

Wir machen Arbeit sicher und gesund.

VDSI-Guideline

VDSI

Verband für Sicherheit,
Gesundheit und Umweltschutz
bei der Arbeit

01/2013

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

Professional group Renewable Energy

- May 2015 –

VDSI-Guideline:

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.

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Internet: www.fg-erneuerbareenergien.vdsi.de

Responsible for the content

Dirk Richling

EnBW AG

P-HA

Durlacher Allee 93

76131 Karlsruhe

Telefon: +49 721 63-12153

E-Mail: fg-erneuerbareenergien@vdsi.de

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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.

Module	Name	Course duration	Validity
Module 01a	Basic course: PPE, PPEaF, rescue training	2 days	1 year
Module 01b	Repetitive training: PPE, PPEaF, rescue training	1 day	1 year
Module 02a	Electrotechnically instructed person (EIP1)	½ day	1 year
Module 02b	Electrotechnically instructed person (EIP2)	1-2 days	1 year
Module 02c	Qualified electrician for defined tasks (EDF)	80 h	
Module 02d	Obtaining the switching authorisation up to 52 kV	2 days	1 year
Module 03	Powered tools	4 h	
Module 04	Cranes and lifting accessories	½ day	
Module 05	Handling of hazardous substances	2 h	
Module 06	Fire protection on worksites	1 day	
Module 07	Confined spaces	2 h	
Module 08	Driving safety/load securing	2 h	
Module 09	Stays Abroad, General	½ day	
Module 10	Offshore training	3 days	4 years
Module 11	Electrical, magnetic and electromagnetic fields	2 h	
Module 12	Lifting and carrying	4 h	

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Objective:

VDSI Rule 01/2013 is the **safety-related rule defining basic authorisations of employees that are to work in on-shore and off-shore wind turbines**. The modules of this rule describe the minimum training standards required for this purpose.


Members of the “Renewable Energies” section of the Verband für Sicherheit, Gesundheit und Umweltschutz bei der Arbeit (VDSI) [Association for Occupational Safety, Health and Environmental Protection] compiled this Rule. The members of the section are experts of wind turbine operators, raisers, manufacturers, sub-suppliers and service providers; all of them focus on occupational safety, health and environmental protection. The Rule reflects the section's expertise opinion and can be understood to be a guideline of (safety) technical industrial standards. They apply to raising, commissioning, operation, maintaining and repairing as well as dismantling wind turbines in Germany and other countries.

Target groups are public authorities, operators, service providers, handcraft and industry as well as fitters.

The contents of each of the modules independently substantiate the minimum standards of required knowledge and aptitudes, also physical and medical prerequisites, for each of the areas. They have been harmonised with European requirements and, in conjunction with training based on these standards, allow **the pan-European assignment of employees trained in line with VDSI Rule 01/2013**. **Project-specific contents can be integrated** additionally into training courses in line with VDSI Rule 01/2013, provided the basic topics have been covered.

The modules also provide information for educational institutions offering courses in line with VDSI Rule 01. For this purpose, a specific description of the trainers' knowledge and aptitudes and notes on the required equipment of the educational institution is given.

The training of persons in line with VDSI Rule 01 does not exempt the employer from his responsibility to give specific instructions and where necessary train his employees with regard to the working methods, work environment, tasks, equipment and other particular specifications. The latter depend on the risk assessment for the task to be carried out and have to be adapted to match changed conditions. Employees will be capable of correctly handling work processes and safety equipment

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only after having received basic training in line with VDSI rule 01/2013 and special instructions and, where applicable, necessary additional training.

Definition of terms:

Employer

The following individual or legal persons are employers in the sense of §2 (3) of the Occupational Health Act. The employer is also the entrepreneur referred to in the regulations of the Employer's Liability Insurance Association.

Educational institution

Educational institutions are enterprises, enterprise divisions or other institutions providing safety-related training to persons.

Training officer

Responsible representative of the educational institution.


Trainers

Trainers are persons employed by the educational institution directly charged with providing training, e.g. instructor, course instructor, height rescue trainers.

Scope:

The training standards are divided into several modules and comprise information regarding physical prerequisites and medical evidence testifying sufficient physical fitness, knowledge and expertise of handling tools, loads and protective equipment, knowledge of emergency equipment and emergency systems, training regarding special work methods and conduct in case of an emergency, special knowledge in handling required electrical devices and hazardous substances, special instructions regarding the handling of vehicles, vessels and aircraft as well as stays abroad.

Notes for educational institutions are also given.

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Structure:

Each of the modules covers the following main topics:

- Group of participants
- Prerequisites
- Number of participants
- Duration of the training course
- Training topics, usually theory and practice
- Specifications for educational institutions
- Certificate with evidence and validity period

Requirements to educational institutions and trainers:


Being responsible for occupational safety, the entrepreneur has to verify when selecting and drafting the contract whether the educational institution and the training programme are suited for his purposes. Educational institutions providing training in line with VDSI Rule 01 can be generally regarded as being suited.

The educational institution has to qualify the trainers accordingly. Relevant information, techniques and equipment has to be provided; training sites have to be accessible to a certain extent.

The specialised trainers have to have the necessary knowledge and expertise to communicate the information and also to be able to assess a sufficient learning success (e.g. by way of questions).

The number of trainers has to match the size of the groups. The modules contain respective specifications.

The educational institutions and trainers are obliged to keep their knowledge up to date. Respective proof has to be provided and archived. Public authorities, insurance companies, relevant manufacturers, service providers and VDSI also offer respective training courses.

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It is mandatory that the trainers for some modules (e.g. height rescue training, electrical instructions) have the respective technical qualification and, where applicable, completed the manufacturer training, and can provide appropriate evidence. For example, this applies to height rescue and securing devices, special measuring instruments, etc.

The respective details are mentioned in the modules in question.

Prior to performing the training, the educational institution has to compile a risk assessment for the training and make sure that neither trainers nor participants can come to harm.

The training officer declares the compliance with all specifications of the VDSI Rule 01 to VDSI e.V. (Renewable Energies Section) in writing prior to any training and is then entitled to use the VDSI logo on the training certificate. These declarations will be documented in a list.


