

COMMERCIAL ELECTRICAL TESTING

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Commercial Electrical Testing by E. F. Collins

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E. F. COLLINS

**COMMERCIAL
ELECTRICAL
TESTING**

COMMERCIAL ELECTRICAL TESTING

BY
E. F. COLLINS

Technical Superintendent, Schenectady Works,
General Electric Company

SECOND EDITION

GENERAL ELECTRIC REVIEW
Schenectady, N. Y., 1914

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Introduction

THE following chapters on commercial electrical testing, by Mr. E. F. Collins, Technical Superintendent of the General Electric Company's Schenectady Works, cover a branch of engineering, the study of which is of great importance at the present time. The rapid growth of electrical engineering has necessitated a corresponding development in testing practice to keep pace with engineering and commercial needs; and therefore a description of the arrangements, methods and apparatus used by the Schenectady Works of the largest electrical manufacturing company in the world cannot but prove instructive, not only to the engineering student, but also to all electrical engineers, besides being of considerable aid to those schools and colleges which give a course of instruction in electrical laboratories.

The testing department of a large company is, of necessity, one which employs only those methods which have been found by experience to combine accuracy, efficiency and economy. The subject can be naturally divided into two classes; *viz.*, tests made to obtain engineering information to serve as a basis for future design or for other purposes, and commercial testing. In the latter case, which forms the greater part of the testing work, commercial considerations require that each job be finished as quickly as possible. The machines supplying power and the switchboards must therefore be located and designed from this point of view, and all connections and wiring laid out with the greatest possible care. The personnel must be thoroughly drilled and instructed in their work by experienced men, and each job as it comes along must be assigned to a small group who assume the responsibility for the proper completion of the test. The switchboards must be wired so that a large number of connection combinations

can be readily obtained. The instruments used must be of the highest quality to insure accurate results, and must frequently be compared with reliable standards—work for which a standardizing laboratory is necessary. All these matters must be kept in mind and a system provided for enforcing testing regulations for obtaining clear records of the work done. In short, the testing department is a complex organization whose keynote is efficiency. Economy of labor and power, and the arrangement of apparatus are of equal importance with accuracy; with the latter, of course, a *sine qua non*, since the majority of apparatus tested must meet specification as regards performance, heating, efficiency, and the like. When, as often happens, more than one method can be employed in a given case, the test must be chosen which yields the maximum of accuracy practicable, consistent with the character of the work.

These questions are fully considered in this little book and will appeal to all those having charge of similar departments, college laboratories, etc. To the student of engineering, however, the description of the various tests, their preparation, how they are carried out, the instruments used, and the diverse calculations required will appeal most strongly. Nearly all types of electrical machinery have been covered, and many examples have been given showing the kind of results that actually obtain in the more important cases, and the means employed for discovering electrical or mechanical faults.

* * * * *

The demand for the first edition of this book was so great that the supply was soon exhausted. We have felt it imperative, therefore, to have a second edition printed, thus enabling those who were disappointed in securing a copy to avail themselves of this new opportunity. As stated on the cover, this later edition is not a mere reprint of last year's book for it contains additional material and, so far as has been brought to our attention, has had those minor errors corrected which it seems are unavoidable in all first editions.

EDITOR, GENERAL ELECTRIC REVIEW.

CHAPTER I

MEASUREMENT OF RESISTANCE, VOLTAGE, CURRENT AND POWER

RESISTANCE MEASUREMENTS

Unit employed (International Ohm)	(Primary Std.) (Working Std.)	(Coils from N.B.S.) (Current Carrying Stds.)
Medium 0.01 to 1000000	{ Wheatstone Bridge Slide Wire . . .	{ P.O. Dial or Decade Ohm Meter Special Bridges
Low Below 5	{ Thomson Bridge Drop Method	{ Voltmeter and Am- meter Quick Period Gal- vanometer Low resistance Out- fit
High above 50000	{ High Resistance D.C. Voltmeter Insulation Measuring Outfits	

Unit Employed

The unit employed is known as the "International Ohm." It is represented by the resistance offered to an unvarying electric current by a column of mercury at 0 deg. C., 14.4521 gm. in mass, of a uniform cross-sectional area, and 106.3 cm. in length." The cross-sectional area of this column is approximately 1 sq. millimeter.

Primary Standard

The primary standards against which the working standards of resistance may be checked are standard resistance units of the National Bureau of Standards or Reichsanstalt form. In order, however, to be assured of their continuing accuracy, they should be compared oc-