Guideline for Assessing the Competence of Electrically Skilled Persons

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Section for Electricity

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1 Objectives of this Guideline

This guideline contains recommendations for the assessment of required competence of electrically skilled persons for performing electrotechnical work.

This guideline is in line with the known normative CENELEC provisions and offers additional information on various national provisions for electrically skilled persons.

2 Terms

For the purpose of this guideline, the following terms apply:

2.1 Electrically skilled person

A person with relevant vocational education, knowledge and experience to enable him or her to analyse risks and to avoid hazards which electricity could create.[1)]

2.2 Person responsible for the work activity

A person authorized to take over ultimate responsibility for carrying out the work activity. Some of these duties can be delegated to other persons as required.[1)]

2.3 Person responsible for the installation

A person authorized to take over ultimate responsibility for the operation of the electrical installation. Some of these duties can be delegated to others as required.[1)]

Note: As limitation for the “operation” only the period of time shall be considered, which is required for carrying out the work.

[1)] See Clause 9

3 Theoretical training contents

Hazards arising from carrying out work on/near electrical installations and danger resulting from handling electrical equipment depend on a number of features of electrical installations and equipment and the type of work activity being carried out.

3.1 Which are dangerous voltages?

How dangerous the voltage is, depends on the current flow, which occurs by contact with live parts in a fault circuit. The electric current, also in case of an accident, follows the definition of Ohm's Law, with which all electricians are familiar with: the relationship between voltage, current and resistance is, that the higher the voltage is, the higher the current level, too.

Each current flow, exceeding the threshold sense, combined with resulting electric shock and secondary accident, can be critical (but generally not life-threatening). In comparison, also small amounts of contact voltage far below the limit value of 50 V ac (120 V dc in accordance with HD 384-4-41) are significant, depending on the cause of accident. Contact voltages which lead to a current passing through, above the release limit of approx. 10 mA, should be considered critically here. If there are no particular critical work area conditions (e. g. confined spaces), than in general, there is no life threatening flow of electric current through the human body expected up to approx. 50 V.

Fatality is to be expected at values above 50 V, as a result of the flow through the human body. This electrophysiologically caused limit value is also proved by accident statistics.

Most of accidents happen at usual consumer voltages of 230 V (against earth) and 400 V (between two external conductors) – equivalent to the frequency of existence of low-voltage distribution installations and the frequency of electrical consumer goods, e. g. machinery, devices and apparatus.

3.2 Voltage levels

Internationally, a division of voltage levels is usual according to nominal voltage areas U_N as follows:

- Low voltage
  In general, ac voltage values between 0 and 1000 V.
  – smallest voltage, e. g. SELV, PELV (see also HD 384-4-41)
  – small voltage, ELV
- High voltage
  Normative ac voltage values exceeding 1000 V are described as high voltages.

3.3 Types of current

Most of electrical installations installed within low-voltage and high-voltage areas are supplied and operated by ac current.

95 per cent of all accidents are caused by ac current. The majority of them are caused at 50 Hz supply frequency. A further accident major point can be observed in railway areas which are partly operated with other frequencies (e. g. 16 2/3 Hz).

In comparison, dc current is only applicable in some technologies (e. g. operation of railways or electric filters). Accidents within the dc current area play only an insignificant part.

3.4 Danger from electricity

3.4.1 Which effects has electricity on the human body?

Depending on the source of an electrical accident, the following direct or indirect harmful effects can occur from electricity:

Accidents due to pass through current – mainly within the low-voltage area – are caused by adverse effects of current and its specific stimulation of sensitive tissues (nerves, muscles, heart). It is known that all functions in a human body (arbitrary and non-arbitrary) – starting with the reception of stimulation during sensory perception to irritation and irritation distribution in stimulation processes, up to command execution of physical-chemical processes of bioelectrical nature

in muscles. They are controlled by the complicated nervous system within dependent regular mechanisms by own body current pulses. Externally impressed body currents are, if they exceed certain current values, in the position to impair the functionality.

During long-term exposure to current and heavy currents, e. g. particularly the way they can pass through the body during a high-voltage accident, due to electric heat, which develops in the body alongside the current conducting path (similar to a spiral of an electric heater), also thermal damages to the body resulting from internal burn injuries can be caused.

The body current flow is normally harmless under the physiological point of view, but can often cause reflexes and uncontrolled movements of the victim, which can result in secondary accidents (falling from a ladder, slipping of the hand and catching into rotating machinery or by causing bruises from strong reflex movements).

Essential for sequences from an electrical accident is the current passing through the body of the victim. In a worst-case assessment, the body resistance can be determined with approx. 1000 ohm (measured between the limbs).

This means that during bridging of normal consumer voltage of 230 V against earth in accordance with Ohm's Law I = U/R with the above mentioned current paths, a current of 230 mA can flow through the body of the victim. Mostly a smaller current will adjust within the fault electric circuit still existing efficient resistances of the floor and the shoes of the victim and the very high tissue resistance at the beginning – at least at the beginning – which falls far below this value. Nevertheless the mentioned value of 230 mA must be taken as an approximate value of current strength for estimation of a potential danger at a low-voltage accident.

The physiological effects of current on the human body are not only dependent on the magnitude of the current, but amongst others, essentially on the duration of the current influence.
There exists a non-linear relationship between the harmless effect of a current quantity on the human body and exposure duration of the current.
In comparison, large current quantities over short exposure times leave no damaging effects as opposed to long exposure times.[2)]

[2)] See Clause 9

3.4.2 Danger from electric arcs

Accidents from electric arcs mostly cause external thermal damages. They result in – provided that at the same time there is no other current passing through – similar damages to the body like from burn injuries from an open fire.

3.4.3 Requirements on personnel

Since it is significant that personnel follow strictly the working instructions and procedures, appropriate personal characteristics shall be considered.
Where electrical work requires teamwork – this refers particularly to systems with nominal voltages exceeding 1 kV – employees should be able to rely on their fellow colleagues.

Both, physical and mental requirements are of particular significance for carrying out work safely; e. g. fear of heights, colourblindness and teamwork competency.

3.5 First Aid

It is recommended that electrically skilled persons shall pass a course in First Aid including heart-lung resuscitation and refresh their knowledge every three years at minimum.
The European Resuscitation Council issues guidelines on general life support measures (see also www.erc.edu/).

4 Required knowledge and experience of specific work activities

The extent of theoretical knowledge and practical experience within some electrotechnical fields of activities is given on examples as detailed below. In case theoretical knowledge and/or practical experience were already gained during a previous qualification, these can be also considered for the assessment of electrotechnical competence.

