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**Hydropower Investment
Promotion Project (HIPP)**

LIST OF INTERNATIONAL STANDARDS RELATED TO GEORGIAN ELECTRICITY GRID CODE

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USAID HYDROPOWER INVESTMENT PROMOTION PROJECT
(HIPP)

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Definition of Abbreviations

ACEC	Advisory Committee on Electromagnetic Compatibility
ASME	American Society of Mechanical Engineers
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
CENELEC	European Committee for Electrotechnical Standardization
CE	Communauté Européenne
CBE	Circuit Breakers for Equipment
DIN	Deutsche Industrie Norm
DCFTA	Deep and Comprehensive Free Trade Area Agreement
EMC	Electromagnetic Compatibility
EIS	Electrical Insulation Systems
ETA	Event tree Analysis
HVDC	High-Voltage Direct Current
HDPE	High Density Polyethylene
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
ISO	International Organization for Standardization
ICC	International Chamber of Commerce
ITU	International Telecommunication Union
IES	Individual Electrification Systems
IP	Internet Protocol
MMI	Man Machine Interface
NEMA	National Electrical Manufacturers Association
OFCS	Safety of optical fibre communication systems (OFCS)
PV	Photovoltaic
PBB	Polybrominated Biphenyls
PBDE	Polybrominated Diphenyl Ethers
RCBO	Residual Current Operated Circuit Breaker
RoHS	Restriction of Hazardous Substances (directive)
STS	Static Transfer Systems
SELV	Safety Extra Low Voltage
TS	Transport Stream
VDE	Association for Electrical, Electronic & Information Technologies
VDI	Association of German Engineers
VSC	Voltage Sourced Converter
WEEE	Waste of Electrical and Electronic Equipment (Directive)

1.0 Background

The development of electrical standards is closely linked with that of the whole field of electrical and electronic engineering. The higher currents, voltages and power levels of power installations increase the potential for disturbance, and the integration and interpenetration of the components of the power and information sectors bring the sources of disturbance and the equipment that is sensitive to it even closer together. Generally speaking, the aim of creation of electrotechnical standards is to ensure the reliability and safety of all types of equipment and systems wherever they are used.

By Adoption internationally accepted electrotechnical standards, it is possible to achieve electromagnetic compatibility of power system that deal with two different aspects: electrical aspects with respect to power systems, and electronic aspects where control or communication systems are concerned. This explains why electrotechnical standards and requirements relating to electromagnetic compatibility, worldwide or harmonized at regional level, are welcomed by manufacturers and users of electrical and electronic equipment. EMC standards are a prerequisite to ensuring that numerous items of electronic equipment do not put each other out of action or, still worse, give rise to malfunctioning of the equipment.

Standards are only one aspect of the problems associated with EMC. They lay down the performance requirements to be met by the products but leave it to the power system operators to achieve them. The requirements of the standards can only be met, however, if the necessary technical know-how and solutions adapted to EMC are available.

The purpose of the document is to explain targets of Georgian power system with regards to international standardization, to describe how these standards are organized, to provide an overview on the existing international standards and existing situation in Georgia along with recommendations.

2.0 The different product categories

For practical reasons, it has been found convenient to distinguish four product categories: components, apparatus, systems and installations, according to their range of application and their certification conditions in the market. They also correspond in a general manner to the application of the European EMC Directive.

Component:

An electrical or electronic unit which does not itself have a final function but which is intended for incorporation in an apparatus.

Examples: Passive components: reactors, resistors, capacitors, integrated circuits;

Active components: certain types of synchronous compensators, motor, power supply units.

Apparatus:

A single finished product with a direct function(s) intended for final use.

Examples: generators, power transformers, measuring transformers, reclosures, relays, surge arresters,

electrical appliances, electrical equipment, tools, circuit-breakers, certain motor types.

System

A combination of apparatus and/or (active) components constituting a single functional unit and intended to be installed and operated to perform a specific task.

Example: Electricity system consists of generators, electricity lines, substations, transformer stations, etc.

Installation

A combination of apparatus, components and systems assembled and/or erected (individually) in a given area.

Examples: industrial plants, electricity substations, telecontrol systems for large areas.

3.0 Regulation

A standard in general means criterion, principle or measure, used by the power industry players to plan, design and operate the generation, transmission and distribution systems of the electrical network. Standards can have several sources and can be a combination of national and/or international standards established by recognized organization (IEC, IEEE, MS, STD etc), set by regulator or documented by industry player and approved by the Regulator or relevant Ministry or technical supervisory committee.

In most countries, electrical installations shall comply with more than one set of regulations, issued by national authorities or by recognized private bodies. Legal status of standards is of importance both in view of the certification of compliance with national electrical operational, reliability and security requirements and in the event of a dispute.

In certain cases, standards related to electrical systems may have a more binding character, where they are published as European standards (EN) and are the basis for “the harmonization of standardization“ in all EU member countries. They must be transferred into the framework of national standards, where they replace all other standards on the same subject. They then assume the status of either a recommendation or a law.

IEC standards are in principle only recommendations representing the state of the art and in this sense may serve as reference. They may acquire a legal status, however, if they are introduced into the legislation of a country by law, decree, rules or other secondary regulations as National Transmission and Distribution Grid Codes.

New Grid Codes of Georgia together with internationally accepted standards will enable the use of the full potential of international experience delivering operational reliability, security, and high quality of services to the overall power system and ancillary services to the local grid. Developing grid codes for Georgia should be based on common contemporary European requirements with reflected consensus across national standards and regulations but at the same time it is essential to take into account the local constraints before starting the design of the documents. The reason to adopt Grid Codes in Georgia satisfying international requirements for

design and operation of power system is to ensure security of supply and a stable operation of the power system, an economically and technically optimal development of the transmission and distribution grid and personnel safety

4.0 Standards

In most of the European countries all materials and equipment supplied and all work carried out as well as calculation sheets, drawings, quality and class of goods, methods of inspection and constructional peculiarities of the facility shall comply in every respect with the technical codes of the International Organization for Standardization (ISO). Besides EU and National Standards (e.g. BS, DIN VDE, etc.) most of European countries recognize and rely on relevant IEC standards. IEC recommendations apply to the electrical equipment. It has been established by medical and engineering experts of all countries in the world comparing their experience at an international level. Currently, the safety principles of IEC are the fundamentals of most electrical standards in the world.

Goods and special guarantees beyond the scope of ISO and IEC shall conform at least to the following standards and codes:

- DIN, VDE, VDI or equivalent in English language edition;
- BS;
- ANSI, ASME, ASTM, IEEE, NEMA;
- EURONORMS;
- ICC and International Building Codes.

Any electrical work must be performed according to the most recent relevant codes, standards, accident prevention regulations and National legal regulations. All equipment shall be inspected and tested in accordance with the requirements of the relevant standards and codes. In all circumstances, the finally accepted codes and standards shall be the last published version prior to the date of embarkment upon any activity. All the recommendations contained in the relevant applicable standard shall be considered as mandatory requirements. Specific requirements and special design features detailed in technical specifications and contracts over and above those clarified in the applicable standards shall be complied with.

Note:

Where no appropriate standards are available, tests and any other activity shall be carried out in accordance with the manufacturer's standard practice, which needs the approval of the Buyer's Representative.

In such cases the Contractor shall submit to the Buyer's Representative complete data and a suggested procedure for the testing to be performed before manufacture commences. If the proposed procedure is accepted, the Contractor shall provide the Buyer's Representative with four copies in English language before any test is performed.

The main and auxiliary equipment, specified in the Technical Specification, shall be designed and manufactured in accordance with the latest editions of the standards as shown in sections below and in the relevant individual sections of the technical specifications and contracts.

4.1 IEC Standards

The International Electrotechnical Commission (IEC) is a non-profit, non-governmental international standards organization that prepares and publishes International Standards for all electrical, electronic and related technologies – collectively known as "electrotechnology". IEC standards cover a vast range of technologies from power generation, transmission and distribution to home appliances and office equipment, semiconductors, fibre optics, batteries, solar energy, nanotechnology and marine energy as well as many others, in addition to related general disciplines such as terminology and symbols, electromagnetic compatibility, measurement and performance, dependability, design and development, safety and the environment. The IEC also manages three global conformity assessment systems that certify whether equipment, system or components conform to its International Standards. As per drafted Georgian Grid Code, IEC standards are frequently referenced in national standardization and metrication programs.

The IEC charter embraces all electrotechnologies including energy production and distribution, electronics, magnetics and electromagnetics, electroacoustics, multimedia, telecommunication and medical technology, as well as associated general disciplines such as terminology and symbols, electromagnetic compatibility (by its Advisory Committee on Electromagnetic Compatibility, ACEC), measurement and performance, dependability, design and development, safety and the environment.

IEC cooperates closely with the International Organization for Standardization (ISO) and the International Telecommunication Union (ITU), IEEE. Other standards developed in cooperation between IEC and ISO are assigned numbers in the 80000 series. Like IEEE in North America, IEC in Europe cover harmonic interference and electrical impacts on the grid.

The Standards related to Generation, transmission and distribution activity is subdivided into sections which may be ordered separately or in any combination:

- Appliances;
- Applications;
- Components;
- Insulation;
- Machines and motors;
- Microelectronics;
- Switchgear;
- Terminology;
- Turbines and generators.

