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Standardization organizations around the world

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I.1 The History of Standards and Electrical Engineering

The history of electrical engineering is inextricably linked to the development of standards, a partnership that transformed a field of wild experimentation into the foundation of the modern technological world. This evolution began with a "War of the Currents" and progressed through foundational safety and measurement standards to the complex interoperability protocols that underpin today's global digital infrastructure. In the late 19th century, the lack of standards was starkly evident in the battle between Thomas Edison's Direct Current (DC) and Nikola Tesla/George Westinghouse's Alternating Current (AC). This was more than a technical debate; it was a commercial war fought over fundamental system standards for power generation and transmission, which was ultimately won by AC's superior efficiency over long distances. This conflict highlighted the critical need for uniformity, leading to the establishment of the world's first dedicated electrical standards body, the International Electrotechnical Commission (IEC), in 1906. National bodies like the American Institute of Electrical Engineers (a precursor to IEEE) and Germany's VDE soon followed, tackling the immediate and dangerous challenges of safety, measurement, and component ratings.

The 20th century was defined by the drive for interconnection and compatibility. The rapid expansion of the power grid required standards for voltage, frequency, and plug/socket designs to ensure that electricity from any power plant could safely power any device in any home. This era of standardization enabled mass production and consumer confidence. The invention of the transistor and the integrated circuit then shifted the frontier of standardization from power to information. New standards were needed for the "alphabet" of digital communication, leading to codes like ASCII (American Standard Code for Information Interchange). The need to connect different computer systems drove the creation of open, consensus-based standards for data networks, most famously the TCP/IP protocol suite, which became the universal language of the internet. This culminated in the development of foundational technologies like Ethernet (IEEE 802.3).

A brief history of electrical engineering standards evolved from the need for consistent units in the 19th century to the creation of international organizations like the IEC and IEEE for global safety and interoperability. Early standards focused on defining fundamental units like the ohm and volt, which were later formalized in 1893. As electrical technology grew, standards also emerged for safety regulations, particularly after industrial accidents, leading to the first wiring rules and later the creation of bodies like the IEE (now IET) and the IEEE Standards Association.

And today, the role of standards is more crucial than ever, governing the wireless and miniaturized world. The Institute of Electrical and Electronics Engineers (IEEE) has become a global powerhouse, producing thousands of standards that enable seamless interoperability,

from Wi-Fi (IEEE 802.11) and Bluetooth to USB and power management in microchips. Without this intricate, invisible framework of standards, the complex global ecosystem of devices, networks, and the Internet of Things (IoT) would be a chaotic mess of incompatible parts, making the progress of electrical engineering from a scientific curiosity to the backbone of modern society impossible .

I.2 Food and Agriculture Organization

The Food and Agriculture Organization of the United Nations (FAO) is a specialized agency of the United Nations that leads international efforts to defeat hunger and improve nutrition and food security. Its Latin motto, *fiat panis*, translates to "let there be bread". It was founded on 16 October 1945 [?].

The FAO comprises 195 members, including 194 countries and the European Union. Its headquarters is in Rome, Italy, and it maintains regional and field offices worldwide, operating in over 130 countries. It helps governments and development agencies coordinate their activities to improve and develop agriculture, forestry, fisheries, and land and water resources. It also conducts research, provides technical assistance to projects, operates educational and training programs, and collects agricultural output, production, and development data.

The FAO is governed by a biennial conference representing each member country and the European Union, which elects a 49-member executive council.



Figure I.1: Food and agriculture organization logo.

I.3 World Health Organization

The World Health Organization (WHO) is a specialized agency of the United Nations responsible for international public health. It is headquartered in Geneva, Switzerland, and has six regional offices and 150 field offices worldwide [?].

The WHO was established on April 7, 1948, and formally began its work on September 1, 1948. It incorporated the assets, personnel, and duties of the League of Nations' Health Organization and the Paris-based Office International d'Hygiène Publique, including the

International Classification of Diseases (ICD). The agency's work began in earnest in 1951 after a significant infusion of financial and technical resources.