While allocating orders to sub-contractors, it shall be checked in accordance with statutory trade regulations if the sub-contractor is entitled to carry out work.

The assessment of each individual employee of a sub-contractor is not required. It is required that the person responsible for carrying out work has command of the national language in the workplace.

4.1 General low voltage installations

Vocational knowledge of low voltage installations is the basis for training of an electrically skilled person and consequently describes the basic knowledge of specific work activities as stated below. Electrically skilled persons must gain extensive knowledge of electrical hazards from installations and required safety measures.

Furthermore, the acquiring of vocational knowledge of erection requirements, particularly, the proper selection of equipment to be installed, shall be part of the training

Recommended minimum time-related periods for acquiring electrical knowledge (can be part of a vocational training)	weeks
■ **Theoretical training**	26
• **Basics of electrotechnics** • **Risk assessment of a workplace** • **Using protective equipment** • **Danger from electricity** □ Hazardous body currents □ Danger from electric arcs • **Design of low voltage installations** □ Installations in buildings □ Overhead lines □ Cable installations □ Earth installations • **Operation of electrical installations** • **Maintenance, extension and modification of installations**	20
• **Regulations and standards** □ Low Voltage Directive (73/23/EEC) □ HD 384 Erection of low voltage installations □ HD 516 Guide for harmonized cables □ Regulations on installations of local suppliers □ EN 50 110	4
• **Protective measures** □ Net systems and assigned protective measures □ Basic protection □ Fault protection □ Supplementary protection	1

• **Selection of equipment to be installed** □ Safety and indicating devices □ Wiring materials ○ Cables and circuits ○ Plugs and sockets ○ Switching devices ○ Indicator lamps □ Measurement and meter devices, remote-control technology	1
■ **Practical experience**	26
□ Preparation of the workplace □ Vocational knowledge of installing low voltage installations □ Instruction and supervision of instructed persons □ Protective measures during carrying out work activities □ Introduction and supervision of instructed persons □ Protective measures during carrying out work activities ○ Five safety rules ○ Working in the vicinity ○ Live working □ Using hand-held equipment □ Laying, connecting of electrical equipment □ Heat development of electrical equipment □ Spaces and areas with specific environmental conditions	
Total	**52**

4.2 Installing electrical installations in buildings

The electrically skilled person in charge of the erection/installing of the electrical installation has to be competent to select and implement the work provisions regarding this installation. The major point is the protection of humans against electric shock under fault conditions in line with the switching-off conditions.

Recommended minimum time-related periods for acquiring specific knowledge and experience for installing electrical installations in buildings	weeks
■ **Theoretical training**	8
• **Regulations and standards** □ Low Voltage Directive (73/23/EEC) □ HD 384 Erection of low voltage installations; in particular, parts of the standards series HD 384-7 □ Regulations on installations of individual electricity suppliers	4
• **Protective measures** □ Net systems and assigned protective measures □ Basic protection □ Fault protection □ Supplementary potential equalization □ RCD ≤ $I_{\Delta N}$ 30 mA	1
• **Selection of equipment to be installed** □ Wiring material ○ Cables and circuits ○ Equipotential bonding and earthing systems ○ Plugs and sockets ○ Switching devices ○ Indicator lamps ○ Cable conduit and cable trunking □ Measurement and metering devices, remote control technology	3

■ **Practical experience**	4
□ Preparation of a workplace □ Vocational knowledge of installing low voltage installations □ Instruction and supervision of instructed persons □ Selection and application of electrical equipment in spaces and areas with specific environmental conditions	
■ **Total**	**12**

4.3 Use of electrical installations and equipment under specific environmental conditions with a specific risk potential

The operation of electrical installations and equipment under specific environmental conditions can result in an increased electrical risk. These specific conditions (e. g. building sites, farming, refinery) require supplementary safety measures to be selected by the responsible electrically skilled person. Additionally to basic training, electrically skilled persons require extensive knowledge of specific provisions regarding permissible and necessary safety measures in these areas.

In addition to vocational training, the practical implementation of erection requirements is a necessary part of the supplementary training (e. g. water protection, dust-contamination, chemical influences, confined spaces etc.).

Recommended minimum time-related periods for acquiring vocational knowledge of low voltage installations within specific areas	weeks
■ **Theoretical training**	12
• **Basic knowledge of electrotechnics and implementation into individual areas** • **Risk assessment of specific workplaces** • **Selection and use of protective equipment** • **Danger from electricity** □ Increased electrical risk □ Design of low voltage installations within specific areas ○ Confined conductive areas ○ Building sites ○ Farming sites ○ Shipyards • **Supplementary provisions for operation of specific electrical installations**	4
• **Regulations and standards** □ HD 384-7 Erection of Low Voltage Installations (Requirements for special installations or locations) □ EN 50110 □ EN 50191	2
• **Protective measures** Supplementary potential equalization □ RCD ≤ $I_{\Delta N}$ 30 mA □ Protective separation □ SELV □ Temperature monitoring	2

• **Selection of equipment to be installed and connected** □ Safety and indicating devices □ Wiring materials with IP protection ○ Cables and circuits ○ Cable conduit, trunking and routing (mechanical protection) ○ Plugs and sockets ○ Switching devices ○ Equipment (e. g. machinery, hand-held tools, indicator lamps, cable-reels)	4
■ **Practical experience**	6
□ Knowledge of installing low voltage installations within specific areas □ Knowledge of possible mechanical stresses	
■ **Total**	**18**

4.4 Fire and explosion protection

There are specific requirements for areas with potential risks of explosion and increased fire occurrence. This refers to the selection of special electrical installation materials and compliance with the required protection measures for explosion and fire. The electrically skilled person has to be in the position to assess the effectiveness of the required safety measures within the framework of initial verifications and periodic inspection.

