



Designation: **F3245 – 17 F3245 – 19**

# Standard Guide for Aircraft Electronics Technician Personal Personnel Certification<sup>1</sup>

This standard is issued under the fixed designation F3245; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 The purpose of this guide is to address the basic fundamental subject knowledge, task performance, and task knowledge activities and functions for avionics professionals to be titled Aircraft Electronics Technicians (AETs).

1.2 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.3 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

## 2. Referenced Documents

2.1 *ASTM Standards:*<sup>2</sup>

**F3060 Terminology for Aircraft**

2.2 *FAA Standards:*<sup>3</sup>

**FAA AC43.13-1B Acceptable Methods, Techniques, and Practices – Aircraft Inspection and Repair (with Change 1)**

**FAA AC43.13-2B Acceptable Methods, Techniques, and Practices – Aircraft Alterations**

**FAA Federal Aviation Regulations for Aviation Maintenance Technicians**

**FAA-H-8083-30 Aviation Maintenance Technician Handbook – General**

**FAA-H-8083-30 Aviation Maintenance Technician Handbook – Airframe Volume 1**

**FAA-H-8083-30 Aviation Maintenance Technician Handbook – Airframe Volume 2**

## 3. Terminology

3.1 See Terminology **F3060**.

3.2 See **Table 1** for task and knowledge definitions relating to the education requirements for Aircraft Electronics Technician (AET) professionals.

3.3 *Explanations for Task Knowledge and Subject Knowledge Levels:*

3.3.1 A task knowledge scale value may be used alone or with a task performance scale value to define a level of knowledge for a specific task. (Example: b and 1b)

3.3.2 A subject knowledge scale value is used alone to define a level of knowledge for a subject not directly related to any specific task, or for a subject common to several tasks.

## 4. Significance and Use

4.1 The guide is intended to be used to assess competencies of qualified individuals who wish to become certified as an Aircraft Electronics Technician through a certification program.

<sup>1</sup> This guide is under the jurisdiction of ASTM Committee **F46** on Aerospace Personnel and is the direct responsibility of Subcommittee **F46.02** on Avionics and Information Technology Endorsements.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the [standard's](http://www.astm.org) Document Summary page on the ASTM website.

<sup>3</sup> Available from Federal Aviation Administration (FAA), 800 Independence Ave., SW, Washington, DC 20591, <http://www.faa.gov>.

**TABLE 1 Task and Knowledge Levels**

Scale Value	Definition: The Individual
Task Performance Levels	1 <b>IS LIMITED.</b> (Can do simple parts of the task. Needs to be told or shown how to do most of the task)
	2 <b>IS PARTIALLY PROFICIENT.</b> (Can do most parts of the task. Needs only help on hardest parts.)
	3 <b>IS COMPETENT.</b> (Can do all parts of the task. Needs only a spot check of completed work.)
	4 <b>IS PROFICIENT.</b> (Can do the complete task quickly and accurately. Can tell or show others how to do the task.)
Task Knowledge Levels	a <b>KNOWS NOMENCLATURE.</b> (Can name parts, tools, and simple facts about the task.)
	b <b>KNOWS PROCEDURES.</b> (Can determine step-by-step procedures for doing the task.)
	c <b>KNOWS OPERATING PRINCIPLES.</b> (Can identify why and when the task must be done and why each step is needed.)
	d <b>KNOWS ADVANCED THEORY.</b> (Can predict, isolate, and resolve problems about the task.)
Subject Knowledge Levels	A <b>KNOWS FACTS.</b> (Can identify basic facts and terms about the subject.)
	B <b>KNOWS PRINCIPLE.</b> (Can identify relationship of basic facts and state general principles about the subject.)
	C <b>KNOWS ANALYSIS.</b> (Can analyze facts and principles and draw conclusions about the subject.)
	D <b>KNOWS EVALUATION.</b> (Can evaluate conditions and make proper decisions about the subject.)

4.2 The guide is intended to be used in concert with a certification provider’s structure and materials for management, exam delivery, and candidate preparation.

## 5. Test Knowledge Requirements

5.1 The following subject, performance, and task knowledge areas shall be assessed by levels (referenced in **Table 1**) of competency in the exam items.