Legal requirements:

All the modules shall be such that the required legal requirements can be complied with. To do so, their contents have to be matched to the currently valid legal requirements and, where applicable, specified to reflect national requirements. Additional specific supplements may be integrated.

Certificates:

Every participant who has reached the defined course objective shall be awarded a certificate with the following minimum contents:


- Complete name of the educational institution
- Participant's name, first name and date of birth
- Complete name of the training module with contents and duration
- Certificate's duration of validity
- Restrictions or limitations where applicable
- Signature of the training officer.

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Current modules:

At present, the following modules are available.
The validity of the modules in Germany is ruled by the specifications of the statutory accident insurance that stipulates annual safety instructions for the employees.

Module	Name	Course duration	Validity
Module 01a	Basic course: PPE, PPEaF, rescue training	2 days	1 year
Module 01b	Repetitive training: PPE, PPEaF, rescue training	1 day	1 year
Module 02a	Electrotechnically instructed person (EIP1)	½ day	1 year
Module 02b	Electrotechnically instructed person (EIP2)	1-2 days	1 year
Module 02c	Qualified electrician for defined tasks (EDF)	80 h	
Module 02d	Obtaining the switching authorisation up to 52 kV	2 days	1 year
Module 03	Powered tools	4 h	
Module 04	Cranes and lifting accessories	½ day	
Module 05	Handling of hazardous substances	2 h	
Module 06	Fire protection on worksites	1 day	
Module 07	Confined spaces	2 h	
Module 08	Driving safety/load securing	2 h	
Module 09	Stays Abroad, General	½ day	
Module 10	Offshore training	3 days	4 years
Module 11	Electrical, magnetic and electromagnetic fields	2 h	
Module 12	Lifting and carrying	4 h	

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Applicability of modules to specific job profiles:

The requirements to training and skills of persons working on wind turbines require a diverse scope. The following table recommends appropriate assignments.


Module	Unskilled workers	Mechanical engineer	Electrical engineer (EFK) NS / MS	Plant Manager	EHS staff / auditors	Management	Rescue and emergency staff	Guests
Module 01a	X	X	X	X	X	E	X	-
Module 01b	X	X	X	X	X	X	X	X
Module 02a	X	X	-	X	X	X	X	X
Module 02b	-	E	-	-	-	-	-	-
Module 02c	-	E	-	K	K	-	-	-
Module 02d	-	-	- / E	X	K	K	-	-
Module 03	X	X	X	X	K	K	-	-
Module 04	X	X	E	E	K	K	K	-
Module 05	E	X	X	X	K	K	K	-
Module 06	X	X	X	X	K	K	K	-
Module 07	E	X	X	E	K	K	K	-
Module 08	X	X	X	E	K	K	K	-
Module 09	B	B	B	B	B	B	B	B
Module 10	B	B	B	B	B	B	B	B
Module 11	-	-	E	K	K	-	-	-
Module 12	X	X	X	K	K	-	-	-

X: Training required

E: Training recommended

K: Knowledge required

B: additionally if needed, e.g. stay abroad/offshore

	VDSI Rule 01/2013 <u>Module 01a</u> Basic course: PPE, PPEaD, rescue training	Revision/	04
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Objective: The participants get to know all the personal protection and know how to use it properly. They know the general hazards of a stay inside a wind turbine, get to know the basics of rescue / evacuation and the conduct in case of accidents.

Group of participants:

All employees working on wind turbines for the first time

Participants' prerequisites:

First aider training and physical fitness

The necessity of physical fitness is derived from DGUV Regulation 1 and the risk assessment. On the basis of employment agreements or individual contractual agreements, the contractor can have aptitude tests performed. The contractor can use the results (suited, suited with restrictions, unsuited) to make responsible choices.

The training provider is recommended to have the participants confirm their physical fitness on the training day.

Prerequisites for training centres and trainers:
see also VDSI Rule 01/2013: General information:

Being responsible for occupational safety, the entrepreneur has to verify when selecting and drafting the contract whether the educational institution and the training programme are suited for his purposes.


The educational institution has to qualify the trainers accordingly. Relevant information, techniques and equipment has to be provided. Training sites have to be accessible if practical training requires so.

The specialised trainers have to have the necessary knowledge and expertise to communicate the information and also to be able to assess an appropriate learning success (e.g. by way of questions).

The educational institutions and trainers are obliged to keep their knowledge up to date. Respective proof has to be provided and archived.

It is mandatory that the trainers have the respective expertise and technical qualification and, where applicable, completed the manufacturer training, and can provide appropriate evidence. For example, this applies to height rescue and securing devices.

Prior to performing the training, the educational institution has to compile a risk assessment for the training and make sure that neither trainers nor participants can come to harm.

	VDSI Rule 01/2013 <u>Module 01a</u> Basic course: PPE, PPEaD, rescue training	Revision/	04
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The training officer declares the compliance with all specifications of the VDSI Rule 01 to VDSI e.V. (Renewable Energies Section) in writing prior to any training and is then entitled to use the VDSI logo on the training certificate. These declarations will be documented in a list.

Number of participants: Maximum 12 persons

Duration: 2 days: 1 day theory, 1 day practice

Topics: **Theoretical part** (1 day):

- Legal background with all further applicable national and European regulations and European Standards.
- In Germany: employers' liability insurance association incl. all further applicable regulations such as BGR, BGI, TRBS and in particular BGR 198/199 and BGI 515

Personal protective equipment (PPE)

Principle of function, when and how to use


- Safety helmet
- Protective shoes
- Protective gloves
- Breathing protection
- etc.

Personal protective equipment against falling (PPEaF)

Principle of function, when and how to use,

- Harness
- Shock absorber, forces acting on the body with/without shock absorber
- Tether
- Various rope grabs, presentation and function of climbing protection systems
- Trailing catching devices
- Checks
- Cleaning
- Repairing PPE
- Discard criteria for harness/ropes/helmets
- PPE storage
- Correct fitting of harness and PPE

Exercise:

	VDSI Rule 01/2013 <u>Module 01a</u> Basic course: PPE, PPEaD, rescue training	Revision/	04
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Identifying defective PPE; every participant must be capable of identifying damaged PPE.