More than 6,200 standards documents are published by the IEC, that have numbers in the range 60000–79999 and their titles take a form such as IECXXXXXX. The 60000 series of standards, preceded by EN in various documents, are harmonized as European standards. Table 1 below provides an incomplete list of standards published by IEC relevant to Generation; Transmission; Distribution and User installations. Depending on a type of an electrical apparatus; installation and/or

facility, its' design, manufacturing, construction and testing shall comply with a specific set of IEC standards from the Table 1.

Note: The list doesn't include standards related to: Railway and Marine applications, radiation protection instrumentation, Radio and Telecommunication equipments, medical electrical equipments. The list includes limited number of Standards related to: Household appliances, photovoltaic devices and teleprotection.

Table 1: List of IEC standards recommended for various electrical installation applicable in transmission and distribution networks and systems.

IEC 60027	Letter symbols to be used in electrical technology
IEC 60027-1:	Part 1: General
IEC 60027-2:	Part 2: Telecommunications and electronics
IEC 60027-3:	Part 3: Logarithmic and related quantities, and their units
IEC 60027-4:	Part 4: Symbols for quantities to be used for rotating electrical machines
IEC 60027-6:	Part 6: Control technology
IEC 60027-7:	Part 7: Physiological quantities and units
IEC 60028	International standard of resistance for copper
IEC 60034	Rotating electrical machinery (This standard specifies energy-efficiency classes for single-speed, three-phase, cage-induction motors with 2, 4 or 6 poles).
60034-1	Part 1: Rating and performance-Eleventh Edition
60034-2	Part 2: Methods for Determining Losses and Efficiency of Rotating Electrical Machinery from Tests (Excluding Machines for Traction Vehicles)-Third Edition
60034-3	Part 3: Specific requirements for cylindrical rotor synchronous machines
60034-4	Methods for Determining Synchronous Machine Quantities from Tests
60034-5	Part 5: Degrees of Protection Provided by the Integral Design of Rotating Electrical Machines
60034-7	Part 7: Classification of Types of Construction Mounting Arrangements and Terminal Box Position
60034-8	Part 8: Terminal Markings and Direction of Rotation of Rotating Machines
60034-9	Part 9: Noise Limits
60034-10	Part 10: Conventions for Description of Synchronous Machines
60034-11	Part 11: Built-In Thermal Protection Chapter 1: Rules for Protection of Rotating Electrical Machines
60034-11-2	Part 11: Built-In Thermal Protection Chapter 2: Thermal Detectors and Control Units Used in Thermal Protection Systems
60034-11-3	Part 11: Built-In Thermal Protection Chapter 3: General Rules for Thermal Protectors Used in Thermal Protection Systems
60034-12	Part 12: Starting Performance of Single-Speed Three-Phase Cage Induction Motors
60034-13	Part 13: Rotating Electrical Machines Part 13: Specification for Mill Auxiliary Motors
60034-14	Part 14: Mechanical vibration of certain machines with shaft heights 56 mm and higher Measurement evaluation and limits of vibration severity
60034-15	Part 15: Impulse Voltage Withstand Levels of Rotating A.C. Machines with Form-Wound Stator Coils
IEC TR 60034-16-2	Part 16: Excitation systems for synchronous machines Chapter 2: Models for power system studies
60034-17	Part 17: Guide for the Application of Cage Induction Motors When Fed from Converters
60034-18	Part 18: Functional Evaluation of Insulation Systems for Rotating Electrical Machines
IEC 60038	IEC Standard Voltages, edition 7.0 (defines a set of standard voltages for use in low voltage and high voltage AC electricity supply systems. Three-phase 50 Hz 230 V/400 V; 400 V/690 V; 1000 V).
IEC 60041	Field acceptance tests to determine the hydraulic performance of hydraulic turbines, storage pumps and pump-turbines

IEC 60044	Instrument transformers
60044-1	Part 1: Current transformers
60044-2	Part 2: Inductive voltage transformers
60044-3	Part 3: Combined Transformers
60044-5	Part 5: Capacitor voltage transformers
60044-6	Part 6: Requirements for Protective Current Transformers for Transient Performance
60044-7	Part 7: Electronic Voltage Transformers
60044-8	Part 8: Electronic current transformers
IEC 60045	Specification for Steam Turbines -Third Edition
IEC 60050	International Electrotechnical Vocabulary
60050-321	Chapter 321: Instrument Transformers
60050-351	Part 351: Control technology-Edition 3
60050-371	Chapter 371: Telecontrol-Amendment 1-1997
60050-411	Chapter 411: Rotating Machines-Second Edition
60050-415	Part 415: Wind Turbine Generator Systems
60050-421	Chapter 421: Power Transformers and Reactors
60050-448	Chapter 448: Power System Protection-Second Edition
60050-466	Part 471: Insulators-Edition 2.0
60050-471	Chapter 466: Overhead Lines-First Edition
60050-551	Part 551: Power Electronics-Edition 2
60050-551-20	Part 551-20: Power Electronics - Harmonic Analysis
60050-581	Part 581: Electromechanical components for electronic equipment-Edition 2.0
60050-601	Chapter 601: Generation Transmission and Distribution of Electricity
60050-602	Chapter 602: Generation Transmission and Distribution of Electricity – Generation
60050-603	Chapter 603: Generation Transmission and Distribution of Electricity - Power System Planning and Management
60050-604	Chapter 604: Generation Transmission and Distribution of Electricity - Operation-First Edition;
60050-605	Chapter 605: Generation Transmission and Distribution of Electricity – Substations
60050-704	Chapter 704: Transmission-First Edition
IEC 60051	Direct Acting Indicating Analogue Electrical Measuring Instruments and Their Accessories
IEC 60052	Voltage measurement by means of standard air gaps-Third Edition
IEC 60055	Paper-insulated metal-sheathed cables for rated voltages up to 18/30 kV
IEC 60056	High Voltage Alternating Current Circuit Breakers
IEC 60059	IEC Standard Current Ratings
IEC 60060	High-voltage test techniques
60060-1	Part 1: General Definitions and Test Requirements
60060-2	Part 2: Measuring Systems
60060-3	Part 3: Definitions and requirements for on-site testing
IEC 60062	Marking Codes for Resistors and Capacitors-Fifth Edition
IEC 60063	Preferred number series for resistors and capacitors
IEC 60068	Environmental Testing Procedures
IEC 60071	Insulation coordination
60071-1	Part 1: Definitions, principles and rules for insulation coordination
60071-2	Part 2: Application guide-Third Edition
60071-3	Part 3: Phase-To-Phase Insulation Co-Ordination Principles Rules and Application Guide
TR 60071-4	Part 4: Computational guide to insulation co-ordination and modeling of electrical networks
IEC 60072	Dimensions and Output Series for Rotating Electrical Machines
IEC 60073	Basic Safety principles for man-machine interface (MMI), marking and identification - Coding Principles for Indication Devices and Actuators

IEC 60076	Power transformers
60076-1	Part 1: General-Edition 2.1;
60076-2	Part 2: Temperature Rise-Second Edition;
60076-3	Part 3: Insulation Levels Dielectric Tests and External Clearances in Air-Edition 2; Power
60076-4	Part 4: Guide to the Lightning Impulse and Switching Impulse Testing - Power Transformers and Reactors-First Edition; Replaces IEC 60722
60076-5	Part 5: Ability to Withstand Short Circuit-Edition 3.0
60076-6	Part 6: Reactors
60076-7	Part 7: Loading guide for oil-immersed power transformers-First Edition; Replaces IEC 60354:1991
60076-8	Part 8: Application Guide-First Edition; Replaces IEC 60606
60076-10	Part 10: Determination of Sound Levels-First Edition; Cancels and Replaces IEC 60551
60076-10-1	Part 10-1: Determination of sound levels Application guide
60076-11	Part 11: Dry-type transformers
60076-12	Part 12: Loading guide for dry-type power transformers
60076-13	Part 13: Self-protected liquid-filled transformers
60076-14	Part 14: Design and application of liquid-immersed power transformers using high- temperature insulation materials-Edition 2.0
60076-15	Part 15: Gas-filled power transformers
IEC 60079 1–34	Electrical Installations in Hazardous Areas
IEC 60083	Plugs and socket-outlets for domestic and similar general use standardized in member countries of IEC
IEC 60085	Electrical insulation - Thermal evaluation and designation
IEC 60086	Primary batteries
IEC 60088	Standard rated currents of fuse links for low voltage (2 to 63 A)
IEC 60093	Methods of Test for Volume Resistivity and Surface Resistivity of Solid Electrical Insulating Materials –Second edition
IEC 60099	Surge arresters
IEC 60104	Aluminum-Magnesium-Silicon Alloy Wire for Overhead Line Conductors-Edition 2
IEC 60105	Recommendation for Commercial-Purity Aluminium Busbar Material
IEC TS 60110	Power Capacitors for Induction Heating Installations
IEC 60112	Method for the determination of the proof and the comparative tracking indices of solid insulating materials
IEC 60115	Fixed resistors for use in electronic equipment
IEC 60117	Recommended graphical symbols
IEC 60119	Recommendations for Polycrystalline Semiconductor Rectifier Stacks and Equipments
IEC 60121	Recommendation for Commercial Annealed Aluminum Electrical Conductor Wire
IEC 60122	Quartz Crystal Units for Frequency Control and Selection
IEC 60127	Miniature Fuses
IEC 60129	Alternating current disconnectors and earthing switches
IEC 60131	Lever Switches
IEC 60132	Rotary Wafer Switches (Low Current Rating)
IEC 60134	Absolute maximum and design ratings of tube and semiconductor devices
IEC 60137	Bushings for alternating voltages above 1000V - Edition 6.0
IEC 60143	Series capacitors for power systems

