

# Improving Qualification in Electrical Safety

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**Abstract.** This article aims to elaborate proposals for improving the organisation of safe operation of electrical equipment. The situation in the sphere of normative acts regulating safe operation of electrical facilities has been examined; recommendations on elaboration of such acts have been given. It is proposed to elaborate new regulations of the Cabinet of Ministers and introduce six electrical safety groups, as well as form unified principles for attributing electrical safety groups to electric equipment with voltage up to 1000V and above 1000V.

**Keywords:** electrical safety groups, unified principles in electric safety.

## I. INTRODUCTION

The level of occupational safety is highly influenced by keeping up with the regulations, work methods used and attitude and understanding of every individual. Therefore, to reduce the number of accidents, one should keep up with the normative documents, reduce risk factors and train the personnel in order to improve their knowledge to correspond to appropriate electrical safety group.

Occupational safety for electrical equipment service staff – attributing electrical safety groups is not specially regulated in normative acts. To ensure human and environmental protection from electric current stroke, the design and construction of electrical facilities up to 1000V is defined by Construction Standard of Latvia LBN 261-07 “Constructing Inner Electrical installations of Buildings”. Other spheres connected with electrical safety lack qualitative materials that would help employers of occupational safety system with unified electrical safety group attributing procedure.

The article aims to elaborate the proposals for improving a training system in electrical safety, working out normative documents with a new approach to electrical safety group attributing procedure.

## II. EXAMINING NORMATIVE DOCUMENTS

Laws, special literature and other information sources are the sources of the research, including laws of the Republic of Latvia and other normative acts, state standards, field standards, normative documents of «Latvenergo» JSC, State Labour Inspectorate data and Internet sources.

The results of the research commissioned by the Employers' Confederation of Latvia “Working situation and risks in Latvia, 2009 – 2010” show the opinion of occupational safety specialists, who have higher professional education in the field of occupational safety. They were asked to note 10, in their opinion, the most important risk factors at an enterprise they were working (including provision of

competent specialist's services). The results of their inquiry in 2006 and 2010 cannot be precisely compared, as in 2010 new possible answer variants were included into the inquiry and for the first time among them – ELECTRICAL TRAUMA RISK. This risk mentioned by 53.3% of respondents is the seventh most important risk factor at an enterprise [12].

To arrange the electric-power field, after state independence restoration on 14th August, 1992, the Ministry Council accepted resolution No.337 “On Applying Standards, Technical Norms and Regulations in the Republic of Latvia”. It defined that standards, technical norms and regulations applied till 21st August, 1991 are valid until elaboration, confirmation and introduction of new standards, technical norms and regulations. In the field of power industry, about 4500 USSR State standards (GOST), field leading documents (RD), building norms and regulations (SNiP) and other technical norm requirements regulating power industry were valid and applied obligatorily.

The Cabinet of Ministers with the Regulation No. 120 “The Procedure of Terminating the Application of Normative Acts of the Latvian SSR”, approved on 23rd March 1999, defined that from 1st January, 2000 no one of till that time valid normative acts is valid anymore and is no obligatory for application including norms of the field of electrical power engineering. On 17th December, 1999 the Ministry of Economics with its Order No. 273 “On the List of the Latvian SSR Normative Acts Applied after 1st January, 2000” defined that 100 normative acts can still be applied, indicating the voluntary application of these normative acts until establishing new normative acts. Although instead of these normative acts the new ones have not been established, the Order of the Ministry of Economics No.273 is not valid from 1st January, 2006 based on “The Law of Administrative Process Law Coming into Effect».

At present, there is no valid state national standard or other normative document in the field that would regulate the construction of electrical facilities, operation of electrical facilities and operation safety. LBN 261-07 “Construction of Inner Electrical Installations of Buildings” certified by the Regulation No. 709 of the Cabinet of Ministers as of 16th October, 2007 [11] can be mentioned as an exception.

Due to amendments to “Power Law”, on 15th April, 2005 “Power Supply and Use Regulations” lost validity, but the Decision No.312 of the Cabinet of Ministers as of 16th June, 1993 “On Dangerous Electrical Facilities under the State Technical Supervision» lost its validity on 12th April, 2007.

These legal acts defined the status of applying technical norms.

