

Class II
WKI 1000711-04 EN
2006-04-25

Health & Safety Instruction

History of this Document

Revision	Date	Description of changes
	2003-04-25	New document number. Earlier TIC902'001 is changed to number WKI 1000711'01.
2	2003-09-05	Description for safety signs, safety equipment. Instruction for using and checking safety equipment.
3	2005-08-30	New logo – Vestas design and minor language changes.
4	2006-04-24	Language revision.

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1 Health & Safety Instructions

The Health & Safety Instruction is for accredited working personnel and visitors in Vestas Wind Systems A/S's wind turbines and on turbine sites.

This Health & Safety Instruction must be read and understood before accessing the turbine and before any installation or servicetask is carried out.

1.1 Signs in Manuals and in the Turbine

In this document, safety and warning signs are shown in connection with an explanation for the signs. Explanations for relevant safety equipment are shown together with the signs.

Pictograms/signs are placed in the installation and/or service instructions, indicating required safety equipment and health and safety conditions for specific tasks.

Whenever a pictogram is found in the installation and/or service instructions, an explanation for the pictogram can be found in this instruction.

Safety sign – SAFETY FOOTWEAR MUST BE WORN



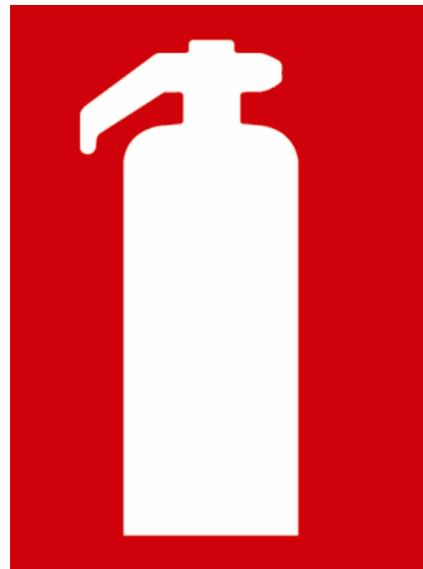
Safety sign – HARD HAT MUST BE WORN



Warning sign – NO SMOKING



Information Sign – FIRE EXTINGUISHER



2 General Rules

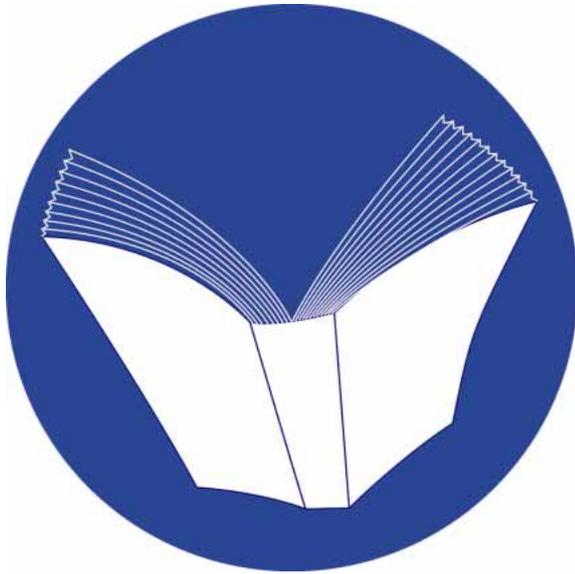
The Health & Safety Instruction must be read and understood before entering the turbine site and/or before taking any action.

The Health & Safety Instruction is focused on general personal health and safety. It gives instructions for safety when working in the turbine. Further safety instructions are given in the service and/or installation instruction for a relevant component or tool.

Signs shown below are placed several places in the turbines and they indicate that the Health & Safety Instruction and the turbine-specific safety instruction must be read.

Appropriate and approved Personal Protection Equipment (referred to as PPE in the following and in the service and installation instructions) must be worn at all times when visiting or working on a turbine site. Special PPE required for a task is specified in the general information in each installation or service instruction.

Sign – HEALTH & SAFETY INSTRUCTION MUST BE READ



2.1 Authorised Personnel and Site Access

Normally only authorised personnel are allowed access to a wind turbine. Visitors are only allowed access when accompanied by authorised personnel, equipped with and instructed in the correct use of Personal Safety Equipment.

The sign below indicates that only authorised personnel have access or as described above.

Warning sign – ONLY AUTHORISED PERSONNEL ALLOWED



2.2 Site Access

PPE:



Warning:



- When entering a site, persons must as a minimum wear a hardhat and safety foot wear.
- Personnel not appointed by Vestas Wind Systems A/S are not allowed to work in the turbine or on the turbine site.
- Only personnel who have received appropriate safety, rescue and first aid training are allowed to work on the turbine site.
- During visits to turbine sites there must be two persons present, except for visits to the substation control room or in very special circumstances. A single person is allowed to carry out monitoring work, provided he/she has notified the site supervisor or other Vestas Wind Systems A/S operatives in advance. He/she may also notify the site supervisor or other Vestas Wind Systems A/S operatives when the work is completed.
- Access to a turbine site is prohibited in extreme weather conditions. This includes, but is not limited to, heavy drifting snowfalls, severe storms and risk of lightning striking the turbine.
- About weather conditions, please see chapter “Weather Conditions” later in this document.

2.2.1 Approach and access to the wind turbine

- The tower door must always be locked in order to prevent inadvertent or deliberate access.
- When working in a turbine, the tower door must be attached to the installed catch in order to avoid personnel being hit by a slamming door.

For information about approach and access during severe weather conditions, please see chapter “Weather Conditions” later in this document.

2.2.2 Visitors and public access

- Visitors are defined as: all persons present at a wind turbine site without a site-related work assignment.
- All visits demand permission from the supervisor/site manager. A competent person must always accompany the visitor. Visitors *must* wear PPE on site.

2.3 Site Rules

PPE:



Warning:



- All personnel must inform the person responsible at the site prior to leaving a turbine site.
- Smoking inside the turbine is strictly forbidden.
- No alcohol, illegal substances or medicine with influential effect must be consumed on a turbine site.
- No person under the influence of alcohol, illegal substances or medicine is permitted access to a turbine site.
- Firearms of any kind are strictly forbidden on a turbine site.
- Areas of specific scientific or historical interest are identified, roped off and strictly out of bound.
- All waste must be disposed off in the bins or in the containers provided. Plant operators and site personnel must only discard waste in the bins provided.
- Any burning of waste or other materials on a turbine site is strictly forbidden.
- All welding, burning or other operations connected with high temperatures have to be authorised in writing by an engineer responsible prior to commencement. Upon commencement, all necessary precautions must be taken.
- Personnel must whenever possible use toilet facilities and not use the surrounding area.
- Use of open fire is forbidden on site outside the designated work area.
- Personnel should not drink natural water but only drink water marked as “Drinking Water”.

2.4 Emergency Instructions

An emergency response plan must be established between all parties on the site. As a minimum, the plan must include availability of rescue equipment, first aid supplies, eyewash facility, fire extinguisher and other relevant equipment.

An emergency contact system, two-way radios, mobile telephones or other communication systems must be established. A list of emergency contact numbers for fire department, police, paramedics, site manager, supervisor, owner and other relevant persons must initially be distributed and must be updated when changes occur. A correct address for the turbine site must be available for all personnel on site.

Installation and service personnel must have current first aid and CPR training.

2.5 Fire Prevention

Fire must be prevented on the site. This includes fires inside turbines, transformers, and other wind-related structures, as well as site buildings, offices, warehouses and rest areas.