Recommended minimum time-related periods for acquiring specific knowledge and experience of electrical fire and explosion protection	weeks
■ **Theoretical training**	10
• **Regulations and standards** □ Directive 94/9/EC "… for equipment and protective systems intended for use in potentially explosive atmospheres" dated 23 March 1994/26 January 2000 □ Guideline 1999/95/EG ATEX 137 □ IEC 61241 □ IEC 61340 □ EN 50014 □ EN 50018 □ EN 50264 □ EN 50272 □ EN 60079 □ EN 60695 □ EN 60519 □ HD 516 "Guide for harmonized cables" □ In Germany aditionally: VDE 0132 "Measures to be taken in the case of fire in or near electrical installations"	5
• **Protective measures** □ Fire and fire classes □ Maintenance stages □ RCD □ Distances in air and creep lengths □ Separation □ Safety and monitoring current circuits	2
• **Measurement procedures** □ Temperature measurements □ Air current	1

• **Safety equipment** □ Wind vane relay □ Temperature monitoring □ Fire alarm and smoke detectors □ Fire monitoring	2
■ **Practical experience**	8
• **Basic knowledge**	7
• **Supplementary knowledge in accordance with the task area;** **Examples:** □ Escape routes and emergency plans □ Explosive atmosphere warning devices and oxygen level measuring devices	1
■ **Total**	**18**

4.5 Operation of electrical test stations

In test laboratories and experimental stations exists a high risk from electricity, since the test tasks often change and live parts can be freely accessible. Therefore, while performing electrotechnical work – besides the knowledge of safety – there is also need for a deeper knowledge of specific protective measures, of safety requirements whilst performing testing and a need for a safe design of the test set-up.
Possible qualification/training contents are given in the following table.

Recommended minimum periods of time for acquiring specific knowledge and experience of erection and operation of electrical installations	weeks
■ **Theoretical training**	5
• **Regulations and standards** □ EN 50191 Erection and operation of electrical test equipment	

□ EN 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use □ EN 61010-2-031… Measurement equipment □ EN 50110 particularly Appendix A	1
• **Safety measures** □ Protective separation □ Supplementary potential equalization □ Isolation of location □ RCDs □ SELV/PELV	1
• **Measurement procedures** □ U, I, R, C, L	1
• **Design of test stations/laboratories** □ Barriers, marking and identification of stationary test stations ○ High voltage ○ Low voltage □ Barriers, marking and identification of temporary test stations □ Emergency switching-off devices □ Warning signs and indicator lamps □ Regulations on accessing test stations □ Interlocking devices for doors	1
• **Safety switches** □ Emergency switching-off devices □ Interlocking devices for doors	0.5
• **Basic knowledge of electromagnetic fields**	0.5
■ **Practical experience**	8
■ **Total**	**13**

In accordance with the task area additional knowledge of e. g. outdoor cable testing is required:

– Knowledge of equipment
– Local barriers
– Communication possibilities
– Emergency switch-off.

4.6 Initial verifications and periodic inspection and testing of electrical equipment

The person carrying out inspection and testing has to be competent to perform the following tests without danger to persons, livestock or property. The person carrying out inspection and testing has great responsibility and has to be qualified for the selection of the required measurement and testing equipment and the assessment of the investigated testing results. The testing person has also to cooperate while determining the inspection terms (also see IEV 826-07-02).

Recommended minimum time-related periods for acquiring specific knowledge and experience of testing electrical equipment	weeks
■ **Theoretical training**	4
• **Regulations and standards** □ EN 50110 □ EN 60204 □ HD 384-6 □ EN 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use □ EN 61010-2-031… Measurement equipment □ EN 61557 □ In Germany aditionally: BGV A3, VDE 0701 and VDE 0702	1.5
• **Safety measures** □ Protective separation □ Isolation of location □ RCD □ SELV/PELV □ Loading and current limitation	0.5

• **Measurement procedures** □ Insulation resistance □ Dielectric strength □ Discharge current □ Contact current □ Protective earth conductor resistance □ Distance in air and creep lengths	1.5
• **Design of test stations/laboratories** □ Barriers and marking of stationary test stations to traffic routes /other workplaces ○ High voltage ○ Low voltage □ Emergency switching-off devices □ Warning signs and indicator lamps □ Operating instructions	0.5
■ **Practical experience**	6
• **Additional knowledge in accordance with the task area; Examples:** □ Hand-held equipment □ Electric heating devices □ Indicator lights □ House-hold devices □ Protective insulated equipment □ Equipment used under specific environmental conditions (building sites, confined spaces)	
■ **Total**	**10**

4.7 Initial verifications and periodic inspection and testing of installations

The electrically skilled person carrying out inspection and testing shall be competent to perform the following tests in such a way that there is no possibility of harm

– from the installation during proper operation
  and
– when performing testing

to persons, livestock or property.
Inspection and testing of an electrical installation shall be carried out by an electrically skilled person on the basis of valid regulations and standards, particularly under consideration of safety aspects.

Recommended minimum time-related periods for acquiring specific knowledge and experience of initial verifications and periodic inspection and testing of installations	weeks
■ **Theoretical training**	10
• **Regulations and standards** □ EN 50110 □ EN 60204 □ HD 384-6 □ EN 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use □ EN 61010-2-031… Measurement equipment □ EN 61557 □ Fault and tolerance calculation □ In Germany aditionally: BGV A3	4
• **Protective measures** □ Protective separation □ Isolation of location □ RCD □ SELV/PELV □ Load and current limitation □ Personal Protective Equipment (PPE)	2

• **Measurement procedures** □ Insulation resistance, isolation of location □ Contact voltage □ Total operating time □ Potential equalization □ Tripping current □ Dielectric strength □ Short circuit/overload □ Voltage drop □ Discharge current □ Protective earth conductor resistance □ Loop impedance □ Earth or ground resistance □ Distance in air and creep lengths □ Rotary field direction	3
• **Escape and emergency routes** □ Marking and illumination □ Minimum light strength	1
■ **Practical experience**	6
• **Additional knowledge** □ Required adaption □ Inspection and testing of the installation in line with technical records ○ Inspection ○ Testing ○ Measurement ○ Selection and assessment of required measurement procedures	
■ **Total**	**16**

4.8 Measurement and control controlling/automation technology

Measurement and control encompasses a diverse part within the installation and equipment technology. Differentiated and extensive knowledge and experience are required, in order to carry out safely operation of machinery, circuit analyses, measurements and fault detection, both in laboratories and surroundings of a production site.