As in the field of electrical power engineering no legal act – law or regulation of the Cabinet of Ministers – regulates the

construction of electrical facilities, operation of electrical facilities and safe operation of electrical facilities, an entrepreneur can voluntarily define which state standard or power standard can be used. Latvian power standards elaborated by the Latvian Electrotechnical Committee can be used as recommendory standards.

Latvian Electrotechnical Committee (LEK) is a standardisation institution responsible for elaborating and introducing enterprise power system standard, regulations and norms. LEK has the right to issue and publish Latvian power standards.

Standard LEK 025 "Safety Requirements while Performing Works in Electrical Facilities" was being formed during a complicated transition period when former USSR safety norms lost their validity, but the norms used in other European countries were not studied and analysed.

Latvian Association of Power Engineers and Energy Constructors, the organisation representing the field, in cooperation with the Ministry of Welfare and the Ministry of Economics should find the possibility to prepare and issue regulations of the Cabinet of Ministers on "Technical Operation of Electrical Installations, Electric Power Networks and Users' Electrical Facilities" and "Safety Requirements while Working with Electrical Facilities".

The State Joint Stock Corporation "Latvenergo" commissions standards for its production needs from Latvian Electrotechnical Committee and prepares and issues orders on their application. Those orders are not compulsory for independent commercial undertakings.

### III. TYPES OF VALID NORMATIVE ACTS

Ministry of Economics organises the formation of electrotechnical standardisation institution with the aim to work out valid or elaborate new normative acts for the field of electrical power engineering in the state language and to faster incorporate into the European and world standardisation institutions CENELEC (European Electro technical standardisation committee) and IEC (International Electrotechnical Committee). On 15th December, 1993 a standardisation institution Latvian Electrotechnical Committee (LEK) was registered in the Enterprise Register according to the established procedure.

LEK examined and certified more than 100 submitted Latvian Power Standards projects that would replace valid guideline documents and regulate requirements for constructing, operation and safe operation requirements of electrical facilities. IEC and CENELEC do not issue such normative acts, although separate norms of electrotechnical standards are included in power standards.

LEK, as CENELEC national committee, began adapting several electrotechnical standards using first-page or complete translation methods in state standard status. In 2002 field standardisation functions were delegated to "Latvijas standarts" Ltd. (further in the article – LVS). Among LVS standardisation electrotechnical committees there is no one that would deal with operation, operation safety of electrical facilities, etc.

If the field of electrical power engineering needs state standards in a definite field, then according to Clauses 10 and 11 of "Standardisation Law", a new standardisation technical committee is founded to perform standardisation in the field. Unfortunately, Clause 13 of "Standardisation Law" defines that application of standards are voluntary and only the Cabinet of Ministers can define obligatory applied Latvian national standards.

### IV. LABOUR PROTECTION TRAINING SYSTEM IN ELECTRICAL SAFETY

Unified labour protection training system in Latvia includes instructions and training at educational institutions of all levels, enterprises, organisations, institutions, companies, farms and fishing farms, artisan or family enterprise (Fig.1). Labour protection law defines that pupils of educational institutions of all levels, schoolchildren and students, employers, labour protection specialists, managers of all levels, specialists, workers, trustees can be trained [2].

The aim of a training system is to develop a conscientious attitude towards personal safety and safety of others, as well as obtaining that organisers and performers of work and other kinds of activities in all fields of economy of any form of property knew and followed labour protection norms and electrical safety requirements.

Training system is based on Labour Protection Law, International Labour Organisation Agreements and Recommendations on production environment, occupational safety and hygiene, as well as vocational training.

Training in labour protection is of compulsory continuous character, starting with educational institutions of all levels and up to further improvement of knowledge during working process at one's working place. In Fig.1 types of training are examined in connection with acquisition of electrical safety issues.

An employer is in charge of organising timely and qualitative training and knowledge testing at an enterprise. Employer, head of an enterprise or an institution should appoint a labour protection specialist (labour protection engineer) or other qualified employee trained according to the order established by the Cabinet of Ministers. The person appointed should meet these liabilities – labour protection training monitoring and control, including participation in electrical safety testing commissions.

All the expenses related to labour protection training are covered by an employer.