The WHO's official mandate is to promote health and safety while helping the vulnerable worldwide. It provides technical assistance to countries, sets international health standards, collects data on global health issues, and serves as a forum for scientific or policy discussions related to health. Its official publication, the World Health Report, provides assessments of worldwide health topics.

The WHO has played a leading role in several public health achievements, most notably the eradication of smallpox, the near-eradication of polio, and the development of an Ebola vaccine. Its current priorities include communicable diseases, such as HIV/AIDS, Ebola, malaria and tuberculosis; non-communicable diseases such as heart disease and cancer; healthy diet, nutrition, and food security; occupational health; and substance abuse. The agency advocates for universal health care coverage, engagement with the monitoring of public health risks, coordinating responses to health emergencies, and promoting health and well-being generally.

The WHO is governed by the World Health Assembly (WHA), which is composed of its 194 member states. The WHA elects and advises an executive board made up of 34 health specialists; selects the WHO's chief administrator.



Figure I.2: World health organization logo.

I.4 International Organization for Standardization

The International Organization for Standardization (ISO) is an independent, non-governmental, international standard development organization composed of representatives from the national standards organizations of member countries. Membership requirements are given in Article 3 of the ISO Statutes [?].

ISO was founded on 23 February 1947, and (as of July 2024) it has published over 25,000 international standards covering almost all aspects of technology and manufacturing. It has

over 800 technical committees (TCs) and subcommittees (SCs) to take care of standards development.

The organization develops and publishes international standards in technical and nontechnical fields, including everything from manufactured products and technology to food safety, transport, IT, agriculture, and healthcare. More specialized topics like electrical and electronic engineering are instead handled by the International Electrotechnical Commission. It is headquartered in Geneva, Switzerland. The three official languages of ISO are English, French, and Russian.



Figure I.3: International organization for standardization logo.

I.5 European Committee for Standardization

The European Committee for Standardization (CEN, French: Comité Européen de Normalisation) is a public standards organization whose mission is to foster the economy of the European Single Market and the wider European continent in global trading, the welfare of European citizens and the environment by providing an efficient infrastructure to interested parties for the development, maintenance and distribution of coherent sets of standards and specifications [?].

The CEN was founded in 1961. Its thirty-four national members work together to develop European Standards (ENs) in various sectors to build a European internal market for goods and services and to position Europe in the global economy. CEN is officially recognized as a European standards body by the European Union, European Free Trade Association and the United Kingdom; the other official European standards bodies are the European Committee for Electrotechnical Standardization (CENELEC) and the European Telecommunications Standards Institute (ETSI).

More than 60,000 technical experts as well as business federations, consumer and other societal interest organizations are involved in the CEN network that reaches over 460 million people. CEN is the officially recognized standardization representative for sectors other than electrotechnical (CENELEC) and telecommunications (ETSI). On 12 February 1999, the European Parliament noted in a resolution that CEN, CENELEC and ETSI co-operate smoothly

and that a merger of the three standardization bodies would not have clear advantages.

The standardization bodies of the thirty national members represent the twenty seven member states of the European Union, three countries of the European Free Trade Association (EFTA), the United Kingdom and other countries that are highly integrated into the European economy. CEN is contributing to the objectives of the European Union and European Economic Area with technical standards (EN standards) which promote free trade, the safety of workers and consumers, interoperability of networks, environmental protection, exploitation of research and development programmes, and public procurement. An example of harmonized standards are those for materials and products used in construction and listed under the Construction Products Directive. The CE mark is a declaration by the manufacturer that a product complies with all relevant EU directives.

CEN (together with CENELEC) provide a CEN/CENELEC platform for the development of European Standards and other technical specifications across a wide range of sectors, also ensuring that standards correspond with any relevant EU legislation.

CEN (together with CENELEC) owns the Keymark, a voluntary quality mark for products and services. A product bearing the Keymark demonstrates conformity to European Standards.



Figure I.4: European committee for standardization logo.

I.6 French Standardization Association

Established in 1926, AFNOR is an association governed by the law of 1901, consisting of nearly 2500 member companies. Its aim is to lead and coordinate the standards development process and to promote the application of those standards [?].

