VDSI-Guideline
01/2013

Content of Work Safety Instructions and Training in the Wind Energy Sector

Professional group Renewable Energy
- January 2013 -
VDSI-Guidelines are elaborations of VDSI working groups, VDSI professional groups and other committees within the VDSI. They focus on topics requested by whomever out of engineering practice where no other institutions in the sector occupational health and safety and environmental protection have published information. As a result of this VDSI-Guidelines document a new circumstance or show up the state of technology in a defined specific field.
Information:
First aid training, occupational health checks (G20, G25, G26/1, G41 and in case of residence in foreign countries possibly G35) and the vaccination status of new employees/workers are prerequisites. The specific instruction and training topics are based on a module system and can be selected according to requirements or work to be done.

If required, the WTG (Wind Turbine Generator) type including hub height is to be mentioned in the certificates. Example: Reason and repeated instructing concerning personal protection clothing/equipment, equipment to protect against falling and rescue training.

Generally instructions/training should be repeated annually or after a hazard/risk evaluation has been conducted.

Overview:

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<th>Name</th>
<th>Minimum time required</th>
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<td>Basic training course personal protection clothing and equipment, equipment to protect against falling, rescue training</td>
<td>2 days</td>
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<td>Module 1a:</td>
<td>Repetition instruction concerning personal protection clothing and Equipment, equipment to protect against falling, rescue training,</td>
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<td>Module 2a:</td>
<td>Electrically trained person (EuP)</td>
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<td>Module 7:</td>
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<td>Module 8:</td>
<td>Driving safety / securing loads (theory)</td>
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<td>Module 9:</td>
<td>Residence in foreign countries</td>
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<td>Module 11:</td>
<td>Electromagnetic fields</td>
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Objective: Participants are familiarized with personal protection clothing and equipment and how to use it properly. They know the general dangers when working on a WTG and learn the basics concerning rescue / evacuation / behavior after an accident.

Participants: All employees/workers working for the first time on a WTG

Prerequisites: Passed occupational health check according to the old principles G41 or similar and first aid training

Total participants: Maximum of 12 persons

Duration: 2 days of which 1 day theory and 1 day practical instruction

Contents: **Theoretical Part** (1 day):

- Legal background including rules, regulations and information of the Trade Insurance Body e.g. BGR, BGI, etc., TRBS (Technical Regulations for Operational Safety) etc.
- Specifically BGR 198 / 199

**Personal Protection Clothing / Equipment**

- Functioning and how to use properly
  - Protective helmet (hard hat)
  - Protective shoes / Safety shoes
  - Gloves
  - Breathing protection
  - etc.

**Personal Protection Equipment to Protect Against Falling**

- Functioning and how to use properly,
  - Harness
  - Impact absorber, acting body force with / without impact absorber
  - Grip (holding) rope
  - Various fall arrest devices, fall arrest systems, illustration and functioning
  - Moving fall arrest devices
  - Checks
  - Cleaning
  - Maintenance of personal protection clothing / equipment
Module 1
Basic Training Personal Protection Clothing/Equipment, Equipment to Protect Against Falling, Rescue Training

- Replacement of harness / ropes / hardhats
- Storage of personal protection clothing / equipment
- Correct application of fall arrest harness and personal protection clothing / equipment
- Exercise: Recognizing faulty or damaged personal protection clothing / equipment. Participants must be able to identify faulty / damaged personal protection clothing / equipment

Safe Working in or on a Wind Energy Plant

- How must personal protection clothing / equipment be treated
- Attachment points
- Safe work behavior depending on work locations
  - Working in the tower
  - Working in the nacelle
  - Working in the spinner, on the rotor blades and in these areas
  - Working on the tower - outside
  - Inspection of the spinner / hub
  - Working on the roof of the nacelle
  - Working in the man basket
  - Working when in windy conditions

Working with Special Authorization (brief presentation)

- Instructed person in the field of electricity, electrician for specific tasks, electrician
- Working near voltage
- Switching the medium voltage switchgear
- Working on electrical systems

Accident and Rescue

- Rescue equipment
- Abseiling equipment
- Abseiling equipment with lifting function

- Presentation of various rescue procedures
  - Rescue out of the ladder
  - Descending from nacelle
  - Rescue of a person having had an accident out of the hub by using a stretcher (in theory only)
  - Evacuation out of the WTG
o Abseiling of persons having had an accident by using a stretcher (e.g. show film)

