

Order of Engineers and Architects – Beirut Lebanon



Preference Evaluation for Branch Circuits Requirements IEC vs NEC

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Introduction

- The objective of any electrical engineering works, in any country around the world, has always been the **establishment of a set of standards, norms, rules, guidelines and codes** that should be **adopted by design professionals** when preparing tender documents of any project facility.
- In Lebanon, design guidelines, like any where else in the world, are **required to guarantee** that the installation works incorporate the needed **unified** set of safety codes and standards for implementation.



The Lebanese National Electrical Code

- In Lebanon, the Lebanese National Electrical Code **has not been set yet?**
- In accordance with the Public Safety decree 7964 (2012), regarding electrical works, the decree states that in the absence of such a National code, the articles of the **U.S National Electrical Code,® ANSI/NFPA 70,** or the articles of the **International Electrotechnical Commission Standard, IEC 60364,** Electrical Installations of Buildings, can be enforced by the “Bureau de Control”.



Engineers' View

- Electrical engineers at the Order of Engineers and Architects, in Lebanon continuously address the issues about **the need to establish a unified national electrical code.**
- **Branch circuits requirements** is one of the fundamental issues that our 3rd branch technical committees address and argue about.
- Preference between IEC standards and NEC Code requirements has at all times been **debated.**



IEC vs NEC

- These two codes or wiring standards, both **serve as a basis for national wiring rules** throughout the world.
- The review shows that these documents **are different** and were developed with **different purposes** in mind.
- The NEC evolved along with the growth of electrical systems in North America more than 100 years ago **in order to establish a uniform level of safety.**
- The development of electrical installation requirements in several European countries started about the same time as the National Electrical Code.



IEC 60364

- Because the European countries are **in close proximity** to each other, **harmonization** of electrical installation requirements became desirable.
- In 1969, a number of European countries embarked on an effort to **harmonize** their respective national wiring practices. **The multitude of differences rendered this effort unsuccessful.**
- Agreement on a complete set of wiring rules **could not be achieved.** However, it was determined that **a document defining fire and life safety principles and objectives was feasible.**
- These principles were able to serve as the basis on which national wiring practices could be developed. **The effort was refocused on this objective and development of IEC 60364 documents ensued, using Chapter 13 of Part 1 as the cornerstone.**



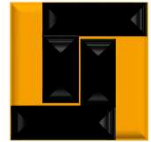
IEC 60364

- The note to **Chapter 13**, which covers **fundamental principles**, indicates that:
- “Where countries not yet having national regulations for electrical installations deem it necessary to establish legal requirements for this purpose, it is recommended that such requirements **be limited to fundamental principles which are not subject to frequent modification** on account of technical development. **The contents of Chapter 13 may be used as a basis for such legislation.**”
- The fundamental principles cover the need for protection against various hazards that may occur due to the use of electricity. **IEC 60364 is broadly performance-based and is not intended to be used directly by designers, installers, or verification bodies, but rather for use as a guide for development of national wiring rules.**



IEC vs NEC

- IEC 60364 is a collection of documents that define **fundamental principles, practices, and performance requirements** which reflect the **European concept of wiring and distribution systems**.
- The NEC is a set of specific rules intended to be used for design, installation, and **uniform enforcement** of electrical system installations based on North American principles and practices.
- To be effective, an **electrical installation code in Lebanon**, must be suitable for the existing electrical infrastructure, for the electrical safety systems employed in Lebanon, and **must be capable of being uniformly interpreted, applied, and enforced**.
- It must also have **compatibility with standards applicable to products whose installation, use, and maintenance is intended to be governed by the code**.



Evaluation and Comparison in relation to Branch Circuits

NEC, NFPA 70

Art. 210 Branch Circuits

210-1 Scope

Covers branch circuits other than for motors, which are included in Art. 430. A branch circuit by definition is unidirectional. A final ring circuit would be considered a parallel circuit because current to any one outlet point flows from two different directions.

Only size No. 1/0 and larger conductors are permitted to be paralleled.

IEC 60364

- 314.1 [Division into several (final) circuits]

- 433.3 Does not prohibit

final ring circuits Final ring circuits rule out use of receptacle type feed-through RCDs.



Evaluation and Comparison in relation to Branch Circuits

NEC, NFPA 70

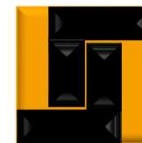
- 210-2 Other articles for Specific-Purpose Branch Circuits

References to other articles or sections for requirements concerning specific-purpose branch circuits assists user of the document.

IEC 60364

- Part 7 Requirements for special installations or locations

Some sections in Part 7 include special rules for circuits and cables.