IEC 60146 60146-1-1 60146-1-2 60146-1-3 60146-2 60146-3 60146-4 60146-5 60146-6	Semiconductor convertors - General requirements and line commutated convertors Part 1-1: Specification of basic requirements-Edition 4.0 Part 1-2: Application Guide-Third Edition Part 1-3: Transformers and Reactors-Third Edition Part 2: Semiconductor Self-Commutated Convertors Part 3: Semiconductor Direct D.C. Convertors Part 4: Method of Specifying the Performance and Test Requirements of Uninterruptible Power Systems Part 5: Switches for Uninterruptible Power Systems (UPS Switches) Part 6: Application guide for the protection of semiconductor convertors against overcurrent by fuses
IEC 60148	Letter Symbols for Semiconductor Devices and Integrated Microcircuits
IEC 60156	Insulating Liquids
IEC 60164	Recommendations in the Field of Quantities and Units Used in Electricity
IEC 60168	Tests on Indoor and Outdoor Post Insulators of Ceramic Material or Glass for Systems with Nominal Voltages Greater Than 1 000 V-Fourth Edition
IEC 60183	Guide to the selection of high voltage cable
IEC 60185	Current Transformers-Second Edition
IEC 60186	Voltage Transformers Second Edition
IEC 60193	Hydraulic Turbines Storage Pumps and Pump-Turbines - Model Acceptance Tests-Second Edition
IEC 60204	Safety of machinery - Electrical equipment of industrial machines
IEC 60214 60214-1 60214-2	On-load tap changers Part 1: Performance requirements and test methods Part 2: Application guide
IEC 60216	Guide for the Determination of Thermal Endurance Properties of Electrical Insulating Materials
IEC 60227	PVC insulated cables of rated voltages up to and including 450/750 V Test methods
IEC 60228	Conductor of Insulated Cables
IEC 60230	Impulse tests on cables and their accessories
IEC 60233	Tests on Hollow Insulators for use in Electrical Equipment
IEC 60234	Dimensions of Ceramic Dielectric Capacitors of the Plate Type
IEC 60242	Standard Frequencies for Centralized Network Control Installations
IEC 60243	Methods of Test for Electric Strength of Solid Insulating Materials
IEC 60245	Rubber-Insulated Cables
IEC 60252	AC motor capacitors
IEC 60255	Electrical Relays
IEC 60265	High voltage switches
IEC 60269	Low voltage fuses
IEC 60270	High-Voltage Test Techniques – Partial Discharge Measurements
IEC 60273	Characteristics of indoor and outdoor post insulators for systems with nominal voltages greater than 1000 V
IEC 60280	Impulse tests on cables and their accessories
IEC 60282	High voltage fuses
IEC 60287 60287-1-1 60287-2-1 60287-3-1	Calculation of permissible current in cables at steady state rating Electric cables - Calculation of the current rating – Part 1: Current rating equations (100% load factor) and calculation of losses – Section 1: General Electric Cables - Calculation of the Current Rating - Part 2: Thermal Resistance - Section 1: Calculation of Thermal Resistance Electric Cables - Calculation of the Current Rating - Part 3: Sections on Operating Conditions - Section 1: Reference Operating Conditions and Selection of Cable Type
IEC 60289	Reactors

IEC 60291	Fuse Definitions
IEC 60296	Specification for Unused Mineral Insulating Oils for Transformers and Switchgear
IEC 60297	Dimensions of mechanical structures
IEC 60298	AC metal-enclosed switchgear and control gear for rated voltages above 1 kV and up to and including 52 kV
IEC 60300 60300-1	Reliability and Maintainability Management-Second Edition Part 1: Dependability Program Management-First Edition; Replaces IEC 300
IEC 60301	Preferred Diameters of Wire Terminations of Capacitors and Resistors
IEC 60304	Standard Colors for Insulation for Low-Frequency Cables and Wires - Edition 3
IEC 60305	Insulators for Overhead Lines with a Nominal Voltage Above 1 000 V - Ceramic or Glass Insulator Units for A.C. Systems - Characteristics of Insulator Units of the Cap and Pin Type-Edition 4
IEC 60308	Hydraulic turbines - Testing of control systems-Second Edition
IEC 60309	Plugs, socket-outlets and couplers for industrial purposes
IEC 60310	Traction Transformers and Inductors
IEC 60317	Specifications for particular types of winding wires
IEC 60319	Presentation and Specification of Reliability Data for Electronic Components-Third Edition
IEC 60322	Rules for Ohmic Resistors Used in the Power Circuits of Electrically Powered Vehicles
IEC 60324	Ceramic Dielectric Capacitors
IEC 60331	Fire resisting characteristics of electric cables
IEC 60332	Tests for Electric Cables under Fire Conditions
IEC 60335	Safety of electrical household appliances
IEC 60341	Push-Button Switches
IEC 60342	Safety Requirements for Electric Fans and Regulators
IEC 60344	Guide to the Calculation of Resistance of Plain and Coated Copper Conductors of Low-Frequency Cables and Wires-Edition 2
IEC 60354	Loading Guide for Oil-Immersed Power Transformers-Second Edition
IEC 60355	Appraisal of the Problems of Accelerated Testing for Atmospheric Corrosion
IEC 60356	Dimensions for Commutators and Slip-Rings
IEC 60359	Electrical and Electronic Measurement Equipment -Expression of Performance-Third Edition
IEC 60364	Electrical Installations of Buildings
IEC 60367	Cores for Inductors and Transformers for Telecommunications
IEC 60371	Specification for Insulating Materials Based on Mica
IEC 60376	Specification of technical grade SF6 for use in electrical equipment
IEC 60381	Analogue Signals for Process Control Systems
IEC 60383-1 IEC 60383-2	Insulators for overhead lines; Definitions, test methods and acceptance criteria Insulators strings and insulator sets; Definitions, test methods and acceptance criteria
IEC 60384	Fixed Capacitors for Use in Electronic Equipment
IEC 60391	Marking of Insulated Conductors
IEC 60398	Installations for electroheating and electromagnetic processing - General test methods
IEC 60404	Magnetic Materials
IEC 60408	Low-voltage air-break switches air-break disconnectors air-break switch-disconnectors and fuse-combination units – Edition 2
IEC 60413	Test procedures for determining physical properties of brush materials for electrical machines
IEC 60414	Safety Requirements for Indicating and Recording Electrical Measuring Instruments and Their Accessories

IEC 60417 60417 DB SNAPSHOT	Graphical symbols for use on equipment Graphical symbols for use on equipment-DATABASE SNAPSHOTS: 02/06/2009
IEC 60420	High voltage alternating current switch fuse combinations
IEC 60422	Supervision and maintenance guide for mineral insulating oils in electrical equipment
IEC 60423	Conduits for electrical purposes - Outside diameters of conduits for electrical installations and threads for conduits and fittings-Edition 2.0
IEC 60427	High-voltage alternating current circuit-breakers
IEC 60428	Standard cells
IEC 60429	Classification of Resistance Wires for Heating Purposes
IEC 60433	Insulators for overhead lines with a nominal voltage above 1000 V – Ceramic insulators for A.C. systems – characteristics of insulator units of the long rod type
IEC 60437	Radio Interference Test on High-Voltage Insulators
IEC 60438	Tests and Dimensions for High-Voltage D.C. Insulators
IEC 60439	Low voltage switchgear and control gear assemblies
60439-1	Part 1: Enclosed low-voltage switchgear and controlgear Type-tested and partially type-tested assemblies (VDE 0660 Part 500)
60439-2	Part 2: Low-voltage switchgear and controlgear assemblies - Particular requirements for busbartrunking systems (busways) (VDE 0660 Part 502)
60439-3	Part 3: Low-voltage switchgear and controlgear assemblies - Particular requirements for low-voltage switchgear and controlgear assemblies intended to be installed in places where unskilled persons have access for their use - Distribution boards (VDE 0660 Part 504)
60439-4	Part 4: Low-voltage switchgear and controlgear assemblies - Particular requirements for assemblies for construction sites (ACS) (VDE 0660 Part 501)
60439-5	Part 5: Low-voltage switchgear and controlgear assemblies - Particular requirements for assemblies intended to be installed outdoors in public places- Cable distribution cabinets (CDCs) (VDE 0660 Part 503)
IEC TR 60440	Method of Measurement of Non-Linearity in Resistors-Edition
IEC 60445	Basic and safety principles for man-machine interface (MMI) marking and identification - Identification of equipment terminals and conductor terminations-Edition 4.0
IEC 60446	Basic and safety principles for man-machine interface (MMI) marking and identification - Identification of conductors by colors or alphanumeric-Edition 4.0
IEC 60447	Basic and safety principles for man-machine interface (MMI) marking and identification Actuating principles-Third Edition
IEC 60451	Maximum Case Dimensions for Capacitors and Resistors
IEC 60461	Time and control code-Edition 4.0
IEC 60466	A.C. Insulation-Enclosed Switchgear and Controlgear for Rated Voltages Above 1 kV and up to and Including 38 kV
IEC 60468	Method of Measurement of Resistivity of Metallic Materials
IEC 60470	High-voltage alternating current contactors and contactor-based motor-starters
IEC 60475	Method of Sampling Liquid Dielectrics
IEC 60477	Laboratory d.c. Resistors-First Edition; Amendment 1
60477-2 AMD 1	Laboratory Resistors Part 2: Laboratory a.c. Resistors-First Edition; Amendment 1
IEC 60478	Stabilized power supplies d.c. output
IEC 60479	Effects of current on human beings and livestock
60479-1	Part 1: General aspects
60479-2	Part 2: Special aspects
60479-3	Part 3: Effects of currents passing through the body of livestock
IEC 60485	Digital Electronic D.C. Voltmeters and D.C. Electronic Analogue-to-Digital Convertors
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IEC TS 61394	Overhead Lines - Characteristics of Greases for AluminiumAluminium Alloy and Steel Bare Conductors

