort Worth, TX 76137

Aeronautical Study No.  
2013-WTE-254-OE

Issued Date: 02/07/2013

Windlab Developments USA  
Windlab Developments USA  
927 Wing Street  
Plymouth, MI 48170

**\*\* DETERMINATION OF NO HAZARD TO AIR NAVIGATION \*\***

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine Greenwich Wind Turbine
Location:	Greenwich, OH
Latitude:	41-02-32.08N NAD 83
Longitude:	82-27-06.19W
Heights:	1040 feet site elevation (SE) 490 feet above ground level (AGL) 1530 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

As a condition to this Determination, the structure is marked/lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, white paint/synchronized red lights - Chapters 4,12&13(Turbines).

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be e-filed any time the project is abandoned or:

       At least 10 days prior to start of construction (7460-2, Part I)  
  X   Within 5 days after the construction reaches its greatest height (7460-2, Part II)

This determination expires on 08/07/2014 unless:

- (a) the construction is started (not necessarily completed) and FAA Form 7460-2, Notice of Actual Construction or Alteration, is received by this office.
- (b) extended, revised, or terminated by the issuing office.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO

SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

Additional wind turbines or met towers proposed in the future may cause a cumulative effect on the national airspace system. This determination is based, in part, on the foregoing description which includes specific coordinates and heights . Any changes in coordinates will void this determination. Any future construction or alteration requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

If we can be of further assistance, please contact our office at (404) 305-7081. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2013-WTE-254-OE.

**Signature Control No: 181072434-182742593**

( DNE -WT )

Michael Blaich  
Specialist



Mail Processing Center  
Federal Aviation Administration  
Southwest Regional Office  
Obstruction Evaluation Group  
2601 Meacham Boulevard  
Fort Worth, TX 76137

Aeronautical Study No.  
2013-WTE-252-OE

Issued Date: 02/07/2013

Windlab Developments USA  
Windlab Developments USA  
927 Wing Street  
Plymouth, MI 48170

**\*\* DETERMINATION OF NO HAZARD TO AIR NAVIGATION \*\***

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine Greenwich Wind Turbine
Location:	Greenwich, OH
Latitude:	41-02-27.61N NAD 83
Longitude:	82-27-54.25W
Heights:	1043 feet site elevation (SE)
	490 feet above ground level (AGL)
	1533 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

As a condition to this Determination, the structure is marked/lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, white paint/synchronized red lights - Chapters 4,12&13(Turbines).

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be e-filed any time the project is abandoned or:

       At least 10 days prior to start of construction (7460-2, Part I)  
  X   Within 5 days after the construction reaches its greatest height (7460-2, Part II)

This determination expires on 08/07/2014 unless:

- (a) the construction is started (not necessarily completed) and FAA Form 7460-2, Notice of Actual Construction or Alteration, is received by this office.
- (b) extended, revised, or terminated by the issuing office.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO

SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

Additional wind turbines or met towers proposed in the future may cause a cumulative effect on the national airspace system. This determination is based, in part, on the foregoing description which includes specific coordinates and heights . Any changes in coordinates will void this determination. Any future construction or alteration requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

If we can be of further assistance, please contact our office at (404) 305-7081. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2013-WTE-252-OE.

**Signature Control No: 181072432-182742594**

( DNE -WT )

Michael Blaich  
Specialist



Mail Processing Center  
Federal Aviation Administration  
Southwest Regional Office  
Obstruction Evaluation Group  
2601 Meacham Boulevard  
Fort Worth, TX 76137

Aeronautical Study No.  
2013-WTE-246-OE  
Prior Study No.  
2011-WTE-22247-OE

Issued Date: 02/07/2013

Windlab Developments USA  
Windlab Developments USA  
927 Wing Street  
Plymouth, MI 48170

**\*\* DETERMINATION OF NO HAZARD TO AIR NAVIGATION \*\***

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine Greenwich Wind Turbine
Location:	Greenwich, OH
Latitude:	41-01-24.54N NAD 83
Longitude:	82-27-55.12W
Heights:	1110 feet site elevation (SE) 490 feet above ground level (AGL) 1600 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

As a condition to this Determination, the structure is marked/lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, white paint/synchronized red lights - Chapters 4,12&13(Turbines).

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be e-filed any time the project is abandoned or:

       At least 10 days prior to start of construction (7460-2, Part I)  
  X   Within 5 days after the construction reaches its greatest height (7460-2, Part II)

This determination expires on 08/07/2014 unless:

- (a) the construction is started (not necessarily completed) and FAA Form 7460-2, Notice of Actual Construction or Alteration, is received by this office.
- (b) extended, revised, or terminated by the issuing office.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO

SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

Additional wind turbines or met towers proposed in the future may cause a cumulative effect on the national airspace system. This determination is based, in part, on the foregoing description which includes specific coordinates and heights . Any changes in coordinates will void this determination. Any future construction or alteration requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

If we can be of further assistance, please contact our office at (404) 305-7081. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2013-WTE-246-OE.

**Signature Control No: 181072426-182742595**

( DNE -WT )

Michael Blaich  
Specialist



Mail Processing Center  
Federal Aviation Administration  
Southwest Regional Office  
Obstruction Evaluation Group  
2601 Meacham Boulevard  
Fort Worth, TX 76137

Aeronautical Study No.  
2013-WTE-241-OE

Issued Date: 02/07/2013

Windlab Developments USA  
Windlab Developments USA  
927 Wing Street  
Plymouth, MI 48170

**\*\* DETERMINATION OF NO HAZARD TO AIR NAVIGATION \*\***

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine Greenwich Wind Turbine
Location:	Greenwich, OH
Latitude:	41-00-10.53N NAD 83
Longitude:	82-28-46.15W
Heights:	1162 feet site elevation (SE) 490 feet above ground level (AGL) 1652 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

As a condition to this Determination, the structure is marked/lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, white paint only - Chapters 12&13(Turbines).