- Comply with the site-specific smoking rules.
- Do not use unauthorised heating, lighting or cooking arrangements.
- Do not place clothing on or near heaters.
- Do not allow accumulations of flammable material or waste. Use labelled waste-specific trash containers.
- Use fire blankets when carrying out work with a risk of fire. Take appropriate safety precautions.
- Be familiar with the location and use of fire extinguishers on the site.
- Learn the emergency procedures in case of fire.
- Do not park vehicles on dry grass or other dry areas.

2.6 Site Vehicles

Important: *Protect the environment: stop engines when vehicles are not in use.*

- All site vehicles must contain fully charged and operable fire extinguishing equipment.
- Suitable first aid equipment must be available in site vehicles and refilled as used.
- Vehicles must drive on approved access roads ONLY while on the site.
- Vehicles must not drive outside the site boundaries.
- All fuel operated vehicles and machines must be fuelled correctly using proper fuel dispensing equipment.
- When dispensing fuel, do not leave the vehicle or machine unattended or alter the pump handle to pump automatically.
- All fuel and/or oil spills must be cleaned up immediately and reported to the supervisor/site manager to facilitate prompt remedial action.
- Maintenance and oil change on vehicles, except in emergency situations, are not permitted on site. All worn parts or oil used in emergency repairs must be contained, labelled and properly disposed.
- The speed limit on a turbine site is recommended to be maximum 30 km/h. Local regulations and conditions must be observed and respected.

2.6.1 Special vehicles

Important: *Protect the environment: stop engines when vehicles are not in use.*

- Drivers of special vehicles, such as extra wide or high vehicles, must only drive onto the site with prior agreement with the supervisor/site manager who will advise as to the preferred route and possible site risks.
- The supervisor/site manager will also arrange for auxiliary vehicles, if necessary.

2.7 In Case of Runaway Operation

A runaway operation is almost impossible, as it would require several circumstances to happen at the same time.

- If a runaway operation should occur, the plant must be evacuated immediately by running upwind, and access to the surrounding area in a radius of at least 500 metres must be restricted.

2.8 Rules for Two Person Teams

Normally, tasks are assigned to teams with a minimum of two persons. Lone working is permitted only in special circumstances. Lone working tasks must be planned to prevent or minimise team member isolation, for example out of sight or hearing range. If team members must be isolated from one another, however briefly it may be, they must maintain communication to ensure one another's safety for example by using two-way radio or mobile phone.

- If two persons are so far from each other that they are out of hearing range, two-way radio or mobile phones must be used. Always bring a fully charged spare battery for the communication device.
- If one of the team members needs a break, the work must be interrupted.
- One member of the team must under no circumstances stop the work or leave the area without informing the other person.

2.9 Lone Working

In special cases not involving electrical work, service personnel might be permitted to work independently.

- Only competent and educated personnel are allowed to carry out lone working.
- Communication between the lone worker and a contact/base person must be established.
- An emergency plan must be agreed between the lone worker and the contact/base person

2.9.1 Emergency plan for lone working

- The lone worker must contact a base person with agreed intervals. It is recommended that intervals between calls are 15 minutes. Intervals between calls might be different considering the risk connected to a specific task.
- If the lone worker is not in contact with the base person the base person must:
 - Contact the lone worker.
 - If impossible to make contact to the lone worker, "The Emergency Procedure for Working Injury" must be carried out.

2.9.2 Before the work starts

- The lone worker informs the contact/base person when arriving at the turbine site.
- Ensure that communication lines are working properly.
- Agree on an estimate for the time when the task must be finished.
- The lone worker and the contact/base person must go through the emergency plan together.

2.9.3 During work

- The contact/base person is contacted by the lone worker as agreed in the emergency plan.

2.9.4 When work is finished

- The lone worker must contact the contact/base person and inform that the work is finished.

3 General Working Rules

3.1 Rules for Electrical Work

Important:: *Electrical work must be performed by trained, authorised personnel only and always with a working partner present.*

It is only permitted for technicians employed by Vestas Wind Systems A/S or Vestas Wind Systems A/S' electrical supplier to carry out inspection, testing and repair of electrical installations and equipment. There must always be two persons present when working on live equipment (120 V and above).

Prior to any electrical task, persons working with electricity must remove all metal jewellery.

Prior to work on any circuit, the circuit must be de-energised and secured by means of a personal lockout device or tag. The appropriate test equipment must confirm the de-energised state. Always use the "Check – Test – Check" method where test equipment (meter) is checked before and after testing the circuit.

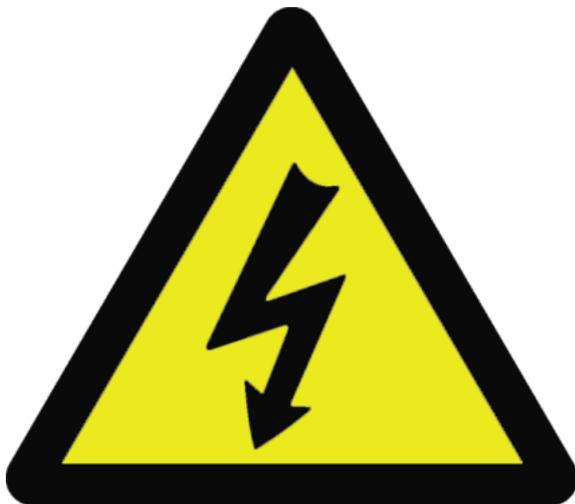
No circuits are to be energised without first informing and receiving clearance from a supervisor/site manager, manager or appropriate site personnel.

Areas and cabinets with electric power are marked with signs. Please see below. Furthermore, the pictogram for electric power will be placed in the relevant installation and service instruction.

The pictogram below to the right indicates that approved insulated tools and rubber gloves must be used.

DANGER – HIGH VOLTAGE

Sign – INSULATED GLOVES AND TOOLS MUST BE USED



The electrician carrying out electrical work must use adequate PPE including, but not limited to, special gloves, rubber mats and insulated footwear. Electricians must use insulated electrical tools.

3.2 High Voltage

PPE



Warning



In this manual, high voltage is defined as 1000 V and above in accordance with international standards. (In the United States > 600 V).

- There must always be two persons present when working on high voltage equipment.
- Before work begins, a qualified person must disconnect the electrical equipment.
- The circuit being worked on must be confirmed de-energised by the use of authorised test equipment before work can begin. The test equipment must be tested before and after the circuit is confirmed de-energised.
- If it is necessary to test a circuit in live state, the test equipment must be contact-voltage proof.
- The contact-voltage proof testing equipment must be grounded.
- The switch controlling the electrical equipment must be locked, if possible and the key kept by the person leading the work.
- All instructions regarding the high voltage system must be in writing, if possible. If communication is verbal, the instructions must be written down and read back to the originator to make sure that they have been correctly received. Signals or an agreed time interval **MUST NOT BE USED** for switching equipment on or off.
- The electrician carrying out the task must have additional and task-specific PPE, including but not limited to, approved rubber gloves, approved rubber insulated mats and insulated foot wear.
- Electricians must use insulated electrical tools. Please see pictures below.

A pair of rubber gloves



Approval stamp on rubber gloves



Approved and insulated screwdrivers



Approved and insulated pointed pliers and cutting nippers



3.2.1 Low voltage

PPE



Warning



In this manual, low voltage is defined as less than 1000 V in accordance with international standards. (In the United States < 600 V).