Recommended minimum time-related periods for acquiring specific knowledge and experience of measurement & control	week
■ **Theoretical training**	6
• **Regulations and standards** □ EN 60204 Electrical equipment of machinery; especially EN 60204-32 for safety circuits □ EN 60947 Low-voltage switchgear assemblies □ EN 60439 Switchgear assemblies □ EN 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use □ EN 61010-2-031 … Measurement equipment □ EN 50110 Operation of electrical installations	2
• **Protective measures** □ Protective separation □ Isolation of location □ RCD □ SELV/PELV	1
• **Measurement procedures** □ U, I, R, C, L, f □ Fault detection	2
• **Workplace equipment** □ Live working in small and low-voltage installations □ Barriers, marking and identification of the workplace in production areas ○ High voltage ○ Low voltage	1

■ **Practical experience**	6
• **Additional knowledge according to tasks; Examples:** □ Electrical equipment of furnaces ○ Knowledge of equipment ○ Fire detector systems □ Photovoltaic installations ○ Knowledge of equipment	
■ **Total**	**12**

4.9 Power distribution in low voltage installations

The qualification for an electrically skilled person for work activities in low-voltage areas within electricity supply companies.

4.9.1 General

Due to the variety of work being carried out in the low-voltage area within an electricity supply company, a special training is required for persons carrying out this work. This means, e. g. an electrically skilled person carrying out work in a low-voltage cable network area will not in general have the knowledge and competency to be also an electrically skilled person for carrying out work within low-voltage overhead power line areas. In order to obtain a link between a qualification level and competency to carry out specific works, the three qualification levels given in EN 50110 should be further subdivided. In practice this means that due to internal regulations and instructions, e. g. it will have to be differentiated between electrically skilled persons for carrying out work on cable networks, electrically skilled persons for carrying out work on overhead power lines, (electrically) skilled person for working on switchgears, (electrically) skilled persons for exchanging power meters etc.

In addition, specific company knowledge, e. g. organisation of a company, knowledge of the network, knowledge of the location and installation, can also be of major importance for the qualification. It cannot be assumed, in principle, that a person working in a certain power supply company can have the same level of

qualification in another power supply company without gaining additional knowledge/training.

The work within an electricity supply company can be carried out by its own employees or can be partly sub-contracted to other companies.

4.9.2 The assessment of qualification of company employees

Since an independent company assessment of a certain qualification level is in general impossible, it is the employer's responsibility, to assess the qualification of each individual person. In practice, the immediate manager assesses the qualification of an employee according to a non-specified procedure and authorizes the employee to carry out a certain work activity. A completed vocational training (e. g. as an electrician or electronics engineer specialized in energy and building technology) is of far more importance, since a certain qualification level can be obtained faster the better the training and consequently the breath of skills can be extended.

For some work activities internal company training programmes (e. g. for live working) and also company internal tests (entitlement for switching actions) are required, which allow an objective assessment of the qualification.

4.10 Power distribution in high voltage installations

The safe operation of high voltage installations requires a firm and extensive knowledge and experience on protective measures and procedures to be applied. Besides the safe application of the five safety rules, the design and separation of the workplace are major aspects towards safety of persons and of the installation. The knowledge of specific provisions is essential.

Recommended minimum time-related periods for acquiring specific knowledge and experience of high voltage installations	weeks
■ **Theoretical training**	12
• **Regulations and standards** □ EN 50110 □ HD 637 □ EN 50341 □ EN 60652 □ EN 61243	6
• **Safety measures** □ Earthing measures □ Potential equalization □ Distance	2
• **Measurement procedures** □ Verifying the dead condition □ Phase comparison	2
• **Design of workplace** □ Separation and marking of workplaces □ Operating instructions □ Protective measures during switching activities □ Protection against capacitive and inductive coupling □ Introduction of earthing and short-circuiting devices	2
■ **Practical experience**	8
• **Additional knowledge in accordance with task areas; Examples:** □ Re-connection procedure/authorization for switching activities □ Documentation of the work order	
■ **Total**	**20**

4.11 Additional training for live working

In some countries, the acquiring of introductory knowledge of live working is already an integral part of the basic qualification/training of an electrically skilled person. Depending on the complexity of the procedure to be implemented, specific training is required. In order to obtain competency for live working in the low voltage area, a whole-day theoretical training is required, in addition to a half-day practical instruction per working procedure with the corresponding tests.
In general, qualification for medium and high voltage installations requires a few weeks training.

Further information on selection of personnel for live working can be taken from the ISSA “Guideline for Assessing the Competence of Persons involved in Live Working”.

5 Non-electrical work activities on/or in the vicinity of electrical installations

On the contrary to operation of electrical installations, there exists danger of hazardous electric current flowing through the body or of arcing, while carrying out work at or in the vicinity of electrical installations. The required safety of a person carrying out work has to be achieved by organizational measures and the proper selection and application of working procedures. These measures have to be assessed without any doubt, by the competent electrically skilled person.

Non-electrical work within an electrical installation is for example construction and erection work, earth work, acid work, painting and corrosion preventive work. This kind of work is normally carried out by laymen. In order to ensure that persons, while carrying out non-electrical work, do not reach the hazardous zone with parts of their body or equipment, the competent electrically skilled person shall select appropriate protective measures.

Examples for protective measures, which have to be determined on site by a competent electrically skilled person:

– to ensure the dead condition for the duration of work
– to protect live parts for the duration of work, particularly considering the voltage, type of operation, kind of work activity and used working tools, equipment and devices, by means of covering and barriers.

If required, the electrically skilled person shall likewise investigate and assess the required extent of supervision with regard to the respective work activity.

6 Work-related task allocation

Depending on the respective work activity, the responsible electrically skilled person (electrically skilled person with leadership function) has to ensure the work-related tasks and instructions. The competency level of the employees carrying out the work has to be considered in this case. Necessary basic and additional instructions shall be recorded.

6.1 Company organizational requirements

In order to follow the required protective measures within the electrotechnical area, it is necessary, to clearly define the task areas and responsibility areas of the personnel.

Each company/organizational structure has to determine clear and task-related competency areas. Personnel need to be instructed and task-oriented as required. All local features have to be taken into account and considered while determining the working procedures.
The risk-related introduction and instruction has to be systematically structured, documented and carried out with personnel in mind. Other possible interactions should be considered with regard to safety aspects.

In order to prepare a required risk assessment according to schedule and to implement lasting improvements, an introduction of a company health and safety management system is recommended.

Systematic and comprehensive occupational health and safety regulations ensure a permanent success. By means of an unequivocal documentation a continuous company health and safety assessment is made possible.

6.2 Person responsible for an electrical installation, person responsible for a work activity

6.2.1 Person responsible for an electrical installation

The person responsible for the electrical installation has to ensure that while carrying out work activities on or near this installation, the specific hazards in connection with this installation shall be considered and a safe operation of the installation shall be ensured.
The consideration of this responsibility for the installation requires:

- special knowledge and experience
- knowledge of the operational status of the electrical installation
- competency to assess the influence of foreseen work activities for the safe operation of the installation
- ability to recognize specific hazards, which can occur while carrying out work activities on or near electrical installations.