### V. BASIC REQUIREMENTS FOR SAFE EXPLOITATION OF ELECTRICAL FACILITIES

#### A. Personnel qualification

It is necessary to perform the following operations of the functioning electrical equipment: maintenance of this equipment, assemblage monitoring, repair, switchover and other works. The personnel performing such works should be theoretically and practically prepared for safe operation.

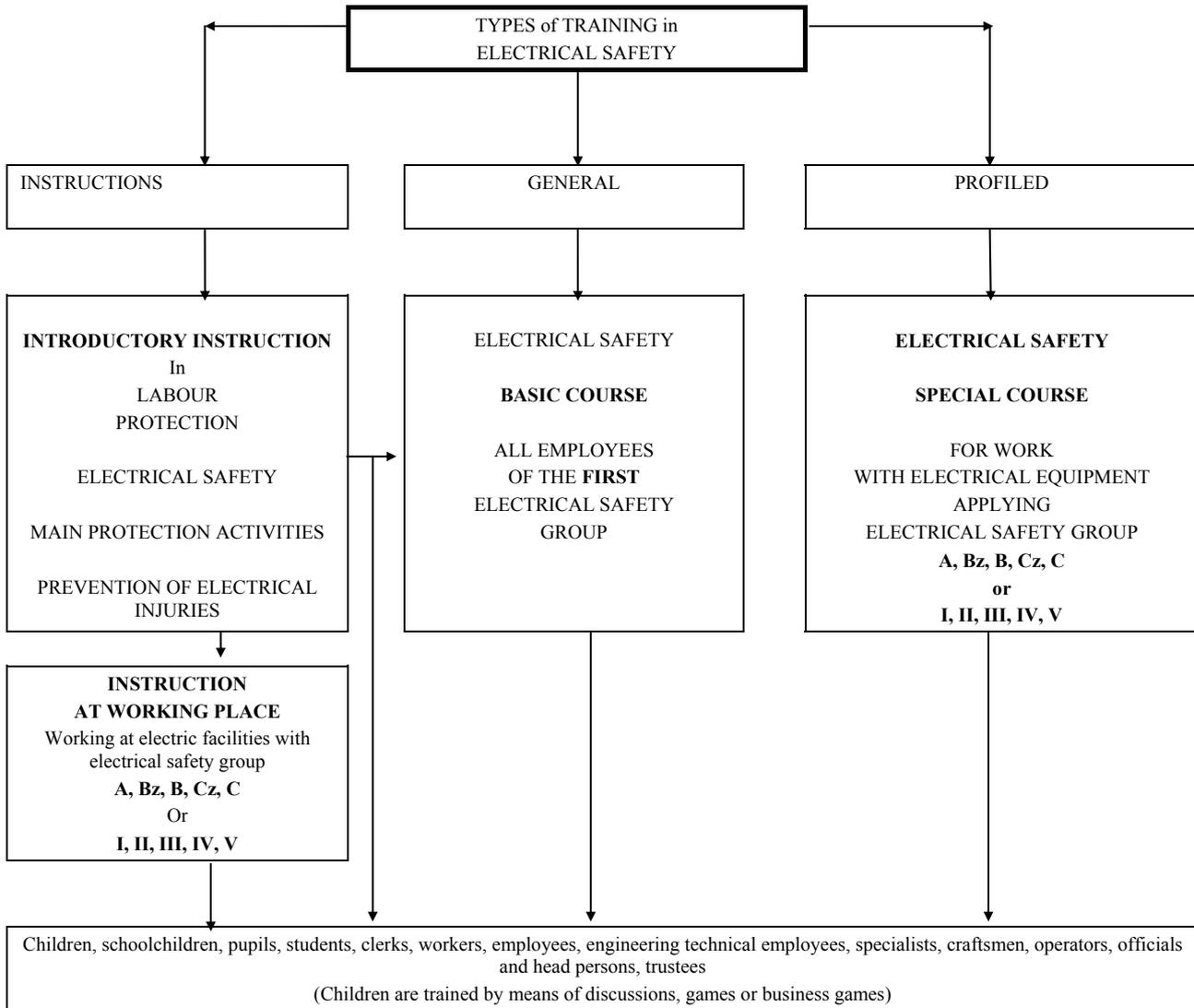


Fig.1 Electrical safety training scheme

It means professional and vocational training, as well as additional certification in occupational safety is necessary.