- If possible, equipment must be isolated (de-energised) before starting work and lock out tag out procedures.
- If it is necessary to test a circuit in live state, test equipment must be contact-voltage proof.
- Where electrical equipment can be de-energised with a switch, this switch must be interrupted, wherever possible.
- If fuses control the equipment instead of a switch, these must be removed and kept by the person leading the work.
- When using authorised test equipment, the circuit must be confirmed de-energised before work begins. The test equipment must be tested before and after the circuit is de-energised.
- The electrician carrying out this task must use adequate PPE including, but not limited to, special gloves, rubber mats and insulated footwear. Electricians must use insulated electrical tools.

3.3 Working Outside the Nacelle and Tower

Reference: Installation & Service Data

PPE



Warning



- The nacelle hatch must not be opened in high wind speeds. For further details, please see the document “I&S Data”.
- When the turbine is in operation, actual work is not allowed - only inspection. See the document “I&S Data” for specific information on maximum wind speeds.

- When working “over the side”, all tools must be securely fixed to either the safety belt or a suitable part of the nacelle.
- When working in the hub, all tools must be securely fixed when handed over from nacelle to hub.

Tool secured with safety line



3.4 High Temperatures

PPE



Warning:



- High temperature work includes all processes involving welding, burning or grinding in plant containing flammable material.
- PPE: as a minimum, use suitable safety footwear, hard hat, eye protection, proper gloves, long-sleeved shirt (or other long-sleeved garment) and long trousers.
- Inform the supervisor/site manager that work involving risk of fire is being carried out in order to allow co-ordination with other work on site.
- Take all precautions to prevent fire. Clear up flammable materials or set up screens around flammable material. Fire blankets must be used during work involving risk of fire.
- Ensure that a fire extinguisher is available at the work area.

3.5 Excavations

- The supervisor/site manager must be informed in advance of any kind of excavation in order to coordinate with other nearby work.
- Hidden installations must be located prior to any excavation.
- A work permit must be obtained if excavation is to be carried out near underground cables.
- Place noticeable barricades and warning signs around the excavation site.
- Do not permit vehicles or equipment to get too close to the edge of excavation site.
- Slope or shore all sides to prevent cave-ins.
- Carefully inspect after rain and/or flooding or other hazard-increasing occurrences.
- Sides must be shored if deeper than 1.5 metres.

4 Weather Conditions

References: *Installation & Service Data*

- Always obtain an updated weather forecast before starting any work on a turbine site.
- Before any task is carried out the site manager and or supervisor must decide whether or not work can be carried out in a safe manner in present weather conditions.

4.1 Electric Storms – Lightning

- No personnel are permitted in or near a turbine during an electric storm.
- During an electric storm there is a risk of lightning striking the turbine despite lightning protection on the turbine.
- If an electric storm approaches, evacuate the turbine immediately by running upwind. Be cautious of blade parts falling to the ground due to strokes of lightning.
- Do not approach a turbine for at least one hour after an electric storm has passed due to the risk of static electricity on the blades.
- If there are crackling noises coming from the wet blades, the turbine is still charged with electricity. Do not approach or touch the turbine.
- If the turbine has been struck by lightning and has been visibly damaged, cut of the power supply to the turbine and contact Vestas Wind Systems A/S' Service Department for further inspection.
- A stroke of lightning will usually cause an automatic stop of the turbine and only damage the transient protection block.

4.2 Extreme Winds

References: *Installation & Service Data*

Note: *Always obtain an updated weather forecast for the site area*

- In storms, hurricanes and extreme wind in general, access to the wind turbine and site area is strictly forbidden.
- Before any task is carried out the supervisor and or site manager has to determine whether or not the limit for maximum allowed wind speeds for the specific task is exceeded.
- If cranes are involved, the supervisor/site manager in co-operation with the crane driver decides whether or not the tasks can be completed within the maximum wind speed limits.
- Most of the specified critical wind speeds in the installation and service data must be considered as recommendations.
- Local circumstances and local regulations must always be taken into consideration before any task is carried out.

4.3 Cold Weather and Heavy Snow

- In cold weather and heavy snow there is a risk of ice or large amounts of snow falling from the blades or the nacelle.
- Especially when the turbine starts up after a period of cold weather, there is a risk of ice falling from the blades.
- Do not approach a turbine if there is any risk of falling snow or ice.

4.3.1 Correct clothing when working in a turbine

When working in heights, the actual weather and wind conditions can be different from those on the ground.

For example, the winds may be stronger in a height of 60-70 metres than at ground level.

Before climbing the turbine, make sure to wear or bring the appropriate clothes. If a body gets wet, the body temperature drops 25 times faster than dry skin in contact with surrounding air.

Wind chill factor index																			
Temperature °C				25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50
Wind speeds																			
Km/h m/s k/h Mph																			
0	0	0	0	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50
7	2	4	4	25	20	15	9	5	-1	-6	-11	-16	-21	-26	-31	-36	-41	-46	-51
14	4	8	9	23	17	12	5	0	-6	-12	-18	-24	-30	-36	-42	-48	-54	-60	-66
22	6	12	13	23	16	10	3	-3	-10	-16	-23	-29	-36	-42	-49	-55	-62	-68	-75
29	8	16	18	22	15	8	1	-6	-13	-19	-26	-33	-40	-47	-54	-61	-68	-75	-82
36	10	19	22	21	14	7	0	-7	-15	-22	-29	-36	-43	-50	-58	-65	-72	-79	-86
43	12	23	27		14	6	-1	-9	-16	-23	-31	-38	-46	-53	-61	-68	-75	-83	-90
50	14	27	31		13	6	-2	-10	-17	-25	-32	-40	-47	-55	-63	-70	-78	-85	
58	16	31	36			5	-3	-10	-18	-26	-33	-41	-49	-57	-64	-72	-80	-87	
65	18	35	40					-11	-19	-26	-34	-42	-50	-58	-65	-73	-81	-89	
72	20	39	45							-27	-35	-43	-50	-59	-66	-74	-82	-90	
79	22	43	49										-51	-59	-67	-75	-83		

Also warm and humid weather can affect the body. High temperatures and humidity causes the body to dehydrate easier, get low blood sugar and loose minerals.

4.3.2 Food and drink

Work in a turbine may be prolonged in all kinds of weather. Always bring food, fruit, water, juice or the like when climbing the turbine.

5 Hoist and Crane Work

When possible, mechanical aids must be used for lifting.

Plan the lift and make sure all involved personnel understand the plan.

Before lifting with crane, forklift or other mechanical equipment, ensure that the lifting equipment is certified. The lifting equipment must be marked with its maximum lifting capacity. The responsibility for certification and marking of lifting equipment rests with the supplier of the equipment.

Make sure that no one walks or stands under suspended loads.

Establish and maintain communication between everyone involved. Unless otherwise agreed, use international recognised crane signals.

Only trained and competent personnel must carry out lifting of main components such as tower sections, nacelle and rotor.

No persons other than those involved in the lifting procedure may enter the lifting area.

5.1 Safety during Mechanical Lift

Standing or walking under suspended loads is strictly prohibited.

The two safety signs below indicate that a crane is operating and that standing under suspended loads is strictly prohibited.

Sign – STANDING UNDER SUSPENDED LOAD PROHIBITED Sign – CRANE IN WORK



5.2 Radio or Mobile Phones

Personnel leading the lifting procedure can be hidden in or behind the turbine and hand signals can be indistinct over long distances or because of the weather conditions. Personnel involved in the lifting procedure must use two-way radios or mobile phones during the lift.

Make sure that batteries are fully charged before the lifting procedure is started.

The pictogram below indicates the use of radio or mobile phone.

Sign – USE RADIO OR MOBILE PHONE

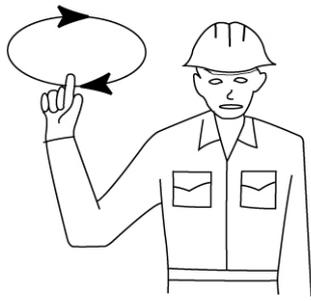


5.3 Crane Signals

The figures below show the internationally recognised signals when controlling a lift.