IEC 61400	Wind turbines
61400-1	Part 1: Design requirements-Edition 3
61400-2	Part 2: Design requirements for small wind turbines-Edition 2.0
61400-3	Part 3: Design requirements for offshore wind turbines
61400-11	Part 11: Acoustic noise measurement techniques-Edition 2.1; Consolidated Reprint
61400-12-1	Part 12-1: Power performance measurements of electricity producing wind turbines-Edition 1; Supersedes IEC 61400-12
61400-13	Part 13: Measurement of Mechanical Loads
61400-14	Part 14: Declaration of apparent sound power level and tonality values
61400-21	Part 21: Measurement and assessment of power quality characteristics of grid connected wind turbines-Edition 2.0
61400-22	Part 22: Conformity testing and certification
61400-23	Part 23: Full-Scale Structural Testing of Rotor Blades
61400-24	Part 24: Lightning protection
61400-25-1	Part 25-1: Communications for monitoring and control of wind power plants - Overall description of principles and models
61400-25-2	Part 25-2: Communications for monitoring and control of wind power plants - Information models
61400-25-3	Part 25-3: Communications for monitoring and control of wind power plants - Information exchange models
61400-25-4	Part 25-4: Communications for monitoring and control of wind power plants - Mapping to communication profile-Edition 1.0; Includes Access to Additional Content
61400-25-5	Part 25-5: Communications for monitoring and control of wind power plants - Conformance testing
IEC TS 61423	Heating Cables for Industrial Applications
IEC 61439	Low-Voltage switchgear and controlgear assemblies
IEC 61443	Short-Circuit Temperature Limits of Electric Cables with Rated Voltages Above 30 kV (Um = 36 kV)
IEC TR 61459	Low-Voltage Fuses - Coordination between Fuses and Contactors/Motor-Starters - Application Guide
IEC 61462	Composite hollow insulators - Pressurized and unpressurized insulators for use in electrical equipment with rated voltage greater than 1 000 V - Definitions test methods acceptance criteria and design recommend
IEC TS 61463	Bushings - Seismic Qualification-Edition 1.1; Edition 1:1996 Consolidated with Amendment 1:2000
IEC TS 61464	Insulated Bushings - Guide for the Interpretation of Dissolved Gas Analysis (DGA) in Bushings where Oil is the Impregnating Medium of the Main Insulation (General Paper)-First Edition; Corrigendum 1: 1/2003
IEC 61466	Composite String Insulator Units for Overhead Lines with a Nominal Voltage Greater Than 1 000 V
IEC 61467	Insulators for overhead lines - Insulator strings and sets for lines with a nominal voltage greater than 1000 V - AC power arc tests
IEC 61472	Live Working - Minimum Approach Distances - Method of Calculation
IEC 61477	Live Working - Minimum Requirements for the Utilization of Tools Devices and Equipment-Edition 1.2; Edition 1: 2001 Consolidated with Amendment 1: 2002 and 2: 2004
IEC 61478	Live Working - Ladders of Insulating Material -First Edition; Amendment 1: 02 2003
IEC 61479	Live Working - Flexible Conductor Covers (Line Hoses) of Insulating Material-First Edition; Amendment 1: 05-2002
IEC 61481	Live Working - Portable Phase Comparators for Use on Voltages from 1 kV to 36 kV a.c.-Edition 1.1; Edition 1: 2001 Consolidated with Amendment 1: 2002; Corrigendum 1: 11/2002; Amendment 2: 04/2004
IEC 61482	Live Working - Flame-Resistant Materials for Clothing for Thermal Protection of Workers - Thermal Hazards of an Electric Arc
IEC 61491	Electrical equipment of industrial machines - Serial data link for real-time communication between controls and drives
IEC 61496	Safety of machinery - Electro-sensitive protective equipment
IEC 61499	Function blocks
IEC 61508	Functional safety of electrical/electronic/programmable electronic safety-related systems
IEC 61511	Functional safety – safety instrumented systems for the process industry sector

IEC 61523	Delay and Power Calculation Standards
IEC 61537	Cable management – Cable tray systems and cable ladder systems
IEC 61554	Panel Mounted Equipment - Electrical Measuring Instruments - Dimensions for Panel Mounting
IEC 61557	Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c. - Equipment for testing measuring or monitoring of protective measures
IEC 61558	Safety of power transformers, power supply units and similar, Edition 2.1; Consolidated Reprint
61558-1	Part 1: General requirements and tests-Edition 2.1; Consolidated Reprint
61558-2-1	Part 2-1: Particular requirements and tests for separating transformers and power supplies incorporating separating transformers for gen
61558-2-2	Part 2-2: Particular Requirements for Control Transformers-Edition 2.0
61558-2-3	Part 2-3: Particular requirements and tests for ignition transformers for gas and oil burners-Edition 2.0
61558-2-4	Part 2-4: Particular requirements and tests for isolating transformers and power supply units
61558-2-5	Part 2-5: Particular requirements and test for transformer for shavers power supply units for shavers and shaver supply units
61558-2-6	Part 2-6: Particular requirements and tests for safety isolating transformers and power supply units
61558-2-7	Part 2-7: Particular requirements and tests for transformers and power supplies for toys-Edit 2.0
61558-2-8	Part 2-8: Particular requirements and tests for transformers and power supply units for bells and chimes-Edition 2.0
61558-2-9	Part 2-9: Particular requirements and tests for transformers and power supply units for class III hand lamps for tungsten filament lamp
61558-2-12	Part 2-12: Particular Requirements for Constant Voltage Transformers
61558-2-13	Part 2-13: Particular requirements and tests for auto transformers and power supply units incorporating
61558-2-15	Part 2-15: Particular Requirements for Isolating Transformers for the Supply of Medical Locations
61558-2-16	Part 2-16: Particular requirements and tests for switch mode power supply units and transformers
61558-2-20	Part 2-20: Particular requirements and tests for small reactors-Edition 2.0
61558-2-23	Part 2-23: Particular Requirements for Transformers for Construction Sites-First Edition 05-2000
IEC 61587	Mechanical structures for electronic equipment - Tests for IEC 60917 and IEC 60297
IEC TR 61597	Overhead Electrical Conductors - Calculation Methods for Stranded Bare Conductors
IEC 61620	Insulating Liquids - Determination of the Dielectric Dissipation Factor by Measurement of the Conductance and Capacitance - Test Method
IEC 61621	Dry Solid Insulating Materials - Resistance Test to High-Voltage Low-Current Arc Discharges
IEC TR 61634	High-Voltage Switchgear and Controlgear - Use and Handling of Sulphur Hexafluoride (SF ₆) in High-Voltage Switchgear and Controlgear
IEC TS 61639	Direct connection between power transformers and gas-insulated metal-enclosed switchgear for rated voltages of 725 kV and above
IEC TS 61640	Rigid High-Voltage Gas-Insulated Transmission Lines for Rated Voltage of 725 kV and Above
IEC 61641	Guide for testing under internal arc fault conditions
IEC TR 61641	Enclosed low voltage switchgear and controlgear assemblies - Guide for testing under conditions of arcing due to internal fault-Edition 2.0
IEC 61642	Industrial a.c. Networks Affected by Harmonics – Application of Filters and Shunt Capacitors
IEC 61643	Surge protective devices connected to low-voltage power distribution systems
IEC 61666	Industrial Systems Installations and Equipment and Industrial Products - Identification of Terminals within a System
IEC 61672	Electroacoustics – Sound level meters
IEC 61690	Electronic design interchange format, EDIF
IEC 61709	Electronic Components - Reliability - Reference Conditions for Failure Rates and Stress Models for Conversion