A person responsible for the electrical installation in line with EN 50110, is only a person, who carries out work activities within electrical installations and is adequately acquainted with local conditions. Only in this way, the person can assess properly and completely the situation. For this reason, the person responsible for the electrical installation has to be an electrically skilled person, authorized to give instructions. This means to take over executive duties and refer to required measures and the preparation of the workplace, e. g.:

- instruction on switching operations
- instruction to change the operation status of the electrical installation
- instruction for determination of safety measures and working methods
- instruction of the responsible person for the work activity
- determination and control of the work process
- coordination between several contractors.

It may be adequate that the function of the person responsible for an installation and the person responsible for a work activity is carried out by one and the same person.
This situation happens in practice automatically in many cases. See also Clause 2.3.

6.2.2 Person responsible for a work activity

A responsible person shall be nominated in order to carry out work activities on or near electrical installations. This person is responsible that all relevant safety requirements, safety regulations and company instructions are adhered to, while carrying out work activities.

The person responsible for a work activity has to meet various requirements:

- have knowledge of the transferred to him/her work activities and experience to carry out such work
- have knowledge of regulations and standards for carrying out the transferred to him/her work activities
- ability to assess the transferred work activities
- ability to recognize hazards, while carrying out the transferred to him/her work activities.

These mentioned requirements require an **electrically skilled person** as a person responsible for the work activity. Depending on the kind of work activity, also an electrotechnically instructed person can take over the function of a person responsible for the work activity. An example is the supervision during corrosion protective work on overhead lines by an electrotechnically instructed person.

When work activities are carried out in a work team, the person responsible for the work activity shall take care for a well-ordered cooperation.

Normally, the person responsible for the work activity is the leader of a work-team, foreman or supervisor.

It can be effective, that the function of the person responsible for the work activity and the person responsible for the electrical installation is carried out by one and the same person. In practice this situation happens automatically in many cases. Please see also Clause 2.2 of this Guideline.

7 Basic safety regulations and occupational health and safety regulations

The framework directive on occupational health and safety of the EC dated 12 June 1989 (89/391 EEC) serves as a basis for individual directives.

This guideline applies first of all to those responsible for occupational health and safety in the company, i.e. the employer. Employers are obliged to ensure the health and safety of employees in every aspect related to their work. Besides general duties in occupational health and safety, this guideline sets out organisational duties and also safe organisation and structure of the company and its work procedures, as well as personnel management, which means selection, instruction and supervision of the personnel. Tasks can only be transferred to the employees considering their professional qualifications (proper employee selection). It is also of major importance to provide the employees with adequate and effective instructions on occupational health and safety.
It is set out in different parts of the guideline that the employer has to supervise and monitor employees. Additionally, the employer shall inform and consult employees. Instruction and training of employees are also included in these issues.

As set out in the framework directive, compliance with occupational health and safety is also an obligation of each employee. Each employee is obliged within his abilities to take care for his health and safety. Correct use shall be made of machinery, equipment, tools, hazardous substances, means of transport etc. Personal protective equipment (PPE) shall be used. Safety devices shall not be disabled and any risks to health and safety shall be reported.

Part 2 of EN 50110[1] consists of a set of national (normative) Appendices to the basic standard. The basic standard part contains currently valid safety requirements and national supplements to the minimum requirements.

8 Competence certification card

A competence certification card shall contain details as follows (see Appendix 2):

- Holder's photograph
- Surname, first name
- Qualification centre
- Vocational qualification/training in specialist fields
- Date of passed qualification test
- Signature of manager

The holder has **specific electrotechnical qualifications** in the following fields:

- Low voltage installations
- Use of electrical installations and equipment under specific environmental conditions and particular risk potential
- Fire prevention and protection
- Operation of electrical test stations
- Installing electrical installations in buildings
- Initial verifications and periodic inspection and testing of installations (installations in buildings)
- Initial verifications of non-stationary equipment
- Measurement, control, controlling/automation technology
- Power distribution – low voltage
- Power distribution – high voltage.

9 Literature references

[1)] EN 50110 “Operation of electrical installations”
IEC 60479 “Effects of currents on human beings and livestock – Part 1: General aspects”

10 Examples of national provisions

– Recueil D'instructions générales de sécurité d'ordre électrique, publication UTE C 18-510 de l'union technique de l'electricité, Novembre 1988 (France)
– CEI 78-27 Lavori su Impianti elettrici (Italy)
– Regulations of the Authority on Safety and Security (Regelungen der Sachversicherer – VdS, Germany)
– Regulations on Installations of Local Electricity Supply Companies (Installationsvorschriften der regionalen Energieversorger, Germany)
– Qualification modules of ZVEH (Ausbildungsmodule des ZVEH, Germany)

Appendix 1 – Examples for national competency/qualification levels

Czech Republic

In accordance with the requirements of Regulation No 50/78 SB, the qualification levels for carrying out work on electrical installations are as follows:

1. Persons without electrotechnical training
   a) electrotechnically instructed persons according to § 3
   b) semi-skilled employees according to § 4

2. Persons with electrotechnical training
   a) qualified according to § 5
   b) qualified with higher skills for
      – independent work activities according to § 6
      – supervising activities according to § 7
      – supervising delivery activities according to § 8
      – supervising operation activities according to § 8
      – audit activities according to § 9
   c) independent assessors
   d) leading assessors.

Persons with qualifications from § 5 up have to undergo regular tests at 36 months intervals.

Instructed persons are permitted to:

a) independently operate electrical installations, which are designed in such a way, that during operation persons will not come into contact with live parts
b) carry out work in the vicinity of live parts, if distances are adhered to, in line with the requirements of ČSN 343 108; in other cases, only after approval of the operator of the installation, who sets out the safety requirements (e. g. disconnection of the installation or the appointment of the supervisor).

Semi-skilled employees are permitted to:

a) independently operate simple electrical installations of all voltages
b) work on dead parts of electrical installations; work under supervision – in the vicinity of non-protected parts at a distance of more than 20 cm, but are not allowed to work on live parts. Introduced restrictions under this point do not apply to simple work activities carried out after completion of work
c) work on disconnected high voltage and very high voltage electrical installations under supervision. This is not allowed in the vicinity of live parts
d) carry out measurements.