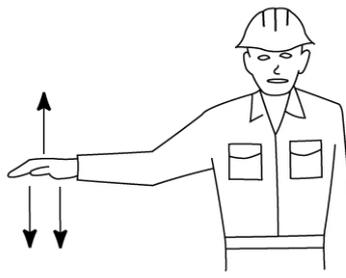
Only one person may signal to and guide the crane driver.

International Crane Signals



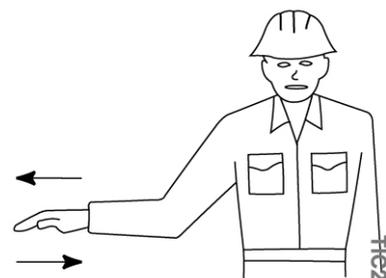
1

TIC20'0064'01



2

TIC20'0065'01



3

TIC20'0066'01



4

TIC20'0067'01



5

TIC20'0068'01

1. **Hoist:** Lift one hand and move it in circles.
2. **Lower:** Move one hand up and down.
3. **Direction:** Stretch out one hand and move it back and forth in desired direction.
4. **Emergency stop:** Lift both hands with the palms facing the crane driver. The sign can be given by anyone facing the crane driver.
5. **Stop:** Lift one hand and turn the palm towards the crane driver.

5.4 Nacelle Crane

Use the nacelle crane for lifting tools and equipment into the nacelle. Brake the rotor before using the crane. If an object must be lifted more than 2 metres, tag lines must be attached to ensure full control during the lift.

5.5 Mobile Cranes and Machinery

Machine operators must have a valid and approved licence for operating cranes and forklifts. If an object must be lifted more than 2 metres, tag lines must be attached to ensure full control during the lift.

5.6 Rigging and Lifting Equipment

Only a qualified person may carry out rigging. It is this person's responsibility to determine the weight of the object and to select suitable lifting equipment.

Carry out a visual inspection of the lifting equipment prior to use. Never use defective equipment. Label defective equipment: "DO NOT USE".

6 Personal Protection and First Aid Equipment

When working on a turbine site and in a turbine, certain Personal Protection Equipment (PPE in the following and in the specific instructions) must be used.

There may be small differences between the equipment in this instruction and the equipment used on site or equipment delivered to site and placed in a turbine.

Whenever the different signs for PPE are shown in the installation and/or service instructions as pictograms, the service technician must wear the PPE indicated.

In the following part signs and pictograms are shown with explanations for the signs.

6.1 First Aid Equipment

As standard all Vestas Wind Systems A/S' installation and service cars are equipped with a small box of standard first aid equipment. The box contains, among other things, eyewash equipment, adhesive bandage, different compress bandages, disinfecting swabs, different band-aids, disposable gloves, rescue sheet, scissors and a plastic bag.

During installation and service, the first aid box must be in close range of the working area.

The first aid box can be brought up in the turbine along with the rescue equipment.

First aid box



6.2 Fall Arrest Equipment

The sign for fall arrest equipment indicates that complete fall arrest equipment must be used. In installation and/or service instructions, other types indicating the minimum demand for fall arrest can follow the sign/pictogram.

Sign - FALL ARREST EQUIPMENT MUST BE WORN

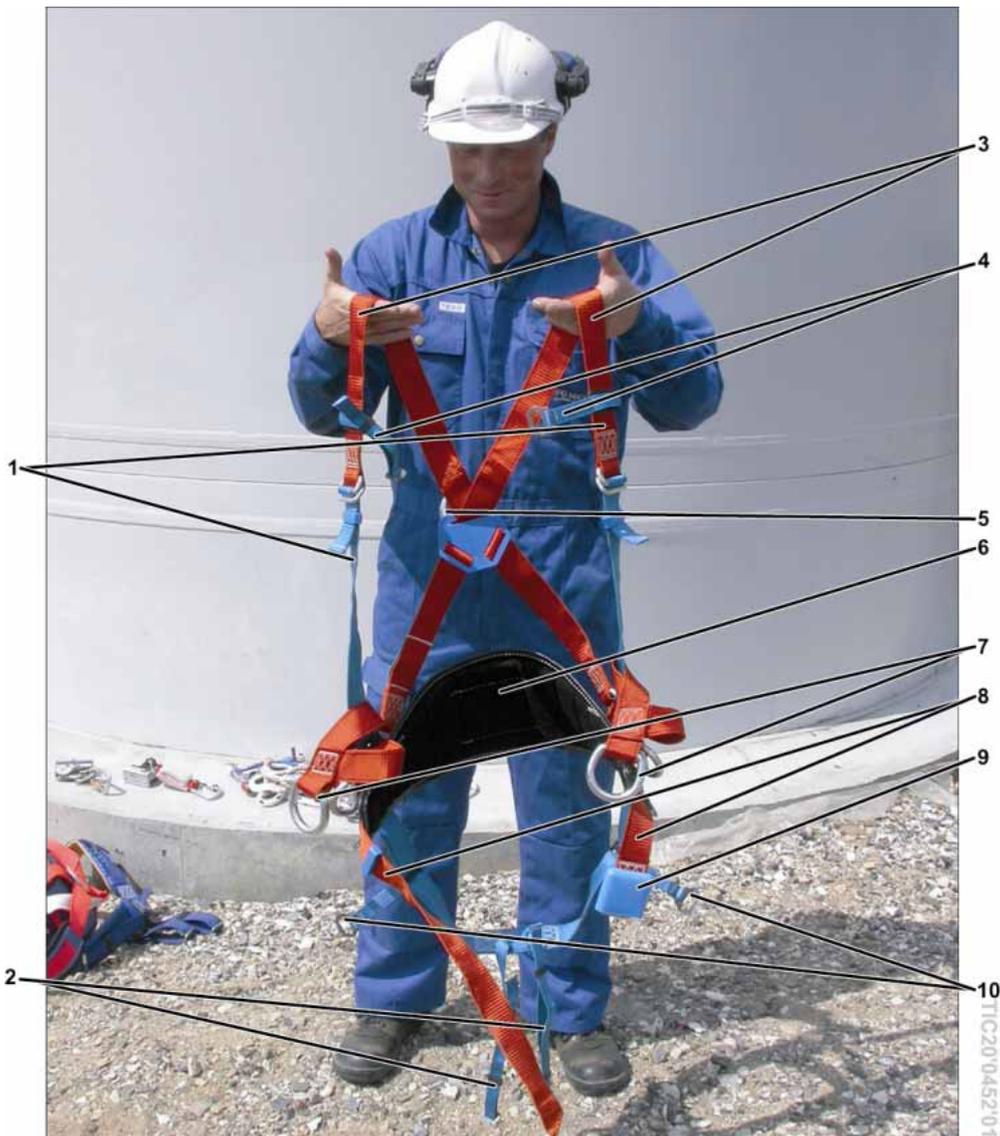


6.3 Full Body Harness

A full body harness is a central part of the PPE along with other safety components such as gliders, energy absorbers and lanyards.

When working in areas where fall arrest equipment is not obligatory, it is nevertheless recommended to wear the full body harness when it can be done without being caught in rotating parts. This ensures high safety in case of accidents where a rescue is needed.