Safe working in and on a wind turbine

- How to handle the PPE
- Attaching and securing points

Safe conduct in dependence of work locations

- Working in the tower
- Working in the nacelle
- Working in the spinner, on the rotor blades and vicinity
- Working on the tower outside
- Inspecting the spinner/hub
- Working on the nacelle roof
- Working in the personnel cage
- Working in windy conditions

Working with special authorisation (brief portrait)

- EuP, EffT, EFK
- Working on live components
- Operating the medium voltage switchgear
- Working on electrical systems

Accident and rescue


- Rescue equipment
- Lowering devices
- Lowering devices with hoist function

Presentation of various rescue procedures

- Rescue from a ladder
- Lowering from the nacelle
- Rescuing casualties out of the hub using a stretcher, describe in theory
- Evacuation from the wind turbine
- Lowering casualties from the wind turbine using a stretcher (e.g. show video)

Conduct after accidents

- Accident notification
- First aid
- Hang trauma

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- Prusik hitch
- Presentation of the Windenergieanlagen Notfallinformationssystem (WEA-NIS) [wind turbine emergency information system] or Geo Information System (GIS Enercon)

Practical part (1 day):

Preparatory meeting

- Travel to wind turbine
- Additional necessary prerequisites for working on wind turbines
- Radio units
- Mobile phones
- “Take notepad and pen with you”
- Conduct at/in a wind turbine
- Waste

Practical exercises

- Suspension test exercise for all participants
- Ascending and conduct inside the tower
- Conduct when leaving the vertical ladder
- Conduct in the nacelle
- Explanation of emergency stops
- Safe conduct when nacelle hatches are open
- Descending in the tower
- Introduction to an elevator system (if present)
- Rescue exercises
- Rescue from vertical ladder and from a platform (Rautek manoeuvre)
- Lowering from the nacelle


Final meeting

- Conduct in case of exceptional weather conditions
- Conduct during a thunderstorm
 - Ice dropping

Questions by participants
Some notes...

Note: The occupational safety instructions have to be documented.

The participants receive a certificate with details on the training topics

	VDSI Rule 01/2013 <u>Module 01b</u> Repetitive training: PPE, PPEaF, rescue training	Revision/	04
		Date	05/2015
		Author:	VDSI - FEE M. Huwald
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Objective: The participants repeat the Personal Protection covered in the basic course and know how to use it properly. They repeat the basic rescue/evacuation procedures and teh conduct in case of accidents.

Group of participants:

All employees working on wind turbines

Participants' prerequisites:

Valid first aider training and physical fitness


The necessity of physical fitness is derived from DGUV Regulation 1 and the risk assessment. On the basis of employment agreements or individual contractual agreements, the contractor can have aptitude tests performed. The contractor can use the results (suited, suited with restrictions, unsuited) to make responsible choices.

The training provider is recommended to have the participants confirm their physical fitness on the training day.

Prerequisites for training centres and trainers:
see also VDSI Rule 01/2013: General information:

Being responsible for occupational safety, the entrepreneur has to verify when selecting and drafting the contract whether the educational institution and the training programme are suited for his purposes. The educational institution has to qualify the trainers accordingly. Relevant information, techniques and equipment has to be provided. Training sites have to be accessible if practical training requires so. The specialised trainers have to have the necessary knowledge and expertise to communicate the information and also to be able to assess an appropriate learning success (e.g. by way of questions). The educational institutions and trainers are obliged to keep their knowledge up to date. Respective proof has to be provided and archived.

It is mandatory that the trainers have the respective expertise and technical qualification and, where applicable, completed the manufacturer training, and can provide appropriate evidence. For example, this applies to height rescue and securing devices. Prior to performing the training, the educational institution has to compile a risk assessment for the training and make sure that neither trainers nor participants can come to harm.

	VDSI Rule 01/2013 <u>Module 01b</u> Repetitive training: PPE, PPEaF, rescue training	Revision/	04
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The training officer declares the compliance with all specifications of the VDSI Rule 01 to VDSI e.V. (Renewable Energies Section) in writing prior to any training and is then entitled to use the VDSI logo on the training certificate. These declarations will be documented in a list.

Number of participants: Maximum 12 persons

Duration: 1 day theory and practice

Particularities: One or two trainers can hold this repetitive course. With two trainers, several practical exercises, e.g. taken from the rescue concepts, can be carried out

Topics: **Theoretical part** (approx. 4 h):

- Legal background with all further applicable national and European regulations and European Standards.
- In Germany: employers' liability insurance association incl. all further applicable regulations such as BGR, BGI, TRBS and in particular BGR 198/199 and BGI 515


Repetition:

Personal protective equipment (PPE)

- Safety helmet
- Protective shoes
- Protective gloves
- Breathing protection etc.

Personal protective equipment against falling (PPEaF)

- Harness
- Shock absorber
- Tether
- Various types of rope grabs, climbing protection systems
- Trailing catching devices
- Correct fitting of harness and PPE

	VDSI Rule 01/2013 Module 01b Repetitive training: PPE, PPEaF, rescue training	Revision/	04
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Accident and rescue

- Rescue equipment, principle of function, operation
- Presentation of various rescue procedures
 - Rescue from a ladder
 - Lowering from the nacelle
 - Rescuing casualties out of the hub using a stretcher
 - Evacuation from the wind turbine
 - Lowering casualties from the wind turbine using a stretcher

Practical part (approx. 4 h):

Preparatory meeting

Practical exercise


- Several variants of rescue from vertical ladders
- With two trainers, several practical exercises, e.g. taken from the rescue concepts, can be carried out.

Final meeting

Note:

The occupational safety instructions have to be documented.

The participants receive a certificate with details on the training topics.