There are workers, who do not work at electric facilities, but, due to specific character of their work, can be subject to electric current effect, as they use electrical equipment at their work. Immediate superior performs instruction and knowledge check of these workers, registering it in a corresponding record book or form.

The following persons can work at electrical facilities:

- a) the ones who are at least 18 years old;
- b) the ones who have gone through medical examination and received medical conclusion on their health correspondence to the work performed at electrical facilities. Medical examination should be done when being employed and periodically for persons who perform maintenance of functioning electric facilities with 50V and higher tension, once in two years,
- c) the ones who are trained in providing first aid;

- d) the ones who are trained, instructed and examined in electrical safety issues and are assigned to a corresponding electrical safety group.

In accordance with the **Latvian Power Standard LEK 025** requirements, the necessary minimal requirements for training, education and practical skills for assigning electrical safety groups are as follows [9]:

**Electrical safety group A** – training and instruction on performing certain work at electric facilities being in operation;

**Low-tension electrical safety group B** (shortly – Bz) – acquisition of low-voltage electric safety group and one-month working experience with functioning low-voltage electrical facilities;

**High-voltage electrical safety group B** (shortly – B) – acquisition of high-voltage electrical safety group and three-month working experience with functioning high-voltage electrical facilities;

**Low-voltage electrical safety group C** (shortly – Cz) – the second professional qualification level in electrical

sciences, knowledge of electricity dangers in low-voltage electrical facilities and one-month working experience with low-voltage electrical safety group B;

**High-voltage electrical safety group C (shortly - C)** – the second professional qualification level in electrical sciences, knowledge of electricity dangers in high-voltage electrical facilities and three-month working experience with high-voltage electrical safety group B.

To assign an electrical safety group, a technical superior of an enterprise defines the necessary range of knowledge, procedures for training and certifying of workers. Knowledge testing is performed and electrical safety group is assigned by a commission consisting of not less than three people or a juridical person. Electrical safety group is assigned for a period of time not longer than three years. After the time is expired, repeated knowledge check is made. The worker, who is assigned to an electric safety group, obtains a certificate, which should be at hand when working. Sample of certificate form is not regulated by the regulations of the Cabinet of Ministers. JSC Latvenergo strictly follows the instructions of power standard LEK 025 “Safety Requirements while Working at Electrical Facilities” that are only permissive for other organizations.

**Procedure of assigning electrical safety qualification groups** according to the requirements of Instructions for Consumer Technical Operation of Electrical Facilities and Safety Technique Instructions while working with consumer electrical facilities (permissive) [2].

**Electrical safety group I** – workers do not need experience in electrical facilities, education in electrical techniques, but they should have a notion of electric current dangers and means of protection while performing certain work. They should know how to provide first aid in case of electrical wound.

**Electrical safety group II** – is assigned to workers without secondary education with two-month length of service in electrical facilities being in operation; workers with secondary education with one-month length of service in electrical facilities being in operation; workers with secondary or higher electrotechnical education – without length of service in electrical facilities being in operation and after knowledge check.

**Electrical safety group III** – is assigned to workers without secondary education with four-month electrical safety group II length of service in electrical facilities being in operation; workers with secondary education and two-month electrical safety group II length of service in electrical facilities being in operation; workers with secondary or higher electrotechnical education and one-month electrical safety group II length of service in electrical facilities being in operation and after knowledge check.

**Electrical safety group IV** – is assigned to workers without secondary education with eight-month electrical safety group III length of service in electrical facilities being in operation; workers with secondary education and three-month electrical

safety group III length of service in electrical facilities being in operation; workers with secondary or higher electrotechnical education and two-month electric safety group III length of service in electrical facilities being in operation and knowledge check.

**Electrical safety group V** – is assigned to workers without secondary education with twenty-four-month electrical safety group IV length of service in electrical facilities being in operation; workers with secondary education and twelve-month electrical safety group IV length of service in electrical facilities being in operation; workers with secondary or higher electrotechnical education and three-month electrical safety group IV length of service in electrical facilities being in operation and after knowledge check.