The full body harness and its parts



- | | |
|-----------------------------|------------------------------|
| 1. Chest straps | 2. Thigh straps |
| 3. Shoulder straps | 4. Chest straps |
| 5. Metal ring on back | 6. Back support |
| 7. Metal rings on front | 8. Stomach straps |
| 9. Buckle for stomach strap | 10. Buckles for thigh straps |

6.3.1 Putting on the body harness

- The harness is lifted with the backside facing the user of the harness. Please see picture above.
- Put on the harness like one would put on a jacket by putting one arm through arm gap.
- Put the other arm through the other arm gap.

Turn harness around and put one arm through arm gap



Both arms through arm gaps

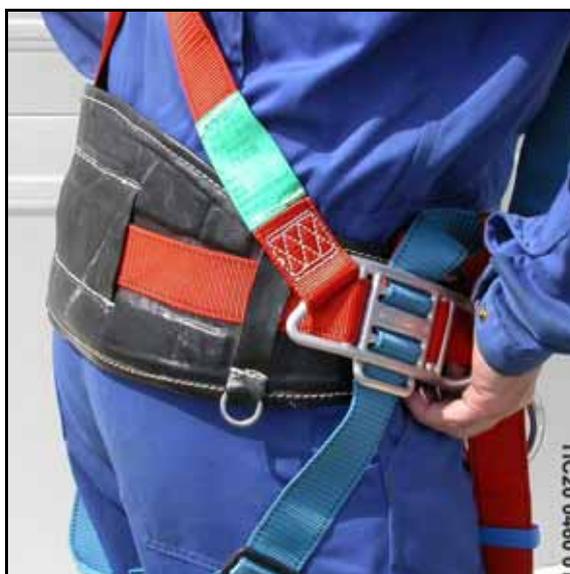


- The hip support is moved up and down on the buckles until it fits exactly on the hipbone.

Pull strap through buckles



Adjust hip support

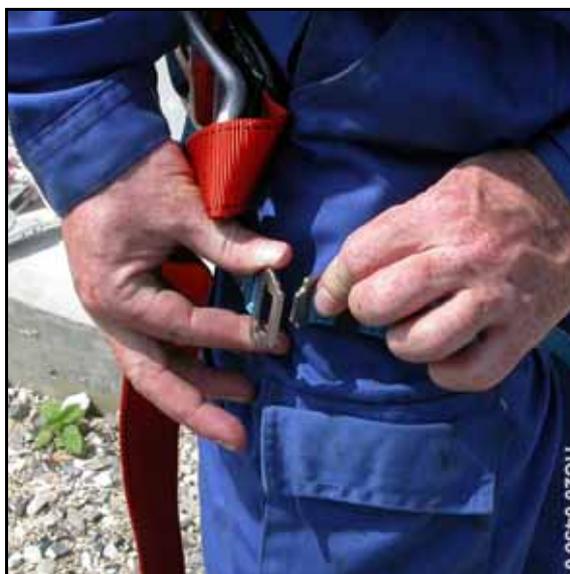


- Lift the thigh straps up between thighs and make sure that straps are not twisted.
- Lock both thigh straps in the buckles on each side of the harness by bringing the small buckle on the thigh strap from backside through the bigger buckle on the short strap near the hip support.

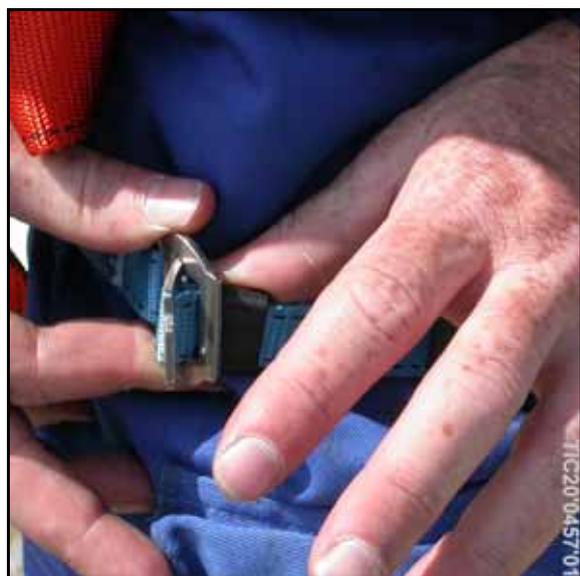
Lift thigh straps and make sure they are not twisted



Small buckle through bigger buckle from backside



Engage buckles on thigh straps



Make sure that buckle is engaged



- The strap around the stomach is tightened and locked by bringing the strap end through the two buckles and return between the two buckles.

Bring strap through the two buckles



Bring strap back between the two buckles



- Tighten strap by pulling.
- Bring strap end through clip on strap.

Tighten strap



Bring strap through clip



- Bring loose strap end through the slotted hole in the buckle cover.
- Push cover over buckle in order to secure buckle and lock loose strap end.

Loose strap end through buckle cover



Lock and secure with buckle cover

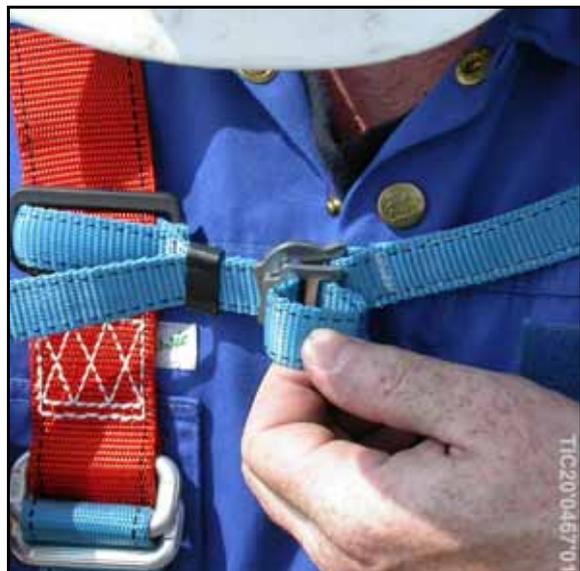


6.3.2 Adjusting the body harness

It is important that the body harness has the right size and is well adjusted so it fits the person wearing it. The body harness must be well adjusted to prevent damages if any falling accidents occur.

- Loosen or tighten chest strap by pulling strap through buckle until it fits. Straps must not squeeze or be loose.
- When thigh straps are correctly adjusted four fingers must be able to slide under both thigh straps. If necessary, adjust strap by pulling the strap through buckle.

Loosen or tighten chest straps



Four fingers able to slide under the thigh strap



- The seat strap must be adjusted by loosening and then pulling the straps passing through the buckles on the hip support.

Adjust seat strap



1. Seat strap

2. Pull strap up or down through buckle

- Tighten and adjust vertical chest straps. The easiest way is to lean your body a little to the same side as the strap being tightened and then pull the loose strap end. The strap must be tightened so that the strap gives a light pressure on the shoulder.

Pull loose strap end on vertical chest strap



Pull strap end on the other vertical chest strap



6.3.3 Checking harness adjustment

The best and easiest way to check if the harness is correctly adjusted and fits the user is to find a place where it is possible to hang in the harness.

- Mount the snap hook on the lanyard in the two rings on the front of the harness.
- Find a place where you can hang in the harness, for example on the backside of the entrance ladder on the tower, and secure the lanyard.

Engage snap hook in body harness



Secure lanyard and hang in the harness



- The body harness must give the body a good overall support, without any parts squeezing or being too loose. Especially the hip support and seat strap must give support.

6.3.4 Checking the full body harness

Apart from the legally demanded safety check of the body harness, users must check their fall arrest equipment regularly.

- Check all straps for wear, damage and large amounts of grease and oil.
- Check all seams for damage and wear.
- Check that the edges on the straps have not been worn more than to the indicator line.