	VDSI Rule 01/2013 Module 02a Electrotechnically instructed person (EIP1), plant inspection	Revision/	04
		Date	05/2015
		Author:	VDSI - FEE F. Mester
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Objective: Authorisation as electrotechnically instructed person. Acquisition of electrotechnical knowledge required to enter the wind turbine.

Group of participants:

Persons not being qualified electricians who are to obtain access to the wind turbine.

Participants' prerequisites:

Successful participation in Module 1

Prerequisites for training centre:

see also VDSI Rule 01/2013: **General information:**

Licence as mandated by trade law, suitable training classrooms with training material, appointed responsible qualified electrician

Instructor/trainer prerequisites:

Qualified electrician for the topics to teach, working at height authorisation, sufficient language skills, at least 2 trainers for plant inspection

Number of participants:


Maximum 12 persons

Duration:

1/2 day theory and a visit to a wind turbine (may have been covered in module 1)

Topics:

- General rules of conduct and prerequisites for a stay inside wind turbines
 - Accompanying guests
 - Special rules of conduct for a stay inside wind turbine, operating manual
 - Ban on electrotechnical work
 - Hazards posed by electricity
 - Worksite organisation (responsibility for plant and work)
- Areas of activity of electrotechnically instructed persons in wind turbines
- 5 safety rules for equipment of electrical supply and final circuits
 - Protection against contact, supplemental protection, protection classes
 - General rules of conduct for handling electrical equipment
 - Protective measures and protective equipment
 - Electromagnetic fields
 - Major electrical equipment in the wind turbine
 - High-energy plant components
 - Identifying electrotechnically unsafe situations

	VDSI Rule 01/2013 Module 02a Electrotechnically instructed person (EIP1), plant inspection	Revision/	04
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- First aid measures in case of accidents in electrical environments
- Written exam

Visit to a relevant wind turbine

Access, safe stay in tower and nacelle, rules of conduct
Areas to which access is not allowed or restricted

Note:

The appointed authorised electrician of the customer is responsible for approving of the certificate.
Validity: 1 year

	VDSI Rule 01/2013 Module 02b Electrotechnically instructed person (EIP2) Electrical installations	Revision/	04
		Date	05/2015
		Author:	VDSI - FEE F. Mester
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Objective: Authorisation as electrotechnically instructed person. Acquire electrotechnical knowledge and skills to complete the assigned tasks.

Group of participants:

Person not being authorised electricians and having to stay in wind turbines (closed electrical sites) or are to carry out “certain electrotechnical work” of a wind turbine.

Participants' prerequisites:

Successful participation in Module 1 and at least 3.5 years of professional experience in the technical sector, including vocational training in a dual education system and at least 1 year of professional expertise in wind energy operations

Prerequisites for training centre:

see also VDSI Rule 01/2013: General information:

Licence as mandated by trade law, suitable training classrooms with training material, appointed responsible qualified electrician

Instructor/trainer prerequisites:


Qualified electrician for the topics to teach, working at height authorisation, sufficient language skills

Number of participants: Maximum 12 persons

Duration: 1 to 2 days, depending on the topics or scope

Topics:

Basics of occupational safety
Hazards posed by electricity
Introduction to standards (EN 50110)
Worksite organisation (responsibility for plant and work)
Mandatory attendance of the supervisory authorised electrician
Areas of activity of electrotechnically instructed persons in wind turbines
5 safety rules for equipment of electrical supply and final circuits
Protection against contact, supplemental protection, protection classes
General rules of conduct for handling electrical equipment
Construction regulations: Cable types, cross sections, protective devices, basic electrotechnical standards, etc.
Electrotechnical terms: Phase, neutral, protective lead, equipotential bonding, colour code, series circuit, parallel circuit, star circuit
Low voltage, high voltage, protective measures, protective equipment

	VDSI Rule 01/2013 Module 02b Electrotechnically instructed person (EIP2) Electrical installations	Revision/	04
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Major electrical equipment in the wind turbine
Requirements to safety-related components, safety chain
High-energy plant components
Identifying electrotechnically unsafe situations
Particularities of relevant equipment
Power supply of work sites and assembly sites
Testing electrical equipment, labels, documentation
First aid measures in case of accidents in electrical environments

Written exam

Practical exercises (in a wind turbine):

Access, safe stay in all areas, rules of conduct
Execution of “certain electrotechnical work”, instructed and supervised by an experienced authorised electrician by way of “demonstration, imitation, practising”

Examples for “certain electrotechnical work”:


Isolating low-power, low-voltage circuits
Opening switch cabinets (low-power, high-power)
Tightening torques of high-power plant components*)
Replacing the carbon brushes of a generator *)
Routing and connecting cables - generator circuit*)
Routing and connecting cables - low-voltage
Checking that no voltage is present using suitable instruments

*) after deenergisation by an authorised electrician

Note:

Depending on the requirements, the contents depth and scope have to be agreed between educational institution and appointed authorised electrician of the customer. Training has to be given by experienced authorised electricians who, together with the appointed authorised electrician of the customer assess by way of exams whether or not the training objective has been reached at the end of the course.

The appointed authorised electrician of the customer has to appoint persons as being electrotechnically instructed in writing. The term of appointment is restricted to one year. The customer has to specify the work to be assigned in work instructions.

	VDSI Rule 01/2013 Module 02c Qualified electrician for defined tasks (EDF)	Revision/	04
		Date	05/2015
		Author:	VDSI - FEE F. Mester
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Objective: Enable participants to autonomously carry out specified tasks on electrical systems of a wind turbine. They are familiar with the inherent electrical hazards of the work and are able to take protective actions.

Group of participants:

Employees who are to autonomously carry out simple, repetitive electrotechnical work on wind turbines.

Participants' prerequisites:

At least 1 year experience as EIP2 acc. to VDSI training module for the specified tasks. Modifications or extensions of tasks are possible after consultation with the appointed authorised electrician of the customer.

