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A. I. E. E. STANDARDS

Induction Motors and Induction Machines in General (Revised)



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Development of the Standards of the American Institute of Electrical Engineers

Recognizing the importance in the development of electrical engineering, of standardization in the electrical field, the A. I. E. E. in 1898 appointed a Committee on Standardization, consisting of seven members having qualifications and experience from designing, manufacturing and operating standpoints. The report of this Committee was accepted at a meeting of the Institute in June 1899.

Experience gained in applications of the standards and further developments in electrical apparatus and methods showed the necessity of revision, and a committee was appointed which after consultation with manufacturing and operating engineers presented the first revised report on Standardization Rules of the A. I. E. E. in June 1902.

The next revision was undertaken by a committee of ten, which presented its report in May 1906.

In September 1906, a Standards Committee of eleven members was appointed for further revision, and its report was presented in June 1907.

The appreciation of the importance and value of standardization resulted in the formation of a Standing Committee, with the title of Standards Committee of the A. I. E. E. This became effective in the Constitution of June 1907. The scope and amount of work necessitated increasing the number of members from time to time until in 1922 there were 37 members divided into a number of subcommittees specializing on various subjects.

A. I. E. E. Standards published in a single volume as each revision was adopted have been generally accepted as Standards of the electrical industry of the United States since the adoption of the first report in 1899. Subsequent reports on Standards were made and published, in some cases in several editions. The dates of adoption by the Board of Directors of such reports are as follows: June 20, 1902; June 21, 1907; June 27, 1912; July 10, 1914; June 30, 1915; June 28, 1916; November 8, 1918; October 8, 1920, and June 29, 1922.

On June 29, 1922, in view of the increasing complexity of the work, a reorganization of the Standards Committee was effected, and a working organization established which provided for an increase in standardization work and for the appointment on Working Committees of the Standards Committee of non-Institute members.

The present plan under which the Institute Standards are being issued involves the separation of the complete body of Standards into forty—or more—sections, each published as a separate pamphlet and dealing with a specific subject. Each section of the Standards has been formulated either by a Working Committee of the Standards Committee which has been made as representative as possible for the work in hand or by a Sectional Committee organized according to the procedure of the American Standards Association. The division of the Standards into a number of separate publications simplifies the process of keeping the Standards revised to conform with the latest developments and enables those interested in a particular field to obtain in concise form the material relating to that field. In framing the Institute Standards the chief purpose has been to define terms and conditions which characterize the rating and behavior of electrical machinery and apparatus, with special reference to the conditions of acceptance tests.

The Standards Committee takes this occasion to draw attention to the value of suggestions based upon experience gained in the application of the Standards to general practise. Any suggestions looking toward improvement in the Standards will be welcomed for the guidance of the Committee in preparation of future editions, and should be communicated to the Secretary of the A. I. E. E. Standards Committee, 33 West 39th Street, New York.

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The National Electrical Manufacturers Association.

The National Electric Light Association.

The A. I. E. E. Committee on Electrical Machinery.

STANDARDS

OF THE

American Institute of Electrical Engineers

INDUCTION MOTORS AND INDUCTION MACHINES IN GENERAL

(Adopted by the Board of Directors, December 11, 1925.)

(Revised December 10, 1926 and February 10, 1927.—See 9-61, 9-106, 9-151, 9-310(b), 9-312, 9-500, 9-501, 9-502 and Table II.)

SCOPE

The standards in this section apply to the following types of rotating machines:

1. Induction motors larger than fractional horse power (for definition of fractional horse power motor, see 9-60).

2. Induction generators.

They are applicable also to induction machines in general. Alternating-current commutator motors are not covered in detail but they shall conform to these Standards as regards ratings, temperature rises and dielectric tests.

SERVICE CONDITIONS

9-1 Usual Service Conditions.—Machines conforming with these standards shall be suitable for carrying their rated load:

(a) When and where the temperature of the cooling medium does not exceed 40 deg. cent.

(b) Where the altitude does not exceed 1000 meters (3300 ft.).

9-2 Unusual Service Conditions.—The use of machines in cooling mediums having temperatures higher than 40 deg. cent. or at altitudes greater than 1000 meters (3300 ft.) should be considered as special.*

9-3 Conditions Affecting Constructional or Protective Features.—There are conditions which, while not usually affecting the rating, may require special consideration, principally with respect to constructional or protective features. Where such conditions exist it is recommended that they be brought to the manufacturer's attention. Among such conditions are:

- (a) Exposure to damaging fumes or gas
- (b) Exposure to excessive moisture or humidity
- (c) Exposure to excessive oil vapor
- (d) Exposure to excessive dust
- (e) Exposure to gritty dust
- (f) Exposure to carbon or metallic dust
- (g) Exposure to cotton lint

*For apparatus intended for service at altitudes greater than 1000 meters (3300 ft.) it is provisionally agreed that the permissible temperature rises (to be included in contracts and checked by test at low altitude) shall be less than specified in these standards by 1 per cent of the specified rise for each 100 meters (330 feet) of altitude in excess of 1000 meters (3300 feet).

- (h) Exposure to steam
- (i) Exposure to salt air
- (j) Exposure to explosive gases
- (k) Exposure to abnormal vibration or shocks
- (l) Exposure to unbalanced polyphase voltages
- (m) Excessive departure from rated voltage or frequency

DEFINITIONS

Definitions given herein apply specifically to the machines treated in this section. They are included with all other Standard definitions in a separate section.

Machines

9-50 Induction Machine.—An induction machine is an alternating-current machine which comprises a magnetic circuit interlinked with two electric circuits, or sets of circuits, rotating with respect to each other and in which energy is transferred from one circuit to another by electric magnetic induction. Examples of induction machines are induction motors, induction generators, and certain types of frequency converters and phase converters.

9-51 Induction Motor.—An induction motor is an induction machine that converts electrical energy delivered to the primary circuit into mechanical energy by the electromagnetic interaction between the primary and secondary circuits. The secondary circuit is short-circuited or closed through a suitable circuit.

9-52 Squirrel-Cage Induction Motor.—A squirrel-cage induction motor is an induction motor in which the secondary circuit consists of conductors suitably disposed in slots in the secondary core and connected at the two ends of the core.

9-53 Wound-Rotor Induction Motor.—A wound-rotor induction motor is an induction motor in which the secondary circuit consists of a polyphase winding of coils whose terminals are short-circuited or closed through suitable circuits. When provided with collector or slip rings, a wound-rotor induction motor is also known as a slip ring induction motor.

9-54 Induction Generator.—An induction generator is an induction machine structurally similar to an induction motor driven above synchronous speed by an external source of mechanical energy.