Persons with electrotechnical knowledge are permitted to:

a) independently operate electrical installations
b) work on electrical parts “on their own”
c) work on disconnected parts of high and very high voltage installations “on their own”; work only under supervision – in the vicinity of/or on live parts.

Qualified persons with higher skills are permitted to:

operate and carry out work on electrical installations with the exception of forbidden work activities.
Persons for independent work activities according to § 6:
are the first out of the group of qualified persons with higher skills, who are allowed to supervise the work as a nominated person in control of a work activity.

Note
The term “on their own” means that the work activity may be carried out by an electrotechnically qualified person (according to § 5) on condition that the activity is supervised and controlled by at least one person, who is trained according to the requirements of § 6.

The requirement “independent” already permits the work activity of a person with qualifications according to § 6. No supervision is required for persons with higher qualifications.

In accordance with the requirements of ČSN 343100, the following definitions apply:

“Operation of electrical installations” – all operating activities that are required for the operation of electrical installations, e. g. disconnecting or reconnecting, regulation, reading of permanent meters, phase adjustment, replacement of fuses and light bulbs, inspection and testing of electrical installations etc.

“Working on electrical installations” includes construction, inspection and testing, and regular maintenance of electrical installations. Furthermore it includes all activities for releasing and securing of the work location and measurements with portable devices (e. g. voltage detectors).

This regulation also includes requirements for setting up working groups. While selecting persons for carrying work on electrical installations, the minimum qualification according to § 5 is required. For example, a working group consisting of two persons must have one person with qualifications according to § 6. In this case, the requirement on the person in control of the work activity is also adhered to.
A working group with three or more persons shall have a minimum of one person with qualifications according to § 7 who is appointed as the leader of the group.

Switzerland

Skilled Person: in accordance with the Low Voltage Installation Regulation (NIV) Article 9

- Master's exam
- Vocational qualification as Electrical Fitter/Electrical Draughtsman and a pass of FH or HTL with a pass in a practical experience examination
- Vocational qualification as Electrical Fitter/Electrical Draughtsman, a pass of TS (or equivalent) and 3 years practical experience in installing under an expert's supervision with a pass in a practical experience examination
- Vocational qualification in an equivalent training as Electrical Fitter/Electrical Draughtsman, a pass of TS, FH, HTL (or equivalent) and 5 years practical experience in installing under an expert's supervision with a pass in a practical experience examination
- Diploma of a higher vocational exam, equivalent to a master's exam and 5 years practical experience in installing under an expert's supervision with a pass in a practical experience examination
- A final examination equivalent to a master's exam in a CENELEC Member State with a bilateral acknowledgment of individual training certificates and 3 years practical experience in installing under an expert's supervision in Switzerland.

Electrical Fitter: in accordance with the Low Voltage Installation Regulation (NIV) Article 22

- Electrical Fitter with a Swiss certificate of competence

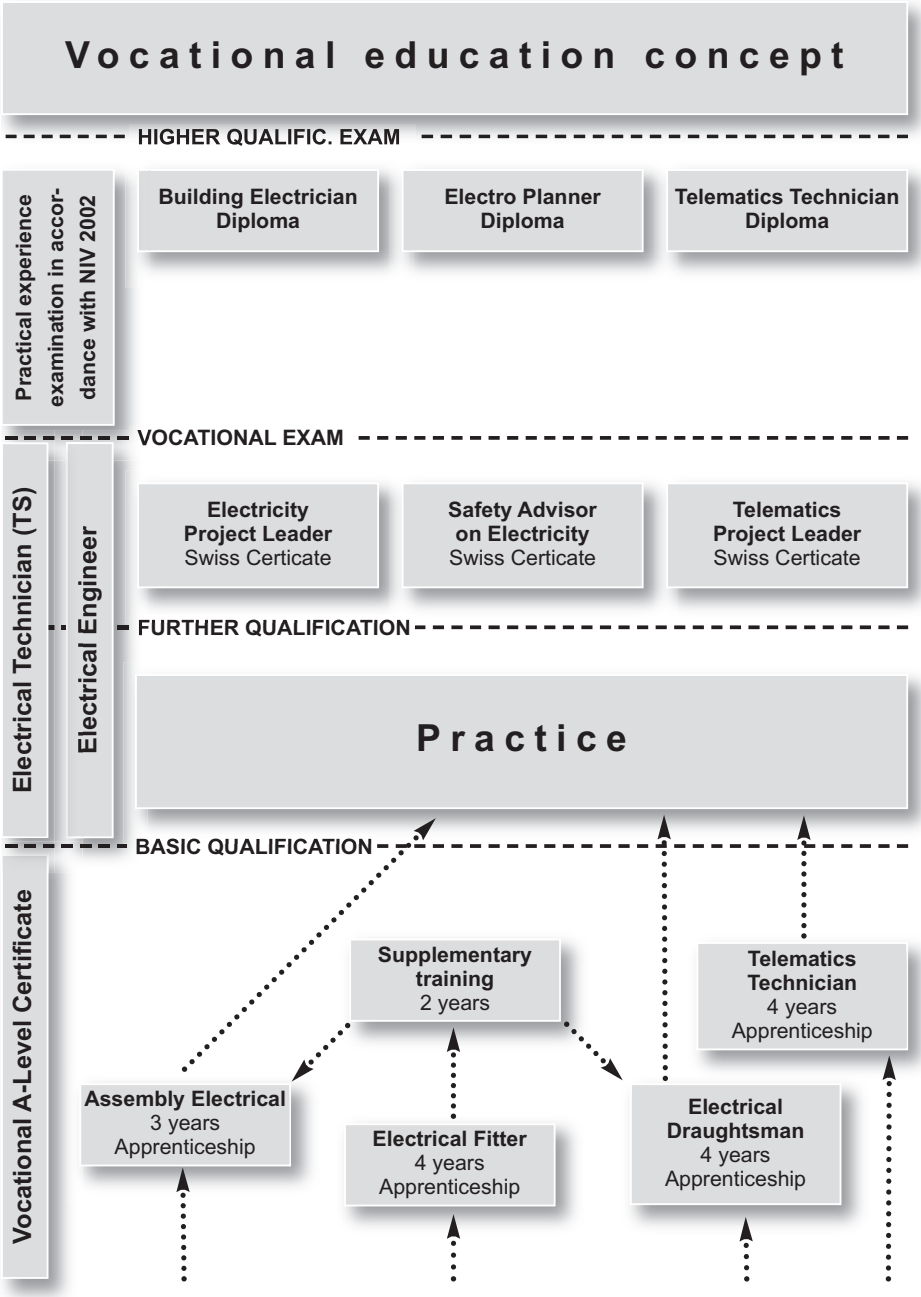
Electrical Specialist: in accordance with Swiss Engineering STV Article 3