Prerequisites for training centre:

see also VDSI Rule 01/2013: **General information:**

Licence as mandated by trade law, suitable training classrooms with training material, appointed responsible qualified electrician


Instructor/trainer prerequisites:

Qualified electrician for the topics to teach, working at height authorisation, sufficient language skills

Number of participants: Maximum 12 persons

Duration: At least 80 hours theory and practice approx. 40 each


- Topics:**
- 1 Basics of electrical engineering
 - 1.1 Electrical voltage, voltage generation
 - 1.2 Electrical current
 - 1.3 Current types
 - 1.3.1 AC, DC
 - 1.3.2 Direct and undulatory currents
 - 1.4 Ohm's law, calculating with powers of ten
 - 1.5 Motors, transformers and capacitors
 - 1.6 Magnetism, electrical field, compensation
 - 1.7 Series circuit, parallel circuit
 - 1.8 Electrical power
 - 1.9 Wattless components, energy storage
 - 2 Hazards and effects of electrical currents on man, animals and objects
 - 2.1 Effects on man and animals

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- 2.11 Limen
- 2.12 Let-go threshold
- 2.1.3 Cardiac arrest, ventricular fibrillation
- 2.14 Burns
- 2.2 Current exposure time on the body
- 2.3 Impedance of the human body
- 2.4 Shock currents, maximum contact voltage
- 2.5 Fire hazard

- 3 Protective measures against direct and indirect contact
 - 3.1 Classification of protective measures and key terms
 - 3.2 Protection against direct contact
 - 3.2.1 Protection by insulating live parts
 - 3.2.2 Protection by covers or enclosures
 - 3.2.3 Protection class acc. to IP code
 - 3.3 Protection against direct and indirect contact
(Protection against shock currents during normal operation or in case of an error)
 - 3.3.1 Protection by safety extra-low voltage
 - 3.4 Protection against indirect contact (protection against shock currents in case of an error)
 - 3.4.1 Protective insulation
 - 3.4.2 Protective separation
 - 3.4.3 Protection by cut-out
 - 3.4.3.1 Protective equipment, basic protection, advanced protection
 - 3.4.3.2 Network variants
 - 3.4.3.3 Protective measures in the TN system
 - 3.4.3.4 Protective measures in the TT system
 - 3.4.3.5 Protective measures in the IT system
 - 3.4.3.6 Protective lead
 - 3.5 Equipotential bonding
 - 3.5.1 Protective-equipotential bonding
 - 3.5.2 Functional-equipotential bonding

- 4 Testing the protective measures
 - 4.1 Requirements and respective measures
 - 4.2 Measuring protective measures regardless of network variant – insulating resistance measurement
 - 4.3 Measuring protective measures regardless of network variant
 - 4.3.1 TN system with overcurrent protection equipment
 - 4.3.2 TN system and TT system with RCD
 - 4.3.3 IT system with insulation monitor
 - 4.4 Measuring the equipotential bonding

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- 4.5 Testing and measuring mobile devices
 - 4.5.1 Visual inspection
 - 4.5.2 Insulation resistance measurements, equivalent leakage current measurement
 - 4.5.3 PE-resistance test (I_{test} approx. 2 A)
 - 4.5.4 Function test
 - 4.5.5 Inscription test
 - 4.5.6 Documentation
 - 4.5.7 Returning tested devices to the user

- 5 Accident prevention measures when working on electrical equipment
 - 5.1 General regulations
 - 5.2 Government regulations regarding accident prevention
 - 5.3 Accident prevention measures; 5 safety rules
 - 5.4 Measures when troubleshooting live components
 - 5.5 Safety provided by personal protection and aids
 - 5.6 Accident notification

- 6 First aid basics
 - 6.1 General, accidents caused by electricity
 - 6.2 Measures to take in case of injuries, rescue chain, particularities of wind industry, offshore sector
 - 6.3 First aid in case of accidents caused by electricity, AED
 - 6.4 Accident notification, recording of first aid given

- 7 Responsibility (technical and managerial responsibility)
 - 7.1 Who is authorised to carry out work on the electrical system?
 - 7.2 Relevant "engineering rules", system manufacturer specifications
 - 7.3 Material used for the electrical system, and liability
 - 7.4 Worksite organisation (responsibility for plant and work)
 - 7.5 Testing stationary and mobile equipment
 - 7.6 Possible consequences arising from human errors
 - 7.7 Occupational safety system, risk assessment

- 8 Operation-specific electrotechnical requirements
 - 8.1 Leads can cables
 - 8.1.1 Wire structure, wire and jacket insulation, wire marking, colour codes, code, VDE logo
 - 8.1.2 Structure and selection of power lines and cables
 - 8.1.3 Fuse protection and allocation of cable cross sections
 - 8.2 Professional electrical connections
 - 8.2.1 Finishing finely and very finely stranded conductors
 - 8.2.2 Connections in energy transmission circuits

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- 8.2.3 Corrosion protection, material pairing, chemical effects of electric currents
- 8.3 Special wind turbine requirements
 - 8.3.1 Major electrical equipment in the wind turbine
 - 8.3.2 Protective-equipotential bonding, lightning protection system in a wind turbine
 - 8.3.3 Safety chain equipment
 - 8.3.4 Particularities of high-power plant components
 - 8.3.4 Particularities from conductive environment and confined spaces
 - 8.3.5 Switching in low-voltage and high-voltage environments
- 9 Final exam

Practical exercise of specified tasks (in a wind turbine):

Operation-specific electrotechnical tasks specified by the entrepreneur

Particularities:

Mandatory written exam
 The practical training has to be carried out under supervision of an experienced authorised electrician.

Note:

The educational institution has to document the training by providing at least the following details:


- Trainer's name and qualification
- Name of the appointed authorised electrician of the customer
- Training topics and timeline
- Exam results

The documentation has to be archived for at least 30 years.


Depending on the requirements, the contents depth and scope have to be agreed between educational institution and appointed authorised electrician of the customer. Training has to be given by experienced authorised electricians who, together with the appointed authorised electrician of the customer assess by way of exams whether or not the training objective has been reached at the end of the course.

The participants receive a certificate with details on the training topics and a recommendation to be approved as qualified electrician for defined tasks.

The appointed authorised electrician of the customer has to appoint persons as being a qualified electrician for defined tasks in writing. The appointment

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may be but need not be restricted in time. The customer has to specify the “defined work” in work instructions.