Evaluation and Comparison in relation to Branch Circuits

NEC, NFPA 70

- 210-3 Rating

The rating of the branch circuit is defined by the ampere rating or setting of the overcurrent device. For multioutlet branch circuits, their ratings are required to be 15, 20, 30, 40, or 50 amperes.

IEC 60364

- No specified ratings for multioutlet circuits



Evaluation and Comparison in relation to Branch Circuits

NEC, NFPA 70

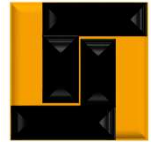
- 210-4 Multiwire Branch Circuits

Addresses disconnecting means (isolation) for outlets supplied by multiwire branch circuits.

IEC 60364

- 312.1 Types of system of live conductors

Includes ac circuits of single-phase, 2- or 3-wire; 2-phase, 3- or 5-wire; 3-phase, 3- or 4-wire; and dc circuits, 2- or 3-wire



Evaluation and Comparison in relation to Branch Circuits

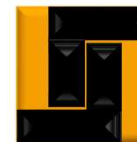
NEC, NFPA 70

- 210-11 Branch Circuits
Required

Based on load calculations as specified in Art. 220 and the proliferation of electrical appliances, specific requirements for providing separate branch (final) circuits was deemed necessary.

IEC 60364

- 132.3 Nature of demand
Indicates only the parameters that need to be considered in determining the number and types of circuits required.



Evaluation and Comparison in relation to Branch Circuits

NEC, NFPA 70

- 210-21 Outlet Devices
- 210-23 Permissible Loads
- 210-24 Branch-Circuit Requirements—Summary
- 210-25 Common Area Branch Circuits

IEC 60364

- Not detailed
- Not detailed
- Not detailed
- Not detailed



Evaluation and Comparison in relation to Branch Circuits

NEC, NFPA 70

- **Art. 220 Branch-Circuit, Feeder and Service Calculations**

The NEC contains specific rules for calculating the size of electrical service, feeders, and branch circuits, and how much load can be safely connected to each. General lighting loads are based on volt-amperes per square foot and the volt-ampere values vary between 0.25 and 3.5 VA per square foot. There are various demand factors for multiple loads where all of the loads are not expected to be energized at the same time. For feeder and service loads, there are optional calculations which are permitted to be used. Farms have a different load composition, therefore, separate rules are specified for computing farm loads.

IEC 60364

- 133.2.4 Power equipment is to be selected to be suitable for the load
- Sec. 311 Maximum demand and diversity

Maximum demand and diversity are two factors that need to be considered in sizing electrical circuits, and the power equipment is to be selected to be suitable for the load. No guidance is provided for determining diversity factors and conditions under which they can be applied. Each country has to determine the minimum safe electrical service that can be provided for premises and how much load can be applied to each circuit.



Conclusion

- IEC 60364 and the NEC both establish **performance requirements** that address fire and electric shock protection, i.e. protection of persons and property.
- **Both documents address installation, use, and maintenance of premises wiring systems and equipment.**
- **Both documents are applicable to wiring systems of premises for residential, commercial, and industrial use.** Hazardous locations (explosive atmospheres) are covered only in the NEC; they are covered separately in IEC 60079.
- Neither document covers installations for generation, transmission, or distribution of electrical energy, nor those under exclusive control of electric or communications utilities.



Conclusion

- **IEC 60364 provides broad performance requirements and it is not usable as an installation document by electrical system designers, installers, or enforcing authorities, but rather it can serve as a guide for development of national wiring rules.**
- **The NEC is a comprehensive set of electrical installation requirements that can be adopted and implemented without development of additional wiring rules.**
- **Countries adopting IEC 60364 in whole, or only Chapter 13 on Fundamental Principles, need to develop additional rules usable by electrical system designers, installers, and enforcing authorities.**
- **Both codes need effective coordination with appropriate product standards to be successful in implementing electrical safety.**



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Conclusion

- The National Electrical Code is a model code written to be suitable for adoption and use with few local deviations, if any, or development of any supplemental rules. **It is written in mandatory language and does not contain any recommendations.** The NEC does contain “Fine Print Notes” which are explanatory in nature.
- They may contain references to other documents, although compliance with the other documents is not mandatory. **The Code is a set of requirements,** the compliance with which provides for practical safeguarding of persons and property from hazards arising from the use of electricity. **It is suitable for adoption and implementation without (or with) modification or additional rules.** It is kept current with the state of technology **on a regular three-year cycle. Because of its mandatory language, it facilitates uniform application and enforcement.**



Conclusion

- The IEC 60364 standard on Electrical Installations of Buildings is intended to **serve as a model for development of national requirements.**
- **It has been characterized as not being suitable for direct adoption as an installation practice.** Due to its composition, layout, and inclusion of recommendatory and advisory provisions, effort is needed to create documents that include mandatory installation language which can be uniformly applied.