

Working in masts and wind turbines	
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<b>Objective</b>	To ensure that work carried out in and around wind turbines, masts and scaffolding is carried out in a safe manner.
<b>Scope</b>	<p>All work carried out by Risø DTU employees involving masts, wind turbines and scaffolding</p> <p>All work carried out by third party business partners/guests involving masts, wind turbines and scaffolding</p> <ul style="list-style-type: none"> <li>• within Risø DTU's premises</li> <li>• in connection with facilities where Risø is responsible.</li> </ul>
<b>Responsibility</b>	<p>It is the responsibility of the head of department to ensure that</p> <ul style="list-style-type: none"> <li>• safety regulations be developed concerning work carried out by personnel working in wind turbines, masts and on scaffolding and that these regulations be observed and kept up-to-date.</li> </ul> <p>It is the responsibility of the programme manager to</p> <ul style="list-style-type: none"> <li>• instruct the employees/third party personnel/guests in how to carry out the work safely.</li> </ul> <p>It is the responsibility of the employee to</p> <ul style="list-style-type: none"> <li>• follow the safety instructions</li> <li>• report any defects to the programme manager</li> <li>• stop the work if this is deemed unsafe.</li> </ul>
<b>Description</b>	<p>Contact persons on the safety committee</p> <ul style="list-style-type: none"> <li>• AL :Poul Hummelshøj</li> <li>• SR: Kasper Clemmensen</li> <li>• SR: Bjarne Sønderkov</li> </ul>
<b>Registrations</b>	

## Detailed checklist for work carried out in masts and wind turbines

### ***1. What does the work involve, do special regulations apply?***

Work at heights carried out in a wind turbine and/or measuring mast requires the presence of a minimum of two Risø staff members, both with the necessary experience in lowering an injured person and both having passed a first aid course.

Using a helmet is compulsory while working in and around turbines and masts. This applies to ground work and work in turbine/measuring mast. Sedentary work at the top level of the nacelle or hub or mast may, however, be carried out without wearing a helmet.

The employee doing the climbing has the sole choice at all times to determine whether it will be safe to carry out the work, in view of weather conditions, the work to be carried out, the mast or turbine structure and any other safety aspects.

## **Working in masts**

Measuring masts must be designed so as to ensure that it is safe in terms health and ergonomic working conditions to work in these at all times.

Always mount the devices of a measuring mast so as to ensure that inspections, repairs and replacements can be carried out without posing a safety risk.

Generally, provide new, newly refurbished or re-erected measuring masts with fall arrest wire rope. Where technically possible, provide existing masts with fall arrest wire rope too.

There can be individual aspects that need to be reviewed in relation to old masts; however, safety compromises will not be accepted.

Where it is not possible to use sliding anchors with the fall arrest wire rope, use at least one strap with a snap hook to secure the harness belt to the mast structure.

For guyed masts, always use two wire rope locks per eye with wire guys whose eyes are made using Eureka wire rope locks for all wire ropes between 4 mm and 16 mm in diameter, according to the supplier's instructions.

If possible always use a stiffener when making the eye of a wire rope.  
If one or more of the wires of a wire rope are found to be broken, the wire rope is to be replaced with a new one as soon as possible.

When using shackles these are to be marked with max. S.W.L.

Assess the weather conditions before and during the work in order to determine whether the weather will impact on the safety of the work carried out in masts. Of particular relevance are thunder storms, wind, rain and/or frost.

Tools and materials used when working in masts should be secured against being dropped. Place tools not in use in a toolbox, toolbelt or similar.

Working in masts should constitute 5 hours per working day as a maximum, for example 3x2 hours under different conditions. If working from a platform, the time spent on the platform can be deducted.

## **Working in wind turbines**

Generally, there can be no work with instrumentation and calibration in a wind turbine whilst any other work is being carried out in the same wind turbine. There can be exception from this rule if this other work being carried out has no bearing on personnel safety. In consideration of this the employee (whom this situation concerns) has the sole right to determine whether the working conditions are safe.

Tools and materials used when working in turbines should be secured against being dropped. Place tools not in use in a toolbox, toolbelt or similar.