	VDSI Rule 01/2013 Module 02d Obtaining the switching authorisation up to to 52 kV	Revision/	04
		Date	05/2015
		Author:	VDSI - FEE F. Mester
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Objective: The participants learn how to carry out switching tasks on high-voltage switchboards.

Group of participants:

Qualified electricians with successfully completed vocational training from companies with comparable electrical systems.

Participants' prerequisites:

Trained qualified electrician or, under certain circumstances, qualified electrician for defined tasks or electrotechnically instructed person.

Prerequisites for training centres and trainers:
see also VDSI Rule 01/2013: General information:


Licence as mandated by trade law, suitable training classrooms with training material, appointed responsible qualified electrician

Number of participants: Maximum 12 persons

Duration: 2 days theory and practice

Topics:

- DIN VDE 0105-100:2009-10
- Legal and subordinate regulations
- Network types, network topology
- Adherence to the 5 high voltage safety rules
- Assessment of der prevailing conditions by the person entitled to perform switching
- Work area handover to and takeover from third parties
- Structure and function principle of electrical equipment
- Structure and function principle of voltage testers
- Using/handling earthing / short-circuiting cables
- Design, interlocks and basic functions of switchboards
- Switch types, areas of application
- Measures providing protection against electricity
- Operating electrical systems, operator's duties
- Knowledge of HH fuses and power switches
- Safety requirements
- Switching actions
- Testing electrical equipment and test instruments
- Conduct of operating staff

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- Switching commands and switching orders, switching conversations
- Reading of Single Line charts
- Reasons for accidents and accident prevention
- Fire fighting in electrical systems
- Effects of electrical currents on man
- Conduct in special cases
- Written exam

Practical exercises:

Switching actions at switchboards in/at wind turbines

Note:

The training has to be documented. The participants receive a certificate with details on the training topics.

	VDSI Rule 01/2013 <u>Module 03</u> Powered tools	Revision/ Date	04 05/2015
		Author:	VDSI - FEE K.-H. Oberender
		Page	1 of 1

Objective: Safe conduct when handling and safe working with hydraulic tools

Group of participants:

All employees working on wind turbines for the first time

Participants' prerequisites:

At least 18 years of age, first aider training and physical fitness

The necessity of physical fitness is derived from DGUV Regulation 1 and the risk assessment. On the basis of employment agreements or individual contractual agreements, the contractor can have aptitude tests performed. The contractor can use the results (suited, suited with restrictions, unsuited) to make responsible choices.

Prerequisites for training centres and trainers:

see also VDSI Rule 01/2013: General information:

Suitable training classrooms and with training material, trainer who has provided evidence of being allowed to teach the devices

Number of participants:

Maximum 12 persons

Duration: 4 hours


Topics:

- Legal background incl. all applicable regulations such as BGR, BGI, TRBS etc.
- Hazards posed by electricity
- Protective measures and rules of conduct
- Visual inspection
- Lines
- Conduct in case of electrical accidents
- Hydraulic devices (hydraulic impact wrench, hydraulic clamping device)

Note:

The occupational safety instructions have to be documented.

The participants receive a certificate with details on the training topics

	VDSI Rule 01/2013 <u>Module 04</u> Cranes and lifting accessories	Revision/	04
		Date:	05/2015
		Author:	VDSI - FEE H. v. Hülßen
		Page:	1 of 2

Objective: The participants learn how to safely operate ground-controlled cranes, sling gear and lifting accessories.

Group of participants:

Persons working with ground-controlled cranes (gantry cranes trestle cranes, overhead cranes).

Participants' prerequisites:

At least 18 years of age, physical fitness

The necessity of physical fitness is derived from DGUV Regulation 1 and the risk assessment. On the basis of employment agreements or individual contractual agreements, the contractor can have aptitude tests performed. The contractor can use the results (suited, suited with restrictions, unsuited) to make responsible choices.

Prerequisites for training centres and trainers:
see also VDSI Rule 01/2013: General information

Suitable training classrooms and with training material, trainer who has provided evidence of being allowed to teach the devices


Number of participants: Maximum 12 persons

Duration: 1-3 days theory and practice (depending on the type of crane and the participants' knowledge)

Topics: **Legal basis**
Ordinance on Industrial Safety and Health, Machinery Directive, BGV D6, BGR 500, BGG 921, BGG 905 and others.

Crane technology
Crane definition and topics: Crane designs; classification according to design, fundamental physical terms as far as they are required for safe operation of cranes.

Crane operation
Areas of application and function of cranes, manufacturer's operating instructions, operator's instructions for use, crane time-book, hand

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signs for banksmen, crane operation mode, joint operation of several cranes, crane inspections, occupational safety, crane exercises

Lifting accessories and slinging loads


Definition and terms of lifting accessories, marking of accessories, estimating weights, selecting and using suitable lifting accessories and sling gear, correct slinging of loads, correct depositing and storing of loads, discard criteria for sling gear and lifting accessories.

Note:

The occupational safety instructions have to be documented.

The participants receive a certificate/ crane operator licence with the following details:

- Participant's name, first name and date of birth
- Crane types covered during the training
- Types of sling gear and lifting accessories
- Name and address of the educational institution

	VDSI Rule 01/2013 <u>Module 05</u> Handling of hazardous substances	Revision/	04
		Date	05/2015
		Author:	VDSI - FEE B. Schäfer
		Page	1 of 1

Objective: The participants are trained how to handle, transport, store and dispose of hazardous substances.

Group of participants:

All employees coming into contact with hazardous substances

Participants' prerequisites:

None

Prerequisites for training centres and trainers:

see also VDSI Rule 01/2013: General information:

Suitable training classrooms and with training material, trainer who has provided evidence of being allowed to teach the hazardous substances

Number of participants: Maximum 12 persons


Duration: 2 hours

Topics:

- Legal background incl. all applicable regulations such as BGR, BGI, TRBS etc.
- Properties and hazards (fire, explosion, lack of oxygen,...)
- Intake routes into the body
- Marking of hazardous substances
- Safety data sheets and operating instructions
- Transporting hazardous substances (load securing/regulations on limited quantities)
- Handling and transporting gas cylinders
- Spray cans
- Personal protection/general protective measures
- First aid measures
- Environmental protection
- Existing concepts for environmental accidents shall be mentioned if applicable

Note: The occupational safety instructions have to be documented.