Check straps for damages



Check wear indicator on straps



Check seams for wear and damages



Check seams for wear and damages



- Check all buckles for damages and corrosion. Remember to check parts hidden under straps and seams by turning the ring/buckle or loosening the straps to make hidden parts visible.
- Check all metal rings and hooks for damages. Check hidden parts by turning the ring and make the hidden part visible.

Check buckles for damage, wear and corrosion



Check parts hidden behind straps



Check metal rings for damage, wear and corrosion



Check hidden parts of metal rings



6.4 Gliders

Note: Before climbing the tower, hook the energy absorber and lanyard to the body harness

Before starting to climb the tower ladder, your body harness has to be connected to the bar or wire on the ladder via a glider.

There are different systems on the tower ladders so it is vital that the right system is used.

Some gliders can be equipped with energy absorber in order to make climbing on the tower ladder easier.

Glider for wire



Glider for bar with energy absorber



6.4.1 Checking gliders

- Check gliders for wear and cracks.
- Check that the braking mechanism works properly.

6.5 Using Glider for Bar

- Open snap hook on glider/energy absorber in order to mount the snap hook into two metal rings on the front of the body harness.

Open snap hooks on the glider



- Place the snap hook and glider in the rings on the front of the body harness.
- Mount the glider on the bar by pushing from below and up, and make sure the glider is secured above the lock.

Glider hooked to the body harness



Glider being mounted on the bar



Glider secured above the lock on the bar



6.6 Using Glider for Wire

- Make sure that the glider is in the right direction. The little arrow on the side of the glider must point upwards.
- Hook the glider onto the two rings on the front of the body harness.
- Make sure that the snap hook is locked and secured.

Glider with arrow pointing upwards



Hook the snap hook on the glider into the body harness



- Open the glider by pressing and turning the little locking pawl on the side of the wire.
- Open the glider by holding the glider with one hand and pressing the top against the body.

Turn the locking pawl



Open glider by pressing the top of glider



- When glider is fully opened it is mounted on the wire by pressing it over the wire.
- Check that the glider is locked and secured on the wire.

Press the glider over the wire



Glider mounted and secured on wire



6.7 Safety when using the Climbing Assistance

When a climbing assistance is present and used it is vital that appropriate PPE by means of a glider and perhaps a chock absorber is used. The hook and the climbing assistance are not appropriate PPE.

- The glider mounted on the front of the body harness must be secured on the bar or wire on the tower ladder.
- The hook for the climbing assistance is hooked onto the two rings on the front of the body harness using a snap hook.

Glider secured and hook being mounted on body harness



Open hook for climbing assistance



- Open the hook for the climbing assistance.
- Mount the hook on the rope for the climbing assistance.

Mounting hook on rope



Glider and hook ready for climbing



6.8 Energy Absorber

The energy absorber is part of the fall arrest system. The energy absorber prevents serious injuries when falling from high altitude and must always be used when working and/or climbing in places where there is a risk of falling. The energy absorber must always be hooked onto the body harness when ascending the tower ladder in order to make a safe unhooking from the safety wire or safety bar on the tower ladder.

The energy absorber is always used in connection with the full body harness.

The sign for fall arrest equipment can also indicate the use of energy absorber.

Parts in the energy absorber



- | | |
|-------------------------------------|--------------------------------------|
| 1. Rope | 2. Knot securing the energy absorber |
| 3. Safety lock in large safety hook | 4. Hook on large safety hook |
| 5. Energy absorber/brake | 6. Safety lock on small safety hook |
| 7. Hook on small safety hook | |

6.8.1 Using the energy absorber

Reference: For further information about anchorage points, please see turbine-specific “Safety Instruction”.

- The small snap hook must be hooked to the ring on the backside of the full body harness. The large snap hook is hooked onto the ring on the hip support for easy access when not in use.
- When working at heights or before disengaging the glider from the wire or bar on the ladder, hook the energy absorber to an anchorage point.

Open safety lock and hook onto ring on the back



Energy absorber hooked onto the ring on the back



- Always hook the energy absorber to an anchorage point placed as high above you as possible to minimise the fall distance.

6.8.2 Checking the energy absorber

Apart from the annual legally demanded safety check of the energy absorber, users must check their fall arrest equipment regularly.

- Check strap or rope for wear and damage.
- Check knots at the two snap hooks and the finishing knot on the loose rope end.
- Check that colour markings are equal on both sides of the energy absorber to ensure that the absorber has not been released.
- Check both small and large snap hook for cracks and other damages.
- Check safety lock on both small and large snap hook.

Check rope for damages and oil/grease contamination



Check that all knots are tight and secured



1. Knot
2. Sealed and secured knot

Check colour markings on the rope at the energy absorber



Check small snap hook for cracks and damages



Check safety lock on small snap hook



Check large snap hook for cracks and damages



Check safety lock on large snap hook



6.9 Lanyard

The lanyard is used as an extra support in along with the body harness and the energy absorber.

Parts in the lanyard



1. Rope or strap
3. Snap hook
5. Safety knot on loose rope end

2. Knot at snap hook end
4. Shortener/glider
6. Snap hook for hooking in on safety harness

6.9.1 Using the lanyard

The lanyard can for example be used on the tower ladder in a working or emergency situation where it gives the user an extra support and a good working position.

- The lanyard is hooked onto the body harness on the ring on the hip support.
- The end of the lanyard is twisted once or twice round a suitable point, in this example the side bar on the tower ladder.

Lanyard secured on tower ladder and with shortener/lock



6.9.2 Checking the lanyard

Apart from the annual legally demanded safety check of the lanyard, users must check their fall arrest equipment regularly.

- Check strap and/or rope for wear and damage.
- Check that knots are tight and secured.
- Check metal parts for damage, cracks and corrosion. Remember to check the parts hidden behind ropes or straps.

Check rope for damages and oil/grease contamination



Check hidden parts on snap hook



- Check brake/rope glider for damages.
- Check functionality of brake/rope glider.

Check shortener/brake for damages



Check functionality of shortener/brake



6.10 Safety Footwear

When working on a site or in a wind turbine it is mandatory always to wear approved safety footwear.

The sign for safety footwear indicates that service/installation technicians and visitors must wear safety boots or safety shoes.

Sign – SAFETY FOOTWEAR MUST BE WORN



Light safety shoe



Heavy safety boot



6.11 Hard Hat - Safety Helmet

The hard hat/safety helmet protects the head from strokes and falling objects dropped from high altitude.

The use of hard hat/safety helmet is mandatory when staying or working on a turbine site and in a turbine. The pictogram indicates that both working personnel and visitors must wear hard hat on site and in the turbine.

Sign – HARD HAT MUST BE WORN



6.12 Hearing protection

Hearing protection must be used when performing tasks releasing high noises.

The sign for hearing protection indicates that service/installation technicians and visitors must wear hearing protection.

Sign – HEARING PROTECTION MUST BE WORN



Hard hat with ear defenders



Ear defenders (plugs)



6.13 Respiratory Protection

Respiratory protection must be used when performing tasks that release any respiratory/health threatening vapour.

Respiratory protection must be worn when working with for example paint and solvents.

There are numerous types of protection for all kinds of vapours.

It is vital for one's health that the right type of protection is chosen for the task.

The sign for respiratory protection indicates that service/installation technicians and visitors must wear respiratory protection.

Sign – RESPIRATORY PROTECTION MUST BE USED



Example of respiratory protection



6.14 Dust Masks

Dust mask must be used when performing tasks that release any respiratory/health threatening dust as for example grinding or sanding.

The sign for dust mask indicates that service/installation technicians and visitors must wear dust mask.