IEC 61710	Power Law Model
IEC 61730	Photovoltaic modules
IEC 61753	Fibre optic interconnecting devices and passive components performance standard
IEC 61754 - 61755	Fibre Optic Connector Interfaces
IEC 61773	Overhead lines – Testing of foundation for structures
IEC 61784	Industrial communication networks – Profiles
IEC 61788	Superconductivity
IEC 61800	Adjustable Speed Electrical Power Drive Systems
61800-1	Part 1: General Requirements - Rating Specifications for Low Voltage Adjustable Speed d.c. Power Drive Systems
61800-2	Part 2: General Requirements - Rating Specifications for Low Voltage Adjustable Frequency a.c. Power Drive Systems
61800-3	Part 3: EMC requirements and specific test methods-Second Edition
61800-4	Part 4: General Requirements - Rating Specifications for a.c. Power Drive Systems above 1 000 V a.c. and not Exceeding 35 kV
61800-5-1	Part 5-1: Safety requirements - Electrical thermal and energy-Edition 2.0
61800-5-2	Part 5-2: Safety requirements – Functionalsystems
61800-6	Part 6: Guide for determination of types of load duty and corresponding current ratings-First Edition; Replaces IEC 61136-1
61800-7-1	Part 7-1: Generic interface and use of profiles for power drive systems - Interface definition
61800-7-201	Part 7-201: Generic interface and use of profiles for power drive systems - Profile type 1 specification
61800-7-202	Part 7-202: Generic interface and use of profiles for power drive systems - Profile type 2 specification
61800-7-203	Part 7-203: Generic interface and use of profiles for power drive systems - Profile type 3 specification
61800-7-204	Part 7-204: Generic interface and use of profiles for power drive systems - Profile type 4 specification
61800-7-301	Part 7-301: Generic interface and use of profiles for power drive systems - Mapping of profile type 1 to network technologies
61800-7-302	Part 7-302: Generic interface and use of profiles for power drive systems - Mapping of profile type 2 to network technologies
61800-7-303	Part 7-303: Generic interface and use of profiles for power drive systems - Mapping of profile type 3 to network technologies
61800-7-304	Part 7-304: Generic interface and use of profiles for power drive systems - Mapping of profile type 4 to network technologies
61800-8	Part 8: Specification of voltage on the power interface
IEC 61803	Determination of Power Losses in High-Voltage Direct Current (HVDC) Converter Stations-First Edition; Corrigendum 10-1999
IEC 61810	Electromechanical elementary relays
IEC 61811	Electromechanical Non-Specified Time All-Or-Nothing Relays of Assessed Quality
IEC 61812	Specified Time Relays for Industrial Use
IEC TR 61818	Application guide for low-voltage fuses
IEC 61836	Solar photovoltaic energy systems - Terms definitions and symbols-Edition 2.0
IEC 61850	Communication Networks and Systems in Substations
IEC 61854	Overhead Lines - Requirements and Tests for Spacers
IEC 61857	Electrical insulation systems - Procedures for thermal evaluation
IEC 61865	Overhead Lines - Calculation of the Electrical Component of Distance between Live Parts and Obstacles - Method of Calculation
IEC 61868	Mineral Insulating Oils - Determination of Kinematic Viscosity at Very Low Temperatures
IEC 61869	Instrument transformers
IEC 61882	Hazard and Operability Studies (HAZOP Studies) - Application Guide
IEC 61897	Overhead Lines - Requirements and Tests for Stockbridge Type Aeolian Vibration Dampers

IEC TR 61901	Development tests recommended on cables with a longitudinally applied metal foil for rated voltages above 30 kV ($U_m = 36$ kV)
IEC 61907	Communication network dependability engineering
IEC TR 61911	Live Working - Installation of Distribution Line Conductors - Stringing Equipment and Accessory Items
IEC TR 61912 61912-1 61912-2	Low-voltage switchgear and controlgear – Overcurrent protective devices Part 1: Application of short-circuit ratings Part 2: Selectivity under over-current conditions
IEC 61915	Low-voltage switchgear and controlgear - Device profiles for networked industrial devices
IEC TR 61916	Electrical Accessories - Harmonization of General Rules
IEC 61921	Power capacitors Low-voltage power factor correction banks
IEC 61922	High-frequency induction heating installations – Test methods for the determination of power output of the generator
IEC TS 61934	Electrical insulating materials and systems - Electrical measurement of partial discharges (PD) under short rise time and repetitive voltage impulses
IEC 61936	Power installations exceeding 1 kV a.c.
IEC 61950	Cable Management Systems - Specification for Conduit Fittings for Electrical Installations for Extra-Heavy Duty Metal Conduit
IEC 61952	Insulators for overhead lines - Composite line post insulators for A.C. systems with a nominal voltage greater than 1 000 V - Definitions test methods and acceptance criteria-Edition 2.0
IEC 61954	Power Electronics for Electrical Transmission and Distribution Systems - Testing of Thyristor Valves for Static VAR Compensators-Edition 1.1; Edition 1: 1999 Consolidated With Amendment 1: 2003
IEC 61958	High-Voltage Prefabricated Switchgear and Controlgear Assemblies - Voltage Presence Indicating Systems
IEC 61968	Application integration at electric utilities – System interfaces for distribution management
IEC 61969	Mechanical Structures for Electronic Equipment - Outdoor Enclosures
IEC 61970	Application integration at electric utilities – Energy management system application program interface (EMS-API)
IEC 61972	Method for determining losses and efficiency of three-phase cage induction motors
IEC 61975	High-voltage direct current (HVDC) installations - System tests
IEC 61984	Connectors - Safety Requirements and Tests
IEC 62001	High-voltage direct current (HVDC) systems - Guidebook to the specification and design evaluation of A.C. filters
IEC 62004	Thermal-resistant aluminium alloy wire for overhead line conductor
IEC 62006	Hydraulic machines - Acceptance tests of small hydroelectric installations
IEC 62007	Semiconductor optoelectronic devices for fibre optic system applications
IEC 62019	Electrical Accessories - Circuit-Breakers and Similar Equipment for Household Use - Auxiliary Contact Units
IEC 62020	Electrical Accessories - Residual Current Monitors for Household and Similar Uses (RCMs)-First Edition; Amendment 1: 9/2003
IEC 62023	Structuring of Technical Information and Documentation
IEC 62026	Low-voltage switchgear and controlgear - Controller-device interfaces (CDIs)
IEC 62027	Preparation of Parts Lists
IEC 62032	Guide for the application specification and testing of phase-shifting transformers-Edition 1; Same as IEEE C57.135
IEC 62040 62040-1 62040-2 62040-3	Uninterruptible power systems Part 1: General and safety requirements for UPS Part 2: Electromagnetic compatibility (EMC) requirements-Edition 2 Part 3: Method of Specifying the Performance and Test Requirements-First Edition; Cancels and Replaces IEC 60146-4: 1986 and IEC 60146-5: 1988; Corrigendum 1: 7/2003
IEC 62041	EMC requirements for power transformers, power supplies, reactors and similar products

IEC 62051	Electricity metering - Data exchange for meter reading tariff and load control
IEC 62052	Electricity metering equipment (AC) General requirements tests and test conditions, Replaces IEC 61036
IEC 62053	Electricity metering equipment (a.c.) Particular requirements
IEC 62054	Electricity metering (a.c.) Tariff and load control
IEC 62055	Electricity metering - Payment metering systems
IEC 62056	Electricity Metering - Data Exchange for Meter Reading Tariff and Load Control
IEC 62058	Electricity metering equipment (AC) - Acceptance inspection
IEC 62059	Electricity metering equipment - Dependability
IEC 62061	Safety of machinery: Functional safety of electrical, electronic and programmable electronic control systems
IEC TR 62063	High-Voltage Switchgear and Controlgear - The Use of Electronic and Associated Technologies in Auxiliary Equipment of Switchgear and Controlgear
IEC TR 62066	Surge Overvoltages and Surge Protection in Low-Voltage a.c. Power Systems - General Basic Information
IEC 62067	Power cables with extruded insulation and their accessories for rated voltages above 150 kV (Um = 170 kV) up to 500 kV (Um = 550 kV) - Test methods and requirements- Edition 1.1 * Consolidated Reprint
IEC TR 62068	Electrical Insulation Systems (EIS) - Electrical Stresses Produced by Repetitive Impulses
IEC TS 62073	Guidance on the measurement of wettability of insulator surfaces
IEC 62076	Industrial electroheating installations – Test methods for induction channel and induction crucible furnaces
IEC 62079	Preparation of Instructions - Structuring Content and Presentation
IEC TR 62095	Electric cables Calculations for current ratings Finite element method
IEC 62097	Hydraulic machines radial and axial - Performance conversion method from model to prototype-Edition 1.0; Includes Access to Additional Content
IEC TS 62101	Electrical insulation systems Short-time evaluation of combined thermal and electrical stresses
IEC 62103	Electronic equipment for use in power installations
IEC 62109	Safety of power converters for use in photovoltaic power systems
IEC 62114	Electrical Insulation Systems (EIS) - Thermal Classification
IEC TR 62140	Fossil-fired steam power stations
IEC TR 62125	Environmental statement specific to IEC TC 20 - Electric cables
IEC 62153	Metallic communication cable test methods
IEC 62155	Hollow pressurized and unpressurized ceramic and glass insulators for use in electrical equipment with rated voltages greater than 1 000 V-First Edition; Replaces IEC 60233: 1974 and IEC 61264
IEC TR 62195	Power System Control and Associated Communications - Deregulated Energy Market Communications-First Edition; Amendment 1: 04-2002
IEC 62196	Plugs and sockets for charging electric vehicles
IEC 62197	Connectors for electronic equipment Quality assessment requirements
IEC 62199	Bushings for d.c. application
IEC 62208	Low voltage switchgear and controlgear assemblies: Empty enclosures
IEC 62217	Polymeric insulators for indoor and outdoor use with a nominal voltage >1 000 V General definitions test methods and acceptance criteria
IEC 62219	Overhead Electrical Conductors - Formed Wire Concentric Lay Stranded Conductors
IEC 62223	Insulators - Glossary of terms and definitions
IEC 62230	Electric cables - Spark-test method
IEC 62231	Composite station post insulators for substations with a.c. voltages greater than 1 000 V up to 245 kV - Definitions test methods and acceptance criteria
IEC 62256	Hydraulic turbines storage pumps and pump-turbines - Rehabilitation and performance improvement