- Behavior after accidents
  o Accident notification
  o First aid
  o Trauma of hanging
  o Prusik sling
  o Introduction of WTG Emergency Information System (WEA – NIS) or respectively Geo Information System (GIS Enercon)

**Practical Part** (1 day)

**Introduction**

- Drive to the WTG
- Further prerequisites for working on a WTG
- Radio units (walkie-talkie)
- Mobile phones
- “Take pen and paper with you”
- Behavior at/on or in a wind energy plant
- Refuse (waste)

**Practical Exercises**

- Test / hanging exercise for all participants
- Climbing and behavior in the tower
- Behavior when leaving the vertical ladder
- Behavior in the nacelle
- Explanation of emergency shutdowns
- Safe behavior if hatches are open in the nacelle
- Descending when in the tower
- Instructions concerning the service lift (if on site)
- Rescue exercises
- Rescue from the ladder and from a platform (special rescue grip for unconscious persons)
- Abseiling from nacelle

**Final Discussion**

- Behavior during extraordinary weather conditions
  - Behavior during thunderstorm
  - Falling ice
- Questions from the participants
- Further advice...
Further information: The occupational safety instruction sessions must be documented.

The participants receive a certificate indicating the contents of the instructed topics.
Objective: The participants are instructed about the dangers of electric current and measures to prevent dangers.

Participants: Persons without any training in the field of electricity who enters a WTG (closed electric operation site) or who must work on the electric equipment of a WTG.

Prerequisites: --

Participants: Maximum of 10 persons

Duration: Depending on contents the training should require 1 day

Contents: **Basics of electricity**

Dangers of electric current
Contents of accident prevention regulations
Relevant contents of the Accident Prevention Regulations (BGV A1, BGV A3), Information and Regulations of Trade Insurance Body e.g. BGI 657 and Technical Regulations for Operational Safety (TRBS)
Organization on the work site (responsibility for work and equipment)
Setup regulations, cable types, cross-sections, protective elements, VDE0100 etc.
Phase, neutral conductor, protective conductor, protective equipotential bonding, color code, serial circuits, parallel circuits, neutral (star) point, low voltage, high voltage, protective measures

Protective equipment
Introduction to the standard DIN VDE 0105-100 (latest edition)
Important electric operation equipment in the WTG
Work areas of persons instructed in the field of electricity in the WTG

System configurations, voltage levels, topologies and their specifics
Protective (electrical) separation, if possible
5 safety rules for operation equipment for supply and final circuits
Protection against touching, additional protection by RCD, protection classes (degrees), protection types
General behavior rules
Energy supply on construction sites
Check of electric operation equipment, stickers, documentation
First aid measures after accidents in the field of electricity
Written test on the knowledge gained

Practical exercises (in a wind energy plant):
Access, safe stay in all areas, rules of conduct
Doing work under the guidance and supervision of an experienced
electrician using the method "show, imitate/copy and practice"

Example list for specific work:
Disconnecting low voltage electric circuits
Opening of switch cabinets (low energy, high energy)
Bolt tensioning *)
Change of coal brushes on the generator *)
Laying and connecting cables – generator circuit *)
Laying and connecting of cables – low voltage

Determination / checking of the absence of voltage with suitable measuring instruments. Only a two-pole voltage detector is suitable for persons instructed as EuP!
Should persons instructed as EuP have to use a multimeter, then this must be specifically indicated upon their appointment and the training documented
Visual checks with information on possible errors and dangers

*) after disconnection by an experienced electrician

Further information: Contents of training in regard to the depth and extent must be agreed upon by the company and the person/company offering the training. The training sessions must be conducted by experienced electricians. The occupational safety instruction sessions must be documented.
The participants receive a certificate indicating the contents of the instructed topics which is valid for 1 year.
**Module 2b**

**Skilled electrician for specified tasks (EffT)**

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<tr>
<th>Revised / Date</th>
<th>01 / 27.02.2012</th>
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<tr>
<td>Prepared by:</td>
<td>Michael Huwald</td>
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</table>

**Objective:**

The participants are instructed on simple work on electric systems of a WTG, the dangers of electric current and measures to prevent these.

**Participants:**

Employees/workers who under their own responsibility must do simple and repeated electric engineering work in or on WTG.