Sign – DUST MASK MUST BE USED



Two different dust masks



6.15 Working Gloves

Working gloves must be worn in order to protect hands from injuries when working with warm, sharp or burr filled components.

When working with for example cleansers, oil and other chemicals other types of gloves, for example vinyl, must be used.

The sign for gloves indicates that service/installation technicians and visitors must wear gloves.

Sign – WORKING GLOVES MUST BE WORN



Light cotton glove



Heavy leather glove



A box with vinyl gloves



7 Safe Working with Noxious Materials

Sign – FOLLOW SAFETY SHEETS FOR CHEMICAL PRODUCTS

Sign – PROTECTIVE GLOVES MUST BE WORN



When working with noxious materials, always read the Material Safety & Data Sheets before use. The Material Safety & Data Sheets must be delivered with the products.

Always wear:

- Clothing.
- Gloves.
- Eye or face protection.

Always avoid:

- Inhalation of mist or vapour.
- Skin contact.
- Wearing contaminated clothing.

7.1 Working with Oil

- Avoid inhalation of mist and vapour.
- There are no special requirements for respiratory protection under normal conditions and with adequate ventilation.
- Protective clothing must be impervious to oil.
- Avoid prolonged or frequent skin contact. Do not wear contaminated clothing.
- Avoid eye contact. Use eye or face protection.
- Practice good personal hygiene.

7.2 Coolant Liquid

- There are no special requirements for respiratory protection under normal conditions and with adequate ventilation.
- Wear eye or face protection if splashing is likely to occur.
- Wear gloves.

- Practice good hygiene. No smoking, drinking or eating in the working area.

7.3 Hydraulic Oil

- High-pressure accidental injection through skin requires immediate medical attention.
- Avoid inhalation of mist or vapour.
- No special requirements for respiratory protection under normal conditions and with adequate ventilation.
- Protective clothing must be impervious to hydraulic oil.
- Avoid prolonged or frequent skin contact.
- Avoid eye contact. Use eye or face protection.
- Wear gloves.

7.4 Paint

- Avoid prolonged or frequent skin contact.
- Do not wear contaminated clothing.
- Use gloves.
- Ensure adequate ventilation.

7.5 Solvent

- Avoid inhalation of mist and vapour.
- Use respiratory protection.
- Use eye or face protection.
- No smoking, drinking or eating in application area.

7.6 Cleansers and Chemicals

Certain operations during installation or service involve the use of different cleansers or chemicals.

When possible, Vestas Wind Systems A/S provides cleansers and chemicals which are not dangerous to health or the environment. The use of chemicals is limited to a minimum.

Even the mildest cleanser has another pH value than human skin and may cause local irritation or allergic reactions.

When using cleansers or chemicals, the right PPE must be used and the Material Safety & Data Sheets must be read and followed before use.

Sign – FOLLOW SAFETY SHEETS FOR CHEMICAL PRODUCTS



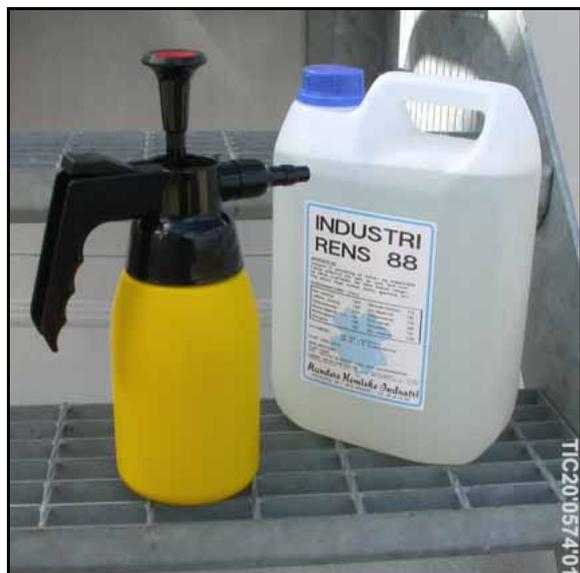
Sign – PROTECTIVE GLOVES MUST BE WORN



7.6.1 Safety with cleansers and chemicals

The cleansers are often used in spray cans. When cleanser is filled into a spray can, use a funnel to avoid spilling the cleanser.

Industrial cleanser and spray can



Cleanser and chemicals



- Avoid inhalation of mist or vapour.
- Wear protective gloves and clothing.
- Use eye or face protection.
- No smoking, eating or drinking in application area.

7.7 Aerosol

Certain operations during installation or Service involve the use of different aerosols.

When possible, Vestas Wind Systems A/S provides aerosols which are not dangerous to health or the environment. Use of aerosols is limited to a minimum.

Whenever using aerosols, the right PPE must be used and Material Safety & Data Sheets must be read and followed before use.

Cleanser in aerosol



Metal cleanser in aerosol



8 Evacuation and Rescue from the Turbine

Reference: For further information about escape routes, please see turbine specific “Safety Instruction”.

In certain circumstances as for example a fire, it may be necessary to make an evacuation of the turbine.

If a working accident occurs, it may be necessary to rescue an injured person, for example from the nacelle, nacelle roof, hub or tower.

Working personnel must be trained and educated in the use of evacuation/rescue equipment as well as the use of fall arrest equipment. Furthermore, working personnel must have proper first aid training.

8.1 Equipment for Evacuation and Rescue

The rescue equipment AG10 for evacuation/rescue must be present at the working area at all times when performing an installation or service task.

The equipment must be brought up through the turbine, either connected to a full body harness or lifted up to the nacelle with the nacelle crane/hoist.

AG10 equipment attached to full body harness



8.1.1 Checking the rescue equipment

Apart from the legally demanded safety check of the AG10 and the equipment in the rescue bag, users must check their equipment regularly.

- Check snap hook on both rope ends for cracks and damages.
- Check functionality of locking mechanism on snap hook.

Check snap hook for damages



Check locking mechanism



- Check that the knot tying the snap hook to the rope is tight and secured

Check that knot is tight



- Check cabinet on AG10 for cracks and damages.
- Check that the wheel on AG10 turns freely and that the rope passes easily through the AG10.

Check cabinet on AG10



Check that rope passes easily through the AG10



- Check the functionality of the rope locks on the backside of the AG10 and check that they are free from damages and wear.
- Check that the screws holding the AG10 cabinet together are tight and in place.

Check rope locks



Check screws on cabinet



- Check the mounting for the snap hook on the top of the AG10 for damages and cracks and check that the bolts are tight and in place.
- Check the snap hook on the top of the AG10.

Check the mounting on the top of the AG10



Check snap hook and locking

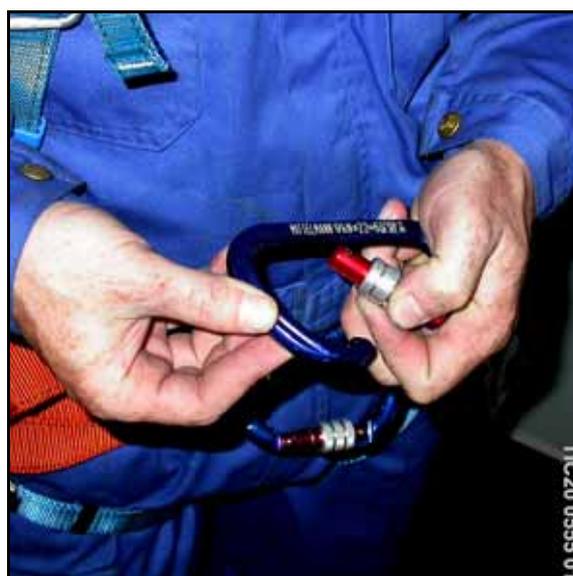


- Check seams on straps and check for wear and damages.
- Check extra snap hooks for cracks and damages and check the locking.