IEC 62257	Recommendations for small renewable energy and hybrid systems for rural electrification
62257-1	Part 1: General introduction to rural electrification
62257-2	Part 2: From requirements to a range of electrification systems
62257-3	Part 3: Project development and management
62257-4	Part 4: System selection and design
62257-5	Part 5: Protection against electrical hazards-First Edition; Cancels and replaces the relevant parts of IEC/PAS 62111
62257-7	Part 7: Generators
62257-7-1	Part 7-1: Generators - Photovoltaic arrays
62257-7-3	Part 7-3: Generator set - Selection of generator sets for rural electrification systems
62257-8-1	Part 8-1: Selection of batteries and battery management systems for stand-alone electrification systems
62257-9-1	Part 9-1: Micropower systems
62257-9-2	Part 9-2: Microgrids-Edition 1.0; Partially supersedes IEC/PAS 62111
62257-9-3	Part 9-3: Integrated system - User interface-Edition 1.0; Partially supersedes IEC/PAS 62111
62257-9-4	Part 9-4: Integrated system - User installation-Edition 1.0; Partially supersedes IEC/PAS 62111
62257-9-5	Part 9-5: Integrated system - Selection of portable PV lanterns for rural electrification projects
62257-9-6	Part 9-6: Integrated system - Selection of Photovoltaic Individual Electrification Systems (PV-IES)
62257-12-1	Part 12-1: Selection of self-ballasted lamps (CFL) for rural electrification systems and recommendations for household light
IEC 62262	Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)
IEC 62264	Enterprise-control system integration
IEC 62270	Hydroelectric power plant automation Guide for computer-based control

IEC 62271	Standards for high-voltage switchgear and controlgear
62271-1	Part 1: Common specifications for high-voltage switchgear and controlgear standards
62271-3	Part 3: Digital interfaces based on IEC 61850
62271-100	Part 100: High-voltage switchgear and controlgear - High-voltage alternating-current circuit-breakers
62271-101AMD1	Part 101 AMD: Synthetic testing
62271-102	Part 102: Alternating current disconnectors and earthing switches
62271-104	Part 104: Alternating current switches for rated voltages of 52 kV and above-Edition
62271-105	Part 105: Alternating current switch-fuse combinations
62271-107	Part 107: Alternating current fused circuit-switchers for rated voltages above 1 kV up to and including 52 kV
62271-108	Part 108: High-voltage alternating current disconnecting circuit-breakers for rated voltages of 72.5 kV and above
62271-109	Part 109: Alternating-current series capacitor by-pass switches
62271-110	Part 110: Inductive load switching
62271-111	Part 111: Overhead pad-mounted dry vault and submersible automatic circuit reclosers and fault interrupters for alternating current systems up to 38 kV
62271-200	Part 200: Alternating current metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV
62271-201	Part 201: AC insulation-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV
62271-202	Part 202: High-voltage/low voltage prefabricated substations
62271-203	Part 203: Gas-insulated metal-enclosed switchgear for rated voltages above 52 kV- Replaces IEC 60517
62271-205	Part 205: Compact switchgear assemblies for rated voltages above 52 kV
62271-207	Part 207: Seismic qualification for gas-insulated switchgear assemblies for rated voltages above 52 kV
IEC TR 62271-208	Part 208: Methods to quantify the steady state power-frequency electromagnetic fields generated by HV switchgear assemblies and HV/LV prefabricated substations
62271-209	Part 209: Cable connections for gas-insulated metal-enclosed switchgear for rated voltages above 52 kV - Fluid-filled and extruded insulation cables
IEC TR 62271-300	Part 300: Seismic qualification of alternating current circuit-breakers
IEC TR 62271-301	Part 301: Dimensional standardisation of high-voltage terminals-Edition 2.0
IEC TR 62271-302	Part 302: Alternating current circuit-breakers with intentionally non-simultaneous pole operation
IEC TR 62271-303	Part 303: Use and handling of sulphur hexafluoride (SF6)
IEC TS 62271-304	Part 304: Design classes for indoor enclosed switchgear and controlgear for rated voltages above 1 kV up to and including 52 kV to be used in severe climatic conditions
IEC TR 62271-305	Part 305: Capacitive current switching capability of air-insulated disconnectors for rated voltages above 52 kV
IEC TR 62271-308	Part 308: Guide for Asymmetrical Short-Circuit Breaking Test Duty T100a
IEC TR 62271-310	Part 310: Electrical endurance testing for circuit-breakers above a rated voltage of 52kV
IEC 62282	Fuel cell technologies
IEC 62305	Protection Against Lightning
IEC 62308	Equipment reliability - Reliability assessment methods
IEC 62309	Dependability of products containing reused parts Requirements for functionality and tests
IEC 62310-1	Static transfer systems (STS)
62310-1	Part 1: General and safety requirements
62310-2	Part 2: Electromagnetic compatibility (EMC) requirements
62310-3	Part 3: Method for specifying performance and test requirements
IEC 62314	Solid-state relays
IEC 62325	Standards related to energy market models & communications
IEC TS 62332	Electrical insulation systems (EIS) Thermal evaluation of combined liquid and solid components
IEC 62337	Commissioning of electrical instrumentation and control systems in the process industry - Specific phases and milestones
IEC PAS 62344	General guidelines for the design of ground electrodes for high-voltage direct current (HVDC) links
IEC 62351	Power System Control and Associated Communications – Data and Communication Security

IEC TS 62371	Characteristics of hollow pressurised and unpressurised ceramic and glass insulators for use in electrical equipment with rated voltages greater than 1000 V
IEC 62391	Fixed electric double-layer capacitors for use in electronic equipment
IEC 62395	Electrical resistance trace heating systems for industrial and commercial applications
IEC 62420	Concentric lay stranded overhead electrical conductors containing one or more gap(s)
IEC 62424	Representation of process control engineering - Requests in P&I diagrams and data exchange between P&ID tools and PCE-CAE tools
IEC 62428	Electric power engineering - Modal components in three-phase a.c. systems - Quantities and transformations
IEC 62440	Electric cables with a rated voltage not exceeding 450/750 V - Guide to use
IEC 62446	Grid connected photovoltaic systems - Minimum requirements for system documentation commissioning tests and inspection
IEC 62455	Internet protocol (IP) and transport stream (TS) based service access
IEC 62474	Material declaration for products of and for the electrotechnical industry
IEC 62491	Industrial systems installations and equipment and industrial products - Labelling of cables and cores
IEC 62501	Voltage sourced converter (VSC) valves for high-voltage direct current (HVDC) power transmission - Electrical testing
IEC 62502	Analysis techniques for dependability – Event tree analysis (ETA)
IEC TR 62510	Standardising the characteristics of electricity
IEC PAS 62515	Requirements concerning the interoperability between electromechanical and electrical applications in CAx-systems
IEC 62539	Guide for the statistical analysis of electrical insulation breakdown data
IEC PAS 62543	DC transmission using voltage sourced converters
IEC PAS 62544	Active filters in HVDC applications
IEC PAS 62559	IntelliGrid Methodology for Developing Requirements for Energy Systems
IEC 62578	Power electronics systems and equipment - Operation conditions and characteristics of active infeed converter applications
IEC TR 62602	Conductors of insulated cables - Data for AWG and KCMIL sizes
IEC 62693	Industrial electroheating installations – Test methods for infrared electroheating installations
IEC 62796	Energy efficiency in electroheating installations
IEC 62798	Industrial electroheating equipment – Test methods for infrared emitters
IEC 745	Safety of Hand-Held Motor-Operated Electric Tools
IEC 7498	Information Processing Systems - Open Systems Interconnection - Basic Reference Model
IEC 8571	Information Processing Systems - Open Systems Interconnection - File Transfer Access and Management
IEC 9041	Information Technology - Open Systems Interconnection - Virtual Terminal Basic Class Protocol
IEC 9066	Information Processing Systems - Text Communication - Reliable Transfer
IEC 9072	Information Processing Systems - Text Communication - Remote Operations
IEC 7	Vocabulary of Fundamental Concepts
IEC 80000	Quantities and units
IEC 80416	Basic principles for graphical symbols for use on equipment
IEC 81714	Design of graphical symbols for use in the technical documentation of products
IEC DICT	IEC Multilingual Dictionary-Edition 6
IEC CISPR 14-1 IEC CISPR 14-2	Electromagnetic Compatibility - Requirements for Household Appliances Electric Tools and Similar Apparatus
IEC CISPR 22 IEC CISPR 24	Information technology equipment - Limits and methods of measurement-Edition 5; Amendment 1: 07/2005; Amendment 2: 01/2006

4.2 IEC standards for substation design

In the interest of EU and worldwide harmonization, the rules of CENELEC impose an obligation to adopt certain standards of the IEC and also European standards (EN) issued by CENELEC. Agreement between IEC and CENELEC regulate the incorporation of international standards into national standards. National standard agency should take responsibility for the publication of respective standards translated into certain national language without deviation. The following list shows an overview of the most important IEC standards for switchgear engineering.