**Electrical safety groups I – V have safety divisions up to 1000V and above 1000V.**

#### *B. Improvement of normative documentation*

One of the documents regulating electrical safety requirements is a Power Standard LEK 025 “Safety Requirements while Working at Electrical Facilities”. This standard has been elaborated according to JSC Latvenergo requirements and is introduced into this company. For other entrepreneurs this standard is permissive for use. The standard refers to electrical facilities being in operation with voltage 50V and more.

In LEK 025 it is defined that personnel is assigned to five electrical safety qualification groups A, Bz, B, Cz and C.

In many European countries the issues of electrical safety are linked with personnel qualification and knowledge on electrical facilities, and these issues are not viewed separately from electrical safety groups.

After acquainting oneself with the situation in normative documentation, one can conclude that the Cabinet of Ministers needs to elaborate new instructions for safe work performance in electrical safety, corresponding to the requirements of the European standard EN 50110-1:2004 “Operation of Electrical Installations”. Universal electrical safety regulations should be elaborated for working at any electrical facilities or close to them.

At present there are no unified principles for assigning electrical safety groups. Assigning each group of electrical knowledge, an audit committee may do so at their own discretion, because there is no set amount of knowledge for each electrical group. For example, electrical safety group Cz can be assigned to a house-manager electrician without any electrotechnical education, as well as to a high class JSC “Sadales tīkls” specialist with a corresponding higher education.

By creating six electrical safety groups, taking into account the level of professional or vocational education in electrical sciences, length of service in electrical facilities and knowledge of electricity dangers, the present situation can be improved: A1, A2, Bz, B, Cz and C.

TABLE I  
CERTIFICATE OF ELECTRICAL SAFETY GROUP – SAMPLE

RIGA TECHNICAL UNIVERSUTY IEVF INSTITUTE OF LABOUR SAFETY AND CIVIL DEFENCE  Technogenic Safety Consulting and Training Centre CERTIFICATE No. 0001 <i>of electrical safety group</i>  JĀNIS DZENIS Personal ID xxxxxx-xxxxx  Electric Safety Group Bz (THIRD GROUP UP TO 1000V) granted on 28th April, 2011  Head of TSC and Training Centre Valdis Ziemelis  While performing official duties, the certificate should be in the owner's possession	Certificate valid till	Head of the commission	
		Name, surname	Signature
	27.04.2014.	ValdisZiemelis Electrical specialist certificate No.0038 Electric safety group C	

**Electrical safety group A1** – after instructions on performing certain work – work with office and consumer electrical equipment (computers, printers, copying machines, cash-registers, faxes, vacuum cleaners, refrigerators, TV sets, etc.), as well as in rooms without high electricity dangers working with manual electrical instruments.

**Electric safety group A2** – acquisition of low-voltage electrical safety training course after training and instruction performing at electrical facilities being in operation, as well as in rooms with high electricity dangers and rooms with special dangers while working with manual electrical instruments.

At Riga Technical University the system of assigning six electrical safety groups is being practically implemented and certificates have been issued to five electrical safety groups according to the sample given in Appendix 1.

“Electrical Safety Law” has been introduced in the neighbouring country Estonia. According to the law, there should be a person in charge of energy handling facilities at every enterprise, and this person should be certified as an energy specialist.

To introduce an equivalent law in Latvia, new instructions of the Cabinet of Ministers, regulating requirements for personnel, organisation of work, means of protection and other significant issues referring to electrical safety, should be issued or the existing ones should be reconsidered. For example, in the instructions of the Cabinet of Ministers No. 372 “Requirements for Labour Protection while Using Individual Protective Means” as of 20th August, 2002 only some protective means for work with electrical equipment are mentioned. In these instructions there is a requirement: “performing the work where there is possible a contact with electrical equipment connected to electrical energy source – dielectric gloves are necessary”. One can understand from this formulation that dielectric gloves should be used even working with a reading lamp.

## VI. CONCLUSIONS AND PROPOSALS

1. After analysing and examining normative documents, one can conclude that there are almost no normative documents regulating safe operation with electrical equipment in Latvia. Power Standard LEK-025 can be used as a recommendatory standard.

2. At present there are no unified principles of applying electrical safety groups. Each knowledge probation commission can use its own judgement.