**Prerequisites:**

Completed professional training (apprenticeship) in the field of metal fabrication or electric engineering including vehicle engineering

**Participants:**

Maximum of 10 persons

**Duration:**

80 hours of which 40 theory and 40 practical learning

**Contents:**

Training based on BGG 944 (Trade Insurance Body)  
Relevant contents of the Accident Prevention Regulations (BGV A1, BGV A3) and Information and Regulations of Trade Insurance Body e.g. BGI 657 and Technical Regulations for Operational Safety (TRBS)  
Organization on the work site (responsibility for work and equipment)  
Setup regulations, cable types, cross-sections, protective elements, VDE0100, etc.  
Phase, neutral conductor, protective conductor, protective equipotential bonding, color code, serial circuits, parallel circuits, neutral (star) point, low voltage, high voltage, protective measures  
Protective equipment  
Responsibility as a professional and leadership VDE 1000 Part 10  
Basics of electrical engineering  
Terminology in the field of electrical engineering, refer to BGG 944  
Dangers and effects of electric current  
Protection measures against direct and indirect touching, additional protection  
Circuit/Grid configurations and their specifics  
Protective (electrical) separation  
5 safety rules  
Protection measures, protection classes (degrees), protection types  
Check of the protection measures  
Important electric operation equipment in the WTG  
Measures to prevent accidents  
First aid measures after accidents in the field of electricity

**Practical exercises regarding the specified tasks (in a WTG):**

The determined operation-specific tasks listed by the company
Specifics: Written test on the knowledge gained is absolutely required. A very experienced electrician must be in charge of the practical training. All practical training must be documented.

Further information: The training must be documented.

The participants receive a certificate indicating the instructed topics and the recommendation to be recognized as an electrician for specific tasks. The appointment can but must not be limited for a specific time period.

The appointment to electrician for specific tasks must be done by the responsible electrician of the company.
Module 2c

Obtaining switch authorization up to 52 kV

Objective: The participants are instructed how to conduct switch operations on high voltage switch equipment.

Participants: Electricians with completed professional training (apprenticeship) from companies having such electrical equipment.

Prerequisites: Trained electrician or under certain conditions skilled electrician for specified tasks (EffT) or electrically trained person (EuP).

Participants: Maximum of 12 persons

Duration: 2 days theory and practical learning

Contents: DIN VDE 0105-100:2009-10
Legal regulations and sub-legal regulations
Circuit/Grid configurations and topology
5 safety rules for high voltage
Assessment of ambient conditions by the person authorized to do switching operations
Transfer and taking back work responsibilities to/from third persons
Setup and functioning of electric operation equipment
Design and functioning of voltage detectors
Use / handling of grounding and short-circuit set
Design, locking and basic functions of switchgear
Switch types, application areas
Measures to protect against electricity
Operation of electric systems, operator obligations
Knowledge of HRC fuses and performance switches
Safety requirements
Switching operations
Checking of electric operation equipment and testing equipment
Behavior of operating personnel
Switching commands, switching conversations
Reading of single line diagrams
Causes for accidents and accident prevention
Firefighting in the vicinity of electric equipment
Effect of electric current on the human being
Behavior in specific cases
Written test of the knowledge gained
Module 2c

Obtaining switch authorization up to 52 kV

Practical Exercises

Switching operations on switchgear in or on WTG

Further information: The training must be documented.

The participants receive a certificate indicating the contents of the instructed topics.
Module 3
Power-operated tools

<table>
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<tr>
<th>Objective:</th>
<th>Safe working when using hydraulic tools</th>
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<tbody>
<tr>
<td>Participants:</td>
<td>All employees/workers who are working for the first time in or on a WTG.</td>
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<tr>
<td>Prerequisites:</td>
<td>Passed occupational health examination according to the principles of G41 or similar and first aid training</td>
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<tr>
<td>Participants:</td>
<td>Maximum of 12 persons</td>
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<tr>
<td>Duration:</td>
<td>4 hours</td>
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<tr>
<td>Contents:</td>
<td>Legal background including all valid regulations such as BGR, BGI of the Trade Insurance Body, TRBS (Technical Regulations for Operational Safety) etc.</td>
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Dangers of electric current
Protective measures and behavior rules
Visual inspection
Electrical cables
Behavior in case of electric accidents
Hydraulic equipment (hydraulic screwdriver, hydraulic tensioning device)

Further information: The training and instructions given must be documented.