Before commencement of the work, each employee must be instructed (by the owner requesting the work to be carried out) in how to operate the turbine and how the safety system works. Always follow instructions concerning staying in the turbine, with particular emphasis on the following:

- *General description of the turbine and the electrical installations*
- *Operating instructions for normal operation and start and stop*
- *Precautions to be taken in connection with emergency operation and runaway situations*
- *Precautions to be taken when faults are reported in the turbine*
- *Use of personal means of protection when walking and staying in and around the turbine*
- *Instructions concerning mechanical locking of rotor, pitch and yaw system (at which wind speeds to do the locking)*
- *Safety precautions in connection with service and maintenance*
- *Description of control and safety systems*
- *Identification of relevant parts of turbine mass and fastening points for repair jobs*

- *Diagrams, drawings and specifications necessary to carry out service and maintenance*
- *Specification of type designation.*

All data and access codes required to be able to carry out service and maintenance and to test safety systems are to be available.

Once an employee has climbed up the turbine, he/she is to verify that the necessary safety equipment (lowering devices, fire extinguisher, first aid kit) is available in the turbine. If this is not so, he/she is to bring his/her own equipment and place this in the nacelle at an easily accessible place before commencing the work.

Locate the emergency stop. Activation of an emergency stop may produce dangerous situations. In an emergency activate the emergency stop and observe the movable parts of the turbine (blades, pitch cylinders, brakes etc.) so as to ensure that dangerous situations do not arise because of activation of the emergency stop.

Arrest the rotor while work is being carried out in hub/rotor (latch blocking the turbine rotor), as per the wind turbine operating instructions.

Arrest the blades while work is being carried out on pitchable blades, if required, as per the wind turbine operating instructions.

Arrest the yaw system while work is being carried out on this, if required, as per the wind turbine operating instructions.

### ***Work using hoist and crane***

Work using a hoist and crane should be avoided if there is a risk of the hoist/crane colliding with a turbine rotor. If this cannot be avoided then it can only be carried out under the following conditions:

- 1) Wind turbine is stopped, rotor is arrested (latch blocking turbine rotor) and yawing is prevented. Work can be carried out on the turbine in this condition, including using a hoist in the rotor plane. Work using a crane can be carried out.
- 2) Wind turbine is stopped, brake is on and yawing is prevented. Work can, when required, be carried out on rotating parts but only by paying the utmost attention. Working in the rotor plane is not allowed.
- 3) When the turbine is stopped without activation of latch and brake, work may not be carried out in the vicinity of rotating parts. Any other work can be carried out paying the utmost attention. Work using a hoist in the vicinity of the rotor is not allowed. Work using a crane is not allowed.

### ***Inspection and supervision of turbines***

If only inspection/supervision of a turbine is to be carried out, this can be realised by employees who have not passed courses in lowering procedures and first aid. Before ascending the turbine, the employee is to ascertain himself/herself that the necessary safety precautions have been taken. This involves among other things that as a minimum one person who has passed a course in lowering procedures and first aid is to be present. If so, always activate the turbine emergency stop before starting the ascent. The emergency stop is to be activated for the full duration of the inspection. Work may not be carried out in the turbine during inspections. The employee may not enter the hub. During inspections, the employees concerned are to wear safety equipment such as belt straps, fall arrest equipment and helmet, as is normally required. The equipment must be approved but need not be personal.

### ***Demonstration of wind turbines at Risø***

Employees may not demonstrate the turbine to a third party, unless a VEA programme manager or head of department has consented to this. There are to be two persons as a minimum having passed a course in lowering and first aid within the fence and in radio contact. During such events, activate the turbine emergency stop before starting the ascent; the emergency stop is to remain active for the full duration of the demonstration. Work may not be carried out in the turbine during demonstrations. All individuals are prohibited from entering the hub during

demonstrations. During demonstrations, the employees concerned are to wear safety equipment such as belt straps, fall arrest equipment and helmet, as is normally required. The equipment must be approved but need not be personal. During demonstrations any necessary safety equipment is to be available in the turbine. The owner bears the full responsibility for any third parties.

## 2. Where does the work take place?

Before commencing the work (whether on the ground or at a height) it is the responsibility of the individual employee to know the exact location (address) of the turbine or mast to be able to call for help.

## 3. Which weather conditions will allow work to be carried out?

Work postures offering severe strains and impact from low temperatures and winds are to be limited to the extent possible. If an employee finds the conditions too straining, breaks are to be included or the work is to be put on hold till conditions have improved; the employee concerned can be asked to carry out other work. The employee doing the actual climbing always has the sole choice to determine whether the work can be carried out.

If it is assessed that the work cannot be carried out safely, due to the weather or for any other reason, it is to be put on hold immediately and notice given to the programme/project manager.

Always verify whether special rules apply to the work concerned.