### 5.2 Introductory and General Requirements:

5.2.1 *Direct Current (DC) Basic Terms*—Knows and can identify the relationship of basic facts and state general principles about “Direct Current.” The following is a minimum list of terms associated with this subject. (ref. **Table 1**, Level B)

- 5.2.1.1 Ampere,
- 5.2.1.2 Battery,
- 5.2.1.3 Capacitor,
- 5.2.1.4 Conductor,
- 5.2.1.5 Coulomb,
- 5.2.1.6 Current,
- 5.2.1.7 Direct Current,
- 5.2.1.8 Electron,
- 5.2.1.9 EMF,
- 5.2.1.10 Farad,
- 5.2.1.11 Henry,
- 5.2.1.12 Inductor,
- 5.2.1.13 Insulator,
- 5.2.1.14 Left-Hand Rule,
- 5.2.1.15 Magnetic Permeability,
- 5.2.1.16 Magnetism,
- 5.2.1.17 Metric Prefixes,
- 5.2.1.18 Neutron,
- 5.2.1.19 Ohm,
- 5.2.1.20 Proton,
- 5.2.1.21 Resistance,
- 5.2.1.22 Scientific Notation,
- 5.2.1.23 Static Electricity,
- 5.2.1.24 Volt, and
- 5.2.1.25 Watts.

5.2.2 *Alternating Current (AC) Basic Terms*—Knows and can identify the relationship of basic facts and state general principles about “Alternative Current.” The following is a minimum list of terms associated with this subject. (ref. **Table 1**, Level B)

- 5.2.2.1 Alternating Current,
- 5.2.2.2 Apparent Power,
- 5.2.2.3 Capacitive Reactance,
- 5.2.2.4 Delta Wound,
- 5.2.2.5 Effective Voltage,
- 5.2.2.6 Frequency,
- 5.2.2.7 Impedance,
- 5.2.2.8 Inductive Reactance,
- 5.2.2.9 Phase,

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- 5.2.2.10 Polyphase,
- 5.2.2.11 Power Factor,
- 5.2.2.12 Rectifier,
- 5.2.2.13 Resistance,
- 5.2.2.14 RMS,
- 5.2.2.15 Sine Wave,
- 5.2.2.16 True Power, and
- 5.2.2.17 Wye Wound.

5.2.3 *Basic Circuit Theory of Operation*—Knows and can identify the relationship of basic facts and state general principles about “Basic Circuit Theory of Operation.” The following is a minimum list of terms associated with this subject. (ref. [Table 1](#), Level B)

- 5.2.3.1 Amps,
- 5.2.3.2 Bridge Circuits,
- 5.2.3.3 Complex Circuits,
- 5.2.3.4 Joules,
- 5.2.3.5 Kirchhoff’s Law,
- 5.2.3.6 Ohm’s Law,
- 5.2.3.7 Parallel Circuits,
- 5.2.3.8 Power,
- 5.2.3.9 Resistance,
- 5.2.3.10 Resistors in Parallel Circuits,
- 5.2.3.11 Resistors in Series Circuits,
- 5.2.3.12 Series Circuits,
- 5.2.3.13 Voltage Drop,
- 5.2.3.14 Volts, and
- 5.2.3.15 Watts.

5.2.4 *Basic Circuit Troubleshooting*—Partially proficient in the performance task of “Basic Circuit Troubleshooting.” Able to do most parts of the task and will need help only on the hardest parts. Know the task procedures, and can determine the step-by-step procedures for doing the task. The following is a minimum list of terms associated with the task. (ref. [Table 1](#), Level 2b)

- 5.2.4.1 Troubleshooting Theory,
- 5.2.4.2 Basic Circuits,
- 5.2.4.3 Complex Circuit Voltage Drop,
- 5.2.4.4 Kirchhoff’s Law,
- 5.2.4.5 Parallel Circuit,
- 5.2.4.6 Resistors in Parallel Circuits,
- 5.2.4.7 Resistors in Series Circuits, and
- 5.2.4.8 Series Circuit.

5.2.5 *Basic Circuit Calculations*—Knows and can identify the relationship of basic facts and state general principles about “Basic Circuit Calculations.” The following is a minimum list of terms associated with this subject. (ref. [Table 1](#), Level B)

5.2.5.1 Alternating Current AC, AC:

- (1) Apparent Power,
- (2) Capacitance,
- (3) Capacitive Reactance,
- (4) Effective (working) Voltage,
- (5) Frequency,
- (6) Impedance,
- (7) Inductance,
- (8) Inductive Reactance,
- (9) Peak Voltage,
- (10) Period,
- (11) Phase Angle,
- (12) Power Factor,
- (13) Resonance, and
- (14) True Power.

5.2.5.2 Direct Current DC, DC:

- (1) Amps,
- (2) Ohms,
- (3) Volts, and

(4) Watts.

5.2.6 *DC / AC Basic Circuit Measurements*—Partially proficient in the performance task of “DC / AC Basic Circuit Measurements.” Able to do most parts of the task and will need help only on the hardest parts. Know the task procedures, and can determine the step-by-step procedures for doing the task. The following is a minimum list of terms associated with this task. (ref. **Table 1**, Level 2b)

- 5.2.6.1 Ammeters,
- 5.2.6.2 Ohmmeters,
- 5.2.6.3 Oscilloscopes, and
- 5.2.6.4 Voltmeters.