The participants receive a certificate indicating the contents of the instructed topics.
Objective: The participants are instructed how to safely operate cranes, slinging equipment and any load bearing equipment.

Participants: All workers who must operate cranes

Prerequisites: Technical training

Participants: Maximum of 12 persons

Duration: ½ day theory and practical learning

Contents: Legal background, Regulations, Rules and Information of the Trade Insurance Body e.g. BGR, BGI, etc., TRBS (Technical Regulations for Operational Safety) etc.

Types of cranes, dangers as result of incorrect operation of cranes, crane designations, steering station/operation systems, danger zones, safety equipment, requirements the operator must fulfill, checking the cranes, operation of cranes, end of crane operation

Definition of equipment bearing (supporting) loads (suspension equipment, hoisting gear, sling equipment), chain slings, rope slings, steel or synthetic ropes, hoisting belts, change of load capacity via inclination angle and slinging configuration, crane hook, prevention of damages, inspections.

Further information: The training and instructions given must be documented.

The participants receive a certificate indicating the cranes, chains and/or hoists that were part of the instruction including contents of the instructed topics.
Objective: The participants are instructed how to work with, transport, store and dispose hazardous substances.

Participants: All employees/workers who work on or in a WTG

Prerequisites: -

Participants: Maximum of 12 persons

Duration: 2 hours

Contents: Legal background, All Regulations, Rules and Information of the Trade Insurance Body e.g. BGR, BGI, TRBS (Technical Regulations for Operational Safety) etc.

Properties & dangers (fire, explosion, lack of oxygen, …)

Access ways into the human body

Designation/marking of hazardous substances

Safety data sheets and company safety directives

Transport of hazardous substances (securing loads / regulations governing limited quantities)

Handling and transport of compressed gas cylinders

Spray cans

Personal protection clothing and equipment / general protection measures

First aid measures

Environment protection

Possibly mention existing concepts to avoid accidents harming the environment

Further information: The training and instructions given must be documented.

The participants receive a certificate indicating the contents of the instructed topics.
Objective: The participants are instructed how to prevent fires, familiarized with the dangers of fires and proper behavior in the case of fire.

Participants: All employees/workers who work in or on a wind energy plant

Prerequisites: Basic training in personal protection clothing and equipment, equipment to protect against falling, rescue training

Participants: Maximum of 12 persons

Duration: 1 day

Contents: Legal background - Trade Insurance Body regulations, rules and information e.g. BGR, BGI, TRBS (Technical Regulations for Operational Safety) etc.

Fire load and fire dangers / how fires ignite

Dangers as result of fire and smoke

Fire extinguishers and respirators

Handling fire extinguishers and fire extinguishing equipment

Evacuation out of WTG (rescue exercises) / escape and rescue plans

Fire reporting

If possible, mention information of existing fire prevention concepts

Further information: The instructions and training must be documented.

The participants receive a certificate indicating the contents of the instructed topics.
Objective: The participants are instructed how to move and work safely in restricted or confined areas and space.

Participants: All employees/workers who are working in or on a WTG for the first time

Prerequisites: Passed occupational health examination according to the principles of G41 or similar and first aid training

Participants: Maximum of 12 persons

Duration: 2 hours

Contents: Legal background, Rules, Regulations and Information of the Trade Insurance Body e.g. BGR, BGI, TRBS (Technical Regulations for Operational Safety) etc.

Dangers (electrical and mechanical dangers) when working in restricted or confined areas / space

Working in restricted or confined areas / space with hazardous substances

Working in areas / space with the danger of fire

Rescue concept

Further information: The instructions and training must be documented.

The participants receive a certificate indicating the contents of the instructed topics.
Objective: Driving safety training for drivers of small trucks (sprinter class)

Securing of loads and getting acquainted with equipment
Understanding and applying basic loading concepts. Willingness to take the initiative and assume responsibility.

Participants: Service mechanics, drivers, loaders, forklift operators

Prerequisites: -

Participants: Maximum of 12 persons

Duration: 2 hours theory

Contents: Legal background, Regulations, rules and information of the Trade Insurance Body e.g. BGR, BGI, etc., TRBS (Technical Regulations for Operational Safety) etc.