Table 2: IEC standards for switchgear engineering

Power installations	
IEC 60364	Electrical Installations of Buildings
IEC 60909	Short-Circuit Current Calculation in Three-Phase A.C. Systems
IEC 60865	Short Circuit Current: Calculation of Effects
IEC 60664	Insulation Co-ordination within Low-Voltage Systems
IEC60071	Insulation coordination
IEC 60204	Safety of machinery - Electrical equipment of industrial machines
IEC 61140	Protection against electric shocks
IEC 60079	Electrical Installations in Hazardous Areas
IEC 62305	Protection Against Lightning
IEC 60073	Basic Safety principles for man-machine interface (MMI)
IEC 60446	
Conductors	
IEC 61773	Overhead lines – Testing of foundation for structures
IEC 61284	Overhead lines – Requirements and tests of fittings
IEC 60245	Rubber-Insulated Cables
IEC 60228	Conductor of Insulated Cables
Insulating materials	
IEC 60505	Evaluation and Qualification of Electrical Insulation Systems-Second Edition
IEC 60610	Principal Aspects of Functional Evaluation of Electrical Insulation Systems: Aging Mechanisms and Diagnostic Procedures
IEC 60611	Guide for the Preparation of Test Procedures for Evaluating the Thermal Endurance of Electrical Insulation Systems
IEC 60112	Method for the determination of the proof and the comparative tracking indices of solid insulating materials
IEC 60243	Methods of Test for Electric Strength of Solid Insulating Materials
IEC 60216	Guide for the Determination of Thermal Endurance Properties of Electrical Insulating Materials
IEC 60296	Specification for Unused Mineral Insulating Oils for Transformers and Switchgear
IEC 60422	Supervision and maintenance guide for mineral insulating oils in electrical equipment
IEC 60156	Insulating Liquids
IEC 60376	Specification of technical grade SF6 for use in electrical equipment
Measurement, Control, Testing	
IEC 61010	Safety requirements for electrical equipment for measurement, control and laboratory use
IEC 61557	Electrical safety in low voltage distribution systems up to 1 KV a.c. and 1.5 KV d.c.
IEC 61557-2	Insulation resistance
IEC 61557-3	Loop impedance
IEC 61557-4	Resistance of earth connection and equipotential bonding
IEC 61557-5	Resistance to earth
IEC 61557-7	Phase sequence
IEC 60044	Instrument transformers
IEC 62053	Electricity metering equipment (a.c.)
IEC 60514	Acceptance inspection of class 2 a.c. watt-hour meters
IEC 62054	Electricity metering (a.c.)
IEC 61358	Acceptance inspection for direct connected a.c. static watt-hour meters for active energy (classes 1 and 2)

IEC 60060	High-voltage test techniques
IEC 60270	
IEC 61083	Instruments and Software Used for Measurement in High-Voltage Impulse Tests
IEC 61810	Electromechanical elementary relays
IEC 61812	Specified Time Relays for Industrial Use
IEC 60255	Electrical Relays
IEC 60660	Insulators
Machines, Converters	
IEC 60034	Rotating electrical machinery
IEC 60076	Power transformers
IEC 60289	Reactors
IEC 60214	On-load tap changers
IEC 60146	Semiconductor convertors - General requirements and line commutated convertors
IEC 62040	Uninterruptible power systems
IEC 60871	Shunt Capacitors for a.c. Power Systems Having a Rated Voltage Above 1 KV
IEC 60143	Series capacitors for power systems
IEC 60831	Shunt power capacitors of the self-healing type for AC systems having a rated voltage up to and including 1 KV
IEC 60931	Shunt power capacitors of the non-self-healing type for AC systems having a rated voltage up to and including 1 KV
IEC 60252	AC motor capacitors
Installation material, Switchgear	
IEC 61386	Conduit systems
IEC 60670	Boxes and enclosures for electrical accessories for household and similar fixed electrical installations
IEC 60999	Connecting devices Electrical copper conductors Safety requirements for screw-type and screwless-type clamping units
IEC 60947	Standards for low-voltage switchgear and controlgear
IEC 60309	Plugs, socket-outlets and couplers for industrial purposes
IEC 60269	Low voltage fuses
IEC 62208	Low voltage switchgear and controlgear assemblies: Empty enclosures
IEC 62020	Electrical Accessories - Residual Current Monitors for Household and Similar Uses
IEC 60427	High-voltage alternating current circuit-breakers
IEC 61166	High-Voltage Alternating Current Circuit-Breakers
IEC 60265	High voltage switches
IEC 60282	High voltage fuses
IEC 61330	High-voltage/low voltage prefabricated substations
IEC 60694	Common Specifications For High-Voltage Switchgear and Controlgear Standards
IEC 62271	Standards for high-voltage switchgear and controlgear
IEC 60168	Tests on Indoor and Outdoor Post Insulators of Ceramic Material or Glass for Systems with Nominal Voltages Greater Than 1 KV
IEC 60099	Surge arresters
IEC 60900	Hand Tools for Live Working up to 1 K V A.C. and 1.5 KV D.C
IEC 61243	Live Working - Voltage Detectors
IEC 61230	Live Working – Portable equipment for earthing and short-circuiting
Information technology	
IEC 60950	Safety of information technology equipment
IEC 60127	Miniature Fuses
IEC 60691	Thermal links – requirements and application guide
IEC 60825	Safety of optical fibre communication systems (OFCS)
IEC 61000	Electromagnetic compatibility
IEC 61326	Electrical equipment for measurement, control and laboratory use – EMC requirements
IEC 60868	Flickermeter
IEC 60834	Teleprotection equipment of power system – performance and testing
IEC 60794	Optical fibres

4.3 Other relevant standards

Other than IEC 61386-24:2004 mechanical and electrical characteristics of HDPE conduits shall comply with the requirements of the following standards:

- DIN 53 479
- DIN 53 455
- DIN 53 456
- DIN 53 453
- DIN 52 612
- DIN 52 328
- DIN 53 481
- DIN 53 482

The following ISO, DIN and EN (EU) standards are often referred for general construction (e.g. substation buildings) and/or specific installations (e.g. compressor stations).

Table 3: ISO, DIN & EN standards relevant for construction works and specific installations

ISO 10077	Thermal performance of windows, doors, shutters
ISO 1328-2	Quality gears
ISO 2533	Standard atmosphere
ISO 5167	Measurement of fluid flow by means of pressure differential devices
ISO 6336	Calculation of load capacity of spur and helical gears
ISO 7240	Fire detection and alarm systems
ISO 8501	Preparation of steel substrates before application of paints and related products
ISO 8573	Class certification of air purity
ISO 898	Mechanical properties of fasteners made of carbon steel and alloy steel
DIN 1311	Vibrations, oscillations and vibration systems
DIN 1318	Loudness level
DIN 1320	Acoustics terminology
DIN 105	Clay masonry units
DIN 4102	Fire behavior of building materials and building components
DIN 4150	Structural vibration
DIN 51501	Lubricants, lubricating oils
DIN 625	Rolling bearings
DIN IEC 61117	Determining short-circuit withstand strength
DIN VDE 0100-729	Installation and connection of switchgear and control gear and distribution boards
DIN VDE 0603	Consumer units and meter panels
EN 13480	Metallic industrial piping
EN 14511	Air conditioners
EN 197	Cement
EN 1990	Basis of structural design
EN 1992	Design of concrete structures
EN 1993	Design of steel structures
EN 1998	Design of structures for earthquake resistance
EN 206	Concrete
EN 50274	Operation with partial protection against electric shock
EN 50300	Low voltage substation distribution boards (VDE 0660 Part 505)
EN13445	Unfired pressure vessels

5.0 BACKGROUND QUALITY AND SAFETY OF AN ELECTRICAL INSTALLATION

In so far as control procedures are respected, quality and safety will be assured only if:

- The initial checking of conformity of the electrical installation with the standard and regulation has been achieved
- The electrical equipment comply with standards
- The periodic checking of the installation recommended by the equipment manufacturer is respected.

5.1 Initial testing of an installation

Before a utility will connect an installation to its supply network, strict pre-commissioning electrical tests and visual inspections by the authority, or by its appointed agent, must be satisfied.

These tests are made according to local (governmental and/or institutional) regulations, which may differ slightly from one country to another. The principles of all such regulations however, are common, and are based on the observance of rigorous safety rules in the design and realization of the installation.

IEC 60364-6-61 and related standards included in this guide are based on an international consensus for such tests, intended to cover all the safety measures and approved installation practices normally required for residential, commercial and (the majority of) industrial buildings. Many industries however have additional regulations related to a particular product (petroleum, coal, natural gas, etc.). Such additional requirements are beyond the scope of this guide.

The pre-commissioning electrical tests and visual-inspection checks for installations in buildings include, typically, all of the following:

- Insulation tests of all cable and wiring conductors of the fixed installation, between phases and between phases and earth
- Continuity and conductivity tests of protective and earth-bonding conductors
- Resistance tests of earthing electrodes with respect to remote earth
- Verification of the proper operation of the interlocks, if any
- Check of allowable number of socket-outlets per circuit
- Cross-sectional-area check of all conductors for adequacy at the short-circuit levels prevailing, taking account of the associated protective devices, materials and installation conditions (in air, conduit, etc.)
- Verification that all exposed- and extraneous metallic parts are properly earthed (where appropriate)
- Check of clearance distances in bathrooms, etc.

These tests and checks are basic (but not exhaustive) to the majority of installations, while numerous other tests and rules are included in the regulations to cover particular cases, for example: TN-, TT- or IT-earthed installations, installations based on class 2 insulation, SELV circuits, and special locations, etc.

The aim of this guide is to draw attention to the particular features of different types of installation, and to indicate the essential rules to be observed in order to achieve a satisfactory level of quality, which will ensure safe and trouble-free performance.

The methods recommended in this guide, modified if necessary to comply with any possible variation imposed by a utility, are intended to satisfy all pre-commissioning test and inspection requirements.

5.2 Periodic check-testing of an installation

In many countries, all industrial and commercial-building installations, together with installations in buildings used for public gatherings, must be re-tested periodically by authorized agents.

Table 4 below shows the frequency of testing commonly prescribed according to the kind of installation concerned.