The participants receive a certificate with details on the training topics

	VDSI Rule 01/2013 <u>Module 06</u> Fire protection on worksites	Revision/	04
		Date	05/2015
		Author:	VDSI - FEE B. Schäfer
		Page	1 of 1

Objective: The participants are trained with regard to fire prevention, the hazards posed by fires, and conduct in case of a fire.

Group of participants:

All employees working on wind turbines

Participants' prerequisites:

Module1: basic PPE, PPEaF, rescue training courses

Prerequisites for training centres and trainers:
see also VDSI Rule 01/2013: General information:

Suitable training classrooms with training material, trainer with experience in fire protection

Number of participants:

Maximum 12 persons

Duration:

1 day

Topics:

- Legal background incl. all applicable regulations such as BGR, BGI, TRBS etc.
- Thermal load and fire hazards/formation of fires
- Hazards posed by fire and smoke formation
- Fire-fighting equipment and breathing protection
- Practical exercises with fire extinguishers/fire-fighting equipment
- Evacuating wind turbines (see Rescue exercises) / escape / rescue plans
- Notification in case of a fire
- Existing fire protection concepts shall be mentioned if applicable

Note:

The occupational safety instructions have to be documented.

The participants receive a certificate with details on the training topics

	VDSI Rule 01/2013 <u>Module 07</u> Confined spaces	Revision/	04
		Date	05/2015
		Author:	VDSI - FEE K.-H. Oberender
		Page	1 of 1

Objective: The participants learn how to safely move and work in confined spaces

Group of participants:

All employees working on wind turbines for the first time

Participants' prerequisites:

First aider training and physical fitness

The necessity of physical fitness is derived from DGUV Regulation 1 and the risk assessment. On the basis of employment agreements or individual contractual agreements, the contractor can have aptitude tests performed. The contractor can use the results (suited, suited with restrictions, unsuited) to make responsible choices.

The training provider is recommended to have the participants confirm their physical fitness on the training day.

Prerequisites for training centres and trainers:

see also VDSI Rule 01/2013: General information:

Suitable training classrooms with training material, trainer with experience in the topics to teach

Number of participants:

Maximum 12 persons

Duration: 2 hours


Topics:

- Legal background incl. all applicable regulations such as BGR, BGI, TRBS etc.
- Hazards (electrical and mechanical hazards) of working in confined spaces
- Handling hazardous substances in confined spaces
- Hot work
- Rescue concept

Note:

The occupational safety instructions have to be documented.

The participants receive a certificate with details on the training topics

	VDSI Rule 01/2013 Module 08 Driving safety/load securing	Revision/	04
		Date	05/2015
		Author:	VDSI - FEE M. Huwald
		Page	1 of 1

Objective: Safe driving with vehicles, getting to know how to secure loads and how to apply them.

Group of participants:

Service engineers, drivers, hauliers, forklift drivers

Participants' prerequisites:

At least 18 years of age, first aider training and physical fitness

The necessity of physical fitness is derived from DGUV Regulation 1 and the risk assessment. On the basis of employment agreements or individual contractual agreements, the contractor can have aptitude tests performed. The contractor can use the results (suited, suited with restrictions, unsuited) to make responsible choices.

Prerequisites for training centres and trainers:
see also VDSI Rule 01/2013: General information:

Suitable training classrooms with training material, trainer with experience in the topics to teach

Number of participants:

Maximum 12 persons


Duration: 2 hours theory

Topics:

- Legal background incl. all applicable regulations such as BGR, BGI, TRBS etc.
- Stress and strain driver's daily routine
- Practical driving, braking and evasive manoeuvres on different road conditions (theory)
- Statutory rules and und generally recognised codes of load securing practice
- Physical fundamentals
- Transport vehicles and transport aids
- Correct load distribution Load securing types
- Where applicable: BGV 29

Note: The occupational safety instructions have to be documented.

The participants receive a certificate with details on the training topics

	VDSI Rule 01/2013 <u>Module 09</u> Stays Abroad, General	Revision/	04
		Date	05/2015
		Author:	VDSI - FEE H. v. Hülsen
		Page	1 of 1

Objective: Inform the participants about the particularities of assignments abroad; e.g. required vaccination, general rules of conduct in the country, etc.

Group of participants:

All employees who have to work abroad

Participants' prerequisites:

At least 18 years of age, first aider training and physical fitness

The necessity of physical fitness is derived from DGUV Regulation 1 and the risk assessment. On the basis of employment agreements or individual contractual agreements, the contractor can have aptitude tests performed. The contractor can use the results (suited, suited with restrictions, unsuited) to make responsible choices.

Prerequisites for training centres and trainers:
see also VDSI Rule 01/2013: General information:

Suitable training classrooms with training material, trainers, e.g. company physician, with necessary expertise


Number of participants: Maximum 24 persons

Duration: ½ day theory

Topics:

- Legal background incl. all applicable regulations such as BGR, BGI, TRBS etc.
- General preparations such as passport, driver's license
- Medical preparation (e.g. necessary vaccinations)
- Possible physical strains, preventive action
- Cultural differences, particularities of the country's culture
- Language issues
- Climatic or hygienic conditions
- Protection against infections
- Behaviour in case of attacks
- Precautions during hotel stays
- Employer's accident and health insurance coverage

Note: The occupational safety instructions have to be documented.
The participants receive a certificate with details on the training topics

	VDSI Rule 01/2013 <u>Module 10</u> Offshore training	Revision/	04
		Date	05/2015
		Author:	VDSI-FEE H. v. Hülse
		Page	1 of 3

Objective: Impart knowledge to the participants so that in an emergency they can diligently and consequently apply the life-saving appliances carried aboard ships and helicopters in an emergency and under mental and physical strain.