	Icing	Thunder approaching	Thunder	High wind speed
<b>Masts</b>	Stop work immediately	- Unhook as fast as possible - Protect tools and equipment against damage from water and storm - Abandon mast	Stop work immediately	Do not work at wind speeds above 10 m/sec measured as 10 min. mean wind speeds
<b>Turbines</b>				
<b>Work inside</b>	No restrictions	Stop work immediately, descend from turbine	Stop work immediately, descend from turbine	No restrictions
<b>Work outside at height</b>	Stop work immediately, enter turbine	Stop work immediately, descend from turbine	Stop work immediately, descend from turbine	Do not work at wind speeds above 10 m/sec measured as 10 min. mean wind speeds

## 4. What safety equipment is required?

When working in wind turbines or masts always use the required safety equipment, including an approved safety harness and ensure that approved lowering devices are easily accessible. The people concerned must be given the required instructions and training in the use of the equipment. See [instructions about practice and training](#).

An employee who works in a turbine or a mast must as a minimum be provided with the following safety equipment. Basically, safety equipment is for personal use; however, borrowed equipment may be used provided it has been approved.

CE marked: Helmet, safety harness, two straps with snap hooks, lanyard, sliding anchor for fall arrest wire rope.

The harness is to be designed in such a manner that nerves and blood vessel are not squeezed while at the same allowing an injured person to be lowered down in a horizontal position, with unobstructed passage to airways and the abdominal cavity.

Wear suitable footwear, gloves and clothes that offer the best protection depending on the season against the weather, or any other safety related aspects.  
The clothes should be as ideal as possible in order to avoid limitations in movement while working in the mast.

## **5. Who will carry out the work?**

Only individuals who have been given the necessary instructions may carry out work in turbines and masts. Third party individuals are to have equivalent experience, have passed valid safety courses (plus courses in lowering and first aid) and have been approved in advance by the safety committee. See the "shortlist". The CVs of third party individuals documenting the required experience and training are to be available.

Work carried out at heights abroad will always require two employees. If only one employee has been sent, inspection can only be made from the ground.

## **6. What if somebody violates the safety requirements?**

If one or more individuals violate the safety requirements, whoever notes it is to notify the person concerned immediately that what he/she is doing is wrong. If this person does not want to change behaviour, you are to stop your work and report it to your programme manager. Third party individuals will be black listed.

## **7. Check up of safety equipment**

Before and after use always check the fall arrest equipment to ensure full functionality. It is to be clean, without ruptures and with no visible defects.

Scrap the equipment and replace it with a new set, if ruptures or other defects are found or if the equipment has been exposed to maximum load.

Check the fall arrest equipment once a year and have it approved by a duly qualified person. See [fall arrest instructions](#) under control and inspection.

## **8. Check your auxiliary equipment (wire rope, straps etc.)**

Before and after use always check the equipment to ensure full functionality. It is to be clean, without ruptures and with no visible defects.

Scrap the equipment and replace it with a new set, if ruptures or other defects are found or if the equipment has been exposed to maximum load. When mandatory inspections are required, there are to be completed within the validity period.

## **9. How to ensure contact with your partner on site?**

The employees are to be either in direct/visual contact with each other or via walkie-talkie, mobile phone or similar. Employees are to be so close to each other that they can launch a rescue mission within 10 minutes of the alarm. Employees are to contact each other as a minimum every 30 minutes. If contact cannot be established via for example a mobile phone, the employee is to establish direct/visual contact within 30 minutes.

## **10. How to mark the work site?**

Make marking as required when instrumentation or calibration is being carried out on a turbine or mast. The marking is to follow local rules and regulation. All traffic is to be restricted during the work.

Erect sufficient barricades when there is a risk of a breakdown (safety testing) of a turbine during test runs.

## **11. How to call for help?**

Before commencing the work (whether on the ground or at a height) it is the responsibility of the individual employee to know the exact location (address) of the turbine or mast. If the turbine/mast is part of a wind farm, the employee is to note the unique identification of the turbine/mast.

If necessary, the employee must be able to guide help to the site. For this purposes it is critical to note specific characteristics when working in remote locations with no road signs or similar.

Before initiating work on the ground or at heights, it is the responsibility of the individual employee to find out how to make an emergency call, call an ambulance or the fire brigade and direct them to the site concerned (what is equivalent to 112 in Denmark). It is likewise the responsibility of the individual employee to verify that emergency calls can be made in either Danish or English. If this is not possible, it must be possible to make emergency calls by the assistance of the owner. In that case a procedure is to be arranged with the owner stating how to make emergency calls. It is the responsibility of the individual employee to make such a procedure.

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