Stress during the workday of drivers

Driving experience, braking and avoiding obstacles on different road conditions (theory)

Legal regulations and generally accepted engineering standards for securing loads

Basics in physics

Transport vehicle and means of transport
Correct distribution of loads, methods of securing loads
Possibly: BGV 29 (Accident Prevention Regulations)

Further information: The instructions and training must be documented.

The participants receive a certificate indicating the contents of the instructed topics.
Objective: Participants will be informed about the specifics of an assignment to a foreign country, e.g. required vaccinations, general behavior rules in the country of residence etc.

Participants: All employees/workers who must work in a foreign country

Prerequisites: None

Participants: Maximum of 24 persons

Duration: ½ day theory

Contents: Legal background including regulations, rules and information of the Trade Insurance Body e.g. BGR, BGI, etc., TRBS (Technical Regulations for Operational Safety) etc.

General preparation, e.g. passport, driving license, Medical preparation (e.g. required vaccinations), Possible psychological stress, precautionary measures Cultural differences, specifics of the culture, Language difficulties Climate or hygienic conditions Protection against infections, Behavior upon being attacked or robbed Precautionary measures if residing in a hotel Accident and health insurance for employee/worker

Further information: The instructions and training must be documented.

The participants receive a certificate indicating the contents of the instructed topics.
Objective: The participants are instructed how to properly use rescue equipment on board ships and helicopters in the case of an emergency when persons are under extreme physical and psychological stress.

Participants: All employees/workers who work offshore

Prerequisites: Passed occupational health examination for offshore work according to the principles of G41 or similar and first aid training

Participants: Maximum of 12 persons

Duration: 3 days theory and practical learning

Contents: 1st day: survival on sea and helicopter emergency evacuation procedure

Theoretical contents:
Design, functioning and handling of rescue equipment, use of day and night emergency signals (including pyrotechnical signals and sea emergency transmitters), correct behavior in emergency situations and problems that affect the body of a human being upon an emergency landing on water, rescue and winch procedure, hypothermia, hanging or rescue death

Practical exercises:
Exercises to get used to water, (swimming on the water surface without moving your body and getting acquainted with your personal "breath holding time"), life jacket (automatic and manual activation), inflatable life raft (getting in and turning a capsized life raft back into the correct position, behavior while in the life raft), survival suit / cold protection suit, simulation of helicopter emergency evacuation procedures, evacuation out of the air, on the water surface and under water

2nd day: boat safety

Theoretical contents:
Safety organization on board of boats, knowledge of the personal and collective rescue equipment, signage and escape routes on the boat, knowledge of the location of all rescue and safety equipment, use of life jackets and work safety jackets, survival suits and life buoy, behavior on the boat upon sounding of an alarm and climbing into rescue vessels upon leaving the boat, rescue out of the water and connected behavior measures, knowledge of the most important sailor’s knots, basics concerning radio at sea (two-way radios), refuse disposal (protection of the environment) MARPOL
Practical exercises:
Behavior with and in a life raft, climbing in, maneuverings, docking at and leaving the pier with a rescue or work boat, “man overboard” maneuver, training boat to boat and boat to WTG, standard knots

3rd day: Firefighting

Theoretical contents:
Firefighting: oil and electric fires, automatic extinguisher equipment, personal and collective equipment for firefighting, breathing protection, escape breathing devices, escape from rooms filled with smoke

Practical exercises:
Firefighting: oil and electric fires, handling of different types of fire extinguishers (water, powder, CO2), extinguishing of fires in closed, confined rooms, fighting liquid and other types of fires

Further information: The instructions and training must be documented.

The participants receive a certificate indicating the contents of the instructed topics.
**Objective:** The participants are instructed about the specifics of wind energy plants, specifically about electromagnetic fields.

**Participants:** All employees, workers or visitors with medical implants who work in or on a wind energy plant or who want to visit such a plant.

**Prerequisites:** None.

**Participants:** Maximum of 24 persons.

**Duration:** 2 hours theory.

**Contents:**
- Where are the electromagnetic fields on or in a wind energy plant?
- What are the dangers for persons with a medical implant?
- Access prohibition
- Designation of the danger areas
- Maximum period of stay
- Information obligation (e.g. for craftsmen due to rescue measures)

**Further information:** The instructions and training must be documented.

The participants receive a certificate indicating the contents of the instructed topics.