5.2.7 *Resistor / Theory of Operation*—Knows and can identify the relationship of basic facts and state general principles related to (ref. **Table 1**, Level B):

- 5.2.7.1 Theory of operation,
- 5.2.7.2 Construction, and
- 5.2.7.3 The use of color codes to identify resistor/resistance values.

5.2.8 *Resistor / Fault Isolation*—Partially proficient in the performance task of “Resistor / Fault Isolation.” Able to do most parts of the task and will need help only on the hardest parts. Know the task procedures, and can determine the step-by-step procedures for doing the task. The following is a minimum list of terms associated with this task. (ref. **Table 1**, Level 2b)

- 5.2.8.1 Improperly Installed Resistors,
- 5.2.8.2 Open Resistors,
- 5.2.8.3 Resistors of Incorrect Value, and
- 5.2.8.4 Shorted Resistors.

5.2.9 *Inductors*—Knows and can identify the relationship of basic facts and state general principles about “Inductors.” The following is a minimum list of terms associated with this subject. (ref. **Table 1**, Level B)

- 5.2.9.1 Theory of Operation,
- 5.2.9.2 Calculation of Inductive Reactance,
- 5.2.9.3 Correct Operation of Inductors (coils), and
- 5.2.9.4 Use of Multiple Inductors.

5.2.9.5 *Isolate Faulty Inductors*—Partially proficient in the performance task of “Resistor / Fault Isolation.” Able to do most parts of the task and will need help only on the hardest parts. Know the task procedures, and can determine the step-by-step procedures for doing the task. The following is a minimum list of terms associated with this task. (ref. **Table 1**, Level 2b)

- 5.2.9.6 Improperly Installed Inductors,
- 5.2.9.7 Open Inductors, and
- 5.2.9.8 Shorted inductors.

5.2.10 *Capacitor / Theory of Operation*—Knows and can identify the relationship of basic facts and state general principles about “Capacitor Theory of Operation.” The following is a minimum list of terms associated with this subject. (ref. **Table 1**, Level B)

- 5.2.10.1 Calculation of Capacitive Reactance,
- 5.2.10.2 Operation of Capacitors,
- 5.2.10.3 Dielectric,
- 5.2.10.4 Electrolytic,
- 5.2.10.5 Farad,
- 5.2.10.6 Fixed Capacitors,
- 5.2.10.7 Time Constants,
- 5.2.10.8 Use of multiple Capacitors, and
- 5.2.10.9 Variable Capacitors.

5.2.11 *Capacitor / Fault Isolation*—Partially proficient in the performance task of “Capacitor / Fault Isolation.” Able to do most parts of the task and will need help only on the hardest parts. Know the task procedures, and can determine the step-by-step procedures for doing the task. The following is a minimum list of terms associated with this task. (ref. **Table 1**, Level 2b)

- 5.2.11.1 Improperly Installed Capacitors,
- 5.2.11.2 Open Capacitors, and
- 5.2.11.3 Shorted Capacitors.

5.2.12 *Transformer / Theory of Operation*—Knows and can identify the relationship of basic facts and state general principles about “Transformer Theory of Operation.” The following is a minimum list of terms associated with this subject. (ref. **Table 1**, Level B)

- 5.2.12.1 Counter EMF,
- 5.2.12.2 Eddy Currents,
- 5.2.12.3 Hysteresis, and
- 5.2.12.4 Primary Winding.

5.2.13 *Transformer / Fault Isolation*—Partially proficient in the performance task of “Transformer / Fault Isolation.” Able to do most parts of the task and will need help only on the hardest parts. Know the task procedures, and can determine the step-by-step procedures for doing the task. The following is a minimum list of terms associated with this task. (ref. **Table 1**, Level 2b)

- 5.2.13.1 Improperly Installed Transformers,
- 5.2.13.2 Open or Shorted Primary Coil,
- 5.2.13.3 Primary and Secondary Resistance Testing, and
- 5.2.13.4 Secondary Coil.

5.2.14 *Analog Circuits, Devices, and Switches*—Knows and can identify the relationship of basic facts and state general principles about “Analog Circuits, Devices, and Switches.” The following is a minimum list of terms associated with this subject. (ref. **Table 1**, Level B)

- 5.2.14.1 Derating Factor,
- 5.2.14.2 DPDT,
- 5.2.14.3 DPST,
- 5.2.14.4 Micro Switch,
- 5.2.14.5 Normally Closed (contacts),
- 5.2.14.6 Normally Open (contacts),
- 5.2.14.7 Proximity Switches,
- 5.2.14.8 Push Button Switches,
- 5.2.14.9 Relays,
- 5.2.14.10 Rocker,
- 5.2.14.11 Rotary,
- 5.2.14.12 Solenoids,
- 5.2.14.13 SPDT,
- 5.2.14.14 Switches, and
- 5.2.14.15 Toggle.