Recognized by the public authorities (who entrusted the Ministry in charge of industry with the task of ensuring interministerial coordination and control functions), AFNOR is at the hub of the French standardization system. Bringing together all the major socio-economic players, AFNOR is alert to their needs and cooperates closely with the 25 standards bureaus and the other professional bodies in developing a set of standards that meet their strategic objectives. As a service provider, AFNOR has developed a variety of deliverables - for companies in particular - which, ranging from the distribution of standards to certification, including training, helps in a practical way to integrate standards into the company's development.

AFNOR has concentrated its commercial and competitive activities within specialised subsidiaries by creating AFNOR Certification and AFNOR CompÃtences in the training area. The figures herewith refer to the group as a whole, which maintains strong synergy between its different activities.



Figure I.5: French standardization association logo.

I.7 Algerian Institute of Standardization

IANOR, or Algerian Institute of Standardization, is an industrial and commercial public institution (EPIC) founded on February 21, 1998, following Executive Decree 98-69 [?]. This creation is part of a broader restructuring including INAPI (Algerian Institute of Standardization and Industrial Property). Under the supervision of the Ministry of Industry and Mines, IANOR represents Algeria within the International Organization for Standardization (ISO).

As a national standards body, IANOR's main objectives are to :

- Coordinate development of national standards with different sectors.
- Identify standardization needs at national level.
- Implement the national standardization plan.
- Disseminate information on standardization and related activities.
- Manage the national information point on technical barriers to trade for the World Trade Organization (WTO).
- Administer the conformity mark to Algerian standards

In addition, IANOR offers a range of services including training, consulting, auditing and certification for economic operators, public bodies and consumers. These services cover the areas of standardization, regulation and certification. The organisation has an information centre, various technical committees and a testing and calibration laboratory.



Figure I.6: Algerian institute of standardization logo.

I.7.1 Which products need to be certified by an IANOR standard ?

IANOR offers companies the opportunity to certify their products according to its standards, thus ensuring their compliance with technical and regulatory criteria and highlighting their quality on the market. Certification is carried out via the TEDJ mark, a national quality label for voluntary certification, issued by IANOR. This label, once affixed to a product, certifies that it meets the applicable Algerian standards. EASD certification applies to a variety of products, including :

I.7.1.1 Industrial products

Concerning the products manufactured in various Algerian industrial sectors such as construction, energy, household appliances, metallurgy, plastics, etc. Among the examples of TEDJ certified industrial products are HDPE tubes for drinking water, cement, taps and manhole plugs.

I.7.1.2 Agri-food products

These are products of agriculture, livestock, fishing or food processing, intended for human or animal consumption. Examples of TEDJ-certified agri-food products include vegetable oils, dates, canned tomatoes, cheeses, and meats.

I.7.1.3 Halal products

These products meet the standards of the Islamic Sharia in terms of legality, purity, safety, and traceability. Meat, dairy, seafood, and bakery products are examples of TEDJ-certified halal products.

Obtaining TEDJ certification involves laboratory testing, evaluation of the manufacturer's quality system, and regular monitoring to ensure product compliance. The TEDJ certification

is issued for three years and can be renewed, provided that the product-specific requirements are always met.

I.8 The International Electrotechnical Commission

(IEC; French: Commission *l'*ectrotechnique internationale) is an international standards organization that prepares and publishes international standards for all electrical, electronic and related technologies *â* 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. The IEC also manages four global conformity assessment systems that certify whether equipment, system or components conform to its international standards [?].

All electrotechnologies are covered by IEC Standards, including energy production and distribution, electronics, magnetics and electromagnetics, electroacoustics, multimedia, telecommunications and medical technology, as well as associated general disciplines such as terminology and symbols, electromagnetic compatibility, measurement and performance, dependability, design and development, safety and the environment.



Figure I.7: International electrotechnical commission logo.

I.9 National Institute of Standards and Technology

The National Institute of Standards and Technology (NIST) is an agency of the United States Department of Commerce whose mission is to promote American innovation and industrial competitiveness. NIST's activities are organized into physical science laboratory programs that include nanoscale science and technology, engineering, information technology, neutron research, material measurement, and physical measurement. From 1901 to 1988, the agency was named the National Bureau of Standards [?].



Figure I.8: National institute of Standards and Technology logo.