- Basic electrotechnical training
- Apprenticeship or equivalent internal company training (5 years)
- Electrotechnical studies
- Technical experience in handling electrotechnical equipment

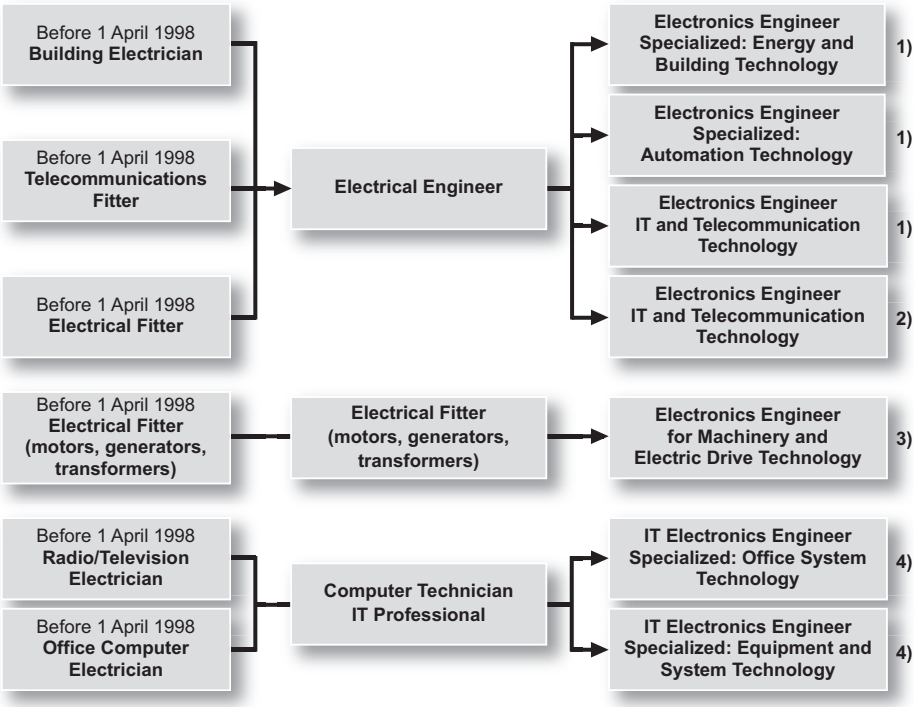
Instructed Person: in accordance with Swiss Engineering (STV) Article 3

- Without technical training/qualification
- Knows the local conditions and safety measures to be applied
- Knows how to carry out limited, exactly described work activities

FH = University of Applied Sciences (Fachhochschule)
HTL = University of Applied Sciences (Hochschule für Technik und Informatik)
TS = Technical College (Techniker Schule)


Vocational education concept
HIGHER QUALIFIC. EXAM
Practical experience examination in accordance with NIV 2002
Building Electrician Diploma
Electro Planner Diploma
Telematics Technician Diploma
VOCATIONAL EXAM
Electrical Technician (TS)
Electrical Engineer
Electricity Project Leader Swiss Certicate
Safety Advisor on Electricity Swiss Certicate
Telematics Project Leader Swiss Certicate
FURTHER QUALIFICATION
Practice
BASIC QUALIFICATION
Vocational A-Level Certificate
Supplementary training 2 years
Telematics Technician 4 years Apprenticeship
Assembly Electrical 3 years Apprenticeship
Electrical Fitter 4 years Apprenticeship
Electrical Draughtsman 4 years Apprenticeship

Germany



Legal basis

Ordinances of the Federal Official Journal, Part I:

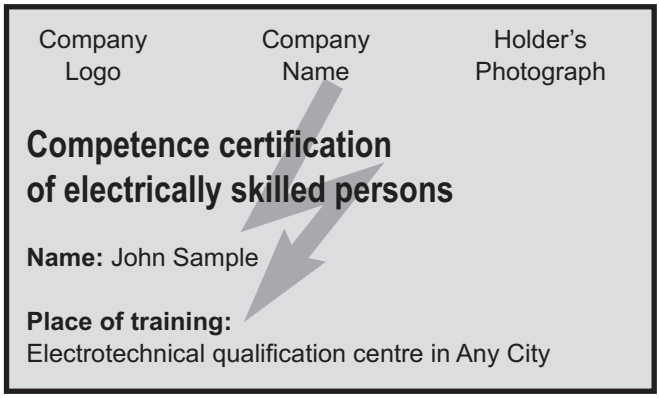
1) Verordnung über die Berufsausbildung zum Elektroniker/zur Elektronikerin vom 3.7.2003, Bundesgesetzblatt Jahrgang 2003, Teil I Nr. 31

2) Verordnung über die Berufsausbildung zum Systemelektroniker/zur Systemelektronikerin vom 3.7.2003, Bundesgesetzblatt Jahrgang 2003, Teil I Nr. 31

3) Verordnung über die Berufsausbildung zum Elektroniker für Maschinen und Antriebstechnik vom 11.7.2003, Bundesgesetzblatt Jahrgang 2003, Teil I Nr. 49

4) Verordnung über die Berufsausbildung zum Informationselektroniker/zur Informationselektronikerin vom 12.7.1999, Bundesgesetzblatt Jahrgang 1999, Teil I Nr. 36

Appendix 2 – Example for a competence certification card



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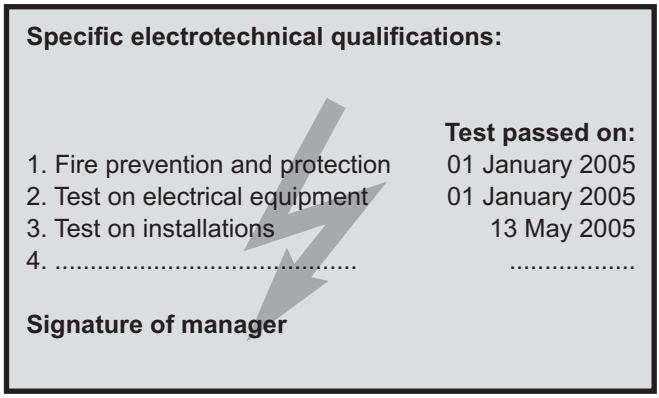


Reverse

Appendix 3 – International Codes for electrical competence

Introduction

The aim of this document is to present an international approach to allow the identification of the main electrical competences of utilities' electricians concerning dead or live work on Overhead lines or cables on transmission networks, distribution networks, customer's connections (including meter activities) or in substations.