Check straps



Check extra snap hooks



- Check the functionality of the rope wheel and check for cracks and damages.

Check functionality of rope wheel



Check for cracks and damages



- Check edge protector, wire and snap hook for cracks and damages.
- Check fishing hook and snap hook in “fishing hook” for cracks and damages.

Check edge protector



Check “fishing hook” for damages



- Check functionality of “fishing hook”.

Check functionality of fishing hook



- Put the snap hook on the long rope end down into the rescue bag.
- In order to check the rope for damages let the rope run through fingers while pulling the rope down into the bag with the other hand.

Put snap hook down into bag



Let rope run through fingers



8.2 Before the Rescue

It is vital that personnel in the turbine remain calm. First of all it is important to make an estimate of both the injuries, the situation and give first aid, if necessary. Make sure that no more accidents happen and cause the person further injury.

Calls to rescue service and paramedics must be made. Use emergency numbers available on the turbine site.

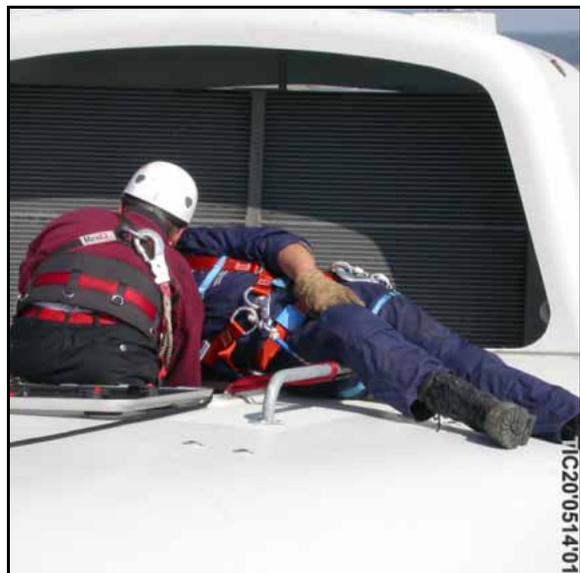
8.3 Rescue from the Turbine

Rescue of an injured person is divided into several phases.

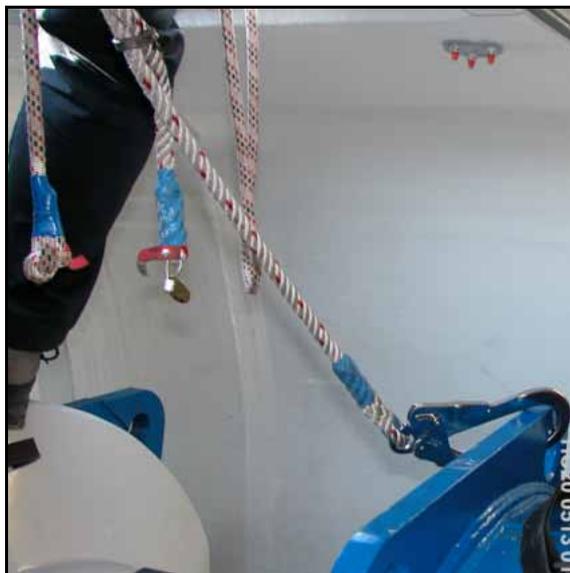
When an injured and helpless person is observed, it is vital that the person who has to make the rescue is properly secured with fall arrest equipment.

Make sure that the injured person is properly secured.

Injured person observed



Energy absorber hooked onto approved anchorage point



- Bring the bag with the rescue equipment to the injured person.
- Empty the bag piece by piece and make sure that the equipment is secured/tied so it is not dropped.

The bag with equipment brought to the injured person



AG10 taken out of the bag



- Attach the AG10 to an approved anchorage point with the round sling.

AG10 being secured to anchorage point



AG10 secured to an anchorage point on generator



- Secure the snap hook with the attached edge protector. Hook and tackle with a round sling.
- Attach the hook on the rope on the AG10 to full body harness on the injured person. Make sure the hook is locked and secured.
- Make sure that the rope can glide freely and that it is not twisted around any obstacles or can be caught or squeezed anywhere.

Attach the AG10 rope to injured person



Make sure that rope can glide freely.



- Make sure that the rope on the AG10 is tight and secured in the rope lock so that the injured person does not fall.
- Carefully help the injured person out over the edge at the nacelle top.

Rope on AG 10 must be tight to avoid further injuries



Help injured person out over the edge on nacelle top

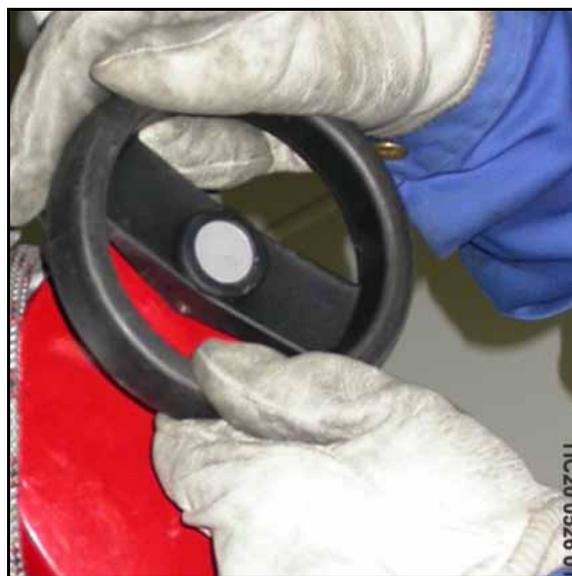


- If needed, mount the edge protector in order to protect the rope on the AG10 from damages from sharp edges.
- If the injured person is caught in the energy absorber or the tag line, the wheel on the AG10 can be used to lift the person enough to detach the energy absorber.

Mount edge protector



Turn wheel to lift injured person



- Release the rope from the brake on the AG10, but not from the eye where the rope passes through as this will allow the person performing the rescue to use little force to control the lowering.
- Lower the injured person.

Lower the injured person.



The injured person on his way down



- If possible a third person helps and supports the injured person when he reaches the ground.

Help and support the injured person



8.4 Accident on the Ladder

If a person gets sick or is injured when working or climbing on the tower ladder in the turbine, he will be caught in the glider and the full body harness.

If an injured or helpless person is observed on the turbine ladder, it is vital that the person who has to make the rescue remains calm and evaluates possible injuries and the situation in general.

- Provide first aid and make call to rescue service.

8.4.1 Rescue on the ladder

- The person who must do the rescue climbs down or up, just above the injured person, must have the bag with the rescue equipment attached to the full body harness.

- The bag must be attached to the tower ladder.

Attach bag to step on tower ladder



- When emptying the bag do it piece by piece and attach the parts in the bag to the ladder to prevent the parts from falling.

Attach the AG 10 to the ladder



Attach equipment to ladder



- When AG10 is attached, release the rope from the lock and pull the rope out so the hook can reach the injured person.
- Hook the rope/hook onto the ring on the backside of the body harness on the injured person.

Pull out the rope from the AG10



Hook onto ring on bodyharness



- By turning the wheel on the AG10 the injured person can be lifted enough to disengage the glider or the energy absorber.
- The person performing the rescue hooks a snap hook on the ring at the buckle on the hip support on the body harness and then opens the snap hook and engages the rope into the snap hook. This way it is possible to guide the injured person down through the tower.

Turn the wheel to lift the injured person



Hook rope onto snap hook and bodyharness