5.2.15 *Power Supply Circuit / Rectifiers*—Knows and can identify the relationship of basic facts and state general principles about “Power Supply Circuit / Rectifiers.” The following is a minimum list of terms associated with this subject. (ref. **Table 1**, Level B)

- 5.2.15.1 Diode,
- 5.2.15.2 Forward Bias,
- 5.2.15.3 Full-Wave Rectifier,
- 5.2.15.4 Germanium,
- 5.2.15.5 Half-Wave Rectifier,
- 5.2.15.6 Reverse Bias,
- 5.2.15.7 Ripple Amplitude,
- 5.2.15.8 Silicon,
- 5.2.15.9 Solid-State,
- 5.2.15.10 Three Phase Rectifier,
- 5.2.15.11 Switching Regulators (voltage converter),
- 5.2.15.12 Types and Components used, and
- 5.2.15.13 Use of Power Supply Circuits.

5.2.16 *Power Supply Circuit / Filters*—Can identify basic facts and terminology about “Power Supply Circuit / Filters.” The following is a minimum list of terms associated with this subject. (ref. **Table 1**, Level A)

- 5.2.16.1 Active Filters, and
- 5.2.16.2 Passive Filters.

5.2.17 *Frequency Sensitive Filter – Theory of Operation*—Can identify basic facts and terminology about “Frequency Sensitive Filter – Theory of Operation.” The following is a minimum list of terms associated with this subject. (ref. **Table 1**, Level A)

- 5.2.17.1 Band-Pass,
- 5.2.17.2 Band-Reject,
- 5.2.17.3 Cutoff Frequency,
- 5.2.17.4 Demodulation,
- 5.2.17.5 Detection,
- 5.2.17.6 Filtering,
- 5.2.17.7 High-Pass,
- 5.2.17.8 Low-Pass,
- 5.2.17.9 Tuning Circuit, and
- 5.2.17.10 Use of Crystals.

5.2.18 *Wave Generation Circuits*—Can identify basic facts and terminology about “Wave Generation Circuits.” The following is a minimum list of terms associated with this subject. (ref. **Table 1**, Level A)

5.2.18.1 Oscillators:

- (1) Crystal-Controlled Oscillators,
- (2) Hartley Oscillator,
- (3) LC Tank,
- (4) Oscillators, and
- (5) Regenerative Feedback Path.

5.2.18.2 Waveshaping Circuits:

- (1) A-stable Multivibrator,
- (2) Bi-stable Multivibrator,
- (3) Crystal-Controlled Oscillators,
- (4) LC Tank,
- (5) Mono-stable Multivibrator, and
- (6) Oscillator.

5.2.19 *Limiter Circuits*—Knows and can identify the relationship of basic facts and state general principles about “Limiter Circuits.” The following is a minimum list of terms associated with this subject. (ref. **Table 1**, Level B)

5.2.19.1 Diodes:

- (1) Forward Bias,
- (2) Proper use and Installation,
- (3) Reverse Bias, and
- (4) Schematic Diagram Symbol.

5.2.19.2 Zener Diodes:

- (1) Proper use and Installation, and
- (2) Schematic Diagram Symbol.

5.2.19.3 Transistors:

- (1) Base Current,
- (2) Bipolar,
- (3) Collector Base Junction,
- (4) Collector Current,
- (5) Emitter Base Junction,
- (6) Emitter Current,
- (7) NPN,
- (8) PNP,
- (9) Polarity of Connections,
- (10) Proper use and Installation, and
- (11) Schematic Diagram Symbols.

5.2.20 *Digital Numbering System*—Knows and can identify the relationship of basic facts and state general principles about “Digital Numbering Systems.” The following is a minimum list of terms associated with this subject. (ref. **Table 1**, Level B)

5.2.20.1 Binary:

- (1) Base 2,
- (2) Conversion from/to decimal, octal, and hexadecimal,
- (3) Digital Signal,
- (4) One, and
- (5) Zero.

5.2.20.2 Octal:

- (1) Base 8,
- (2) Conversion from/to binary and decimal,
- (3) Octal Notation, and
- (4) Triad.

5.2.20.3 Hexadecimal:

- (1) Base 16,
- (2) Conversion from/to binary and decimal, and
- (3) Letter designations A through F.

5.2.21 *Digital Logic Functions*—Knows and can identify the relationship of basic facts and state general principles about “Digital Logic Functions.” The following is a minimum list of terms associated with this subject. (ref. **Table 1**, Level B)

5.2.21.1 Main Logic Gates:

- (1) AND,

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