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Recommended Practice

for

A-C SYSTEM VOLTAGE NOMENCLATURE

for

INDUSTRIAL AND COMMERCIAL POWER SYSTEMS

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ACKNOWLEDGMENT

The Institute wishes to acknowledge its indebtedness to those who have so freely given of their time and knowledge to the preparation of its many publications.

This Recommended Practice was prepared by a Working Group of the Codes and Standards Subcommittee of the AIEE Industrial and Commercial Power Systems Committee. The membership of this Group was:

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A-C SYSTEM VOLTAGE NOMENCLATURE FOR INDUSTRIAL AND COMMERCIAL POWER SYSTEMS

Nomenclature for alternating-current system voltage should include designations for nominal system voltages and, associated with each nominal voltage: (1) an identification of the minimum and maximum acceptable limits for the system operating voltage under favorable and tolerable conditions, and (2) an identification by voltage rating of devices and equipment to be applied on each system.

The AIEE Industrial and Commercial Power Systems Committee has documented preferred system voltage nomenclature for industrial plant and commercial building power systems in Tables I(A), I(B), and II. It is intended that this information be useful to plant engineers, power-system engineers, application engineers, consulting engineers, electrical contractors, and equipment manufacturers in understanding current system voltage nomenclature. In addition, a comparison is made to current electric utility power-system practice.

This report represents the unanimous agreement of the Working Group with the approval of the Industrial and Commercial Power Systems Committee. Every attempt was made to incorporate preferred practice as well as to include existing practice in industrial and commercial use, recognizing also electrical utility use.

It is the objective that the preferred practices in this report be followed, and that due consideration be given in any Standards revision.

Need to Review Nomenclature

The only nationally accepted Standard for system voltage designations is the Edison Electric Institute (EEI)–National Electrical Manufacturers Association (NEMA) "Guide for Preferred Voltage Ratings for A-C Systems and Equipment."[1] It is recognized by this Committee that the 1949 revision of this Standard incorporated many significant improvements and covered a broader documentation of the ratings for various devices and equipments. It is also recognized that, under the sponsorship of the EEI, the Standard is primarily directed towards the electrical utility field.

A portion of this Standard was extracted, modified, and placed in the AIEE publication, "Electric Power Distribution for Industrial Plants."[2] The system voltage designations had to be modified because the Standard does not include all of the presently accepted preferred industrial voltages. To illustrate, the EEI–NEMA Standard does not list the 13,800-volt system and gives preference to the 7,200-volt electrical utility system over the 6,900-volt industrial system. As a result, the Committee felt there was a need for further clarification in industrial and commercial power systems of (1) the preferred system voltages, as well as (2) the method of identifying the voltages.

A very comprehensive AIEE paper was presented as a report of this Committee at the 1957 AIEE Summer General Meeting. This "Report of Industrial Voltage Requirements" (unpublished) covered a definition of terms, and an extensive review of the effect of voltage drop and voltage spread for the industrial system. The report also included a comprehensive recommendation on transformer voltage ratings and their effect on utilization equipment. It should be noted that the conclusions of this paper regarding system voltage nomenclature were not completely included in the American Standard.

It is anticipated that the American Standards Association will revise their Standard *C84.1-1954*,[1] and it is appropriate for a revised Standard to give "equal treatment" to the preferred system voltages applied in industrial plants and commercial buildings.

Recommended Nomenclature

The preferred system voltages are presented in Table I(A), "Preferred System Voltage Nomenclature, Three-Phase Systems"; Table I(B), "Preferred System Voltage Nomenclature, Single-Phase Systems"; and Table II, "Preferred Voltage Ratings for A-C Equipment."

In these tabulations, a comparison is made of the preferred nominal system voltage for industrial and commercial power systems, as well as electrical utility power systems. In some cases, it was necessary to expand the tables to cover industrial voltages omitted from the American Standard. The documentation uses the generally accepted minimum and maximum voltages for the favorable zone and tolerable zone as given in the Standard.

Favorable zone and tolerable zone voltages are listed using the technique of the American Standard, for the following three conditions:

1. Voltages at point of utilization equipment.
2. Primary voltages at distribution transformers.
3. Voltages at substations or on subtransmission or transmission systems.

The widespread and extensive practice of applying power systems for industrial plants is to use three-phase systems. Because of this practice, the industrial plant operator identifies the name of his system by the nomenclature on the supply transformer.

As an example, for medium-voltage systems, the industrial plant operator will identify his system as a 13.8-kv system if it is supplied by a transformer rated 13,800 volts. This practice should be continued.

Similarly, for low-voltage systems, it has also been the practice to identify the system nominal voltage by using the same voltage as the rating on the nameplate of the transformer. To illustrate, it has been the practice to iden-

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