Table 4: Frequency of check-tests commonly recommended for an electrical installation

Type of installation	Testing frequency	
Installations which require the protection of employees	<ul style="list-style-type: none"> • Locations at which a risk of degradation, fire or explosion exists • Temporary installations at worksites • Locations at which MV installations exist • Restrictive conducting locations where mobile equipment is used 	Annually
	Other cases	Every 3 years
Installations in buildings used for public gatherings, where protection against the risks of fire and panic are required	According to the type of establishment and its capacity for receiving the public	From one to three years
Residential	According to local regulations	

6.0 conformity with standards of equipment used in installation

6.1 Attestation of conformity

The conformity of equipment with the relevant standards can be attested:

- By an official mark of conformity granted by the certification body concerned, or
- By a certificate of conformity issued by a certification body, or
- By a declaration of conformity from the manufacturer

The first two solutions are generally not available for high voltage equipment.

6.2 Declaration of conformity

Where the equipment is to be used by skilled or instructed persons, the manufacturer's declaration of conformity (included in the technical documentation), is generally recognized as a valid attestation. Where the competence of the

manufacturer is in doubt, a certificate of conformity can reinforce the manufacturer's declaration.

6.3 CE marking

In Europe, the European directives require the manufacturer or his authorized representative to affix the CE marking on his own responsibility. It means that:

- The product meets the legal requirements
- It is presumed to be marketable in Europe

The CE marking is neither a mark of origin nor a mark of conformity.

6.4 Mark of conformity

Marks of conformity are affixed on appliances and equipment generally used by ordinary non-instructed people (e.g. in the field of domestic appliances). A mark of conformity is delivered by certification body if the equipment meets the requirements from an applicable standard and after verification of the manufacturer's quality management system.

6.5 Certification of Quality

The standards define several methods of quality assurance which correspond to different situations rather than to different levels of quality.

6.6 Assurance

A laboratory for testing samples cannot certify the conformity of an entire production run: these tests are called type tests. In some tests for conformity to standards, the samples are destroyed (tests on fuses, for example).

Only the manufacturer can certify that the fabricated products have, in fact, the characteristics stated. Quality assurance certification is intended to complete the initial declaration or certification of conformity.

As proof that all the necessary measures have been taken for assuring the quality of production, the manufacturer obtains certification of the quality control system which monitors the fabrication of the product concerned. These certificates are issued by organizations specializing in quality control, and are based on the international standard ISO 9001: 2000.

These standards define three model systems of quality assurance control corresponding to different situations rather than to different levels of quality:

- Model 3 defines assurance of quality by inspection and checking of final products.
- Model 2 includes, in addition to checking of the final product, verification of the manufacturing process. For example, this method is applied, to the manufacturer of fuses where performance characteristics cannot be checked without destroying the fuse.
- Model 1 corresponds to model 2, but with the additional requirement that the quality of the design process must be rigorously scrutinized; for example, where it is not intended to fabricate and test a prototype (case of a custom-built product made to specification).

7.0 Environment

Environmental management systems can be certified by an independent body if they meet requirements given in ISO 14001. This type of certification mainly concerns industrial settings but can also be granted to places where products are designed.

A product environmental design sometimes called “eco-design” is an approach of sustainable development with the objective of designing products/services best meeting the customers’ requirements while reducing their environmental impact over their whole life cycle. The methodologies used for this purpose lead to choose equipment’s architecture together with components and materials taking into account the influence of a product on the environment along its life cycle (from extraction of raw materials to scrap) i.e. production, transport, distribution, end of life etc.

In Europe two Directives have been published, they are called:

- RoHS Directive (Restriction of Hazardous Substances) 2006 - aims to eliminate from products six hazardous substances: lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE).
- WEEE Directive (Waste of Electrical and Electronic Equipment) 2005 - in order to master the end of life and treatments for household and non household equipment.

In other parts of the world some new legislation will follow the same objectives.

In addition to manufacturers’ action in favor of products eco-design, the contribution of the whole electrical installation to sustainable development can be significantly improved through the design of the installation. Actually, it has been shown that an optimized design of the installation, taking into account operation conditions, MV/LV substations location and distribution structure (switchboards, busways, cables), can reduce substantially environmental impacts (raw material depletion, energy depletion, end of life).

8.0 Applicable Standards in Georgian Power Sector

In 2006 year Georgia regained the member status of ISO. In 2008 Georgia became member of CEN and from 2010 year Georgia is the associated member of IEC, that has increased availability of electrotechnical standards which are very important for Georgian power sector. Membership of IEC was the necessary condition for entering in the CENELEC as member that was fulfilled in 2010. It is worth to mention that for reaching DCFTA, one of the first requirement is to harmonize technical regulations in Georgian with European legislation. The membership of IEC and CENELEC assures that international and European standards are available for every stakeholder at Georgian National Agency for Standards and Metrology

Standardization organizations are listed below, whose standards are available through Georgian National Agency for standards and metrology:

- ISO (International Organization for Standardization);
- IEC (International Electrotechnical Commission);
- CEN (European Committee for Standardization);

- CENELEC (European Committee for Electrotechnical Standardization)

Despite Georgia's membership in the world recognized standardization organizations, by the order of minister of economy and sustainable development in 2011 year, Georgia readopted old soviet standards regarding projection, construction, operation, technical supervision, maintenance and testing of electrical installation and systems based on ГОСТ, ПТЭ, ПУЭ, СНИП.

- electrical equipments installation rules (ПУЭ) – 1987;
- electric equipments technical exploitation rules of Customers – 1986;
- Technical safety rules of exploitation of costumer's electrical equipments – 1986;
- Technical safety rules of exploitation of power station's and substation's electrical equipments – 1972;
- Electric installations technical exploitation rules (ПТЭ) – 1988;
- Synchronous hydroaggregates - 1955;
- Test rules of electrical machinery – 1978;
- Electrotechnical guidebook - 1980

Electrical installations and electrical system operation and safety standards are defined by the orders of minister of energy of Georgia, which are Georgian translations of older soviet documents:

- Technical exploitation rules of Power stations and electrical networks – 2008;
- Safety rules of power station exploitation – 2008.

Electricity supply quality norms are determined by GNERC resolution that obliges Electricity distribution licensee to ensure safe, continuous and reliable electricity supply of costumers:

- Electricity (capacity) Supply and Consumption Rules – 2008.

Recognition and adoption by Georgia of foreign countries technical regulations are defined by the resolution of the government of Georgia:

- Recognition of technical regulations and rules of conduct of foreign country by Georgia – 2006.

By this document Georgia recognizes part of technical regulations of EU member countries that defines only safety conditions and requirements of products and services that are deemed as obligatory. Also Georgia recognizes The New Approach and The Global Approach Directives of EU and all technical norms and standards harmonized with the directives. But at the same time, the resolution leaves in force the old standards for technical regulation (ГОСТ, СНИП) in Georgia.

9.0 Recommendations

To ensure transparency, facilitate harmonization with EU and foster power system development, part of IEC standards should become normative requirements in Georgia for new installations and gradually for existing grid users and service providers. State adopting IEC and other international standards need to be aware that they are developing “state of the art” standards, which must have the widest possible acceptance on the global market, but before accomplishment of acceptance, the following issues must be addressed:

- Specifics in legal and regulatory requirements;
- Specifics in technical infrastructures;
- Specifics in climatic conditions.

Beside above mentioned, particular recommendations for Georgian transmission and distribution networks are listed below:

- Reorganization of IEC standards in planning and operation. Besides EU and National Standards (e.g. BS, DIN VDE, etc.) most of European countries recognize and rely on relevant IEC standards;
- Adoption of Transmission and Distribution Grid Codes in Georgia, that sets up procedures and technical norms for all transmission and distribution grid users for design, planning, connection, usage and operation in both normal and emergency situations, with all necessary references to internationally recognized electrotechnical standards;
- All Plant and Apparatus at the Connection Point shall comply with the relevant Georgian standards, or in their absence, other IEC, DIN VDE, ГОСТ, ANSI, or IEEE standards, unless modified by any provision in the applicable Connection Agreement;
- All new installations should comply with generally applicable standards for the connection of electric equipment to the electric grid defined in Georgian Electricity Grid Codes;
- In Europe most commonly used standards are the IEC 61000 series. IEC 61000-3 Series: Electromagnetic compatibility (EMC), in particular Part, Limits on harmonics, distortion, voltage fluctuations.
- Plant and Apparatus connected to the Transmission Grid shall not impose current Harmonics on the Transmission Grid which exceed the limits specified in the latest revision of IEC/TR 61000-3-6: Electromagnetic compatibility Limits – Assessment of emission limits for the connection of distorting installations to MV, HV and EHV power systems;
- Generation units should be able to meet IEC 60034 and transformers IEC 60076 standard series;
- The Transmission Grid shall be designed to withstand the more probable contingencies without widespread system failure Single Contingency (N-1), Overlapping Single Contingency and Generator outage (N-G-1) and Trip - Maintenance (N-1-1) disturbances;
- No overloading on equipment shall be acceptable in planning and operation of power system, for all installation manufacturers specification and appropriate IEC Standards shall be followed;

- For purposes of rising metering quality and data reliability current and voltage transformers should comply with IEC 60044-1 and 60044-2 provisions, electricity meters – IEC 62053 provisions;
- Reorganization of IEC 60364 and 60479 standards. Currently, the safety principles of IEC 60364 and 60479-1 are the fundamentals of most electrical standards in the world, which have been established by medical and engineering experts of all countries in the world comparing their experience at an international level. Frequently countries using installation practices according to IEC 60364 have additionally enacted them into national law or regulations.
- Worldwide recommended practice is to implement IEC 61850 standard for substations, especially where multi-vendor equipment environment exists.

USAID Hydropower Investment Promotion Project (USAID-HIPP)

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