3. When elaborating normative documents that would define safety requirements for working at electrical facilities, one should use JSC “Latvenergo” experience gained while working according to requirements of the Power Standard LEK 025 and reworking this standard to form it as regulations of the Cabinet of Ministers.

4. While elaborating regulations for working with electrical equipment, the **six electrical safety groups with safety division up to 1000V and above 1000V should be introduced.**

5. It is necessary to define general requirements for electrical safety in the state, field, enterprise that can be solved by introducing “Electrical Safety Law”.

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#### **Valdis Ziemelis. Kvalifikācijas pilnveidošana elektrodrošībā**

Šā raksta mērķis ir izstrādāt priekšlikumus elektroiekārtu drošas ekspluatācijas organizācijas pilnveidošanai. Izskatītas pamatprasības drošai darbu veikšanai elektroiekārtās. Izpēti normatīvie dokumenti, kas reglamentē elektroietaišu drošu ekspluatāciju, sniegtas rekomendācijas to izstrādē. Darba aizsardzības speciālistu 2010.gada aptaujas jautājumos tika iekļauti jauni atbilstu varianti un starp tiem pirmo reizi ELEKTROTRAUMU RISKS – šo risku minējuši 53,3 % respondentu, un tas ir septītais būtiskākais riska faktors uzņēmumā. Elektroietaišu līdz 1000 V projektēšanu un izbūvi, lai nodrošinātu cilvēku un vides aizsardzību pret elektriskās strāvas triecieniem, nosaka Latvijas būvnormatīvs LBN 261-07 „Ēku iekšējo elektroinstalāciju izbūve”. Citās, ar elektrodrošību saistītās, jomās trūkst kvalitatīvu materiālu, kas darba devējiem palīdzētu veidot darba aizsardzības sistēmu ar vienotu elektrodrošības grupu piešķiršanas kārtību. Šobrīd nav vienotu principu elektrodrošības grupu piešķiršanā. Piešķirot elektrodrošības grupu katra zināšanu pārbaudes komisija var rīkoties pēc saviem ieskatiem, jo nav noteikts zināšanu apjoms katrai elektrodrošības grupai. Tiek piedāvāts izstrādāt jaunus Ministru kabineta noteikumus un ieviest sešas elektrodrošības grupas un izveidot vienotus principus elektrodrošības grupu piešķiršanā elektroiekārtās ar spriegumu līdz 1000 V un virs 1000 V. Nepieciešams definēt vienotas vispārējās prasības elektrodrošībā valstī, nozarē, uzņēmumā, ko varētu novērst, ieviešot valstī „Elektrodrošības likumu”.

#### **Валдис Зиемелис. Усовершенствование квалификации по электробезопасности**

Цель статьи – разработать предложения для усовершенствования организации безопасной эксплуатации в электроустановках. Рассмотрены основные требования по безопасной работе в электроустановках. Рассмотрена ситуация в области нормативных документов, регулирующих безопасную эксплуатацию электроустановок, были вынесены рекомендации по их развитию. При проведении исследований специалисты охраны труда в 2010-м году включили новые вопросы и ответы, а также первый раз риск электротравмы, этот риск упомянули 53,3% респондентов и он является седьмым по значимости фактором риска для компании. Для электрооборудование до 1000 В издан латвийский нормативный документ LBN 261-07. Название этого документа – Строительство внутренней электропроводки зданий. Новый документ рассматривают проектирование и строительство электропроводки зданий для обеспечения человека и защиты окружающей среды от поражения электрическим током. Отсутствуют качественные нормативные материалы, которые помогают работодателям разработать профессиональную систему охраны труда с единой процедуры присвоения группы по электробезопасности. В настоящее время нет единого принципа по присвоению групп электробезопасности. Каждая комиссия по проверке знаний по электробезопасности может сделать это по своему усмотрению, так как нет определенных требований знаний по электробезопасности для каждой группы. Предлагается разработать новые правила Кабинета Министров, ввести шесть групп по электробезопасности и создать единые принципы по присвоению групп электробезопасности в электроустановках до 1000 В и выше 1000 В. Необходимо определить общие требования к электрической безопасности в стране, отрасли, компании. Рекомендуется введение в стране закона о электробезопасности.