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REPORT ON AIRCRAFT D-C APPARATUS VOLTAGE RATINGS

(Proposed AIEE Standard for one year's trial use)



*Prepared under auspices
AIEE Committee on Air Transportation*

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PREFACE

It has been widely recognized that there is a distinct need for preferred voltage ratings for aircraft d-c electrical apparatus which will be generally acceptable to manufacturers and users to serve as a basis for voltage standards for aircraft systems and equipment.

Many difficulties and much confusion will be eliminated by adopting suitable standard voltage ratings for all aircraft electrical equipment. These standard voltages should then be made a part of specifications and nameplates marked accordingly. Apparatus should be designed for satisfactory operation over the voltage ranges given in the table, but with performance not necessarily the same as guaranteed at rated voltage. Performance data and acceptance tests should be on the basis of standard voltages.

It is recognized that special applications may require operation over wider voltage ranges than shown.

Standardization of voltage ratings for aircraft electrical accessories is especially difficult because of the close margins for application of aircraft equipment. The great majority of systems in use today are designated as "24-volt systems" since they employ 12-cell, lead-plate storage batteries in parallel with the system. This designation has been thoroughly established by a long period of usage, and will not be changed in spite of the fact that ordinarily no part of the system operates at 24 volts. A "24-volt" motor, if actually designed and tested for operation at 24 volts, may be considerably overloaded when operated from a system maintained at a voltage high enough to keep a 24-volt battery reasonably well charged.

Although the battery represents only a small portion of the available system capacity, its limitations determine the voltages which must be used and voltage ratings must be set accordingly. System voltage must be high enough to maintain the battery in a charged condition, but not high enough to cause excessive battery heating. Twenty-four volt systems are usually operated at between 27 and 28.5 volts at the point of regulation. Voltage is adjusted by setting the generator regulators and the particular value chosen is at least partially dependent on the condition of the batteries. Generators must be capable of 30 volts output over the specified speed range to allow for voltage drops totalling $1\frac{1}{2}$ volts minimum (including the voltage drop in the paralleling resistors, when used) between each generator and its regulated point.

To obtain minimum weight, aircraft system wiring is deliberately loaded heavily and allowance must be made for voltage drop between the regulated point and the electrical accessories. Best weight economy dictates the use of higher cable ratings for intermittent loads than for continuous loads. Rated voltage has been selected as 27 volts for continuous-duty devices and as 26 volts for intermittent-duty devices.

Accessories such as engine-starter motors must be capable of operation when the battery is the sole source of power. They must also operate after one or more generators have been paralleled with the battery and in most cases they must be suitable for operation from 30-volt starter trucks.

Dielectric test voltages for used or repaired equipment are not included in the table, because sufficient information upon which to base a standard is not available. Dielectric test should not be made unless the machine is clean and dry, and, even after thorough cleaning and drying, a used machine cannot be expected to withstand more than a fraction of the original factory test voltage. Testing used equipment at 40 to 50 per cent of the test voltage for new machines is rather common practice. Several Army Technical Orders recommend a 220-volt test for 12- and 24-volt generators, or 44 per cent of the original test voltage.

These matters have been studied carefully by a subcommittee of the AIEE Committee on Air Transportation, and the attached tabulation gives recommended standard voltages for all types of aircraft d-c electrical apparatus.

This proposed standard was prepared by the following subcommittee of the Committee on Air Transportation:

J. D. Miner, Jr., Chairman, J. W. Allen, W. F. Fell, H. J. Finison, A. D. Gilchrist, F. M. Roberts.

The AIEE 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 practice. 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 AIEE Standards Committee, 33 West 39th Street, New York.