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be e-filed any time the project is abandoned or:

- ☐ At least 10 days prior to start of construction (7460-2, Part I)  
☒ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

This determination expires on 08/07/2014 unless:

- (a) the construction is started (not necessarily completed) and FAA Form 7460-2, Notice of Actual Construction or Alteration, is received by this office.
- (b) extended, revised, or terminated by the issuing office.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

Additional wind turbines or met towers proposed in the future may cause a cumulative effect on the national airspace system. This determination is based, in part, on the foregoing description which includes specific coordinates and heights . Any changes in coordinates will void this determination. Any future construction or alteration requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

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If we can be of further assistance, please contact our office at (404) 305-7081. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2013-WTE-241-OE.

**Signature Control No: 181072421-182742651**

( DNE -WT )

Michael Blaich  
Specialist



Mail Processing Center  
Federal Aviation Administration  
Southwest Regional Office  
Obstruction Evaluation Group  
2601 Meacham Boulevard  
Fort Worth, TX 76137

Aeronautical Study No.  
2013-WTE-248-OE

Issued Date: 02/07/2013

Windlab Developments USA  
Windlab Developments USA  
927 Wing Street  
Plymouth, MI 48170

**\*\* DETERMINATION OF NO HAZARD TO AIR NAVIGATION \*\***

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine Greenwich Wind Turbine
Location:	Greenwich, OH
Latitude:	41-01-58.46N NAD 83
Longitude:	82-28-25.90W
Heights:	1066 feet site elevation (SE)
	490 feet above ground level (AGL)
	1556 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

As a condition to this Determination, the structure is marked/lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, white paint only - Chapters 12&13(Turbines).

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be e-filed any time the project is abandoned or:

- ☐ At least 10 days prior to start of construction (7460-2, Part I)  
☒ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

This determination expires on 08/07/2014 unless:

- (a) the construction is started (not necessarily completed) and FAA Form 7460-2, Notice of Actual Construction or Alteration, is received by this office.
- (b) extended, revised, or terminated by the issuing office.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

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If we can be of further assistance, please contact our office at (404) 305-7081. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2013-WTE-248-OE.

**Signature Control No: 181072428-182742652**

( DNE -WT )

Michael Blaich  
Specialist



Mail Processing Center  
Federal Aviation Administration  
Southwest Regional Office  
Obstruction Evaluation Group  
2601 Meacham Boulevard  
Fort Worth, TX 76137

Aeronautical Study No.  
2013-WTE-244-OE

Issued Date: 02/07/2013

Windlab Developments USA  
Windlab Developments USA  
927 Wing Street  
Plymouth, MI 48170

**\*\* DETERMINATION OF NO HAZARD TO AIR NAVIGATION \*\***

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine Greenwich Wind Turbine
Location:	Greenwich, OH
Latitude:	41-01-07.60N NAD 83
Longitude:	82-28-44.59W
Heights:	1107 feet site elevation (SE)
	490 feet above ground level (AGL)
	1597 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

As a condition to this Determination, the structure is marked/lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, white paint only - Chapters 12&13(Turbines).

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be e-filed any time the project is abandoned or:

- ☐ At least 10 days prior to start of construction (7460-2, Part I)  
☒ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

This determination expires on 08/07/2014 unless:

- (a) the construction is started (not necessarily completed) and FAA Form 7460-2, Notice of Actual Construction or Alteration, is received by this office.
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If we can be of further assistance, please contact our office at (404) 305-7081. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2013-WTE-244-OE.

**Signature Control No: 181072424-182742653**

( DNE -WT )

Michael Blaich  
Specialist



Mail Processing Center  
Federal Aviation Administration  
Southwest Regional Office  
Obstruction Evaluation Group  
2601 Meacham Boulevard  
Fort Worth, TX 76137

Aeronautical Study No.  
2013-WTE-247-OE

Issued Date: 02/07/2013

Windlab Developments USA  
Windlab Developments USA  
927 Wing Street  
Plymouth, MI 48170

**\*\* DETERMINATION OF NO HAZARD TO AIR NAVIGATION \*\***

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine Greenwich Wind Turbine
Location:	Greenwich, OH
Latitude:	41-01-33.74N NAD 83
Longitude:	82-28-13.45W
Heights:	1093 feet site elevation (SE)
	490 feet above ground level (AGL)
	1583 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

As a condition to this Determination, the structure is marked/lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, white paint only - Chapters 12&13(Turbines).

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If we can be of further assistance, please contact our office at (404) 305-7081. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2013-WTE-247-OE.

**Signature Control No: 181072427-182742654**

( DNE -WT )

Michael Blaich  
Specialist

**This foregoing document was electronically filed with the Public Utilities**

**Commission of Ohio Docketing Information System on**

**12/27/2013 10:51:35 AM**

**in**

**Case No(s). 13-0990-EL-BGN**

Summary: Application of 6022 Greenwich Windpark, LLC - Exhibit Exhibits Q, R and S electronically filed by Teresa Orahod on behalf of Sally Bloomfield