It does not replace the local regulation.

It is an additional approach used when necessary: for example, in case of damage on an electricity network or in electrical installations due to storm, heavy snow etc, electrical utilities need help and have to welcome some electricians from foreign companies.

Based on an intuitive approach using pictograms, it avoids any language difficulty of understanding.

It allows, in a simple way and very quickly, for a company which welcomes electricians from a foreign company to know the skills and the type of work which can be done by these electricians.

TABLE I: Examples of level of voltage in EU electricity networks or grids

		Very Low Voltage VLV	Low Voltage LV	High Voltage HV	Extra High Voltage EHV
UK	Legislation		50 V→1000 V	1000 V→	No Legislation levels
	Network level		400 V	6.6 kV, **11 kV**, 20 kV	**33 kV**, 66 kV, **132 kV, 275 kV, 400 kV**
Germany	Legislation		1000 V	1000 V→132 kV	> 132 kV
	Network level		400 V	10 kV, **20 kV**, 30 kV, 60 kV, **110 kV**	220 kV, 380 kV
Italy	Legislation	0 V→50 V	50 V→1000 V	1000 V→30 000 V	> 30 000 kV
	Network level		400 V	6 kV, **10 kV**, 15 kV, **20 kV**, 30 kV	40 kV, 65 kV, **132 kV, 220 kV, 400 kV**
Hungria	Legislation		→1000 V	1000 V→120 000 V	> 120 kV
	Network level		400 V	**11 kV, 22 kV,** 35 kV	**132 kV**
Slovakia Czech Republic	Legislation		→1000 V	1000 V→110 000 V	> 110 000 kV
	Network level		400 V "NN"	10 kV, **20 kV** medium voltage "VN"	**110 kV**, 200 kV, 400 kV high voltage "VVN"
Poland	Legislation		→1000 V	1000 V→110 000 V	> 110 000 kV
	Network level		400 V	10 kV, 20 kV medium voltage	200 kV, 400 kV high voltage
France	Legislation	0 V→50 V	50 V→500 V (LV "A") 50 V→1000 V (LV "B")	1000 V→50 000 V (HV "A")	> 50 000 kV (HV "B")
	Network level		400 V	15 kV, **20 kV**	**63 kV**, 90 kV, 125 kV, **220 kV, 400 kV**

Presentation of the International Codes

These international codes for electrical competences refer only to the basic skills that are normally needed in emergency situations: they facilitate the demand for help from external electricians with associated skills.
They propose a simple approach with the benefit to avoid any translation

A. Approach concerning competences to realise dead or live work:

Competences linked with dead or live work are symbolized as switches (switch on = 1; switch off = 0):

All Live work competencies are prefixed **1**

All Dead work competencies are prefixed **0**

B. Approach concerning competences to authorize dead work

Competences to authorize dead work are symbolized by a sheet of paper (the formal authorization or permit which is given at the end of the process to authorize dead work):

Senior Authorized Person (refer to EN 50110 [2]) 

C. Approach concerning competences linked with the level of voltage

Competences linked with the level of tension are symbolized by an arrow like a voltmeter and its marker (left = low tension: middle = half scale level of tension; right = maximum level of tension):

Low voltage 

High voltage 

Extra high voltage 

D. Approach concerning competences linked to apparatus

Competences linked with the apparatus are symbolized by these symbols:

⚌ which means Cable: it represents the level of ground zero with a cable below;

T which means Over Head Line: it represents the pole with the line anchor device;

☐ which means Substation: it represents a closed space.

E. Approach concerning competences linked to team leader

Competences linked with the responsibility of team leader are symbolized by this symbol:

F. Approach concerning competences linked to customer's connection activities, including meter activities

Competences linked with a customer's connection (from electrical network to customer's home), are symbolized by this symbol:

G. Approach concerning competences linked to first aid

Competences linked with first aid are symbolized by this symbol:

H. Approach concerning competences linked to mobile generator connection

Competences linked with the connection of a mobile generator on an electrical network are symbolized by this symbol:

Use of these International Codes

These international codes for electrical competences are used only when an electrician from a company has to reach a foreign company to work under the responsibility of this last one.

It means that they do not replace the State legal practices in term of recognition of electrician competences. It is only a way to communicate easily to a “foreign” company the skills of an electrician who is sent to work for it.

Responsibility

In this framework, this is the responsibility of the employer of the electrician (the “owner” company) to certify his skills. The form presented in the Appendix can be used to reach that goal.

It is the responsibility of the welcoming company to check if the competences certified can be easily used to work in a different context, on different apparatus etc. The recognition of competences with these international codes by the employer of an electrician is just a help to know about them: only the welcoming company can (or not) use this skills certification as an input of its process to safely put an electrician to work in its country on its networks or installations.

Form International Codes

Here is the form to recognize an electrician‘s skills with the international codes:

International code for electrical competences

Name of the company: _____

First name of the employee: _____ Last name of the employee: _____

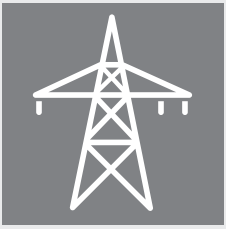
Age: _____ Function in the company: _____

International code: put a „X“ in the appropriate boxes

Remind the local competence code linked with the electrical task	LV	HV	EHV
Local code for DEAD WORK ON UNDERGROUND CABLE	1 =		
Local code for DEAD WORK ON UNDERGROUND CABLE	0 =	0 =	0 =
Local code for LIVE WORK ON OVERHEAD LINE	1 T	1 T	1 T
Local code for DEAD WORK ON OVERHEAD LINE	0 T	0 T	0 T
Local code for LIVE WORK IN SUBSTATION	1 □	1 □	1 □
Local code for DEAD WORK IN SUBSTATION	0 □	0 □	0 □
Local code for CUSTOMER'S CONNECTION	Wh = T		
Local code for MOBILE GENERATOR CONNECTION			
Local code for SAP	= T □	= T □	= T □
Local code for TEAM LEADER	= T □	= T □	= T □
Local code for FIRST AID			

The employer _____ (name of the employer) certifies that these competences are effective.

Signature _____



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