Group of participants:


All persons performing offshore work

Participants' prerequisites:

Offshore first aider training, physical aptitude
The necessity of physical fitness is derived from DGUV Regulation 1 and the risk assessment. On the basis of employment agreements or individual contractual agreements, the contractor can have aptitude tests performed. The contractor can use the results (suited, suited with restrictions, unsuited) to make responsible choices.
The training provider is recommended to have the participants confirm their physical fitness on the training day.

**Prerequisites for training centres and trainers:
see also VDSI Rule 01/2013: General information**

Being responsible for occupational safety, the entrepreneur has to verify when selecting and drafting the contract whether the educational institution and the training programme are suited for his purposes. The educational institution has to qualify the trainers accordingly. Relevant information, techniques and equipment has to be provided. Training sites have to be accessible if practical training requires so. The specialised trainers have to have the necessary knowledge and expertise to communicate the information and also to be able to assess an appropriate learning success (e.g. by way of questions). The educational institutions and trainers are obliged to keep their knowledge up to date. Respective proof has to be provided and archived. It is mandatory that the trainers have the respective technical qualification and, where applicable, completed the manufacturer training, and can provide appropriate evidence. For example, this applies to life vests, life rafts, EBS systems etc. Prior to performing the training, the educational institution has to compile a risk assessment for the training and make sure that neither trainers nor participants can come to harm.

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The training officer declares the compliance with all specifications of the VDSI Rule 01 to VDSI e.V. (Renewable Energies Section) in writing prior to any training and is then entitled to use the VDSI logo on the training certificate. These declarations will be documented in a list.

Number of participants:

Maximum 12 persons

Duration:

4 days theory and practice

Topics:

Day 1: survival at sea

Theoretical topics:

Structure, function and handling of life-saving appliances, use of daylight and night signalling aids (incl. pyrotechnics and emergency locator transmitters), judge conduct in emergency situations, understand the effects of ditching on the body and learn how to react correctly, rescue/winch procedures, hypothermia, death due to suspension/rescue.


Practical exercises:

Water acclimatisation exercises (swimming on the water surface without moving and getting to know your personal "breath holding time"), life vest (automatic and manual), life rafts (entering and raising a capsized life raft, conduct inside a life raft), survival/thermal suit, simulation of emergency exit procedures from a helicopter, airborne evacuation, on the water surface and under water.

Day 2: Ship safety

Theoretical topics:

On-board safety organisation, knowledge of personal and collective life-saving appliances, on-board signs and escape paths, knowledge of storage locations of all rescue and safety equipment, use of rescue and safety work vests, survival suits and life-savers, conduct on-board in case of alarms, and entering rescue vehicles when leaving the ship, water rescue and pertaining rules of conduct, knowledge of key sailor's knots, maritime radio basics (radiotelephones), waste disposal (environmental protection).

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Practical exercises:

Conduct in and with a life raft, entering, driving, mooring and unmooring with a rescue boat or workboat, “man-over-board-manoeuvre”, transfer training ship/ship and ship/wind turbine, common knots.

Day 3: Helicopter underwater exit training (HUET)

Theoretical topics

See Rescue at sea and theoretical instructions on how to handle an underwater rescue respirator.

Practical exercises:

Simulation of emergency helicopter exit procedures, airborne evacuation, on the water surface and under water.

Day 4: Fire fighting

Theoretical topics:

Fire fighting, oil and electric fires, automatic extinguishing devices, personal and collective fire fighting equipment, breathing protection, emergency escape breathing devices, escape from smoke-filled rooms

Practical exercises:


Fire fighting, oil and electric fires, handling various types of fire extinguishers (water, powder, CO₂), extinguishing fires in closed, confined rooms, fighting burning liquids and other fires

Note:

After successful attendance, the participants receive a certificate documenting the training topics and duration, name and address of the educational institution as well as the name, first name, date of birth of the participant, and the date of validity.

DGMM - Deutsche Gesellschaft für maritime Medizin (German Association for Maritime Medicine)

EBS - Emergency Breathing System

	VDSI Rule 01/2013 <u>Module 11</u> Electromagnetic fields	Revision/	04
		Date	05/2015
		Author:	VDSI - FEE M. Huwald
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Objective: The participants are to get to know the particularities of wind turbines, in particular the electromagnetic fields emitted by radio aerials, for example

Group of participants:

All employees or guests with active medical implants who have to work on or wish to visit the wind turbine

Participants' prerequisites:

None

Prerequisites for training centres and trainers:
see also VDSI Rule 01/2013: General information

Suitable training classrooms with training material, trainer with experience in the topics to teach

Number of participants:

Maximum 24 persons


Duration: 2 hours theory

Topics:

- Where in wind turbines do electromagnetic fields occur
- What are the hazards posed to persons with active medical implants
- Prohibition of access
- Identification of hazard areas
- Maximum duration of stay
- Duty to inform (e.g. engineers because of rescue measures)

Note: The occupational safety instructions have to be documented.

The participants receive a certificate with details on the training topics

	VDSI Rule 01/2013 <u>Module 12</u> Lifting and carrying	Revision/	04
		Date	05/2015
		Author:	VDSI –FEE K.-H- Oberender
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Objective: Impart knowledge to the participants so that they can safely handle loads

Group of participants:

All employees who have to perform work on/in the wind turbine

Participants' prerequisites:

None

Prerequisites for training centres and trainers:
see also VDSI Rule 01/2013: General information

Trainer: Knowledge of Load Handling Regulation, knowledge of wind energy sector

Number of participants:

Maximum 12 persons

Duration: ½ day theory, 4 hours practice

Topics:

- Legal basis, e.g. Load Handling Regulation
- Risks and hazards during manual handling
- Anatomy - skeleton and muscle - function, health impacts - potential damage
- Risk assessment
- Possibilities and methods of risk minimisation - technical measures
- Conscientious conduct as basis for safe working
- Secure lifting techniques in practice
- Test - 15 questions

Note: The occupational safety instructions have to be documented.

The participants receive a certificate.