

The Electrical Distribution Systems in Buildings

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Electricity and the Importance of Building Distribution Systems

Electricity has become one of the essential commodities in the modern world. It has been expertly integrated into almost every aspect of our lives. It is rightfully considered one of the most significant inventions in the entire history of humankind. However, at the time of its invention, only a few individuals recognized its real significance and the massive effect it would have on the lives of human beings worldwide. With time, it has been incorporated into every sphere of human life. Electricity was imperative during the Industrial Revolution, which would not have been possible without this fundamental invention.

Of all the applications of electricity, one of the foremost is the electrical systems in buildings. In the beginning, electricity was costly and out of the reach of the ordinary people. It was considered a luxury that only the rich could afford. The period of 1890 to 1930 is the most important regarding the electrical industry revolution. The main reason behind its broad scale and rapid adoption is that it is a much more efficient and better energy source than conventional energy sources, such as coal, gas, and oil. Also, it does not generate any smoke or pollutants and does not accompany any odor. All these factors led to its quick adoption worldwide.

However, electricity was accompanied by numerous related hazards and risks in the early days, such as electric shocks, electrocution, and fires. These dangers were further maximized by the inexperience of the electricians and the poorly insulated electric cables. These played a significant role as the impediments to the more rapid adoption of electricity in buildings. However, with time, the electrical distribution systems in buildings improved greatly. The American Banker, J.P. Morgan was among the first individuals to install a complete electrical distribution system in his house. His example led many other people to follow suit, and many of the United States' buildings were provided with electrical distribution systems. Nowadays electricity has become fundamental to every building or house, and no home is without electricity. In this research paper, the electrical distribution systems of a small-scale building are examined and its underlying components are discussed.

Utility Supply and the Delivery of Power to

Buildings

The power utility organizations are responsible for providing electric power to buildings and houses. They transfer the electricity generated from the electrical power plants and distribute it to individual buildings through the electrical transmission lines. The electric power is transmitted in the form of a high voltage, which in the case of the United States is 13.8 kilovolts (kV). This high voltage cannot be directly applied to the buildings and must be decreased using transformers. The transformer steps down the voltage, and this reduced voltage is then provided to the end users. However, the type of user directs the voltage, as the industrial complexes need much higher electric power than the residential buildings, (*Electrical Power Systems in Buildings - Archtoolbox.Com*). Therefore, the voltage systems of buildings are divided into two types that are mostly used. These are.

- The Single-Phase System
- The Three-Phase System.

The Single Phase electrical system is the one that is used in the majority of cases. It is mostly utilized in small or residential buildings. The current in this system is low, i.e., 50 to 60 hertz (Hz), and not direct but alternating current (AC). This current is transmitted via two separate lines, classified as neutral and live. In the case of the United States, the voltage of this current is 120 V. The current is transmitted from the power source to the appliances and the load and then is transmitted to the neutral line. However, it is imperative to note that such a system only works for small buildings and cannot be applied to cater to heavy equipment and machinery needs. See Figure # 1 on page 1 of the attached figures.

On the other hand, the three-phase voltage system comprises three separate transmission lines and carries alternating current (AC). All three electric cables of the system transfer the same voltage as AC, i.e., 120 V. Moreover, the three lines are not in phase and out-phased by 120 degrees. This electrical system is suited for buildings with high power requirements, such as industrial complexes and commercial buildings. All these buildings require massive electrical power and hence resort to the three-phase system. It further holds several advantages over the single-phase system regarding the costs of its installation, which are significantly lower than the single-phase system. Also, it has been demonstrated to incur much fewer power losses. See Figure # 2 on page 1 of the attached figures.

It has already been described that the electrical power cannot be directly provided to the consumers. It first goes through a transformer, which lowers the voltage and then transfers this decreased voltage to the buildings. This transformer is installed at a location close to the building. An essential factor in this regard is the process of regulation by the authorities. In this context, the power utility company installs electric meters to gauge the quantity of electricity consumed by the building. This meter measures the amount of electricity passing through it and gives a reading. It helps the power utility companies with billing.

Meters, Panel Boards, and Main Circuit Protection

The electricity, after passing through the meters, is then transferred to the panel board of the building. This board contains the main service breaker which functions for the whole building. This circuit breaker plays the most critical role in protecting electrical appliances and equipment against any damages from electricity malfunctions, such as voltage fluctuations. In the case of any fault, the main service breaker disconnects the whole building from the electricity. This isolation prevents malfunctioning electric power from reaching any object; hence, the appliances are protected from damage. The panel board contains numerous other electrical circuit breakers that correspond to various building circuits (*Electrical Wiring for Buildings*).

Different buildings contain different electrical appliances, but the lighting is the standard aspect of every building. The power from the main panel is transferred to the bulbs or tube lights through the wires installed according to the developed wiring plan. However, using electric cables that are adequately insulated to avoid any hazards is highly recommended. See Figure # 3 on page 1 of the attached figures.

One of the most critical aspects of the electrical distribution system of any building is the earthing system. Also known as the grounding system, it connects a portion of the electric circuit of the building to the ground. It results in the determination of the system's electric potential and the earth's potential. Therefore, the building is protected against fluctuating or high voltages and protects from the destructive effects of natural lightning.

Lighting and Power Circuits Within the Building

The electricity is distributed to the appliances within the building via the distribution circuits. There are two types of such circuits.

- The lighting load sub-circuit
- The power load sub-circuit

The lighting sub-circuit provides electricity to the lighting sources or other appliances requiring low power, such as the fans. On the other hand, the power sub-circuits distribute the electric power to the electrical sockets. Most of the electric appliances are connected to the sockets to draw power and hence, the cable used for this sub-circuit should be able to carry massive electricity, (*Modular Electrical Distribution System for a Building*).

In conclusion, electricity is one of the most significant inventions in the history of the world. It has become fundamental for humans. The electrical distribution systems are evolving and are becoming increasingly sophisticated. With time, more and more people are shifting to electrical systems based on microcontrollers. Therefore, one has to incorporate the rapidly advancing technology in electrical

systems.

Works Cited

Electrical Power Systems in Buildings – Archtoolbox.Com.

<https://www.archtoolbox.com/materials-systems/electrical/electrical-power-systems.html>. Accessed 14 Feb. 2018.

Electrical Wiring for Buildings. 24 Oct. 2003, <https://patents.google.com/patent/US7511226B2/en>.

Modular Electrical Distribution System for a Building. 11 Aug. 2008,

<https://patents.google.com/patent/US7697268B2/en>.